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United States Coast Guard

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COMDTNOTE 16130
10 JAN 2006

COMMANDANT NOTICE 16130

CANCELLED: 9 JAN 2007

Subj: CH-1 TO THE U.S. COAST GUARD ADDENDUM TO THE UNITED STATES NATIONAL SEARCH AND RESCUE SUPPLEMENT (NSS) TO THE INTERNATIONAL AERONAUTICAL AND MARITIME SEARCH AND RESCUE MANUAL (IAMSAR), COMDTINST M16130.2D

1. PURPOSE. This Notice promulgates change one to the U.S. Coast Guard Addendum to the United States National Search and Rescue Supplement (NSS) to the International Aeronautical and Maritime Search and Rescue Manual (IAMSAR), COMDTINST M16130.2D.

2. ACTION. Area and District Commanders and Commanding Officers shall ensure that the provisions of this Notice are followed, and that personnel performing SAR duties are familiar with the provisions of this change to COMDTINST M16130.2D. Internet release authorized.

3. DIRECTIVES AFFECTED. None.

4. SUMMARY OF MAJOR CHANGES.

   a. Preface and Program Overview:
      (1) PPO-3-4, section VI: SAR System Performance Benchmark.
   b. Chapter 1:
      (1) 1.2.5: Expands on Health Risks to Coast Guard personnel.
      (2) 1.2.5.2: Adds information on respiratory diseases and identifying disease threats.
      (3) 1.5.4.1: Includes the requirement to notify state or local officials of boating accidents or information the enter into the Boating Accident Database (BARD) System.
   c. Chapter 2:
      (1) 2.1.5.1: Adds further policy on the monitoring of 2182 MHz.
      (2) 2.1.5.8: Includes the INMARSAT decision to halt Inmarsat E beacon service.
      (3) 2.2.5.5: Clarifies action to be taken for VHF-FM DSC distress calls on both the legacy and R21 systems.
      (4) 2.5.7.a: Clarifies the circuit breakdown for each Remote Fixed Facility (RFF).
      (5) 2.5.7.c: Expands asset tracking policy.
      (6) 2.7.1.4: Adds cellular tower locator Policy.
      (7) 2.11: Adds Ship Security Alert Systems Policy.

DISTRIBUTION – SDL No. 144

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
A	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1		1		1					
B		8	10	1	1	1	1	1			1	1	1	10	1	1	1	1	1		1	1		1	1	
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NON-STANDARD DISTRIBUTION:

d. Chapter 3:
   (1) 3.4.4.2.b.4-7: Clarifies SARSAT 50/50 Split Solutions and Beacon Solutions with garbled beacon ID codes.
   (2) 3.4.9.3.c: Clarifies actions for 2182 kHz auto alarms.
   (3) 3.4.13: Updates Automated Information System (AIS) SAR policy.
   (4) 3.4.14: Introduces the Vessel Monitoring System (VMS) Use for SAR.
   (5) 3.7: Expands the Aspects of Survival information and policy.
   (6) 3.8.3.1: Expands policy on Active Search Suspended (ACTSUS) to include considerations following sector implementation.
   (7) 3.9.2.5: Adds SAR implications of Rapid reporting via Critical Incident Comms Procedures.

e. Chapter 4:
   (1) 4.2: Adds the Forcible Evacuations of Vessels policy.
   (2) 4.7.7: Adds Protocols When Encountering Infectious Diseases.
   (3) 4.8.3: Expands Policy on Air Transportation Between Medical Facilities.
   (4) 4.11.2.1: Expands SLDMB Deployment Considerations.
   (5) 4.11.2.1.i: Adds procedures for Combining USCG and Canadian SLDMB data.
   (6) 4.11.2.2.b: Clarifies policy on Marking SLDMBs as deployed.
   (7) 4.11.2.3: Expands SLDMB Data Retrieval and output.
   (8) 4.11.9.3: Adds new policy on (SLDMB) Deactivation and Disposal.
   (9) 4.13: Adds SAR implications of Maritime Law Enforcement and Vessel Safety policy.
   (10) 4.14: Adds implications for SAR of Places of Refuge policy.
   (11) 4.15: Adds Persons Falling or Jumping from Bridges policy.

f. Chapter 5:
   (1) 5.9: Adds Passive Watchstanding policy.

g. Chapter 6:
   (1) 6.3.2: Deletes paragraph and replaced with reference.
   (2) 6.6.3: Clarifies Transport of Diving Accident Patients guidance.

h. Appendix B:
   (1) B.3.2-3: Adds Case Data Validation and Case Data Review Policy.
   (2) B.5.4.7: Clarifies “Lives unaccounted for” policy.
   (3) B.5.8: Adds Incident Classification policy.

i. Appendix H:
   (1) H.1.5.1-3: Expands and clarifies Search Planning Methodology.
   (2) H.3.5.4: Adds River SAR planning policy.

j. Appendix I:
   (1) I.1.5: Adds information on Sightings That Can Be Mistaken for Distress Flares, including new Table I-1 Major Meteor Shower Activities Table.
   (2) I.1.6: Expands Assessing Flare Sighting Reporting Source Reliability.
   (3) I.5.3: Expands Search Planning after establishing a datum area for flare sightings.
   (4) I.6: Adds flare case Mission Conclusion policy.
   (5) Flare Sighting Checksheet: Revised.

5. PROCEDURES. Remove and insert the following pages.

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6. ENVIRONMENTAL ASPECT AND IMPACT CONSIDERATIONS. Environmental considerations were examined in the development of this change and have been determined to be not applicable.

W. E. JUSTICE /s/
Director of Enforcement and Incident Management

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CHAPTER 6 PROCEDURES FOR UNDERWATER INCIDENTS

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Appendix C Standard CG SAR Messages

REFERENCES

(a) National Search and Rescue Supplement
(b) IAMSAR Manual
(c) Coast Guard Incident Management Handbook, COMDTPUB P3120.17 (series)
(d) U.S. Coast Guard Incident Command System Implementation Plan, COMDTINST 3120.15 (series)
(e) Boat Crew Seamanship Manual, COMDTINST M16114.5 (series)
(f) Team Coordination Training, COMDTINST 1541.1 (series)
(g) Operational Risk Management, COMDTINST 3500.3 (series)
(h) Public Affairs Manual, COMDTINST M5728.2 (series)
(i) The Coast Guard Freedom of Information and Privacy Acts Manual, COMDTINST M5260.3 (series)
(j) Federal/State Relations – Recreational Boating Safety, COMDTINST 16750.8 (series)
(k) Memoranda of Understanding /Agreements, COMDTINST 5216.18 (series)
(l) Maritime Law Enforcement Manual (MLEM), COMDTINST M16247.1 (series)
(m) U.S. Air Force Foreign Clearance Guide
(n) Management and Operation of the Amver System, COMDTINST 16122.2 (series)
(o) Radio Frequency Plan, COMDTINST M2400.1 (series)
(p) International SafetyNET Manual, IMO Publication
(q) Telecommunications Manual (TCM), COMDTINST M2000.3 (series)
(r) USMCC National Rescue Coordination Center and Search and Rescue Point of Contact Alert and Support Messages
(s) HQ USAF Operations Order 68-80; Busy Playmate – Search and Rescue; (HQ USAF msg 201330Z JAN 88)
(t) (Reserved)
(u) Emergency Medical Services Manual, COMDTINST 16135.4 (series)
(v) Marine Safety Manual, Vol. VI, Ports and Waterways Activities, COMDTINST M16000.11 (series)
(w) Federal Highway Safety Act of 1966
(x) Mandatory Use of the Training Management Tool (TMT), COMDTINST 5270.2 (series)
(y) 30’ SRB Operator’s Handbook, COMDTINST M16114.15 (series)
(z) 47’ MLB Operator’s Handbook, COMDTINST M16114.25 (series)
(aa) 41’ UTB Operator’s Handbook, COMDTINST M16114.2 (series)
(bb) Rescue and Survival Systems Manual, COMDTINST M10470.10 (series)
(cc) Auxiliary Operations Policy Manual, COMDTINST M16798.3 (series)
(dd) Coast Guard Air Operations Manual, COMDTINST M3710.1 (series)
(ee) Coast Guard Helicopter Rescue Swimmer Manual, COMDTINST M3710.4 (series)
(ff) Cutter Surface Swimmer Program, COMDTINST 16134.2 (series)
(gg) Coast Guard Diving Policies & Procedures Manual, COMDTINST M3150.1 (series)
(hh) NAVSEA SUBMISS/SUBSUNK Bill for Submarines and Manned Noncombatant Submersibles, NAVSEAINST 4740.1 (series)
(ii) Exercise Planning Manual, COMDTINST M3010.21 (series)
(jj) IMO Radiocommunications and Search and Rescue Circular 31, Guidance for Mass Rescue Operations
(kk) Contingency Preparedness Planning Manual (CCPM), Volume I, Doctrine and Policy, COMDTINST M3010.11 (series)
(ll) Critical Incident Communications, COMDTINST 3100.8 (series)
(mm) Supply Policy and Procedures Manual (SPPM), COMDTINST M4400.19 (series)
(nn) Boarding Officer Job Aid Kit (BOJAK), COMDTINST M16247.6 (series)
(oo) Prevention of BloodBorne Pathogen Transmissions, COMDTINST M6220.8 (series)
(pp) United States Coast Guard Regulations, COMDTINST M5000.3 (series)

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PREFACE & PROGRAM OVERVIEW

I Mission and Purpose

The mission and purpose of the Coast Guard's Search and Rescue (SAR) Program is to prevent death or injury to persons and loss or damage to property in the marine environment. The overall success of the Coast Guard's SAR program depends on many separate efforts, including SAR program management (doctrine, policy and procedures), facility management (platforms and units), support management (equipment, systems), training (proficiency), boating safety and marine inspection (prevention), and others. Ultimately, the success of our SAR program depends on the success of each and every SAR mission that we perform. The focus of this addendum is on the four key processes involved in performance of our SAR missions: (1) distress monitoring and communications; (2) search planning; (3) search coordination; (4) search and rescue operations. The addendum also addresses SAR records and administration, public affairs, SAR liaison and agreements, SAR exercises, and several other aspects of our SAR mission.

II Risk Management

We do dangerous work in a perilous environment. Our heritage is based in large part on the selfless acts of courageous men and women who use their tools and their judgment under the most demanding conditions to save the lives of others. This tradition continues as we perform duties that often place us in harm's way. With a renewed commitment to careful risk management, we seek to avoid jeopardizing the success of our missions by not unnecessarily endangering the lives of our own crews and the lives of those we go out to save. Successful missions begin with thoroughly understanding the environment in which we operate. Based on that understanding, we develop operational concepts, acquire appropriate equipment, and put our people through rigorous formal training. We build on that foundation by continuous operational training and drills, by improving our personal skills, and by maintaining our equipment at the highest state of readiness. In short, successful performance requires thorough preparation.

Preparation alone, however, is not enough. Success also requires that our people and equipment be used within the limits of their abilities. No small boat or aircraft, no matter how well maintained or skillfully piloted, can be expected to survive, much less perform a rescue, when wind and sea conditions are beyond the limitations of hull, airframe or the humans that operate them. Responsible commanders evaluate the capability of crew and equipment against the conditions likely to be encountered when deciding on the proper course of action. Conscious attention to time-tested and time-honored principles of risk management is a necessity.

Today's Coast Guard standard of response remains true to its legacy. We honor our heritage daily by casting off all lines or lifting off the runway in severe weather to save others' lives, while carefully weighing the risk of losing our own. We honor our heritage as well by attending to the principle that a proper and practiced understanding of duties, a thorough evaluation of the risks involved in an operation, and the exercise of good judgment in carrying out that operation is of paramount importance for success. With this in mind, Coast Guard units will carry out SAR missions only after the operational commander has ensured the unit is properly trained, equipped, maintained and ready for the mission and has assessed crew and equipment capabilities and limitations against the operational scenario and the known and predicted challenges the crew will face. Amplified discussion of SAR risk assessment is contained in Section 1.2.3 of this Manual.

III SAR Functions and Hierarchy

a. **Search:** An operation normally coordinated by a rescue coordination center (RCC), rescue sub-center (RSC), or group/activities operations center, using available and appropriate personnel, facilities and resources to locate persons or property in distress.

b. **Rescue:** An operation with the primary purpose of retrieving persons in distress and delivering them to a place of safety. This may include providing for certain medical care or other critical needs. Rescue operations may also be performed for the purpose of preventing or mitigating property loss or damage. However, missions shall not normally be performed for the purpose of salvage or recovery of property when those actions are not essential to the saving of life. Beneficial secondary consequences of a rescue operation may be to prevent environmental damage or remove hazards to navigation, but these are not considered part of the rescue operation's objective.

c. The rescue of persons in distress is the highest priority SAR mission. Missions solely for saving property or for other purposes such as preventing environmental damage will always give way to saving a person's life.

IV Statutory Authority and Responsibility

The statutory authority for the U. S. Coast Guard to conduct SAR missions is contained in Title 14, Sections 2, 88, and 141 of the U.S. Code. The code states that the Coast Guard **shall** develop, establish, maintain and operate SAR facilities and **may** render aid to distressed persons and protect and save property on and under the high seas and waters subject to the jurisdiction of the United States. It also states that the Coast Guard **may** use its resources to assist other Federal and State entities. Thus, Coast Guard performance of SAR is essentially permissive in nature. Search and Rescue activity may be considered a mandated function, but no specific level of performance has been cited under the legislative authority. Nevertheless, judicial rulings have made it clear that once the Coast Guard undertakes a particular mission, we must conduct that mission with due diligence, we must not worsen a situation by our actions, and we must meet a reasonable standard of performance. Moreover, it is within our service's own code of ethics and our creed to carry out each mission to the best of our ability.

In accordance with the National Search and Rescue Plan, the Coast Guard is responsible for organizing available SAR facilities in Search and Rescue Regions (SRRs) as defined in the National SAR Supplement. These waters generally include all navigable waters subject to the jurisdiction of the United States, but also include international waters stretching far into the Atlantic and Pacific Oceans and the Gulf of Mexico.

V SAR Publications

a. **Description.** SAR doctrine, policy and procedures for the Coast Guard are provided in three primary publications. These publications provide material that applies to each of three levels (international, national & agency) within our SAR system. Each publication both complements and supplements the others.

(1) The **National Search and Rescue Plan** is a federal executive level inter-agency document that describes how the United States will meet its international legal and humanitarian obligations to provide SAR services. It establishes over-arching federal SAR policy, assigns SAR responsibilities to various federal agencies, and adopts the International Aeronautical Search and Rescue Manual and the National SAR Supplement for use by U. S. SAR agencies.

(2) The **International Aeronautical and Maritime Search and Rescue (IAMSAR) Manua**l, in three volumes, provides doctrine applicable on an international level. Volumes I and II of the manual describe the basic structure of the SAR system and address the fundamentals of the four basic processes listed in Section I of this preface: SAR communications, planning, coordination and operations. Volume III is designed for use by SAR facilities and by units or individuals in need of SAR services. Not all Coast Guard commands require the full three-volume set. In general, those commands, which serve as SAR Coordinator (SC), will require all three volumes, those commands which may serve as SAR Mission Coordinator (SMC) should have volumes II and III, and response units may need only volume III.

(3) The **United States National Search and Rescue Supplement (NSS) to the IAMSAR Manual** provides the inter-agency doctrine applicable at the federal level. This manual defines the national SAR system, expands on topics covered by the IAMSAR Manual, and provides specific guidance for coordination and operations unique to the United States.

(4) The **Coast Guard Addendum (CGADD) to the NSS** provides policies, procedures, and standards applicable specifically to the U. S. Coast Guard. The CGADD serves as the standard reference for the entire Coast Guard to use in planning and conducting SAR missions. Further, it provides a common reference for discussion among Coast Guard SAR professionals and a timely mechanism for recommending and implementing improvements to the SAR system. Just as SAR is not the only mission conducted by our RCCs, Sectors, Groups, air stations and boat stations, the SAR Program functions as part of the larger Coast Guard, and has developed our SAR doctrine as part of both the larger national and international maritime and aeronautical SAR networks. The CGADD addresses this organizational relationship and focuses on the particulars of search planning and response.

(5) There are several additional Coast Guard and other publications that provide policy, procedures and guidance that apply to SAR, and serve to enhance the overall professional knowledge of SAR personnel. A list of some of these publications is found in Appendix K.

b. **Precedence.** Each successive level of primary SAR publications, from the National SAR Plan to the CGADD, provides greater refinement of doctrine, policy and procedure. If conflicts arise between guidance or information in the various publications, Coast Guard SAR personnel shall follow the CG Addendum, unless otherwise directed by COMDT (G-RPR).

VI SAR Program Objectives, Goals, Standards and Requirements:

a. **Program Objectives.** Four general objectives provide direction for the SAR Program:

- Minimize loss of life, injury, and property loss and damage in the maritime environment;
- Minimize crew risk during SAR missions;
- Optimize use of resources in conducting SAR;
- Maintain a world leadership position in maritime SAR.

b. **SAR Program Primary Goal.** The ultimate **goal** of the Coast Guard's SAR program is to prevent loss of life in every situation where our actions and performance could possibly be brought to bear. Our success in meeting this goal is the result not only of how well the SAR system responds to maritime SAR incidents, but also the efforts of other maritime safety programs, including recreational boating safety and commercial vessel safety. Success reflects how these combined efforts provide mariners with seaworthy craft, proper equipment, necessary knowledge, training, and information to operate safely in the maritime environment, and to take the correct actions when faced with a distress situation.

c. **SAR System Performance Benchmark.** From a humanitarian perspective we would like to prevent all loss of life at sea. We recognize, however, the inherent danger involved in the maritime environment makes this unattainable. The current performance **benchmark** for our maritime safety mission strives to measure the effectiveness of our collective prevention and response efforts. Simply stated it measures the number of "lives saved" versus the number of "lives in distress." "Lives in distress" as used in this measure refers to persons in peril caused by some extraordinary event (e.g. injury, material failure of the vessel, environmental conditions, etc.) beyond the inherent danger of the maritime environment. When a life is in distress there are two possible outcomes – the life is saved or the life is lost. The "lives lost" portion of the measure further recognizes that some of those lives will be lost before the Coast Guard is notified or has any chance to affect the outcome. Therefore "lives lost" is further divided into "lives lost before notification" and "lives lost after notification." To calculate this measure we use the equation:

$$= \frac{LS}{(LS + (LLB + LLA))}$$

Where: LS = "lives saved," LLB = "lives lost before notification" and LLA = "lives lost after notification" as defined and input into MISLE.

(1) Our performance benchmark goal is based on calculations of historical performance and estimations of attainable levels of success. As future improvements are made in the SAR System we expect these

improvements to be reflected in our performance as shown below with planned periodic adjustments to the benchmark.

Goal	*Fiscal Year*					
	2006	*2007*	*2008*	*2009*	*2010*	*2011*
All mariners in distress, save	86%	86%	87%	87%	88%	88%

(2) Two specific benchmarks have been established to measure a subset of the overall Coast Guard Maritime Safety of Lives and Property goals - the response component of the service's maritime safety team. These indicate how well we are performing within the constraints of our current resources.

After Coast Guard notification, in waters over which the Coast Guard has SAR responsibility:

- Save at least **93%** of those people whose lives are in distress. As improvements are made in the SAR System, we expect these improvements to be reflected in our response performance as shown below with planned periodic adjustments to the benchmark.

Goal	*Fiscal Year*					
	2006	*2007*	*2008*	*2009*	*2010*	*2011*
All mariners in distress after CG has been notified, save	93%	93%	94%	94%	95%	95%

To calculate this measure we use the equation:

$$= \frac{LS}{LS + LLA}$$

Where: *LS* = "lives saved" and *LLA* = "lives lost after notification" as defined and input into MISLE.

- Prevent the loss of at least **80%** of the property that is at risk of destruction. To calculate this measure we use the equation:

$$= \frac{PS}{PS + PL}$$

Where: *PS* = "property saved" and *PL* = "property lost" as defined and input into MISLE.

NOTE: These benchmarks were established based on a macro analysis of expected survival times of people in the water and based on an excellent standard of response by existing rescue resources under the current SAR system. It is recognized that regional variances (cold water versus warm, resource-rich port area versus remote locations) will impact the success rate in specific regions.

d. **Data Exclusions from SAR System Performance Benchmark Measurement.** The SAR System Benchmarks are primarily in place to measure long term trends in SAR system performance. To avoid undue influence on the measures by a small number of events with large numbers of lives and/or property value, the data associated with these events is excluded from calculation of the measure(s). Although not included in measure calculations, they are footnoted in reports. The thresholds for exclusion are:

- **Lives** – 11 or more lives saved and/or lost in a single incident
- **Property** - $5 million or more in property saved and/or lost in a single incident

e. **General SAR Program Standards and Requirements.** Certain standards and requirements have been developed for various components of the Coast Guard's SAR system.

(1) **SAR Readiness.** Each Coast Guard unit with a SAR readiness responsibility shall have a suitable SAR resource ready to proceed within 30 minutes of notification of a distress. This readiness requirement may be

adjusted by District Commanders, and by unit commanders when this authority is delegated, based on resource constraints, crew fatigue limits, environmental considerations or other factors. This response standard is in no way intended to negate or supercede proper risk management. It is recognized that mechanical malfunction, unusual mission preparations or other factors may make it necessary to deviate from this standard. Such deviations shall be reported to the cognizant District Commander.

(2) **SAR Mission Response.** Based on assigned SAR areas of responsibility (AOR) for Coast Guard Sectors and other Coast Guard units with specified SAR AORs, the siting, basing or staging of search and rescue units (SRU) should provide for no greater than a two-hour total response time for any one surface or air SRU within that Sector or unit's AOR to arrive at any location within the AOR. This time is calculated from time of notification of the Coast Guard until the time of arrival on scene of an SRU, based on moderate environmental conditions which allow for operation of the SRUs at their top cruise speeds, and including 30 minutes of preparation time (i.e. a total of 90 minutes from underway to on-scene). This is a SAR system resource-planning standard; it does not create a requirement for SRUs to actually arrive on scene within this time in each and every case, as the particular circumstances of any given mission may make this impossible or contrary to proper risk assessment. It is recognized that this response standard may not be met in the AORs of all Coast Guard units with SAR responsibility, especially in those which include vast areas of open ocean and/or remote areas with little or no SAR demand.

NOTE: Search and Rescue Regions (SRRs) associated with Rescue Coordination Centers (RCCs) are determined by international agreement, and are not strictly based on Coast Guard readiness and response standards. RCCs are nevertheless responsible for directing and coordinating response to SAR incidents, within their SRRs, by dispatching the most suitable assets in the timeliest manner possible. Likewise, the Coast Guard's SAR program is responsible for providing suitable assets in the proper locations to provide SAR capability throughout as much of our SRRs as possible.

(3) **SAR Watch Duty Length at CG Command Centers**. Military and civilian command center watchstanders shall not stand more than 12 hours of continuous watch in any 24-hour period. Units unable to comply with the 12 hour standard shall request a waiver from the appropriate operational commander in their chain of command and notify G-RPR.

(4) **National Distress and Response System (NDRS) Coverage.** NDRS is the primary distress alerting and SAR command, control and communications (C3) system for U.S. coastal waters (Sea Area A-1, which extends from the territorial baseline out to 20 nautical miles). The standard for the VHF-FM network is a minimum 90% continuous coverage for reception of a one-watt signal of a one-meter antenna, out to 20 nautical miles from shore around the coastline of the continental U.S., the Great Lakes, main Hawaiian Islands, the Commonwealths of Guam, Puerto Rico, the U.S. Virgin Islands and portions of Alaska.

(5) **Basic SAR Training.** Successful completion of resident SAR planner training at the National SAR School is required for all Area, District, and Sector Command Center (Rescue Coordination Center) watchstanders who perform SMC functions. Area/District (osr and aosr) and other SAR staff personnel should also attend the resident course on a lower priority basis. An additional goal is to complete training in the Incident Command System (ICS) for all SAR planning personnel and SAR staffs.

(6) **SAR Command and Control Responsiveness.** SMCs shall process and evaluate information about a SAR incident, determine appropriate initial action, and initiate action within five minutes of notification of a distress incident. Units other than SMC receiving SAR incident information shall relay information to the SMC immediately.

(7) **Employment of Approved Search Planning Methodologies.** Use and documentation of an approved search-planning tool for all incidents that require search planning. Approved tools include manual solution work sheets with manual plotting, C2PC/JAWS, and CASP. (See Section 3.2)

(8) **Computer Assisted Search Planning (CASP) System.** CASP should be used for planning guidance for all cases involving incidents outside the 30 fathom mark when:

- The duration of an incident has or could have exceeded 24 hours, and
- There is uncertainty concerning the incident time, incident location, or type of search object(s) involved

NOTE: This does not preclude the use of CASP in other circumstances.

(9) **Amver System.** SMCs shall use Amver for identification of SAR facilities for all cases involving maritime and aeronautical incidents offshore when such facilities might be useful for mission accomplishment. SAR Coordinators (SC), SMCs, and others within the Coast Guard SAR System shall seek to increase ship participation in this voluntary ship reporting system for SAR and promote the use of Amver information for SAR purposes by other RCCs.

(10) **SAR Unit Training and Professionalism.** The SRU crew shall be able to correctly operate all equipment provided on their vessels, aircraft or land vehicles to aid a person or property in distress. Specialized and recurrent training shall be provided to personnel designated by the unit as Rescue Swimmers, Emergency Medical Technicians (EMTs), or First Responders. All personnel assigned these specialized rescue duties shall demonstrate a high level of professionalism and competency as documented by completion of appropriate PQS, practical factors, and by their performance.

f. **Coast Guard Unit SAR Readiness Requirements.** Readiness requirements for individual units are assigned by the District Commander iaw the CG Organization Manual, COMDTINST M5400.7 (series), and CG Regulations, COMDTINST M5000.3 (series). The SAR unit response standard is geared toward quick response craft at boat and air stations. To meet the SAR response standard for most Coast Guard unit AORs, units will be required to maintain a B-0 (ready to proceed in 30 minutes) readiness. In certain areas and/or at certain times of the year, the presence of unit coverage overlap may allow a lower readiness than B-0 (greater than 30 minutes).

VII SAR Program Focus

The Coast Guard Headquarters Office of Search and Rescue (G-RPR) performs the functions of the SAR Program Manager. The SAR Program's overall purpose is to provide the resources and policy that facilitate Coast Guard field units in achieving optimal effectiveness in saving lives and property in distress or at risk of injury or damage. The program addresses known and latent deficiencies in the SAR system and strives for continuous improvement in Coast Guard SAR response capabilities through policy-making and budget actions. SAR Program efforts are focused in six key areas:

a. **SAR Doctrine and Procedures:** adoption and development of IAMSAR Manual, National SAR Plan, National SAR Supplement, CG Addendum to the National SAR Supplement.

b. **SAR Professionalism:** update of SAR School curriculum (including CBT courses); renewed emphasis on SAR planning skills for RCC and Sector Command Center planners; development of SAR PQS, SAR Standardization (Command Center Stan Team).

c. **SAR Capabilities:** development and acquisition of computer-assisted SAR planning and case management tools (SAROPS, CASP, MISLE (response module, SAR data entry, MMSI), C2PC/ JAWS,) and other operational equipment (self-locating datum marker buoys, Personal Locator Beacons (PLBs) for SAR crews, new SAR signaling and detection devices, etc.).

d. **SAR Communications:** SAR related comms procedures; comms systems improvements (National Distress and Response System Modernization Project (NDRSMP)/Rescue 21, and Global Maritime Distress and Safety System (GMDSS)).

e. **International SAR System:** cooperation in doctrine, standards, organization, coordination, and R&D.

VIII SAR System Infrastructure:

The Coast Guard's SAR System infrastructure is composed of a network of Headquarters, Area, District and field commands:

a. **Headquarters offices** with key SAR program, resource and support responsibilities include: Office of SAR Policy (G-RPR) (serves as program manager for all CG command centers), Office of Small Boat Forces (G-R CB), Office of Aviation Forces (G-RCA), Office of Boating Safety (G-PCB), Office of Auxiliary (G-PCX), Office of Command & Control Capability (G-RCC); Office of Communications Systems (CG-62), Office of Force Management (CG-48/G-SRF).

b. **Area and District staffs** include senior officers and key staff assigned specifically to oversee operational and programmatic SAR matters ((Aosr), (Posr) and District (osr)). The functions of SAR Coordinator (SC) are carried out at this organizational level. Depending on the nature, complexity, duration, geography, and resource requirements of a particular SAR case, SMC functions are sometimes carried out at this level in the Area or District's multi-mission Command Center, which is also and serves as an internationally recognized RCC.

c. **Sectors.** These multi-mission commands are undergoing conversion from separate Group Commands to combining Groups and Marine Safety Offices to form Sector Commands. SMC functions are typically carried out at the Sector for most SAR cases.

[**NOTE:** within the CGADD the terms Sector, Group, and Activities will appear until relevant sections are contained in a published change. For purposes of policy, the terms are interchangeable except where specifically noted.]

d. **Air Stations and Boat Stations.** These units perform specific assigned SAR missions as well as many other Coast Guard missions (LE, MEP, ATON, RBS, etc.). Over 1900 vessels (ships & boats) and over 200 aircraft (fixed wing and rotary wing) provide ready response around the nation.

e. **An extensive communications network** for distress alerting and response coordination, consisting of the National Distress and Response System (NDRS) VHF-FM sites and MF/HF sites serving SAR communications needs. The sites are operated by a combination of Sector communications centers and Communications Area Master Stations (CAMS), depending on the frequency band, location and other communications infrastructure considerations.

IX Terms within the Addendum. The following terms found in the Addendum have these intended meanings:

a. **"Shall"** is used to show an action, procedure or application that is mandatory.

b. **"Should"** is used to show an action, procedure or application that is recommended and expected as the normal course of action, although is not deemed mandatory.

c. **"May"** is used to show when an action, procedure or application is optional.

d. **"Will"** is used only to indicate futurity, never to indicate any degree of requirement for action, procedure or application.

X Applicability and Obligation

The policies and procedures in this manual apply to U. S. Coast Guard facilities within the U.S., territories, and possessions, and to U. S. Coast Guard SAR operations worldwide. This directive promulgates internal Coast Guard planning guidance solely intended to promote efficiency and consistency in public service above and beyond the requirements of law and regulation. Any obligations discussed, flow only to the Coast Guard. Coast Guard personnel are expected to exercise broad discretion and to exercise sound judgment in performing the functions discussed. The Coast Guard retains the discretion to deviate from or change this guidance without notice. This document creates no duties, standard of care or obligations to the public and should not be relied upon as a representation by the Coast Guard as to the manner of proper performance in any particular case.

This manual represents internal policy guidance to Coast Guard units and is not intended to create any right or cause of action on behalf of the public.

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CHAPTER 1
SEARCH AND RESCUE SYSTEM

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1.2.3.3 Crew Briefings. A mission briefing shall be conducted among the crew of all SRUs prior to launching on a particular SAR case. Chapter 4 of the Boat Crew Seamanship Manual (reference (e)) outlines specific coxswain requirements for risk management, crew briefings and crew debriefs as part of standard boat operations. Aircraft commanders are responsible for all phases of flight, and are tasked with ensuring that all crewmembers and passengers are properly briefed on all aspects of the mission. Coast Guard Flight Manuals for rotary wing aircraft require crew briefings prior to hoisting operations, and mandate a discussion of, among other things, the assignment of crew duties, a discussion of rescue methods to be used, and specific emergency procedures to be followed.

1.2.3.4 Training Sources. Specific Team Coordination Training requirements for active duty, reserve, and auxiliary members are outlined in reference (f), Team Coordination Training. Chapter 4 of reference (e), and the course book “Team Coordination Training Student Guide” (available from the Coast Guard Institute), are two excellent sources for Coast Guard specific training on Risk Management and Team Coordination.

All units conducting SAR operations will review these two documents and incorporate them within the unit’s training plan. Reference (g) and associated job aids (available from Commandant (CG-1134), Afloat Safety Division website) should also be used to integrate Operational Risk Management (ORM) into daily SAR activities and processes.

1.2.4 Adverse Weather

1.2.4.1 As adverse weather is such an important, and relatively common, risk factor to be considered by the SMC and SRUs in the execution of a SAR case, the following definitions are extracted from the Boat Crew Seamanship Manual with the purpose of enhancing proper risk assessment:

1.2.4.2 Heavy Weather is defined as seas, swell, and wind conditions combining to exceed 8 feet and/or winds exceeding 30 knots. If heavy weather is forecasted, it should be considered when planning a mission. Reliable and up to the minute information is critical for planning. There are many sources of information available to the coxswains, heavy weather coxswains, surfmen, and commands of Stations. Ensuring that the information is found and used is the responsibility of every one involved in the mission. Note: This definition of heavy weather is not intended to define a heavy weather situation for a specific boat type. Heavy weather for each specific boat type may be determined at any time by the coxswain.

1.2.4.3 Rough bar/surf is determined to exist when:

- breaking seas exceed 8 feet;
- in the judgment of the Commanding Officer/Officer in Charge, rough bar/surf conditions exist; and/or
- in the judgment of the coxswain, there is doubt as to the present conditions.

When rough bar/surf conditions exist, a surfman shall be assigned as coxswain and all members of the boat crew shall wear all personal protective equipment unless waived by the Commanding Officer/Officer in Charge.

Rough bar – A rough bar is a river entrance or inlet where heavy seas or surf conditions exist. Also, in situations when the coxswain or the CO/OIC is unsure, a rough bar is assumed.

Surf – Surf is defined as the waves or swell of the sea breaking on the shore or a reef.

1.2.5 Health Risks

Rescue personnel frequently encounter persons who are injured or ill in the course of rescue work. Personnel must be aware of high threat and/or prevalent diseases in their operating region and in the area of origin of possible victims. Recognition of the symptoms of such diseases, over and above possible injuries from the SAR incident, and use of proper personal safety procedures are critical.

1.2.5.1 Blood-Borne Pathogens. Possible exposure to blood-borne pathogens exists during any SAR case. All SAR personnel should be cognizant of the possible presence of blood-borne pathogens and use sound situational awareness when planning and/or dispatching personnel to the scene of an incident. Appropriate safeguards should be put in place to protect rescue personnel from possible infection.

1.2.5.2 **Respiratory Diseases**. During SAR incidents, rescuers may encounter persons who have infectious respiratory diseases such as the Severe Acute Respiratory Syndrome (SARS) and other viruses that are of an epidemic or pandemic nature. Rescue personnel should stay informed of current disease threats and keys to recognizing symptoms that may indicate persons they are rescuing may be infected. Appropriate safeguards should be put in place to protect rescue personnel from possible infection.

1.5.3.6 **Exercise Planning Guidance and Sharing Lessons Learned.** The Coast Guard's Exercise Planning Manual provides guidance on how to plan and conduct an exercise, as well as reporting requirements for lessons learned. In addition**,** the Coast Guard Contingency Preparedness System (CPS) gives planning guidance. The purpose of CPS is to provide an efficient means of entering, integrating, managing, and monitoring Contingency Plans, Concept of Exercise reports, and capturing After Action Reports, Lessons Learned, and Best Practices from operations, contingency responses, and exercises. It can be found at http://llintra.comdt.uscg.mil/CPS/.

1.5.4 Information Sharing and Case Coordination

Coast Guard units will extend the maximum practicable cooperation to federal, state, local and private agencies in the prosecution of SAR missions.

1.5.4.1 The SAR Coordinator of any Coast Guard unit responding to a recreational boating accident (as described in 33 CFR 173.55) occurring within concurrent state jurisdiction shall notify the cognizant state authority as soon as practical to ensure inclusion of the information in the state Boating Accident Report Database (BARD) system.

1.5.4.2 Any Coast Guard unit receiving a request for SAR case information from a federal, state or local agency within their AOR will comply with that request unless there is a compelling reason to withhold it. Before the request is denied, concurrence will be obtained from the cognizant district commander.

1.5.4.3 Coast Guard commands, at all levels, shall establish sound working relationships with counterpart agencies within their AOR. Such relationships may take the form of formal agreements or MOU's. MOU's should be regularly reviewed for currency. This working relationship with other federal, state and local agencies must include timely and effective means of sharing SAR case information, as well as mission resources. This information is essential to these agencies to optimize their SAR case contribution, and for their investigative purposes, which ultimately benefit the Coast Guard.

1.5.5 SAR Assessments

A SAR assessment is intended to identify areas for improvement and to help assess needs of the SAR system.

1.5.5.1 The Coast Guard conducts two general types of assessment: internal and international. The internal (national) assessment is an evaluation of our national system as performed within the Coast Guard. Coast Guard personnel trained for this duty perform this type of assessment at a specific level (unit or RCC).

1.5.5.2 International SAR assessments are conducted by the U.S. Coast Guard at the request of a foreign government. Such requests from a foreign government may come directly to Coast Guard Headquarters SAR Program (G-RPR) or may come indirectly; e.g., through another U.S. agency, from IMO in accordance with an existing MOU, or to another part within the Coast Guard. An international SAR assessment is typically an evaluation of that country's overall SAR service. There are few people in the Coast Guard with experience in conducting this type of assessment.

1.5.5.3 All requests for an international SAR assessment shall be brought to the attention of Commandant (G-RPR). Such assessments shall be conducted under the guidance provided in reference (b), Volume I, Chapter 5, which provides broad guidance and Appendix H, *National Self-Assessment on Search and Rescue*, which is a general questionnaire on arrangements to develop and provide SAR services.

1.5.5.4 The U.S. SAR system has served as a model for many countries but should not be viewed as the exclusive way of providing SAR services. Any country requesting U.S. Coast Guard assistance in assessing their SAR system will be encouraged to complete the *National Self-Assessment on Search and Rescue* questionnaire contained in Volume I of the IAMSAR Manual before an on-site visit is conducted. The country will also be encouraged to provide an advance copy of the completed questionnaire since this document is very useful in preparing for the visit.

1.5.6 Sharing Computer SAR Applications

The authority to distribute SAR computer tools varies by application and agency and is different for domestic and foreign agencies as well as federal, state and local. These agencies desire to use the software for SAR coordination/planning and other emergency response operations. It is consistent with the SAR Program's goal to be a leader in SAR to promote using the best tools available for all SAR agencies (domestic and foreign).

1.5.6.1 **Use of C2PC/SARPC and CASP by Domestic and Foreign agencies.** The C2PC/SARPC, CASP and associated SAR planning applications require a high level of competency to be effective. More importantly, the SAR Module and specifically the Joint Automated Worksheets (JAWS) functions within the SAR Module and rely on the SAR Controller to fully understand certain assumptions that are made in the processing. Without proper training an operator can easily develop incorrect search plans that can result in the loss of life. It is essential and critical that all users of the SAR Module participate in a SAR Training curriculum that will provide planners the knowledge required to effectively prosecute a case using these applications.

1.5.6.2 **Specific guidelines required for domestic state and local use of C2PC**: Consistent with the SAR leadership goal the SAR Program supports the distribution of the C2PC software to domestic agencies within the following specific guidelines.

(a) Domestic agencies requesting the software must have a sponsoring USCG command. The sponsoring command will provide assistance as needed to ensure the domestic agency has the necessary knowledge/skills to properly use C2PC and associated SAR planning software. Training via the National SAR School (either resident or exportable course) cannot be offered due to the overwhelming need within the USCG for these quotas. Any training would necessarily be provided locally by the sponsoring command. Sponsoring commands are limited to those that receive formal SAR School training (Groups, Activities, Sections, Districts).

(b) Domestic agencies having problems with software should first be required to contact their sponsoring command. If the sponsoring command cannot resolve the problem then the use of the Hotline should be authorized. This use should be carefully monitored to ensure any costs are adequately covered.

(c) C2PC/SAR Tools software may be provided free of charge to domestic agencies. Domestic agencies should receive their software via their sponsoring USCG command. When the software is transferred, the sponsoring command will ensure the agency information is properly documented for the C2CEN distribution list and software is receipted for by the agency.

1.5.6.3 **Specific guidelines required for other federal agencies use of C2PC**. C2PC and the SAR Module are Government off the Shelf (GOTS) application. Requests for C2PC may be made to the Office of Search and Rescue (G-RPR):

1.5.6.4 **Specific guidelines required for foreign use of SARPC**. To meet international SAR requirements the Coast Guard has merged C2PC and SAR module into a variant for international agencies called SARPC that can be purchased for nominal fee. Units shall refer all requests for SARPC to:

Commandant (G-CI)
U. S. Coast Guard
2100 Second Street, Southwest,
Washington D.C. 20593-0001.
Copy: G-RPR

1.5.6.5 **Specific guidelines for domestic and foreign use of CASP:** For legal and practical reasons, access to CASP software is not provided outside the United States Coast Guard.

1.5.6.6 **Specific guidelines for domestic and foreign use of other SAR applications:** Use of other SAR application will be on a case-by-case basis. These requests should be forwarded to the Office of Search and Rescue (G-RPR):

Commandant (G-RPR)
U. S. Coast Guard
2100 Second Street, Southwest,
Washington D.C. 20593-0001

considered in light of the views of the nation whose territorial sea or overlying airspace is being entered.

(i) The right to carry out AE extends only to bona-fide rescue operations, not to search operations. Coastal nation permission must be secured prior to flying over or landing in territory or territorial seas of a foreign nation for search operations unless other prior arrangements have been made. This can sometimes be arranged with an RCC of that nation.

(j) Ships and aircraft of other nations should be afforded comparable freedom to enter U.S. territorial seas. U.S. actions that unreasonably restrict entry will inevitably jeopardize the ability of U.S. vessels and aircraft to carry out AE.

1.6.5.2 Guidance for AE operations

(a) When the Coast Guard can render or arrange assistance to persons in danger or distress from perils of the sea within foreign territorial seas, it should do so in accord with the following guidance. Such actions must consider the safety of assisting personnel, and the safety of the persons in danger or distress. Such actions must also be taken with an appreciation of U. S. foreign relations with the coastal nation, and in accordance with any applicable international SAR agreement. Our goal is to balance concerns for saving lives and concerns about sovereignty and national security.

(b) A Coast Guard <u>cutter or boat</u> may carry out AE (unless a SAR agreement with the country requires a different procedure), when in the judgment of the unit or operational commander:

(1) There is reasonable certainty (based on the best available information regardless of source) that a person is in danger or distress from the perils of the sea,

(2) The distress location is reasonably well known, and

(3) The rescue unit is in position to render timely and effective assistance.

(c) Coast Guard <u>aircraft</u> may carry out AE as follows, unless a SAR agreement with the country provides differently. Accordingly:

(1) A Statement of No Objection (SNO) from Commandant (G-R) is required for Coast Guard aircraft to enter airspace over foreign territorial seas when, in the judgment of an aircraft commander or operational commander:

(i) A person is in danger or distress from perils of the sea, and delay in rendering assistance would not be life-threatening, and

(ii) Provisions in 1.6.5.2(b)(2) and 1.6.5.2(b)(3) are met.

(2) An SNO from Commandant (G-R) is not required for Coast Guard aircraft to immediately enter airspace over foreign territorial seas only when, in the judgment of an aircraft commander or operational commander:

(i) A person is in danger or distress from perils of the sea, and delay in rendering assistance is potentially life-threatening,

(ii) The provisions of in 1.6.5.2(b)(2) and 1.6.5.2(b)(3) are met, and

(iii) The aircraft is the only available resource capable of rendering safe, effective, and timely assistance.

(d) In all cases, Commandant (G-RPF) shall be promptly notified of an AE action in progress or contemplated by Coast Guard rescue units.

(e) Normally, the Coast Guard should refrain from AE when other rescue units, capable of rendering timely and suitable assistance, are known to be on scene or en route, unless there is good reason to believe that the other rescue units cannot or will not respond in an adequate or timely manner.

(f) When exercising the right to conduct AE operations as described in 1.6.5.2(b) and 1.6.5.2(c) above, permission of the coastal nation should not be requested, unless otherwise directed by Commandant. However, the coastal nation should be notified of the entry at the earliest opportunity, both as a matter of courtesy and so its rescue units may be activated if necessary. Communications must avoid implying that permission is being requested; however, in recognizing the sovereignty of nations within their own territorial seas and the airspace over their territorial seas, communications should be carefully worded to foster cooperation in rescue efforts. If a coastal nation registers a protest against the entry of a rescue unit before that unit actually enters the nation's territorial seas, Coast Guard units shall not enter the territorial seas unless directed to do so by the operational chain of command.

(g) Reasonable doubt as to the immediacy or severity of a situation should usually be resolved by assuming the person(s) is in danger or distress, or that a life-threatening situation exists.

(h) AE should not be carried out to conduct searches. Entry for searching is permitted only with coastal nation consent, which may be arranged in advance by treaty, agreement, or informal arrangement, or on a case-by-case basis.

(i) Cutters conducting AE operations shall not deploy aircraft to, or use aircraft at, the distress scene unless an SNO from the Commandant has been obtained, or a determination has been made that the situation is potentially life-threatening under paragraph 1.6.5.2(b).

(j) If, while a Coast Guard unit is engaged in or intending to carry out AE, the coastal nation objects to the presence of the unit, or if its military or police units attempt to interfere with or otherwise disrupt efforts of the Coast Guard unit, attempts should be made to arrange alternative assistance to those in danger or distress, resolve disagreements amicably on scene, convince the coastal nation and its units of the humanitarian nature of the situation, and advise them of Coast Guard intentions. If such opposition, interference or disruption:

(1) Ceases, the rescue unit may proceed with its mission.

(2) Continues, and the distress is unlikely to be life-threatening, surface units and land based aircraft should depart and cutter-based aircraft should return to the cutter.

(3) Continues, and the distress appears life-threatening, Coast Guard units should, when possible, await direction via the operational chain of command, but may proceed to render immediate assistance.

(k) When deciding what actions to take under paragraph 1.6.5.2(j) above, the operational or unit commander must weigh the risk to the person(s) in distress including potential for other assistance, the apparent seriousness of the foreign government's communicated opposition, and its potential enforcement capability.

(l) The right of self-defense applies when conducting operations in or over foreign territorial seas. For the Coast Guard unit assisting on scene, the right of self-defense extends to and includes persons, vessels or aircraft being assisted and/or escorted; however, the right of self-defense does not include protecting the assisted persons (unless aboard the Coast Guard unit), vessels, or aircraft from legitimate law enforcement efforts conducted by a coastal nation (see paragraph 1.6.5.1(f) above). Chapter 4 of reference (l) and applicable Rules of Engagement provide more detailed information and procedures.

(m) In addition to other notifications discussed earlier, it may be useful for the SAR unit commander to make SECURITE broadcasts when entering into or over foreign territorial seas to conduct SAR operations. Furthermore, a coastal state should be notified of actual or potential marine pollution associated with a SAR incident.

1.6.5.3 Procedures

(a) Commandant (G-R) has established appropriate procedures, including prompt notification of or consultation with DOS as appropriate, to apply during the following situations:

(1) A Coast Guard unit is contemplating or undertaking AE (paragraphs 1.6.5.2(b) and 1.6.5.2(b));

(2) Entry of a Coast Guard unit is being objected to by a coastal nation, or being interfered with or otherwise disrupted by the nation's military or police, while carrying out AE; or

(3) A Coast Guard unit is exercising the right of self-defense in or over foreign territorial seas.

COUNTRY	PROCEDURES
	the U.S. and the Dominican Navy Operations Center, would develop local operational procedures.
Haiti	Obtain confirmed clearance from USDAO, American Embassy, Port Au Prince. Armed aircraft are not permitted to land under any circumstances.
Indonesia	IAW bilateral SAR agreement signed 1988
Japan	IAW bilateral SAR agreement signed 1986 (and amended in 1998)
Marshall Islands, Republic of the	IAW bilateral SAR agreement signed 1985
Micronesia, Federated States of	IAW bilateral SAR agreement signed 1988
New Zealand	IAW bilateral SAR agreement signed 2003
Palau	IAW bilateral SAR agreement signed 2002
People's Republic of China	IAW bilateral SAR agreement signed 1987
Russia	IAW bilateral SAR agreement signed 1988, in force even though signed under USSR

1.6.6 Amver System

Amver is a worldwide voluntary ship reporting system for SAR sponsored by the U.S. Coast Guard. Amver's primary function is to quickly provide SAR authorities with accurate information on the positions and characteristics of ships near a reported maritime or aviation distress that may be able to provide assistance. Vessels of all nations on a coastal or oceanic voyage anywhere on the globe are encouraged to participate by reporting their position. Amver-participating vessels are typically merchant vessels but can include megayachts, commercial fishing vessels or any other vessel that is capable of providing assistance. Vessels participate by sending movement reports (sailing plan, periodic position updates, and final report) to the Amver Center at the OSC via assigned coast or international radio stations or satellite service providers. Information from these reports is entered into a database that computes dead reckoning positions for vessels anywhere in the world while they are participating in the system. Vessel characteristics valuable for determining SAR capability from other available sources of information will be accessed through the Amver application.

Appropriate information about predicted locations and SAR characteristics of vessels within the area of interest is made available to recognized SAR authorities of any nation for use during an emergency. Because vessel movement information provided to Amver is considered proprietary commercial or financial information, it should be carefully guarded from external release and handled in accordance with the specific guidelines in reference (n) and the FOIA/Privacy Act Manual, reference (i). Predicted locations or Amver information are disclosed only for safety purposes, it is not provided to Coast Guard personnel in other mission areas (e.g., law enforcement or maritime investigations) nor other types of agencies. Search planning policy and procedures using Amver are discussed in Chapter 3 of this Addendum. Other guidance material includes:

- **Amver User's Manual (Ship Reporting System for Search and Rescue)**: Detailed guidance for the vessel and company on how to participate and general educational information. Published by G-RPR.
- **Management and Operation of the Amver System, COMDTINST 16122.2 (series)**: Coast Guard directive providing specific policy for the management and operation of the Amver system.
- Amver web site at: www.amver.com.
- OSC web site for various user guides and documents of particular interest to U.S.RCCs at: http://intra.osc.uscg.mil/cgweboscintra/Portal/Systems/Sysweb/AMVER/.

1.6.6.1 Deciding when to divert an Amver-participating vessel in response to a SAR operation is the responsibility of the SMC based on careful consideration of all available information. Commercial vessels that participate voluntarily in our SAR system are usually on tight logistical schedules, and diversions for SAR are costly for shipping companies.

1.6.6.2 CH-1 Amver-participating vessels should be called upon to assist whenever necessary to respond to a life threatening situation. They may be used along their track to help verify distress information and to keep a lookout. Use of Amver-participating vessels to assist in extended searches should be weighed against use of other available resources. Divert as many vessels as are needed, but release them as soon as possible, consistent with the situation and their apparent importance to the SAR operation. SOLAS ships may be asked to serve as the OSC or to perform other functions in accordance with Volume III, *Mobile Facilities*, of the IAMSAR Manual, which they should carry on board. While ships are valuable rescue facilities, they should be used sparingly for extended searches due to their relatively low speeds, small sweep widths, and high costs involved. Aircraft are preferred search facilities when available, but ships may be asked to search as warranted in the judgment of the SMC. (Regulation V/33 of the SOLAS Convention, in part, states "The master of a ship at sea which is in a position to be able to provide assistance, on receiving a signal from any source that persons are in distress at sea, is bound to proceed with all speed to their assistance…" – use of Amver allows the SMC to select the best facility(s) and allow the other vessels to proceed without diverting.)

NOTE: Merchant vessels are valuable rescue facilities, but should be used sparingly for extended searches.

1.6.6.3 Reporting usage of the Amver system by the RCC will ensure continued Coast Guard provision of Amver services and also encourage participation by commercial vessels. SAR SITREPs and District/Area Operations Summaries are to be sent to Amver Maritime Relations (message PLAD "COGARD AMR NEW YORK NY" or by e-mail) whenever an Amver-participating vessel makes a rescue (including number of persons rescued) or diverts to assist (with or without positive results), or a foreign RCC requests a SURPIC. This information will be compiled by AMR and reported in annual statistics for Coast Guard and public use. As feasible, the Coast Guard RCC should follow-up on foreign RCC requests for Amver information and report the outcomes as appropriate. The RCC should have procedures in place to quickly recognize any Amver-participating vessel that diverts or makes a rescue. Such recognition can be in the form of a thank you letter to the company/owner or a public service award for the vessel in an actual rescue.

CHAPTER 2
SAR COMMUNICATIONS

Section 2.1
Global Maritime Distress and Safety System (GMDSS)

2.1.1 Introduction

The Global Maritime Distress and Safety System (GMDSS) is an internationally established distress and safety system. GMDSS was established by the International Maritime Organization (IMO) in 1988, and GMDSS equipment carriage requirements are now mandatory for vessels subject to the Safety of Life at Sea (SOLAS) Convention. GMDSS also can benefit all maritime interests. GMDSS relies upon the establishment of specific "sea areas" of communications and multiple distress alerting and communications networks and methods. This improvement in ship-to-shore distress alerting requires particular equipment on board vessels and at Coast Guard RCCs, Groups, and CAMS in order to send and receive alerts. The primary purpose of GMDSS was to change from a ship-to-ship method of distress alerting to a ship-to-shore method. It provides for the automatic identification of the caller and the location of a vessel in distress. GMDSS became fully effective for the signatory nations of the SOLAS convention on February 1, 1999.

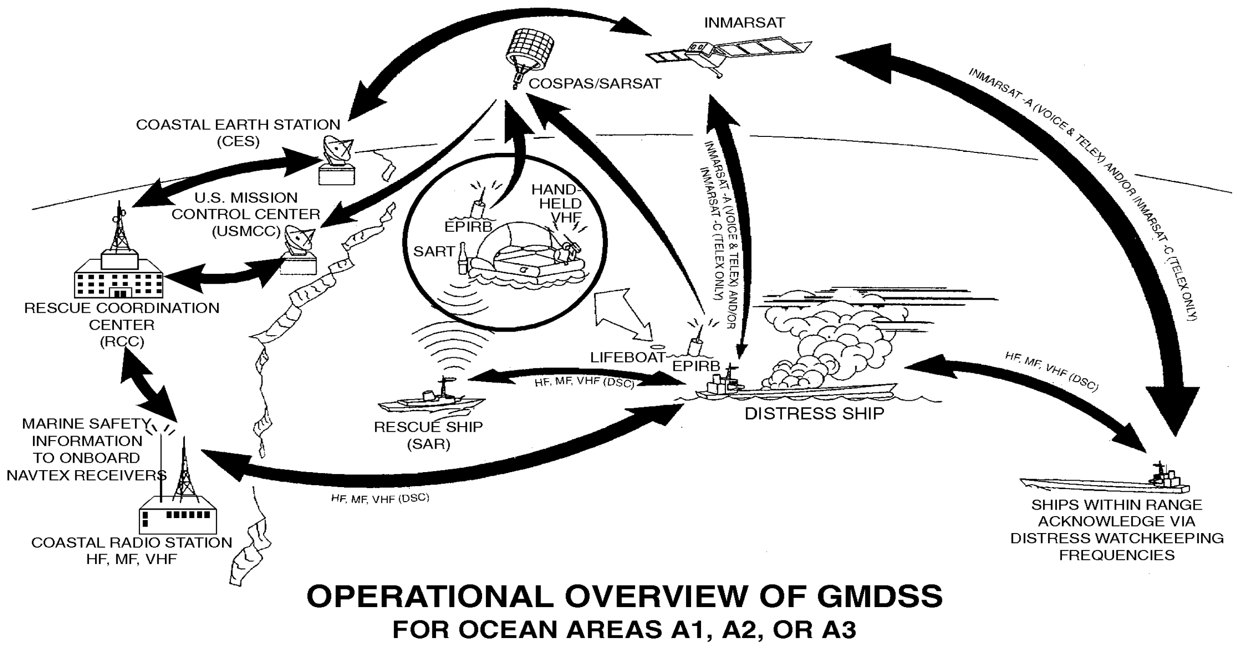

Figure 2-1 Operational Overview of GMDSS

GMDSS is the umbrella of internationally approved distress telecommunications systems. INMARSAT and 406 MHz EPIRBs are the internationally recognized methods of satellite distress alerting under GMDSS. Digital Selective Calling (DSC) is the internationally recognized method of sending a terrestrial digital distress alert. For mariners not equipped with INMARSAT, EPIRBs, or DSC, use of traditional HF/MF/VHF-FM distress voice channels is the preferred method of distress alerting.

2.1.2 GMDSS Functions

GMDSS has 9 specific functions which SOLAS ships must be capable of performing:

- Transmitting ship-to-shore distress alerts by at least two independent and separate means.

- Transmitting and receiving ship-to-ship distress alerts.
- Receiving shore-to-ship distress.
- Transmitting and receiving search and rescue (SAR) coordination communications.
- Transmitting and receiving on-scene communications.
- Transmitting and receiving locating signals (EPIRBS/ELTs).
- Transmitting and receiving maritime safety information (MSI).
- Transmitting and receiving general radio communications (ship/ship and ship/shore).
- Transmitting and receiving bridge-to-bridge communications.

2.1.3 GMDSS Coverage Areas

GMDSS divides the world's oceans into four "sea areas." SOLAS ships have distinct equipment carriage requirements for each area through which they transit.

2.1.3.1 **SEA AREA A1:** VHF-FM range - Coastal area within the radiotelephone coverage of at least one VHF coast station with continuous DSC alerting capabilities (approximately 20 miles offshore). Sea Area A1 must be declared effective by a signatory nation. The United States will declare Sea Area A1 when the Rescue 21 system is fully deployed.

2.1.3.2 **SEA AREA A2:** MF range - The area beyond VHF-FM coverage, within the radiotelephone coverage of at least one MF station with continuous DSC alerting capabilities (approximately 75 nautical miles offshore). Sea Area A2 must be declared effective by a signatory nation. The United States will declare A2 for the continental United States and selected OUTCONUS areas as soon as practicable.

2.1.3.3 **SEA AREA A3:** HF range Inmarsat - Generally defined as the area between 70N and 70S. Sea Area A3 includes Sea Areas A1 and A2 if those areas are not declared effective by the signatory nation.

2.1.3.4 **SEA AREA A4:** Beyond areas A1, A2, and A3. Generally defined as the polar region north of 70N and south of 70S.

2.1.4 GMDSS Sub-Systems

GMDSS consists of numerous telecommunications sub-systems, including:

2.1.4.1 **Digital Selective Calling (DSC):** for distress, urgency, safety, routine, ship's business, and test calling via HF/MF/VHF-FM.

2.1.4.2 **NAVTEX:** narrow-band direct-printing telegraphy for transmission of navigational and meteorological warnings and urgent information to ships on MF.

2.1.4.3 **SITOR:** Simplex Teletypewriter Over Radio for ship-to-shore communications and transmissions of Maritime Safety Information (MSI).

2.1.4.4 **Inmarsat A (analog) and B (digital):** for ship-to-ship and shore-to-ship voice, telex and fax communications utilizing satellite. It can be interconnected to public switched telephone and data networks.

2.1.4.5 **Inmarsat C:** for distress alerting via telex only, data communications and reception of MSI.

2.1.4.6 **Radio-Telephone:** for transmission via HF/MF/VHF-FM.

2.1.4.7 **Satellite EPIRB:** Satellite Emergency Position-Indicating Radio Beacon for distress alerting and locating survivors of distress incidents (406 MHz and Inmarsat E on 1645 MHz (Inmarsat E service is to be withdrawn December 2006)).

2.1.4.8 **SART:** Search and Rescue Transponder, for locating survival craft.

2.1.5 Description of GMDSS Sub-Systems

2.1.5.1 **Digital Selective Calling (DSC) --** DSC is a new IMO-specified technology intended to **initiate communications** over maritime radio and provide distress alert information to RCCs. DSC is similar to an electronic paging system: users of DSC may call a specific station or group of stations to establish communications. DSC calls are made using the applicable Maritime Mobile Service Identity (MMSI) number and appropriate DSC guard or calling frequencies, depending upon whether it is a distress alert or another type of call. The MMSI is the equivalent of the international radio call sign for establishing DSC communications. Federal Communication Commission (FCC) regulations require that all marine radio types accepted after June 17, 1999, have DSC capability. SOLAS convention regulated ships were required to outfit with DSC equipment as of February 1, 1999. Although DSC was intended to replace voice for initiating radio calls, the requirement for SOLAS class vessels to maintain a 24-hour continuous radio watch on VHF-FM channel 16 was to remain in effect until at least February 1, 2005. The requirement for SOLAS ships to guard 2182 KHz was abolished on February 1, 1999. **However, because many vessels not required to comply with the SOLAS Convention continue to use 2182 kHz voice as a primary means of distress communications, Coast Guard cutters equipped with the capability to monitor 2182 kHz shall continue to do so at all times when underway. This mandate will remain in effect until Sea Area A-2 for the United States has been formally declared.**

(a) DSC distress calls may also be electronically relayed to the Coast Guard by any vessel that has a DSC compatible radio, or by other DSC equipped RCCs. All DSC distress calls, and DSC distress relays, shall be acted upon according to the guidance provided in this chapter.

(b) Detailed policy guidance for Coast Guard units equipped with DSC is provided in section 2.2.4. In general, shore units receiving DSC distress alerts should first acknowledge receipt of the call via DSC and then attempt to establish voice communications on an appropriate channel. Afloat units must wait 5 minutes to allow the shore units to respond. If there is no response then respond to the call and relay the alert as soon as possible to the nearest Coast Guard shore unit. RCC personnel should attempt to identify the vessel, either through database sources or by contacting the appropriate foreign RCC based on the country code (first three digits) of the caller's MMSI. There are no restrictions on RCC personnel contacting foreign RCCs for the purposes of SAR case execution.

(c) DSC calls fall into the following categories: Distress, Urgency, Safety, Routine, and Ship's Business. The most important information to be gleaned from an incoming DSC call is the category of call, the MMSI number, and (for distress calls) the position and nature of distress.

2.1.5.2 **NAVTEX** is a service specifically designed for the promulgation of Maritime Safety Information as a part of the GMDSS. All SOLAS-regulated ships were required to carry NAVTEX receivers on February 1, 1993. NAVTEX broadcasts are made by CG CAMS, GANTSEC and MARSEC.

(a) Coast Guard RCCs will use this broadcast method to alert ships in those coastal areas covered by NAVTEX to SAR and SAR-related information. The International Ice Patrol will use this system as a means of disseminating ice bulletins and warning messages. Districts, Sections and the CG NAVCEN will use this system as a means of disseminating notices to mariners.

(b) NAVTEX message drafters should be aware of specific formatting required to ensure messages reach the targeted area. NAVTEX messages are prepared in accordance with the Chapter 13 of the CG Aids to Navigation Manual - Administrative. Charts of NAVTEX service areas are available on the CG NAVCEN Internet site: http://www.navcen.uscg.gov.

2.1.5.3 **INMARSAT A, B and C distress alerts** are received via phone and fax at LANTAREA and PACAREA command centers from the Santa Paula, CA coast earth station, or by relay from other RCCs. Faxes from TELENOR arrive on a standard form.

2.1.5.4 **INMARSAT C telex replies** to ships sending distress alert messages are sent using distress priority. Command Centers have access to a web page established and maintained by INMARSAT C provider, TELENOR. This web page allows the RCCs to send distress priority messages to the vessel, or vessels in the vicinity of the distressed vessel. If web or Internet access is not available, RCCs can fax the desired message TELENOR for broadcast. RCCs shall call the TELENOR operator to verify receipt of fax. INMARSAT C telex messages are prepared in accordance with guidance provided in Section 2.3 and Appendix C, Section 4.

2.1.5.5 INMARSAT SafetyNET -- SafetyNET is a service of Inmarsat's Enhanced Group Call (EGC) system and was specifically designed for promulgation of Maritime Safety Information (MSI) as a part of GMDSS. The EGC system (technically a part of the INMARSAT-C system) provides an automatic, global method of broadcasting messages to all GMDSS-equipped vessels in both fixed and variable geographical areas or to predetermined groups of ships.

(a) Coast Guard RCCs shall disseminate and monitor search and rescue (SAR) distress related information using the INMARSAT SafetyNET system when the SAR case location is deemed to be outside the coverage of NAVTEX. In general, NAVTEX coverage extends to 200 NM off the coast. For specific coverage, charts of NAVTEX service areas are available on the CG NAVCEN Internet site: http://www.navcen.uscg.gov. The International Ice Patrol will disseminate ice warnings and International Ice Patrol bulletins to the appropriate NAVAREA using the SafetyNET system. Meteorological information is disseminated via SafetyNET by the National Weather Service and navigational information is disseminated by the National Imagery and Mapping Agency NIMA). **Coast Guard RCCs shall not disseminate routine meteorological and navigational information via SafetyNET**. Meteorological and navigational information should be forwarded to the appropriate agency for dissemination.

(b) SafetyNET service is provided through TELENOR's web interface, and via voice operator in case of Internet failure, as described in Section 2.1.1.4d. SafetyNET message drafters should be aware of specific formatting required to ensure messages reach the targeted area. SafetyNET Messages are prepared in accordance with guidance provided in Section 2.3 and Appendix C, Section 4. Charts of INMARSAT service areas are available on the CG NAVCEN Internet site: http://www.navcen.uscg.gov

2.1.5.6 HF/MF/VHF-FM Radio Telephone -- HF, MF, and VHF-FM Radiotelephone are also components of GMDSS.

2.1.5.7 406 MHz EPIRBs/ELTs/PLBs-- a component of GMDSS-- are integrated into the COSPAS-SARSAT system, which is an international joint venture in satellite-aided search and rescue. The concept involves the use of multiple satellites in low, near-polar orbits (LEOs) and geo-stationary satellites (GEOs) "listening" for distress transmissions from emergency beacons. The signals received by the satellites are relayed to a network of COSPAS-SARSAT ground stations where the location of the emergency is determined by measuring the doppler shift induced by the satellite motion relative to the distress signal. The fact that an alert has been detected, along with its position, is then relayed by way of a national Mission Control Center (MCC) to an appropriate national RCC or to another international MCC for initiation of the SAR activities. While EPIRBs are the primary equipment providing SARSAT emergency notification in the maritime environment, both Emergency Locator Transmitters (ELTs) used aboard aircraft and Personal Locator Beacons (PLBs) function identically within the SARSAT system. PLBs became legal for use in the United States in 2003. Due to their relatively low commercial price, it is expected that recreational boaters will increasingly use them as a method of emergency signaling. Policy for Coast Guard response to a PLB beacon is identical to that for an EPIRB or ELT.

2.1.5.8 INMARSAT-E EPIRBs -- (a.k.a. L-band EPIRBs) **SERVICE TO BE WITHDRAWN IN DECEMBER 2006**. These EPIRBs are not authorized for sale in the U.S. but they do meet the International Maritime Organization (IMO)'s carriage requirements for satellite EPIRBs. INMARSAT-E EPIRBs do not have homing signals. They make use of the Inmarsat satellites and not the COSPAS-SARSAT satellites that 406 MHz EPIRBs use. Note: Most INMARSAT EPIRB reports will also supply position information as a result of these EPIRBs being typically outfitted with an integrated GPS receiver. In September 2004 Inmarsat made the decision to halt this service December 2006.

2.1.5.9 Search and Rescue Transponder (SART) -- The SAR Transponder (SART) is used for locating survival craft in the 9 GHz frequency band. Unique signals (swept frequency) are generated for interpretation only after being triggered by ship or aircraft radar. Range of air is 40 nautical miles; surface is 10 nautical miles. An audible alarm or light is activated on the SART when a rescue ship or aircraft is within close range. Battery capacity should be at least 96 hours. The SART signal appears as a distinctive line of 12 equally spaced blips on a radar screen extending outward from the SART position along its line of bearing.

Section 2.2
Digital Selective Calling (DSC)

2.2.1 DSC Guard Requirements

2.2.1.1 Coast Guard Shore Unit DSC Guard Requirements. Coast Guard CAMS will guard 6 DSC frequencies: 2187.5kHz, 4207.5kHz, 6312.0kHz, 8414.5kHz, 12577.0kHz, and 16804.5kHz. Coast Guard Groups equipped with MF DSC will guard 2187.5kHz. When equipped, Groups will also guard 156.525mHz (channel 70). DSC guard frequencies, and their equivalent voice and SITOR frequencies are listed in Table 2.1.

Table 2-1 DSC Guard Frequencies, Associated Voice and SITOR Frequencies

DSC Guard Frequency	Voice Frequency	SITOR Frequency
156.525MHZ	156.8MHZ	N/A
2187.5 KHZ	2182 KHZ	2174.5KHZ
4207.5 KHZ	4125 KHZ	4177.5KHZ
6312.0 KHZ	6215 KHZ	6268KHZ
8414.5 KHZ	8291 KHZ	8376.5KHZ
12577.0 KHZ	12290 KHZ	12520KHZ
16804.5 KHZ	16420 KHZ	16695 KHZ

2.2.1.2 Coast Guard Cutter/Boat DSC Guard Requirements

(a) Coast Guard vessels underway or at anchor equipped with VHF-FM DSC radios shall guard DSC frequency 156.525 MHz (channel 70).

(b) Coast Guard vessels underway or at anchor equipped with HF/MF DSC radios shall guard DSC frequency 2187.5 kHz.

2.2.1.3 Canceling Alerts. The proper method for stations or ships to cancel a false distress alert they initiated is outlined below:

(a) Stop the transmission immediately (i.e. turn the transceiver “off” then “on” again),

(b) Send a “Distress Cancellation” message from the DSC radio (HF only),

(c) Switch to the associated voice frequency,

(d) Make an “all stations” broadcast on the corresponding voice frequency.

The broadcast should indicate the name, call-sign, MMSI number, and that the station is canceling the false alert sent (quote distress text) with the local date and time.

Note: Other communications specific DSC policy and procedures can be found in Chapter 12 of ref (ii).

2.2.2 HF/MF/VHF-FM DSC Distress Alert Response Policy: Coast Guard DSC Equipped Shore Units

2.2.2.1 Purpose. To provide operational shore units with policy guidance for responding to HF, MF and VHF-FM DSC distress alerts.

2.2.2.2 Coordination. DSC is unique, in that distress communications are initiated by digital data bursts that are widely distributed, but all follow-up communications after initial acknowledgement are typically handled by voice. International Telecommunications Union (ITU) regulations require each unit that receives a DSC distress alert or distress relay to send an acknowledgment, even if other units are already known to have done so. As such, it is probable that multiple groups, along with the appropriate communications area master station (CAMS), will receive and acknowledge the same MF DSC distress alert. It is also possible that the same distress alert may be received on both HF and MF bands. For these reasons, it is important that Coast Guard units communicate with one another and with the default SAR Mission Coordinator (SMC) to ensure role clarity during DSC case execution.

2.2.2.3 Initial Action. All shore-based units that receive a DSC distress call or distress relay shall complete the following actions:

(a) Acknowledge the distress alert or distress relay.

(1) Distress Alerts - Use the DSC acknowledgement function (sent to "All Ships") before taking any further action. Acknowledgements shall be made via DSC on the same frequency on which the distress alert was received, and shall take place after one minute to allow for units with automated MF/HF/VHF-FM DSC to make calls on all MF/HF/VHF-FM frequencies, and in all cases within 2.75 minutes of receipt, in accordance with ITU regulations. Acknowledgement does not imply assumption of SMC by the acknowledging unit. Acknowledgement simply means that a shore unit has received the DSC call and the U. S. Coast Guard is responding to it.

(2) Distress Relays – Shore units shall acknowledge all DSC distress relays as they are received. The first DSC Distress Relay for a given case shall be acknowledged via DSC. Subsequent Distress Relays that are received that relate to the same case may be acknowledged in one of two ways: a Distress Relay Acknowledgement sent to the "Individual" relaying vessel, or a voice acknowledgement. All acknowledgements shall take place within 2.75 minutes of receipt.

(b) Monitor the corresponding voice frequency. After acknowledging a DSC distress alert, each receiving unit shall monitor the corresponding voice frequency for at least 10-minutes, or until follow-up communications between the distressed vessel and the Coast Guard is established.

(c) Notify SMC. Each receiving unit shall notify the appropriate default SMC as outlined in section 2.2.2.6 ("SMC Determination"). Such notification will take place concurrent with the 10-minute monitoring period mentioned above.

(d) Simplex Teletype Over Radio (SITOR) response. In the small percentage of cases where a group receives a request to respond via SITOR instead of voice, they shall immediately inform their respective District Command Center, who will in turn pass the SITOR request to the appropriate CAMS.

2.2.2.4 2182 KHz AM and 2182 KHz USB Incompatibility. If the distress alert or distress relay originates on 2182 kHz voice instead of 2187.5 kHz DSC, the ACKNOWLEDGEMENT will be by voice on 2182 kHz USB. If the station does not answer, then the shore unit must change the mode of transmission to H3E (AM) and ACKNOWLEDGE using this mode. Older marine radios may not be able to "understand" USB transmissions – even if the shore unit can hear the transmission.

The older MF/HF radios carried by recreational boaters are unable to copy 2182 kHz USB. The reason for this is that these older radios automatically revert to AM when the "2182" red DISTRESS button is depressed. In the event that a boater sends an AM DISTRESS, the USB radios used by the USCG will be able to copy the transmission. When the USCG responds using USB, the boater will be unable to copy the transmission. In the event the USCG receives a distress on 2182 kHz, and after responding using USB, if the USCG is unable to establish contact**, then change to AM mode and repeat the call**.

2.2.2.5 Primary Voice Responder

(a) For all HF DSC distress calls, the primary voice responder shall be the appropriate CAMS. For MF/VHF DSC calls where a position is known, the primary voice responder shall be the group within whose AOR the distressed vessel is located. These units shall have the primary responsibility to initiate a voice response if the distressed vessel does not promptly come up on the corresponding voice frequency. The primary responder shall make a single callout to the vessel in distress on the appropriate voice frequency, using any available information included in the DSC alert to identify the vessel. This information may include the vessel's position, nature of distress, or MMSI number. If communications are established, the primary voice responder shall verify that a distress situation exists, verify the vessel's position if possible, and notify the appropriate default SMC as outlined in section 2.2.2.6.

(b) If the primary voice responder is unable to establish communications with the distressed vessel after making the voice callout and monitoring the voice frequency for five minutes, the primary responder shall send a single point DSC call to the distressed vessel's MMSI number, distress priority.

(c) Failure to establish communications. If communications with the distressed vessel cannot be established by the primary voice responder after following the steps outlined above, notification of such will be made to the default SMC. Only the SMC can make the determination that a DSC distress alert is a probable false alert.

(d) MF/VHF DSC distress calls with no position or invalid position. For MF/VHF DSC distress calls where no position information is known, and for calls where the position of the distressed vessel falls outside the AOR of any group with DSC capability, the 10-minute monitoring period for all receiving units remains in effect. If no communications are heard from the distressed vessel, the SMC may direct a specific unit that received the alert to assume the primary voice responder function.

2.2.2.6 SMC Determination

(a) Area Command Centers shall be the default SMC for all HF DSC distress calls. CAMS shall notify (by telephone, with follow-up via fax or message) the Area Command Center upon the receipt of all HF (and MF) DSC distress calls.

(b) District command centers shall be the default SMC for all MF DSC distress calls. Groups shall notify (by telephone, with follow-up via fax or message) their parent District Command Center upon receipt of all MF DSC distress calls.

(c) Sector/Group command centers shall be the default SMC for all VHF-FM distress calls.

(d) As this policy intends District Command Centers to be the default SMC for MF DSC distress cases, Area Command Centers should ensure that the appropriate district is notified whenever the area is informed of the receipt of an MF DSC distress call from its CAMS.

(e) In the small percentage of cases where groups receive MF DSC distress calls requesting a SITOR response, they shall indicate this in their initial notification to their respective District Command Center. In this situation, the area and district command centers shall jointly determine SMC on a case-by-case basis, and the applicable CAMS shall handle communications. The CAMS may be better suited to coordinate a response by selecting the most effective transmitter.

(f) In the small percentage of cases where it is determined by the CAMS that the same DSC distress alert has been received on both the HF and MF bands, they shall indicate this in their initial notification to their respective Area Command Center. In this situation, the Area and District Command Centers shall jointly determine SMC on a case-by-case basis.

2.2.2.7 Delegation of SMC

(a) Area Command Centers may delegate SMC for HF DSC distress cases to no lower than the District level. Delegation should normally occur in those cases where the position of the distressed vessel is known.

(b) Area Command Centers should also ensure that the appropriate District is informed of the receipt of MF DSC calls reported by the CAMS.

(c) Districts may delegate MF DSC distress cases to no lower than the Group level. Delegation should normally occur in those cases where the position of the distressed vessel is known. For cases where voice communications have not been established, Districts should attempt to identify the vessel via the MMSI Database and other known database sources on behalf of the Group.

2.2.2.8 SMC Responsibilities. DSC is an internationally recognized distress alerting system, and, as such, DSC initiated distress calls shall be immediately placed in the "distress" emergency phase. The first priorities of the default SMC are to determine if communications have been established with the distressed vessel, and to plot the distressed vessel's position, if known. For DSC distress cases outside of the U.S. area of SAR responsibility, the default SMC shall transfer SMC to the appropriate foreign RCC. If communications are established, and the distressed vessel is in the SMC's AOR, the case shall be prosecuted according to existing SAR policies and procedures. For districts coordinating MF DSC cases, the district should determine which group will handle voice communications with the distressed vessel, as multiple groups may have received and acknowledged the initial MF DSC distress alert. Usually, the group in whose AOR the distressed vessel is located should be tasked to coordinate follow-up communications. If communications cannot be established, the default SMC should use the vessel's MMSI to query OSC Martinsburg "MMSI Database," and/or the "Maritime Mobile Access and Retrieval System (MARS)" database located on the ITU's website. The MMSI number can be used with either database to help determine the vessel's identity and any other possible means of contacting the vessel (such as an Inmarsat number). Where no communications are possible, but a position is provided via DSC that is inside the SMC AOR, assets should be dispatched to investigate as soon as possible.

2.2.2.9 Case Claiming. Units shall claim cases for DSC initiated distress calls according to the existing guidelines for cases in this Addendum. Generally, a case shall be claimed and MISLE data entered by all units that dispatch resources, and by units that expend at least 30 minutes of effort in coordination/communications.

2.2.2.10 Case Suspension. DSC alerts shall be treated as all other alerts. See Chapter 3, section 3.4.9 for uncorrelated distress broadcast & alert procedures.

Normal SAR case suspension procedures apply for those DSC initiated distress cases where:

(1) no communications with the distressed vessel can be established,

(2) no further information or means of contacting the vessel can be obtained from either database sources or other sources, and

(3) no position information is known.

2.2.2.11 Procedures for Non-Distress DSC Calls. Non-distress category DSC calls (Urgency, Safety, Routine, Ship's Business) should be acknowledged if requested by the originator. "Test" DSC calls should always be acknowledged. The originator of the DSC call will normally dictate the method of acknowledgment (i.e., DSC, voice, or SITOR) and the working frequency in the initial DSC data transmission. If a specific method of response (i.e., SITOR) is not available to the called station, it shall advise the nearest equipped Coast Guard station to respond to the originator on its behalf.

2.2.2.12 Reporting Requirements. The collection of DSC statistics is an important tool as we attempt to measure both the effectiveness of DSC as a distress alerting mechanism, and the volume of calls being generated by this new system. MISLE incorporates DSC as a method of notification, and detailed MISLE entries by SMCs are crucial to this statistical gathering process. Although MISLE will allow us to measure case specific DSC data, a separate reporting mechanism is needed in the short term to collect other crucial data, including the total number of DSC calls (distress and non-distress) received by units equipped with DSC.

Units equipped with the SWII HF/MF DSC system and software patch (CAMS and Groups) should maintain a log of the following data, broken down by month:

(a) Total number of DSC calls

(b) Total DSC distress calls

(c) Total DSC distress relays

(d) Total DSC urgency calls

(e) Total DSC safety calls

(f) Total DSC routine calls

(g) Total DSC other calls

Areas and Districts may establish their own procedures for the consolidation of this statistical data, but all input shall be forwarded by e-mail to cgcomms@comdt.uscg.mil no later than the tenth day of the month following the month being reported.

2.2.3 MF DSC Response Policy: Coast Guard Afloat Resources

2.2.3.1 Purpose. To provide Coast Guard afloat assets equipped with HF/MF DSC equipment with procedures for responding to MF DSC initiated distress alerts.

2.2.3.2 General. DSC radios maintain a continuous radio guard on MF frequency 2187.5 kHz, regardless of the channel that is tuned on the front panel. As such, cutters equipped with the DSC radios could receive a DSC distress alert on 2187.5 kHz. When a DSC distress alert is received, the radio will emit a loud audio alarm. This alarm shall be considered the equivalent of a "mayday" call, and requires the same level of response.

2.2.3.3 Action. Coast Guard cutters equipped with HF/MF DSC transceivers shall guard 2187.5 kHz continuously while underway and at anchor. Cutters that receive a DSC distress alert shall take the following steps:

(a) In areas where reliable MF DSC communications with one or more shore stations are feasible, CO/OinC's should defer acknowledgement so that a shore station can acknowledge receipt of the call. Any cutter receiving a call that is not acknowledged by a shore station within 5 minutes should acknowledge the call using procedures in sub-paragraph (c) below.

(b) In areas where reliable MF DSC communications with a shore station are known not to exist, cutters that receive an MF DSC distress call should wait at least one minute before acknowledging receipt of the distress alert.

(c) Cutters acknowledging receipt of a DSC distress alert in accordance with sub-paragraphs (a) or (b) should:

(1) Acknowledge receipt of the alert on the MF voice distress channel (2182 MHz) and attempt to establish communications with the distressed vessel.

(2) If unable to establish voice communications with the distress ship, cutters should acknowledge receipt of the distress alert using the DSC acknowledgment function. This action will send a DSC acknowledgement message to the distressed vessel, and terminate the DSC distress call.

(3) Cutters that acknowledge receipt of DSC distress alerts are responsible for notifying the applicable RCC (and Operational Control/Tactical Control, if different) by the most expedient means. Relevant information that could be available includes the distress vessel's MMSI number, position, and nature of distress. This information is normally included in the DSC alert and can be retrieved via the DSC radio display.

2.2.4 VHF-FM DSC Response Policy: Coast Guard Afloat Resources

2.2.4.1 Purpose. To provide Coast Guard afloat resources equipped with VHF-FM DSC with procedures for responding to DSC initiated distress alerts.

2.2.4.2 General. Some Coast Guard vessels have already received VHF-FM DSC radios. The United States will not be declaring Sea Area A-1 operational until the Rescue 21 system is fully operational. Deployment of VHF-FM DSC radios is progressing in order to meet the needs of radio replacement and new vessel construction projects. Upon installation, TISCOM personnel will provide familiarization training on the VHF-FM DSC radios to select cutter crewmembers.

These radios maintain a continuous radio guard on VHF-FM channel 70, despite the channel that may be tuned manually on the front panel. As such, vessels equipped with DSC radios could receive a distress alert on channel 70. When a DSC distress alert is received, the radio will emit a loud audio alarm. This alarm shall be considered the equivalent of a "mayday" call, and requires the same level of response.

2.2.4.3 Action. Coast Guard boats and cutters receiving a VHF-FM DSC distress alert shall:

For Coast Guard Boats:

(a) As soon as possible, inform the SMC of the contents of the distress alert.

(b) In areas where reliable VHF-FM DSC communications with one or more shore stations are feasible, coxswains should defer acknowledgement so that the SMC or a shore station can acknowledge receipt of the call. Any boat receiving a call that is not acknowledged by the SMC or a shore station within 5 minutes should acknowledge the call using procedures in sub-paragraph (d) below.

(c) In areas where reliable VHF-FM DSC communications with one or more shore stations are known not to exist, boats that receive a VHF-FM DSC distress alert from a vessel should, as soon as possible, notify the SMC and acknowledge receipt of the distress alert when instructed.

(d) Boats acknowledging receipt of a distress alert in accordance with subparagraphs (b) or (c) should:

(1) Acknowledge receipt of the alert on the VHF-FM voice distress channel 16 and attempt to establish communications with the distressed vessel.

(2) If unable to establish voice communications with the distressed vessel, boats shall acknowledge receipt of the distress alert using the DSC acknowledgment function. This action will send a DSC acknowledgement message to the distressed vessel, and terminate the DSC distress call.

(3) Boats that acknowledge receipt of distress alerts are responsible for informing the applicable Group or RCC (and OPCON/TACON, if different) by the most expedient means, of relevant information, to include but not limited to, the distressed vessel's position, nature of distress and MMSI number. This information is normally included in the DSC alert and can be retrieved via the radio display.

For Coast Guard Cutters:

(a) As soon as possible, inform the CO/OinC of the contents of the distress alert.

(b) In areas where reliable VHF-FM DSC communications with one or more shore stations are feasible, CO/OinC's should defer acknowledgement so that a shore station can acknowledge the receipt of the call. Any cutter receiving a call that is not acknowledged by a shore station within 5 minutes should acknowledge the call using procedures in sub-paragraph (d) below.

(c) In areas where reliable VHF-FM DSC communications with a shore station are known not to exist, cutters that receive a VHF-FM DSC distress from a ship should, as soon as possible, acknowledge receipt of the distress alert.

(d) Cutters acknowledging receipt of a distress alert in accordance with subparagraphs (b) or (c) should:

(1) Acknowledge receipt of the alert on the VHF-FM voice distress channel 16 and attempt to establish communications with the distressed vessel.

(2) If unable to establish voice communications with the distress ship, cutters shall acknowledge receipt of the distress alert using the DSC acknowledgment function. This action will send a DSC acknowledgement message to the distressed vessel, and terminate the DSC distress call.

(3) Cutters that acknowledge receipt of distress alerts are responsible for informing the applicable Group or RCC (and OPCON/TACON, if different) by the most expedient means. Relevant information that could be available includes the distress vessel's MMSI number, position, and nature of distress. This information is normally included in the DSC alert and can be retrieved via the radio display.

2.2.5 VHF-FM DSC Distress Alert Response Policy: Coast Guard Shore Units

2.2.5.1 Purpose. To provide operational shore units with policy guidance for responding to VHF-FM DSC distress alerts.

2.2.5.2 Discussion. Rescue 21 will provide Coast Guard Sector operational shore commands with VHF-FM DSC capability. Until the Coast Guard is fully equipped with this capability, notification of receipt of a VHF-FM DSC distress call may be received by sectors via Coast Guard vessels and other mariners equipped with VHF-FM DSC.

2.2.5.3 **Public Education.** Because Coast Guard shore units will not be equipped with VHF-FM DSC equipment until the completion of Rescue 21, the maritime public should be advised not to use VHF-FM DSC for distress alerting purposes until the Coast Guard is equipped with DSC and the United States declares GMDSS Sea Area A1 operational. Coast Guard vessels which receive a distress call or shore units which receive a distress relay should not immediately acknowledge the call, but forward it to the respective District Command Center for evaluation and to coordinate a response because numerous relays could be received from multiple sources over a vast region.

2.2.5.4 **System Operation.** VHF-FM radios equipped with DSC maintain a continuous radio guard on VHF-FM channel 70, despite the channel the owner may tune manually on the front panel. As such, vessels equipped with these DSC radios can receive a DSC distress alert on channel 70. When a DSC distress alert is received, most of these radios will emit a loud audio alarm and automatically shift to VHF-FM Channel 16. The distressed vessel can then begin a voice transmission on this frequency. VHF-FM DSC distress alerts shall be considered the equivalent of a “mayday” call, and require the same level of response. Current shore-side VHF-FM DSC alert reception infrastructure is limited in the United States. The majority of VHF-FM DSC alerts received today by Coast Guard shore stations are relayed from non-Coast Guard vessels equipped with DSC radios. After Rescue 21 is installed in a region, VHF-FM DSC alerts will automatically be received via the Coast Guard’s National Distress and Response System.

2.2.5.5 **Action.** All VHF-FM DSC distress alerts shall be assumed to be distress incidents and will be classified in the distress emergency phase. Coast Guard shore units that receive notification of a VHF-FM DSC distress alert shall:

(a) Legacy System. Obtain relevant information from the reporting source, to include the distressed vessel’s position, nature of distress, voice frequency and MMSI number. This information is normally included in the DSC alert and can be retrieved by the reporting source via the radio display. DSC equipped radios are also capable of transmitting messages other than distress. Although the Coast Guard will only respond to alerts that are of a DISTRESS nature, it is prudent for units to monitor ALL SHIPS and SAFETY alerts in the event that a situation could further develop into a DISTRESS incident.

(b) Rescue 21 System. The R21 system will automatically alert the watch stander to a distress DSC call with an audible alarm and a red flashing pop-up box that contains the information provided in the data burst. The system will automatically query the MMSI database for the watchstander and provide additional vessel and vessel owner data that may be needed to carry out the case.

(c) Both Systems. Attempt to establish VHF-FM communications with the distressed vessel on channel 16. If unable to establish voice communications with the distressed vessel, the SMC shall issue an Urgent Marine Information Broadcast (UMIB). This is the minimum response requirement for VHF-FM DSC distress alerts. The UMIB shall include text requesting mariners and shore stations that received the VHF-FM DSC distress alert to contact the Coast Guard with their position. The UMIB shall be broadcast for at least one hour at 15-minute intervals. Radio call-outs are not sufficient--a UMIB is required.

(d) Both Systems. The SMC shall launch appropriate resources when there is sufficient information to establish a reasonable search area. In the absence of such information, search planners must engage in aggressive detective work, using every available means to narrow down a search area, including queries to ascertain if other boats or shore-based radios received the digital alert.

(e) Both Systems. It is also possible that the same distress alert may be received by multiple high-level or Remote Fixed Facility (RFF) sites. For these reasons, it is important that Coast Guard units communicate with one another to ensure role clarity (i.e. which unit is SMC) during VHF-FM DSC case prosecution. The Rescue 21 system will be able to break down the data stream to identify the RFF(s) the call was received on and indicate the quality and strength of the signal received on each RFF.

2.2.5.6 **SMC Responsibilities.** For sectors that receive notification from third party vessels within their AOR equipped with VHF-FM DSC, they shall handle the case according to established procedures for “mayday” calls. The reporting source should be queried for the following information specific to the DSC call:

(a) Category of call (verify distress),

(b) Nature of distress,

(c) Position (if the distressed position is unavailable, request the position of the vessel, agency or radio tower that received the DSC alert and, if R21 equipped, refer to the information provided to you in the data stream for the necessary information),

(d) MMSI number.

For DSC calls that cannot be correlated, a UMIB should be made, utilizing the distressed vessel's MMSI. If communications cannot be established, SMC should use the vessel's MMSI to query the MMSI Database maintained by OSC Martinsburg, the MARS database located on the ITU's website, or other sources in an effort to identify the distressed caller. Where no communications are possible, but a position is provided, assets should be dispatched to investigate as soon as possible. If no communications are possible and the MMSI is not registered then treat the distress call as an uncorrelated mayday (ref. 3.4.9).

For RCCs that receive notification from Coast Guard vessels within their AOR equipped with VHF-FM DSC, they shall collect the same information as above. SMC for VHF-FM DSC calls with a position that falls within a sector AOR may be delegated to the sector.

2.2.5.7 Case Claiming and Case Suspension. Units shall claim cases for VHF-FM DSC initiated distress calls according to the existing guidelines in this Addendum. Generally, a case shall be claimed and a MISLE report made by all units that dispatch resources, and by units that expend at least 30 minutes of effort in coordination/communications. Normal SAR case suspension procedures apply for those DSC initiated distress cases where:

(a) No communications with the distressed vessel can be established,

(b) No further information or means of contacting the vessel can be obtained from either database sources or other sources, and

(c) No position information is known.

2.2.5.8 Statistics. Each Sector will send a monthly report indicating the total number of VHF-FM DSC distress calls received and the number of actual VHF-FM DSC calls that were correlated to vessel in distress. Districts and Areas may establish their own procedures for the consolidation of data, but all input shall be forwarded by e-mail to cgcomms@comdt.uscg.mil no later than the tenth day of the month following the month being reported.

2.2.5.9 Process Improvement. All field units with DSC are encouraged to provide input to Commandant (G-RPR) and (CG-62) via their operational commander on any procedural problems encountered or any suggestions for improving DSC response policy.

2.2.5.10 False Alert Violation Reporting

(a) Unless a false alert is handled as a hoax case, a radio violation report should be submitted for every vessel, including foreign vessel in U.S. SAR areas of responsibility, for:

- Those who inadvertently transmit a false distress alert without proper cancellation, or who fail to respond to a distress alert due to misuse or negligence;
- Those who repeatedly transmit false alerts; or
- Those who deliberately transmit false alerts.

(b) Local Federal Communications Commission Field offices should be contacted to determine whether they will handle radio violations from foreign ships. If they will, violation reports should be submitted to them. If not, violation reports should be submitted to CG headquarters.

(c) Procedures for submitting violation reports are included in USCG Radio Frequency Plan, reference (o).

2.2.5.11 False Alert Feedback Solicitations

(a) When a false alert is received a message should be sent to the offending vessel to ascertain the details associated with the alert. For recreational or other small craft that may not have record messaging capability, a mailing address should be found if possible and a letter sent in lieu of a message. The message/letter should indicate we are requesting the information to assist in sorting actual distress calls from false alerts and to help improve DSC system performance. Receipt of the message/letter by the offending vessel will help to educate the mariner on the proper use of the DSC Alert and implications of false alerts. Information received should be used by RCC's to identify system weaknesses. This information should be forwarded to the Office of Search and Rescue (G-RPR).

(b) A sample message format is provided in Appendix C. The same text should form the basis of a false alert feedback letter.

2.2.6 VHF-FM DSC Response Policy: Coast Guard Aircraft

To be developed.

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Section 2.4
Maritime Mobile Service Identity (MMSI) Numbers

2.4.1 Introduction

The International Maritime Organization (IMO) has adopted the International Telecommunication Union's (ITU) Maritime Mobile Service Identity (MMSI) as an internationally recognized method for identifying distress alerts from automated radio equipment (i.e. DSC alerts). In addition, foreign 406 MHz EPIRBs are also being encoded with MMSI data.

MMSIs are nine digits and, like a call sign, uniquely identify a specific vessel. The first three digits of the MMSI indicate the country to which the vessel is registered. The final six digits serve as the Ship Station Identifier.

Vessels using MMSIs can be identified by consulting the MMSI database maintained by OSC Martinsburg (discussed below), or by contacting the following sources:

- For U.S. MMSIs (366, 367, 368 or 303): FCC Watch Officer (202) 632-6975;
- For Bahamian MMSIs (308): Bahamian Telephone Co. (their FCC): (809) 325-0747. Bahamian POC in UK: 44-71-493-5515 (daytime) 44-327-86-0075 (nights);
- For all other countries: ITU Publication "List of Ship Stations"; MARS Database on ITU website; or via POCs listed in the International RCC Directory.

2.4.2 MMSI Assignment and Registration

2.4.2.1 SOLAS Class Vessels. The FCC assigns and will continue to assign marine radio licenses (and MMSI numbers) to U. S. SOLAS class vessels, which were required to have a DSC capable radio by February 1, 1999. The FCC sends the information contained on the vessel licenses to OSC Martinsburg, for inclusion in OSC's MMSI Database.

2.4.2.2 De-licensing of Recreational Boat Radio Stations. An FCC regulation requires that all marine radio type accepted after June 1, 1999 have DSC capability. This only refers to new radio designs existing designs can continue to be manufactured as presently configured (without DSC) for as long as the manufacturer desires. Despite the fact that all newly type accepted VHF-FM marine radio types contain DSC, the de-licensing of recreational boat radio stations that occurred as a result of 1996 Congressional action also removed the most effective means of assigning MMSIs to this constituency.

2.4.2.3 MMSI Assignment for non-SOLAS Class Vessels. In order to avoid having recreational boaters apply for an otherwise unnecessary license from the FCC in order to receive a valid MMSI, and pay the corresponding licensing fee, a new process for assigning MMSI numbers has been developed. The FCC issued a Public Notice in March 1997, soliciting for alternative management of the MMSI issuing process for non-SOLAS class vessels. Boat U.S. and MariTEL have both signed a Memorandum of Understanding (MOU) with the FCC and the Coast Guard in which they are authorized to issue MMSI numbers for non-SOLAS class vessels. Boat U.S. and MariTEL have also agreed to collect registration data from boaters and to download this information to the Coast Guard for search and rescue purposes. Other organizations may also apply to the FCC to provide this service. MMSIs may be applied for online at http://www.boatus.com/mmsi.

2.4.2.4 MMSI Assignment for U. S. Coast Guard Vessels and Shore Units. Information concerning the process of determining or acquiring MMSIs for Coast Guard specific vessels and shore units can be found on the Office of Communication Systems (CG-62) web page: http://cgweb.uscg.mil/CG-6/CG-62/mmsi.shtml. This site also provides general information on the MMSI numbering system.

2.4.3 MMSI SAR Vessel Identification System

In response to the SAR Program's requirement for accurate registration information on the owners of DSC radios, OSC Martinsburg has replaced the SAR ID Database with the web-based Maritime Mobile Service Identity

(MMSI) Search and Rescue (SAR) Vessel Identification System ("MMSI Database") which is accessed via the MISLE interface application. This new database is a visual web-based application that provides the SAR Planner with a rapid, reliable means of obtaining vessel information when planning a SAR case. The application allows the user to search for vessel information by Vessel Name, Vessel Call Sign, Official or State Registration Number, MMSI Number, IMARSAT Number, EPIRB Registration Number, or Soundex Search (vessel name only).

Queries will return all communications and contact information available for the vessel from the MMSI Database, as well as from the Lloyd's database. The MMSI Database includes available information from TELENOR, Federal Communications Commission, Australian Maritime Safety Agency, International Telecommunications Union, International Registries – Liberia, International Registries – Marshall Islands, and also recreational boater information collected by SeaTow (www.seatow.com/boatingsafety/mmsiregistration.htm), MariTEL and Boat U.S (http://www.boatus.com/mmsi/). SAR watchstanders that work cases with vessels not registered in the MMSI database should add new records to the database with as much information as possible.

Section 2.5
National Distress and Response System (NDRS) & Rescue 21

2.5.1 General

The Coast Guard is authorized by federal law (14 USC 2) to develop, operate and maintain "...rescue facilities for the promotion of safety on and over the high seas and waters subject to the jurisdiction of the United States...". This authorizes the Coast Guard to provide distress and safety communications for the boating public, both commercial and recreational. The system established and maintained by the Coast Guard to provide this service is the VHF-FM National Distress and Response System (NDRS). The primary function of the NDRS is to receive distress alerts, coordinate SAR operations, and communicate with all maritime interests in waters (including inland waters) in which the Coast Guard has SAR responsibilities. A secondary function is to provide short-range command and control communications for all Coast Guard missions.

Since 1948, the Coast Guard has been dedicated to the concept of a terrestrial based VHF-FM System as the primary national system for short-range safety and distress communications. A VHF-FM project was established in 1970 to implement nationwide VHF-FM coverage; survey existing facilities, requirements, and needs; and forecast future Coast Guard mission requirements. The system was designed to provide short-range (20 NM from the coastline) distress, safety, and command and control communications in all areas of maritime activity where the Coast Guard had jurisdiction. The title "National VHF-FM Radiotelephone Safety and Distress System" was shortened to the "VHF-FM National Distress and Response System (NDRS)".

Currently the National Distress and Response System Modernization Project (NDRSMP) is replacing the NDRS short-range communication system outdated legacy equipment with an integrated communication equipment suite called Rescue 21. To clarify, the NDRS is the name for the short-range communications function, while Rescue 21 is the name of the equipment suite used to implement the NDRS function. Rescue 21 is an upgrade that is occurring not only to the remote communication sites and connecting infrastructure, but also at the Sectors, Groups, Stations, MSOs, and vessels.

2.5.2 NDRS Coverage

The VHF-FM National Distress and Response System (NDRS) provides distress, safety, and command and control VHF-FM communications coverage in all areas of maritime activity in which the Coast Guard has SAR responsibilities. Coverage is required for:

(a) Coastal areas to at least 20 nautical miles offshore and in adjacent tidal waters. In areas where heavy concentrations of boating activity exist greater than 20 nautical miles offshore, coverage will also be provided to the extent practicable.

(b) All large bodies of inland waters such as Puget Sound, Long Island Sound, Chesapeake Bay and the U.S. waters of the Great Lakes.

(c) Navigable waterways where commercial or recreational traffic exists and the Coast Guard has SAR responsibility.

2.5.3 NDRS Hardware

The current NDRS is a collection of independently controlled VHF-FM base stations with multi-channel transceivers located at more than 300 sites in the continental U.S. (CONUS), Puerto Rico and the Caribbean, Alaska, Hawaii, and Guam. Each site has a transceiver, an antenna, and remote control hardware. In most cases, primary power is provided commercially, although backup power is available at a few selected locations. Locations were selected and distributed to provide the widest coverage possible; consequently, NDRS hardware is frequently co-located with other non-Coast Guard communications equipment. Since antenna height significantly affects the coverage area, the Coast Guard attempts to locate these sites to provide the greatest possible antenna height. As a result, NDRS transceiver sites are frequently referred to as "High Sites". Sectors control base stations locally or remotely through the best available means. Particular attention was paid to optimizing the receiving capability. The system was designed to achieve a high state of operational readiness using leased equipment and maintenance contracts.

2.5.4 Channel 16

Channel 16, 156.8 MHz, is designated as the maritime international distress and calling frequency and is monitored by Groups on a 24-hour-a-day basis via the NDRS. When a non-distress call is received on this frequency, the caller is usually asked to move to a working channel, if possible, to keep the distress channel available. Great care must be used to ensure communications are not lost with the person(s) calling the Coast Guard, in distress or not.

2.5.4.1 **Active Listening.** Two-way radio communications are often less effective due to weak reception/transmission, atmospherics, language dialects, or a heightened emotional state due to an emergent situation. When the information received is not absolutely clear to comprehend, it is *strongly recommended* that an effort be made to repeat the most critical information back to the sender to affirm the specific details. Inaccurate or incomplete information can result in search planners and operational units coordinating a response in a different manner based on the information provided. Time spent on ensuring that the information received is valid and accurate is worthwhile so that responding units can maximize their efficiency. An additional benefit of this practice is that other mariners operating in the general vicinity of a distress situation are better informed regarding the case particulars and may be more inclined to render assistance in a more timely manner than a unit that has to deploy from shore or divert from another mission to respond.

{Example: "Roger Sir, I understand that you are disabled ¼ nautical mile southwest of the sea buoy and are in need of assistance."}

2.5.5 Other Uses of NDRS

In addition to distress traffic, the NDRS is the primary tactical, short-range command and control communications system used by Coast Guard Sectors, stations, and equivalent units. Typical uses include communications between Groups/stations and their underway vessels; MSOs and COTPs; and Vessel Traffic Service controllers and vessels. In addition to these uses, the Coast Guard must transmit marine safety information broadcasts over the NDRS at specified intervals. Note: that the receiver monitoring Channel 16 is inactive at any site that is transmitting safety broadcast or other VHF communications on the current NDRS system but once Rescue 21 is operational within a region, calls on Channel 16 can be received while transmitting.

2.5.6 Channel 16 Monitoring Requirements

All ships required to carry a VHF radio by SOLAS, Federal Communications Commission or Coast Guard regulations are additionally required to maintain a continuous watch on Channel 16. Ships are exempted from this watch only when participating in a vessel traffic service, or when communicating on another VHF channel.

2.5.7 New Capabilities Provided by the Rescue 21 System:

(a) <u>Available channels/circuits</u>

Each high-level site or Remote Fixed Facility (RFF) will have 6 channels/circuits.

VHF-1 – Open to select channels
VHF-2 – Open to select channels
VHF-3 – For asset tracking
UHF – Open to select channels
DSC – Dedicated to channel 70 (data only)
Channel 16 – Dedicated

The open channels can be distributed to the regional stations for use at the Sector command center's discretion. For example, each high level site has 3 channels for general use, and if a command center has 5 high-level sites within their AOR, then that totals 15 channels from which to choose for distribution. The Sector command center maintains full control of every RFF at all times.

(b) Digital Selective Calling

The basic functionality of DSC is described in Section 2.2. In addition to the basic functionality, Rescue 21 also provides the ability to plot the DSC call on a geographic display and to rapidly interrogate the MMSI database to obtain any available information associated with the originating MMSI.

(c) Asset Tracking

This upgrade will provide a continuous common operating picture of Coast Guard assets within a Sector's AOR. Coast Guard positions are recorded and transferred automatically to the Geo Display on the terminal for real time visual display of the common operating picture. Assets will also be automatically tracked even if they transit into adjacent AOR's. Once the assets pass into another AOR the signal will be picked up by the Sector command center in charge of that region. If an asset will be operating in another AOR for more than one day, then the watchstander needs to assign that asset to the new region (temporary assignment to another region). If this temporary assignment is not done, the vessel will miss it's polling from the home AOR and an alert will be displayed on the R21 system alert screen. **Note:** Assets not equipped with the Rescue 21 package (CG aircraft) will not transmit an asset-tracking signal.

(d) Communications Coverage

The Rescue 21 communications coverage has been upgraded to receive a transmission of a 1-watt radio 2 meters high out to 20NM. The majority of maritime radios are 5 to 25-watts and are higher off the water, increasing reception range.

In regions where the Remote Fixed Facilities or RFF's, formerly referred to as high-level sites, are shared (when one RFF covers a portion of 2 AORs), the Sector region in which the RFF resides will have primary control. If the shared RFF is needed to perform Coast Guard missions in the secondary region then the secondary user must request control of the RFF. The primary user will relinquish control of shared towers for higher priority missions, such as, SAR, MEDEVAC, etc.

(e) Conferencing or Phone Patching

Conferencing is a function that allows USCG radio operators to communicate with Federal, State or local agencies. For example, if a Coast Guard boat needs to communicate with an ambulance waiting on shore, the Group communications specialist is able to call the ambulance company and patch the ambulance and Coast Guard boat directly with a few keystrokes in a console-to-console connection. Once the two units are connected all transmissions will be heard over both of the frequencies being used by each asset. It is advisable that the Coast Guard use working channels when connecting into such a phone conference.

(f) Protected Communications (KMF)

To Be Developed with CG62.

(g) Data Communications

To Be Developed with CG-62.

(h) Automated Broadcasts

The automated broadcast feature can be used for single or repetitive radio broadcasts. The broadcast can either be recorded in the operator's voice or broadcast with a voice synthesizer. Once the broadcast has been composed, recorded and is ready for release, a prompt will confirm the request for release so that broadcasts are not released prematurely. Additionally, the prompt will reappear each time the broadcast is to air. This will allow the operator to cancel the broadcast if it is no longer needed or change the broadcast as necessary.

(i) Recording and Playback

To Be Developed with CG-62.

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Section 2.7
Cellular Telephones and *CG

2.7.1 Cellular Telephones

Maritime cellular telephone usage is growing rapidly, and an increasing number of boaters are relying on cellular telephones in conjunction with, or sometimes instead of, VHF-FM radio to communicate with the Coast Guard. Cellular telephones can be a reliable supplemental means of communication for boaters in distress to contact the U.S. Coast Guard for help. However, they are NOT a replacement for VHF-FM radio, which remains the most effective and preferred method of voice communications, particularly in an emergency. While a cellular telephone is not the recommended or preferred method of distress communications, when properly used it does meet the requirements of reliable communications as outlined in the Maritime SAR Assistance Policy.

NOTE: Cellular telephones are NOT a replacement for VHF-FM radio.

2.7.1.1 The Coast Guard continues to encourage the use of VHF-FM radio as the primary method of distress notification. Cellular telephones are not an "alternative" to VHF-FM, which affords additional functionalities that are valuable in SAR, in contrast to the serious limitations of using a cellular telephone, particularly in an emergency.

- VHF-FM allows broadcast capability while cellular limits communications to point-to-point communications. Cellular telephone conversations cannot be heard by other boaters in the area who may be in a position to render immediate aid to someone in distress.
- VHF-FM allows easy direction finding on the generating station. Determining the general area (generally a 10-15 mile radius) of a cellular call requires close coordination with cellular service providers to identify the cellular "cell" from which it was placed, which is a time consuming endeavor.
- VHF-FM allows mariners to easily receive Broadcast Notice to Mariners, Urgent Marine Information Broadcasts, Urgent Weather Advisories, and Marine Assistance Request Broadcasts while cellular telephones will not receive this critical information.

2.7.1.2 Due to the limitations of cellular telephones, as outlined in paragraph 2.7.1.1, SAR checklists should include the following additional items for cases involving their use:

- caller's complete cellular telephone number including area code,
- user's cellular service provider or carrier (i.e., "Bell South Atlantic"),
- whether or not a roam number is needed to recall the user and what the complete roam number is,
- whether or not other means of communications are available (establish other communications with the caller before terminating the cellular call),
- wattage of the cellular telephone, antenna height from the waterline, and approximate battery strength,
- establish a communications schedule or require the caller to call back at a scheduled time if possible; ensure user understands the cellular telephone, if there is sufficient battery strength, must not be turned off in order to receive further communications,
- ask if the user has an alternate power source available, such as a charged back-up battery or the ability to plug into the boat's power system,
- if a Maritime Assistance Request Broadcast will be made, notify the caller that their cellular telephone number will be broadcast when the Commercial Assistance Provider or Good Samaritan contacts the Coast Guard on the alternate working frequency,
- obtain a shore-side point of contact.

2.7.1.3 Most cellular service providers offer some of the following services to assist in locating the origin of cellular calls from disoriented boaters.

- **Call Trace:** As long as there is a connection, the carrier's technician can determine which cell is receiving the call and, if power and antenna height are available, an approximate arc of distance from the cell tower.
- **Call Trace Modified:** After the call is initiated and the technician is notified, the caller can be instructed to call back at a specified time and the technician can determine through the use of signal strength at several cell sites, a more accurate probable position of the caller.
- **Cell Traffic Recording:** A carrier can determine the cell location of the last call placed by the subscriber given the cellular telephone number.
- **Tap:** This function provides notification when a call is made from the user's phone; beneficial in overdue cases.
- **Caller ID:** Indicates the number of the calling party, provided CG emergency line does not go through most private branch exchanges (PBX). Requires subscription from local carrier. If number is not displayed, Caller ID indicates whether carrier limitation or privacy blocking is the cause.

2.7.1.4 Cellular Tower Locator. When a distress call is received via Cell Phone and the caller's location is not known, use the procedures in Figure 2-2 to identify the location of the cell tower and determine the tower's footprint. To supplement this procedure, a list of information to pass and questions to ask when talking with the cellular provider are provided in para. 2.7.1.5 below.

Step	Action
1	Obtain the caller's name, cellular number, and cellular provider.
2	If unable to obtain provider from the caller, enter the cellular number into http://www.fonefinder.net/ to determine the provider.
3	Contact the provider's Subpoena/Court Order Compliance Center and request the tower location (and height) for the most recent call. SPRINT PCS – (877)276-1034 AT&T – (800)635-6840 option 4 VERIZON – (800)451-5242 option 4 US CELLULAR – (630)875-8270 or (865)777-8200 (after hours) NEXTEL – (703)433-4398 option 1
4	Explain that you are from a Coast Guard emergency response center; you have received or are the intended recipient of a distress call from a cellular phone serviced by the provider IAW 18 U.S.C. § 2702(b)(1) & (3). ***If applicable***, tell the provider's Center that you have determined that an emergency exists that involves immediate danger of death or serious physical injury; IAW 18 U.S.C. § 2702 (b)(8), this emergency justifies disclosure of cell tower information without delay.

Figure 2-2 Cellular Tower Locator Process

(a) Communication companies are very reluctant to release information regarding their customer's communications as this may open them to lawsuits for violating their customers' privacy. There are essentially two statutes that will allow communication companies to release information to law enforcement organizations: 18 U.S.C. § 2703 and 18 U.S.C. § 2702.

(b) 18 U.S.C. § 2703 pertains to criminal investigations and requires a communication company to divulge requested information when presented with either a subpoena or a court order. Communication companies are very familiar with this statute; however, as it is geared towards criminal prosecution, it does not apply in the case of the Coast Guard trying to obtain electronic communications information to aid in SAR.

(c) On the other hand, 18 U.S.C. § 2702 is applicable when trying to obtain electronic communications information to aid in SAR. However, communications companies are not as familiar with this statute and some "operators" may think that a court order or subpoena is needed when this is not the case. Consequently, you may need to educate the operator on § 2702.

(d) In the SAR context, § 18 U.S.C. 2702 permits, but does not require, providers to disclose call-identifying information under any of the following circumstances:

(1) Section 2702(b)(1) permits providers to disclose call-identifying information "to an addressee or intended recipient of such communications or an agent of such addressee or intended recipient." SAR controllers may apply this provision when receiving a call directly from the mariner seeking assistance or when receiving a third-party relay of a request for Coast Guard assistance. Likewise, this provision would apply if any "agent" of the Coast Guard, including but not limited to off-duty Coast Guard personnel or Auxiliarists received the initial cellular call and then relayed it to the SAR controller.

(2) Section 2702(b)(3) permits providers to disclose call-identifying information with "the lawful consent of the originator or an addressee or intended recipient of such communication." SAR controllers may apply this provision using a three-way call between the distressed mariner, the SAR controller, and the provider, which allows the provider to confirm consent of the originator. Likewise, but perhaps more difficult for providers to accept, the Coast Guard may consent to the release of call-identifying information when it is the addressee or intended recipient. Providers may be reluctant to implement this authority in the absence of authentication from the originator.

(3) Section 2702 (b)(8) permits providers to disclose call-identifying information to a "Federal, State, or local government entity, if the provider, in good faith, believes that an emergency involving danger of death or serious physical injury to any person requires disclosure without delay of communications relating to the emergency." SAR controllers may apply this provision if the position uncertainty or other factors create an "emergency involving danger of death or serious physical injury to any person." When asserting this basis for disclosure, controllers should explain to the provider fact supporting the emergency rationale underlying the request.

(e) Because §2702 does not require the communication company to release the requested information, unlike §2703, the Coast Guard caller may need to convince the communication company that there really is an emergency and that the situation falls within 18 U.S.C. § 2702.

(f) Getting the desired cellular tower information should normally not be a problem. However, the various communication companies do vary on their policies regarding the release of the information. For some, it is harder to get from than others. The same is true regarding the operators with whom you will speak to. You may need to be persuasive. If the operator does not give you the desired information, ask for the supervisor. If the supervisor will not give it to you, call the duty attorney.

2.7.1.5 Information to pass and questions to ask when talking with the cellular provider. SAR Controllers should tell the Service Provider Operator the following things:

(a) If you have the distressed caller on the three-way line:

(1) I am with the United States Coast Guard.

(2) I am a search and Rescue Operator/Controller.

(3) I have on the line a person who is one of your wireless service customers, and who right now requires assistance from the Coast Guard. Their distress call was received via his/her cellular telephone.

(4) In order to dispatch search and rescue resources I will need to know what cell or quadrant this phone call is being made from and which tower is receiving this transmission.

(5) Since your customer is on the line with me now, he can authorize you to release that information to me right now.

(6) Please go ahead operator and ask the caller what you might need to release this information to me now.

(b) If you can not keep the caller on the line, or do not have access to three-way calling, or received the distress call via relay from a third party, then tell the service provider:

(1) I am with the United States Coast Guard.

(2) I am a search and Rescue Operator/Controller.

(3) I have just received a distress call from a person calling on a cellular phone serviced by your company. I have the name and telephone number of the caller.

(4) In order to release search and rescue resources I need to determine the location of this caller.

(5) The only way to determine the position of the caller is to utilize the information you have on the cell and tower position of this call.

(6) Pursuant to Federal law, the Coast Guard, as a law enforcement entity and federal agency with emergency response authority is entitled to this information if it is the intended recipient of the call or in the event that lives are in danger. It is our belief that the Coast Guard was the intended recipient of this maritime distress call [and, ***if applicable***, if we do not dispatch search and rescue resources to this call this person could be injured or killed].

(7) Would you please release this information to me?

(c) If you get resistance from the operator:

(1) I am prepared to fax to you and to your supervisor a memorandum drafted by our lawyers and signed by the Coast Guard District (or Sector/Group) Commander explaining this authority and why you should release such information as soon as possible. (see para. 2.7.1.6 below)

(2) Can I please have your fax number and the name of your supervisor? I need to bring this to his/her attention as soon as possible.

(d) If there is still resistance:

(1) Please give me the contact information for your in-house attorney. This matter needs to be dealt with as expeditiously as possible.

2.7.1.6 **Standard Release of Call-Identifying Information Letter.** If, after explaining the SAR situation and relevant authority to the provider, the SAR controller is unsuccessful at securing a disclosure of information from the provider, the SAR controller should have available a standard letter, signed by the USCG District or Sector Commander that can be immediately faxed to the provider's offices. This letter, on USCG letterhead, should explain the legal authorities under which the release of the call-identifying information is allowed. The SAR controller should encourage the provider's operator to consult with available management. The following is a Sample Letter Requesting Release of Call-Identifying Information:

3130
Date

Cellular/Wireless Communications Provider
Fax Number:

Dear Sir or Madam:

I am faxing this letter to request the urgent release of the cellular quadrant and tower location of the call made from the cellular telephone number (insert #) in accordance with 18 § U.S.C. 2702.[1] The caller has made an emergency distress call intended for the U.S. Coast Guard.[2] [***If appropriate***: *This is an emergency involving danger of death or serious physical injury to any person requiring disclosure without delay of communications relating to the emergency*. **If available, add brief summary of facts supporting this statement.**] Without the cell quadrant or tower location, the Coast Guard may not be able to locate the caller in time to render assistance to the caller and his/her passengers.

Please release this call-identifying information to my search and rescue controller. If you have any questions, I urge you to contact your supervisor and legal counsel immediately. Time is of the essence.

Thank you very much for your cooperation.

Sincerely,

RELEVANT COMMANDING OFFICER
CAPT/CDR
U. S. Coast Guard

[1] 18 U.S.C. § 2702 (b) provides:

A provider… may divulge the contents of a communication—

(1) to an addressee or intended recipient of such communication or an agent of such addressee or intended recipient;
. . .
(3) with the lawful consent of the originator or an addressee or intended recipient of such communication, or the subscriber in the case of remote computing service;
. . .
(8) to a Federal, State, or local government entity, if the provider, in good faith, believes that an emergency involving danger of death or serious physical injury to any person requires disclosure without delay of communications relating to the emergency.

[2] 14 U.S.C. § 88 provides: "In order to render aid to distressed persons, vessels, and aircraft on and under the high seas and on and under the waters over which the United States has jurisdiction and in order to render aid to persons and property imperiled by flood, the Coast Guard may . . . perform any and all acts necessary to rescue and aid persons and protect and save property."

2.7.2 *CG Agreements/Routing of *CG Calls

In many areas of the country, cellular service providers have implemented a "*CG" access code that routes calls from boaters directly to the applicable Coast Guard operations centers, free of charge to both the boater and the Coast Guard. Other cellular service providers may also wish to implement "*CG." While *CG Agreements should not be initiated by Coast Guard commands, units that are approached by companies that desire to implement this service should actively partner with them to facilitate an agreement. Additionally, Coast Guard commands should also continue partnering with those companies that already provide *CG service to ensure that provisions of the agreement are being met. *CG agreements between cellular telephone companies and the Coast Guard should generally be coordinated at the District level. Within these agreements, the routing of *CG calls should be done to the most appropriate District RCC or Group Operations Center. Appendix L is an approved template that should be used for all *CG Agreements.

2.7.2.1 ***CG Agreement Provisions.** Coast Guard agreements with cellular service providers to provide *CG service shall include the following:

- *CG service shall be provided at no cost to the government or the boating customers.
- All publicity regarding *CG will accurately portray Coast Guard policy regarding use of cellular telephones for distress notifications.
- The Coast Guard will provide appropriate telephone numbers for call routing.
- *CG calls will automatically be routed to the appropriate and responsible Coast Guard resource.
- Cell location and coverage charts/maps detailing geographic location and identification of cell sites will be provided by the cellular service provider.
- Cellular service providers will furnish a 24-hour point of contact for "tracing" *CG calls and providing cell origination information.

2.7.2.2 All agreements with cellular service providers shall be made at no lower than the Group command level. Copies of all agreements within a District's SRR shall be held at the District.

2.7.2.3 **Limitations of *CG.** *CG service is a reliable supplemental means (to VHF-FM radio) of contacting the Coast Guard for help. *CG has the same limitations noted in paragraph 2.7.1.1. Additionally, a distress notification may be delayed if a boater normally operates in an area that has *CG and then tries to call the Coast Guard using *CG in an area where the service is not provided.

2.7.3 911

The *CG network does not replace the 911 telephone system; thus the Coast Guard must still be proactive in ensuring that maritime distress calls to 911 are promptly routed to the proper Group operations center (in some areas it may be to the SAR unit).

Section 2.8
Electronic Mail

2.8.1 E-mail Policy

Some communications providers offer satellite electronic mail capability. Electronic mail was not designed for distress communications, and the Coast Guard does not endorse the use of electronic mail for distress alerting purposes. The Coast Guard will not provide e-mail addresses to the public for the purposes of facilitating e-mail distress alerts, and no RCC or Command Center shall be required to monitor electronic mail for distress alerts.

2.8.1.1 **Although the Coast Guard does not endorse the use of e-mail for distress alerting, all discernable distress alerts--regardless of format--shall be acted upon expeditiously by Coast Guard personnel.** Coast Guard units that receive an e-mail distress alert shall notify the appropriate Coast Guard RCC by telephone. E-mail distress alerts should not be forwarded by e-mail, except as a follow-up to telephone notification to an RCC.

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Section 2.9
Lost Communications with a Coast Guard Asset

2.9.1 Lost Communications Procedures

Chapters 14 and 15 of reference (q) discuss communications requirements for Coast Guard vessels and aircraft. Communications schedules (comm. skeds) for operational cutters, boats, and aircraft are established by the cognizant Operational Commander (OPCON). The decision to initiate a Search and Rescue case following lost communications with a Coast Guard asset is also the responsibility of that unit's OPCON. This decision is a judgment call, but units should not wait to alert the SMC once a comm sked is missed and subsequent attempts to contact the asset fail. For units equipped with the Rescue 21 system upgrade see section 2.9.1.3 – To Be Developed.

2.9.1.1 The following is taken from Chapter 15 of reference (q) regarding Lost Communications with a Coast Guard Aircraft: "If the Aircraft Commander fails to check in on the primary or secondary frequency within five minutes of their communications schedule, the guarding station shall initiate an alert. The aircraft's parent command shall be notified first, followed by the cognizant District Command Center…."

2.9.1.2 As with all search and rescue incidents, time is the enemy of a successful outcome. Lost Communication cases are essentially "overdues," but unlike most cases of overdue private vessels, the stringent communications schedule requirements of Coast Guard assets allow the SMC to proceed more rapidly through the Uncertainty to Alert to Distress emergency phases.

2.9.1.3 To Be Developed. The Rescue 21 procedures for lost communications will be developed and refined during the system Operational Testing and Evaluation process. A decision process and procedure for determining the cause of the loss of communication will be developed and incorporated.

Lost Communications vs. Out-of-Range – To Be Developed.

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Section 2.10
Recorded Radio Transmissions and Telephone Lines

2.10.1 Guidance

2.10.1.1 The following guidance is taken from pages 1-5, 1-6, and 1-7 of reference (q):

Use of Recording or Monitoring Equipment

Coast Guard personnel, in the conduct of their official duties, may not engage in clandestine, surreptitious, or other covert use of telephone recording, listening, or monitoring equipment or aid or acquiesce in the use of such equipment.

Recording equipment is authorized for use at Coast Guard Command Centers, VTS, and COMMCEN units to record telephone or radio conversations since they primarily concern air safety, maritime safety, or SAR. The Coast Guard will not require beep tones or prior consent for the recording of calls.

Equipment installed on telephone lines only to provide a recorded announcement, voice mail service, or invite the caller to leave a message are considered office labor saving devices rather than communications equipment, and do not require approval.

Authorization to install and use monitoring equipment for situations not listed above must be obtained from the servicing legal office.

Inviolability of Information. The Coast Guard adheres to a policy of “inviolability” regarding the handling of wire or radio communication information. “Inviolability” means that no communicated information (including organizational messages, e-mail, and voice) will be released or divulged beyond the expectation intended by the originator of the information. Refer to Chapter 9 of this [Telecommunications] manual for additional information on internal routing and readdressals.

The Coast Guard frequently intercepts communications from masters to owners reporting their vessel disabled, aground, or in a condition that indicates the possible need for assistance. The Coast Guard, in the performance of its duty to protect life and property at sea and along the coast, may properly act on this information and offer the services of the Coast Guard to the vessel in need of assistance. THIS INFORMATION THUS OBTAINED SHALL NOT BE RELEASED FOR PUBLICATION.

Broadcast messages without designation of address are addressed to all concerned and there is no restriction on their release.

2.10.1.2 Public requests for the release of recorded radio or telephone transcripts shall be referred to the applicable Servicing Legal Office.

2.10.2 Recording Manipulation Software/Devices

In some instances the use of recording manipulation software/devices may be required to help determine the validity of distress, uncorrelated mayday, or hoax calls. The use of any recording manipulation software/devices is intended as a tool to help the SMC to make a logical determination for escalation and/or suspension of a SAR case where the caller’s intent is uncertain. SAR case packages shall include a copy of the original unedited recording, and a copy of the final edited version used to help make any escalation or suspension decisions.

R21 Specific Procedures To Be Developed.

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Section 2.11
Ship Security Alert Systems

2.11.1 Background

The International Maritime Organization Safety of Life at Sea (SOLAS) regulations mandate carriage of shipboard equipment called Ship Security Alert Systems (SSAS) for sending covert alerts to shore for vessel security incidents involving acts of violence (such as piracy or terrorism). The regulations went into effect 1 July 2004 for new passenger and cargo ships of at least 500 gross tons; existing passenger vessels and cargo vessels must have the equipment installed prior to the first radio survey after July 1, 2004 but before July 1, 2006. While not directly related to Search and Rescue operations, SSAS systems impose several unique procedural requirements and the potential for incidents involving dual or ambiguous alert involving both security issues and SAR response.

Vessel security incidents include all events that potentially compromise the safety of a vessel's crew or pose a potential security threat to other vessels or coastal states through acts of violence or terrorism. Annex J of reference (l) provides specific Coast Guard policy guidance for actions in response to a variety of vessel security incidents. Ship Security Alert Systems provide one means of external alerting for a vessel security incident, but by there nature, require specific actions upon receipt by the Coast Guard in addition to the guidance in reference (l).

2.11.2 Routing of Ship Security Alerts

The SSAS transmits a security alert to the Coast Guard either directly or via a communications service provider (CSP) indicating the security of the ship is under threat or has been compromised. The shipboard portion of the system is intended to allow covert activation without raising the alarm onboard or with other ships. According to IMO standards, flag states, upon receiving a ship security alert, must notify the coastal state in whose vicinity the ship is operating and authorities of other nations. Additionally, it is imperative that the flag state authority not attempt to contact the ship directly in order to preserve the covert nature of the alert. As the recognized flag state authority for the United States, PACAREA is responsible for receiving and initial actions resulting from Ship Security alerts.

While communication service providers should always route SSAS alerts directly to PACAREA for initial processing, there have been instances where initial SSAS alerts are routed to other command centers simultaneously or in lieu of PACAREA. Upon receipt of an SSAS alert, command centers should immediately notify and forward the alert to PACAREA.

2.11.3 Dual and Ambiguous Alerts

The nature of a ship security alert means the sending vessel is in a distress situation albeit due to a security threat. Through alternative means of communication (DSC, EPIRB etc), the distressed ship may endeavor to secondarily alert response authorities of their situation. In those instances where a vessel sends dual alerts or there is ambiguity as to the nature of their alert, PACAREA, along with the geographically responsible command center shall make every effort to determine the status of the vessel without contacting the vessel directly. If after attempting to resolve the ambiguity it is unclear whether the vessel incident clearly is either a search and rescue incident or rather, a vessel security incident, operational commanders shall respond to the incident as a SAR case while using due diligence to ensure that responding resources are aware of the potential threat and must evaluate the situation once on scene.

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CHAPTER 3
SEARCH PLANNING

Section 3.4
Initial Response, Search Planning, and Search Operations

Effective, efficient prosecution of a SAR incident requires well thought out procedures. Not every incident will develop into a full-blown SAR case, but every case has the potential to greatly expand. Guidance within this section will aid the SAR Controller in developing the thought process for a rapid and thorough reaction upon receiving notification of a potential or actual distress.

3.4.1 Offshore Incidents

As defined in reference (a), the Commandant has divided the Maritime SAR area into two sections, Atlantic Area and Pacific Area Commands, responsible for efficient coordination between all SAR regions and sectors within their sections. The Area and District RCCs generally have responsibility for offshore incidents. Search planning is done with either JAWS or CASP in accordance with the guidance provided above.

3.4.2 Coastal Incidents

3.4.2.1 **Initial Response Search Area.** The Sector Command Center generally has the responsibility for coastal incidents. When an SRU is dispatched, it should be sent to the datum position where the search object is expected to be when the SRU arrives on scene. This includes estimating the object's drift between the time of the incident and the ETA of the SRU on scene if the search object was not reported to be anchored or aground. Often it will be sufficient to mentally estimate the drift based on local knowledge and/or on scene conditions due to the short time spans with initial responses near the coast. When the search object is not located upon arrival on scene, the default initial response is to conduct a search with an average coverage of 1.0. For an expanding square search (SS), this means the track spacing should equal the sweep width. For a sector search by a surface craft, this means the search radius should be about twice the sweep width. For aircraft SRUs, the minimum radius should be the distance the aircraft can cover in one minute at search speed, or twice the sweep width, whichever is larger. Since aircraft can often cover the area several times in a short period, they should cover the area repeatedly until coverage of at least 1.0 is reached. For example, if the search speed were 90 knots and the sweep width was 0.1 NM, then a single six-sector pattern with a radius of 1.5 NM (distance covered in one minute at 90 knots) would achieve a coverage of about 0.19 in about 9 minutes. Covering the area six times would produce a total average coverage of about 6 x 0.19 = 1.1 in about an hour. If the reported position of the distressed craft is in shallow water, it could be either anchored or adrift. Orient the search area and the first leg in the direction of drift, that is, in the same direction as the total drift vector. If success is not achieved quickly, extending the search down the drift line may also be appropriate.

3.4.2.2 The SRU shall also keep the SMC constantly updated on conditions, findings, and when nearing completion of the initial response search. This direction should not preclude a SRU from using an alternate search pattern or area when it is clearly indicated (e.g., narrow waterway or other physical barrier).

3.4.2.3 First SRU on scene procedures. Pre-established operations and search procedures for the first SRU on scene are to immediately report the on-scene conditions and findings to the SMC. If the object of the SAR incident is not initially located, begin the appropriate search pattern. **Important note:** The objective is to perform an accurate search pattern *relative to the search object*. If the search object is adrift and likely to have a high drift rate (strong winds and/or currents), it is often better for surface SRUs to use more traditional DR navigation techniques without correcting for set and drift than to use modern high-precision navigation systems like GPS to trace a nearly perfect pattern over the bottom. The DR technique automatically compensates for the water current component of the search object's drift, which is especially important when searching for PIWs. For aircraft SRUs, the same effect may be obtained by deploying a smoke float at datum and flying the search pattern relative to that object. Surface SRUs may also find smoke floats to be helpful aids.

(a) For surface SRUs -- usually an expanding square search (SS) is performed. If the search area is confined or there is reason to have a high degree of confidence for the selected datum (i.e., debris found), the surface SRU may use a sector search (VS). For an initial search, use the appropriate track spacing from Table 3-1 when the sweep width is not readily available.

(b) For helicopter SRUs. Helicopters are a suitable platform to perform SS and VS pattern searches. Depending on the proximity to the coast and environmental conditions, an area with a larger radius covered multiple times may be appropriate for a helicopter during the initial search due to a higher search speed. For an initial search, use the appropriate track spacing from Table 3-1 when the sweep width is not readily available.

Table 3-1 Initial Track Spacing

Initial Track Spacing (NM)		
	Good Conditions	Poor Conditions
Search Object	wind < 15 kts seas < 3 ft	Wind ≥ 15 kts seas ≥ 3 ft
PIW	0.1*	0.1*
< 15 ft	0.5	0.2
≥ 15 ft	1.0	0.5
* or > 0.1 depending on SRU's minimum navigational accuracy and maneuvering capability		

3.4.2.4 SMC Action. In coastal SAR, the initial response datum shall be quickly established. In the interest of saving time and effort when doing drift computations manually, the datum for the initial response may be determined by calculating drift using the object's last known position and the effects of water current and wind without considering leeway divergence (Figure 3-1). Time of datum must take the underway and transit times for the SRU into consideration. When using JAWS or CASP, there is no time or effort penalty for including leeway divergence so it shall be included when those tools are used, which is the default mode.

If the initial response SRU reports arriving on scene without finding the search object, the SMC shall develop a more comprehensive search plan and shall notify appropriate additional resources that they may be needed and may deploy some of them immediately if conditions warrant. Examples of such conditions include, but are not limited to, the survival prospects of the distressed person(s), remaining daylight hours, remaining endurance of the initial response SRU, etc. In any case, no more than two hours should be allowed to elapse after the initial resource arrives on scene before a more comprehensive search plan is put into effect, which may require deployment of additional resources.

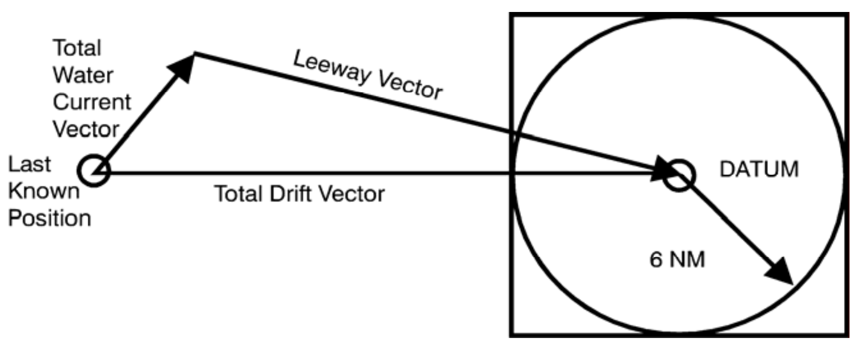

Figure 3-1 Vessel Adrift (Quick Manual Calculation for Initial Response)

(a) Factors to be considered for establishing this initial datum in coastal conditions are primarily tidal, river, coastal, longshore and wind driven currents. SMCs shall maintain data on water currents applicable to their local SAR environment. The annotated bibliography contained within Appendix K has excellent sources of such information.

(b) Local sources such as marinas, Coast Guard Auxiliarists, harbor masters, sailing and yacht clubs, pilot stations, oceanographic research institutions, state fish and game or park services, local sheriff and marine

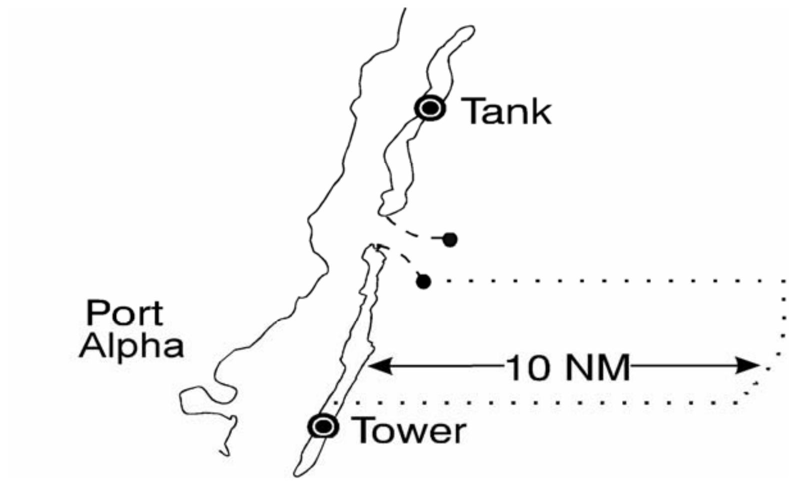

Figure 3-6 Landmark Boundaries Method

3.4.2.8 Track Spacing. Track spacing (S) is the distance between adjacent parallel search legs. The desired track spacing is a function of corrected sweep width, which is a measure of detection capability and will vary with search object type and environmental conditions, and the desired coverage. For a given desired coverage, the more difficult an object is to detect, the closer together the search legs must be.

NOTE: In darkness or extremely low visibility, surface search craft should periodically stop their engines and conduct an auditory search. If it is known or if there is a high probability that the PIW has night detection aids, a search may be conducted with track spacing compatible with the sweep width for the type of detection aid.

(a) Track Spacing by search object type, size and search unit. Detection capability also varies by search unit. The Tables and Graphs in Appendix H show the uncorrected visual sweep widths for search platforms for certain objects and correction factors for weather, fatigue and altitude in the case of aircraft. The most frequent search platforms used by Coast Guard resources for coastal SAR cases are small cutters (WPB), boats (MLB/UTB/UTM), and helicopters (HH-65/HH-60J). It is recommended that Coast Guard units copy and laminate the appropriate tables from Appendix H for each SRU and include them in the SRU pilot or coxswain kit as a quick on scene reference for initial searching while more thorough search planning is being conducted.

(b) Persons in the Water (PIWs). In most cases, a track spacing of 0.1 NM is the lower practical limit for accurate surface navigation, and is recommended for coastal surface PIW searches. Search legs for helicopter SRUs should allow at least one minute of level flight. Once on scene, helicopters should search the assigned area repeatedly using patterns of different orientations to achieve a coverage equivalent to a 0.1 NM track spacing when searching for PIWs.

3.4.3 Flare Incidents

Now that Federal law requires flares on all vessels, assistance cases are routinely affected as a result of response to flare sightings. The nature of flare distress signaling makes planning and execution of searches difficult due to:

- The wide variation of flare types;
- Range of possible maximum altitudes;
- The skill level and position of the reporting source/observer;
- The weather; and several other factors.

For that reason, the accuracy of the initial information received from a reporting source and/or observer is most critical. As with all SAR cases, a prompt, thorough and proper response yields the greatest chance of affecting a rescue. Otherwise, the search planner may have no choice but to dispatch SRUs to search a large area to account for long range sighting possibilities. For example, a hand-held flare in a recreational boat seen on the horizon by a beach observer, assuming the observer's eye and the flare are both six feet above the water, will be approximately 5.75 NM away while a parachute flare rising to 1200 feet and seen on the horizon by the same beach observer could be more than 40 NM away. Specific policies regarding response to flare incidents follow. Guidance on evaluating and planning for distress flare incidents is provided in Appendix I.

3.4.3.1 **Red and orange flares and pyrotechnics** are recognized as marine and aviation emergency signals and shall be treated as a distress and responded to unless available information indicates otherwise. Unresolved (insufficient information to either close or suspend) red or orange flares require first-light searches.

3.4.3.2 **Other flares and pyrotechnics**: Searches and follow-up searches for the sources of flares or other pyrotechnics other than red or orange flares will depend on the specifics of the case. These sightings should be carefully investigated to determine the appropriate level of response.

3.4.3.3 **Initial Search Object.** When a flare is observed at night, the initial search object should be the distress-signaling device unless other information indicates a specific object, such as the reporting source observing the point of origin (vessel, PIW, etc.).

(a) If search object drift is required, the same provisions for drift for first light searches should be followed.

(b) The provisions of section 3.4.5, which covers night and reduced visibility searches, should guide subsequent night searches.

(c) When a flare is observed in daylight, the guidance provided for first light search objects should be followed.

3.4.3.4 **First Light Search Object.** When planning a first light search following a flare sighting, in the absence of local information on probable search objects, the planner should use the factors for drift associated with the object listed in Table H-3 as: power vessel/sport boats/cuddy cabin /modified v-hull. A similar object for sweep width should be chosen (power boat 20 foot) unless local information would justify another object.

3.4.4 Distress Beacon Incidents

Distress beacons are one of the most important tools available to SAR authorities. The various distress beacon systems are covered in Chapter 3 of reference (a) and Section 2.1.4 of this Addendum.

3.4.4.1 **Risk Management Regarding Alert Positions.** In some instances, the indicated position for an alert is so significantly distant from available SAR resources that it is impractical to immediately dispatch resources to assist. Similarly, there are situations in which distress alert information is sketchy and the immediate dispatch of SAR resources would jeopardize the safety of others or leave a relatively large area of responsibility (AOR) without SAR coverage. In these situations, RCCs should spend a reasonable amount of time investigating and evaluating the situation prior to dispatching resources. Additionally, RCCs may attempt to alert alternative resources (e.g., Good Samaritans, Amver participants, other agencies, etc.) that may be in a position to assist.

3.4.4.2 **Response Policy.** In response to beacon alerts, RCCs should consider all available information such as position information, registration information, and the presence of corroborating information. RCCs should evaluate reports and attempt to correlate them with other indications of distress. Concurrently, they should attempt to obtain additional information on those involved. RCCs should expand their investigations as necessary to aggressively pursue the cause of alert signals and dispatch resources to assist, as circumstances require. Types of beacon alerts and response policy guidance are presented in Table 3-4 below.

(a) Audible beacon alerts don't always indicate distress. Historically, many of these alerts have been false alarms resulting from hard aircraft landings or caused by crew error during vessel maintenance. Reports of audible beacon alerts indicate a beacon has been activated. SAR response to an audible beacon signal should be similar to the type of response provided for flare sightings. In cases where Coast Guard resources hear the beacon, they normally respond immediately and determine the signal source. Most other audible signal reports come from commercial aircraft and will help determine general beacon location.

Table 3-4 Beacon Alert and Corresponding Emergency Phase

BEACON ALERT	EMERGENCY PHASE
• 121.5/243 MHz Composite Position Update alert • 406 MHz GEO registered alert, unlocated alert • 406 MHz GEO unregistered, unlocated alert with digital encoded GPS position ("E" Solution) • 406 MHz LEO "A" solution alert • 406 MHz LEO registered, unlocated alert • 406 MHz LEO unregistered, unlocated alert with digital encoded GPS position ("E" Solution)	Initially evaluate as Distress
• 121.5/243 MHz First report of audible alert • 121.5/243 MHz Ambiguity Resolution Alert • *406 MHz LEO "B" solution alert with probabilities > 20%	Initially evaluate as Alert. Investigate, reevaluate and respond as facts and circumstances warrant.
• 121.5/243 MHz first alert • *406 MHz LEO "B" solution alert with probabilities ≤ 20%	Initially evaluate as Uncertainty. Investigate, reevaluate and respond as facts and circumstances warrant.
*All "B" solutions should be coordinated with the "A" solution cognizant RCC in evaluating and/or responding to alert/distress candidate "B" solutions. Always check vessel type/description and homeport/registration POC data against alert position. This practice can help flag correct "B" solutions.	

(b) **406 MHz Beacon Cospas-Sarsat Alerts.** Since 1990, beacon technology has been moving to a solely dedicated frequency for satellite distress beacons, 406 MHz. Use of this frequency will minimize interference problems. In addition, satellite software recognizes and relays only coded 406 MHz beacon signals, minimizing false alerts. The Coast Guard endorses the 406 MHz EPIRB as the preferred beacon type for maritime use. Accordingly, response to 406 MHz beacon alerts is immediate, keeping in mind the precepts of risk management. The use of the 406 MHz emergency frequency is not limited to strictly EPIRBs. Both Emergency Locator Transmitters (ELTs) and Personal Locator Beacons (PLBs) use the same frequency. The use of PLBs in the marine environment will become more common as they represent a more cost effective distress tool for recreational boaters. Beacon manufacturers are actively marketing PLBs to the recreational boating public. As an emergency signaling device, an ELT or a PLB functions similarly to a 406 MHz EPIRB; response policy to these beacons is identical.

(1) First alerts and composite solutions for 406 MHz beacons indicate a beacon has been activated. SAR response to a 406 MHz beacon alert should approximate response to a MAYDAY. The 406 MHz Cospas-Sarsat system and equipment yield high confidence alerts and positions. However, factors such as satellite pass geometry, atmospheric anomalies, and beacon oscillator stability may degrade the beacon signal and position data. Any alert degradation is usually reflected in the split between A and B solution probabilities on first alert messages.

(2) **Registered but Unlocated 406 MHz Alerts.** Treat registered, but unlocated 406 MHz alerts as distress, exploit all reasonable means to ascertain distress position and assist the party in distress, including issuing a UMIB.

- Registered, but unlocated 406 MHz alerts signal distress, but contain no position information. In order to render assistance we must exploit all reasonable means to ascertain at least a general distress position. Armed with a general position or usual operating area and suitable homing capable response assets, we are able to render timely, effective assistance.
- EPIRB registration points of contact are usually the most promising leads for information, particularly for position, situation and further points of contact. In addition, UMIBs should be used as a means to determine distress position and to maximize resource of opportunity response, unless there are compelling reasons to the contrary. When only general position information is available, suitable aircraft should be launched to exploit the 406 MHz beacon's 121.5 homing signal.

- For incidents where no position information other than homeport is available, issuing a UMIB in the vessel's homeport area is appropriate.

(3) **Unregistered/Unlocated GPS Protocol Beacons.** The latest 406 MHz beacon technology is known as Location Protocol Beacons or GPS Protocol Beacons. These beacons contain a GPS chip that can accurately calculate the position of the beacon and transmit that position as part of the beacon registration information received by the satellite. Since the Cospas-Sarsat system requires multiple passes from low earth orbiting satellites to calculate the beacons position by Doppler shift, this technology provides a more timely method of notifying SAR responders of a beacons position.

- For alerts that contain an encoded GPS position (described in alert messages as an “E” solution), responders shall evaluate it as a distress incident regardless of whether the beacon is registered or if a location has been determined by the Cospas-Sarsat system.
- When a composite position is obtained by Cospas-Sarsat satellite passes, SAR planners should compare the encoded GPS position to the composite solution to verify the location of response.

(4) **50/50 Split Solutions.** 50/50 splits are no different then other A/B solutions and merely indicate that mathematically the beacon could be in either location. Plotting the position and carefully analyzing the beacon decode and registration information will usually allow you to determine the actual location. Also note that 50/50 solutions tend to be less accurate than other solutions.

(5) **Beacon Solutions which contain a garbled beacon ID code.** There are alerts which are received which contain a garbled beacon ID code. This may be a result of a beacon which has been damaged or is faulty. A garbled beacon ID code does not allow use of the registration database or to decode the beacon ID to determine the type and usage of the beacon. The Cospas-Sarsat system is also an international provider of Ship Security alerts. Thus a garbled beacon code may mask the fact that the beacon is part of the Ship Security Alert System (SSAS). Section 2.11 of this manual, discusses the interrelationship between the SSAS system and SAR. Within the U.S. SRR, beacons which are forwarded from the MCC with a garbled beacon ID are dual routed to PACAREA and the responsible district SRR. For these situations, the policy for response in section 2.11.3 applies and PACAREA along with the responsible SRR shall make every effort to determine the status of the vessel without contacting the vessel directly. If after attempting to determine the nature of the alert, it is unclear whether the beacon incident is either a SAR case or rather, a vessel security incident, operational commanders shall respond to the incident as a SAR case while using due diligence to ensure that responding resources are aware of the potential threat and must evaluate the situation once on scene.

(6) **Use of Elementals For Rapid Moving Search Objects or Long Drifts**. When processing 406MHz alert position update messages, the composite solution position may not always be the most accurate position to use for search planning. SARSAT data processing algorithms average several elemental position updates (the raw position data from a single satellite pass) to generate the composite position. In instances where the system has been receiving data for a significant period of time (multiple satellite passes) or in an environment where there is significant total datum drift, using the elemental position (raw data) from each satellite pass will provide a more accurate update to the beacons position. This elemental position date is provided on each update message and can be manually plotted using SARTOOLs. Figure 3-7 shows an example of a rapid moving object and position comparison.

(7) **Notification of Country of Registry (NOCR).** Command Centers may occasionally receive messages through the SARSAT system providing "Notification of Country of Registry" or NOCRs. These messages provide notification of the activation of a U.S. registered EPIRB in a location outside of the U.S. SAR Region. In these instances, the beacon activation alert has been forwarded to the appropriate RCC in the nation that has SAR responsibility for the composite position of the beacon, and the United States SAR authorities are being notified as a follow up to the normal SAR response process. Whenever possible, RCCs should attempt to contact the responsible RCC to ensure that SAR response efforts are being taken to assist U.S. citizens in distress.

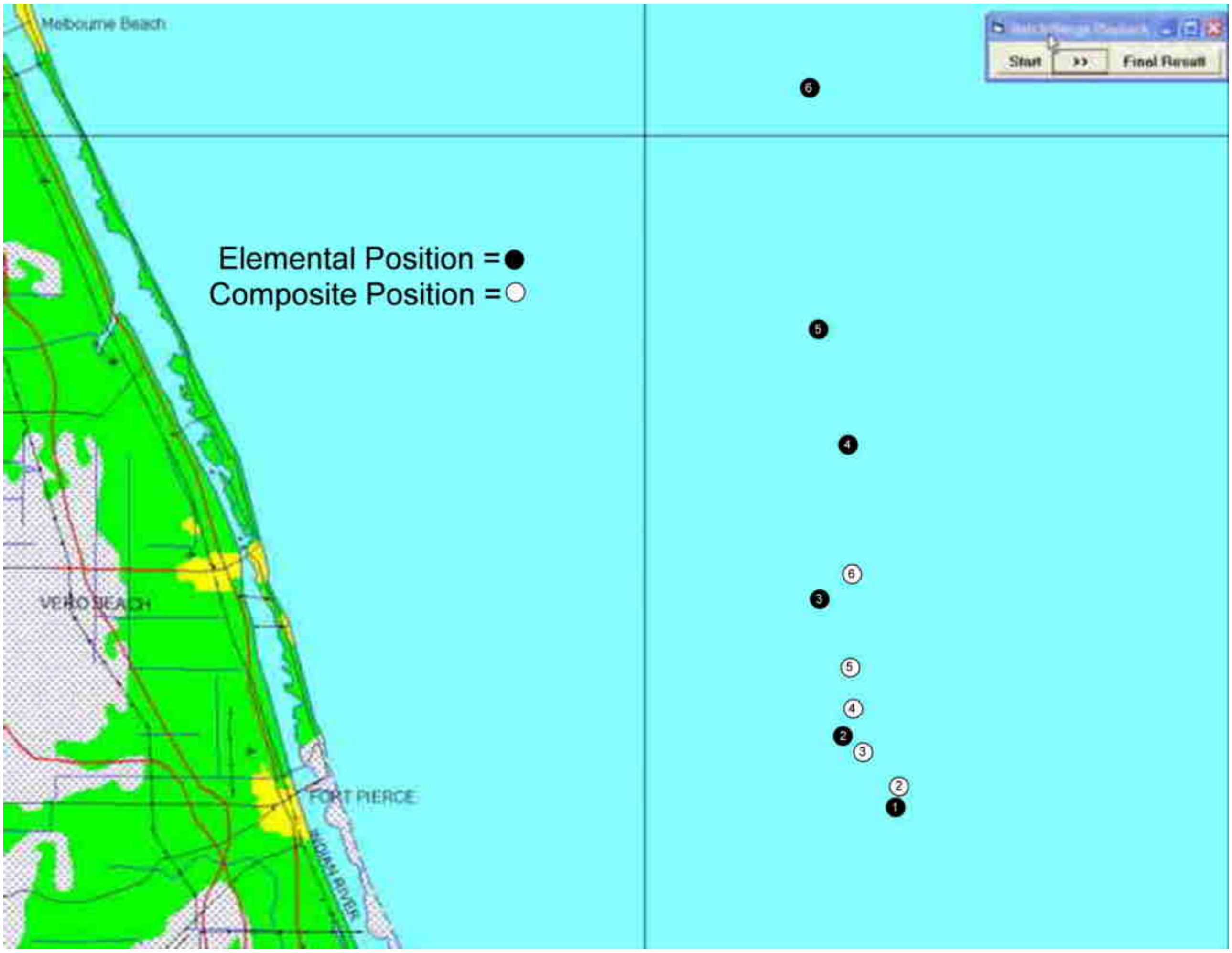

Figure 3-7 Elemental vs. Composite Positions for Rapid Moving Search Objects

(c) **121.5/243 MHz Beacon Cospas-Sarsat Alerts.** 121.5/243 MHz first alerts and even composite solutions don't always indicate a beacon has been activated. On average only 1% of first alerts are actual distresses. Spurious signal detections, due mainly to non-beacon emissions, cause numerous false alerts. Spurious signal sources include voice transmissions on 121.5/243 MHz, garage door openers, microwave transmissions, pachinko machines, satellite TV systems, computers and other systems.

(1) Because of their high false alert and false alarm rates, 121.5/243 MHz First Alerts, in and of themselves, initiate the Uncertainty Emergency Phase. RCCs should aggressively attempt to corroborate 121.5/243 MHz first alerts with any other potential distress information. RCCs should normally dispatch resources when they obtain amplifying information such as highflier audible reports and overdue or other distress reports. Following a first alert, RCCs will normally receive a composite solution, provided the beacon continues to transmit, within 48 minutes (average range from 30 - 90 minutes).

(2) The first Composite solution, or "Ambiguity Resolution" message, from a 121.5/243 MHz beacon alert corresponds, at a minimum, to the Alert Emergency Phase. RCCs should track the geographic position of composite solutions and respond accordingly. While composite solutions located at or near local airports are often non-distress, some have been caused by unreported aircraft crashes. A Second composite solution, or "Composite Position Update" message, from a 121.5/243 MHz beacon alert corresponds, at a minimum, to the Distress Emergency Phase.

(3) Though response to 121.5/243 MHz beacon alerts and composite solutions represents a significant resource commitment with a limited likelihood of actual distress, once a second composite solution has

been received, RCCs should make every effort to locate and determine the source of the signal. While it is common to determine that a signal source is emanating from an area where distress is unlikely (such as a marina, anchorage or airfield), due to Cospas-Sarsat system limitations, allowing a 121.5/243 MHz signal to continue to transmit indefinitely will result in the masking of other possible 121.5/243 MHz distress signals within a 20 km radius of the existing transmission.

(d) **Alert Query Reports.** In pursuing amplifying distress information, RCCs may query the USMCC database to see whether or not a particular 406 MHz beacon has been activated, or to check for all beacon activations over a specific time period or in a specific area. RCCs may do so by requesting an Alert Query Report from the USMCC. The USMCC user's manual, reference (r), has more information on this process and guidelines for interpreting these reports.

(e) **Limitations of the System.** As with any tool, search planners must be aware of system limitations. False alarms (inadvertent activations or hoaxes), non-beacon alerts, and unresolved beacon alerts reduce the efficiency of the C-S system. Operator misuse, equipment malfunctions, improper testing, and hoaxes may downgrade beacon effectiveness. Unresolved alerts are predominantly associated with 121.5/243 MHz, which is a congested aviation distress frequency. In addition, many false alerts are caused by non-beacon emissions, harmonics emanating from transmissions on those frequencies, and numerous other signal sources in this frequency band. While 121.5/243 MHz beacon alerts provide two equally possible beacon positions, requiring the RCC to wait for another satellite pass prior to dispatching resources, the A solution on a 406 MHz first alert will be the correct position 95% of the time. SAR resources can reasonably be dispatched immediately upon receipt of a 406 MHz first alert. A composite solution will be received, provided the beacon continues to transmit, usually within 60 minutes (average range from 45 - 90 minutes). Table 3-5 compares 121.5/243 MHz and 406 MHz beacons.

3.4.4.3 Policy on Follow-up to False Alarms. Results of beacon activation investigations are essential to improve the system. Units should ensure personnel aggressively pursue and document the cause of all accidental and inadvertent beacon alerts.

(a) Historically, problem areas include bracket failures, improper switch setting and marking, operator error, and water intrusion. False alarm information obtained by the Coast Guard should be passed to beacon manufacturers to improve beacon/bracket design or to improve national and international standards.

(b) In all cases, investigating personnel should educate beacon users on proper registration procedures and beacon usage. Coast Guard personnel should follow guidance in reference (o) and other appropriate directives in reporting all incidents to the FCC, advising them of the incident and of the actions taken. In the case of first-time offenders, the District Commander in which the vessel is registered should send an administrative letter to the owner expressing concern from a SAR and safety perspective. This letter should remind them of the importance of up-to-date beacon registration (for 406 MHz and other "registered" beacons), and user training and knowledge of EPIRB and ELT systems. In the case of repeat offenders, close coordination with the beacon owner and the manufacturer can help identify beacon problems and operator errors.

3.4.4.4 Registration/Follow-up Policy. All Coast Guard and Coast Guard Auxiliary units should make every effort to encourage beacon users to register their beacon. The easiest method for registration is online at www.beaconregistration.noaa.gov. Units should also have spare 406 MHz EPIRB registration cards for users to fill out and mail to the USMCC. A sample registration card is in Appendix J. **It is mandatory for the owner to register the 406 MHz beacon.** In addition, units should relay registration information to the USMCC. Other beacon types are registered in various ways. Units should strongly encourage beacon owners to "register" as soon as possible.

Table 3-5 406 MHz and 121.5 MHz Beacons Comparison Table

406 MHz Beacons	121.5 MHz Beacons
Coverage: Global.	**Coverage:** Ground station dependent; ground stations have an effective radius of about 1800NM. Current coverage: about one-third of the world.
Reliability -- False Alerts/False Alarms: All alerts come from beacons. Satellite beacon transmissions are digital, coded signals. Satellites process only coded data; other signals are rejected. About 1 in 10 alerts are actual distresses. Individual beacon-unique coding and registration allow rapid incident corroboration. About 70% of 406 MHz beacons are registered. More than 80% of 406 MHz false alarms are resolved by a phone call.	**Reliability -- False Alerts/False Alarms:** Only about 1 in 4 alerts come from beacons. Satellites cannot discern beacon sources from many non-beacon 121.5 MHz sources. Fewer than 1 in 100 alerts are actual distress. 121.5 MHz beacons transmit anonymously. The only way to ascertain the situation is to dispatch resources to investigate -- a costly disadvantage.
Alerting: First alert confidence is sufficient to warrant launch of SAR assets. Earlier launches put assets on scene earlier-average 2 hrs saved in maritime, 6 hrs in inland. These savings are survival significant. Estimates put 406 MHz ELT lives saved potential at more than 100 per year in the U.S. alone. Average initial detection/alerting by orbiting satellites is about 45 minutes -- worst case about 60 minutes. Average time between subsequent satellite passes is about 60 minutes. Vessel/aircraft ID, point of contact information provided with alerts allows rapid corroboration or stand-down. Allows false alarm follow-up to continuously improve system integrity/reliability. Near instantaneous detection by geostationary satellites.	**Alerting:** High false alarm rate makes first-alert launch infeasible. Absent independent distress corroboration RCCs must wait for additional alert information. 121.5 MHz beacon launch decisions take six hours longer than for 406 MHz beacons on average (based on inland region data). Almost half of aviation accident survivors perish in the first six hours after the incident. Same as 406 MHz. Same as 406 MHz. Alerts are anonymous. 121.5 MHz technology not capable of transmitting data. No capability. No capability.
Position Information: 2-5 km accuracy on average. Position calculated by Doppler shift analysis. Capable of processing beacon transmitted position information from independent source, e.g.: GPS.	**Position Information:** 10-20 km accuracy on average. Position calculated by Doppler shift analysis. No capability.
Locating the Object: Superior alert position accuracy limits initial position uncertainty to about 40 sq. km. 121.5 MHz homing signal facilitates object location by radio detection finder equipped search units.	**Locating the Object:** Initial position uncertainty is about 700 sq. km. on average. Same as 406 MHz.

3.4.4.5 Improper Use of EPIRBS as DMBs. EPIRBs are **distress beacons**. As such, search planners shall not normally use them as DMBs. While it may seem convenient at times to leave an EPIRB drifting to mark datum during a SAR case, that beacon's signal may prevent another distress beacon from being properly tracked or heard.

(a) SLDMBs are the appropriate tools for marking datum in extended search cases. When located, EPIRBs shall be recovered and, whenever necessary and possible, SLDMBs deployed in the same position to mark datum. Standard radio DMBs work fairly well when no SLDMBs are available.

(b) In situations where the EPIRB is the only means of marking datum, close coordination between the SMC and the USMCC will be required.

3.4.5 Night and Reduced Visibility Searches

Reduced visibility, either due to night or weather, significantly reduces the effectiveness of a search, particularly for objects that are not readily located using radar or other electronic sensors. For planning and conducting searches during night or under otherwise reduced visibility conditions, the following guidance is provided.

3.4.5.1 **Timeliness.** In addition to SAR incidents occurring at night, it is common for incidents to occur towards the end of the day when mariners are returning (or due to return) from a day on the water. A rapid response with a full search using the remaining daylight may obviate the need for a night search. For searches with reduced visibility in daylight hours, getting search units into the area rapidly will provide some search coverage and facilitate a rapid resumption of full search capability should conditions improve.

3.4.5.2 **Search units.** The choice of search units, air or surface, depends greatly on safety of operations under the given conditions, the search object, and the sensors available on the various search units.

(a) With reduced visibility it is imperative to employ those search units with the best sensors for the conditions.

(b) The expected duration of reduced visibility conditions will also dictate, to some degree, the choice of search units. If reduced visibility is expected for only a short period, surface units may proceed into the search area immediately while air units, which can arrive more rapidly, may be timed to arrive when conditions are improved. For reduced visibility of longer duration, the decision to use surface and air search units will be more dependent on search object, the sensors available on each search unit, and the effectiveness of those sensors for existing weather conditions.

(c) There may be times when conditions do not permit units to conduct a search such as severe storms. Although not able to effectively search, deploying a surface unit in the search area ready to respond rapidly to a signal or chance sighting should be considered. When this occurs, risk management mitigation strategies must be employed.

(d) Keeping a search unit in the area during reduced visibility is also important for survivor confidence. Sighting a search unit in the area lets survivors know the search is still on and will bolster their will to live.

3.4.5.3 **Search object.** The ability to detect an object is based on the sensors available on assigned search units. Depending on the incident and sensors available, the primary search object may be something other then the overall object of the search.

(a) Unaided visual searches at night will not readily detect unlit objects. Even large vessels may be hard to detect if not illuminated and smaller objects such as rafts and persons in the water are nearly impossible to see. Under such conditions the primary search object should be a night signaling device (flare, strobe, light).

(b) Enhanced visual searches using night vision goggles under favorable conditions will permit searchers to keep a PIW or small craft as the primary search object. The night vision goggles can take advantage of less bright light sources and reflective surfaces or materials.

(c) Night searches following a flare should have a primary search object of additional signaling devices. Sensors for other then visual search should also be utilized so that objects of interest within the search area may be investigated.

3.4.5.4 **Search tactics.** Searchers should utilize all possible means of detecting search objects, visual, electronic, and aural. These tactics are dependent on accurate search planning and coordination. The following should be considered in the planning and conduct of a reduced visibility search:

(a) The SMC should be fully aware of on scene conditions, as searches begin and any changes that occur during the search. Search units should pass to the SMC (or OSC if one is assigned), conditions upon arrival on scene and any changes. This information is critical to assigning appropriate track spacing to achieve the desired search results.

(b) At night all unnecessary lighting on search units should be secured, electronics lighting should be shifted to low light mode to minimize glare on the inside of windows and to preserve night vision.

(c) If the distressed craft or survivors are known to have distress signals, it is important for search units to make their presence known in hopes of getting the survivors to signal. Often the navigation lights alone may not be enough and additional lighting (blue light, search light) may be necessary to get a response. This tactic may be most appropriate for early on searches. The need to limit excess light for night vision considerations may be more appropriate for later searches where there has been ample opportunity for survivors to discharge or use any signaling devices.

(d) If a debris field is discovered, it may be appropriate for search crews to use lights or flares to illuminate the area to enable a better visual search of the concentrated area. This may mean sacrificing night vision for the crew in hopes of spotting PIWs or reflective material that the lights may illuminate.

(e) Ambient light sources should be exploited in a search.

(1) With bright shoreline lights, light colored objects or objects with reflective material in particular may be illuminated enough for the unaided eye to detect, while detection using NVGs will be greatly improved.

(2) A full or near full moon can also provide enough light for the unaided eye to detect an object and greatly improves NVG effectiveness. The reflection of the moon on the water also can be used to search for objects as it “moves” across the surface with the search unit’s motion. This is particularly effective in calm conditions with the moon low in the sky.

(3) Large backlit objects may also provide a detectible profile when searching along a well-lit shoreline.

(f) Electronic sensors should be set according to search object as discussed in 3.4.6 below.

(g) On surface search units the engines should be secured (brought to idle if securing not possible) and all other noise minimized in order to call out to and hear calls from survivors. This is a particularly good practice when encountering a debris field or at regular intervals even though no debris is present.

(h) Search units should check buoys and fixed aids in the vicinity. PIWs may swim to something that floats or provides them some form of stability.

3.4.6 Electronic Sensors and Sensor Searches

3.4.6.1 Surface Vessel Radar. Appendix H contains recommended sweep width tables for surface vessel radar. In addition, the following information should be considered when planning searches utilizing surface vessel radars:

(a) The effective search range of radars varies greatly.

(b) Radar range sweep widths for small objects should only be applied in low sea states.

(c) Radar reflective devices significantly improved object detection probability.

(d) The decision of whether or not to utilize the surface vessel radar in a search, especially if it requires dedicating a crewperson who could be used for visual search, should be based on a comparison of the radar sweep width to those for other available sensors. Surface radar searches will generally be preferred when visibility is poor, sea state is low to moderate, and the object is equipped with a radar reflector. Radar sweep widths deteriorate rapidly with the onset of precipitation and/or seas of greater than 4 feet.

(e) Visual scanners should concentrate on the area in the immediate vicinity of the search unit during low visibility radar searches to avoid missing objects that pass through the area of heavy sea return.

3.4.6.2 Forward-Looking Airborne Radars (FLAR). The Coast Guard Research and Development Center has conducted research on Coast Guard fixed wing aircraft to determine detection capabilities of FLARs for SAR operations. From detection data collected under realistic search scenarios estimates of sweep width have been calculated. Appendix H includes the recommended sweep widths for the AN/APS-137, AN/APN-215, AN/APS-127, and RDR-1300.

(a) The AN/APS-137 radar, installed on the Coast Guard's HC-130 fleet, was evaluated for SAR object detection during three field tests conducted by the Coast Guard R&D Center and were reported on in Coast Guard

R&D Reports CG-D-14-93, CG-D-07-94, and CG-D-18-94. The AN/APS-137 FLAR is an X-band, air-to-surface Inverse Synthetic Aperture Radar (ISAR) that provides high resolution, small-object detection, weather avoidance, sea surveillance, and Doppler display. The AN/APS-137 system has special selectable features that enhance system performance against weak radar returns. Sweep width recommendations for conducting and planning AN/APS-137 (aircraft) SAR searches are provided in Appendix H.

(b) The RDR-1300 model radar is found on the HH-65 and HH-60J aircraft. This radar is comparable to the APS-215 and the sweep width tables corresponding to the APS-215 are applicable for searches conducted using the RDR-1300 radar.

3.4.6.3 Side-Looking Airborne Radar (SLAR). Side-looking airborne radar is installed on some Coast Guard fixed wing aircraft. The AN/APS-135 model is currently installed on two C-130s at CGAS, Elizabeth City and the AN/APS-131 model is found on the HU-25Bs at CGAS, Cape Cod. The main difference between the models is the length of the antenna.

(a) The AN/APS-131 model SLAR on the HU-25B aircraft is part of the AIREYE system. The AIREYE system was developed primarily as an oil pollution surveillance resource. The system includes infrared/ultraviolet (IR/UV) line scanning device and a KS-87B Aerial Mapping camera. The IR/UV and camera have very limited applicability to SAR. When doing electronic searches the HU-25B aircraft should rely on the AN/APS-131 in combination with its FLAR, the AN/APS-127, and not the IR/UV or mapping camera.

(b) Recommended sweep widths for SLAR on Coast Guard aircraft are shown in Appendix H. Specific findings of the research that are of interest to SAR planners are:

(1) SLAR models tested are capable of detecting 180-foot ships nearly 100% of the time in seas up to at least 6 feet and ranges up to 30 NM.

(2) Objects as small as 16-foot boats with metal equipment (engine, gas tanks, frames, etc.) can be detected better than 90% of the time in seas less than 3 feet and 30% - 50% of the time in seas of 3-6 feet. These objects can be detected in low sea states out to the 30 NM swath width limit.

(3) Four to ten person life rafts can be detected 40% to 70% of the time in seas less than 3 feet, but can be detected less than 15% of the time in seas of 3 to 6 feet.

(c) Presently these SLAR equipped aircraft are the primary iceberg surveillance platforms for the International Ice Patrol.

(d) SLAR has limited use during a search. SLAR is essentially an aerial surveying system. To adequately survey an area, the aircraft must fly level and straight. The SLAR aircraft or other SRUs can then identify the resultant SLAR film's objects.

3.4.6.4 Forward-Looking Infrared System (FLIR). FLIR data was collected in experiments conducted by the Coast Guard Research and Development Center. These studies tested the Northrop Corporation SeaHawk FLIR system, which is not being carried on any Coast Guard aircraft. Chapter 4 of this Addendum lists which Coast Guard aircraft carry FLIR capability.

(a) Extensive testing of FLIR as a SAR search resource with various objects has not been conducted. FLIR has a very narrow field of view. Most units operate with a 7-15 degree field of view. Recommended sweep widths and altitudes for use of FLIR are contained in Appendix H. Sweep widths should not exceed the effective azimuthal coverage of the system in use. Appendix H also contains illustrations of how to estimate a sweep width for a FLIR unit.

3.4.6.5 Night Vision Goggles (NVG). Many SAR incidents occur or become known to the Coast Guard during the afternoon or night. The greatest benefit of NVG is that this sensor enables searchers to conduct effective searches at night, thus search planners will not have to wait until first light the following day to begin effective visual searches. This will increase the probability of survival for those persons in distress. Research showed NVG searches from UTBs are not recommended because the lookouts are prone to seasickness when using NVG, but they are effective from aircraft. Sweep Width Tables for NVG Searches are provided in Appendix H.

3.4.6.6 Photo Reconnaissance Support. Photoreconnaissance is one resource that may have limited benefit in locating those in distress in a large maritime search area. Aircraft equipped for highflying photography include the Coast Guard HU-25B with a KS-87B camera and U.S. Air Force aircraft.

(a) High flying reconnaissance aircraft have the capability of covering large areas, up to 20,000 square nautical miles for example, with photographs that are developed and interpreted by technicians. If the sky is cloud free, the cameras cover the area thoroughly; however, specially trained technicians have to search the photographs, not unlike a crewmember on a search aircraft.

(b) The technicians thoroughly review the photographs looking for the search object; difficult and time-consuming work. Interpreting technicians have little experience with photographs of open ocean, since they usually look for ground sites using various reference points such as roads, forests, communities, etc. There are no such reference points at sea and this makes the "photograph search" more difficult. Also, they are often unfamiliar with what search objects look like from the air for identification purposes. The successful outcome of a search by these reconnaissance aircraft is solely dependent on the interpreting technician finding the object.

(c) In past SAR cases, the Coast Guard has requested Air Force aircraft use colored film. These requests were made under the assumption that the search objects will be more easily found due to the color contrast with the surface of the water than by the contrast on black and white film. Some limited testing by the Air Force was done with color film and high altitude aircraft during 1987. These tests were conducted under ideal weather conditions with minimal cloud cover and known objects in fixed positions. It was determined that small, brightly colored objects, such as a one-man yellow life raft could be detected, but dark objects were more difficult to find, and a one-man black life raft failed to be detected at all. Black and white film has not been tested for maritime searches, though it might be most suitable for large craft such as a fishing vessel. Coast Guard HU-25B aircraft equipped with a KS-87B camera will take black and white pictures only.

(d) Planners can assume that it will take at least one day to get the approval and establish the operations plan for the aircraft. After completion of the flight it may be another day for black and white film to be processed and interpreted. If color film is used the process may take longer because of the special processing that has to be done by one of the limited number of resources. Black and white film is normally processed and interpreted at the home base of the Air Force aircraft.

(e) Due to limited testing and low historical success rate, the Air Force, by agreement with the Coast Guard, will provide aircraft for photoreconnaissance support of SAR, only if requested by proper authority and under certain conditions. USAF policy regarding use of these aircraft for SAR support was promulgated by reference (s). The guidelines established by this directive are as follows:

(1) Use of highflying reconnaissance aircraft for all SAR efforts will be on a strict noninterference minimum cost basis. Scheduled operational requirements and priority training will normally not be rescheduled.

(2) U.S. Air Force Strategic Air Command (SAC/DORS) shall determine the availability of aircraft support based on area coverage, range, weather, type of film requested, mission and training impacts, etc.

(3) Unless directed by higher authority, only black and white film products shall be used. If color film is specifically required, the requester must coordinate handling procedures and possible cost reimbursement for film processing and exploitation.

(4) SAC/DORS will advise Air Force Headquarters of the SAR request and intended plan of action.

(5) "Special interest" situations involving Headquarters USAF or USCG, or Congressional directed SAR support shall be approved on a case-by-case basis at the air staff level. Air Force Headquarters will coordinate such cases with appropriate major commands, Headquarters ACC and Headquarters USCG, as required.

(f) The following procedures apply to Coast Guard commands:

(1) All Coast Guard requests for photoreconnaissance support of SAR are to be made through the operational chain of command to the appropriate Area Command Center. If the Area determines that this type of support is appropriate for the case, the Area shall initiate a request to USAF Headquarters Strategic Air Command (SAC)/DORS via AFRCC, Langley AFB, VA. If highflying assets are made available, the SMC will then be authorized direct liaison for passing SAR planning/execution information. The Area is to be kept informed of the status of the mission.

(2) Initial communications should be made by telephone, followed by formal request message. This will give the Area and SAC a heads up to an incoming request so time will not be lost waiting for record traffic. Commandant (G-RPR) shall be information addressee on all message communications involving a request for photoreconnaissance support.

(g) The above guidance is meant to be restrictive due to the expense of using these resources and their limited application to maritime SAR. However, when it is determined that a particular case may benefit by utilizing these resources, search planners should begin the request process as early as possible. These resources take considerable time to arrange and receive the final result of interpretation. An example of a beneficial use may be when the forecast is for bad weather that will preclude normal searching. Photo imagery collected before weather sets in could be studied while other resources are grounded.

(h) Applicable USAF phone contact numbers (SAC/DORS) are:

- During working hours: Autovon 271-5417, Commercial (402) 294-5417
- After working hours: Autovon 271-5707, Commercial (402) 294-5707

(i) The USAF message address is:

- STRATRECONCEN OFFUTT AFB NE//DORS//

3.4.7 Searches for Bodies

Coast Guard units are often requested to search for bodies. However, Coast Guard units are not provided the specific gear (e.g., dragging equipment, etc.) or training to conduct such searches. As per Chapter 4 of the USCG Regulations, "when it has become definitely established, either by time or circumstances, that persons are dead, the Coast Guard is not required to conduct searches for bodies. If, however, requests are received from responsible agencies, such as local police, military commands, etc., Coast Guard units may participate in body searches provided that these searches do not interfere with the primary duties of the units." The participation normally is confined to a surface search or support platform for other agencies to use their equipment.

3.4.8 Aircraft Incidents

Aircraft incidents present a particular challenge to SAR planners. The speed of aircraft and the distance they can travel in a short period of time often makes determining datum difficult. Once determined, the datum is rarely a well-defined point and results in a large initial search area. Various systems associated with aviation safety and tracking can assist in narrowing initial datum and reduce the area to be searched.

3.4.8.1 Emergency Locator Transmitters (ELTs), if operating properly following an aircraft crash or ditching, may provide a position through Cospas-Sarsat or direction finding by SAR assets. However, once in the water aircraft rarely stay afloat and submerged ELTs will cease to provide a signal.

3.4.8.2 Aviation tracking radar systems are present throughout the United States and along the coast for defense and tracking of civil aviation. Several radar-tracking systems are covered in Chapter 2 of reference (a).

(a) Hill AFB provides technical certification and service for a nationwide array of linked air defense radar's that may provide valuable "near real-time" information to search and rescue planners prosecuting maritime and/or inland aircraft incidents. The radar information is fully archived for a 90-day period and playback of the event can give a "near real-time" dynamic picture of the subject aircraft's activities leading up to, and at the time of, the incident. Some of this information may be available from the local Air Route Traffic Control Center (ARTCC), which provides greater radar coverage, both in geographic areas and in lower altitudes. It archives “RAW” or “SKIN PAINT” aircraft radar contact information, while the information that is available to ARTCC systems is generally filtered to show only radar information from aircraft that are using a transponder. RCC requests for this information should be made directly to one of the three points of contact given below. If the incident did not occur within that particular Air Defense Sector’s (ADS) AOR, they will refer the RCC to the appropriate ADS for the incident.

CONTACTS

SAR requests (24 hours): Air Defense Sector (ADS)
Mission Crew Commander (MCC)

Western ADS	(253) 984-4311/4312
Southeast ADS	(850) 283-5205/5206
Northeast ADS	(315) 334-6802
84 RADES:	
Director of Operations	(801) 777-2047
Fax	(801) 777-3268
Hill AFB Command Post 24 hr pager to 84 RADES	(801) 777-3007

(b) Shortly after contact, the ADS should be able to furnish a last known position of the incident aircraft. Give ADS as much information as possible, as the radar system archives ALL air contacts received, and the incident aircraft must be selected from the data available. Within a period of up to a few hours, they will be able to call in an analyst who will review the radar system’s archived information, review the available data and update the information. ADS will provide an electronic copy of the aircraft incident to the RCC, and assist in its interpretation. This playback will generally fit on a single floppy diskette and/or may be sent electronically. No special hardware or software is required to perform the playback; it will perform well on CGSWIII. The playback may be advanced rapidly, slowed, and paused as required. Each data point of the incident may be “clicked” to show that data point’s related information, such as altitude, etc. Copies of the given screen pictures are also easily made using the existing “ALT-PRINT SCREEN” buttons on the PC and copying that information into the program of choice. NO special training is required.

3.4.9 Uncorrelated Distress Broadcasts & Alerts

This section provides the standard Coast Guard procedures to be used in prosecuting uncorrelated distress broadcasts. An uncorrelated distress broadcast is a distress broadcast that does not include position and/or identification information sufficient to generate a reasonable search area. A distress broadcast may use the internationally recognized distress word "MAYDAY" or any number of words that would indicate a need for assistance including, but not limited to, help, emergency, trouble, sinking, etc. An uncorrelated distress broadcast could also originate from a radio equipped with DSC where the radio was not interfaced with a GPS and the MMSI was not registered.

3.4.9.1 Thousands of distress broadcasts are received on VHF-FM channel 16 by Coast Guard units each year. Some are made by mariners who may not be able to transmit more than a single broadcast before the condition of their vessel, communication gear or a person renders them unable to transmit additional information. In these cases, we do not have the opportunity to establish direct communications with the caller, and may not be able to ascertain a location or identification. These situations severely hamper the Coast Guard’s search planning and rescue coordination efforts. Regrettably, we also receive distress calls from calling parties with the clear intention to mislead or deceive our watchstanders. Despite this fact, all distress broadcasts shall be treated as legitimate distress calls unless determined otherwise.

DSC is a relatively new radio capability that allows the maritime public to transmit a distress by holding down a button located on the radio for 3 seconds. When properly installed and registered in the MMSI database the distress and GPS location would be transmitted via channel 70 to the closest receiving station. The imbedded information contains the owner/operator’s information. However, if the radio was improperly installed, not integrated with GPS, and was not registered in the MMSI database, this would be considered an uncorrelated distress broadcast. The watchstander’s only response option would be to issue a UMIB. A disadvantage to making a distress call via the DSC radio is that the transmitted distress is a data stream that does not allow the system to home in on the signal and create a line of bearing.

3.4.9.2 **Watchstanders shall initially treat all distress broadcasts as distress incidents.** All distress broadcast incidents shall be aggressively executed and carefully documented.

(a) The SAR mission coordinator (SMC) shall issue an urgent marine information broadcast (UMIB) for all distress situations, unless clearly not warranted. This is the minimum response requirement for uncorrelated distress broadcasts – callouts are not sufficient. The UMIB shall include text-requesting mariners and shore stations that heard the distress broadcast to contact the Coast Guard with their position. The UMIB shall be broadcast for at least one hour at 15-minute intervals.

(1) Based on information provided as feedback or lack of feedback, the UMIB should be modified to take advantage of this information.

(b) When sufficient information exists to establish a reasonable search area, the SMC shall launch appropriate resources to respond to a distress broadcast. In the absence of such information, search planners shall engage in aggressive detective work, using all means at their disposal to narrow down a search area, including:

(1) Analysis of high-level site reception. When an uncorrelated distress broadcast is received on two intersecting high-level sites, a reasonable search area may be developed from the overlapping area (depending on the size of overlapping area) and/or from the direction finding capability that provides a line of bearing from each high-level site to within +/- 2 degrees of the transmission. In some cases reception on a single high-level site may result in a searchable area due to the form of the geographic area in relation to high-level site location. Not receiving the distress broadcast on adjacent high-level sites may also allow elimination of overlap areas in initial search efforts. Additionally, the single line of bearing provided by the direction finding would help narrow the search.

(2) Queries to ascertain if other boats or shore based radios heard the call over low-level antennas. This should be accomplished via the UMIB. Additional queries may be made to refine this information. Knowledge of low-level antenna reception may yield additional reception area arcs, further narrowing the probable location of the distressed caller.

(3) Replay the transmission. For all uncorrelated distress broadcast cases, the SMC should immediately review recorded transmissions. The SMC should also immediately review all channel 16 transmissions addressed to the Coast Guard that cannot be readily identified as non-emergent. If possible, several different individuals should listen to the transmission to aid in verifying information. The SMC should be prepared to send an email with the distress transmission attached for the District command center upon request.

3.4.9.3 **Auto-Distress Communications.** In recent years, the Coast Guard has experienced an increase in the number of S-O-S transmissions and electronically synthesized MAYDAY calls on VHF-FM, as well as 2182 kHz distress alarms on MF/HF radio. Experience shows that these types of auto-distress transmissions are often triggered accidentally, creating potentially dangerous safety of life issues for the public and Coast Guard. For uncorrelated auto-distress notifications and alarms, the SMC does not need to launch unless there is a reasonable search area AND there are additional factors that would lead a controller to conclude that a mariner may be in distress. The reasoning is that a voice MAYDAY is an intentional act on the part of the mariner, whereas automatic broadcasts and alarms can be, and often are, triggered inadvertently.

(a) **Auto-Distress Broadcasts.** All Morse Code S-O-S transmissions and automated/synthesized voice MAYDAY broadcasts on Channel 16 VHF-FM are transmitted without position or vessel identification and shall be treated as uncorrelated MAYDAYs. Upon receipt of an S-O-S transmission or automated/synthesized voice MAYDAY broadcast, the SMC shall thoroughly investigate the incident and broadcast a UMIB as a minimum response in accordance with the policy and discussion noted in paragraph 3.4.9.2. Assets need not be immediately launched based solely on a single S-O-S or synthesized MAYDAY broadcast. Launching an asset would be appropriate if a reasonable search area can be determined *and* there are additional factors that may indicate an actual distress situation, i.e. voice MAYDAY, overdue vessels, flare sightings, local conditions or circumstances, etc. Note that this is a slight departure from the policy in 3.4.9.2(b) that requires assets to be launched based on establishing a reasonable search area alone. However, this policy does not preclude Districts from establishing the level of apprehension that will require a launch within their AOR; in fact they are encouraged to do so.

(b) **Auto-Distress Alarms.** Distress calls on 2182 kHz are often preceded by a radiotelephone alarm signal (a tone alternating between 1300 and 2200 Hz four times each second lasting for 30-60 seconds) that alerts listeners to the forthcoming distress message, and are no different from voice radio transmissions of "MAYDAY" or "Coast Guard, Coast Guard come in"**.** In cases where 2182 kHz alarms are sent with no accompanying distress message (regardless of how long the alarm is sounded), they shall be treated in the same manner as uncorrelated Auto-Distress Broadcasts above.

(c) Auto alarms occur only on 2182 kHz. They are used to alert ship and coast stations that a distress call will follow. You should NOT attempt to answer an auto-alarm with a "unit calling" attempt. You should instead **WAIT AND LISTEN** for the distress call. Testing of an auto alarm is only allowed on 2670 kHz under dummy load conditions. If the Auto Alarm preamble is heard on 2182 kHz for other then the specified amount of time of 30-60 seconds, then it should be classified and treated as an Uncertainty type situation requiring no further action other then to wait and listen for additional details. If there is however the possibility of correlating information to the brief Auto alarm preamble all efforts should be made to correlate the information into a cogent theory of who or what the source of the signal is. If further investigative work is required or SAR Planning efforts are put in motion, then adherence to established case prosecution should be followed.

3.4.9.4 The principles of aggressive prosecution and full use of available investigative tools applied for VHF-FM, MF and HF uncorrelated distress broadcasts shall be applied to the receipt of all forms of distress signals (e.g., Cospas-Sarsat, cell phone, flares, etc.). The review process for case suspension or evaluation as a probable hoax should be equally rigorous.

3.4.9.5 **Reasonable Search Area.** In responding to uncorrelated distress broadcasts the SAR planner is faced with the decision to search or not search under the given circumstances. Search planners should keep in mind that the distress broadcast may be the only opportunity the mariner has to indicate a distress situation. A search for the source of the broadcast, if at all possible, should be the foremost objective. Coast Guard policy is to search if a reasonable search area can be determined. There are however, situations where a reasonable search area cannot be established. The following guidance is provided to assist in determining if an area is reasonable or not. As guidance, it does not relieve SMC's from making a decision, based on all the facts available, for each individual case. What may be a reasonable amount of time to devote to a search in one set of circumstances may not be true under another set of circumstances.

(a) **Search Resource:** SMC should select the resource most appropriate for searching in the general area of the uncorrelated distress signal (i.e. boat in bays/inlets, bounded or near coastal waters may be appropriate while a fixed-wing aircraft may be appropriate for open ocean area.).

(b) **Search Object:** First choice is the search object as included in the distress alert. If the distress alert does not mention a specific object, the second choice is an object selection based on local knowledge of craft, which typically operate in the general area of the alert. If no specific object can be selected based on local knowledge, the final choice is to use a 20-foot powerboat as the initial search object.

(c) **Search Area:** The SMC should determine from the transmission method of distress alert and any information contained in the alert, the probable area. Methods to do this are included in para. 3.4.9.2(b).

(d) **Search Time:** Calculate the time that would be required to complete a search with the chosen search resource, object and area.

(e) **Reasonable Decision:** If the search can be completed with 2 hours of on scene search time by a surface vessel or one hour by aircraft, it is reasonable to conduct the search. This equates to approximately a full sortie of search for an HH-65 being reasonable. Clearly the area that can be searched by other resources will not equal that of an HH-65, the same amount of time should be applied, and based on choice of appropriate search resource will determine the area that will be covered in a reasonable search. The 2 hours should not be considered a hard cutoff for when to conduct a search or not, rather an indicator considered with all the other facts of the case in making the decision.

3.4.10 False Alerts, Hoaxes and Suspected Hoaxes.

False alerts and hoaxes waste valuable operational resource dollars, frustrate SAR response personnel, and may adversely affect the Coast Guard's ability to respond to real distress calls. The situation is complicated by the fact that it is often very difficult to determine if an incident is a false alert, hoax, or real distress due to sketchy and/or contradictory information.

3.4.10.1 The following definitions apply:

(a) **False Alert:** A case where the subject reported to be in distress is confirmed not to be in distress and not to be in need of assistance. In a false alert case, the reporting source either misjudged a situation or inadvertently activated a distress signal or beacon resulting in an erroneous request for help, but did not deliberately act to deceive.

(b) **Hoax:** A case where information is conveyed with the intent to deceive.

NOTE: Until determined otherwise, Coast Guard units shall appropriately respond without delay to any notification of distress, even if suspected to be a false alert or hoax.

3.4.10.2 Distress broadcasts suspected to be hoaxes shall be thoroughly evaluated. The conclusion that a particular distress call is a probable hoax must be based on several articulable factors that would lead a reasonable person to conclude that the distress broadcast is false and there is no distress. **Until that determination is made, the distress broadcast shall be responded to as a distress**. At a minimum the following procedures shall be used in the evaluation to determine a probable hoax distress:

(a) Locate and replay the suspected hoax distress broadcast on the unit's voice logging recorder and utilize the direction finding capability, if available, to determine the direction of the call. If the line of bearing (LOB) is over land, identify any major waterways that are in the area of the LOB and eliminate the possibility that the distress is originating from that area. Use of sound manipulation software, if available, is encouraged to enhance or clarify the distress call. If used, the original and enhanced versions must be documented and saved as per Section 2.10.2.

(b) Analyze the call and consider all possible correlating SAR scenarios that could be associated with the event.

(c) If still deemed a probable hoax by the watchstander, replay the call to each level up the SAR chain of command. Each level should consider possible SAR scenarios. The final level of review is the District command center prior to final disposition by SMC.

(d) After all levels of review, if the consensus remains that the call is in fact a probable hoax, no other action will be required. If there is not consensus that the broadcast is a probable hoax, or if a recording was not made, the procedures for an uncorrelated distress broadcast will be followed.

3.4.10.3 **Closing or Suspending a False Alert/Hoax Case.** When the source of a hoax or false alert has been confirmed, SMC or the SC should close the case. However, when the source of a suspected false alert or hoax remains unknown, the case cannot be closed, but only suspended. Either the SC or SMC (with concurrence from the SC) may do this. In the event Coast Guard resources responded to a suspected hoax at the request of another agency, Coast Guard active involvement should only be withdrawn or reduced when the SC so directs.

3.4.10.4 **Investigation/Follow-up.** False alerts and hoaxes significantly drain our limited resources. All Coast Guard personnel are encouraged to find innovative ways to reduce the occurrence of these incidents. In the case of hoaxes, aggressive efforts to identify and prosecute offenders are important. To that end, all pertinent information relating to a suspected hoax shall be reported as soon as possible to the SC's RCC. The RCC shall evaluate the reports as they are received and determine the need for additional investigation. Early contact with their servicing legal office and coordination with CGIS will greatly enhance the likelihood of a successful criminal prosecution.

(a) **Federal Communications Commission (FCC) or other agency involvement.** The FCC can be an invaluable resource in efforts to identify a hoax caller. All RCCs should maintain a close relationship with the nearest FCC office and be familiar with its capabilities to assist in locating the source of a hoax call. The original recordings of a suspected hoax call shall be retained for use as part of the distress case evaluation and/or evidence for legal action. Legal action can result in penalties as discussed in Chapter 1 of this Addendum.

(b) **Coast Guard Investigative Services (CGIS).** CGIS is also a good source to relay information regarding hoax or suspected hoax cases. Often, they can follow-up with FCC and possibly assist in the investigation.

NOTE: 14 U.S.C. §88 (c) makes it a federal felony, punishable by significant imprisonment and/or a monetary fine, for anyone to knowingly and willfully communicate a false distress message to the Coast Guard or cause the Coast Guard to attempt to save lives and property when no help is needed. The statute also provides for a civil penalty of not more than $5,000 and holds the individual liable for all costs the Coast Guard incurs as a result of the individual's actions.

3.4.10.5 This policy does not attempt to define what is or is not an appropriate response in any given case. Operational commanders on a case-by-case basis must make that determination. This policy should not be interpreted by the public as creating any duty or obligation of the Coast Guard to respond to false alarm or hoax cases, and is intended only for internal agency administration, and is subject to change without notice. If public inquiry is received, the public may be informed of the policy. If informed, the public should be cautioned that it is solely for internal Coast Guard use, and that public reliance on the policy is not intended.

3.4.11 Mass Rescue Operations

Mass Rescue Operations (MROs) are civil SAR services characterized by the need to provide immediate assistance to large numbers of persons in distress, and doing so would exceed the capabilities normally available to SAR authorities. MRO planning, preparations and exercises are challenging and relatively complex. Effective arrangements for use of national and often international resources beyond those normally used for SAR are essential. MRO preparations require substantial commitments and partnerships among SAR authorities, regulatory authorities, transportation companies, military, commercial assistance and others.

MROs often need to be carried out and coordinated within a broader emergency response context that may involve hazards mitigation, damage control and salvage operations, pollution control, complex traffic management, large-scale logistics, medical and coroner functions, accident-incident investigation, and intense public and political attention, etc. Efforts often start immediately at an intense level and may need to be sustained for days or weeks.

The Coast Guard, as appropriate, should coordinate MRO plans with companies that operate aircraft and ships designed to carry large numbers of persons. Companies such as cruise ship or ferry operators should share in preparations to minimize the chances that MROs will be needed, and to ensure success if they are.

Planning for a contingency response to a MRO incident must be done before the fact in order to identify and engage resources and activities not normally used or called upon during normal Coast Guard operations. This may often include resources located hundreds of miles from the unit's area of responsibility to include inland and out-of-state assets. **Therefore, each SMC shall complete the forms provided in annexes two through seven in Appendix G (or locally reproduced versions; and updated yearly) in anticipation of a mass rescue event to document potential suppliers of air and surface assets, to document potential staging areas for resources and survivors, and to identify areas of risk where point of contact information is essential to a successful response.**

What the media reports may matter more than what SAR services do for shaping of public opinion about MROs. There should be no unwarranted delays in providing information to the media. Information must be readily available, and freely exchanged among emergency service providers, shipping, airline or other primary companies involved. Since opportunities to handle actual incidents involving mass rescues are rare and challenging, exercising MRO plans is particularly important.

Scenarios that could lead to an MRO include:

- hurricanes,
- heavy flooding,

- tornados,
- earthquakes,
- avalanches,
- weapons of mass destruction incident,
- hazardous material incidents,
- passenger ship or large airliner disasters.

3.4.11.1 An MRO focuses on the lifesaving aspects (rescue phase) of an incident response.

(a) The National SAR Plan (NSP) and the National Response Plan (NRP) provide basic guidance for immediate multi-agency MRO response. However, response to an MRO under the NRP is in addition to the SAR response, not in lieu of it. More detailed information and interagency guidance on this topic will be developed in the U.S. National Search and Rescue Supplement (NSS). The International Maritime Organization has incorporated MRO input to the IAMSAR Manual (See Radiocommunications and Search and Rescue Circular 31, Guidance for Mass Rescue Operations).

(b) Whenever a situation may lead to an MRO and require a surge in response resources, the District or Area RCC, as determined by consultation, should normally handle SAR mission coordination. The SMC function may be shifted to or from another RCC (e.g., the Area or Air Force Rescue Coordination Center (AFRCC)) as appropriate, based on either geographic responsibilities or who is in the best position to coordinate the response.

(c) When a Coast Guard RCC is responsible for response, it should immediately notify applicable federal, state or local resources in the area for assistance. DOD Directive 3025.1, *Military Support to Civil Authorities,* provides guidance to local military commanders for DOD response authority and procedures. The Coast Guard RCC shall also immediately contact the USCG Command Center (G-RPF) and, if the RCC is at the District level, the Area command, with the available information on the incident. Faxing the initial SAR check sheet, Mass Rescue Operation Supplemental check sheet, and other relevant documentation should follow up the initial call. Timely initial notification is critical; the report should not be delayed simply to gather additional information. The Command Center Duty Officer will initiate a conference call between USCG (G-RPR), DOD's Director of Military Support (DOMS), U.S. Joint Forces Command, the Federal Emergency Management Agency (FEMA), the National Guard Bureau and the Air Force Rescue Coordination Center (AFRCC). The purpose of this conference call is to consider the need for immediate response, initiate an immediate response by the appropriate parties, and/or expedite the Federal disaster declaration process.

(d) For overall coordination of lifesaving and other missions, an incident involving an MRO will often warrant designating an Incident Commander (IC) within or outside of the Coast Guard. In this case, until the rescue efforts are terminated or suspended, the RCC-designated SMC working under the organizational structure of the ICS should normally coordinate the MRO portion of the response.

(e) Coordination of SAR functions with other functions is usually achieved by assigning a representative of the SAR agency or of the SMC to the Operations Section of the ICS organization. This allows SAR services to be integrated into ICS and overall operations while still being able to function with relative independence in accordance with normal SAR procedures. ICS has an overall incident focus, while SAR services must remain focused on lifesaving. Except when functions other than SAR are relatively insignificant to the incident response, the IC should normally be someone other than the SMC. The priority mission will always be lifesaving, and the SMC should normally remain unencumbered by additional non-SAR duties. In some cases involving MROs, it may be better to locate the SMC near the incident site rather than at the RCC.

3.4.11.2 SAR Plan onboard Passenger Vessels

(a) The International Convention for the Safety of Life At Sea (SOLAS) requires certain passenger ships to have onboard a plan for cooperation with the SAR services in event of an emergency. The plan is sometimes referred to as a "SAR Plan" and is developed in cooperation between the ship, its company and the SAR service (U.S. Coast Guard for the U.S.). Also, the plan must include provisions for periodic exercises to test its effectiveness. Passenger ships falling under this SOLAS requirement are typically passenger ships and ferries on international voyages.

(b) To meet this SOLAS requirement, G-RPR, in conjunction with cruise industry input, developed the "*Search and Rescue Information Form*" (Figure 3-8) based on guidelines developed by IMO. The intent was to have the essential information needed to make an initial SAR response while maximizing access to the more detailed information available elsewhere (e.g., ship engineering plans). The "Search and Rescue Information Form**"** serves as the SAR Plan for a cruise ship and will be incorporated into the G-M inspection process for carriage of the plan by cruise ships and ferries under SOLAS. The form serves as a template but additional information may be included at the company's discretion. Other countries may require more extensive information as provided for in the IMO guidelines. Cruise ship companies will provide the completed form, and updated versions as needed, to G-RPR for forwarding to all the RCCs. The RCC will distribute within its district, as deemed necessary. In turn, G-RPR will provide any changes to the general Coast Guard information to a central point in the cruise industry for further distribution.

(c) SAR exercises will include passenger vessels. RCC and port-level contingency preparedness planning will incorporate the need for a passenger vessel SAR Plan into their exercise planning and their efforts with other emergency responders for SAR exercises.

SEARCH AND RESCUE INFORMATION FORM

Ship's Name:
Company's Name/Address:
Ship Information:
- Basic Details of Ship:
  - MMSI:
  - Call Sign:
  - Country of Registry:
  - Type of Ship:
  - Classification Society:
  - Gross Tonnage:
  - Length Overall (in meters):
  - Maximum Draft (in meters):
  - Service Speed:
  - Maximum Number of Persons allowed onboard:
  - Number of Crew normally carried:
- Communications:
  - EPIRBs:
  - HF/MF Capabilities:
  - Inmarsat Capabilities:
    - SATCOM Numbers:
  - VHF capabilities:
  - Non-GMDSS communications capabilities:
- Lifesaving Equipment and capacities of each:
  - Lifeboats:
  - Rescue Boats:
  - Tenders:
  - Life rafts:
- Contact List:
  - 24-hour emergency contacts in order of precedence:
    - Name position phone number (As detailed as necessary, but should be multiple contacts)
  - Further Company Points of Contact: (Company public relations officer is recommended.)

Figure 3-8 Search and Rescue Information Form for SOLAS Requirement

3.4.12 Search Action Plans

A standard SAP allows the reader to quickly find critical information by knowing that it will always be in a certain place and to identify vital information that is missing. Equally as important, the drafter of the SAP only needs to learn the format once, since it is standardized throughout the Coast Guard. The standard SAP format is provided in Appendix C. Benefits of this standardized format include:

- time saved in preparing the message;
- fewer calls looking for missing information;
- time saved finding information critical to executing the mission.

3.4.13 Automatic Identification System (AIS)

Automatic Identification System (AIS) is a mobile digital radio broadcast by a ship of its safety of navigation information. Though not designed specifically as a SAR tool, AIS can be useful in that role. AIS is mandated for carriage on a variety of ships on international voyages as well as certain U.S. domestic vessels. Many ships now carry AIS and this number will greatly expand as the requirement is phased-in through 2008. U. S. Coast Guard Cutters 65 feet and above will be outfitted with AIS.

Currently, there is no international requirement to install equipment on shore but the U.S. is establishing nationwide AIS as an element of maritime domain awareness (MDA) to identify vessels approaching or near the coastline, within U.S. ports and inland regions. Present capability for terrestrial-based AIS, including placement at sea on NOAA data buoys, is limited but it is expected to grow quickly in the ports and then expand for the coastal waters.

AIS is a line-of-sight VHF-FM radio data transmission designed to:

- provide automatically to appropriately equipped shore stations, other ships and aircraft, information including the ship's identity, type, position, course, speed, navigational status, text messages and other safety-related information;
- receive automatically such information from similarly fitted ships;
- monitor and track ships; and,
- exchange data with shore-based facilities.

Benefits for SAR from this technology include:

- locate and identify the distressed vessel;
- identify vessels near the distress location or other vessels around the SAR facility;
- identify vessels and aircraft involved in SAR;
- communicate between vessels, CG vessels, CG aircraft and CG command centers;
- vector potential assisting vessels to the scene;
- serve as a means to crosscheck other reported information (radar, visual sighting, etc.);
- if carried on board the SAR response craft, serve as a means to track and monitor its safety;
- depending on the shoreside data network, provide local or regional electronic display of ongoing SAR operations.

3.4.14 Vessel Monitoring System (VMS) Use for SAR

The Vessel Monitoring System (VMS) is a satellite-based tracking system which provides various data, including the vessel's name and position. Some VMS units are also capable of sending and receiving message communications between the vessel and shore. The National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) is the lead federal agency and requires certain commercial fishing vessels to carry VMS. Though VMS was established for fisheries management and enforcement, NOAA allows use of VMS position information for SAR operations.

NOAA maintains a nationwide VMS (N-VMS) network which is linked to the Coast Guard's common operational picture. Various local procedures have been developed within the Coast Guard for command centers to gain access to this information. VMS data is confidential information as defined by the confidentiality provisions of the Magnuson-Stevens Fisheries Conservation and Management Act. While SAR operations may use VMS data, other non-fisheries enforcement purposes do not have such use. NOAA maintains a control system to prohibit unauthorized use or disclosure of VMS data. Limited additional discussion is provided in reference (l).

Section 3.7
Aspects of Survival

3.7.1 The Cold Exposure Survival Model

3.7.1.1 Use of the Cold Exposure Survival Model. The CESM application shall be used for all cases involving persons in the water (PIW) and where persons are at risk of hypothermia when not immersed. These are minimum guideline and should not preclude the use of CESM when doubt exists as to the possible effects of cold weather. CESM is also useful in determining how environmental factors may affect Coast Guard personnel during operations and training evolutions.

(a) All Areas, Districts, Sectors, Groups, Air Stations, the National SAR School and the National Motor Lifeboat School are authorized to use the CESM hypothermia software.

(b) Electronic or hard copies of the inputs and results of running the model shall be included in all SAR cases files in which CESM is used as part of the case suspension decision.

(c) CESM is a reliable means for the prediction of survival times from the effects of hypothermia. Times provided are not considered as absolute values, but rather as guidelines for search planning and case suspension. CESM should be used in conjunction with the existing hypothermia graph (Figure N-14) in reference b. SAR planners should ensure alternate means of determining hypothermia effects, such as Figure N-14 in ref. b, are available in the event the CESM is unavailable via the web.

(d) CESM software can be accessed via the CG Intranet at the following web site: http://osctrxweb.osc.uscg.mil by selecting the CESM 2.2 Launch Application button on the opening screen. No user name or password is required to access CESM.

(e) CESM has a built in HELP function (Press F1 once in the system) that will answer most user questions. Questions about the entry of values in the CESM application can be addressed by contacting the National Search and Rescue School at (757) –856-2380.

3.7.1.2 Understanding Cold Exposure Survival Model Results. Canada's Defense and Civil Institute for Environmental Medicine developed the Cold Exposure Survival Model (CESM) to predict survival times for cold air exposure and cold-water immersion. CESM version 2.2 predicts functional time and survival times based upon cooling of the body's core. These times are based upon an individual's physical characteristics, clothing, and weather and sea conditions. Functional time is the predicted number of hours after initial exposure that a person's body core temperature decreases to the end of mild hypothermia at 34°C (93.2°F). At functional time, the person is incapacitated by hypothermia and is at his limits of self-help. Survival time is the predicted number of hours after immersion when the person's core body temperature falls to the end of moderate hypothermia at 28°C (82.4°F). A person with a core temperature of 28°C will lose consciousness. An immersed unconscious person is unable to maintain an airway, which quickly results in drowning. CESM also provides the Probability of Being Alive at Functional Time with and without floatation, which provides estimates of fatalities from initial immersion Cold Shock and from Swimming Failure. CESM's Probability of Being Alive at Functional Times are based upon the UK National Immersion Incident Survey.

3.7.1.3 Limitations of the Cold Exposure Survival Model. CESM's is a mathematical model using physiological data of heat production from shivering and heat lost through the person's fat and clothing layers. If cold lost overwhelms heat production from shivering then survival time is largely determined by the rate of heat lost from the body. If, heat shivering heat production can balance heat lost, then survival time is governed by the endurance time of shivering. This balance and the limitations on the understanding of shivering endurance limits CESM to predictions of 36 hours or less. CESM assumes a person has floatation, is sedentary, and has a normal cooling response to cold. The input ranges of age, weight, height, and percent body fat of the individual are limited to 7 to 70 years, 22-1102 pounds, 20 –118 inches, and 5 to 50% body fat. CESM Predictions for individuals older than 70 years would be optimistic based upon a 70 year old. Youths between 7 and 16 years old are based upon the responses of 17 years olds adjusted for their height, weight and body fat. CESM is strictly a hypothermia model and does not include the affects of dehydration, injuries, medications, drugs, alcohol, sleeplessness, circadian hormonal cycles and the chances of predation. These factors all have an increasing affect on survival in warmer waters.

3.7.2 The Four Stages of Cold Water Immersion

There are four stages of immersion in which death can occur in cold waters. (1) The initial Cold Shock Response can kill within 1-3 minutes of immersion by respiratory or cardiac problems leading to drowning or sudden death. (2) Cold Incapacitation can kill with 5-30 minutes of immersion by impairing physical performance, thus leading to the inability to self-help, swimming failure, and then drowning. (3) Hypothermia occurs after 20-30 minutes of immersion and will progress until shivering stops and unconsciousness occurs. This will lead to drowning if the head is not held above water, or eventual cardiac standstill if the head is held above water. (4) Circum-Rescue Collapse can occur just prior to, or during, rescue. It can also occur minutes to several hours post-rescue. Symptoms ranging from syncope (fainting) to death, due to cardiac standstill, occur due to loss of arterial blood pressure or the rapid and uncontrolled return of cold blood from the limbs through the unstable heart leading to cardiac arrest during circum-rescue collapse.

3.7.2.1 Stage 1: Initial Immersion Cold Shock.

Sudden immersion into cold water stimulates a large inspiratory gasp response (involving one to several breaths) that may be followed by hyperventilation plus substantial increase in blood pressure and heart rate. If entry into the water involves complete head-under submersion, the gasp reflex could result in immediate drowning. Subsequent hyperventilation will normally diminish within seconds to minutes but could be increased and exaggerated due to emotional stress and panic. Uncontrolled hyperventilation can cause numbness, muscle weakness or even fainting, leading to drowning. Either of these respiratory responses can lead to aspiration of water into the lungs; panic, with subsequent drowning. Cold shock can occur in water colder than 20 ^{o}C (68^{o}F) with symptoms increasing as water temperature decrease to freezing. Healthy individuals may succumb to cold shock through uncontrolled respiratory responses, while those with underlying cardiac disease may experience sudden death due to cardiac arrest or ventricular fibrillation (uncoordinated heart beats). To counteract this phenomenon, control the entry into cold water by slowly entering and keep the head from being submersed. Followed by focusing on surviving the first minute by not panicking and consciously getting breathing under control.

3.7.2.2 Stage 2: Cold Incapacitation.

In addition to the short-term Cold Shock response, the body attempts to preserve the normal core temperature of 37°C (98.6°F) by decreasing heat loss and increasing heat production. Vasoconstriction in the limbs shunts blood from the extremities to the core in order to decrease body core heat loss through the limbs; this allows limb tissue to cool rapidly. Due to intense cooling of muscle and nerve tissues, the victim experiences muscular failure and is no longer able to swim, maintain posture or position in the water, or use the hands meaningfully. In water near 0°C (32°F), incapacitation can occur within 5-15 minutes.

Approximately a third of all cold immersion deaths in 5 to15°C waters occur during Cold Shock and Cold Incapacitation stages.

3.7.2.3 Stage 3: Hypothermia.

Continued excess of heat loss versus heat production will eventually result in decrease of core temperature (primarily the heart, lungs and brain) to clinically hypothermic levels of 35°C. Core cooling can occur when a person is immersed in waters of temperatures below 22^{o}C (72^{o}F). The rate of cooling depends on water temperature, body metabolism and fatness, as well as external insulation provided by clothing and survival gear.

Hypothermia is divided by body core temperature into three sub stages of mild, moderate and severe hypothermia. These stages are defined by the State of Alaska State Cold Injuries Guidelines (downloadable from http://www.chems.alaska.gov/EMS/Downloads_Rx.htm), which also provide guidelines for basic to advance treatment of hypothermia. During **Mild Hypothermia** (35°C to 32°C, 95°F to 90°F) the body's thermoregulatory system functions normally, thus shivering will normally increase in intensity as core temperature drops (unless a limited energy supply inhibits muscular activity). Physical disabilities will be seen first with fine motor movements followed by gross motor movement failure. Mental impairment will also be noted as core temperature approaches 32°C. Thus the victim is experiencing lost of coordination and judgment and is nearing the limits of self-help. The person would have significant problems with: climbing into a life raft, climbing a ladder, lighting a flare, or performing manual tasks. During **Moderate Hypothermia** the core temperature drops from 32°C to 28°C (82.4°F) and thermoregulatory responses are waning or absent. In this stage, shivering will decrease in intensity and eventually stop, and consciousness will be lost (at about 30°C). Possible cardiac arrhythmia (irregular heartbeats) and sensitivity to ventricular fibrillation deceased consciousness or lost of consciousness occurs. **Severe Hypothermia** occurs when the core temperature drops below 28°C (82.4°F); at this stage death is imminent. Acid-base abnormalities occur in the blood, and the cold heart will eventually go into ventricular fibrillation and subsequent full cardiac arrest. This cardiac standstill can occur spontaneously (at heart temperatures approaching 25°C) or can be prematurely induced by mechanical stimulation at higher temperatures (up to 28°C). Thus it is important to be as gentle as possible when handling a moderate-to-severely hypothermic patient. During this stage of hypothermia, metabolism is minimal and cardiorespiratory activity may be difficult to document, and a patient in full arrest may survive for an extended period due to the protective effect of brain cooling. Thus, unless there are obvious signs of fatal injury, victims are not declared dead until they are re-warmed to a core temperature of at least 32°C and further resuscitation efforts fail.

3.7.2.4 Stage 4: Circum-Rescue Collapse.

The hypothermic victim may experience symptoms ranging from fainting to cardiac arrest during the period just prior to rescue, during rescue or within minutes to hours post-rescue. Prior to imminent rescue, mental relaxation and decreased output of stress hormones, may result in a drop of blood pressure resulting in fainting and drowning. The act of rescue itself may also cause sudden collapse. Pulling a victim out of the water in a vertical position removes the hydrostatic squeeze around the lower limbs and may cause blood pooling in the these extremities and subsequent decreased blood pressure. This extra cardiac work or rough handling may induce a reflex cardiac arrest of the cold heart.

Finally, death may occur within minutes to hours post-rescue. A rescued victim may be severely compromised with cold alkaline or acidic blood in the extremities, a heart extremely prone to failure, decrease or lose of consciousness, low blood volume (hypovolemia). Sudden redistribution of blood to the extremities (especially the lower extremities) may cause collapse through decreased blood pressure and cardiovascular instability, sudden return of metabolic byproducts to the irritable heart, or continued decrease in temperature (afterdrop) of an irritable heart. Core temperature will continue to drop and the heart reacts by tachycardia (extremely high heart rate) or fibrillation. Up to twenty percent of those recovered alive, die during due to circum-rescue complications, either before and during rescue or within hours after rescue.

3.7.2.5 Notes on Ice Water Immersion

Even in ice water, a victim may not become unconscious due to hypothermia (~30°C) if a PFD is worn or some other factor prevents the need for vigorous exercise to keep from drowning. If the head is kept above water at this point, the victim could still survive for up to one hour more before the heart stops, as long as the sea is relatively calm and waves do not wash over the mouth.

The following slogan can be used to educate the public that they are not necessarily going to die if suddenly immersed in cold water.

"If you fall into ice cold water you have **1 Minute – 10 Minutes – 1 Hour.**"

- You have **1 Minute to get your breathing under control**, don't panic.
- You have **10 Minutes of meaningful movement** to get out of the water or attain a stable situation.
- You have up to **1 Hour until you become unconscious from hypothermia**, if you don't panic and struggle unnecessarily. And if you are warming a PFD, it may take another 1 Hour until the heart stops due to hypothermia

3.7.3 Near Drowning

3.7.3.1 Any person who has been submerged and unconscious is considered to be in a near drowning incident. All persons who were submerged and unconscious should be transported to a hospital, even if he or she has regained consciousness. Accumulation of fluids in the lungs (pulmonary edema) may develop 6 - 24 hours after submersion. If a person has been under water for **less** than one hour, full resuscitative effort should be employed. If a person has been under water for **more** than one hour, resuscitative efforts are usually unsuccessful. There is generally little differences between fresh and salt water near drowning regarding outcome or treatment, however aspiration of even moderate amounts of salt water (and slightly larger amounts of fresh water) into the lungs may result in severe pulmonary complications within a few hours. These manifest with an increasing breathing and heart rate. Neck injuries and their associated risk of spinal cord injures are common after diving into shallow water or when a boat strikes an object, therefore it is best to maintain the survivor's body in a horizontal position during removal from the water, if it does not delay rescue.

3.7.3.2 Submersions greater than 6 minutes in waters colder than 70°F (21°C) have a better chance of survival than those submerged in warmer waters. The colder the water the better the chance of survival.

3.7.4 Will to Live

The will to live is defined as the desire to live despite seemly insurmountable mental and/or physical obstacles and varies from one individual to another. The attributes that have the greatest effect on a person's will to live are their attitude and physical condition at the time of the incident. The will to live is one of the greatest intangibles for SAR controllers to consider when planning or suspending a search. Survival times are calculated minimums based on an average person, and the data does not take into consideration the will to live, which will differ, for every person depending on their situation. The will to live is extremely hard to define under any circumstances, but it is a part of the "Art of Search and Rescue versus science" and should be considered throughout the case.

3.7.4.1 Controllers should do their detective work by talking with family members, friends and/or co-workers. Questions should be posed tactfully about any significant emotional events (i.e. death in family, divorce, birth of child, newly wed) that may have occurred recently. This can provide a gauge of the victim's mental and physical state when he or she was last seen.

3.7.4.2 Case suspensions should not be solely based on data or tables. Times of possible case suspensions should be an optimistic guess that a person has a strong 'will to live'. Conversations with family members, friends, and/or co-workers will provide the best indication of this. Again, every case is different and every person's will to live is different and should be an educated guess weighing all internal and external factors.

3.7.4.3 With the proper attitude, people can exhibit exceptional physical and mental strength not normally thought possible.

Section 3.8
Conclusion Of SAR Operations

There are three terms used to indicate the status of search and rescue cases; *Case Closed*, *Case Pends*, and *Active Search Suspended Pending Further Developments*. Each status has particular criterion associated with its use. The definitions and criterion for each status are described in the following sections.

3.8.1 Case Closed

When the search object(s) is located, assistance to the object is completed, and no other SAR issues arise, the search and rescue case is considered closed. No further SAR related action by the Coast Guard is necessary or contemplated.

3.8.1.1 Persons who are the object of a search must all be accounted for in order for a case to be closed. When persons remain missing at the conclusion of SAR efforts, the case cannot be closed.

3.8.1.2 Personnel in MEDEVAC cases must either be transferred to other medical authorities or no longer require medical assistance once delivered ashore for the case to be closed.

3.8.1.3 When the object of a SAR case is property, the case may be closed when the object no longer requires SAR assistance. For vessels aground, sunk or in other condition requiring what is determined to be purely salvage assistance, the case may be closed.

3.8.2 Case Pends

This term refers to an open case in which the search object has not yet been located and not all search efforts have been completed, or the search object is located, but rescue or assistance efforts have not yet been undertaken or concluded. Further action by the Coast Guard is necessary and planned. (Action may include coordination of other agency assets.)

3.8.3 Active Search Suspended (ACTSUS) Pending Further Developments

When a SAR case cannot be closed and further search efforts appear futile, the search may be discontinued. The SAR case will remain open until the object of the search is located. If new information is received indicating the object of the search may not have been in the areas searched, or pertinent details of the search object were other than those previously reported, the search may be resumed.

3.8.3.1 The decision to grant ACTSUS is a judgment call that must be based on a careful analysis of the factors of an individual case. The authority to grant ACTSUS carries with it the responsibility for final review of the SAR efforts; requiring knowledge of search planning and a clear understanding of the measures of search effectiveness (see section 3.6.). ACTSUS authority inherently rests with the SAR Coordinator. At the discretion of the SAR Coordinator, ACTSUS authority may be delegated in writing as detailed below. Such delegation shall take into account that in general the level for ACTSUS authority should reside in the SAR chain of command one level above the SMC.

(a) ACTSUS authority may be delegated to Group Commanders and Sector Commanders. Sector Commanders may further delegate authority to the Deputy Sector Commander and/or the Sector Response Chief/Commander. District (osr) shall be advised if this delegation is made.

(b) Consideration should be given to limiting delegated authority based on scope and severity of cases. Prior to ACTSUS for cases involving persons known to be missing, the District (osr) at a minimum shall be briefed.

(c) In the absence of the most junior delegated ACTSUS authority recognized by the SAR Coordinator (Group Commander or the Sector Response Chief/Commander in most cases), ACTSUS authority shall revert to the next most senior authorized ACTSUS authority in the chain of command.

3.8.3.2 A sample SAR Case Suspension Checklist is included in Appendix G. This checklist or a locally produced checklist is recommended as an integral part of the suspension decision process.

3.8.4 Suspension by Other SAR Authorities when Coast Guard Units are Assisting

When another agency is the SMC for a search and Coast Guard units are participating in the effort, the Coast Guard will normally cease all efforts when the SMC suspends the case.

3.8.4.1 **Actions in response to questionable suspension by other SAR authorities.** There may arise cases, of which the Coast Guard is involved, when the other SAR authority, according to Coast Guard standards, makes a questionable suspension decision. Under these circumstances the following actions should be taken:

(a) The involved unit(s) should first convey their concern to the other agency SMC.

(b) If the nature of the concerns is not adequately addressed by the other agency SMC, the unit should brief up their SAR chain of command to the Coast Guard SAR Coordinator (RCC).

(c) The SAR Coordinator (or representative RCC) should contact the other agency to discuss the concerns.

(d) If the concerns are not answered at this level, the SC shall make a decision to either proceed independently to conduct further searches or accept the decision of the other agency.

Section 3.9
Case Documentation

Case documentation occurs both during and after an incident. During an incident, it serves to keep other involved parties informed and also to assist planning of subsequent operational effort. The SAR case file provides invaluable documentation for record purposes, determination of potential lessons learned and data for MISLE, which is an important management tool.

3.9.1 SAR Case Claiming

Coast Guard units shall claim credit for actions taken in response to an activation of the SAR system. Generally, activation of the SAR system will be those situations in which resources coordinate or render assistance, regardless of position or location of the incident. The intent is to ensure Coast Guard resource activity is properly documented to support analysis of SAR operating needs, management and budgetary decisions. Accordingly, this policy should be interpreted using common sense and reasonableness. Case claiming is documented by means of the Marine Information for Safety and Law Enforcement (MISLE) discussed later in this section and more extensively in Appendix B.

3.9.1.1 Requirements for Claiming a Case. Units may claim a case whenever a response is made no matter the time or effort expended. However, units are required to claim a case and submit MISLE data when a Search Rescue Unit (SRU) is launched or when more than 30 minutes of effort are expended. This applies to cases initiated by ELT/EPIRB, DSC and INMARSAT distress alerts. There is no need to claim every ELT/EPIRB case that expends less than 30 minutes of effort, as the RCCs are already required to submit an Incident History Feedback Sheet to the NOAA MCC, who enters the data into their database. For further DSC reporting requirements, see Section 2.B.2.j.

3.9.2 SAR Case Situation Reports (SITREPs)

General reporting requirements for operational incidents, including SAR, are contained in current Commandant, Area and District directives. Passing key operational information in a timely manner, both up and down the SAR organization, is critically important to effective SAR case prosecution.

3.9.2.1 Standard Coast Guard SAR SITREP format. The standard format shall be used, other formats are not allowed except as detailed in paragraph 3.9.2.4; operational commanders may require additional information. The standard SAR SITREP format for Coast Guard use has been developed based on references (a) & (b), and the United States Message Text Format (USMTF), with consideration of field unit requirements and desires. The Coast Guard standard SAR SITREP format and an example are provided in Appendix C.

3.9.2.2 Transmission methods. Timely dissemination of information can be more critical than the method of its transmission. Voice communications, followed later with written record traffic, may be substituted for initial SITREPs between the On Scene Commander (OSC) and SMC. Facsimile and e-mail are also acceptable substitutes in all cases at the discretion of the SMC. Information required does not change with transmission method and should be provided to the fullest extent possible.

3.9.2.3 Frequency of reports. Frequency of SITREPs for individual SAR cases shall be set by the SMC and subject to the following conditions:

(a) The period covered will normally coincide with each search effort (efforts of each individual search plan).

(b) The minimum frequency shall be daily.

(c) Initial SITREPs should be submitted as soon as significant information is available but should not be delayed unnecessarily for confirmation of all details. Amplifying information can be provided in subsequent reports.

These are the minimum requirements. SAR Coordinators may establish a higher frequency for operations within their search and rescue region.

3.9.2.4 SITREPs for DOD operations. The USMTF format shall be used for SITREPs when the SAR operation is DOD directed or if otherwise instructed.

3.9.2.5 **Rapid reporting via Critical Incident Communications Procedures**. Specific SAR incidents may also be Critical Incidents (Incidents of National Interest as detailed in reference (ll)). When this is the situation, normal SITREP reporting procedures at the onset of the incident may not apply. Units shall follow the established streamlined notification system procedures to rapidly report initial, limited information about critical incidents throughout the Coast Guard and to interagency partners.

3.9.3 Medical Evacuation (MEDEVAC) Report

As directed by reference (u), MEDEVAC Report Form (CG-5214) shall be used for all SAR cases involving injured or ill persons. The form provides patient clinical information for the receiving medical facility, serves as a treatment guide for administering medical care, and allows data collection and evaluation. A sample MEDEVAC Report Form is in Appendix D.

3.9.4 Marine Information for Safety and Law Enforcement (MISLE) Reports

3.9.4.1 MISLE is the primary means of collecting and storing information relative to all Coast Guard SAR operations. This information is essential in order to have a true picture of the effort expended by the Coast Guard in support of SAR operations and a clear understanding of SAR incident trends. Additionally, the MISLE database is a measurement tool for determining the Coast Guard's effectiveness in the SAR aspect of its Maritime Safety Mission. MISLE information can also be used to:

- measure unit workload and effectiveness,
- determine resource utilization and needs,
- justify budget requests to meet projected requirements,
- analyze system operations for potential improvement and savings, and
- justify policies and procedures to manage the overall SAR Program more effectively.

3.9.4.2 MISLE data is entered at the unit level directly into a web-based database. Use, access and training information is provided on-line at the Operations System Center MISLE intranet site. Appendix B specifies the data collection and reporting procedures for Coast Guard units.

3.9.4.3 Units shall enter SAR data for every case they claim.

3.9.5 SAR Case Studies

To improve performance at all levels of the SAR system, it is critical to thoroughly analyze significant cases and share lessons learned. Volume II of the International Aeronautical and Maritime Search and Rescue Manual provides an overview of when, why and how to conduct a SAR Case Study.

3.9.5.1 Coast Guard SMC's shall conduct a case study when:

(a) Survivors are found inside the search area, after a search has been suspended;

(b) Survivors are found by someone not involved in the search, outside the search area;

(c) Directed by Commandant (G-RPR), the Area or District Commander.

3.9.5.2 A SAR case study should be conducted whenever a SAR coordinator believes there may be benefit to the SAR System to share lessons learned and best practices. If recommendations have Coast Guard wide, national or international SAR system implications, the original study shall be routed via the chain of command to Commandant (G-RPR) for action. If recommendations impact local (unit, Sector, District) policies or procedures, the original study shall be routed to the level that has authority over those policies or procedures for action. Copies of all SAR case studies shall be forwarded to Commandant (G-RPR) and the National SAR School. The program manager will be responsible for working with the National SAR School to extract lessons learned and best practices and disseminate that information.

3.9.5.3 SAR Case Studies are not Administrative Investigations; they are to be used primarily as a means of improving the SAR system. SAR Case Studies are also valuable teaching tools that benefit current and future SAR and communications watchstanders. Case studies consider actions that could or should have been taken, as well as those actions not typically expected but show a benefit to the SAR system. Our goal is forward-focused and straightforward: to foster the continuous improvement, which is the hallmark of Coast Guard Search and Rescue.

3.9.5.4 A SAR case study deals only with significant factors, and should include the following:

(a) Subject line identifying the case with descriptive wording and SAR case number.

(b) A consolidated case narrative.

(c) Assumptions used in planning each search effort, including distress positions and times, search object types, and leeway parameters.

(d) Environmental data used, including water current, wind, and visibility.

(e) Actual distress positions and times, and actual search object type.

(f) For each day of the operation, search area coordinated, type of craft assigned, search patterns used, planned and actual sweep widths and track spacing, and computed datum points.

(g) Debriefing information from survivors, giving actual drift reconstruction, observed environmental conditions, and any sightings of search craft. See section 3.9.5.7 for information regarding survivor debriefing.

(h) Analyses of the effectiveness of Computer Assisted Search Planning (CASP) or other computerized search planning system used, and, when appropriate, the reasons why CASP was not used. The Coast Guard Operations System Center (OSC) and the NOAA Mission Control Center (MCC) shall be notified immediately of any pending case studies involving Cospas-Sarsat, Amver, or CASP so historical data, voyage files, environmental data, system status, etc., as appropriate, can be captured on magnetic tape and retained for later analysis. SAR Case Studies sent to Commandant (G-RPR-1) should also include copies of computer SAR inputs and outputs and mailed separately if too bulky.

(i) Comments on use or lack of detection aids, performance of equipment, adequacy of communications and SRUs, and suspected reasons for failing to detect the object.

(j) Information on objects and persons located, including reference to their location within the CASP generated probability map (when CASP is used).

(k) Controller debrief and RCC/Command Center equipment data. Whenever practicable, interview or obtain statements from all controllers and watchstanders who participated in case prosecution. Include reference to the performance and adequacy of RCC/Command Center equipment.

(l) Computer floppy disks or appropriate electronic media containing all C2PC calculations and output including drift planning, icons, chart reference, etc.

(m) Copies of all Search Action Plans, SITREPS and other Message Traffic.

(n) All completed Checklists and Quick Response Cards.

(o) Chronological logs.

3.9.5.5 More than one person should conduct a SAR case study. Participation should be extended to the HQ program manager (Commandant (G-RPR)), SAR School, other RCCs, and Sector Command Center’s, as appropriate.

3.9.5.6 SAR Case studies may be limited to addressing only certain aspects of a case that are of particular interest. For example, problems with communications, use of computer search assets (CASP/Amver etc.) or international coordination or assistance might be singled out for examination. The Operations Systems Center shall be notified by most direct/rapid means of any problems encountered when using or attempting to use Amver or CASP. The

MCC shall be notified by most direct/rapid means of any problems encountered when using or attempting to use the Cospas-Sarsat system. Problems shall be documented via SITREP.

3.9.5.7 Survivor debriefing and equipment data. SAR case studies provide opportunities to analyze survivor experience and also lifesaving equipment performance. Survival in hostile environments is affected by many variables including the physical condition of the survivors, action of the survivors, reinforcement given by rescue resources prior to rescue, and safety or survival equipment.

(a) Immediate survivor debriefing is necessary in cases where other persons remain missing. In addition, information given by survivors soon after their ordeal will be beneficial in determining how their experience affected their survival and how rescue personnel prosecuted the case from their perspective. This information is important for the Coast Guard to use in critiquing its rescue operations and in making improvements in SAR operations. The particulars of a survivor debriefing will vary case by case. Interviewers are to ascertain what information is pertinent for a case. Some examples of the type of information are:

(1) Cause of accident or distress;

(2) Age, physical condition, experience of survivors and fatalities;

(3) In cases where unsuccessful searches were conducted prior to location or case closing, determine whether search resources were seen or heard, whether any other vessels or aircraft were seen or heard, and what means survivors used to attempt to communicate or signal;

(4) Times of significant events during the distress, and times of sightings of resources.

(b) If survivors had onboard, used, or had problems with safety and survival equipment, or have recommendations for improvements, Coast Guard personnel debriefing survivors should obtain the following information and include it in the SAR case study or narrative:

(1) General condition of equipment, including defects and inherent capabilities;

(2) Coast Guard approval number (if approved);

(3) Name of manufacturer (if not approved);

(4) Size, capacity, or model number (if not approved);

(5) Date of manufacture; and

(6) Survivor statements on their experience with the equipment, including use and effectiveness.

3.9.5.8 Freedom of Information Act (FOIA) considerations. FOIA governs releasing case studies to the public. Certain portions of case studies may be exempt from release under the Freedom of Information Act or if the incident is under litigation, some records could fall within the public disclosure exemptions. Refer to reference (i) and consult with the servicing Legal Office for specific instructions on release of information prior to releasing case studies.

CHAPTER 4
GENERAL SAR POLICIES

Section 4.1
Maritime SAR Assistance Policy (MSAP)

This section sets forth policy and procedures for handling requests for any type of Search and Rescue (SAR) assistance from the Coast Guard and defines Coast Guard relationships with other possible sources of assistance. It establishes internal Coast Guard policy guidance only and is not intended to confer any right or benefit nor create any obligation or duty to the general public.

4.1.1 Preamble

The MSAP is the result of an effort enacted by Congress in 1982. It directed the Commandant to "review Coast Guard policies and procedures for towing and salvage of disabled vessels in order to further minimize the possibility of Coast Guard competition or interference with...commercial enterprise." The review was directed because of congressional concern that Coast Guard resources were being used unnecessarily to provide non-emergency assistance to disabled vessels that could be adequately performed by the private sector.

The MSAP represents more than a decade of development of relationships among the Coast Guard, Congress, the commercial towing industry, and the Coast Guard Auxiliary. Each iteration of the MSAP has received close scrutiny. It has been a give-and-take process that has culminated in a policy that is equitable to all stakeholders.

Problems have often arisen when individuals or groups have interpreted the MSAP to fit their own particular situation or personal agenda. This contradicts the aim of the policy and creates unnecessary conflict among those for whom it was intended to serve. The key is to follow the policy as it is intended, to seek clarification where necessary, and to collectively ensure that the disabled and/or endangered mariner gets fair, reasonable and consistent service throughout the United States. However, in order to clarify some of the more often misinterpreted aspects of the MSAP, notes have been added.

4.1.2 Definitions

4.1.2.1 **Coast Guard Resources:** Includes regular active duty personnel; reserve personnel when serving under any form of active or inactive duty orders; auxiliary personnel when serving under orders; cutters; boats; aircraft; and equipment of regular, reserve, and auxiliary Coast Guard units.

4.1.2.2 **Emergency Phase:** Classification made by the SAR Mission Coordinator (SMC) upon receiving a request for assistance. The three emergency phases; i.e., UNCERTAINTY, ALERT, and DISTRESS, are described in reference (a). A shortened definition of each is:

(a) An UNCERTAINTY phase exists when there is knowledge of a situation that may need to be monitored, or to have more information gathered, but that does not require moving resources.

(b) An ALERT phase exists when a craft or person is experiencing some difficulty and may need assistance, but is not in immediate danger or in need of immediate response. Apprehension is usually associated with the ALERT phase.

(c) The DISTRESS phase exists when grave or imminent danger requiring immediate response to the distress scene threatens a craft or person.

4.1.2.3 **On Scene:** When the assisting resource has completed any necessary transit to the vessel requiring assistance.

4.1.2.4 **Safe Haven:** A Safe Haven is considered a place that can accommodate and will accept the safe mooring of the vessel, and has available a means of communication, normally a telephone.

4.1.3 Background

4.1.3.1 **Coast Guard Mission.** The Coast Guard promotes safety on, over, and under the high seas and waters subject to the jurisdiction of the United States. The Coast Guard is authorized by law to develop, establish, maintain, and operate search and rescue facilities. The Coast Guard is authorized to perform any and all acts necessary to rescue and aid persons; and to protect and save property at any time and at any place where its facilities and personnel are available and can be effectively used. However, there is no legal obligation for the Coast Guard to undertake any particular rescue mission.

4.1.3.2 Coast Guard Auxiliary Mission. The Coast Guard Auxiliary is a volunteer, non-military organization of civilians under the direction and administration of the Coast Guard. The functions of the Auxiliary include promoting safety and effecting rescues on the high seas and U.S. navigable waters. Auxiliary operational facilities are excellent resources that can, within their capabilities, enhance the Coast Guard's ability to respond to maritime emergencies. The Auxiliary has a proud tradition of support to the Coast Guard and helping mariners needing assistance on the water.

4.1.3.3 Other Assistance Available. The Coast Guard has often been the only source of readily available assistance to recreational boaters. However, commercial and additional volunteer sources of assistance exist and are capable and willing to provide various services to mariners. Additionally, other federal agencies and many state, county, and local governments have resources which may be capable and willing to assist the Coast Guard or otherwise provide assistance to mariners.

4.1.3.4 Commercial Operator's License Required. 46 U.S.C. § requires the operator of any vessel that tows a disabled vessel for compensation to have a valid license to operate that type of vessel in that particular geographic area.

4.1.4 Discussion

4.1.4.1 Prevention. The Coast Guard emphasizes that the best deterrent to needing assistance is a prepared and knowledgeable mariner. Before departing, the prepared operator ensures that all safety equipment, sufficient fuel for the voyage, and necessary charts are onboard; the vessel is in good operating condition; the radio is operating properly; and that someone knows the sailing plan of the operator and will notify the Coast Guard if the vessel fails to return when expected.

4.1.4.2 Primary Concern. The Coast Guard's primary concern in a search and rescue situation is that timely and effective assistance be provided.

4.1.4.3 Responsibility for Action. In search and rescue, the Operational Commander/SMC is usually in the best position to assess the circumstances of a particular case, and to take whatever steps are necessary to promote the safety of life and property.

4.1.4.4 Safety Concerns When Disabled. There is an inherent danger associated with being disabled on the water. Although a specific situation may not be classified as being in the DISTRESS emergency phase by the SMC, there may still be a real concern for safety either in the mind of the SMC or the mariner; i.e., the incident is in the ALERT emergency phase. The SMC must be sensitive to the level of apprehension caused in the mind of the mariner when having a problem in a small recreational vessel, particularly when concern is specifically expressed. The policy herein permits more expeditious response in those cases where the mariner expresses apprehension for the near-term safety of the occupants.

4.1.5 Policy

4.1.5.1 Distress. Immediate response will be initiated, if feasible, to any known situation in which the mariner is in imminent danger. This response may be provided by regular Coast Guard; Coast Guard Auxiliary; or other federal, private, state, local, or commercial entity resources. The SMC may use all sources of assistance in a distress situation without concern for conflict with private enterprise.

4.1.5.2 No Conflict Concern--Any Situation. Private organizations (non-commercial), state and local organizations, and Good Samaritans are acceptable sources of SAR assistance. When volunteered or available, their help can be used without any concern for conflict with commercial providers. However, if their expertise is unknown, the SMC shall more closely monitor the assistance provided. This is especially true in the case of Good Samaritans.

4.1.5.3 Guiding Principles in Non-Distress Cases. When specifically requested assistance, such as a commercial firm, marina, or friend, is not available, a request for assistance will be broadcasted. If a commercial provider is available and can be on scene within a reasonable time (usually one hour or less) or an offer to assist is made by a responder listed in the previous paragraph, no further action by the Coast Guard, beyond monitoring the incident, will be taken. Otherwise, a Coast Guard Auxiliary facility, if available, or a Coast Guard resource may be used.

NOTE: "Monitoring" of a non-distress incident need not necessarily constitute a radio communications schedule.

Three principles that guide assistance to vessels not in distress are:

(a) The first responder on scene with the vessel requesting assistance normally will provide assistance,

(b) If a Coast Guard resource or Auxiliary facility takes a disabled vessel in tow, the tow will normally terminate at the nearest safe haven, and

(c) Once undertaken, there is no requirement to break the tow except as described below in paragraph 4.1.6.6, "Relief of Tow".

NOTE: General procedures and instructions for towing are contained in the Boat Crew Seamanship Manual, COMDTINST M16114.4 (series) (ref. (e)).

4.1.5.4 Non-Distress Use of Coast Guard. The Coast Guard both supports efforts of private enterprise and encourages volunteerism in assisting mariners. Coast Guard resources will not unnecessarily interfere with private enterprise. Coast Guard resources normally do not provide immediate assistance in non-distress cases **if alternative assistance is available.** A Coast Guard resource may assist in a non-distress situation when no higher priority missions exist and no other capable resource is reasonably available.

NOTE: "Reasonably available" means that the resources should be able to respond before the situation deteriorates.

4.1.5.5 Acceptable Auxiliary Employment. When on routine safety patrol under orders, Auxiliary operational facilities may be deployed to minimize response time to requests for assistance. Every effort shall be made to provide maximum SAR coverage in the assigned area of responsibility by using all available resources effectively. Auxiliary facilities may also be available for callout when not on routine patrol. Auxiliary facilities will be used to the extent of their capabilities and availability.

4.1.5.6 Inspection of Alternate Resources Not Required. There is no requirement for the operational commander to inspect, certify, or otherwise categorize the capabilities of commercial providers or any organization that responds to requests for assistance by mariners. Accepting or rejecting an offer of assistance is a function of the vessel operator. However, the operational commander should be familiar with the availability, capabilities, and operating practices of these alternate assistance providers, as they may form a significant element in the overall assistance network.

4.1.5.7 Conflict of Interest for Coast Guard and Auxiliary Personnel. Because of the possibility of conflict of interest, active duty Coast Guard personnel, Reservists under active duty or inactive duty orders, and Auxiliarists under orders are prohibited from engaging in commercial assistance activity of any sort. Likewise, Reserve and Auxiliary personnel are not to be used in any capacity that might give rise to the perception of a conflict of interest. Vessels and aircraft used for commercial assistance activities shall not be accepted as an Auxiliary facility, and a designated Auxiliary operational facility shall not be used as part of commercial assistance activities **at any time.**

NOTE: An Auxiliary facility remains so designated even when not under orders as long as the person(s) is/are a member of the Auxiliary.

4.1.5.8 Assistance to Auxiliary Facilities. Coast Guard resources or Auxiliary facilities may be used to help Auxiliary facilities in need of assistance at any time.

4.1.5.9 Use of Government Frequencies. Government frequencies are reserved for authorized use by government agencies. Commercial enterprise must use designated commercial frequencies. Commercial enterprise is NOT permitted to interfere with the Coast Guard's gathering of information or communicating with a vessel requesting assistance. They may, upon hearing of a request for assistance on a government channel, hail the vessel desiring assistance on an authorized calling frequency and switch them to a commercial channel to conduct business when Coast Guard communications are completed. They may also proceed to the location of the vessel requesting assistance, based on information overheard on the government channels. As net control, the Coast Guard MAY permit nongovernmental entities to conduct short business transactions on a government channel on a not-to-interfere basis, but any unit so doing must continue to monitor the communications.

NOTE: There is no requirement that the commercial channel be a frequency normally monitored by the Coast Guard.

4.1.6 Procedures

4.1.6.1 Obtain Information and Classify Case. When the Coast Guard receives a call for assistance, the SMC shall evaluate the circumstances to determine the severity of the case using information obtained from the mariner. It is the **initial** determination that will govern how a case is to be initially treated. Later developments may cause the SMC to reclassify the case and modify the response. If there is any question as to the degree of danger to persons or property, the case should be classified as being in the DISTRESS phase. A SAR event is dynamic. Information must be obtained and evaluated as the case progresses. The SMC shall take action appropriate to the situation. In determining the appropriate emergency phase, the SMC may consider a variety of factors, such as, but not limited to, the following:

(a) Nature of the situation;

(b) Position or lack of known location;

(c) Type, size, reported condition of vessel, food, water, emergency signaling devices, and survival/life saving equipment onboard;

(d) Visibility, including daylight or darkness conditions;

NOTE: A lack of visibility, in-and-of-itself, does not necessarily constitute a distress situation. Other factors, such as equipment limitations, proximity to shipping lanes, etc., must be considered prior to case classification.

(e) Tide and current conditions, and the ability of the vessel to anchor;

(f) Present and forecasted weather including wind and sea conditions, air and sea temperature;

(g) Special considerations such as number of personnel onboard, age, health, and special medical problems;

NOTE: "Special medical problem" requires use of common sense, e.g. an otherwise healthy person, who simply has a limb in a cast, does not necessarily constitute a special medical problem.

(h) Ability of the vessel to maintain reliable communications with a source of assistance. CB radio communications should be considered only under ideal conditions. They are not authorized on Coast Guard vessels for communication and Coast Guard shore units have no requirement to have CB capability;

NOTE: Another on scene vessel can act as the communications platform for a disabled boater. Although the Coast Guard discourages boaters from using cellular telephones for emergency purposes, they ***may*** be considered a reliable form of communication. If the cellular telephone connection is good, and there is no danger of losing the connection, then, in the absence of any other factors listed that would raise SMC's level of apprehension, the case should be classified as non-distress and treated as such. In such cases, the Command Center should act as a communications intermediary and should closely monitor the case to ensure the disabled boater does, in fact, receive the assistance required. It is acceptable for the SMC to dispatch a resource while broadcasting a MARB, but it is the intent of the policy to allow commercial providers the opportunity to respond.

(i) Degree of concern of the mariner for the safety of the occupants of the vessel - ask the questions, "Do you have safety concerns?" and if so, "What are they?"; and

(j) The potential for the situation to deteriorate after evaluating the relevant factors,.

4.1.6.2 Distress. For cases determined to be in the DISTRESS emergency phase:

(a) **Respond Immediately If Able.** An immediate response may be provided either by Coast Guard or Coast Guard Auxiliary resources. The SMC might be aware that other resources, such as private, local/state-operated vessels, or commercial providers, might be responding. That fact, however, normally should not delay or preclude a Coast Guard response. If Coast Guard resources cannot or are not responding, the caller should be notified.

NOTE: As mentioned in 4.1.6.1, if a case is classified as distress, the Coast Guard will respond immediately if able, to include broadcasting a UMIB and dispatching appropriate resources.

(b) **First On Scene Assists.** The first assisting resource on scene capable of stabilizing and handling the situation, whether Coast Guard or other resource, should render appropriate assistance and complete the case if they desire. If a Coast Guard resource arrives on scene and another responder has the situation under control, the SMC should determine whether or not they are able to fully execute the case. If it appears that they can, then the Coast Guard resource may be withdrawn.

NOTE: If a Coast Guard resource arrives on scene first in a distress situation, and through their actions they render the situation non-distress, they may elect to complete the case, i.e., they may tow the disabled boat to the nearest safe haven if there is no higher need for the resource.

(c) **Intervene If Required.** If, upon arrival, a Coast Guard resource finds another responder on scene whose assistance is not adequate, the Coast Guard resource should immediately attempt to stabilize the emergency. Once the situation is stabilized, the Coast Guard resource may be withdrawn if the first responder appears capable and is willing to conclude the case. The Coast Guard resource should not normally be withdrawn if continued stability of the situation is dependent on Coast Guard equipment or expertise.

NOTE: The Coast Guard may direct a responding resource to drop tow or cease operations if it is determined that the resource or equipment is not adequate to perform the job at hand, e.g., a 23' boat cannot be expected to adequately tow a 70 ton fishing vessel.

(d) **Treat As Non-Distress If Appropriate.** If the Coast Guard responds to a request for assistance and determines, once on scene, that there is no emergency, the case will be handled as a non-distress, following the procedures outlined below.

4.1.6.3 Non-Distress. For cases determined NOT to be in the DISTRESS emergency phase:

(a) **Advise and Seek Desires.** The requester should be advised that:

(1) It appears there is no imminent danger;

(2) It is Coast Guard policy to defer to an alternate responder; and

(3) The Coast Guard will assist in contacting any specifically requested alternate assistance, such as a commercial provider or friend.

NOTE: The issue of what constitutes a "specific request for alternate assistance" has led to confusion. Clearly, if a requester names a specific individual, company, or network, that is a specific request. In the case of generic requests for a specific network organization, contact general dispatch at the parent organization. However, if the mariner is unable to clearly articulate the name of the desired source of assistance, the SMC should ask for clarification. If unable to get clarification, a MARB should be issued.

(b) **Offer a Marine Assistance Request Broadcast (MARB).** When specific alternate assistance is not requested or available, the mariner will be informed that a broadcast can be made to determine if someone in the area can come to his or her assistance.

(1) If the mariner requesting assistance states that a MARB is not desired or specifically requests that a Coast Guard resource or an Auxiliary facility be dispatched, again outline the policy and notify the mariner that unless a specific request is made for alternate assistance, the mariner must either accept the alternative of letting the Coast Guard make a MARB or arrange for his own assistance.

(2) If a MARB is declined, the SMC may monitor the condition of the mariner, but need take no further action unless requested or the situation deteriorates.

NOTE: If a MARB is declined in a non-distress situation, the Coast Guard has no further obligation to monitor or respond unless the boater changes his/her mind or the situation deteriorates. The burden lies solely with the boater.

(3) When a MARB is requested, proceed as described below.

(c) **Make a MARB.** A MARB will be made to solicit the voluntary response of anyone who can assist the mariner, and the MARB will include a general location of the vessel. (See sample MARB at the end of this section). The MARB must be worded carefully in order not to create an obligation by the vessel operator to accept or pay for the services of any and all responders. It is used to invite persons, such as commercial providers or Good Samaritans, interested in responding to do so **if they desire.** If no intent to respond to the MARB is heard within a reasonable period of time, Coast Guard resources or Auxiliary vessels may be directed to respond. A guideline of 10 minutes is recommended for the SMC to await an answer to a MARB before the SMC directs Coast Guard or Auxiliary resources to respond. Once the MARB is answered, the SMC will determine what a reasonable period of time is for a response time on scene, based on his or her experience with responders in the area and the circumstances of the case. Coast Guard resources or Auxiliary vessels may also be directed to respond if no alternate responder can do so within a reasonable period of elapsed time. Factors governing the elapse of a reasonable period of time for assistance to arrive on scene are discussed below, but such a period should not normally exceed one hour from first awareness of the case.

(d) **Monitor Response.** As part of the MARB, any resource that is responding should be requested to notify the Coast Guard of the estimated time of arrival (ETA) on scene. This notifies the Coast Guard of the actions of a responder. It also notifies the vessel requesting assistance of the ETA of the assisting resource. Moreover, it notifies other potential responders of the need for further assistance or whether they should proceed with any expectation that they will arrive on scene first. The SMC may repeat the identity and ETA of potential responders so that the mariner requesting assistance and others will know who has responded.

NOTE: Although it is encouraged that the MARB include Coast Guard notification of ETAs, it is not mandated. Neither is it mandated that the SMC repeat the identity and ETA of responders. It is, however, advised.

(e) **Maintain Communications.** A communications schedule between the Coast Guard and the requestor should be established until direct communication is achieved between the requester and responder to ensure that the situation does not deteriorate and that assistance has arrived.

(f) **Reasonable Time Determination.** Following the initial MARB, the SMC may wait a reasonable period of time before taking further action, during which additional MARBs may be made if desired by the SMC. The "reasonable period of time" decision must be made by the SMC based upon the information collected at the outset of the communication with the mariner requesting assistance (see listing in paragraph 4.B.6.a. above), as updated by subsequent communications checks. Loss of or lack of effective direct communications may increase the level of apprehension. The definition of the ALERT emergency phase is again referred to, with its key word "apprehension." It should be considered that the situation may be causing apprehension in the mind of the mariner, especially if they have so indicated, and any action to alleviate that stress may be instrumental in preventing the situation from deteriorating. The greater the level of apprehension, the shorter the "reasonable period of time."

(g) **Simultaneous Arrival.** To minimize conflict, if an Auxiliary facility under orders or a Coast Guard resource arrives on scene nearly simultaneously with a commercial provider, they shall report to the SMC, remain on scene until it is confirmed the provider is capable of providing the required assistance and safely completing the case, then clear the area, and take no further part in the incident.

(h) **Mariner May Decline Offered Assistance.** To a limited extent, the mariner requesting assistance has the option to refuse offered assistance. If the requester refuses offers of assistance from a Good Samaritan or an Auxiliarist, another MARB may be issued or the SMC may decide to intervene and dispatch a different Auxiliary facility or a Coast Guard resource. The mariner may also elect to contact a commercial provider on a commercial channel.

(i) **Commercial Assistance Declined.** A more difficult situation may arise if the mariner requesting assistance rejects the first arriving commercial assistance. Coast Guard Auxiliary or Coast Guard units should not assist in these cases so long as the situation remains classified below the DISTRESS phase. Nevertheless, the mariner may be assisted in finding alternatives. Upon notification that the mariner does not desire the assistance offered by the commercial provider, the Coast Guard may, upon the mariner's request, broadcast one additional MARB. The Coast Guard may also provide the telephone numbers of other commercial providers in the area so that the mariner can call them through the Marine Operator. If this is successful, it is the responsibility of the mariner, not the Coast Guard, to negotiate who provides the service. If unsuccessful, and so long as the original commercial provider is on scene, the SMC may maintain a listening watch for the vessel, but must make it clear that neither Coast Guard nor Auxiliary units will be dispatched. Should the commercial provider abandon the case, the SMC may dispatch a Coast Guard or Auxiliary unit or issue an additional MARB, as appropriate. The principle that governs further action by the SMC is that, once a responder has arrived on scene, the level of apprehension regarding the case is probably significantly reduced. Further dealings between the requester and the responder are not Coast Guard responsibility. Additional services provided to the mariner requesting assistance would be provided only on a not-to-interfere basis so long as the level of apprehension remains low.

(j) **If Situation Deteriorates.** The SMC should normally dispatch Coast Guard resources at any time the circumstances in a case threaten to deteriorate into a DISTRESS situation that exceeds the capability of the assisting resource.

4.1.6.4 **Cases Discovered By Auxiliary Facility.** When an Auxiliary vessel on routine safety patrol or otherwise on orders discovers a vessel requesting assistance, but not in radio contact with the Coast Guard, the Auxiliarist will relay the request for assistance to the Coast Guard operational commander and may undertake to provide assistance, if capable. If a tow is undertaken, the Auxiliary vessel is required to notify the operational commander of the identity of the vessel, the location of the vessel, and the destination to which the vessel is being towed. No Auxiliary vessel may undertake the tow of another vessel unless the Auxiliarist is reasonably assured of the safety of both vessels and the persons onboard. If the Auxiliary vessel cannot safely tow a disabled vessel that is standing into danger, it may endeavor to remove the persons from the threatened vessel and stand by until a more capable resource arrives on scene.

> **NOTE:** Cases discovered by the Auxiliary are a particularly sensitive section of the policy. How the situation is dealt with is the end product of sustained negotiations and compromise effort on the part of all concerned parties. It intends that the Auxiliarist, not the SMC, will make the judgement as to whether the Auxiliarist can safely assist. When the Auxiliarist notifies SMC that they intend to assist the vessel, it's not "asking for permission". The Auxiliarist has already determined that he/she can safely provide assistance, and the notification to SMC is a courtesy. This policy does not reduce the operational commander's authority and responsibility to exercise command and control over all assigned forces, including Auxiliary vessels on ordered patrols. The operational commander may override the Auxiliarist's decision if warranted by an evaluation of the circumstances. However, unless there is a specific reason to do so, such as an indication of unusual risk or hazard, or an operational need to assign the Auxiliary vessel to a higher priority mission, the decision to assist should be left to the Auxiliarist.

4.1.6.5 Safe Haven Considerations. In cases involving towing by the Coast Guard or Coast Guard Auxiliary, the vessel being assisted will normally be taken to the **nearest** safe haven. Coast Guard or Auxiliary resources should not tow the vessel beyond the nearest safe haven when there are commercial resources that could perform this function. Exceptions to this policy may be made in specific cases if, in the judgement of the SMC, they are warranted by humanitarian or other concerns. When determining the suitability of a potential safe haven, the SMC should be sensitive to the reluctance of some private firms and yacht clubs to accept a disabled or damaged vessel and the attendant potential liability.

4.1.6.6 Relief of Tow. In cases involving towing by the Coast Guard or Coast Guard Auxiliary where no emergency exists, the assisted vessel **may** be released to another provider who appears capable provided that:

(a) The SMC and coxswain of the assisting vessel determine that a hand-off can be carried out safely; and either

(b) Alternative assistance is desired and arranged by the operator of the vessel being assisted; or

(c) The operational commander has a higher need for the Coast Guard resource or Auxiliary facility.

4.1.6.7 Alternative to MARB. When no response to a MARB is evident, such as late at night or during an off-peak period, the SMC may dispatch Coast Guard resources or Auxiliary vessels. As an alternative, the SMC may pursue by telephone or other communication means any other SAR resource that can provide expeditious response and ask if the resource desires to respond. Again, unless the responder is an Auxiliary facility that will be under orders, the offer should be made in terms of an invitation to provide assistance rather than in terms of "request you proceed and assist." An estimated time of arrival should be obtained and passed to the mariner requesting assistance. Continue to monitor the situation. Direct contact with the vessel requesting assistance as soon as possible should be encouraged.

4.1.6.8 Communications Interference. If someone interferes with government communications, issue the command "CEASE TRANSMISSION." If interference continues, document the incident and process as an FCC violation. For further details regarding how to initiate a violation, refer to title, Radio Frequency Plan, COMDTINST M2400.1 (series) (ref (o)).

4.1.7 SAR Coordinator and SMC Responsibilities

4.1.7.1 Responsibilities

(a) SAR Coordinators shall direct SMCs within their region to follow the policy and procedures established in this section of the Coast Guard Addendum to the National SAR Plan insofar as practicable. SAR Coordinators are authorized to vary procedures where local conditions require it in order to achieve the overall intent discussed. Variances should be documented.

(b) SMCs must remain familiar with all SAR assistance resources within the SMC's AOR, including those of the Auxiliary, and shall direct those resources that the SMC believes are needed to the scene of a vessel in distress.

(c) Operational commanders are urged to work with all who can provide assistance to mariners requesting assistance, including volunteers, state and local organizations, the Auxiliary, and commercial providers, to promote the most effective use of all resources available to the SAR system.

(d) SMCs at the Sector level shall conduct regional public meetings with commercial assistance providers in their AOR no less than semi-annually, preferably prior to and at the conclusion of the local recreational boating season. These units will also maintain regular liaison with all known commercial assistance providers in their AOR in order to discuss policies, build cooperation, and air any Coast Guard or industry concerns. It is highly recommended that commercial providers be invited to participate in training and exercises held with other (state, local, volunteer organization) SAR assistance providers.

4.1.7.2 Maritime Assistance Decision Flow Chart. The Maritime Assistance Decision Flow Chart, figure 4-1, is provided to assist the SMC on MSAP decision-making. The flow chart is a tool to implement the policy, not the policy itself.

4.1.8. Marine Assistance Request Broadcast Format for Radiotelephone Transmission

4.1.8.1 Format

(a) Channel 16 (156.8MHz)

(b) HELLO ALL STATIONS (3 times) THIS IS (unit identification) RELAYING A MARINE ASSISTANCE REQUEST BROADCAST FOR (type of vessel) (nature of problem) IN THE VICINITY OF (location). LISTEN CHANNEL 22A, OUT.

(c) Channel 22A (157.1MHz)

(d) HELLO ALL STATIONS (3 times) THIS IS (unit identification) RELAYING A MARINE ASSISTANCE REQUEST BROADCAST (text) OUT.

4.1.8.2 Example of Text

(a) Channel 16 (156.8MHz)

HELLO ALL STATIONS. HELLO ALL STATIONS. HELLO ALL STATIONS. THIS IS COAST GUARD SECTOR HAMPTON ROADS RELAYING A MARINE ASSISTANCE REQUEST BROADCAST FOR A DISABLED PLEASURE CRAFT IN THE VICINITY OF THE FOURTH ISLAND OF THE CHESAPEAKE BAY BRIDGE TUNNEL, LISTEN CHANNEL 22A, OUT.

(b) Channel 22A (157.1MHz)

HELLO ALL STATIONS. HELLO ALL STATIONS. HELLO ALL STATIONS. THIS IS COAST GUARD SECTOR HAMPTON ROADS RELAYING A MARINE ASSISTANCE REQUEST BROADCAST FOR PLEASURE CRAFT MOONSHINE WYT5138. PLEASURE CRAFT MOONSHINE IS A SEVENTEEN-FOOT FIBERGLASS OUTBOARD DISABLED DUE TO LACK OF FUEL IN VICINITY OF THE FOURTH ISLAND OF THE CHESAPEAKE BAY BRIDGE TUNNEL LATITUDE 37-03N LONGITUDE 76-04W. ANY VESSEL DESIRING TO ASSIST THE MOONSHINE IS INVITED TO PROCEED TO THAT LOCATION OR CONTACT HIM BY RADIO. PLEASURE CRAFT MOONSHINE IS STANDING BY CHANNEL (an appropriate intership frequency). IF YOU ARE OFFERING TO ASSIST THE MOONSHINE, PLEASE RESPOND AND PROVIDE AN ESTIMATED TIME OF ARRIVAL. OUT.

(c) Channel 22A (optional acknowledgment of replies)

VESSEL SEA DOG RESPONDING, ETA 15 MINUTES--ROGER, OUT. VESSEL HELPER RESPONDING, ETA 35 MINUTES--ROGER, OUT.

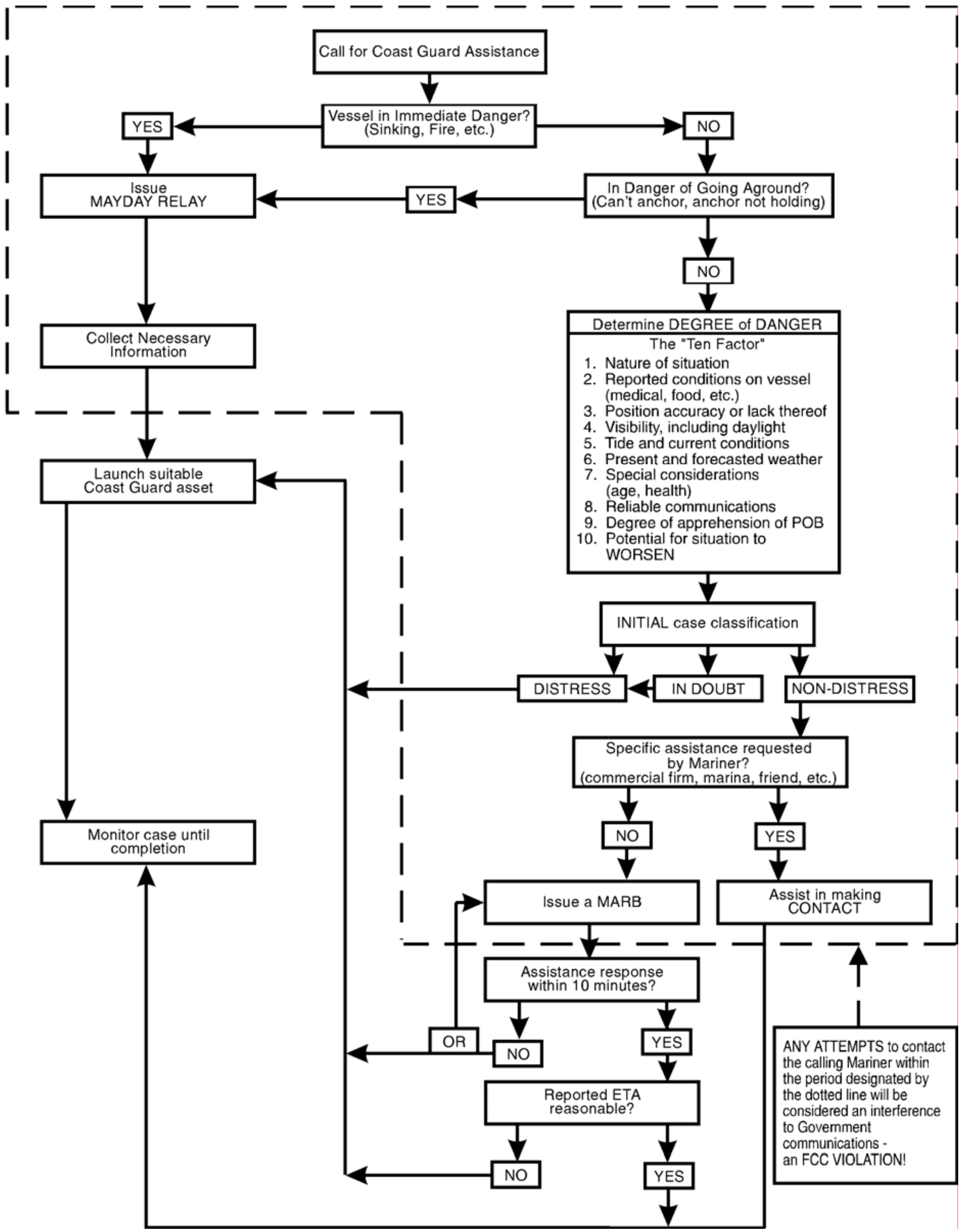

Figure 4-1 USCG SAR Mission Coordinator (SMC) Maritime Assistance Decision Flow Chart

Section 4.2
Forcible Evacuation of Vessels

4.2.1 Authority

The Coast Guard is authorized to perform any and all acts to rescue and aid persons and protect and save property at any time and any place where its facilities and personnel are available and can be effectively used. This includes the authority to force or compel mariners to abandon their vessels when a life-threatening emergency exists, and there is an immediate need for assistance or aid.

4.2.2 Voluntary Evacuation a Preferred Alternative

Although the Coast Guard does have the authority to compel a mariner to abandon their vessel in a life threatening situation, it is always preferable that a mariner would voluntarily evacuate when necessary. Coast Guard personnel should endeavor to use all means, including powers of persuasion, to encourage a mariner to evacuate, when appropriate. Forcible and/or compelled evacuations should only be conducted when a life-threatening emergency exists, and there is an immediate need for assistance or aid.

4.2.3 Risk Considerations

The decision to order a compelled or forcible evacuation for the purpose of saving lives will be based on the myriad of factors that combine to make each SAR mission unique. Therefore, when considering whether or not to take this action, the factors that are considered in Operational Risk Management for SAR planning should serve as a model for evaluating the risk to the civilian mariner and the necessity for ordering such a compelled evacuation. These factors include the on scene environmental conditions, the presence of a hazardous bar, shoals or other hazardous obstruction, the condition of the mariner's vessel, available Coast Guard resources, the fitness and experience of the Coast Guard personnel on scene and the expertise of the authority ordering the evacuation.

4.2.4 Decision Authority

The decision to force or compel mariners to abandon their vessels should normally be made by the cognizant SAR Coordinator (SC). If time does not permit consultation with the SMC and cognizant SC, and if in the On-Scene Coordinator's (OSC) objective judgment a life-threatening emergency exists affecting the subject vessel, and there is an immediate need for assistance or aid, the OSC may authorize this action. In this case, the SMC and SC shall be notified immediately.

4.2.5 Use of Force Considerations

Properly trained, qualified, and supervised Coast Guard law enforcement personnel may use force in accordance with the Coast Guard Use of Force policy found in reference (l), when necessary, to compel compliance with an evacuation order issued under the aforementioned conditions.

4.2.6 Distressed Vessel Master's Authority Limitation in Regards to Crew Evacuation

Once the Coast Guard issues an evacuation order, the master of the vessel has no authority to prevent his or her crew from complying with evacuation instructions, and any use or attempted use of force by the master to prevent his or her crew from complying with evacuation instructions may constitute a criminal offense.

4.2.7 Documentation

All forced evacuations and circumstances leading to such an order shall be fully documented in unit logs by all involved units and reported in Situation Reports to Commandant (G-RPR) and Commandant (G-LMI) via the chain of command. Use of force required to compel compliance with an ordered evacuation shall be reported in accordance with Appendix E of reference (l). The cognizant Flag Officer shall initiate a claims investigation, and, where appropriate, an administrative investigation, in all forcible evacuation cases.

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Section 4.6
SAR Cost Recovery and Reimbursement

This section outlines the Coast Guard's position in regards to cost recovery and reimbursement in light of services provided, statutory direction, international obligations and the impact on SAR system effectiveness.

Issues of cost recovery and reimbursement may surface from both foreign and domestic entities assisting in SAR operations as well as the public in general. While we must be mindful to employ a cost-effective response to an incident, response to distress itself must not be delayed or limited by the misplaced concern of "who is to pay the bill".

NOTE: 14 U.S.C. § 88(c) makes it a federal felony for anyone to knowingly and willfully communicate a false distress message to the Coast Guard or cause the Coast Guard to attempt to save lives and property when no help is needed. Penalties include up to 6 years in prison, $250,000 fine, $5,000 civil penalty, and the possibility of repaying the Coast Guard for costs.

4.6.1 SAR Cost Recovery

The Coast Guard as a matter of both law and policy does not seek to recover the costs associated with SAR from the recipients of those services. There are currently two situations where the Coast Guard may seek to recover costs:

(a) 14 U.S.C. §654 authorizes the Coast Guard, under limited circumstances to sell fuel and supplies to furnish services to public and commercial vessels and other watercraft. Coast Guard policy clarification and procedures for cost recovery under this statute are found in reference (mm).

(b) 14 U.S.C. §88 (c) authorizes the Coast Guard to collect all costs the Coast Guard incurs as the result of an individual who knowingly and willfully communicates a false distress message to the Coast Guard, or causes the Coast Guard to attempt to save lives and property when no help is needed. See section 3.4.9.4.

4.6.2 SAR Cost Reimbursement

The Coast Guard **does not** reimburse other agencies or individuals for costs associated with SAR. Per the National SAR Plan, federal agencies may assist or request assistance in conducting SAR operations, and state and local agencies are encouraged, but not required to assist in SAR operations. Since there is no obligation for any agency to assist the Coast Guard, they do so on a not-to-interfere non-reimbursable basis.

4.6.3 MEDEVAC at Sea

A MEDEVAC at sea is considered SAR. The Coast Guard does not charge or accept charges for SAR.

4.6.4 MEDEVAC vs. Medical Transport/Air Transportation between Medical Facilities

A MEDEVAC from land is also SAR. A Medical Transport, air transportation between medical facilities, is essentially an air ambulance service and should be done only on a not-to-interfere basis with other missions or commercial providers. (See section 4.8.3)

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Section 4.7
Emergency Medical Assistance

The Coast Guard is routinely involved in requests for emergency medical assistance, both traditional maritime response and non-maritime emergency medical service incidents. Medical advice transmitted by Coast Guard facilities must come from qualified medical officers. Also, replies to requests for medical advice should be done on a not-to-interfere basis with commercial providers. Two policy sections address how emergency medical assistance will be provided and the criteria for action under various medical situations for maritime and non-maritime medical response.

The SMC is to have procedures in place for responding to a request for medical advice at sea (MEDICO) or for medical evacuation (MEDEVAC).

MEDICOs and MEDEVACs are part of the traditional Coast Guard SAR mission. Some shipping companies and vessel owners, however, have contractual arrangements with hospitals or commercial medical advisory companies to provide medical advice.

Often calls for emergency medical assistance cannot be immediately classified as a MEDICO or MEDEVAC. Knowledgeable operational medical advice is required to make this determination. The possibility of a MEDICO developing into a MEDEVAC is always present.

4.7.1 MEDICO

4.7.1.1 MEDICO, discussed in references (a) and (b), is an international term normally meaning the passing of medical information by radio. Medical advice is available through many sources that include Coast Guard and DOD medical providers, medical firms and hospitals contracted by shipping companies and international service organizations such as the International Radio-Medical Center (CIRM).

4.7.1.2 The Coast Guard shall cooperate to the extent possible to identify appropriate medical resources to relay medical assistance messages or assist in establishing communication between the vessel and their contracted services if commercial channels of communication are not available.

4.7.2 MEDEVAC

4.7.2.1 MEDEVAC can be extremely hazardous to both patient and crew because of severe environmental conditions frequently encountered at sea, and from dangers inherent in transferring a patient from vessel to vessel or from vessel to helicopter.

4.7.2.2 When deciding whether a case is sufficiently urgent to justify the risks involved with a MEDEVAC, the SMC should obtain advice from medical personnel, preferably Coast Guard or Department of Defense medical personnel, familiar with:

(a) SAR operations.

(b) Emergency medical capabilities of Coast Guard crews.

(c) Operating characteristics of Coast Guard SRUs.

4.7.2.3 In all MEDEVAC operations, the risks of the mission must be weighed against the risks to the patient and the responding resource. Factors to consider include:

(a) The patient's clinical status.

(b) The patient's probable clinical course if MEDEVAC is delayed or not performed. A delayed MEDEVAC which does not have a negative impact on the patient's probable clinical course may:

(1) Provide for adequate planning,

(2) Allow the rescue unit to stay within its range limits,

(3) Enable a daylight evacuation,

(4) Allow the vessel to enter port, or

(5) Allow for the weather to moderate.

(c) Medical capabilities of responding Coast Guard personnel and equipment. Some Coast Guard operating units have Emergency Medical Technicians (EMTs); a few units have a Health Services Technician attached. Helicopter rescue swimmers are all EMT trained. All qualified boat crews have taken basic first aid training.

(d) Prevailing weather, sea, and other environmental conditions.

(e) Contractual arrangements between vessels and hospitals or commercial medical advisory services.

4.7.2.4 Guidance for filling out the required MEDEVAC Report is provided in Chapter 1 of this Addendum.

4.7.3 District Procedures

4.7.3.1 To help ensure timely response for MEDEVACs and prompt relay of MEDICO advice through Coast Guard channels of communication, each District should maintain a list of:

(a) Medical personnel available and qualified to recommend MEDEVACs and advise on MEDICOs. The medical personnel should be knowledgeable in Coast Guard helicopter and vessel SAR operations and in the capabilities of Coast Guard crews, helicopter rescue swimmers, Emergency Medical Technicians (EMTs), and Health Services Technicians (HSs).

(b) Primary sources of emergency medical advice include:

(1) Coast Guard or Department of Defense flight surgeons.

(2) Coast Guard or Department of Defense aviation medical officers.

(3) Coast Guard or Department of Defense general medical officers.

(4) Civilian physicians.

4.7.3.2 District Commanders should, if possible, indoctrinate personnel likely to make operational medical recommendations. The indoctrination may include aircraft familiarization, helicopter hoisting, and aircraft and boat operations.

4.7.4 Medical Resources

The primary sources of emergency medical advice should be contacted by telephone or the most rapid means available, as soon as possible after a call for emergency medical assistance is received. If none of these sources are immediately available within the District, similar resources in other Districts may be contacted. If contacting a qualified medical advisor is unavoidably delayed, the SMC may act independently, but should continue to seek medical recommendations.

4.7.5 MEDEVAC Procedures for Merchant Vessels

The United States has developed a recommended checklist for merchant vessels to use in medical emergency cases. Most of the information parallels that found on the MEDEVAC/MEDICO Checklist in Appendix G. The information requested to be on the merchant vessel checklist should be incorporated in procedures for MEDEVAC.

4.7.5.1 Recommended checklist content for use by vessels and the controllers is as follows:

"When requesting medical assistance for an ill or injured person, additional relative information as indicated below should be furnished. Other information may also be necessary in certain cases. Codes from Chapter 3 of the International Code of Signals may be used if necessary to help overcome language barriers. If medical evacuations are being considered, the benefits of such an evacuation must be weighed against the inherent dangers of such operations to both the person needing assistance and to rescue personnel.

(a) Patient's name, age, gender and nationality;

(b) Patient's respiration, pulse rate, temperature and blood pressure;

(c) Location of pain;

(d) Nature of illness or injury, including apparent cause and related history;

(e) Symptoms;

(f) Type, time and amounts of medications given;

(g) Time of last food consumption;

(h) Ability of patient to eat, drink, walk or be moved;

(i) Whether the vessel has a medical chest, and whether a physician or other medically trained person is aboard;

(j) Whether a suitable clear area is available for helicopter hoist operations or landing;

(k) Name, address and phone number of vessel's agent;

(l) Last port of call, next port of call, and ETA of next port of call; and

(m) Additional pertinent remarks."

4.7.5.2 Action upon receipt of a request for emergency medical assistance, either MEDICO or MEDEVAC, in general, is to:

(a) Contact qualified medical resources to obtain operational medical advice.

(b) Alert SAR forces when a MEDEVAC is likely.

(c) If an immediate MEDEVAC is not required, determine whether the vessel has a contractual arrangement with a commercial medical advisory service or hospital, and assist them as practicable.

SAR Coordinators may delegate this responsibility.

4.7.6 Transport of Next of Kin (NOK) with MEDEVAC Patients

Transporting NOK decisions are made by the SMC. The following paragraphs provide guidance for transport decisions for the possible situations that may arise. Final decisions to transport NOK for safety of operations are made by cutter commanding officers, boat coxswains and aircraft commander. Normally, in those situations where the decision is made to transport NOK with a patient, only one person would be permitted.

4.7.6.1 **Hoisting of NOK**. Due to the inherent dangers of hoisting, NOK will not normally be hoisted along with MEDEVAC patients except in cases where the patient is a minor child. For minor children one parent (or legal guardian) may accompany the child. Other situations, which may call for hoisting NOK, are:

(a) Patient being hoisted is the only parent present of a minor child (NOK),

(b) Hoisting of patient(s) from a vessel would leave the vessel and remaining person(s) in danger due to inability to safely operate the vessel in conjunction with current weather, location, delay in other help arriving, or

(c) There is severe emotional trauma to either the patient or NOK and on recommendation of the flight surgeon or other MEDEVAC advice source; it would be medically beneficial for the NOK to accompany the patient.

4.7.6.2 Transporting NOK by aircraft not involving hoisting. In MEDEVAC situations where a patient is to be transported by aircraft but hoisting is not involved, allowing NOK to accompany the patient may be allowed after evaluation of the risks and capabilities of the on scene resource.

4.7.6.3 Transporting NOK by surface craft. In MEDEVAC situations where a patient is to be taken off a vessel or other location by cutter or boat, the risks involved are generally lower then those with hoisting. Transporting the NOK by surface craft may be permitted after evaluation of risks and capabilities of the on scene resource. The SMC must consider the following in evaluating the risk involved when making a decision to transport NOK by surface craft:

(a) Dangers in transferring between vessels given relative sizes of vessels,

(b) Current on scene conditions (seas, winds, weather, daylight/dark), and

(c) Physical ability of the NOK to negotiate the move across to the Coast Guard vessel.

4.7.7 Protocols When Encountering Infectious Diseases.

Commandant (CG-112) is responsible for establishing appropriate protocols for medical response and protection of Coast Guard rescue personnel from infectious diseases they may encounter in the performance of their duties. Protocols may be found via their web site: http://www.uscg.mil/hq/g-w/g-wk/wkh/index.htm.

4.7.7.1 Blood-borne Pathogens

(a) Blood-borne pathogens are microorganisms that are passed via exposure to human blood or other infectious materials that could result in disease or death. Hepatitis B virus and Human Immunodeficiency Syndrome Virus (HIV) are most commonly associated with blood-borne pathogen diseases. Other infectious materials could include semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluid visibly contaminated with blood and all body fluids in situations where it is difficult or impossible to differentiate between body fluids, as well as any unfixed tissue or organs other than intact skin from a human (living or dead). Personnel shall take precautions whenever the potential of exposure to blood-borne pathogens exists. To reduce possible exposure, properly fitting latex or vinyl gloves shall be worn whenever the hands of personnel may come in to contact with blood or other potential infectious material. Eye protection, facemasks, or face shields shall be worn whenever splashes, spray, spatter or droplets of blood could contaminate the month, nose, or eyes. The use of pocket masks and resuscitation bags shall be used when emergency mouth-to-mouth resuscitation is performed.

(b) Personnel shall refer to reference (oo) for further guidance to minimize the inadvertent exposure and disposal of contaminated materials due to blood-borne pathogens. This instruction provides detailed instructions on the use of protective equipment and proper disposal and clean up of contaminated materials

4.7.7.2 Respiratory Diseases such as the Severe Acute Respiratory Syndrome (SARS) and various strains of influenza are serious health concerns for rescue personnel and may be encountered in the course of rescue as well as other Coast Guard missions requiring interaction with vessel crews and passengers. Appropriate safeguards should be put in place to protect rescue personnel from possible infection. Protocols and updates may be found via the CG-112 web site.

4.7.8 Cardiopulmonary Resuscitation

During SAR missions or MEDEVACs, Coast Guard SAR responders often recover victims of injury or medical emergencies who are in cardiopulmonary arrest (not breathing and do not have a pulse). The Coast Guard has an established cardiopulmonary resuscitation protocol to address these situations. This protocol may be found at: http://www.uscg.mil/hq/g-w/g-wk/wkh/index.htm. All SMC's and EMS responders should become familiar with this protocol.

4.7.8.1 Withholding CPR. Recent medical research on emergency cardiac resuscitation has resulted in new recommendations on "Do Not Start CPR" and "Stop CPR" guidelines. The Coast Guard protocol addresses these aspects of response to cardiopulmonary arrest incidents.

4.7.8.2 Stopping CPR to conduct a hoist or transferring a patient. Stopping CPR may turn sometimes near futile effort into a virtually certain futile effort to save a life. Accordingly, the decision to stop CPR for a hoist is made by the flight surgeon, if available. If the flight surgeon is not available, the CPR protocol should be consulted and followed assuming the start time for CPR is on completion of the hoist. A multitude of factors impact this decision, among them:

- Time elapsed since the patient went into cardiopulmonary arrest,
- Proximity to advanced medical care,
- Expected duration of hoist (patient and rescue personnel if sufficient personnel are not available on board the helicopter to continue CPR without on deck rescue personnel),
- On scene conditions and risk in conducting the hoist in regards to medical condition, and
- Other medical factors (injuries, chronic illness, etc.).

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Section 4.8
Non-Maritime EMS Response

Coast Guard SAR resources may, and often do, become involved in the following types of non-maritime emergency medical service (EMS) incidents, MEDEVAC and Medical Transport missions, even though they are not required to do so:

- Emergency evacuation of injured from highways.
- Transfer of critically injured or ill persons from isolated locations to medical care facilities.
- Evacuation of non-critically injured or ill persons from remote or inaccessible areas where surface transportation is not practicable.
- Transfer of critically injured or ill persons from a medical care facility to another more capable of treating the case.
- Emergency deliveries of medical supplies, equipment, blood, and human organs for transplant.

What distinguishes medical transportation as a MEDEVAC, is the transportation takes the persons from a distress situation to a medical care facility.

4.8.1 Statutory Background

4.8.1.1 Reference (w) requires states to develop a highway safety program following Department of Transportation guidelines. Standard 11, "Emergency Medical Services (EMS)," of reference (w) is the basis for many state EMS systems. This standard is being supplanted by national voluntary standards developed by the American Society for Testing Materials (ASTM) F30 Committee on Emergency Medical Services. These standards provide for growth and quality assurance of future prehospital care.

4.8.1.2 Research has shown that helicopters are used effectively in civilian EMS systems. The Military Assistance to Safety and Traffic (MAST) program evolved as a cooperative effort of the Departments of Transportation, Defense, and Health and Human Services. The National Highway Traffic and Safety Administration of the Department of Transportation administers the program.

4.8.2 EMS Agreements

4.8.2.1 District Commanders are authorized and encouraged to enter into agreements for mutual cooperation and coordination of emergency medical services, with state, county, or local officials. General guidance on establishing agreements is provided in Chapter 1 of this Addendum. EMS agreements should include provisions such as the following:

(a) Coast Guard facilities should respond to requests only when operations permit. Their primary missions in the maritime areas take precedence.

(b) Agencies or officials should limit requests for Coast Guard assistance to serious cases in which response by non-Coast Guard resources would apparently be ineffective or not timely. Competition with private ambulance services, including air ambulances, shall be avoided. As required by reference (w), all inland cases shall be reported to, and coordinated with, the U.S. Air Force RCC (AFRCC).

(c) The pilot of an aircraft responding to an emergency medical request is the final judge of whether a mission can be accomplished safely, and may discontinue the mission.

(d) Agreements should be entitled "Emergency Medical Service Agreements" rather than "SAR Agreements."

4.8.2.2 Operational commanders may include other requirements in agreements, and must forward copies of all agreements to Commandant (G-RPR), (G-RCA), (G-1121) and (G-CCS).

4.8.2.3 A sample EMS Agreement is contained within Appendix E.

4.8.3 Air Transportation Between Medical Facilities (Medical Transport)

Criteria listed below are to be used as a guide for Coast Guard aircraft making emergency transfers of critically ill or injured patients to/between hospitals or other medical facilities:

(a) Non-competition with available, suitable commercial air ambulance services.

(b) Suitability and availability of aircraft.

(c) Non-interference with Coast Guard primary missions and training.

(d) Case is designated as an emergency involving actual lifesaving or reduction of disability.

(e) Documented medical need for the movement.

(f) Appropriately trained health care personnel to be provided by the requesting medical facility in accordance with needs and circumstances to support the care of transported patient. This training shall not only be that necessary to meet the needs of the patient during the transfer, but also in accordance with guidelines established by the Air Station Commanding Officer to safely function in Coast Guard aircraft. It is highly recommended that Commanding Officers (COs) performing frequent Medical Transport missions have an ongoing training program established to train personnel at the supported medical facility to provide care safely aboard CG aircraft.

(g) The transferring medical facility shall supply any special medical equipment (i.e. pumps, ventilators, etc.) needed to effect the transfer. Such equipment shall meet the approval of the Coast Guard for use in CG aircraft prior to being used. Non-approved equipment shall not be used. This will require prior coordination by the COs with frequently supported facilities.

(h) Return transportation for attending medical personnel is NOT provided by, nor the responsibility of, the Coast Guard.

4.8.4 Transportation of Medical Supplies, Equipment, Blood, and Human Organs for Transplant

Emergency medical transportation requests may include the movement of medical supplies, equipment, blood, and human organs for transplant. The criteria for transportation of patients in 4.8.3 above shall be applied to non-patient medical cargo. Key in the decision is the medical necessity and urgency that cannot be met by other transportation.

4.8.5 Escort of MEDEVAC/Medical Transport Aircraft by Emergency Fire Equipment

MEDEVAC/Medical Transport aircraft should request an escort, when available, by emergency fire equipment during landing and taxi operations. This precaution allows for rapid evacuation of non-ambulatory patients from the aircraft in the event of a ground emergency.

Section 4.9
Ice Rescues

4.9.1 Ice Rescue Operations

Several domestic SAR Regions contain a variety of lakes, rivers, and tributaries that are extensively used by the public during the winter for recreational purposes. In some areas "ice bridges" are used to travel from mainland to islands and across frozen streams. Recreational and transit use of the ice, however, is hazardous and often results in the Coast Guard being called upon to perform search and rescue missions. This section discusses responsibilities, procedures, training, and equipment necessary to ensure the safety of Coast Guard personnel tasked with performing search and rescue operations on the ice. These operations, perhaps more than any other category of SAR, depend upon an interactive network of response agencies; each having specific capabilities and limitations. Maintaining close working relationships at the local level is essential to providing, safe, effective response to ice emergencies. Sectors will incorporate this information into their MOUs as appropriate.

4.9.1.1 Sector Responsibilities

(a) Designate those units that are required to maintain an ice rescue capability. This designation should be based on factors such as historical SAR data, and availability of non-Coast Guard ice rescue resources. Designations should be made in SOP or applicable instructions.

(b) Ensure that designated units are properly equipped and personnel trained.

4.9.1.2 Air Station Responsibilities. Air Stations should develop operational procedures specifically adapted for ice rescue situations, and identify training and equipment shortfalls to the applicable District (osr).

4.9.1.3 Cutter Responsibilities

(a) Cutters should identify potential ice emergency situations such as man overboard situations, whether from the cutter itself or vessels in the vicinity. Emergency bills should provide an adequate framework to respond to such situations. Ensure full use of risk assessment procedures for any response.

(b) Cutters should identify any training and equipment shortfalls and notify their applicable OPCON.

4.9.1.4 Station Responsibilities

(a) Stations designated to maintain an ice rescue capability shall follow the guidelines contained in this chapter. These guidelines are open to comment, and should be continuously evaluated and updated as necessary.

(b) ALL Stations shall maintain close working relationships with local agencies that conduct ice rescue operations. This will ensure that the Coast Guard is able to notify the appropriate resources under any circumstances.

  (1) Since multi-agency resources are not uncommon, the conduct of joint training exercises and the development of local working agreements are encouraged as they are essential elements of pre-planning for an ice emergency.

  (2) Mixed agency crews are permissible, but should be organized with care. Jurisdictional issues and conflicting policy guidance often limit the scope of operations for such "teams".

(c) Designated ice rescue stations shall develop and publish an ice rescue bill, instruction, or standing order. Each station's instruction will vary due to the presence of various rescue agencies or other local conditions.

(d) Ice Rescue Courses. There are various ice-rescue training courses available in the private sector. The curriculum of these courses varies, depending upon the type of ice rescue most prevalent in a particular region. Note: the Coast Guard does not endorse these courses.

4.9.2 Ice Development and Characteristics

Crews tasked with ice rescue responsibilities should have a thorough knowledge of ice characteristics, ice formation, and the hazards of hypothermia and frost bite. The more rescuers know about the risks involved with ice rescue, the better they are able to perform the mission, and, more importantly, be a survivor on the ice. Whenever possible, efforts should be made to include identification of different ice conditions during training exercises. Ice conditions are affected by a number of factors.

4.9.2.1 When water is cooled at the surface it begins to sink because it is heavier than the warm water that rises to replace it. This is called vertical circulation. This vertical circulation stops when the body of water becomes isothermic (all water at different depths is exactly 39.2 degrees). At this point water becoming colder stays at the surface and ice begins to form.

4.9.2.2 Ice near shore on a frozen lake may be unsafe due to pressures outward and upward which causes cracks to appear. Fluctuating water levels also cause inshore ice to be unsafe. Dropping water levels leave ice "high and dry" with no liquid beneath it to give it support.

4.9.2.3 Deep lakes usually remain open in the middle throughout the winter because of winds and currents.

4.9.2.4 New ice is stronger than old ice. Direct freezing of lake-water is stronger than ice formed from melting snow or refrozen ice. Clear new ice is stronger than ice clouded with air bubbles. Discolored or cloudy ice tends to indicate weaker ice.

4.9.2.5 Ice around stumps, pilings, or submerged objects is often weakened by convection heat given off by the object.

4.9.2.6 Underwater streams or springs with flowing water will cause weak spots by the circulating water. Any ice over or near moving water is too weak to be safe.

4.9.2.7 Strong sunshine shining through the ice and reflecting back off of the bottom will warm the ice from beneath and cause deterioration.

4.9.2.8 Table 4-1 lists ice thickness levels that are the minimums required to support a person or a vehicle:

Table 4-1 Ice Thickness Minimums to Support a Person or Vehicle
Provided for Internal Coast Guard Use Only

	Centimeters	Inches
Single person on skis/foot/snow shoes	5	2
Two people on skis, side by side shoes	10	4
½ ton vehicle	20	8
¾ ton vehicle	25	10
Over snow vehicle	30	12

Only with complete knowledge of ice formation and strength will the ice rescuer, be able to effectively judge how to complete the ice rescue.

4.9.3 Ice Rescue Planning

A critical part of a safe, effective ice rescue program is planning. Those stations designated as ice rescue units, should identify potential accident sites within their AOR, select the safest and most effective rescue approaches, and practice possible techniques using appropriate equipment at the site. The time spent planning and practicing is not fully appreciated until the time it becomes most valuable during a rescue. Ice rescue stations shall maintain quick-action cards or files that list the locations in their AOR where ice related accidents are most likely to occur and where ice rescue resources can be deployed. Some suggestions are:

(a) Survey all potential accident sites within the unit's AOR before winter freezes. Record the size of the area, water depth and any structures within the water at the site.

(b) Examine those sites to locate natural and man-made hazards, especially those with a history of accidents.

(c) Include the location of access sites and direct routes to them. Pay particular attention to areas that are relatively inaccessible or dangerous such as canyons, marshlands, etc.

(d) Survey all potential accident sites during periods of initial freeze, again recording characteristics of the location.

(e) Hold training exercises at potential accident sites when suitable ice forms. Staying within the limitations of the rescue team will help avoid unnecessary dangers.

(f) Organize and participate in multi-agency ice rescue drills to develop a greater understanding of capabilities, resources, and policies of various contributing agencies.

4.9.4 Risks to Crews

4.9.4.1 **Hypothermia** is primarily a function of temperature, body conditions, and weight, combined with exposure to the elements with inadequate protective clothing. COs/OinCs shall ensure personnel are in top physical condition, and are provided with proper cold weather gear, prior to being sent out on the ice.

4.9.4.2 **Frostbite** is the effect of excessive exposure to extreme cold. To minimize this risk, ice skiff crews shall be provided with adequate protective clothing, including foam padded ski masks, to minimize exposed skin. A wind-chill factor of –54 degrees Fahrenheit will cause frostbite in 10 minutes on exposed skin. At a wind-chill factor of –20 degrees Fahrenheit, frostbite will result on exposed skin in one hour.

4.9.5 Ice Rescue Resources and Utilization

4.9.5.1 **Helicopters.** Helicopters are the primary SAR resource for Ice Rescues. Sector Command Center's shall determine when to request a helicopter, considering such factors as distance offshore, air temperature, ice conditions, urgency, and distance to the nearest air station. If any doubt exists, units should request a helicopter. The applicable Command Center is the approving authority for using helicopters.

4.9.5.2 **Ice Skiffs**

(a) Ice skiffs will normally be launched only in case of a known emergency with reliable position information, and will launch as close as possible to the actual emergency site. Ice skiffs should not be used to search for overdues, or investigate flare sightings.

(b) Untethered crewmembers should not normally go on to the ice without the skiff, or an equivalent platform to provide support in the event of breaking through the ice en route to the victim. In those rare instances where personnel must transit the ice without a skiff, they shall be tethered or closely observed.

(c) Ice skiffs should not be launched when wave height is above two feet, or when a combination of air temperature and wind velocity exceeds a wind-chill factor of –54 degrees (F). The Sector may waive these requirements on a case-by-case basis, but must notify the applicable Command Center.

(d) A minimum of four persons should be dispatched with the ice skiff and government vehicle when responding to a case. The coxswain and two crewmen should conduct the rescue while the fourth person should stay with the vehicle and maintain communications with the skiff and the Station.

(e) Handheld GPS receivers should be used on all deployments to provide reliable position information.

(f) Ice Skiff (and ATV) operations carry an inherent risk to personnel. The SMC shall be notified prior to deployment of personnel on an ice skiff.

4.9.5.3 Small Boat Use

(a) Except for bona fide emergencies involving immediate danger to life, boats should not be operated when wind and temperature conditions are such that accumulations of topside ice in excess of one inch may reasonably be expected.

(b) COs/OinCs needing to operate a boat in the ice shall ***carefully consider*** the situation, ice conditions, and alternative methods of achieving objectives. Coast Guard small boats are not designed to break ice. Sector and District Command Center's shall also be kept advised.

(c) Observation of instability due to topside icing on any class of boat shall be immediately reported to the Command Center.

4.9.5.4 Other Equipment. New equipment that offers enhanced performance for our missions is constantly being developed. Units are encouraged to share information and experiences with such equipment with other units, other agencies, District (osr), and Commandant (G-RPR).

4.9.5.5 Ice Rescue Dive Teams. Many local agencies have ice rescue dive teams that can provide assistance to the CG if requested. Whenever the case involves a person slipping below the surface of the water/ice, diving operations must be considered. All stations shall maintain a file of those agencies in their AOR that have ice rescue dive teams.

4.9.5.6 Animal Rescues. Rescue attempts for animals stranded on the ice should only be conducted under ideal conditions after proper RISK ASSESSMENT. The chance of the animal being wild or rabid must be considered when evaluating the potential for injuries to crewmembers.

4.9.6 Example of an Ice Rescue Instruction/Bill/Standing Order

Subj: ICE RESCUE

Ref: (a) Coast Guard Addendum to the U. S. SAR Supplement, COMDTINST M16130.2D.

1. Purpose Provide guidance and policy for conducting ice rescues.

2. Discussion This station has the responsibility to provide assistance to persons in distress on the ice within our area of responsibility. Our equipment and personnel must be kept at a maximum state of readiness in order to accomplish this responsibility. During those months when ice or icing conditions exist, classroom training and actual ice rescue drills will be held. Ice skiff crewmembers will be required to read Chapter 4 of reference (a) and successfully complete the attached Certification Check-Off sheet. The procedures set forth in this instruction will be kept readily available for ice operations. Procedures outlined in reference (a) will be used in performing ice rescues.

3. Procedure

a) Upon receiving a call reporting an incident on the ice, all information pertaining to the case will be obtained and logged in the SAR Case Folder. The CO/Officer in Charge and Sector Duty Officer will be notified immediately.

b) HELICOPTERS ARE CONSIDERED THE PRIMARY ICE SAR RESOURCE AND WILL BE REQUIRED FOR ALL CASES. This policy does not preclude the timely dispatch of our surface resources in an effort to prosecute the case in an expeditious and safe manner. GPS or a vehicle with emergency lights will also provide a reference point for the helicopter.

c) The minimum ice rescue crew will be three qualified members. A fourth person will be dispatched with the SAR vehicle to act as a spotter from shore and as a communication relay between the ice skiff and the Station. The crew of the ice skiff will wear dry suits/survival suits with ice cleats at all times on the ice.

Section 4.10
Float Plans

4.10.1 General

The Coast Guard has neither the responsibility nor the facilities to follow the voyages of vessels to their destinations and does not generally accept float plans. Mariners should be encouraged to pass information regarding proposed voyages to other responsible parties such as relatives, friends, yacht clubs, marinas or other facilities willing to perform that function.

4.10.2 Receiving a Float Plan

If a mariner insists on providing a Coast Guard unit with information regarding a proposed voyage, all pertinent information should be recorded on an Overdue Check Off Sheet, including estimated times of arrival and departure at way points. The following disclaimer should also be presented or read:

"The Coast Guard will keep this information on file and use it in the event your vessel is reported overdue. However, the Coast Guard does not have the responsibility or the facilities for following the voyages of vessels. The Coast Guard strongly recommends that you keep a responsible party informed of the movements of your vessel, keeping that party specifically advised of your expected and actual arrivals. You should instruct them that in the event your vessel does not arrive as planned, they should contact the nearest Coast Guard station."

4.10.3 Action Taken After Receiving a Float Plan

A copy of all float plans should be retained for a minimum of one month beyond the provided final expected arrival date. Retaining the float plan longer may be appropriate when the length of the voyage itself is of a long duration (e.g. trans-oceanic or around-the-world) and/or where the type of vessel lends uncertainty to duration of the voyage (e.g. sail vs. power vessels). On receipt of overdue vessel reports, Coast Guard units should check float plan files as a part of PRECOM checks.

4.10.4 Float Plan Form

When informed of the Coast Guard's policy many mariners will request a float plan form to fill out and provide to an alternative responsible party. Float Plan forms are available in some boating safety brochures produced by the Coast Guard and have in the past been printed individually. These may be provided directly to mariners. A sample Float Plan form that may be copied and used if other sources are not readily available is provided as Figure 4-2.

4.10.5 Float Plan Services

Some commercial and private organizations provide float plan services for members or subscribers. The methods of tracking voyages or reporting overdue vessels by these services vary. Some services offer SAR authorities access to all voyage and vessel data on the report of an overdue. Coast Guard units that perform SMC duties should maintain a listing and access instructions for all float plan services that serve their area of responsibility.

Complete this page, before going boating and leave it with a reliable person who can be depended upon to notify the Coast Guard or other rescue organization, should you not return as scheduled. **Do Not file this plan with the Coast Guard.**

Name of person filing: Phone Number:

Description of Vessel

Type: ______ Color: ______ Trim: ______
Registration No: ______ Document No: ______ Length: ______
Vessel Name: ______ Make: ______ Other info: ______
Engine Type: ______ Horsepower: ______
No. of Engines: ______ Fuel Capacity: ______

Survival Equipment

(check as appropriate)

☐ PFDs ☐ Flares / Type: ______ ☐ Mirror ☐ Smoke Signals
☐ Flashlight ☐ Food ☐ Paddles ☐ Water
☐ Anchor ☐ Raft ☐ Dinghy ☐ EPIRB/Type: ______
☐ Other

Communication / Navigation Equipment

☐ Radio (check as appropriate) ☐ VHF-FM ☐ MF ☐ HF ☐ Other: ______
☐ Cellular phone Number:
☐ LORAN C ☐ GPS ☐ RADAR

Automobile/Trailer

Auto license No./State: ______ Auto make/model: ______
Auto color: ______ Auto year: ______
Trailer type: ______ Trailer license No. ______
Where parked: ______

Persons On Board (# ____)

Name	Age	Address & Telephone No.

Do you or any of the persons on board have a medical problem? ☐ Yes ☐ No
If yes, what?

Trip Expectations

Leave at ______ From ______ Going to ______
Via ______ Via ______ Via ______
Expect to arrive/return by ______ (time) and not later than ______
Other pertinent info:

If not returned by ______ (time) call the COAST GUARD, or (local authority) ______
Telephone numbers:

Figure 4-2 Sample Float Plan

Section 4.11
Self-Locating Datum Marker Buoys

Self-Locating Datum Marker Buoys (SLDMB) utilize satellite-based technology to determine buoy position. SLDMBs provide frequent, high-resolution position information independent of the search unit (search unit does not have to relocate the DMB). The SLDMBs drift with the water mass, providing high quality current information. The use of satellite technology greatly reduces the cost of a position determination in comparison to the cost associated with the RDF/DMB.

Current information provided by SLDMBs may be used directly in search planning tools in conjunction with leeway data to estimate the direction and distance of drift for a search object.

Although fielded to support the SAR mission, SLDMBs may be used to support other missions as well. Possible applications exist for fisheries (high-seas drift nets tracking), law enforcement (floating contraband; bales of narcotics), maritime environmental response (oil spill tracking), and general maritime safety (marking of vessels or other objects adrift). Available stocks and funding will determine the resource commitment outside the SAR mission.

4.11.1 The SLDMB System

There are three major components to the SLDMB System: the buoys, the satellite system and the data system.

4.11.1.1 Self-Locating Datum Marker Buoy (SLDMB). A 7/10th Coastal Ocean Dynamics (CODE)/Davis-style oceanographic surface drifter with drogue vanes between 12 and 37 inches deep. The onboard electronics provide Global Positioning System (GPS) positioning and sensor data (buoy ID, position, and sea temperature).

(a) GPS positions are acquired at 15-minute intervals for the first two hours and at 30-minute intervals thereafter. Up to 13 half-hour data sets can be stored if necessary before transmission to a satellite.

(b) SLDMBs are air- or ship-deployable, and buoys are operational for 14 to 30 days after deployment.

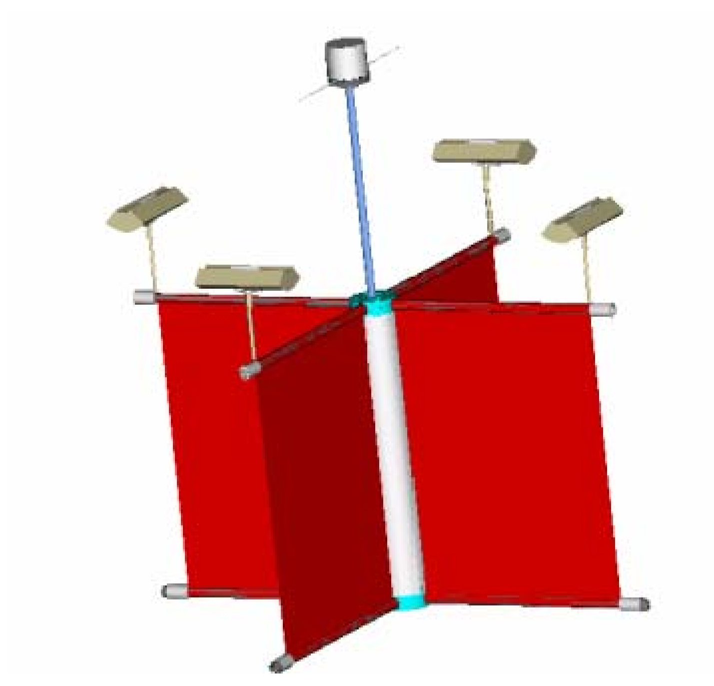

Figure 4-3 Deployed SLDMB (METOCEAN)

4.11.1.2 Service Argos Inc. Argos is the satellite data system that receives and forwards the information transmitted from the SLDMB to the Coast Guard using National Oceanographic and Atmospheric Administration (NOAA) polar-orbiting n-series satellites.

(a) SLDMB data will be transmitted within 30 – 90 minutes of deployment/activation. Depending on the deployment location, time of day, and position of the Argos satellites, there may be as much as a five-hour gap in satellite coverage (satellite footprint). SLDMBs retain up to 13 data reports, which will be uploaded to the Argos network when a satellite comes in view. Drift data requires a minimum of two positions (at least 30 minutes), but additional positions will ensure the electronics on board the SLDMB are operating properly. Waiting for the first hour's data (four 15-minute interval positions) is recommended.

(b) Sources for satellite pass data are available via the Internet. A recommended list is available via the SAR Program's Intranet web site.

4.11.1.3 USCG SLDMB Web Site. The SLDMB web site is hosted at the Coast Guard's Operations Systems Center and is accessed via the intranet at the web address: http://sldmb.osc.uscg.mil/. The site provides operational data, logistics support, system documentation, and administrative functions.

(a) Operational SLDMB position (drift) data is made available via data requests and may be viewed or downloaded as a data table or exported to C2PC as an overlay for visual display.

(b) Logistics functions are used to track the ordering, shipping and deployment of SLDMBs. In addition, the system tracks the buoy shelf life, performance and failures. Reports on various logistics aspects can be generated for system management.

(c) System documentation provides a user's guide, tutorial, frequently asked questions, user forum, comments and new features listing. This on-line documentation provides the line-by-line user information needed to fully use the web site application. Brief descriptions are provided as needed in this Addendum.

(d) Administration functions include user accounts and contacts for the system.

4.11.2 SAR Mission Coordinator Actions

The SMC provides direction to SAR units for the deployment of SLDMBs, enters the deployed status in the SLDMB web site, and retrieves the data produced by the SLDMBs for use in SAR mission planning.

4.11.2.1 Deployment Considerations. The purpose of deploying SLDMBs is to measure the surface currents within the area of interest during the period of interest. The period of interest begins with the distress incident, which often occurs before an SLDMB can be deployed simply because it takes time to respond and travel to the distress location after notification. The amount of time that passes between the distress incident and the deployment of SLDMBs affects the size and location of the area where they should be deployed. The nature and complexity of the situation, e.g., number of possible scenarios, accuracy of the distress location(s), also has an impact. The presence or absence of significant ocean current features that have large horizontal variations or rapidly change with time (e.g., the north wall of the Gulf Stream is example of current with strong horizontal current variation and tidal and wind currents exhibit rapid temporal changes) are also important factors. The proximity to shore will also affect how and where SLDMBs should be deployed, since currents tend to have shorter time and space scales near shore. Significant ocean current features are often easy to see and locate via satellite imagery and other products available from government agencies such as NOAA and the U. S. Navy. A single SLDMB deployed at a datum position (or between two divergent datum positions) soon after the distress incident will provide valuable information. However, when any of the survivors still remain unlocated for any significant period after arrival on scene, it will be necessary to deploy several SLDMBs to get a true picture of the surface currents in the area of interest. The following guidance will help the SMC make decisions as to using SLDMBs as a tool in SAR efforts.

(a) **Type of case.** SLDMBs should be used in all cases where total water current data will be needed to effectively plan a search.

(b) **When to deploy.** One or more SLDMBs should be deployed as soon as it is apparent that the case will not be quickly resolved. It is far better to drop SLDMBs on a case that turns out to quickly resolve than to hold back dropping SLDMBs on a case that will absolutely require sea current information to plan a search. **If**

you <u>think you might</u> need to deploy SLDMBs, then you <u>should</u> deploy SLDMBs. SLDMBs should be dropped as early as possible, since the goal is to provide estimates of the drift of the SAR objects from the time of incident up until the end of the next search period. The earlier an SLDMB is dropped, the more useful the data will be to the case. SLDMBs can also be pre-deployed during peak SAR season, in anticipation of weekend SAR cases, opening of fishing seasons or tournaments, and seasonal refugee migrations. Regardless of why or when they are deployed, SLDMBs provide valuable oceanographic data.

(c) **Number of SLDMBs to deploy.** Software tools are being developed that will be able to compute surface current fields from the trajectories of several SLDMBs in reasonably close proximity and use these fields to estimate the most probable search object locations. In addition, arrangements are being made to quickly provide SLDMB data to the National Data Buoy Center (NDBC) for rapid dissemination to agencies that run the oceanographic models from which new search planning software (Search and Rescue Optimal Planning System—SAROPS) will draw the environmental data needed to estimate search object drift. The number of SLDMBs that should be deployed will depend on the size of the area of interest and the nature of oceanographic features in the area. Larger areas and/or more complex currents will often require deployment of multiple SLDMBs. The size of the region of interest should be sufficient to **cover as many scenarios as possible** for the case. At the start of a case most SRUs arriving on scene will not be carrying multiple SLDMBs unless directed by the SMC to do so before launch; a single SLDMB may all that is available initially.

(1) A single SLDMB may be all that is needed if the currents across the region are essentially the same or if the area of interest is fairly small.

(2) Multiple SLDMBs may be needed when the area of interest includes known or suspected varying currents such as in or near the boundary of the Gulf Stream or other major current feature, around or between island chains, in the vicinity of major river outflows, or in the vicinity of inlets with significant tidal influence. The size of the region may also determine the number of SLDMBs needed. As the size of the region increases so will the number of SLDMBs required to accurately represent the current flow field.

(d) **Where to deploy.** SLDMBs should be deployed in the vicinity of the last known position (LKP) when the time lag between the distress incident and deployment is reasonably short (a few hours at most). Otherwise, they should be deployed in the vicinity of the computed datum(s) or high probability region(s).

(1) **Single SLDMB.** Where a single SLDMB is to be used, it should be deployed at the last known position (LKP), halfway between divergent datums, or in the center of the region that is most likely to contain the search object (which is not necessarily the single highest probability cell on a probability map if that cell happens to be isolated from the main body of the distribution).

(2) **Deployment Patterns for Multiple SLDMBs.** There are three basic geometric patterns for multiple SLDMB deployments—corners of a polygon, in a line, or as an "X". However, other patterns and deployment dispositions may be used if the SMC has reason to believe they will provide better data for search planning purposes, as discussed under "generalized patterns" below.

(i) **Corners of a Polygon.** Three or more SLDMBs may be deployed at corner points of a not-too-large polygon containing the datums(s) or high-probability region(s) that have been estimated for the expected deployment time or possibly a somewhat later time. The SMC may wish to consider using a somewhat later time for computational purposes, especially in high leeway situations, so as to keep the SLDMBs and search objects in closer proximity for a longer period by placing the SLDMBs somewhat ahead of where the high probability regions are expected to be at the time of deployment. When determining the deployment polygon, the idea is ***not*** to contain the entire distribution of possible search object locations but to place the SLDMBs in the midst of the distribution near the high-probability regions in some sensible pattern. The number of corner points will be determined by the number of SLDMBs readily available, and the shape and disposition of the high probability region(s). This type of pattern is best used offshore in the open ocean away from prominent surface current features.

(ii) **In a Line (Transect or Along Track Line).** In areas where specific current features are known or suspected to exist, the best deployment is often along a line perpendicular to the axis of the feature in or near the high-probability region(s). This is called a transect and it is particularly useful for strong currents like the Gulf Stream that exhibit a considerable range of speeds across their width.

Eddies and counter-currents may also exist just outside the main flow and a transect would usually discover these as well if extended far enough. Another reason for a linear deployment would be to accommodate a missing craft's intended track. However, unless the track line is short or the missing craft's pre-distress speed is large (as with an aircraft, for example), the times involved may dictate deployment along a path (possibly curved or even crooked) to accommodate where the search object may have drifted from various points along the intended track up to the time of SLDMB deployment.

(iii) **"X" Pattern.** In situations where it is unclear whether the major surface current influence is parallel or perpendicular to a given feature, such as the shoreline, it may be appropriate to deploy SLDMBs in an "X" pattern so that transects along the two perpendicular axes are obtained.

(iv) **Generalized Pattern.** In areas where surface currents are expected to exhibit considerable complexity due to a complex shoreline, complex bottom topography, river outflows, and/or tidal influences, a less geometrically regular deployment pattern than those given above may be appropriate. In such cases, detailed local knowledge from reliable sources can be an invaluable aid for determining the best placement of SLDMBs.

(v) **Multiple** Scenarios**.** The deployment strategy for cases with multiple scenarios should be to cover all the scenarios using the patterns suggested above.

(3) **Spacing.** Spacing between multiple SLDMBs is dependent upon the situation. The optimal spacing ranges from 3 nm for near-shore cases with strong tidal currents to 6 nm for offshore cases in regions that lack significant open ocean currents. However, the number of SLDMBs that can be made available in combination with the size of the area of interest may dictate larger spacings. For larger spacings, more care is needed to determine the best deployment locations. During the latter stages of a multi-day case, additional SLDMBs should be deployed to fill the gaps between the existing SLDMBs and to seed the area down-drift.

(4) **Other Sources.** Most surface current data for search planning comes from either models that are updated with observations from a variety of sources (which may or may not have direct observational data for the region and time of SAR interest), or from climatological databases or atlases. In both cases it is generally necessary to deploy SLDMBs to get better data for the area of interest. In the (presently rare) event that reliable direct observations are available from other sources in some parts of the region of interest, it may be more beneficial to deploy SLDMBs elsewhere rather than duplicate the efforts of these other sources. As the ability to assimilate SLDMB data into oceanographic models in a timely fashion improves, it will be possible to realize the benefits of both direct observation and modeling with minimal or no impact on the search planner beyond directing the deployment of the SLDMBs as needed. However, for the present time SLDMB-based surface current data will generally take precedence in the vicinity of the SLDMBs over data from other sources.

(e) **Incidents in remote areas** present additional difficulties. Deployment of an SLDMB in an initial sortie is particularly critical due to the likely delay in additional sorties and the need to maximize searching during those sorties. Delaying until a later sortie to deploy an SLDMB can add hours to the delay in receiving critical sea current data. Dropping more then one in case of failure should also be considered for very remote area insertions.

(f) **Approaching nightfall or significant weather** may impact when an SLDMB should be deployed.

(g) **Time of year or climate.** In northern climes where water temperatures are colder, as in all response actions, deploying an SLDMB early may be prudent. Warmer climates make for longer survival of persons in the water, requiring longer searches, which will benefit more from the long-term availability of sea current information.

(h) **SLDMBs from previous cases** may still be in the area of a new incident, or have drifted into that area. A quick check of the data system may yield immediately available total water current information for the vicinity and time of the new incident.

(i) **Combining USCG and Canadian SLDMB data**. Assume the USCG SLDMBs have zero leeway but assume the Canadian SLDMBs have a leeway of approximately 1% of the (standard 10-meter) wind in the downwind direction.

4.11.2.2 SMC Deployment Actions. SMCs are the primary authority for directing the deployment of SLDMBs and will most times make the decision to deploy an SLDMB. However, SRUs arriving on scene often will not immediately find the search object. Prior direction to SRUs by the SMC can be given that would task the SRU to deploy SLDMBs in these situations giving consideration to time spent initially searching the area, nature of the incident, and remaining sortie time.

(a) **Direction to SRU's.** SMCs should provide SRUs with the location(s) for deploying SLDMBs. If multiple SLDMBs are needed, the SMC should direct the SRU to take additional SLDMBs on board. SRUs arriving on scene may not immediately find the search object. Prior direction should be given that would task the SRU to deploy SLDMBs with consideration to time spent initially searching the area, nature of the incident, and remaining sortie time. SRUs should be directed to pass location, time and Argos ID to the SMC immediately after deployment.

(b) **Marking SLDMBs as deployed.** SMCs will receive deployed location, time and Argos ID from SRUs. To mark the SLDMB as deployed within the data system, the SLDMB Web Site (http://sldmb.osc.uscg.mil/) is accessed and SMC's select the appropriate District from the dropdown menu. Scroll to the SRU's home unit and click the "arrow" to the SLDMB, scroll to the bottom of the page enter desired output parameters and click "Submit." The SMC will be asked to input the MISLE case number, the buoy deployment data passed from the SRU, SMC (command/initials) in the "Enter Comment" block and then click "Submit," to begin receiving data. **ONLY** SMCs should be entering this data and marking SLDMBs as deployed. ***If the wrong Argos ID is used inadvertently, the SMC must immediately contact the OSC help desk (304-264-2500) to have the status reset on that Argos ID***.

(c) **Checking SLDMB Operation.** To ensure the SLDMB has deployed and begun operating, the SMC should check to see if data is being transmitted as soon as data would reasonably be available. Timing for this check is dependent on satellite pass (para. 4.10.1.2(b)).

4.11.2.3 Data Retrieval and Output. SMCs and other persons interested in the drift data provided by SLDMBs access that data via the SLDMB Web Site (http://sldmb.osc.uscg.mil) Data Request Page. Select the District that the buoy was deployed in from the main menu and scroll to the SRU that deployed the buoy. Click the box to the left of the buoy number and scroll to the bottom of the page and select your data output parameters. For Advanced Search parameters click on the "Advanced Search" button at the top left of the page once you have selected your District. Within the Advanced Search page buoy data can be selected using tailored time frames and entering geographical regions. Data output is available as either a Coast Guard C2PC overlay or as a screen display. Step-by-step direction is available in the on-line user's guide. *Note: The number of buoys, size of geographical region, and time frame requested all impact the size of the data record returned. It is recommended that a data record count of no more than 1500 be returned to avoid protracted delays when downloading data. A table of data parameters and number of records is available via the SAR Program's Internet web site.*

4.11.2.4 Data Use Guidance

(a) For all situations, an individual SLDMB's data used for the direction and speed of the current should correspond to the entire drift of the SLDMB that most closely matches the drift period of the search plan being developed. This may be obtained by using the distance and times related with the first and last positions that match the drift period. A quick estimate can be done on C2PC by using the quick bearing & distance tool run from start to end point of the drift track. SLDMB position data can be put in the C2PC/JAWS DMB data form and it will calculate the TWC. For CASP current data should be entered as case dependent environmental data (see (e) below).

(b) For a case using a single SLDMB, the data obtained for current from that SLDMB may be entered directly to reflect the entire TWC in JAWS or within a reasonable sphere of influence in CASP case dependent environmentals.

(c) For multiple SLDMBs the SMC must decide how to properly apply the data. If the data from the various SLDMBs is similar this should pose little difficulty for the SMC; simply apply a representative SLDMB data across the region. Where the data form the various SLDMBs is divergent, the SMC should consider running separate scenarios for JAWS. Within CASP the various SLDMB data may be put in as case dependent environmental data (see (e) below). Care must be taken in determining the area over which to apply the data. Consulting with an oceanographer may be needed.

(d) For multiple scenarios, the guidance provided in (b) and (c) should be applied. In general, scenarios are independent of environmental conditions, that is, environmental conditions are related to geography and do not change in regards to scenarios. By having multiple SLDMBs the SMC is essentially faced with the decision over which area to apply the information.

(e) **Using SLDMB data in CASP.** If SLDMB derived current data is to be used in CASP it should be entered as case dependent environmental data; current direction and current speed. Data from multiple SLDMBs may be entered. Data should be entered as vector-averaged values for 12-hour periods from 0600Z to 1800Z and from 1800Z to 0600Z the following day. Additional guidance for CASP use may be found at the SAR Programs Internet web site.

(f) Where SLDMB data appears erratic, consultation with an oceanographer may be needed.

(g) SLDMB data retrieved either as a table or as an overlay for C2PC must be entered manually into SAR planning applications. Automated processes for data incorporation from SLDMBs and other sources are planned for the future.

4.11.3 Failed SLDMBs

Occasionally SLDMBs will fail to operate properly. The failure may be a result of a bad part within the buoy itself, damage in shipping and handling, or damage incurred during deployment. Failure indicators are most often receiving no data or corrupt data. Occasionally units deploying an SLDMB may observe a failure. If there is a suspected buoy failure after deployment, the OSC Customer Service line should be contacted at (304) 264-2500 to verify failure. The possibility exists that a buoy with a different ID than reported was actually deployed; in this instance, no buoy failure would have occurred; the unavailability of data would be due to human error. If a buoy is found to have failed or is damaged prior to deployment, the Engineering Logistics Center's (ELC) should be contacted at (410) 762-6236.

4.11.3.1 No data received (Confirmed buoy ID). When no GPS or Argos data is received from a buoy within ninety minutes, it is likely the buoy has failed, or the wrong buoy ID has been marked deployed. Once the SMC has confirmed the correct buoy ID has been deployed (and that no other buoy was erroneously marked deployed in its place), the SMC should determine whether a satellite pass for the SLDMB has occurred (see subparagraph 4.10.1.2(b)). If so, the buoy is considered inoperative. The SMC should then deploy another SLDMB as soon as possible and notify the OSC (a POC is listed on the SLDMB web site).

4.11.3.2 Corrupt data received. When the data being received appears erratic (widely spaced positions resulting in widely varying speeds/directions, initial position far from the deployed position, very sporadic data, etc.), it is likely the SLDMB has sustained damage or has a failure in the electronics package. The SMC should call the OSC help desk to verify the SLDMB web site and transmissions from Argos are not experiencing problems. If the SLDMB appears to be the source of the corrupt data, OSC help desk personnel should notify the Duty Analyst to terminate the SLDMB. The comments should include the reason for termination as corrupt data. The SMC should deploy another SLDMB as soon as possible.

4.11.4 Requests for SLDMBs deployments by other agencies or nations

The Coast Guard cooperates and lends support to a multitude of other agencies and nations in the conduct of SAR operations. SLDMBs, as with other SAR support, may be deployed on request of non-Coast Guard SMCs subject to the availability of resources. The same level of review should be applied as is for deploying search assets in support of non-CG search efforts.

4.11.5 SLDMBs and use of Standard RDF/DMBs

SLDMBs provide superior current information for the SAR planner's use in search planning. The standard RDF/DMB may still be useful in some roles, such as marking a debris field that searchers wish to relocate (homing function) over a short period of time, or in restricted waters to get a quick idea of drift for the first search effort. Standard DMBs may be used until no longer available.

4.11.6 SLDMB Deployment by Search and Rescue Units

4.11.6.1 Deployment from Aircraft. SLDMBs are deployable from Coast Guard HC-130, HU-25, HH-60 and HH-65 aircraft. Specific deployment procedures for individual aircraft types are provided in each aircraft flight manual. The General fixed and rotary-wing deployment guidance is available on the SAR Program Internet site. Coast Guard testing found for the HH-60 and HH-65 aircraft that 300 feet altitude and 70 knot airspeed was optimal. For situations using the drogue parachute, Coast Guard testing found the launch altitude should be no lower than 200 feet as it appeared to be the minimum altitude which allowed the parachute to open fully and be effective in directing the entry of the SLDMB into the water. **For all deployments, the Drop Master must remove the tag that contains the SLDMB Argos ID 5-digit number.** The Aircraft Commander should then report the time, location and ID for each drop to the SMC.

(a) **Fixed-wing aircraft deployment.** The SLDMB uses a 15-foot (4.5 m) static line to ensure that the parachute is correctly deployed from the buoy. The static line has loops at 10 feet and 15 feet for various aircraft. No tools are required for this deployment. The buoy must be removed from its protective wrapper, then the static line is hooked on and the buoy ejected from the aircraft.

(b) **Rotary-wing aircraft deployment.** For deployment from rotary-wing aircraft, the deployment method depends on the altitude of the aircraft at time of deployment.

(1) When the deployment height is less than 25 feet, (8 meters), and the aircraft is hovering, the buoy is removed from its protective wrapper, and both static line and parachute are removed. No tools are required for this. The buoy can then be launched directly from the aircraft.

(2) When the launch height is greater than 25 feet (8 meters) or if the aircraft has any significant forward speed (10 knots or more), the buoy is removed from its protective wrapper, the static line and parachute cap then must be removed from the launch container. The parachute is then extracted from the top of the launch container, hand deployed from its parachute bag, <u>but not detached from the buoy</u>. The buoy is then launched from the aircraft. ***CAUTION: The shroud lines on the parachute present a tangle hazard to personnel deploying the SLDMB; care should be taken to avoid shrouds snagging on aircrew hands, arms, and/or flight gear before deployment.*** Note that no other parts need be removed and that the buoy will not deploy any other parts during launch or descent.

4.11.6.2 Deployment from Cutters and Boats. The design of the SLDMB with the removable parachute assembly makes it suitable for surface deployment from cutters and boats. Cutters and boats can be underway when deploying the SLDMB, with speed reduced to under 10knots to avoid causing damage during deployment. The SLDMB should be deployed with the bottom (end away from parachute shroud snap hook) of the launch container entering the water first if possible. For all deployments, the deploying personnel must remove the tag that contains the SLDMB Argos ID 5-digit number. The Commanding Officer or Coxswain should then report the time, location and ID for each deployed SLDMB to the SMC. Procedures for preparing the SLDMB for surface deployment may be found at the SAR Program's Internet site.

4.11.6.3 SLDMB Self-deployment. SLDMBs are designed for fully automatic deployment after impact with the water. After impact with the water, the tape holding the launch container dissolves. This allows the launch container to be released and also frees the arms to deploy the drogue panels and removes the magnet, starting the electronics. A few minutes after the arms are deployed, the tape holding the antenna mast down dissolves. This frees the spring-loaded mast to extend, which also detaches the parachute. All parts are ballasted to sink or are biodegradable. At this point the buoy is fully deployed and operational. The self-deployment process takes between 4 and 11 minutes.

4.11.6.4 Deployment Cautions

(a) Proper deployment of the SLDMB is best achieved by leaving the SLDMB in the launch container, and allowing the SLDMB to self deploy. In opening the launch container, damage may inadvertently be done to the SLDMB.

(b) **Drogue Arm deployment.** All SLDMBs are packaged with folded arms. These arms are under tension with shock cord. Excessive stretching may break the shock cord and could cause injury.

(c) **Mast Extension.** The mast is spring-loaded and will extend about 16.5 inches. If the buoy is disassembled beyond simple removal of the parachute, care must be taken to retain the mast in its down position. Care must be taken if the mast is extended manually. Once extended, the mast cannot be retracted without major buoy repairs. ***CAUTION: SLDMBs should not be lifted by the antenna mast; lifting by the mast may damage the O-ring seal and permit water to enter the body of the SLDMB; rendering the SLDMB inoperable.***

4.11.7 Using SLDMBs to Mark Abandoned Vessels and Other Objects.

The self-locating functionality of the SLDMB makes it ideal to use when the Coast Guard has a need to track the location of an abandoned vessel or other floating object (debris, oil, contraband, etc.). When marking vessels or other objects, which will have any significant leeway component of drift, the SLDMB should be attached to the object if possible. This is particularly important when the vessel or object will be tracked for an extended period of time. Procedures for attaching SLDMBs to abandoned vessels and other objects are located on the SAR Program's Internet site.

4.11.8 Operating Parameters

4.11.8.1 Environment

(a) SLDMBs have been designed to operate under the conditions listed below.

Table 4-2 Environmental Operating Parameters for SLDMBs

Parameter	Conditions
Air Temperature	- 4 °F to + 95 °F (- 20 °C to + 35 °C)
Water Temperature	+ 28.4 °F to + 95 °F (- 2 °C to + 35 °C)
Water Type	Fresh and Salt Water
Significant Wave Height	0 to 26 feet (0 to 8 meters)
Wind speed at height of 10 meters	0 to 39 knots (0 to 20 meters per second)

(b) SLDMBs have also been designed to survive more extreme conditions during which they may not operate properly, but when conditions improve, they will resume correct operation. These conditions include: air temperatures down to – 22 °F (– 30 °C), significant wave heights to 39 feet (12 meters) and wind speeds up to 68 knots (35 meters per second).

4.11.8.2 Operating Life. SLDMBs are designed to operate for a minimum of 14 days from deployment. As built the expected lifetime is 22 days after 18 months storage. Newer SLDMBs may last as long as 30 days, after which they will automatically shut down.

4.11.8.3 Water depth. SLDMBs will operate in any waters which permit the free drift of the buoy with the surrounding water. For air-deployment, the water depth should be 10 feet or greater to prevent the buoy from hitting bottom when entering the water.

4.11.9 Disposition of recovered SLDMBs

On occasion the public will find SLDMBs that wash ashore or come upon them while boating. They may describe them as any number of things including buoys, mines, floats, etc. Coast Guard units should be familiar with the characteristics of SLDMBs to help to positively identify them.

4.11.9.1 Washed ashore SLDMBs. Coast Guard units when called should take custody of the SLDMB, record the time & location found, the Argos ID and condition. Forward the information to G-RPR. Current SLDMBs have been designed to be disposable, and in most instances the unit will be directed to dispose of the SLDMB.

4.11.9.2 Afloat SLDMBs. Afloat SLDMBs should be left floating whenever possible. On occasion it may be necessary to remove a floating SLDMB due to the specific location (hazard to navigation, etc.). If an afloat SLDMB may need to be removed, Coast Guard units should first ascertain that the SLDMB is not active by passing the Argos ID to their group/activities or district command center. The ID is on a plate near the base of the SLDMB's body; to see the number the SLDMB must be carefully removed from the water. ***CAUTION: SLDMBs should not be lifted by the antenna assembly; this may cause the O-ring to fail, allowing water into the body of the SLDMB, which will render it inoperable.*** If the command center does not know immediately the status of the SLDMB (in use for a ongoing case; or used in a recent case), the command center should enter the SLDMB web site and use the

Argos ID to run a Buoy History. If the report shows the buoy status as deployed (active), a data request should be run entering a Time Frame of "Last 1 day" and Geographical Region – Select by Buoy Number entering the Argos ID. If no data is present, the SLDMB is no longer active awaiting automatic termination in the system. If data is still present, the SLDMB should be left in the water.

4.11.9.3 Deactivation and Disposal. On the occasion where a SLDMB is recovered it is necessary to deactivate the buoy before disposal. Deactivation is done by cutting the two wire leads running to the top of the antenna which are accessed by removing four screws under the base of the white antenna cover. Detailed deactivation instructions can be found at http://sldmb.osc.uscg.mil/trainingaid.asp. Once deactivated, a SLDMB is safe to be disposed of with standard garbage.

4.11.10 Data Availability Outside the Coast Guard

SLDMB drift data is useful to many other persons and agencies outside the Coast Guard, in particular it is valuable to the oceanographic community (government and academia). At present there is not a direct access capability for persons or agencies outside the Coast Guard to the data produced by Coast Guard deployed SLDMBs. There is no restriction on providing this data upon request. Requests for data should be forwarded to G-RPR.

4.11.11 Logistics

Logistics for the SLDMB are covered primarily within the Equipment Integrated Logistics Support Plan (EILSP) and the logistics section of the SLDMB web site with its associated user's guide. The EILSP along with additional information on distribution, ordering, tracking and stowage of SLDMBs is available via the SAR Program's cgweb site at: http://cgweb.comdt.uscg.mil/g-opr/g-opr.htm.

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Section 4.12
SAR and Security Concerns

4.12.1 Non-Immigrant Security Concerns

In carrying out our SAR mission we routinely MEDEVAC persons from vessels to the US for emergency medical treatment and bring other SAR incident survivors into the US. In such cases where the individual(s) are not believed to be US citizens or US permanent resident aliens, the SMC shall notify immigration enforcement officials (Bureau of Immigrations and Customs Enforecment (BICE)) immediately to coordinate any law enforcement issues.

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Section 4.13
Maritime Law Enforcement and Vessel Safety

4.13.1 Vessel Safety Law Enforcement

Vessel safety law enforcement supports the overall goal of promoting the safety of life and property at sea and protecting the marine environment. In carrying out this mission, the Coast Guard's role primarily consists of ensuring compliance with laws and regulations through enforcement action and educating members of the maritime industry and the boating public. Specific guidance regarding vessel safety law enforcement, including terminating voyages is contained in reference (l).

4.13.1 Safe Operation founded in Law

Titles 33 and 46 of the United States Code and other U.S. laws, international laws, and treaties promote the safe operation of commercial and recreational vessels. The Safety of Life At Sea Convention (SOLAS) and associated Protocols establish international standards for seaworthiness and carriage of life saving equipment.

4.13.2 Manifestly Unsafe Voyage

Pursuant to authority contained in 33 CFR 177.04, the District Commander may declare a U.S. recreational or uninspected passenger vessel to be engaged in a Manifestly Unsafe Voyage.

4.13.3 Termination

Violations of law and treaties that create an especially hazardous condition may subject U.S. recreational and uninspected passenger vessels to voyage termination under 33 CFR Part 177. Termination is authorized when one or more specifically defined unsafe conditions exist, they cannot be corrected on the spot, and continued operation of the vessel constitutes an especially hazardous condition. Procedures regarding voyage termination, including authority to terminate the voyage of an uninspected commercial fishing vessel, are discussed in reference (l).

4.13.3.1 Termination order and additional considerations. The goal of termination is to protect the safety of the persons onboard the vessel and the maritime public. Once the decision to terminate a voyage has been made, Boarding Officers may need to consider additional actions necessary to alleviate the especially hazardous condition (e.g., removing passengers and/or cargo from the vessel, escorting or towing the vessel to port). An intoxicated operator shall not be directed or permitted to operate the vessel.

4.13.3.1 Termination and the Commercial Fishing Industry Vessel Safety Act (CFIVSA), 46 USC 4501-4508.

(a) The CFIVSA establishes a national program to reduce commercial fishing vessel losses and fatalities. Pursuant to, regulations prescribing equipment and operational requirements for U.S. fishing, fish processing and fish tender vessels have been promulgated in 46 CFR Part 28. It is beyond the scope of this Manual to describe elements and enforcement policy associated with each of these regulations. The most significant regulatory requirements are contained in reference (nn).

(b) Violations of the CFIVSA that create an especially hazardous condition may subject the boarded vessel to voyage termination under 46 CFR Part 28.

4.13.3.2 Termination and SAR considerations. Based on the situation, our response to a vessel termination should be assigned the appropriate SAR phase.

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Section 4.14
Places of Refuge

4.14.1 General

Ships in need of assistance may request national authorities to make available a place of refuge. Authorities may provide such assistance, while exercising the prerogatives and rights of sovereignty, including border control, coastal zone protection and national self-defense. The International Maritime Organization (IMO) has established guidelines on places of refuge (Assembly Resolution A.949(23)). A ship may: be involved in an incident or marine casualty (e.g., fire, engine or other casualty that affects the seaworthiness of the vessel) and may need assistance (e.g., sheltered area where cargo can be lightered or repairs can be performed, etc.), but not be in a distress situation that requires rescue of those on board; or may be in distress, but those on board have already been rescued, with the possible exception of those who have remained or been placed on board to deal with the ship's situation. IMO recommends that nations establish a maritime assistance service (MAS) to serve as a national point of contact in such situations, and has developed relevant guidelines (Assembly Resolution A.950(23)). Both of these Resolutions are available on the internet web site of Commandant (G-RPR).

4.14.2 Definitions

Ship in need of assistance: a ship in a situation, apart from one requiring rescue of persons on board, that could give rise to loss of the ship or to an environmental or navigation hazard

Place of refuge: location where actions can be taken for a ship in need of assistance to stabilize its condition, reduce hazards to navigation, and protect human life and the environment

Maritime assistance service (MAS): a contact between a ship master or company and national authorities on matters relating to a place of refuge

4.14.3 Discussion

Places of refuge are for ships needing assistance, and are distinct from places of safety to which persons are delivered once they are recovered from a distress situation. Although a claim of force majeure under international law may give rise to a request for a place of refuge, technically, the two concepts are distinct. Place-of-refuge decisions typically involve complex technical, legal and political considerations beyond the realm of SAR. An MAS provides communication services similar to those provided by an RCC, and in most countries, including the U.S., RCCs perform the MAS function since shipmasters naturally contact them when dealing with dangerous situations.

4.14.4 Relevance to Search and Rescue

Assistance to ships and other craft in distress is not considered to be a SAR effort unless it also entails assisting persons in distress (see the definition of "rescue"). A national point of contact that serves as the MAS often is, as in the U.S., an RCC; however, other authorities may serve as MAS in some countries. A shipmaster or shipping company dealing with a ship needing assistance can be expected to contact a Coast Guard RCC. Some scenarios may actually or eventually involve persons in distress as well as a ship in distress.

4.14.5 Priorities

Granting of a place where a ship needing assistance can come may be a difficult decision, because overall risks to the ship, safety, security or the environment may be greater if the ship remains in the open sea, or greater if the ship is taken to a place of refuge. The concerns need to be balanced and considered on a case-by-case basis by experts, and might involve a political decision. ***If the situation ever evolves to where a person or persons on board the ship are in distress, concerns for lifesaving should take priority over other concerns, and SAR authorities become responsible for assisting the persons in distress.***

4.14.6 Responsibility for Places of Refuge and Maritime Assistance Service

Within the Coast Guard, Captains of the Port (COTPs) have the primary responsibility for decisions made on place-of-refuge requests, and should incorporate the relevant IMO guidelines into their contingency planning and response activities. RCC staff should understand the distinctions between place-of-refuge and SAR cases, be prepared to function as MAS should the need arise, and have plans of operation in place to ensure close cooperation with the appropriate COTP in such cases. RCCs should be prepared to immediately relay any request for a place of refuge to the COTP, have cooperative arrangements in place with the COTP to monitor such cases if potential exists for persons in distress, and as appropriate facilitate communications between the COTP and the shipmaster or other company representative who made the request.

Section 4.15
Persons Falling or Jumping from Bridges

4.15.1 Appropriate Response

Whenever a Coast Guard facility receives a report of a person falling or jumping from a bridge into the water and any doubt about the person's safety exists, the report shall be treated as a distress call with a corresponding appropriate response. Appropriate local authorities shall be notified immediately and requested to investigate the incident and, if they have appropriate resources, to assist in the search. If the report is received from local authorities with a request to provide Coast Guard assistance, standard policy for providing assistance to local authorities applies (see section 1.5.4 of this Addendum and section 15-3-1 of reference (pp)).

4.15.2 Duration of Search

4.15.2.1 The duration of Coast Guard participation in a search for someone who has fallen or jumped from a bridge may be based on the following factors:

- Chances of surviving the fall. The primary factor is height of the bridge above the water at the point from which the person fell or jumped. Water depth at the point of impact is another consideration.
- Chances of continued survival in the water. Primary factors include likelihood of injuries from the fall, water temperature, and nature of the currents.
- Will to live. Some who jump from bridges are attempting suicide, but this does not necessarily correspond to a lack of the will to live.
- Availability of adequate resources on scene from local agencies.
- Nature of the searching being done by the responsible local agencies. If in body recovery mode, the SAR aspects of the incident may be considered ended. Further Coast Guard participation may take place at the discretion of the local unit or higher authority, but only as providing non-SAR assistance to local agencies.
- Knowledge of distress location narrowing the initial search area.
- Cessation of search activities by the responsible local agencies.

4.15.2.2 When deemed by the SMC after searching the specific area around the water entry point (with consideration for drift), that the chance of survival is negligible, search efforts may be suspended. An additional consideration is survivors are most often found soon after rescuers arrive on scene.

4.15.3 Local Liaison

Units with bridges in their areas of responsibility should liaise with the appropriate local authorities and develop joint plans and agreements on responses to incidents involving persons falling or jumping from bridges.

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CHAPTER 5
COAST GUARD SEARCH AND RESCUE UNITS (SRUs)

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Section 5.2
Surface Craft Operations

5.2.1 Overview

Coast Guard surface craft have numerous capabilities and characteristics that make them excellent search and rescue platforms. SMCs must have knowledge of the capabilities of all Coast Guard vessels, including Coast Guard Auxiliary vessels and non-Coast Guard surface assets. Some of these non-Coast Guard assets include: state and local marine agency vessels, recreational vessels, commercial fishing vessels, and large merchant ships, such as those that participate in the Amver program.

Coast Guard patrol boats, High and Medium Endurance cutters, and Icebreakers have extensive communications suites that make them excellent command and control platforms. They also have the capability to stay on scene for longer periods of time than aircraft. Cutters are capable of rendering assistance in weather conditions than may preclude or limit the use of Coast Guard aircraft, and can generally recover a greater number of survivors than Coast Guard aircraft. Although larger cutters tend to operate primarily in Deepwater regions, all cutters (except WLIC's, WLI's, and WLR's) are capable of performing search and rescue operations in the coastal zone.

All cutters are equipped with boats that are capable of directly recovering survivors from the water. In conditions that do not allow for the launching of cutter boats, direct cutter recovery can be accomplished through the use of cargo nets deployed over the side. Many cutters also have a designated cutter swimmer who can be deployed (tethered) directly from the ship under certain conditions to recover survivors from the water.

Cutters equipped with flight decks may have deployed helicopters that can improve the range and effectiveness of the cutter in a sustained offshore search operation. In addition to Coast Guard surface assets, SMC's should engage USN commands to determine if USN vessel "Lily Pad" support is a possibility to increase the range of the rescue helicopter. Some cutters are also equipped with night vision goggles that are useful during night searches.

Coast Guard boats are the primary surface search and rescue platform. Their smaller size allows them to conduct searches in harbors, bays, and other remote areas that are inaccessible to larger patrol boats and cutters. The majority of Coast Guard search and rescue cases takes place within the range of station boats such as the 41' Utility Boat and 47' Motor Lifeboat. Both the 41' UTB and the 47' MLB are equipped with de-watering pumps to assist flooding vessels, and they can tow vessels up to 100 and 150 gross tons, respectively. All Coast Guard boats can be used to insert Datum Marker Buoys, execute search patterns, and recover and transport survivors.

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Table 5-4 Coast Guard Boat Characteristics and Limitations *

		USCG Boats					
		UTL (NSB)	**RB-S/RB-HS**	**RB-M**	**41' UTB**	**47' MLB**	**52' MLB**
Type		NSB-Ashore	Std – Shore		Std – Shore		
Length (ft)		17-30	25'		41'	47'	52'
Cruise Speed (KTS)		20-30	35		18	21	
Sprint Speed (KTS)		Avg 37	44		26	25+	11
Max Range (NM)		Varies	150/175		300	200	495
Max Offshore Distance (NM)		Avg 5-10	10		30	50	
Max Sea conditions (ft)		2-6	6		8	20	35
Max Surf/Bar Conditions		None	None		None	20	25
Max Wind (KTS)		Avg 20	25		30	50	
Max Draft (DIW)		Avg 2'	3' 3"		4' 1"	4' 6"	6' 11"
Operating Draft (u/w)		Avg 18"	2'				
Towing Capacity (tons)		Avg 3-5 tons	10		100 Tons	150 Tons	100 Tons
Max Persons O/B (incl. Crew)		Avg 6-8	10		23	9	45
Min. Operational Crew	**SAR**	2	3		3	4	5
	LE/HS	3	4		4	4	
SAR Equipment	Medical	Varies	Basic First Aid		Basic First Aid	Basic First Aid	
	Litter	No	Capable		Yes	Yes	Yes
	Dewatering Pump	Some have P-1	Capable for P-6		P-6	P-6	
	Illumination Flares	Varies			Varies	Varies	
Special Equipment Capability	Searchlight	Some have handheld	Yes		2 Installed 1 Handheld	3 Installed 1 Hand-held	
	Radar	Some	Yes		Yes	Yes	
	Deck Mounted Weps Capable	Typically no	2 X M60 or below		2 X M60 or below	No	
Comms	UHF	No	R21 only		R21 only	R21 only	
	VHF-AM	No	No		No	No	
	VHF-FM	Yes	Yes		Yes	Yes	
	HF Freq. Range	No	No		(HF/SSB) Transmit: 1.6-29.99 MHz Receive: 0.1-29.99 MHz		
	Asset Tracking	No	R21 only		R21 only	R21 only	
	DES	No	Yes		Yes	Yes	
	ANDVT	No	No		No	No	
	Loud Hailer	Some	Yes		Yes	Yes	
Navigation	ADF Channel/Freqs	No	No		VHF 16, 21, 83, 121.5 and 243 MHz		
	GPS/DGPS	Some	WAAS (HS) DGPS (S)		DGPS	DGPS	

* Summary only – See Operator's Manual for definitive and most current information.

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Section 5.9
Passive Watchstanding

Many operational units in a BRAVO readiness status adhere to a passive watchstanding ("sleeper watch") posture to maintain the highest degree of readiness and for risk management purposes. This guidance governing Passive Watchstanding is intended to ensure that SAR Mission Coordinators have established a reliable means to contact crewmembers of operational units after-hours for tasking.

5.9.1 Maintaining Contact Access

Commanders of operational units shall ensure that adequate fail-safe measures are established and incorporated in unit Standard Operating Procedures and local directives. Commanding Officers and Officers-In-Charge responsible for units using passive watches shall ensure that phone systems are tested regularly for proper operation (i.e.; ring audio level and phone line connectivity). It is imperative that commands tasked with providing a BRAVO-0 response establish secondary call notification procedures using other CG support elements, methods or equipment external to the unit in the event of catastrophic failure of their phone system. Support elements or methods may include other adjacent Coast Guard commands, external local 7X24 emergency response providers, etc, who may physically relay CG Command Center notifications.

5.9.2 Command Center Requirements

Command Centers that exercise launch authority must examine their phone contact lists to ensure all notification means are quickly and clearly outlined in their respective SOP's.

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CHAPTER 6
PROCEDURES FOR UNDERWATER INCIDENTS

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Section 6.1
Underwater Incidents Overview

Though not mandated to perform underwater rescues, the Coast Guard is responsible for developing, maintaining and operating facilities for the promotion of safety under--on and over--the high seas and waters subject to the jurisdiction of the United States. Traditionally, the Coast Guard has assisted distressed persons wherever and whenever possible. The responsibility extends to civilian submersibles operating on scientific, industrial or other missions; capsized or sunken vessels; or crashed aircraft in which persons may be trapped. In many of these incidents the use of rescue divers is a likely course of action. Reference (gg) should be used in conjunction with this manual for all matters regarding the employment of rescue divers.

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Section 6.3
Persons Trapped in Capsized Vessels

Persons trapped under capsized vessels or in compartments (among others, this includes vessels, aircraft, and automobiles) pose extreme safety risks to both the victim and the SAR responders. Coast Guard resources for rescue in these cases are severely limited. Immediate Coast Guard SAR response resources may include SRUs that have rescue or surface swimmers. Rescue of persons trapped below the surface of the water must fully consider proper risk assessment and management. The situation could easily be of such extreme risk that it is imprudent to risk the lives of Coast Guard personnel even when the lives of others are in peril. The District Commander shall ensure guidance is in place so that experienced supervisors--not the SRU crew--decide how to proceed with rescue attempts.

6.3.1 Swimmers

Section 5.I provides a description and operating guidelines for the various Coast Guard rescue swimmers. References (e), (ee), and (ff) provide detailed operating guidance and limitations on what the rescue swimmer, cutter swimmer and surface swimmer are allowed to do. Essentially, a Coast Guard swimmer is NOT to go under the water and enter a capsized or submerged object.

6.3.2 Divers

For diving policy refer to the Coast Guard Diving Policies & Procedures Manual, COMDTINST M3150.1 (series), reference (gg). For policy on Rescue Diving use reference (gg), section 1.G.4 and for policy on Public Safety Diving use reference (gg), section 5.E.5.

6.3.3 Rescue Procedures

Procedures recommended for rescuing personnel trapped in a capsized vessel are:

- Keep in contact with the person(s).
- Stabilize the hull.
- Estimate the volume of air remaining.
- Surface swimmers may attempt to direct trapped persons out but shall not dive under the vessel.
- Inject clean air if possible.
- Only if no rescue is possible, may you consider re-righting the vessel. Refer to reference (e).

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Section 6.5
Action Required for Underwater SAR Preparation

Due to the limited capability of Coast Guard resources to respond to underwater incidents, the best response is to plan ahead, to know the limitations and to know whom to contact for additional assistance.

6.5.1 Coast Guard Rescue Coordination Centers

Coast Guard Rescue Coordination Centers shall:

(a) Monitor civilian submersible and underwater habitat activity within the District and advise the Commandant of developments that may affect procedures and policies of this directive.

(b) Encourage submersible manufacturers, owners and operators to participate in the voluntary reporting system for submersible operations.

(c) When informed of a civilian submersible operation, send a message to Chief of Naval Operations and issue a Notice to Mariners giving the location(s) and time(s) of the operation. Tourist submersibles are approved for specific sites and may have as many as 12 dives per day; therefore, notification for tourist submersibles should be as a permanent record.

(d) Maintain files of copies of the Certificate of Inspection (COI) and a copy of the submersible operations manual as approved by the COTP in the RCC for reference in the event of a rescue incident.

(e) Establish a resource file of local, state, commercial, military rescue and/or salvage divers and submersibles for use in underwater search and rescue.

(f) When assistance is required for a civilian underwater SAR incident:

  (1) Notify the Navy Command Center Duty Captain at the Pentagon (on duty 24 hours: Commercial (703) 695-0231, Autovon 225-0231).

  (2) If the incident involves a civilian submersible, request implementation of SUBMISS/ SUBSUNK per reference (hh). Send a follow-up message confirming the request.

  (3) Respond with Coast Guard resources as appropriate (On Scene Commander, rescue platform such as buoy tender, traffic control, aircraft, communications and/or logistics.).

  (4) Serve as SAR Mission Coordinator (SMC). If Navy resources are used, the Navy may assume SMC. If the Navy assumes SMC, continue to assist as requested.

  (5) Inform the Area Commander and Commandant (G-RPF) and (G-RPR) of the progress of the rescue before and after the Navy assumes SMC.

  (6) Prepare a SAR case study in addition to the normal assistance report.

(g) Maintain liaison with the Navy and other organizations to coordinate planning for civilian underwater SAR emergencies.

(h) Be familiar and ensure subordinate SMCs are familiar with the contents of reference (gg) in regards to use of rescue divers, and treatment & evacuation of injured divers.

6.5.2 Marine Safety Office (MSO)/Captain of the Port (COTP)

MSOs/COTPs shall:

(a) Forward copies of the Certificate of Inspection (COI) and the approved operations manual of passenger carrying submersibles which they license to the appropriate RCC showing safety features and conditions, determined route, depth and any other applicable information necessary to prosecute a SAR case with the vessel.

(b) Submit to the appropriate RCC information on any requirements developed for recreational submersibles. Authorizations for recreational submersible operations should be copied to the RCC.

Section 6.6
Scuba Diving Incidents

Scuba divers occasionally suffer unique, compressed-gas injuries that few SAR response personnel understand or are prepared to handle. Coast Guard SRUs are not required to be experts in providing medical diagnosis or treatment for such injuries. However, it is expected that personnel will be able to recognize the general symptoms of dive related injuries so that their potential severity is recognized and that basic steps are taken to minimize worsening the medical condition.

6.6.1 Dive Related Injuries and Symptoms

Dive related injuries fall into three general categories, decompression sickness, air embolism and nitrogen narcosis. Decompression sickness and air embolism are the most serious threats to the diver and require immediate treatment with hyperbaric oxygen in a recompression chamber.

6.6.1.1 Decompression sickness, sometimes called the "bends", is generally brought about by the diver absorbing gas into the blood from the compressed air breathed while diving. A diver must ascend slowly to avoid having these gases form into bubbles. Symptoms of bubble formation include pain at the joints, chest pain, headache/dizziness, confusion and numbness.

6.6.1.2 Air embolism is caused by excess gas pressure inside the lungs. It is most likely to develop during an improperly executed ascent. As the diver ascends, the air in the lungs expands, forcing gas bubbles directly into the bloodstream. This air (bubble) typically is transported to the brain where blockage of blood flow will occur depriving the brain of oxygen. Symptoms include blurred vision, paralysis, dizziness/nausea, weakness, confusion, headache, chest pain and unconsciousness.

6.6.1.3 Nitrogen narcosis or "rapture of the deep", which is not a decompression illness, is caused by the narcotic effect of the nitrogen in the diver's breathing medium and disappears when the diver moves into shallower water or surfaces.

6.6.2 Emergency Treatment for Decompression Sickness and Air Embolism

Other divers with the victim will be excellent sources of information and an effort should be made to have one travel with the patient to the medical facility. Since it can be difficult to differentiate between decompression sickness and air embolism, it is best for field treatment of both. While many SRUs cannot provide extensive medical assistance, they do serve the essential role of transporting the victim and possibly stabilizing the situation.

6.6.2.1 Where the capability exists, the following steps are advised:

(a) Ensure airway, breathing, and circulation (ABC).

(b) Calm and reassure the victim.

(c) Attempt medical assessment and diving history.

(d) Administer fluids: If more than one hour from medical help, allow victim oral fluids at the rate of 4 fluid ounces every 15 minutes as tolerated. Oral Fluids should be withheld if transport time is less than one hour.

(e) Administer 100% oxygen.

(f) Place victim in a supine (flat on back) position; if the victim is nauseated, place the victim on his/her left side for airway management.

(g) Transport to nearest medical facility/recompression chamber.

6.6.3 Transport of Diving Accident Patients

Dive accident injuries are aggravated by reduced atmospheric pressure. Unpressurized aircraft conducting a diving accident MEDEVAC should fly at the lowest safe altitude; recommendation is for MEDEVAC aircraft is to transport at 1000 feet or below. Pressurized aircraft need to pressurize to sea level.

6.6.4 SMC Procedures

Any Coast Guard facility that would expect to perform as SMC for a diving accident case, typically RCCs and Command Center's, shall maintain a list of resources that can provide diving medical advice and a list of available recompression chambers. Divers Alert Network (DAN), located at Duke University Medical Center in North Carolina, is a nonprofit organization that provides emergency medical advice and assistance for underwater diving accidents. Diving emergency guidance can be obtained by telephone, **(919) 684-8111 for emergencies**, and (919) 684-2948 for routine matters.

Table A-4 Other International Documents

	RCC	Activities Group	MSO	AIRSTA	STA	WHEC WMEC	WPB	ANT
Radio-Medical Assistance, Volume I: Part I-Coded Medical Messages	✓			✓				
Radio-Medical Assistance, Volume II: Part I-The More Common Acute Illnesses	✓							
Radio-Medical Assistance, Volume II: Part II-Assistance and First Aid On Board	✓							
List of Radio determination and Special Service Stations (International Telecommunication Union (ITU))	✓							
Standard Marine Navigational Vocabulary	✓			✓				

Table A-5 Regional Documents

	RCC	Activities Group	MSO	AIRSTA	STA	WHEC WMEC	WPB	ANT
North Atlantic Minimum Navigation Performance Specification (MNPS) Airspace Operations Manual	✓			LANT UNITS				
North Atlantic International General Aviation Operations Manual	✓			LANT UNITS				

Table A-6 National Documents

	RCC	Activities Group	MSO	AIRSTA	STA	WHEC WMEC	WPB	ANT
National SAR Supplement (NSS)	✓	✓		✓	✓			
National SAR Plan (NSP) (contained within the NSS)	✓	✓		✓	✓			
Coast Guard Addendum to the NSS	✓	✓		✓	✓			
Flight Services, FAA 7110.10(series) (Federal Aviation Administration)	✓			✓				
Air Traffic Control, FAA 7110.65(series) (Federal Aviation Administration)	✓			✓				
Airport Emergency Plan, FAA's Advisory Circular AC No: 150/5200-31	✓			✓				
Water Rescue Plans, Facilities, and Equipment, FAA's Advisory Circular AC 150/5210-13	✓	✓		✓	✓			
Marine Radiotelephone Users Handbook	✓	✓		✓	✓			✓
Cospas-Sarsat Users Manual for U.S. RCCs	✓	✓		✓				
U.S. Air Force Foreign Clearance Guide	✓			✓				
NAVSEA SUBMISS/SUBSUNK Bill for Submarines and Manned	✓	✓		✓				

Noncombatant Submersibles								
Diving Accident Manual	✓	✓		✓	✓			
Incident Command System Manual/ Field Operational Guide	✓	✓		✓	✓			
Management and Operation of the Automated Mutual-assistance Vessel Rescue (Amver) System, COMDTINST 16122.2 (series)	✓	✓			✓			
Amver (Ship Reporting System) User's Manual	✓							
End User Manual for the Automated Mutual-assistance Vessel Rescue (Amver) System (Amver II Version 1.0, Phase IV) Vessel Arrivals Utility dated April 24, 1994 by Synetics	✓							
CASP User's Manual.	✓	✓						
Admiralty List of Radio Signals, Volume 5, Global Maritime Distress and Safety System (GMDSS)	✓	✓		✓				
NIMA Publication 117 "Radio Navigational Aids"	✓	✓		✓				
"SAR Cooperation Plan for Passenger Ships" carried on board SOLAS-class passenger ships (cruise ships and passenger ferries on international voyages); copies provided from Coast Guard Headquarters	✓							
Coast Guard Air Operations Manual	✓	✓						
Coast Guard Rescue and Survival Systems Manual	✓	✓	✓	✓	✓	✓	✓	✓
Area/District Heavy Weather Plan	✓	✓		✓	✓			
Applicable Hurricane/Typhoon Operations Plan	✓	✓		✓	✓			
U.S. Army Corps of Engineers National Disaster Plan	✓	✓		✓	✓			
Local/subordinate Group SOPs	✓	✓		✓	✓		✓	
Coast Guard Auxiliary Flotilla Procedures	✓	✓	✓	✓	✓			
Civil Air Patrol guidance documents, where applicable	✓	✓		✓	✓			
Fleet Guides	✓	✓		✓	✓			
U.S. Navy Operating Areas and Warning Area instruction	✓	✓		✓	✓			
Bridges Over Navigable Waters of the U.S.	✓	✓			✓			
Bowditch ("The American Practical Navigator", NIMA Publication 9)	✓	✓			✓			
Light List (for own AOR)	✓	✓		✓	✓			
Tidal Current Tables	✓	✓		✓	✓			
Tide Tables	✓	✓		✓	✓			
U.S. Coast Pilot	✓	✓			✓			
Waterway Guide	✓	✓			✓			
U.S. Navy Marine Climatic Atlas of the World (applicable volume(s))	✓	✓		✓				

Appendix B
MISLE

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Section B.1
MISLE System for SAR Data

This appendix prescribes the administrative requirements and responsibilities for submitting and processing Search and Rescue (SAR) operations data.

B.1.1 Purpose

The Marine Information for Safety and Law Enforcement (MISLE) system provides a case management tool, ready access to a wide range of data useful in conducting SAR case response and information to:

- Measure unit workload and effectiveness;
- Determine resource utilization and needs;
- Justify budget requests to meet projected requirements;
- Analyze system operations for potential savings; and
- Promulgate policies and procedures to more effectively manage the overall SAR program.

B.1.2 Discussion

In FY 2003 the Marine Information for Safety and Law Enforcement (MISLE) systems response module was available for SAR data entry. The multi-mission data system replaced the SARMIS II, SAR mission only data system as the repository for SAR data. Having a single data system for entry of data relevant to a variety of missions is a significant benefit to those entering the data in addition to providing rapid access to a wealth of data for response operations, the system facilitates analysis of response across the full range of Coast Guard missions. MISLE is a web central database application maintained and operated by the Operations System Center (OSC). Users access the system using the Web Browser on their CG Standard Workstation.

B.1.2.1 MISLE is a case management system and permits the SMC to enter all SAR data for a case, including unit sortie information. Districts may elect to have all data entered by the SMC or have the SMC enter only the incident management data and individual units enter the sortie data. To best accomplish the latter, the SMC must first enter the minimum required data, and then retrieve the machine generated case number. This number is then provided to participating units for their use in entering sortie data. SMC assignment policy is detailed in Chapter 1. Units subordinate to the SMC may enter single unit cases.

B.1.2.2 Units should enter data in real time or near real time when possible.

B.1.2.3 MISLE generates sequential file numbers for each activity as well as an overall case number. For tracking purposes, the case number should be noted on SMC/Unit SAR case file folders.

B.1.2.4 MISLE has an online user guides to assist users in performing data entry. The user guides give detailed instructions for entering SAR incident data.

B.1.3 Recommendations for System Improvements

Comments or recommendations for improvements to the MISLE system for SAR should be sent to the OSC Hotline, where they will be consolidated and addressed by the MISLE Configuration Control Board.

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Section B.2
Reporting Criteria

B.2.1 SAR Case

A SAR case shall be officially opened for each instance the Coast Guard is specifically requested to render assistance. This requirement applies to those instances in which persons and/or property are subject to the risk of being injured, damaged, or lost and shall include assistance rendered to other Coast Guard resources regardless of the unit assigned. Incidents for which a SAR case must be opened include:

B.2.1.1 A SAR case is opened when a Coast Guard resource(s) is dispatched to render assistance.

B.2.1.2 **Coordination/communications.** A SAR case shall be opened when no hardware was launched, if Coast Guard personnel in coordination/communications expended at least thirty (30) minutes of effort.

B.2.2 SAR Sortie

A unit shall enter a SAR Sortie into MISLE each time one of its resources (hardware or personnel) is dispatched to respond to a SAR incident. The SAR Mission Controller (SMC) may enter all data for a case involving more than one unit, even if that unit launched no sortie.

B.2.3 Case/Sortie Details

For each incident the responding unit should complete a sortie and the SMC (same unit may fill in this portion even if not SMC in the event of a single unit case) shall enter the unique case details.

B.2.4 Reporting efforts for Case Coordination and Communications

An SMC should report all time spent coordinating a multi-unit response through appropriate entry in the Incident Management Activity. The Sortie Activity shall not be used to report coordination and communications efforts.

B.2.5 Co-located Units

Where a station and group are co-located, each should report the work done by its own resources under its own OPFAC. For groups who provide the communications watch and/or OOD for the station, coordination and communications efforts should be reported as the group.

B.2.6 Afloat Units

Afloat reporting units shall have their data entered by their Administrative Control (ADCON) Commander. If deployed the SMC for the case may also enter the data.

B.2.7 Headquarters units

Headquarters' unit's data shall be entered by the unit or by the SMC through prior arrangement with SMC unit.

B.2.8 SAR Mission Coordinator (SMC)

B.2.8.1 The SMC is responsible for ensuring completion of the entire set of SAR data for each case.

B.2.8.2 If the SMC is reassigned during a case, the unit designated SMC upon termination of the case shall fulfill these requirements.

B.2.8.3 The SMC is also responsible for completing the sortie data for non-Coast Guard resources participating in the case. For local/state resources, a subordinate unit that works directly with the local/state agency may do this more expediently.

B.2.9 Special Reporting Situations

B.2.9.1 Helicopters deployed aboard cutters for other than SAR purposes but which are utilized to prosecute a SAR incident shall be considered an extension of the cutter. This instance requires a Report utilizing the cutter's OPFAC.

B.2.9.2 Use of helicopter/shipboard operations for the specific purpose of prosecuting a SAR case constitutes a multi-unit case. This requires a separate Report from both the cutter and the helicopter's assigned Air Station.

B.2.9.3 Resources that are temporarily assigned duty (TAD) to another OPFAC shall report SAR cases under their own OPFAC.

B.2.9.4 Resources deployed to a facility that does not have a Coast Guard OPFAC number, and is not under the operational control (OPCON) of another Coast Guard OPFAC, shall report SAR incidents under their own OPFAC.

B.2.9.5 Bar conditions, frequently encountered in the Thirteenth District, are when the Coast Guard provides an escort service for vessels desiring assistance when crossing the bar. Usually, more than one vessel is escorted on a single trip. In such instances, multiple vessels should be entered. The assisting unit should file only ONE sortie for each trip across the bar regardless of the number of vessels being escorted.

B.2.9.6 Amver vessel participation sorties shall be entered by the SMC. All uses of Amver vessels shall be documented as part of a case. Vessels other then Amver participants should also be entered subject to level of participation.

B.2.10 Auxiliary Reporting

B.2.10.1 When the Auxiliary is the only resource employed, an entire report (notification, incident management, case and sortie sections) will be completed for that case by the Coast Guard unit exercising operational control over the Auxiliarists.

B.2.10.2 When the Auxiliary is just one of several resources employed, the sortie section needs to be completed by the OPCON unit.

Section B.3
Responsibility

SAR data is vital to effective program management and operational case analysis. SAR MISLE entries are part of the legal record of a case and it is imperative that data entry is thorough and accurate. All personnel must be diligent in their data entry, validation, and review to assure accuracy of the legal record. Command cooperation and support are required to achieve a quality database. It is the responsibility of each reporting unit to ensure completeness, accuracy, and timely entry of their SAR response information as outlined below. .

B.3.1 Mandatory Versus Optional Computer Fields

Units shall consider every field for which they have data as mandatory for entry purposes. The system was designed to allow the most rapid entry of data by not requiring the user to visit every screen. To ensure the minimum data common to all cases is collected, fields within the data entry system are designated as mandatory. Not completing these fields will result in an error and require entry before the record is complete. This mandatory designation is NOT indicative of the information that is needed by the Coast Guard for proper analysis and support of this vital mission.

B.3.2 Case Data Validation

Each Command shall designate in writing individuals with the authority to validate MISLE case information and change the status of the MISLE Incident Management Activity. These individuals must be familiar with the case and have message release authority. A case is validated when all appropriate MISLE entries have been made, and the information and timeline are correct, thorough, and accurately reflect the case. Within 12 hours of the case conclusion, but not to exceed 24 hours, the entire MISLE case shall be validated and the MISLE Incident Management Activity status must be changed from “Open-In Progress” to “Open-Submitted for Review.” In cases greater than 24 hours in duration, the MISLE case shall be validated at a minimum once every 24 hours and a response communication entry shall be added in the timeline stating “MISLE validated by (enter staff or watch position title).”

B.3.3 Case Data Review

Each Command shall designate in writing an individual or individuals tasked with completing the review of all MISLE activity at the unit. This individual will ensure the SAR case folder and MISLE information are accurate and completed IAW current policy/instructions. This MISLE Review Officer will change the status of the case to “Closed-Agency Action Complete” or “Open-Suspended” after their final review. This final review shall be completed within five days.

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Section B.4
Action

Area/District Commanders, unit Commanding Officers and Officers-in-Charge shall:

B.4.1 Training

Ensure that personnel assigned with preparation and processing of SAR information have completed available training and familiarity with the MISLE system.

B.4.2 System Passwords

Contact OSC helpdesk to obtain MISLE passwords. OSC helpdesk may be reached by phone (304) 264-2500 or email oschelpdesk@osc.uscg.mil.

B.4.3 Use of Online Guidance

Use the online user guides when performing data entry functions in support of the MISLE.

B.4.4 Meeting Specific Reporting Criteria

Direct their unit's efforts toward meeting the specified reporting criteria set forth in Section B.2 above and review criteria set forth in Section B.3 above.

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Section B.5
General Data Entry Guidelines

B.5.1 Entry Time Zone

All times entered shall be entered in Zulu.

B.5.2 Case Numbers for Reopened Cases

A re-opened case shall be entered under its original case number and electronic file.

B.5.3 Sortie Times

B.5.3.1 A sortie is considered terminated if the resource (1) is an aircraft and shuts down its engines, or (2) is a vessel and becomes moored.

B.5.3.2 A resource which diverts from another mission to respond to a SAR incident, or diverts away from a SAR incident to another mission, shall only report the time spent on the SAR mission in the sortie.

B.5.3.3 Time on sortie should equal only the actual time spent underway and NOT include any time spent in refueling, picking up supplies, layover, etc.

B.5.4 Entering Lives data

Lives data shall include all persons involved in a case that are affected by the incident. For passenger vessels this should include both crew and passengers when appropriate. For MEDEVACs and MEDICOs only the person actually benefiting from the medical assistance shall be counted.

B.5.4.1 **Case level.** Lives at the case level reflect the actual number of persons assisted by the Coast Guard. The lives in all categories must equal the total number of persons involved. This data is used for reporting overall Coast Guard performance.

B.5.4.2 **Sortie level.** Lives at the sortie level reflect the efforts expended by each unit involved. The lives within a single sortie in all categories cannot exceed the total number of persons involved. Lives accounted across a series of sorties within a single case can exceed the total number of actual persons involved. Sortie lives accounting permits multiple units or sorties to assist a single individual and get credit for their contribution. When examining the resulting data, it should not be added across units to reflect the number of persons saved, lost, missing or assisted by the Coast Guard in a particular region. Added data may be used to show level of effort and contribution by a number of units.

B.5.4.3 **Lives saved** are those lives that would have been lost had the rescue action not been taken. This includes actually pulling a person from a position of distress or removing them from a situation that would likely resulted in their death had the action not been taken.

B.5.4.4 **Lives lost** are reported in several subcategories. To count a life as lost there must be a body recovered, otherwise it shall be entered within the Lives Unaccounted for category.

B.5.4.5 **Lives lost before notification** are those lives lost which to the best of the reporting unit’s knowledge occurred before notification of the incident was made to the Coast Guard. This is not a legal declaration of death by a medical authority, but a judgment call to determine if response units could likely have affected the outcome.

B.5.4.6 **Lives lost after notification** are those lives lost which occurred after notification was made to the Coast Guard. When known the appropriate additional lives lost categories shall be used to more clearly refine at what point in the rescue process the life was lost. These include:

(a) **Lives lost after alongside** for lives lost after the assisting unit arrived on scene.

(b) **Lives lost after onboard assisting unit** for lives lost after the person was transferred to the assisting unit until the person was transferred to shoreside services (ambulance/medical personnel or hospital direct when delivered to hospital helo pad).

(c) **Lives lost after reaching shore facility** for lives lost after the assisting unit has transferred the person to shoreside services (ambulance/medical personnel or hospital direct when delivered to hospital helo pad).

B.5.4.7 **Lives unaccounted for** are those known persons missing at the end of a SAR response. This includes those persons presumed as lives lost but no body was recovered. **Only those persons who can be identified by name or by specific count of persons** (persons on board count for a ferry, migrant vessel, etc.) **shall be counted** (lives unaccounted for entry is made in MISLE). Reports of probable person missing (e.g., someone "thought" they saw a surfer, nothing is found, but no persons are reported missing) shall NOT be counted (no lives entry is made in MISLE).

B.5.4.8 **Lives assisted** are those persons who are provided assistance that did not meet the criteria for lives saved but did receive some assistance. An entry for type of assistance provided is required for every life entered under this category. Persons merely onboard a vessel that is provided assistance directed at the vessel (repairs, fuel, etc.) are not necessarily assisted.

B.5.5 Entering Property Data

Property values to be entered include the value of the vessel, aircraft, structure or other property category. For a fishing vessel, the value of catch on board shall be included in values entered as appropriate. Property values in a single case may fall into one or more categories. To accurately reflect the Coast Guard's efforts, it is important that all categories that apply are used. For example, a portion of the property is damaged or lost and the remainder is saved, values of each shall be entered in the appropriate category.

B.5.5.1 **Case level.** Property data at the case level reflects the actual value of property assisted by the Coast Guard. The property in all categories must equal the total value of property involved. This data is used for reporting overall Coast Guard performance.

B.5.5.2 **Sortie level.** Property data at the sortie level reflects the efforts expended by each unit involved. The property value within a single sortie in all categories cannot exceed the total value of property involved. Property values accounted across a series of sorties within a single case can exceed the total value of actual property involved. Sortie property accounting permits multiple units or sorties to assist the same property and get credit for their contribution. When examining the resulting data, it should not be added across units to reflect the amount of property saved, damaged, lost, missing or assisted by the Coast Guard in a particular region. Added data may be used to show level of effort and contribution by a number of units.

B.5.5.3 **Property saved** is the estimated value of property that would have been lost had the rescue action not been taken. This includes actually removing property from a position of distress or providing aid to property in a situation that would likely resulted in the property's loss had the action not been taken.

B.5.5.4 **Property damaged** is the estimated value of damage to property resulting from the incident.

B.5.5.5 **Property lost/totaled** is the estimated value of property that is either absolutely lost (not recovered) or is a constructive loss (beyond reasonable repair; no longer useful). Important to note that for property observed or know to have sunk, it shall be included as property lost.

B.5.5.6 **Property Unaccounted for** is the estimated value of property that at the end of a SAR response remains missing. This category is to be used only for those cases where the fate of the property is unknown and shall not include property observed or known to have sunk.

B.5.6 Position of distress to be entered for uncorrelated distress broadcasts

B.5.6.1 For VHF-FM uncorrelated MAYDAY or automated distress no specific position shall be entered. A generalized area within the call originated shall be entered.

B.5.6.2 For SARSAT unlocated do not enter a location. Enter the word "unlocated" in the text box.

B.5.6.3 For MF or HF unlocated do not enter a location. Enter the word "unlocated" in the text box.

B.5.6.4 For DSC without position follow scheme for VHF-FM, MF or HF as appropriate.

B.5.7 Distance Entries

B.5.7.1 Distance to scene shall be entered from the homeport if the resource is dispatched from there, or from the point diverted to the SAR sortie.

B.5.7.2 Distance off shore shall be entered as the distance from the closest point of land to the incident location.

B.5.8 Incident Classification

Incident classification is a relative measure of the severity of incident. There are three classification levels, Major, Medium and Minor. For some mission areas (MEP for example) there are specific statutory levels that drive the selection. For SAR the incident classification is related to the actual threat to lives & property. This information is used to screen for cases for notification up the SAR chain of command and to evaluate the SAR system. Entry of at least one mission area and incident classification is required.

B.5.8.1 **Levels and criteria for selection.** The SAR incident classification guidelines are provided in Table B-1. Life and property criteria found in sections B.5.4 and B.5.5 respectively, should be used to determine the lives impact in assigning the classification.

Table B-1 SAR Incident Classification Guidelines

Classification	*SAR Incident Type/Results*
Major	• Loss of life • Loss of property • Life saved • Property saved • Life unaccounted for
Medium	• Uncorrelated distress alert • Distress alert with no life/property lost/saved
Minor	• Life assisted with no higher classification property implications • Property assisted with no higher classification life implications

B.5 8.2 **Multiple mission selection.** Multiple mission areas and separate classification levels for each mission area may be entered. It is appropriate in cases where SAR and other missions (LE, MEP, etc.) are involved to enter a classification level for each.

B.5.8.3 Incident classification is displayed on the "Case Details" page within MISLE, but entered via the "Incident Management" page. Entry is made within the "Incident Summary" tab.

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Section B.6
Data Retrieval

B.6.1 SAR Statistics

The Office of Search and Rescue compile summary data approximately one month after the end of each fiscal year. It is posted on the SAR Program Internet web site. (http://www.uscg.mil/hq/g-o/g-opr/sar.htm)

B.6.2 Pre-Formatted Reports

CGInfo via the intranet provides the ability to examine a wide range of data for both the case and sortie level data. Data for the various years is accessed different locations. All data prior to 2003 is accessed via the link for Search and Rescue. All data 2003 and later is accessed via the link for MISLE Response.

B.6.3 Ad Hoc Queries

To retrieve information that is not available from the CGInfo web site, the OSC MISLE staff should be contacted via the help desk.

B.6.4 Density Plots

The location of cases sorted for an individual request plotted on a digitized chart of any area of the globe. This capability is currently limited. Contact the OSC help desk to get a listing of data with associated position data. MISLE Geographic Information System (GIS) provides some ability to create density plots. The process is described in the on-line user guides for GIS and GIS Scatter Plots.

B.6.5 SARSIM

The Search and Rescue Simulation Model (SARSIM) is capable of analyzing a complex system of SAR resources. It is a technically oriented analytical tools which requires close teamwork between G-ORP and the recipient of the information.

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Appendix D
Emergency Medical Treatment Report (CG-5214)

D.1 Emergency Medical Treatment Report Form

Form CG-5214 is a 4-part form used to document patient injuries and general medical condition during the conduct of a MEDEVAC. Each part is identical and is distributed as follows:

- Part 1 to Patient
- Part 2 to Unit
- Part 3 to Triage Officer
- Part 4 (spare – copies are not to be sent to USCG Headquarters)

D,2 Forms Availability

A sample of Part 1 of the form is provided on the following page. Form CG-5214 is available electronically in ADOBE PDF format in the USCG Forms Library.

EMERGENCY MEDICAL TREATMENT REPORT

VICTIM IDENTIFICATION

1. Name ______________________
2. Sex (check one) male ____ female ____
3. Estimated age yrs ____ mos ____

RESCUER INFORMATION

10. Name: ______________ 11. Level:
12. Unit: ______________
13. OPFAC #: ______________
14. Rescue Vehicle: ______________
15. Receiving Unit: ______________
16. Time Patient Transferred: ______________

DESCRIPTION OF INCIDENT

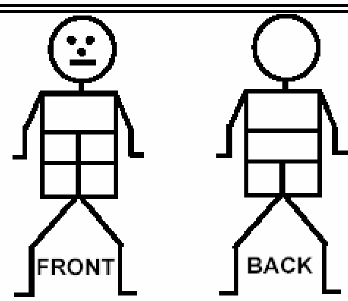
4. Date: ______________
6. Time on scene: ______________
7. Time of incident: ______________
8. Location: ______________

____

5. Type of incident:
a) marine ____
b) aviation ____
c) industrial ____
d) auto ____
e) domestic ____
f) other ____

NATURE OF EMERGENCY / MECHANISM OF INJURY

OBSERVATION OF VICTIM



H - hemmorage **F** - fracture
L - laceration **B** - burns
S - soft tissue injury

TREATMENT
(circle as needed)
1 - dressing
2 - tx splint
3 - splint
4 - c/collar
5 - back board
6 - tourniquet
7 - CPR
8 - airway
9 - oxygen
10 - MAST
11 - Miller B/B
O2 Liters ____

MEDICATIONS:

ALLERGIES:

MEDICAL HISTORY / COMMENTS / ETC.
(include additional vitals, oxygen, fluids, etc.)

SKIN

(Circle appropriate number or numbers)

1 - normal	4 - cyanotic	7 - cold
2 - pale/ashen	5 - dry	8 - warm
3 - flushed	6 - moist	9 - hot

	OBSERVED / TIME				
VITAL SIGNS					
LEVEL OF CONSCIOUS	Alert				
	Responds to Verbal				
	Responds to Pain				
	Uncon / Unresponsive				
PUPILS	Perl				
	Unequal				
	Nonreactive				
	Dilated				
	Pinpoint				
PULSE	Rate (Numeric)				
	Strong				
	Weak				
BREATHING	Rate (Numeric)				
	Regular				
	Shallow				
	Labored				
BLOOD PRESSURE	Blood Pressure	/	/	/	/
TEMP	Temperature (circle) ORAL RECTAL				
MAST	**MAST BP**	/	/	/	/
	COMPARTMENT		R	L	ABD

TIME	MEDICATIONS ADMINISTERED	DOSAGE
____	____	____
____	____	____
____	____	____

TRIAGE INFORMATION (CIRCLE ONE) **PRIORITY I** **PRIORITY II** **PRIORITY III**

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Appendix H
Search Planning Handbook

Section H.1
Search Planning

Search planning is necessary when the location of a distress is not known, or significant time has passed since the search object's position was last known. The SMC is responsible for developing and updating an effective search plan. The plan may involve a single SRU or many SRUs searching for several days.

H.1.1 Overview

Search planning consists of determining datum (the most probable location of the search object, corrected for drift) and search area, developing an attainable search plan, selecting search patterns, planning on scene coordination, transmitting the search plan to OSC/SRUs, and reviewing the search plan. Many factors influence the movement of the search object. The SMC judges the impact of these factors to determine the region to search and methods to use, evaluates the number and capabilities of available SRUs, and determines whether compromise between search area size and search effectiveness is necessary. The methods described in this chapter are based on historical information and mathematical theory, and represent generally accepted techniques for search planning. Though effective tools, they do not in themselves guarantee success; that depends on planner ability and judgment, and SRU effectiveness.

Search planning involves the following steps:

- Evaluate the situation, including any previous search results;
- Estimate the possible distress incident positions and how they are distributed (usually with respect to a datum position, line or area);
- Estimate the survivors' post-distress movements to produce an estimate of their possible locations at the time when search facilities can be on scene;
- Determine the best way to deploy the available search facilities so the chances of finding the survivors are maximized (optimal search effort allocation);
- Define search sub-areas and search patterns for assignment to specific search facilities;
- Provide a search action plan that includes a current description of the situation, search object description(s), specific search assignments for the search facilities, on-scene coordination instructions, and search facility reporting requirements;

These steps are repeated until either all survivors are found and rescued, or evaluation of the situation shows that continued searching is very unlikely to succeed in saving a life.

For land cases, search area is normally dependent on the environment. Natural boundaries, injuries, and other hard-to-quantify factors affecting movement are important in search area decisions. The experience and judgment of the SMC is a key factor. A more detailed discussion and planning guidance for land cases is provided in references (a) and (b).

H.1.2 Search Planning

There are basically only two methods for planning searches—manual and computer simulation. The manual search planning method is found in the *International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual, Volume II*. Although there are several computerized versions of the manual method (sometimes with slight variations from *IAMSAR*) in use in various parts of the world, they are not fundamentally different from the manual method itself. JAWS is one of these. In some cases these computer programs have access to more detailed environmental data than one normally associates with paper-and-pencil methods, but otherwise the computer is simply being used as a tool to perform the same computations and display the same results the paper-and-pencil manual method would produce. The only software that uses the simulation approach is CASP. A new search-planning tool is currently under development that will replace both JAWS and CASP. It is called the Search and Rescue Optimal Planning System (SAROPS). SAROPS will use a simulation approach. The main advantage of simulation is that it allows a more realistic representation of real-world complexity than the grossly over-simplified manual method.

H.1.3 Uncertainty and Probability

Searching necessarily involves uncertainty. If the search object's location were known or could be accurately predicted, no searching would be necessary. Therefore, the first uncertainty the search planner must deal with is the uncertainty about the object's location. This in turn often involves uncertainties about the time and location of the distress incident, the types of objects (disabled craft, PIW, raft, etc) that may be adrift, etc. Even when these are known within close limits, if a significant amount of time will pass between the time of a distress and the arrival of resources on scene, the uncertainty about the object's location will grow due to uncertainties in the available data about the environmental factors that cause drift and uncertainties in our knowledge about how the search object will respond to those factors. In addition, detection of the object once resources arrive on scene and begin searching is by no means certain. These uncertainties require the search planner to think in terms of probabilities. The three probabilities of primary concern are the probability that the search object will be in some bounded area (probability of containment or POC), the probability that the search object will be detected, assuming it will be in an area at the time the area is searched (probability of detection or POD), and the probability of finding the search object (probability of success or POS) based on both the POCs for the areas searched and the PODs from searching those areas. For any given search area,

$$POS = POC \times POD \, .$$

For non-overlapping search areas that are covered more or less simultaneously, the total POS is simply the total sum of all the POS values for the individual search areas. The cumulative POS (POS_{CUM}) is the probability that all searching done to date would have located the search object.

H.1.4 The Goal of Search Planning

The ultimate goal of search planning is to find the survivors of a distress incident as quickly as possible, subject to resource availability. The way to achieve this goal is to increase the cumulative probability of success (POS_{CUM}) as quickly as possible with the available or assigned resources. A search plan that does this is the most efficient, or the optimal, plan. It is also the plan that will minimize the time required, on average, to locate the search object. "Optimal effort allocation" is the process of finding the combination of search area, coverage, and resource assignments that produces the most efficient search plan. Unfortunately, this is a mathematically complex process in the general case that requires a quite sophisticated computer program. CASP performs this function but the resulting search plans are not always operationally feasible, requiring some adjustment by the search planner. JAWS and the *IAMSAR Manual* method also produce "near-optimal" search plans based on a number of (not always realistic) simplifying assumptions and corresponding "optimal search factors." Search and Rescue Optimal Planning System (SAROPS) is being designed to produce the most nearly optimal, operationally feasible, search plans that are possible with the available assets.

H.1.5 Search Planning Methods and Tools

When developing a search plan, search planners must be detectives and information distillers. They must aggressively pursue leads and obtain all information available. They must continually think "outside the box."

Coast Guard Search planners shall plan searches in one of three ways, subject to the guidance provided in this chapter: Manually in accordance with the *IAMSAR Manual* and this Appendix, with JAWS or with CASP.

H.1.5.1 Manual Method: The *IAMSAR Manual* describes the basic manual method for Coast Guard use, with a few exceptions that are described in section H.2.1. This method is often adequate for situations where no more than 24 hours have elapsed between the distress incident and the planned search.

H.1.5.2 Joint Automated Work Sheets (JAWS): JAWS is a software module provided with the USCG SAR Tools suite. It is a computerized version of the USCG manual search planning method, including those exceptions to the *IAMSAR Manual* described in section H.2.1. This method is often adequate for situations where no more than 24 hours have elapsed between the distress incident and the planned search.

H.1.5.3 Computer Assisted Search Planning (CASP): CASP employs a Monte Carlo simulation technique where tens of thousands of independent drift trajectories are computed from a like number of independently selected sample starting positions and times, wind and current values, and leeway parameters from the possible values implied by their respective uncertainties. The results are displayed as a cellular probability map showing the more probable and less probable places the search object could be during the planned search. CASP can handle multiple complex situations, including datum areas and voyages/flights on which craft are unreported or overdue. One of CASP's greatest advantages is the ability to account for previous searching and compute probability of success (POS) values for all searching done to date. Each simulated search object in CASP has an associated "Pfail" value that represents the probability that all searching done to date would have failed to detect that object. When the object is in a search area at the mid-search time, its Pfail value is adjusted according to the POD for that search area. Subsequent probability maps are constructed from these Pfail values. Such probability maps properly account for the effects of previous searching.

CASP may be used at any place and time and for any drift interval regardless of length. However, near shore, especially in areas of tidal influence, it may be necessary to provide wind and current data rather than rely exclusively on CASP's "system" files. C2PC/SAR Tools provides a method for estimating tidal currents near shore in selected areas. On the other hand, CASP has access to much more detailed and timely sea current data in the western North Atlantic Ocean than the other two methods. CASP also recognizes land (on a 6-minute grid for North America) while JAWS does not.

JAWS and the *IAMSAR Manual* method provide good results only in simple situations. These include situations where there is a single distress position and time and the winds and currents are approximately uniform over the entire area and duration of interest. Other situations may be accommodated by computing several drift solutions starting from different locations/times and combining the results, but this should be done only with extreme care and caution. Normally, CASP should be the method of choice in situations that would require multiple JAWS or manual solutions. JAWS and the *IAMSAR Manual* method should be used for drift intervals of no more than 24 hours and never for drift intervals greater than 48 hours unless CASP is unavailable. Each of these methods is discussed in more detail below, along with their capabilities and limitations. Further guidance on usage is also provided in this Appendix.

Section H.3 Datum Estimation

The expected location of the search object at any given time is known as the ***datum*** for that time. Datum is a reference position, line or area that is used as a reference for describing the distribution of possible search object locations and for planning searches. Generally the region near the datum contains the most probable search object locations. As a practical matter, all datums are either single points or are formed by points that are then connected by line segments. Only points are updated for drift. For line and area datums, the points used to form them, plus the possible addition of other carefully chosen points are updated for drift and then a new datum line or area is inferred from the results. Determining datum begins with the reported position of the incident. Unless a distressed craft or individual is immobilized, as in a boat grounding or a debilitating physical injury on land, the actual position of the search object during the search may be substantially different from the initial position. Therefore, possible movement of the search object should be accounted for when calculating datum. Datum should be recomputed periodically as movement due to drift or other factors continues to affect the position of the search object. Recomputed datums are usually labeled sequentially (e.g., Datum1, Datum2, Datum3). The time for which the datum was computed should be noted.

The original manual method, developed during the Second World War, was designed to handle a single simple scenario with simple paper-and-pencil computations and plots. The simple scenario consisted of a single distress incident time with no appreciable uncertainty, and a single initial position that could have a significant amount of uncertainty due to the limitations of navigation at that time. Only a single type of search object was considered: a survivor adrift in a life raft like those carried by aviators. Drift updates assumed that the winds and currents over the entire area and period of concern could be adequately represented by their average values with no significant systematic variations present with respect to either time or space. This tended to rule out use in tidal areas or in areas with strong, persistent currents, such as the Gulf Stream with its high current gradients. In other words, the drift update method was generally adequate for open ocean use away from the influences of tides and strong currents.

It is possible, but not always practical, to extend the original method to include more variations and types of uncertainty than the original. It has been found, for example, that objects tend to have leeway off the down wind direction to the left or right and it is assumed that these port and starboard tacks are equally likely. This requires computing two datums instead of the original one. Other extensions are also possible, but as the number of distinct possibilities increases, so do the number of datums that must be computed. In fact, the number of computations tends to increase exponentially.

H.3.1 Initial Position

The location where the distress occurred is called the *initial position.* Initial positions, of course, depend on the craft's position at the time of the distress. Therefore, knowing where and when a distress could have occurred when definite information is not available (e.g., an overdue craft) depends on the craft's pre-distress behavior. To compute datum, the time and location of the craft's or survivors last reliable position are first considered. This will determine the type of datum to be computed. One of three situations usually exists, based on the initial information obtained:

H.3.1.1 Position Known (Point Datum). The incident is witnessed or reported by radar net, DF net, another craft, or the distressed craft itself, or position is computed from a previously reliable position. When a person on shore witnesses the incident, the incident position can often be derived from the street address of the reporting source's location through the use of geo-location services provided on the internet. When the position and time of the incident are known, drift is determined and an updated datum is computed.

H.3.1.2 Track Known (Line Datum). The intended track is known but the position along the track is unknown, or a single line of bearing, such as a DF bearing, is obtained. In other words, the distress is believed to have occurred somewhere along a line segment or a series of connected line segments. An updated datum line may be established as follows:

(a) The datum line is first plotted, and a series of estimated positions and times are computed for points along the line (e.g., estimated progress along the track). At a minimum, the estimated positions at each end of each line segment are used. If a line segment is long or it is known that significant variation in wind and/or current values exist along the line segment, carefully chosen intermediate positions should be computed. Note that for a single line of bearing, all estimated positions will have the same time as when the line of bearing was observed, whereas for track lines, each estimated position will have its own associated time based on the craft's estimated departure time and speed(s) up to that point.

(b) A DR position and time is recommended for at least every 5° of latitude or longitude for aircraft tracks, at least each 24 hours on the track of a marine craft, and at least every 4 hours on the track of lost persons in inland areas. More frequent DR positions should be computed whenever necessary to represent varying environmental conditions along the intended track.

(c) Each position and time is considered as an initial position/time, and drift is computed for each position up to a common single (datum) time. Thus, a series of datum points is developed. All datum points are sequentially connected by straight lines to form a datum line. Figure H-1 demonstrates drifting a trackline.

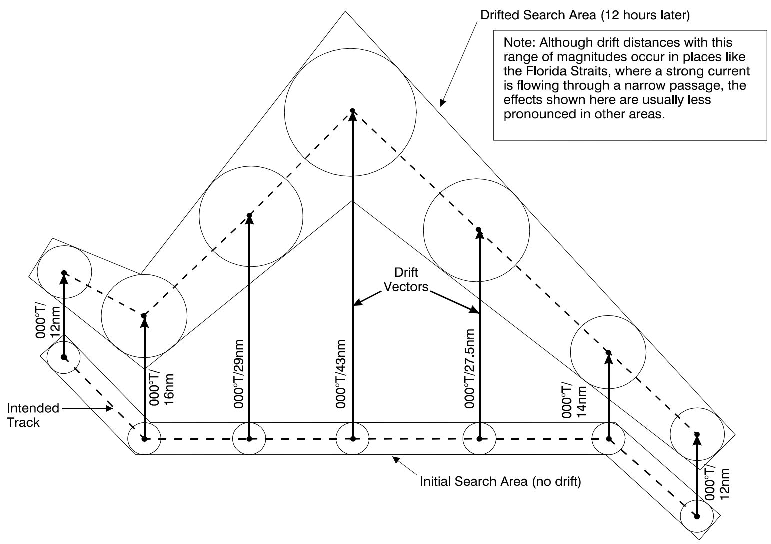


Figure H-1 Track Line Drift

H.3.1.3 General Area Known (Area Datum). Suppose neither the position nor the intended track is known, but the general area the craft was probably in, such as a lake, a military exercise area, or an offshore fishing ground, is known. In this case, a datum area is developed. Datum Areas are normally specified as polygons, using the coordinates of the corner points that define the polygon. Datum area computations depend on many factors, such as fuel endurance, natural boundaries, and known or suspected areas of occupancy. Datum area computations may be reasonably exact, or only a best guess.

(a) An aircraft glide area is normally a datum area, since, in the absence of evidence to the contrary, the aircraft is assumed to have an equal likelihood of being anywhere within that area. In particular, there is usually no reason to assume the central location is the most likely. A maximum possibility area can be developed using hours of fuel on board, wind speed and direction, glide ratio, and time of departure. A vector representing wind speed and direction is added to the departure point. The SMC then determines the distance the aircraft could cruise from the time of departure to the end of fuel endurance, to which the possible glide distance is added. The SMC uses this as a radius for the datum area. A similar approach can be used for marine craft with fuel endurance in hours, maximum range at cruising speed, and drift forces.

(b) Datum areas are usually large when the search object endurance is great or many unknown factors exist. Extensive detective work may be necessary to reduce this size to a reasonable initial region, or the SMC may have to outline the datum area based on other hypotheses. For instance, an aircraft may be reported missing while flying in a defined operating area or along a flight planned route, a fishing vessel may have gone to particular fishing grounds, a private aircraft or pleasure boat operating area may be known, or a yacht is on an extended coastal or ocean cruise without a specific route or destination. The datum area may be readily apparent. In other cases, the area can be narrowed by communications checks and deduction; if not, large general areas may have to be searched.

(c) The larger the area, the more difficult it will be to update the datum area for drift. If the area is small to moderate in size and the environmental conditions (wind and current) are the same over the region containing the area and likely drift trajectories, a single corner point may be chosen and updated for drift, with the same drift applied to the other corner points. This will result in a new polygon identical to the original except for location. The initial probable position error for each corner point is always assumed to be zero, meaning that all possible distress positions are contained within the polygon. (For JAWS, manually enter a position error of 0.01 NM). After the first drift update, the probable position errors for the updated corner points are computed in the usual fashion. For large areas or more complex environmental conditions, more points should be selected as initial positions to ensure variations in environmental data and their effects on drift are adequately represented. At a minimum, each corner point shall be updated for drift individually. The time associated with all initial positions will be the search planner's best estimate for the time of the distress incident. The updated datum positions and their associated probable errors are plotted. Then, enclosing the resulting circles in a new polygon; plots the new datum area.

H.3.2 Environmental Data

H.3.2.1 Drift is movement of a search object caused by external forces present in the environment. Datum is calculated by determining which drift forces will affect the search object, selecting the most appropriate ones, and calculating a vector for each. The vectors are then added to determine a drift direction and speed. The length of time between the time of the incident and the desired datum time is then applied to obtain a drift direction and distance vector. This is added to the initial position to determine datum using standard navigational procedures. Drift distances should be calculated using the time between the last known position and a time selected by the SMC. Generally, the mid-search time is selected as the best compromise.

H.3.2.2 The SMC should determine which environmental forces affected the search object during and after the incident:

(a) For marine incidents, currents and winds.

(b) For aircraft, primarily wind.

(c) For lost persons, terrain and meteorological conditions.

H.3.2.3 The SMC should attempt to quantify each force affecting drift, which is best done by vector, with bearing and length of the vector representing target direction and speed respectively. Since objects that float or fly are more affected by environmental forces, it is easier to quantify their possible movement. Lost persons, while affected by the environment, may choose to move or not, or may move unpredictably.

H.3.2.4 With the exception of certain databases maintained for use by JAWS and CASP, the Coast Guard does not maintain environmental databases that are readily available to search planners. Even those available to JAWS and CASP are sometimes either more coarse than desired or incomplete in some respect. None of the tools has winds aloft data available. CASP has access to global surface wind over water on a 1 x 1 degree x 12-hour grid but JAWS does not have direct access to any surface wind data. Both JAWS and CASP use long-term seasonal averages from climatology for sea current data on a 1 x 1 degree grid, although CASP has access to special regional files on a much finer grid. These include the Florida Straits on a 0.1 x 0.1 x monthly grid and a Gulf Stream (Western North Atlantic) regional product on a 0.2 x 0.2 x 12-hour grid from the U. S. Navy's Fleet Numerical Meteorology and Oceanography Center (FNMOC). CASP does not have access to tidal data and the tidal data available to JAWS is very limited.

H.3.2.5 Only the following sources of environmental data are approved for USCG use:

(a) National Oceanic and Atmospheric Administration (NOAA) Weather Service and Ocean Prediction Centers for analyses and forecasts.

(b) U.S. Navy Meteorology and Oceanography Centers (METOC) for analyses and forecasts.

(c) Wind and current databases maintained for use by CASP and JAWS for analyses and forecasts. (Wind and current data available to CASP may be displayed by selecting "CURRENTS" from the OPCEN menu of the textual "teletype" interface to OSC-hosted SAR applications. C2PC/SAR Tools can also display the sea and tidal currents that it has available for JAWS.)

(d) On scene observations made by search facilities and inferred from DMB tracks.

(e) Other sources at or near the scene that the search planner has good reason to believe are reliable indicators of conditions on scene. Distant observations should not be used just because they are the nearest available.

Important notes: NOAA provides a number of products via the Internet, but includes a disclaimer that those products are not guaranteed to be the best or latest data. Direct observations from stations and weather buoys are also posted and recently the offshore buoy wind observations were formatted into synoptic 6-hour increments for ease of import into JAWS. ***However***, all observed data, regardless of source, must be used with extreme caution whenever the search object is not in the immediate vicinity of the observations. For example, observed wind data 200 NM from scene will often be less representative of actual conditions at the scene than the estimate of a skilled meteorologist or the output of a sophisticated computer model.

An additional issue is that "surface wind" is defined as the wind at a mean height of 10 meters (about 33 feet) above the surface, and the leeway coefficients in Table H-3 are based on this definition. Direct observations may be from any height and should be "normalized" to a height of 10 meters according to a standard procedure used by meteorologists but not generally known to search planners. If in doubt about the most appropriate wind speed and direction to use, every effort should be made to contact the appropriate NOAA or USN METOC office for assistance. All Area, District, and Group command centers are strongly encouraged to establish and maintain periodic contact with personnel at NOAA and/or USN METOC offices with AORs overlapping the command center's AOR and arrange for their assistance when needed for SAR. Familiarization visits to each other's centers/offices are also strongly encouraged, as is the establishment of mutually acceptable standard operating procedures.

Datum Marker Buoys (DMBs), both radio and self-locating, are tools for determining total water current in a search area. When using DMBs, search planners should use their best judgment to estimate the radius of influence for which the DMB information is valid. The radius of influence is smaller in the vicinity of high currents; i.e., the Gulf Stream, Florida Straits, or known variable current areas such as Georges Banks off of New England. Time is also a consideration. Marine science experts, such as those at the International Ice Patrol (IIP) are available to assist in estimates. As a rule, the radius of influence should be no larger than the grid size for water current information already available, such as system environmental information provided to CASP.

User-supplied environmental data for CASP (i.e., case dependent data) must be formatted to match the 12-hour schedule of CASP's "system" files. Both wind and current data should be provided for 12-hour blocks from 0600Z to 1800Z and from 1800Z to 0600Z the following day. Although CASP does drift computations using a one-hour time step, it imports only one set of environmental data points for each 12-hour interval.

H.3.3 Aeronautical Drift

For situations where aircraft glide and parachute drift are needed, planners should refer to Appendix K to Volume II of the IAMSAR Manual (reference (b)).

H.3.4 Maritime Drift

On average, the Coast Guard conducts more than 5,000 searches annually, at a cost of about $50M. Most of the expense is in aircraft usage. A fifth of the searches continue longer than 12 hours. These longer searches, which usually involve multiple resources, are much more expensive than short searches. In the longer searches, knowledge of the drift of the search object becomes very important to the search planner. If the search object is not in the region covered by the search, there is no chance of finding the search object. Thus, the better the drift of an object is known, the more likely it will be found. Shortening the search saves SAR resources, but more importantly, a shorter search increases the probability that the person(s) in distress will survive. The remainder of this section discusses methods for estimating drift offshore, in reasonably large bays and estuaries, and in very large lakes. Drift estimation for rivers is discussed in section H.3.5.4.

H.3.4.1 Drift Theory. Search object drift in the marine environment is caused by the combined effects of currents and drag acting on the underwater surface of the object below the waterline and winds acting on the exposed sail area of the object above the waterline. It is assumed that objects tend to drift with the total water current, so the contribution that current makes to search object drift is the same as the total water current itself at that point in space and time. Leeway is motion relative to the water that is caused by the wind acting against the exposed sail area of the object. Most objects do not have perfectly circular symmetry. As a result, the balance of forces between the wind trying to move the object relative to the water and the drag the water exerts on the underwater surface of the object, the direction of the leeway tends to be to the left or right of the down wind direction rather than directly down wind. It is necessary to allow for each of these two possibilities since it is assumed that port and starboard tacks are equally probable. This in turn requires the computation of two drift velocity vectors and two datums as shown in Figure H-2 below.

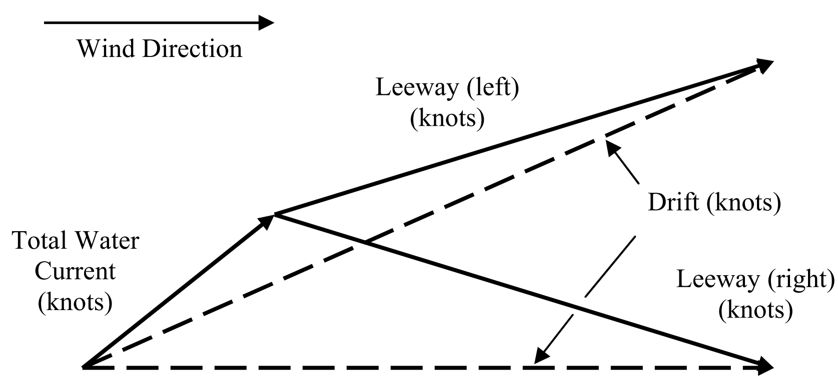


Figure H-2 Vector Plot of Basic Surface Drift Velocities

H.3.4.2 **Leeway (LW)** is the movement through water caused by winds blowing against the exposed surfaces of the search object. The pushing force of the wind is countered by water drag on the under-water surface of the object. Most marine craft have a portion of the hull and superstructure (sail area) exposed above the water. The more sail area the search object has, the greater the wind force on the object. Completely submerged objects are assumed to have no leeway. The SMC should get information on the physical characteristics of the search object to determine the amount of leeway.

(a) **Leeway Calculations.** Leeway is movement through the water caused by wind and waves acting on the search object. These forces are countered by water drag on the underwater portion of the drift object. This balance of forces results in a linear relationship between leeway speed and wind speed. Leeway speed is simply the magnitude of the velocity of the object relative to the water and can be estimated using the following equations.

Equation 1: Leeway speed (knots) = [Slope * Wind Speed (knots)] + Y_intercept (knots), for wind speeds greater than or equal to six knots.

Equation 2: Leeway speed (knots) = [Slope + Y_intercept/6] * Wind Speed (knots), for wind speeds less than six knots.

The second equation ensures that zero wind speed produces zero leeway and that the computed leeway for a six-knot wind is the same for both equations.

(b) **Leeway Taxonomy.** Allen and Plourde (1999) conducted a review of twenty-six leeway field studies. Presented in their report is a systematic approach (taxonomy) to classify leeway objects by primary and secondary characteristics that affect their leeway drift. This taxonomy's purpose is to provide a classification system that allows the search planner to identify an appropriate class for the drifting object of interest.

Given the enormous diversity of objects for which a search planner could be expected to predict drift, the taxonomy was developed with seven object classification levels progressing from general to more specific leeway-determining characteristics (Table H-1). These levels result in a "branching effect" for object classification that can be clearly seen in Figure H-3 where only the first three levels of the taxonomy are depicted.

Table H-1: Names and descriptions of Leeway Drift Taxonomy Levels

Taxonomy Level Number	Level Name	Level Descriptions
Level 1	Governmental Response Mechanism / Organizations	• Reflects governmental response mechanisms that are triggered • Reflects behavioral differences in response units • Identifies expected behavioral characteristics of the drift target • Reflects an expectation of the amount and types of datum information that may be available
Level 2	Primary Source of the Leeway Object	• Identifies the primary source of the drifting object • SAR targets originate from marine or aviation sources • Non-SAR targets originate from non-SAR sources
Level 3	Major Object Categories	• First level using specific drift object characteristics • Identifies broad categories of intended object use • Highest level that could possibly have leeway information
Level 4	Object Sub-Categories	• Identifies major divisions within drift object categories • First level for which the size or shape of the drift object determines its placement in the taxonomy • First level that considers the ratio of drift object surface area above and below the waterline • The majority of current target leeway drift information will be found at this level
Level 5	Primary Object Leeway Descriptor	• Identifies the drift object feature that exerts the greatest influence on the drift object leeway ratio (typically above or below the waterline) • Swamping or capsizing are dominant leeway characteristics
Level 6	Secondary Object Leeway Descriptor	• Identifies the drift object feature that exerts the second strongest influence on the drift object leeway ratio (typically the above or below the waterline features opposite the primary feature)
Level 7	External Modifiers	• Identifies those items that can affect an object's leeway drift that have not been addressed in earlier levels • These items are usually controlled by the occupants onboard leeway targets • These items effectively modify the primary and secondary influences identified in Levels 5 and 6.

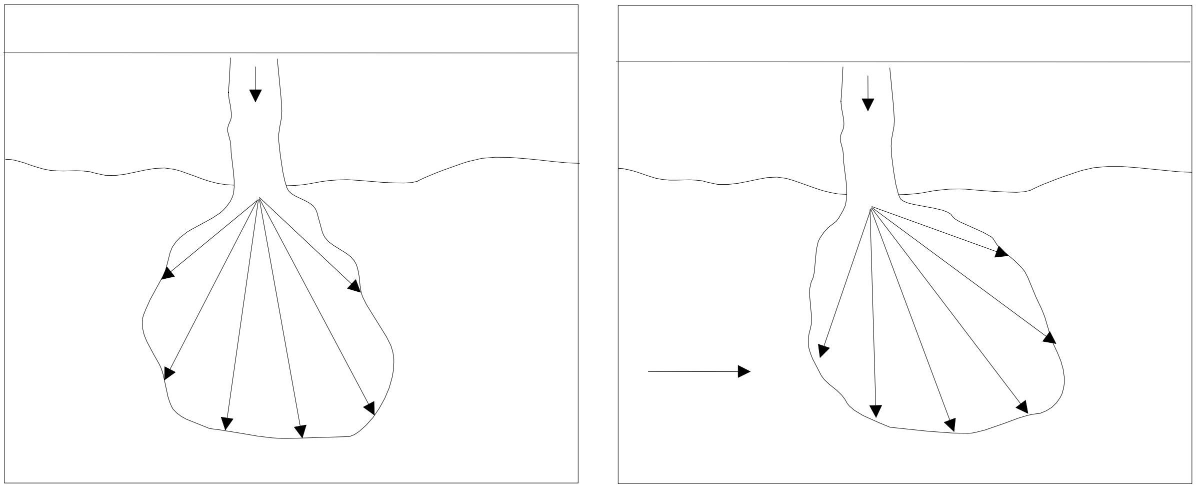


Figure H-14 River Currents

(c) *Bottom Current (BC)* should be considered in underwater incidents. Bottom current is usually not strong enough to move a sunken object, including a body. However, if current exceeds 4 to 5 knots, as in a rain-swollen river, the sunken target may tumble along the bottom. Bottom current information can be obtained from the Defense Mapping Agency Oceanographic Atlas for certain harbor, coastal, and ocean areas. Also, Defense Mapping Agency or Naval Fleet Weather Centers may be able to provide special analysis services for underwater and bottom currents. For bottom currents in harbor areas the Army Corps of Engineers should be consulted.

(d) *Swell/Wave Currents (SWC)* may, in the absence of winds, affect rafts and other small marine craft. Because SWC speed is slight, this drift force is usually disregarded. However, it may be useful for determining probable direction of target movement.

(e) *Surf Current (SUC)* is considered only for coastal surf areas and is more of a factor in rescue or salvage than in search planning. Surf current will move the object perpendicular to the line of breakers toward the shore. The object will also be displaced in the direction of any along-shore current.

H.3.4.7 **Total Water Current (TWC)** is the vector sum of currents affecting the search object. The best information on total water current is usually obtained from a Datum Marker Buoy (DMB).

(a) SLDMBs (Self-Locating Datum Marker Buoys), DMBs and sonobuoys are droppable floating beacons transmitting a signal on UHF frequencies or to a satellite tracking system (SLDMBs). The buoy drifts with surface currents, but shows no leeway. Of the three, SLDMBs provide the most accurate data on the water movement due to their specific design. Each standard DMB used on scene should operate on a different frequency to preclude confusion over DMB origin. SLDMB serial number must be noted to track that particular buoy's data.

(b) With minimal current, first-day standard DMB observations may be questionable because of SRU navigational error. The average over 2 to 3 days can reduce the effect of such error. DMBs should be inserted or relocated as accurately as navigational systems permit. SLDMB data can be used throughout a search.

(c) Information on currents obtained by a DMB should be used with caution. It provides information only while in the water and represents total water current (sea current and wind-driven current) valid only during the time of deployment and for the water area through which it traveled. Even so, it is probably a more accurate representation of current than that previously calculated from historical and statistical data. If there is a wide disparity between DMB and planning information, the SMC should consider adjusting search areas and/or datum.

(d) To preclude diversion from planned search patterns, SRUs should relocate radio beacon DMBs only at the beginning or end of search. SLDMBs do not require relocation by search units. SLDMBs are preferred for that reason and because each SLDMB has a GPS receiver that provides more much more frequent and more accurate positioning than relocation by SRU could ever provide.

(e) Other on scene observations can improve the accuracy of drift estimates where information from normal sources (NOAA, U.S. Navy, SLDMB/DMB, SRUs on scene) is not available. Ships and stations near the incident can be asked for recent wind and local current observations, but these should also be used with caution. The quality of the observations is often unknown and affected by method and instrumentation used (calibration and location of instruments, etc.). These sources also do not provide predictions needed for planning purposes.

H.3.5 Enclosed, Coastal, and Riverine Waters

H.3.5.1 Drift in enclosed and coastal waters is derived by adding leeway and current vectors for the incident area in the same way as described above for the open ocean, except that wind current is not computed. Currents in enclosed and coastal waters tend to be more complex and variable than in the open ocean.

H.3.5.2 Leeway speed is calculated using the leeway speed values from Table H-3 and equations in paragraph H.3.4.2(a). Leeway direction is computed using the leeway divergence angles from Table H-3.

H.3.5.3 Two currents normally encountered in coastal environments are tidal and wind-driven currents. However, other currents should be included in calculations if their effect is significant.

(a) After leeway, tidal currents cause the greatest drift for most objects. Procedures for determining tidal current vectors are provided with the worksheets in this Appendix, and the appropriate tidal current manual.

(b) Wind current, normally present where the wind has a long enough fetch to generate sufficient stress on the water surface, is difficult to quantify. The tidal current manual for the East Coast of the United States has a wind current table based on historical data. Most other areas have no data. Whether to compute a wind current depends on SMC local knowledge and the environmental parameters. Wind current for enclosed and coastal areas, including water depths less than 100 feet and distances closer than 20 miles from shore, is not normally calculated because of variability and short fetch distances. On some larger or deeper lakes, such as the Great Lakes, wind current can be determined with reasonable accuracy.

H.3.5.4 In many instances, responding to SAR cases on rivers is the responsibility of local authorities. However, the Coast Guard is often asked to assist with SAR operations and in cases on the major inland waterways the Coast Guard may be SMC.

(a) Drift in rivers is very complex. It is primarily due to river currents, which can be highly variable. River currents tend to be turbulent; eddies and "hydraulics" are common. Depending on the surrounding topography, winds over the river itself are often turbulent and highly variable as well. The methods for estimating leeway in the open ocean do not apply. Rivers are rarely straight and floating debris tends to collect along the banks in certain locations. Search objects can get hung up on obstacles, remain in place for some period of time and then break loose again to continue drifting. It is even possible in some circumstances for objects to be found somewhat upstream of where they started drifting. Local knowledge is particularly important when rivers are involved. NOAA and other agencies, including state and local, may actively monitor river currents and heights. In many areas there are local agencies with SAR responsibilities and/or volunteer SAR teams who possess valuable experience and knowledge. Units likely to become involved with SAR cases on rivers in their AORs should be familiar with all sources of local knowledge and data.

(b) When determining where to search, the maximum downstream and upstream limits of where the search object could be at the datum time should be estimated. The river and both banks should then be searched. Generally the search area will grow with time in the downstream direction. However, due to the complexity of riverine drift it is not safe to assume that the upstream end of the search area can be moved downstream based only on the passage of time. Leeway is often negligible when compared to the other forces acting on the search object. If leeway is judged to be a significant factor, it should be used to extend the downstream and upstream limits of the search area. Since objects adrift in rivers often spin around due to turbulence in the current, wind at the water's surface is often unpredictable due to local topography, rivers are rarely straight, and drift is constrained by the river banks, leeway divergence and total probable error of position circles are not considered relevant. When searching a river, particular attention should be paid to the banks, especially when shoreside assets are unable to search them well. Areas where debris has collected are also of high interest since the same forces that brought the debris to that location could have brought the search object there as well. Detection of search objects located in debris or along a river bank is often much more difficult (i.e., the effective sweep width is significantly smaller) than detection of the same objects adrift in the middle of the river.

H.3.6 Dealing with Other Sources of Uncertainty

H.3.6.1 The methods discussed so far have dealt only with situations where an initial position can be established or estimated for a specific point in time, there is only one type of search object, and the environmental conditions are more or less constant over the area containing the search object. Actual situations can be much more complex. In such cases it may be necessary to compute multiple drift updates resulting in multiple datums. A few examples of when this might be necessary are:

(a) The time and place of the distress incident are reasonably well known, but the type of search object is unknown (e.g., sailboat disabled and adrift, 4-person life raft adrift, and PIWs adrift are all possibilities).

(b) The craft's intended track is known but the time of the distress is unknown and the craft's pre-distress location cannot be accurately estimated for any given time after it was last known to be safe (e.g., departure time from port could have been any time between midnight and 0600, speed made good along the intended track could have been anything between 12 and 16 knots).

(c) The destination is uncertain (e.g., vessel was either going north to fishing area A or south to fishing area B).

(d) The destination is known but the route is not (e.g., there are two distinct routes that could have been taken).

H.3.6.2 The four examples given above illustrate two distinct kinds of situation for the search planner. In the first two, there is a single basic scenario from which a picture may be inferred about when and where a distress incident may have occurred and what its immediate outcome may have been. This is obvious in the first example. In the second example, the "where" is answered by the intended track and the "when" for any point along that track is may be inferred from the ranges of departure times and speeds.

For the last two examples above, there are distinctly different scenarios about the circumstances leading up to the distress incident. In (c), the vessel could not be going to both fishing areas at once nor was there a continuous range of possible destinations between areas A and B. Two mutually exclusive scenarios have to be considered. The same is presumably true of (d). The two routes are certainly mutually exclusive (even if some legs are in common) since the craft could not follow both routes at once. If two specific routes suggest themselves from the available data and no others seem plausible, then there is no continuum of possible "intermediate" routes, either.

H.3.6.3 The SMC should consider the full range of possibilities when deciding how many datums to compute. For manual search planning, it is generally feasible to consider only the two or three most important of the unknown variables or the two or three most probable scenarios. "Importance" in this context means the variables that will have the most impact the outcome of the case. This could mean the most impact on search area size or it could be more related to expected survivor lifetime remaining. Even though PIWs may not be the most probable search object in a particular case, they could easily be the most important search object for the first search due to limited expected survival time.

H.3.6.4 The complexity of real-world SAR situations can quickly outstrip the capabilities of manual methods. When the search planner sees that it will take many datum updates to cover the range of possibilities, CASP must be used since it is the only tool presently capable of dealing with such complexity.

H.3.7 Computing Subsequent Datums

If the first search fails to locate the survivors, additional searches must be planned and carried out. Since virtually all objects exhibit leeway divergence, a drift update from a single initial position produces two datums. If additional searching is required, it is not immediately obvious how to proceed when two datums are available as starting points. Several possibilities suggest themselves:

(a) Compute the datums for the next search by starting with the original initial position.

(b) Compute new datums by using each of the two "first search" datums as "initial positions" for the next drift interval.

(c) Choose a position halfway between the two "first search" datums as the "initial position" for the next drift interval.

The first choice may require computing each of the two drift trajectories in steps in order to account for changes in the environmental factors over time and space. One advantage is that this method allows the search planner to account for updates in wind and current data since the previous datums were computed. Because the last portion of a drift update that is being used to plan a search must necessarily use forecast rather than actual observed data, this could be important, especially when forecasts prove to be inaccurate. The disadvantage, especially for manual methods, is that the longer the drift intervals from the initial position to the planned search time, the greater the amount of data and computations that are necessary. It is also possible for constantly veering or backing winds to eventually cause the datums to start converging rather than continue diverging.

The second choice has several disadvantages. First, it does not provide for re-computation when forecast data is replaced by observed or "analysis" data. Second, it produces a binary "explosion" of calculations: One initial position produces two datums, these then produce four datums, the next iteration produces eight datums, etc. An apparent "solution" to this problem is to assume that objects never change tack with respect to the wind, i.e., an object with leeway to the right of the down wind direction always has leeway to the right of the down wind direction. This brings it more in line with the first choice above, but the possibility of converging datums remains.

Although the third choice is also a compromise, it is still a viable solution when the forecast data used to plan the search proves to be accurate. When that is not the case, the two datums should be re-computed from more accurate environmental data before proceeding with the next drift update. The only remaining problem is how to establish the probable error (X_2) for the new "initial position." As long as the datums are not too far apart (either a small distance in nautical miles or less than four times the total probable error of position), a reasonable estimate of the probable error is the radius of a circle centered halfway between the two datums that just includes the individual probable error circles for each datum as shown in Figure H-15. This actually overestimates the probable error of position somewhat, but there is no easy way to obtain a more accurate estimate for the radius of a circle that contains just 50% of the possible search object positions. JAWS uses the point halfway between the datums as the "initial position" for the next drift update, but it computes a more accurate and somewhat smaller estimate of the probable error around this position. An added advantage to this method is regularity. Each drift update always starts with a single initial position and produces two datums.

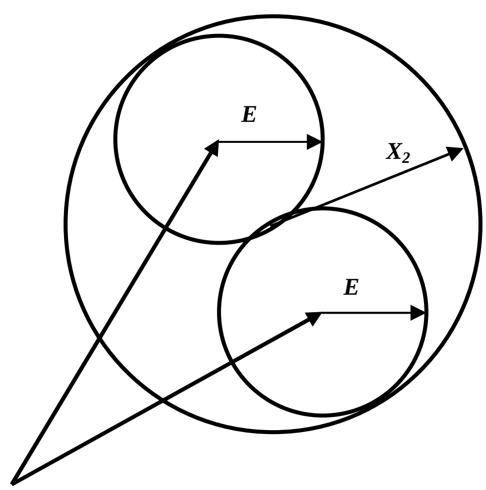


Figure H-15 Establishing a Starting Position and Position Error for Subsequent Drift

Table H-12 Uncorrected Visual Sweep Width – Fixed-wing Aircraft for Altitudes 750-1000 Feet

Search Object	*Altitude 750 Feet Visibility (NM)*							*Altitude 1000 Feet Visibility (NM)*						
	1	*3*	*5*	*10*	*15*	*20*	*30*	*1*	*3*	*5*	*10*	*15*	*20*	*30*
Person in Water	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Raft 1 person	0.3	0.7	0.9	1.2	1.4	1.4	1.4	0.3	0.7	0.9	1.2	1.4	1.4	1.4
Raft 4 person	0.4	1.0	1.3	1.8	2.1	2.2	2.2	0.3	1.0	1.3	1.8	2.1	2.3	2.3
Raft 6 person	0.4	1.1	1.6	2.2	2.6	2.8	2.8	0.4	1.1	1.6	2.2	2.6	2.8	2.8
Raft 8 person	0.4	1.2	1.7	2.3	2.7	3.0	3.0	0.4	1.2	1.7	2.4	2.8	3.0	3.0
Raft 10 person	0.4	1.3	1.8	2.5	3.0	3.3	3.3	0.4	1.3	1.8	2.6	3.0	3.3	3.3
Raft 15 person	0.4	1.4	1.9	2.8	3.3	3.7	4.1	0.4	1.4	2.0	2.8	3.4	3.7	4.2
Raft 20 person	0.5	1.5	2.2	3.2	3.8	4.3	4.9	0.4	1.5	2.2	3.2	3.9	4.3	4.9
Raft 25 person	0.5	1.6	2.3	3.5	4.2	4.7	5.4	0.4	1.6	2.3	3.5	4.2	4.7	5.4
Power Boat ≤ 15 ft	0.4	0.9	1.2	1.6	1.8	1.9	1.9	0.4	1.0	1.3	1.7	1.8	2.0	2.0
Power Boat 20 ft	0.5	1.7	2.4	3.6	4.4	4.9	4.9	0.5	1.7	2.5	3.7	4.4	5.0	5.0
Power Boat 33 ft	0.6	2.1	3.3	5.3	6.7	7.7	9.2	0.5	2.2	3.4	5.4	6.8	7.8	9.3
Power Boat 53 ft	0.6	2.7	4.5	8.2	10.9	13.1	16.5	0.6	2.7	4.5	8.2	10.9	13.1	16.6
Power Boat 78 ft	0.6	2.8	5.0	9.8	13.5	16.7	21.7	0.6	2.8	5.1	9.8	13.6	16.7	21.7
Sail Boat 15 ft	0.5	1.6	2.3	3.3	3.9	4.4	4.4	0.5	1.6	2.3	3.3	4.0	4.4	4.4
Sail Boat 20 ft	0.5	1.8	2.7	4.1	5.0	5.7	5.7	0.5	1.8	2.7	4.2	5.1	5.7	5.7
Sail Boat 25 ft	0.6	2.1	3.1	5.0	6.2	7.0	7.0	0.5	2.1	3.2	5.0	6.2	7.1	7.1
Sail Boat 30 ft	0.6	2.3	3.6	6.0	7.5	8.9	10.7	0.6	2.3	3.6	6.0	7.6	8.9	10.7
Sail Boat 40 ft	0.6	2.6	4.3	7.6	10.0	11.9	14.9	0.6	2.6	4.3	7.6	10.9	12.0	14.9
Sail Boat 50 ft	0.6	2.7	4.6	8.5	11.4	13.7	17.4	0.6	2.7	4.6	8.5	11.4	13.7	17.4
Sail Boat 70 ft	0.6	2.8	4.9	9.3	12.7	15.6	20.0	0.6	2.8	4.9	9.3	12.8	15.6	20.1
Sail Boat 83 ft	0.6	2.8	5.1	9.9	13.8	17.0	22.2	0.6	2.8	5.1	9.9	13.8	17.0	22.2
Ship 120 ft	0.6	2.9	5.4	11.1	15.9	20.1	27.0	0.6	2.9	5.4	11.1	15.9	20.1	27.0
Ship 225 ft	0.6	3.0	5.7	12.5	18.9	24.7	34.9	0.6	3.0	5.7	12.5	18.9	24.7	34.9
Ship ≥ 300 ft	0.7	3.0	5.8	13.2	20.6	27.9	41.4	0.6	3.0	5.8	13.2	20.6	27.9	41.4

Table H-13 Uncorrected Visual Sweep Width – Fixed-wing Aircraft for Altitudes 1500-2000 Feet

Search Object	*Altitude 1500 Feet Visibility (NM)*							*Altitude 2000 Feet Visibility (NM)*						
	1	*3*	*5*	*10*	*15*	*20*	*30*	*1*	*3*	*5*	*10*	*15*	*20*	*30*
Person in Water	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Raft 1 person	0.2	0.7	0.9	1.3	1.4	1.4	1.4	0.1	0.6	0.9	1.2	1.4	1.4	1.4
Raft 4 person	0.3	1.0	1.3	1.9	2.1	2.3	2.3	0.2	0.9	1.3	1.9	2.2	2.3	2.3
Raft 6 person	0.3	1.1	1.6	2.3	2.6	2.9	2.9	0.2	1.1	1.6	2.3	2.7	2.9	2.9
Raft 8 person	0.3	1.2	1.7	2.4	2.8	3.1	3.1	0.2	1.2	1.7	2.5	2.9	3.2	3.2
Raft 10 person	0.3	1.3	1.8	2.6	3.1	3.4	3.4	0.2	1.2	1.8	2.7	3.1	3.5	3.5
Raft 15 person	0.3	1.4	2.0	2.9	3.4	3.8	4.3	0.2	1.4	2.0	3.0	3.5	3.9	4.4
Raft 20 person	0.4	1.5	2.2	3.3	4.0	4.4	5.1	0.4	1.5	2.2	3.4	4.0	4.5	5.1
Raft 25 person	0.4	1.6	2.4	3.6	4.3	4.8	5.6	0.3	1.6	2.4	3.6	4.4	4.9	5.7
Power Boat ≤ 15 ft	0.3	1.0	1.3	1.7	2.0	2.1	2.1	0.2	1.0	1.3	1.8	2.0	2.2	2.2
Power Boat 20 ft	0.4	1.7	2.5	3.7	4.5	5.1	5.1	0.3	1.7	2.5	3.8	4.6	5.1	5.1
Power Boat 33 ft	0.5	2.2	3.4	5.5	6.8	7.9	9.4	0.3	2.2	3.4	5.5	6.9	8.0	9.5
Power Boat 53 ft	0.5	2.6	4.5	8.2	11.0	13.2	16.6	0.4	2.6	4.5	8.3	11.0	13.3	16.7
Power Boat 78 ft	0.5	2.8	5.1	9.8	13.6	16.7	21.8	0.4	2.8	5.0	9.8	13.6	16.8	21.8
Sail Boat 15 ft	0.4	1.6	2.3	3.4	4.1	4.5	4.5	0.3	1.6	2.3	3.5	4.1	4.5	4.5
Sail Boat 20 ft	0.4	1.8	2.8	4.2	5.2	5.8	5.8	0.3	1.8	2.8	4.3	5.2	5.9	5.9
Sail Boat 25 ft	0.5	2.1	3.2	5.1	6.3	7.2	7.2	0.3	2.1	3.3	5.2	6.4	7.3	7.3
Sail Boat 30 ft	0.5	2.3	3.7	6.1	7.7	9.0	10.8	0.3	2.3	3.7	6.1	7.8	9.1	10.9
Sail Boat 40 ft	0.5	2.6	4.3	7.6	10.1	12.0	14.9	0.4	2.5	4.3	7.7	10.1	12.1	15.0
Sail Boat 50 ft	0.5	2.7	4.6	8.5	11.4	13.8	17.5	0.4	2.7	4.6	8.6	11.5	13.9	17.5
Sail Boat 70 ft	0.5	2.8	4.9	9.4	12.8	15.7	20.2	0.4	2.7	4.9	9.4	12.9	15.7	20.2
Sail Boat 83 ft	0.5	2.8	5.1	10.0	13.8	17.1	22.3	0.4	2.8	5.1	10.0	13.9	17.1	22.3
Ship 120 ft	0.5	2.9	5.4	11.1	16.0	20.1	27.0	0.4	2.9	5.4	11.1	16.0	20.1	27.1
Ship 225 ft	0.5	3.0	5.7	12.5	18.9	24.7	34.9	0.4	3.0	5.7	12.5	18.9	24.7	34.9
Ship ≥ 300 ft	0.6	3.0	5.8	13.2	20.7	27.9	41.4	0.5	3.0	5.8	13.2	20.7	27.9	41.5

Table H-14 Uncorrected Visual Sweep Width - Fixed Wing Aircraft for Altitudes 2500-3000 Feet

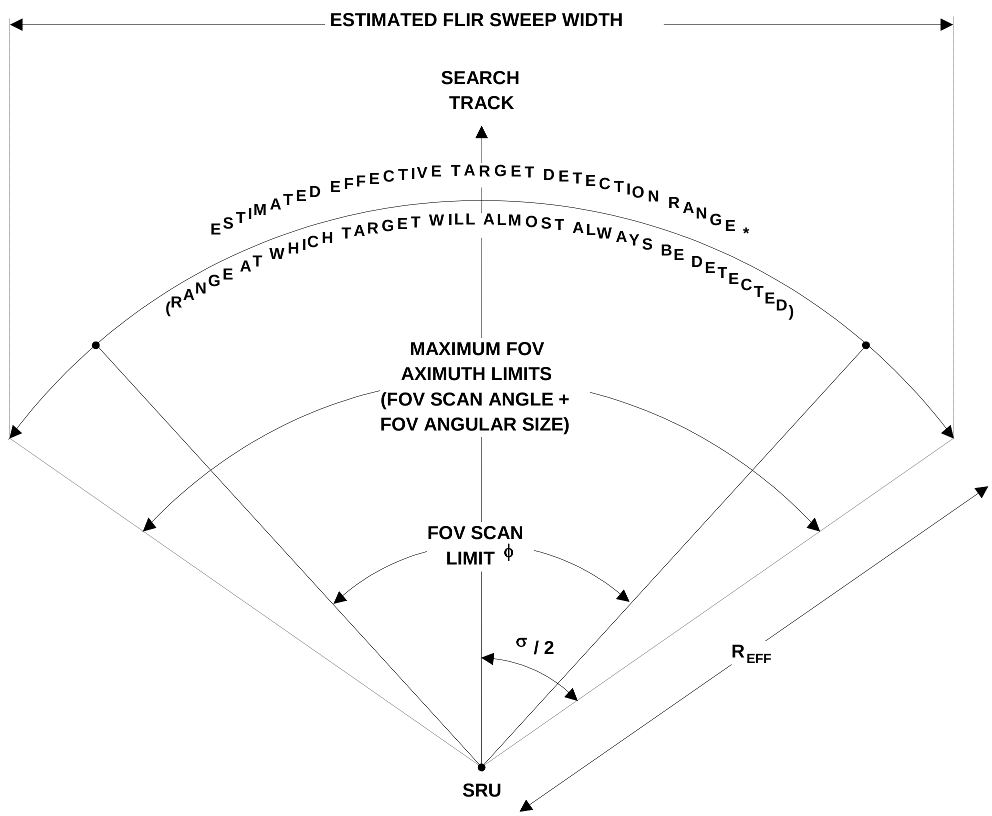
Search Object	*Altitude 2500 Feet Visibility (NM)*							*Altitude 3000 Feet* Visibility (NM)*						
	1	*3*	*5*	*10*	*15*	*20*	*30*	*1*	*3*	*5*	*10*	*15*	*20*	*30*
Person in Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raft 1 person	0.1	0.5	0.8	1.2	1.4	1.4	1.4	0.1	0.5	0.8	1.1	1.3	1.3	1.3
Raft 4 person	0.1	0.8	1.3	1.8	2.2	2.4	2.4	0.1	0.7	1.2	1.8	2.1	2.3	2.3
Raft 6 person	0.1	1.0	1.5	2.3	2.7	2.9	2.9	0.1	0.9	1.5	2.2	2.7	2.9	2.9
Raft 8 person	0.1	1.1	1.7	2.5	2.9	3.2	3.2	0.1	1.0	1.6	2.5	2.9	3.2	3.2
Raft 10 person	0.2	1.2	1.8	2.7	3.2	3.5	3.5	0.1	1.1	1.8	2.7	3.2	3.5	3.5
Raft 15 person	0.2	1.3	2.0	3.0	3.6	4.0	4.5	0.1	1.2	2.0	3.0	3.6	4.0	4.5
Raft 20 person	0.2	1.4	2.2	3.4	4.1	4.6	5.2	0.1	1.4	2.2	3.4	4.1	4.6	5.3
Raft 25 person	0.2	1.5	2.4	3.7	4.5	5.0	5.7	0.1	1.5	2.4	3.7	4.5	5.1	5.8
Power Boat ≤ 15 ft	0.1	0.9	1.3	1.8	2.1	2.2	2.2	0.1	0.8	1.3	1.8	2.1	2.3	2.3
Power Boat 20 ft	0.2	1.6	2.5	3.8	4.6	5.2	5.2	0.1	1.6	2.5	3.9	4.7	5.3	5.3
Power Boat 33 ft	0.2	2.1	3.4	5.6	7.0	8.1	9.6	0.2	2.1	3.4	5.6	7.1	8.1	9.7
Power Boat 53 ft	0.3	2.6	4.5	8.3	11.3	13.3	16.7	0.2	2.5	4.5	8.3	11.1	13.4	16.8
Power Boat 78 ft	0.3	2.7	5.0	9.8	13.6	16.8	21.9	0.2	2.7	5.0	9.9	13.7	16.8	21.9
Sail Boat 15 ft	0.2	1.5	2.3	3.5	4.2	4.7	4.7	0.1	1.5	2.3	3.5	4.3	4.7	4.7
Sail Boat 20 ft	0.2	1.8	2.8	4.3	5.3	6.0	6.0	0.1	1.7	2.8	4.4	5.3	6.0	6.0
Sail Boat 25 ft	0.2	2.1	3.3	5.2	6.5	7.5	7.5	0.2	2.0	3.3	5.3	6.6	7.5	7.5
Sail Boat 30 ft	0.2	2.2	3.7	6.1	7.8	9.1	11.0	0.2	2.2	3.7	6.2	7.9	9.2	11.1
Sail Boat 40 ft	0.3	2.5	4.3	7.7	10.2	12.1	15.1	0.2	2.4	4.3	7.7	10.2	12.1	15.1
Sail Boat 50 ft	0.3	2.6	4.6	8.6	11.5	13.9	17.6	0.2	2.6	4.6	8.6	11.6	14.0	17.7
Sail Boat 70 ft	0.3	2.7	4.9	9.4	12.9	15.8	20.3	0.2	2.6	4.9	9.4	13.0	15.8	20.3
Sail Boat 83 ft	0.3	2.8	5.1	10.0	13.9	17.2	22.4	0.2	2.7	5.1	10.0	14.0	17.2	22.5
Ship 120 ft	0.3	2.8	5.4	11.1	16.0	20.2	27.1	0.2	2.8	5.3	11.1	16.0	20.2	27.1
Ship 225 ft	0.3	2.9	5.6	12.5	18.9	24.8	35.0	0.2	2.8	5.6	12.5	18.9	24.8	35.0
Ship ≥ 300 ft	0.3	2.9	5.7	13.2	20.7	27.9	41.5	0.2	2.9	5.7	13.2	20.7	27.9	41.5

* Visual searches are seldom conducted from altitudes above 3000 feet; however, for altitudes up to 5000 feet where visibility exceeds 3 NM and target size exceeds 25 feet, the sweep widths given for 3000 feet remain applicable.

Table H-15 Uncorrected Visual Sweep Width – Helicopters for Altitudes 300-500 Feet

Search Object	*Altitude 300 Feet Visibility (NM)*							*Altitude 500 Feet Visibility (NM)*						
	1	*3*	*5*	*10*	*15*	*20*	*30*	*1*	*3*	*5*	*10*	*15*	*20*	*30*
Person in Water*	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Raft 1 person	0.4	0.9	1.2	1.5	1.7	1.7	1.7	0.4	0.9	1.2	1.6	1.8	1.8	1.8
Raft 4 person	0.5	1.2	1.6	2.2	2.5	2.7	2.7	0.5	1.2	1.6	2.2	2.6	2.8	2.8
Raft 6 person	0.5	1.4	1.9	2.7	3.1	3.4	3.4	0.5	1.4	1.9	2.7	3.2	3.5	3.5
Raft 8 person	0.6	1.4	2.0	2.8	3.3	3.6	3.6	0.6	1.5	2.0	2.8	3.3	3.7	3.7
Raft 10 person	0.6	1.5	2.1	3.0	3.6	3.9	3.9	0.6	1.6	2.2	3.1	3.6	4.0	4.0
Raft 15 person	0.6	1.6	2.3	3.3	3.9	4.3	4.9	0.6	1.7	2.3	3.3	4.0	4.4	5.0
Raft 20 person	0.6	1.8	2.6	3.8	4.5	5.1	5.8	0.6	1.8	2.6	3.8	4.6	5.1	5.9
Raft 25 person	0.6	1.9	2.7	4.1	4.9	5.5	6.3	0.6	1.9	2.7	4.1	5.0	5.6	6.4
Power Boat ≤ 15 ft	0.5	1.1	1.4	1.9	2.1	2.2	2.2	0.5	1.2	1.5	1.9	2.2	2.3	2.3
Power Boat 20 ft	0.7	2.0	2.9	4.3	5.2	5.8	5.8	0.7	2.0	2.9	4.3	5.2	5.8	5.8
Power Boat 33 ft	0.8	2.5	3.8	6.1	7.7	8.9	10.6	0.8	2.5	3.9	6.2	7.8	9.0	10.7
Power Boat 53 ft	0.8	3.1	5.1	9.2	12.2	14.7	18.5	0.8	3.1	5.1	9.2	12.3	14.7	18.5
Power Boat 78 ft	0.8	3.3	5.7	10.8	15.0	18.4	23.9	0.8	3.3	5.7	10.8	15.0	18.4	23.9
Sail Boat 15 ft	0.7	1.9	2.7	3.9	4.6	5.2	5.2	0.7	1.9	2.7	3.9	4.7	5.2	5.2
Sail Boat 20 ft	0.7	2.2	3.2	4.8	5.9	6.6	6.6	0.7	2.2	3.2	4.8	5.9	6.7	6.7
Sail Boat 25 ft	0.8	2.4	3.6	5.7	7.1	8.1	8.1	0.8	2.4	3.7	5.7	7.1	8.2	8.2
Sail Boat 30 ft	0.8	2.7	4.2	6.8	8.7	10.1	12.2	0.8	2.7	4.2	6.9	8.7	10.2	12.3
Sail Boat 40 ft	0.8	3.0	4.9	8.6	11.3	13.4	16.7	0.8	3.0	4.9	8.3	11.3	13.5	16.8
Sail Boat 50 ft	0.8	3.1	5.2	9.5	12.7	15.3	19.3	0.8	3.1	5.2	9.5	12.7	15.3	19.4
Sail Boat 70 ft	0.8	3.2	5.5	10.3	14.1	17.2	22.1	0.8	3.2	5.5	10.4	14.1	17.3	22.2
Sail Boat 83 ft	0.8	3.3	5.7	11.0	15.2	18.7	24.3	0.8	3.3	5.7	11.0	15.2	18.7	24.4
Ship 120 ft	0.8	3.4	6.0	12.2	17.4	21.9	29.3	0.8	3.4	6.0	12.2	17.4	21.9	29.3
Ship 225 ft	0.8	3.4	6.3	13.6	20.4	26.6	37.7	0.8	3.4	6.3	13.6	20.4	26.6	37.3
Ship ≥ 300 ft	0.8	3.5	6.4	14.3	22.1	29.8	43.8	0.8	3.5	6.4	14.3	22.1	29.8	43.8

* For search altitudes up to 500 feet only, the values given for sweep width for a person in water may be increased by a factor of 4 if it is known that the person is wearing a personal flotation device.



*FOR PREVAILING ENVIRONMENTAL CONDITIONS

NOTE: THE MAXIMUM FIELD OF VIEW (FOV) AZIMUTH LIMIT SHOULD BE USED ONLY IF COMPLETE AREA COVERAGE CAN BE ACHIEVED WITHIN THE EFFECTIVE TARGET DETECTION RANGE. OTHERWISE, A NARROWER FOV SCAN LIMIT SHOULD BE USED IN CALCULATING SWEEP WIDTH.

EXAMPLE CALCULATION

ϕ = FOV SCAN LIMIT (ANGLE THROUGH WHICH FLIR CAMERA SCANS) = 60°

σ = MAXIMUM FOV AZIMUTH LIMITS (FOV SCAN ANGLE + FOV ANGULAR SIZE) = 90°

R_{EFF} = ESTIMATED EFFECTIVE TARGET DETECTION RANGE = 3 nm

ESTIMATED SWEEP WIDTH = 2 SIN (σ / 2) x R_{EFF} = 2 SIN (45°) x 3 nm = 4.2 nm

Figure H-23 Estimated FLIR Sweep Width

(c) **Night Vision Goggles (NVG).** Many SAR incidents occur or become known to the Coast Guard during the afternoon or night. The greatest benefit of NVG is that this sensor enables searchers to conduct effective searches at night, thus search planners will not have to wait until first light the following day to begin effective visual searches. This will increase the probability of survival for those persons in distress. Research showed NVG searches from UTBs are not recommended because the lookouts are prone to seasickness when using NVG, but they are effective from aircraft.

(1) **NVG Search Sweep Widths for Helicopters.** Select the base sweep width (BSW) for Boat, Raft or PIW search object from Table H-32. Illuminated search is a NVG search using one or two helicopter landing lights, or where available, an IR source of illumination, during the search. Select the appropriate environmental situation correction factors from Table H-32a for PIW or Table H-32b for boat/raft. Enter the base sweep width and environmental correction factors in the following equation to calculate the NVG sweep width:

$$BSW \times MVPHS \times CLDC \times VIS \times \left(\frac{Hs + WHCAPS}{2}\right) \times FATIGUE = SWEEPWIDTH$$

Correction factor for number of searchers: Base sweep widths always assume a 4-person NVG search. If only 2 or 3 persons are searching with NVGs, a correction factor must be applied. For Boat/Raft targets the correction factor is 0.8, and for PIWs the correction factor is 0.9. The correction factor should be applied to the sweep width calculated above.

(2) **NVG Search Sweep Widths for Vessels.** Table H-33 provides sweep width estimates for unlighted targets from a 210' WMEC. The values provided can be used as a guide for other unlit targets of similar size and for use of NVGs used from other surface craft.

(3) Other considerations for NVG use:

- During searches with NVGs for lighted targets, the sweep width should be a value equal to the lesser of the distance to the visual horizon or the estimated meteorological visibility.
- During searches for the green chemical Personal Marker Lights, NVGs should not be used because the filters used filter the green chemical light wavelength.
- The use of NVGs during searches from UTBs has found to be of limited value. Night searches should not be conducted from UTBs with NVGs used as the primary search sensor.
- When the moon is up but clouds are present, searchers on scene will have to judge the amount of moonlight reaching the surface and report which phase on a clear night corresponds most closely.

Table H-32 Base Sweep Widths (BSW) for NVG - Helicopters

Search Object		Search Type	
		Illuminated	Non-Illuminated
PIW [1]	w/o PFD or retro-reflective material	0.05	0.01
	w/ PFD	0.6	0.1
Rafts (canopies with retro-reflective material)	1 or 2-person	0.7	0.6
	4-person	0.9	0.8
	6-person [2]	1.0	0.9
	8-person	1.1	1.0
	10-person	1.2	1.1
	15-person	1.4	1.3
	20-person	1.6	1.4
	25-person	1.7	1.5
Boats (no lights or retro-reflective material)	8 to 12 ft	0.4	0.4
	13 to 19 ft [3]	0.8	0.8
	20 to 25 ft [4]	1.2	1.1
	26 to 35 ft	1.8	1.6
	36 to 45 ft	2.2	2.1
	46 to 55 ft	2.5	2.3

1 – values are estimates 2 – based on measured data 3 – based on 18-ft skiff data 4 – based on 21-ft skiff data

of the Probability of Containment and the Probability of Detection: POS = POC x POD. The "safety factors" given in earlier guidance were really optimal search factors that maximized the POS for the levels of effort required to search the recommended search area with a coverage of 1.0. Major shortcomings were that POS and the goal of maximizing its value were not explained, methods for computing its value were not provided because no method for estimating POC was provided, and no provision was made to accommodate levels of effort other than those required to cover the recommended search areas at a coverage of 1.0. This left POD as the only apparent measure of search results, but its limitations in this role were not explained.

POS estimation requires both POD and POC estimates. It is the probability that a given search will succeed in locating the search object. Cumulative POS is the probability that the search should have succeeded by now if all the facts and assumptions that went into developing the search plans and evaluating the search results were substantially correct. Attaining a high POS value without finding the search object is a clear indicator that all of the case data and assumptions need to be carefully reviewed to determine whether an error has been made, whether a plausible scenario was left out, whether some elements of the case data were given more or less credence than they deserved, etc.

H.5.7.2 **POD (Probability of Detection)** is the statistical measure of search sensor detection performance. It is a function of sweep width and track spacing. It is a conditional probability meaning that it is the probability of detecting the search object, assuming it is in the search area.

(a) Probability of Detection is a function of coverage and the total number of searches in an area, and describes the thoroughness of a single search or the cumulative thoroughness of multiple searches of the same area relative to the search object. In maritime SAR, cumulative POD has relatively little meaning because search object motion has a significant random component due to the unpredictable vagaries of winds and currents. Cumulative POD is much more useful when looking for stationary objects using search areas that have fixed boundaries—a common situation in land search.

(b) For any search, the optimum search radius determines the size of the optimum search rectangle for the amount of search effort that is available on scene. This in turn determines the optimum coverage. There are two optimal search factor curves in the *IAMSAR Manual*-one for "ideal" search conditions and one for "poor" or more correctly "normal" search conditions. These optimal search factor curves are based on the two POD vs. Coverage curves shown in Figure H-25. Intermediate values may be used if conditions are between "ideal" and "normal". If in doubt, use the "normal" curves.

(1) Normal conditions include any situation significantly less than ideal. Anytime the corrected sweep width for a search object is less than the maximum uncorrected sweep width for that object, conditions are less than ideal and a value less than the ideal should be used. When the corrected sweep width for a search object is less than 90% of the maximum possible value for that object, the poor conditions curve should be used. Additional discussion on POD curves may be found in the *IAMSAR Manual*.

The "Ideal Search Conditions" curve in Figure H-25 is based on the assumptions that search patterns will be executed precisely, sweep width is accurately known and constant throughout the search, and the search object is in the search area. The "Normal Search Conditions" curve in Figure H-26 relaxes the first assumption but still requires that the searching effort be spread approximately uniformly over the area. The other two assumptions remain intact.

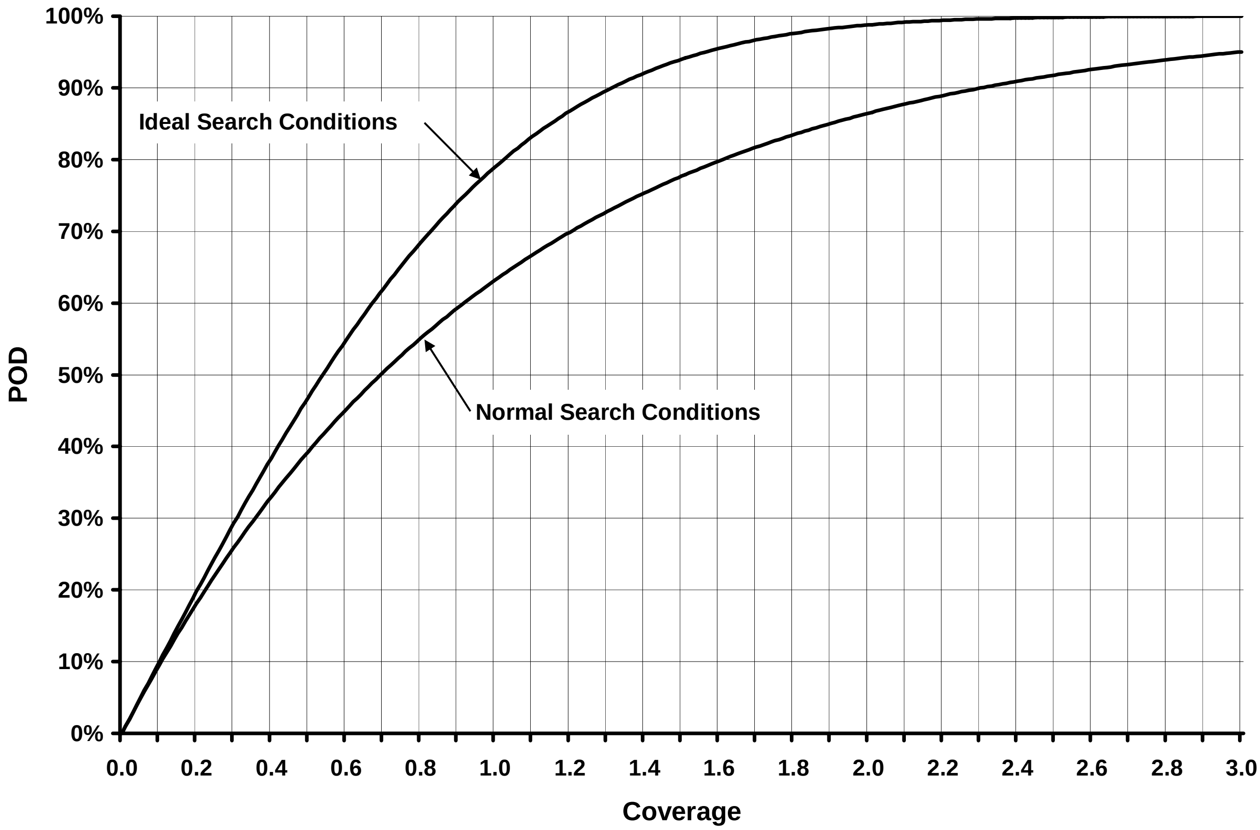


Figure H-25 Maritime Probability of Detection
(Average Probabilities of Detection Over an Area for Ideal: Visual Searches Using Perfect Parallel Sweeps Relative to the Object Under Ideal Conditions Normal: Any Other Object/Sensor/Conditions With A Known Corrected Sweep Width)

(c) Cumulative POD may be calculated from the following equation:

$$POD_{cum} = 1 - \left(\left(1 - POD_1\right) \times \left(1 - POD_2\right) \times \ldots \times \left(1 - POD_n\right)\right)$$

The subscripts 1, 2, …, n indicate that the POD values are for the first, second, …, nth search of the same area relative to the search object. Although maritime search areas usually do not have fixed boundaries, even relative to the updated datum positions, it is reasonable to assume that the cumulative POD value applies in the near vicinity of the updated datum positions used to plan the searches.

An easier way to estimate cumulative POD is to use the "normal search conditions" POD curve as follows:

- If all POD values were obtained from the "normal search conditions" POD curve, then simply add the coverage factor values used to obtain those PODs and use this "cumulative coverage" like any individual coverage value to obtain the cumulative POD from the "normal search conditions" POD curve.
- If some POD values were obtained from the "ideal search conditions" POD curve, it is necessary to first find the corresponding coverage factors for the "normal search conditions" curve. This is done by entering the graph in Figure H-26 from the left with the POD value, moving right to the "normal search conditions POD curve then down to the horizontal axis to get the equivalent "normal search conditions" coverage. Once all coverage values have been referenced to the "normal search conditions" POD curve, they may be added to get an equivalent "cumulative coverage" and used like any other coverage to get the cumulative POD from the "normal search conditions" POD curve.
- If the "cumulative coverage" is greater than 3.0 and therefore off the graph in Figure H-26, the formula

Section H.7
Search Pattern Selection

To ensure that the search area is uniformly searched, use of standard search patterns allows the SMC to calculate probable search effectiveness. This information is valuable for assigning SRUs, and for planning future searches. Any search unit can use the search patterns listed in this Appendix. The complexity of some may preclude their use by SRUs with limited navigational capability.

H.7.1 Factors in Selection

Search pattern selection depends on many factors, including accuracy of datum, search area size, number and capabilities of SRUs, environmental conditions, size of search target, and type of survivor detection aids. While the factors are interrelated, some may be more important than others. The SMC should satisfy the more important factors while meeting others as nearly as possible.

H.7.1.1 The type and number of available SRUs are controlling factors in selection of search patterns. SRU turning diameters, speeds, detection capability, and navigational accuracy have a significant impact on the uniformity of search area coverage and on POD. POD curves are valid only when SRUs follow search pattern tracks accurately.

(a) *Surface Craft.* Navigation accuracy of surface SRUs is generally not a significant problem as long as global positioning systems (GPS & DGPS), LORAN C, inertial, SATNAV, or radar navigation aids are available. However, DR navigation with stopwatch and log may be appropriate in areas with significant currents, especially when searching for PIWs, because this method will produce a more correct pattern *relative to the drifting search object*. Sea states of three feet or more can also adversely affect the ability of small surface SRUs to execute search patterns accurately.

(b) *Aircraft.* High-speed aircraft are more likely to accumulate turn errors, especially with narrow track spacing, because of their larger turn diameters. Low-speed aircraft are more sensitive to wind because the crosswind component will be a higher percentage of search speed. The following should be considered when planning aircraft searches:

(1) Aircraft navigation accuracy has improved due to increased use of, and improvements in, navigation computers, area navigation (RNAV), global positioning systems GPS &DGPS, INS, and LORAN C. More sophisticated systems can be coupled to an autopilot, enabling execution of accurate search patterns.

(2) When accurate navigation systems are not available, the type of pattern that requires minimum turns and maximum search leg length is usually selected to reduce turning errors and to ease navigation. For high-speed aircraft, patterns and search area assignments that allow turns outside the search area should be considered to allow aircraft to establish themselves on each leg, improving uniformity of area coverage.

H.7.1.2 Once large-scale search efforts are under way, redeployment of SRUs or changing of assigned search patterns becomes difficult. Careful consideration should be given to selecting patterns and designating SRUs. Unique patterns based on search circumstances may be developed.

H.7.2 Search Pattern Nomenclature

H.7.2.1 **Commence Search Point (CSP)** is the location in the search pattern where the SRU begins searching. Specifying the CSP allows the SRU to efficiently plan the en route track, and ensures that SRUS are separated and that the SRU begins search at the desired point and time.

H.7.2.2 **Search Leg** is the long leg along the track of any pattern.

H.7.2.3 **Crossleg** is the connection between two search legs.

H.7.2.4 **Creep** is the general direction in which an SRU moves through a rectangular or square area, normally the same direction as the crosslegs.

H.7.3 Search Pattern Designation

A coded system of letters is used to designate search patterns. The first letter designates the major pattern characteristic. The second letter denotes SRU number ("S" is a single-unit search; "M" is a multiunit search). The third letter designates specialized SRU patterns or instructions.

H.7.3.1 **Trackline Patterns (T)** are used when the intended route of the search object is known. A route search is usually the first search action since it is assumed that the target is near track, and that either it will be easily seen or the survivors will signal. The trackline pattern is a rapid and reasonably thorough coverage of the missing craft's proposed track and area immediately adjacent, such as along a datum line.

(a) *Trackline Single-Unit Non-Return (TSN)* search is made along the track or datum line. The letter "N" in the third position indicates that the pattern makes one or more searches along the track, but the search terminates at the opposite end of track from where it began. See Figure H-34.

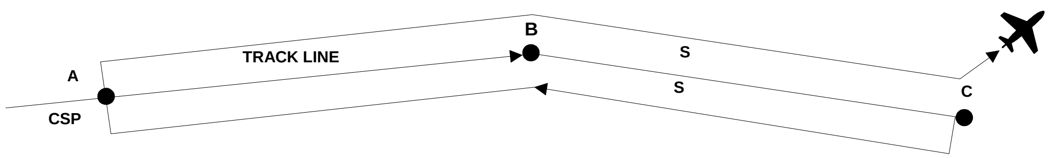


Figure H-34 Trackline Single-Unit Non-Return (TSN)

(b) *Trackline Single-Unit Return (TSR)* has the CSP offset ½-search track spacing from the trackline or datum. The SRU runs up one side and down the other, ending one-track space from where it began. See Figure H-35.

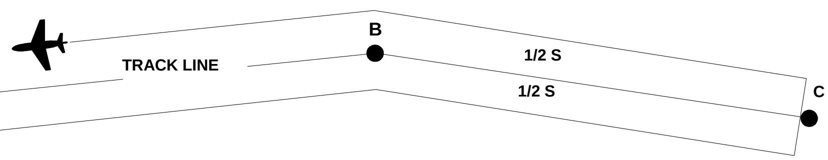


Figure H-35 Trackline Single-Unit Return (TSR)

(c) *Trackline Multi-Unit Return (TMR).* Two or more SRUs are used in an abeam formation to afford greater width coverage along track. See Figure H-36.

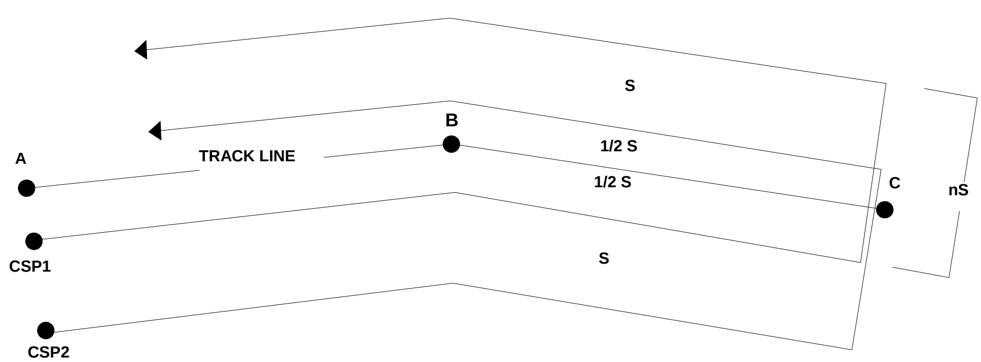


Figure H-36 Trackline Multi-Unit Return (TMR)

Table H-42 Square Pattern Search Computations

Track Spacing	Speed (kts)								
	3	5	8	10	15	20	60	80	90
0.5	10:00	6:00	3:45	3:00	2:00	1:30	0:30	0.225	0:20
1.0	20:00	12:00	7:30	6:00	4:00	3:00	1:00	0:45	0:40
1.5	35:00	18:00	11:15	9:00	6:00	4:30	1:30	1:075	1:00
2.0	40:00	24:00	15:00	12:00	8:00	6:00	2:00	1:30	1:20
2.5	50:00	30:00	18:45	15:00	10:00	7:30	2:30	1:555	1:40
3.0	60:00	36:00	22:30	18:00	12:00	9:00	3:00	2:18	2:00
3.5		42:00	26:15	21:00	14:00	10:30	3:30	2:405	2:20
4.0		48:00	30:00	24:00	16:00	12:00	4:00	3:03	2:40
4.5		54:00	33:45	27:00	18:00	13:30	4:30	3:255	3:00
5.0		60:00	37:30	30:00	20:00	15:00	5:00	3:48	3:20
6.0			45:00	36:00	24:00	18:00	6:00	4:33	4:00
7.0			52:30	42:00	28:00	21:00	7:00	5:18	4:40
8.0			60:00	48:00	32:00	24:00	8:00	6:03	5:20
Note: All times in minutes and seconds Note: Interpolation may be used in this table									

H.7.3.5 **Sector Patterns (V)** These patterns may be used when datum is established within close limits, a very high coverage is desired in the immediate vicinity of datum, and the area to be searched is not extensive. The patterns resemble the spokes of a wheel and cover circular search areas. Datum is located at the center of the wheel and should be marked with a suitable floating marker. By marking datum, the SRU has a navigation check each time the SRU passes through the center of the search area. While there are many types of sector search patterns, a six-sector pattern is usually used. It consists of three equilateral triangles with one corner of each triangle at datum. See Figures H-48 and H-49. The search radius is also the length of every leg. This search pattern can be used in both single and multi- unit searches. An average coverage for sector patterns can be determined by using the mid-leg track spacing or, equivalently, twice the sweep width divided by the radius of the pattern. Sector searches have high Probability of Success (POS) near datum assuming the object is in the search area. Generally, aircraft sector search areas do not have a radius greater than 20 to 30 miles, while marine craft use a maximum radius of 5 miles. Because only a small area is covered, datum should be recomputed on every search to allow for drift. If the search is oriented over a marker, adjustment for total water current (TWC) will occur automatically, and only leeway must be considered. For standardization, all turns should be made to the right.

(a) *In Sector Single-Unit (VS)* searches six-sector patterns are most commonly used. See Figure H-48.

(b) *Sector Single-Unit Radar (VSR)* is used when a radar-equipped marine craft takes station at the center of the pattern and provides radar navigation assistance to one aircraft completing a sector search pattern.

(c) **Sector Search Patterns**

(1) **Sector Search Pattern: Single Unit -- Victor Sierra (VS)**, Figure H-48. When practical, the first leg of the search is normally in the direction of search object drift. All turns in this pattern are 120° to the right. All legs of the search pattern are equal to the chosen radius. Upon completion of the pattern, a second pattern is started with the heading of the new first leg 30° to the right of the final course of the first pattern.

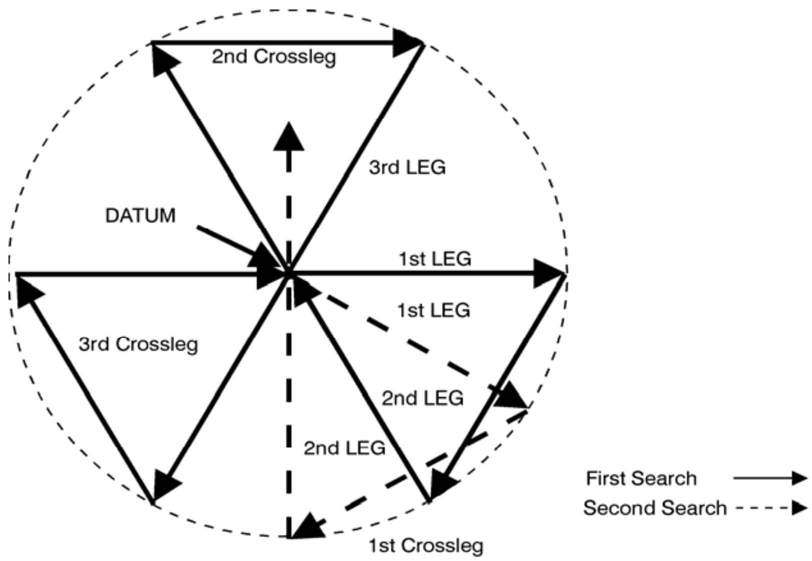


Figure H-48 Sector Pattern Single-Unit (VS)

(2) **Sector Search Pattern: Two-Units -- Victor Mike (VM).** The VM pattern is used when two surface SRUs are available, Figure H-49. This pattern is not used with aircraft SRUs. As the first SRU begins a Victor Sierra search, the second begins its pattern at datum in a direction 90° to the left of the first leg of the first SRU. If the SRUs arrive at datum to begin the search at the same time, the second starts at a lower speed than the first. When the first SRU is about one leg ahead of the second, the second accelerates to search speed. The slow start of the second SRU prevents the SRUs from arriving at datum at the same time. When both have completed one VM pattern, the coverage is the same as if a single SRU had completed two VS patterns.

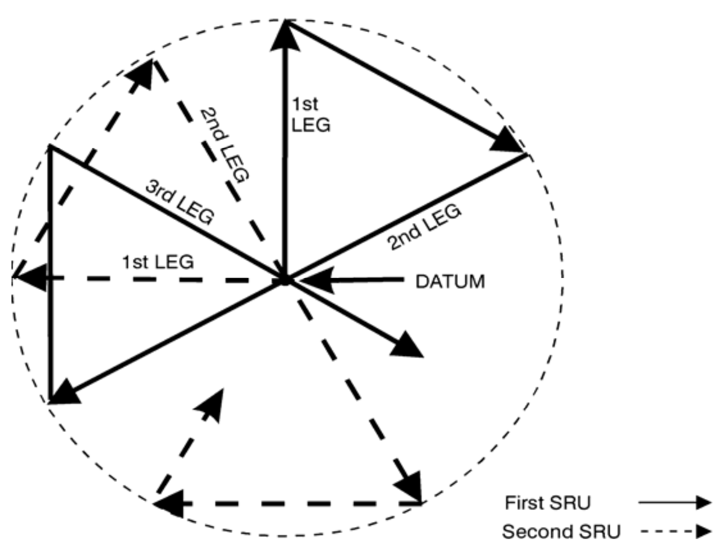


Figure H-49 Sector Pattern Two-Unit (VM)

(3) The sector search pattern becomes too complicated for more than two SRUs. When more than two SRUs are available, consider using a multi-unit parallel track (PM) search pattern, or dividing the search area into smaller areas and conducting single unit searches. Sector search distance and time calculations

Appendix I
Flare Incidents

Recommended procedures and guidance for flare case planning are provided in this Appendix. Flare Sighting Check Sheets start on I-24. (These sheets may also be found in Appendix G.)

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Section I.1 Flare Incidents

I.1.1 Response to Flares

Red and orange flares are recognized as marine and aviation emergency signals. Reported sightings of red/orange flares must be treated as distress situations unless sufficient other available information indicates no distress exists. Examples of other information that might lead to such a conclusion include, but are not limited to, positive indications the sighted object was not a flare, notifications that an exercise involving flares or objects that could be mistaken for flares is underway in the same area, etc. Unresolved (insufficient information to either close or suspend) red or orange flare reports require first-light searches. Continued searches and searches in response to other than red or orange flares will depend on the specifics of the case.

If a flare is reported that is other than red or orange and there is reason to believe it could have originated from a distress situation, it should be treated the same as a red/orange flare sighting. Reasons for believing a flare that is not red or orange may indicate a distress situation include, but are not limited to, unresolved MADAY calls, ELT/EPIRB/PLB transmission in the vicinity, proximity to a known hazard to navigation, poor weather, and a craft being reported overdue in the general area of the flare sighting. Otherwise, there is no requirement to send assets to the scene. However, further investigation short of launching assets should be considered. In any case, the sighting information shall be recorded in an appropriate log where it will be available in the event that additional information becomes available that a distress incident may have occurred in the area near the time of the sighting.

I.1.2 Importance of Accurate Information

The nature of flare distress signaling makes planning and execution of searches difficult due to wide variations in flare types, possible altitudes, skill and position of the reporting source, and weather as well as many other factors. For that reason, the accuracy of the initial information received from a reporting source is most critical. For example, a hand-held flare in a recreational boat seen on the horizon by a reporting source standing on the beach, assuming the observer’s eye and the flare are both six feet above the water, will be approximately 5.75 NM away, while a parachute flare rising to 1200 feet and seen on the horizon by the same reporting source could be more than 40 NM away.

I.1.3 Importance of a Prompt Response

As with all SAR cases, a prompt, thorough and proper response yields the greatest chance of a rescue. Otherwise, the search planner may have no choice but to expand and/or extend the search, dispatching additional SRUs to search larger areas.

I.1.4 Skills Needed for Taking a Flare Sighting Report

Persons taking a flare report should have a good understanding of the applicable principles and procedures. The inquiry process requires patience and good interpersonal skills since reporting sources are rarely familiar with the terminology or procedures for prosecuting flare sightings. A flare reporting checklist must be used to ensure that a proper report is taken to get all the facts.

I.1.5 Sightings That Can Be Mistaken for Distress Flares

There are a number of situations that may be mistaken for distress flares, especially by untrained observers. Determining whether there is a high probability for the reporting source to have actually seen something other than a distress flare requires a combination of interviewing skill and comparison of the report with data from other sources.

I.1.5.1 Meteor Showers and Shooting Stars. Meteor showers occur when the earth passes through the debris field of a comet. This “space trash” burns up as it moves through the atmosphere, leaving behind several “wakes” of light. Most wakes last from one to ten seconds. Some brighter meteors can leave behind a “persistent train” that can last for up to 30 minutes. Meteor wakes are normally white, but may appear in nearly every color of the spectrum.

(a) While a sporadic meteor can appear anytime, most meteor showers occur on a regular basis every year. These showers are named after the nearest constellation from where they seem to originate. The origin is also referred to as the shower's radiant. Table I-1 provides information on major meteor shower activities and can be used to help correlate a suspected false flare sighting with a meteor.

Table I-1 Major Meteor Shower Activities

Name/Radiant	Annual Occurrence	Peak Occurrence	Average Per Hour
Quandranids	28 Dec –7 Jan	3-4 Jan	45 – 200 +
Lyrids	16-25 Apr	21-22 Apr	100 +
Eta Aquarids	21 Apr – 12 May	5 May	20 +
Southern Delta Aquarids	14 Jul – 18 Aug	15 – 20 May	10 +
Northern Delta Aquarids	16 Jul – 10 Sep	13 Aug	10 +
Perseids	23 Jul – 22 Aug	12-13 Aug	80 +
Southern Iota Aquarids	1 Jul – 18 Sep	6 Aug	8 +
Northern Iota Aquarids	11 Aug – 10 Sep	25 Aug	10 +
Alpha Capricornids	15 Jul – 11 Sep	1 Aug	14 +
Orionids	15 –29 Oct	21 Oct	20 +
Leonids	14 – 20 Nov	17 Nov	15 +
Geminids	6 – 19 Dec	13 – 14 Dec	100 +

(b) If it is suspected that a flare sighting report was actually a meteor shower, begin by correlating the bearing of the report with the meteor shower's radiant. The American Meteor Society's web site (found at http://comets.amsmeteors.org/meteors/calendar.html) provides a useful Observer's Guide that describes where a meteor shower's radiant can be located. The radiant will be described in true degrees and declination above the horizon. Start by correlating the reported flare to a meteor by matching the direction and angle of elevation of the flare sighting with a meteor's radiant and declination

(c) Matching the report's bearing with a meteor shower's radiant is not enough to assume the sighting was a meteor. During the interview additional clues should be actively sought. Without putting words in the reporting source's mouth, ask the caller to describe what they saw.

(d) A meteor's wake normally "streaks" across a portion of the sky in an apparent straight line, as opposed to a meteor or parachute flare's vertical arch of trajectory. A meteor's wake can appear at any angle above the horizon. Only flares launched very close to the observer will appear to rise more than 8 degrees above the horizon. Unlike a meteor or parachute flare, there is no "burst" or flame associated with a meteor sighting. Because meteors travel across hundreds of miles of sky at high altitudes, they can be seen at greater distances by multiple observers. Flares on the other hand, can only be seen by observers within the flare's nominal range because of their limited height. Meteors require a relatively clear sky to be seen. If a sighting was observed in an overcast sky, it is not likely a meteor. During a meteor shower, the observer will normally witness several wakes track across the sky. Mariners have a limited number or flares available.

If it is reasonably certain the reporting source mistook a meteor shower as a flare, conclude the interview by asking if it is possible that what was seen could have actually been a shooting star. Some callers might become embarrassed or even defensive at this point. It's important to reassure the caller that meteors are often confused with flares, and that the Coast Guard appreciates the caller's effort none the less

I.1.5.2 Military Operations. Military flight operations are often the source of flare sightings. Military aviators will sometimes deploy red or white flares during the course of a training mission. Military commands that may be operating assets in the vicinity of the flare sighting when it is reported should be queried regarding the nature of their operations.

The military sometimes uses various pyrotechnic devices in various colors and combinations corresponding to specific situations and meanings. Again, military commands that may be operating assets in the vicinity of the flare sighting when it is reported should be queried regarding the nature of their operations and any flare signals that may have been used at or near the time and place of the sighting report.

I.1.5.3 Distant Vessels. Commercial fishing vessels and merchant vessels illuminate their decks with powerful deck lights when performing work on deck or while at anchor. These lights may appear reddish-orange in color and may be confused with a handheld flare. When a report is received where the origin appears to be near known commercial vessel traffic, try to establish communications with those vessel(s) through the Urgent Marine Information Broadcast (UMIB). If a vessel in the area answers, request the operator to turn the deck lights off and on while the reporting source remains on the phone to correlate the sighting with the vessel.

I.1.5.4 Aids to Navigation. Under limited visibility, a distant aid to navigation's beacon may be reported as a distress signal. Ruling out a flare is as simple as asking the reporting source to describe exactly what is seen, including interval between sightings. If the sighting appears and disappears at regular timed intervals (without a rise and fall) that match the light characteristics of an aid on the line of bearing, it can be safely assumed that the origin is an aid to navigation.

I.1.5.5 Ascending and Descending Aircraft. Distant aircraft (beyond aural range) taking off or approaching a runway can often appear to be a flare. The airplane's landing gear lights can appear similar to a flare's trajectory as it flies near the airport. If the report plots near an airport's approach pattern, consider calling the Air Traffic Control Center to correlate the report with any aircraft in the vicinity. If an aircraft was present in the area, ask the reporting source if they might have confused the sighting with an aircraft.

I.1.5.6 Fireworks Displays. Fireworks, whether part of a professional display or those set off by private citizens, are easily mistaken for flares. Local authorities should be queried regarding the possibility of fireworks displays near the time and place of the reported flare sighting.

I.1.6 Assessing Reporting Source Reliability

The reliability of the reporting source should be confirmed whenever possible. Caller ID, if available, should be checked against the information given by the reporting source. An immediate call back to the reporting source should be considered to determine whether the person who answers is the same as the reporting source or can confirm that the reporting source was there and made the call. It may be appropriate to request local law enforcement authorities visit the reporting source, confirm their presence, interview them, and report their assessment of the reporting source's reliability. However, if in doubt, consider the reports reliable.

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Section I.2
Definitions

I.2.1 Meteorological Visibility

The greatest distance, at which a black object of suitable dimensions can be seen and recognized by day against the horizon sky, or, in the case of night observations, could be seen and recognized if the general illumination were raised to the normal daylight level.

I.2.2 Nominal Range

The maximum distance at which a light can be seen in clear weather as defined by the International Visibility Code (meteorological visibility of 10 nautical miles).

I.2.3 Luminous Range

The maximum distance, at which a light can be seen *under existing visibility conditions*. Luminous Range does not take into account the elevation of the light, the observer's height of eye, the curvature of the earth, or interference from background lighting.

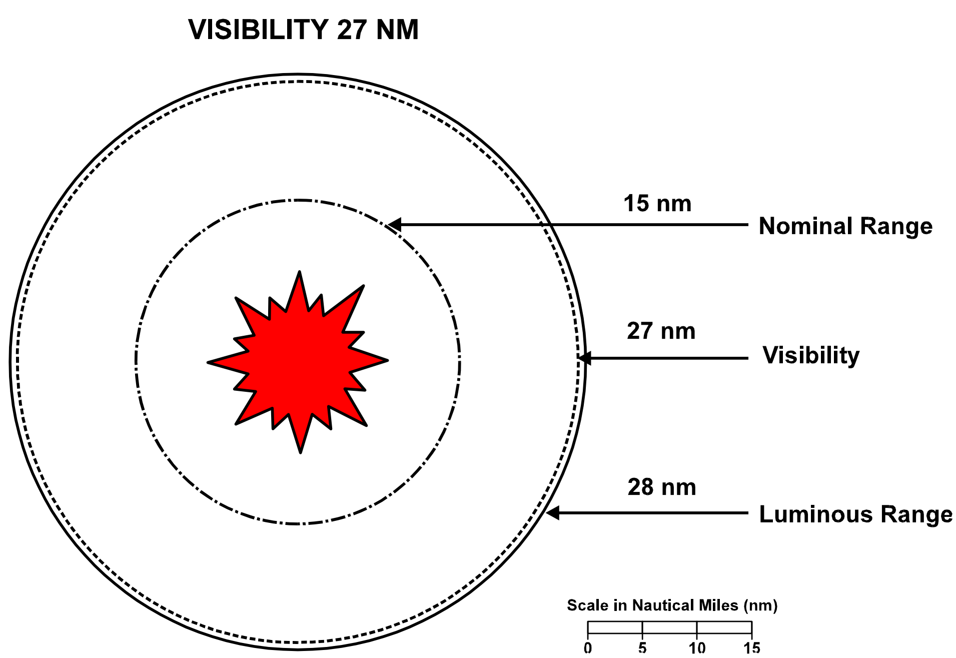

Figure I-1a Luminous Range and Visibility, example with visibility of 27nm

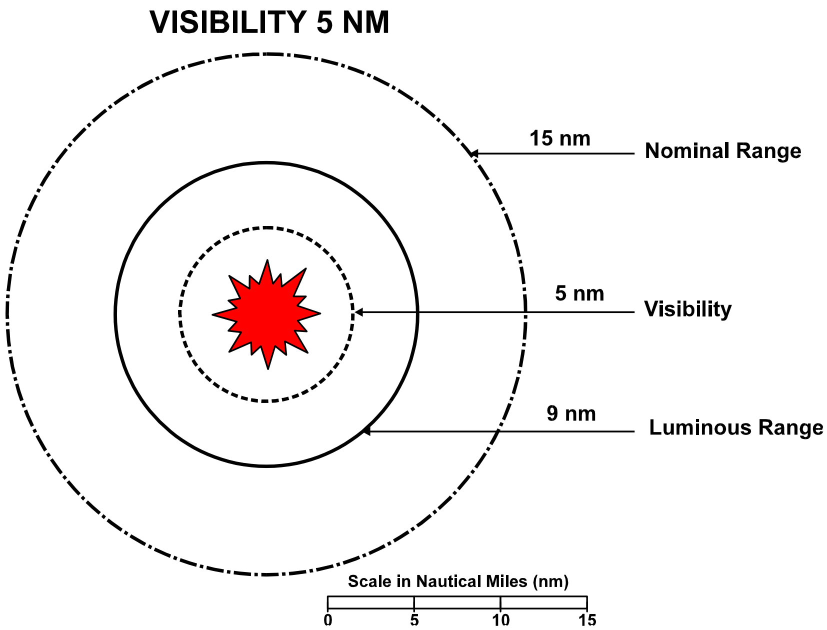

Figure I-1b Luminous Range and Visibility, example with visibility of 5 nm

I.2.4 Geographic Range

The maximum distance at which the curvature of the earth permits a light to be seen from a particular height of eye *without regard to the luminous intensity of the light*. Geographic range can be determined by adding the distance of the horizon from the observer and the distance of the horizon from the light.

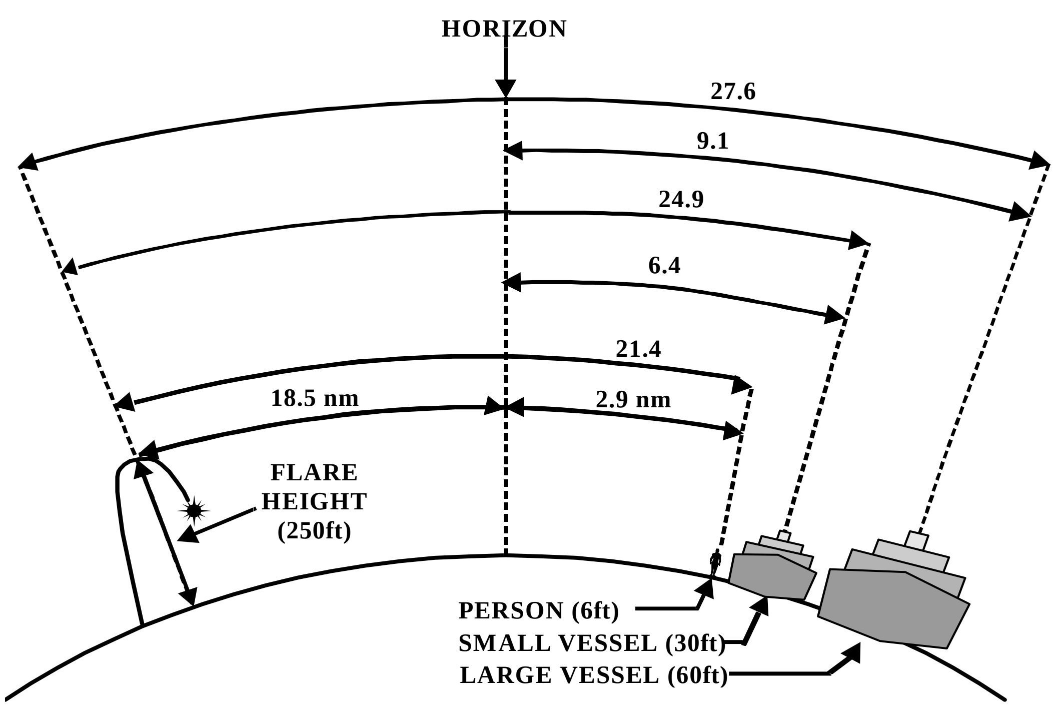

Figure I-2 Geographic Range of a flare by Height of Eye

Section I.3
Obtaining Sighting Data

I.3.1 Reporting Source

The following information about the reporting source should be obtained:

I.3.1.1 Position. Reporting source position is the point from which distance and direction are measured. Attempt to obtain: latitude/longitude; bearing and range from a prominent landmark; or street address.

Note: A latitude and longitude can often be derived from a reporting source's street address through the use of geo-location services provided on the Internet. In the event that no street address is available, consider dispatching an Auxiliarist or a police officer with a hand held GPS to the reporting source location to obtain a GPS position. These practices will reduce the position error of the reporting source to virtually zero.

I.3.1.2 Height of eye. To most accurately estimate the range to the flare from the reporting source, the height of eye of the reporting source is important. If the reporting source is in a tall building, record the floor number and estimate 10 feet per floor above the height of eye at ground level.

I.3.1.3 Personal information of the source. Obtain the name of the reporting source and establish a means of further contact. Request that the reporting source remain on scene or return to the position of the sighting in order to assist in the search and rescue unit (SRU) placement. A reporting source who provides a way to be contacted or is willing to remain on the scene or return to the scene is more credible than one unwilling to do these things.

I.3.2 Flare Characteristics

Characteristics can aid in determining the distress location, and may correlate with other sightings, phenomena, or military exercises. Flares can be identified primarily by trajectory and duration of burn. As Table I-2 describes, meteor flares have a rapid rise and rapid fall. Parachute flares exhibit a rapid rise and slow descent. These characteristics can be observed by an astute reporting source. Judging the height of the flare is much more difficult, even for a trained eye. It is important to note that the height of a flare significantly affects the size of the search area. If the type of flare can be determined to be a meteor flare, rather than a parachute flare, the search area can be significantly reduced since meteor flares can achieve only about 1/3 the maximum height of parachute flares. Parachute flares are rare among recreational boaters. If a flare is determined to be a parachute flare, a major search effort may be needed to cover a large geographic area. Table I-2 lists characteristics by flare type, but additional information can also be helpful. As much of the following information as possible should be collected:

I.3.2.1 Color. It is critical in assessing urgency. Red and orange flares must be treated as distress cases until proven otherwise.

I.3.2.2 Number of flares, time(s) of sighting(s), and intervals between flares.

I.3.2.3 Apparent origin of the flare. Did the reporting source see where the flare came from? If so, was it near the horizon or definitely between the reporting source and the horizon? Did the flare illuminate any objects? If so, what were they?

I.3.2.4 Trajectory. The nature of the flare's trajectory is an extremely important clue. Every effort should be made to obtain accurate answers to the following questions: Did the reporting source see the flare both rise and fall? Rising only? Falling only? What were the rates of rising and falling (rapid rise and fall; rapid rise, slow fall, etc.)? Was the trajectory steep (mostly vertical) or flat (mostly horizontal)? Answers to these questions will help establish the type of flare and therefore the possible heights it could reach as well as provide some additional clues about its location. Table I-2 shows the characteristics of some common types of flares.

I.3.2.5 Time interval and duration of burn. This also aids in determining the type of flare. However, a flare may burn longer than the minimum duration. A flare may also burn less than the required time if the flare was fired incorrectly or if it was beyond its expiration date.

Table I-2 Flare Characteristics

TYPE	TRAJECTORY	AVERAGE HEIGHT	CANDLEPOWER NOMINAL RANGE	MINIMUM PEAK BURN DURATION
METEOR*	RAPID RISE RAPID DESCENT	250 - 400 FT	10000 – 30000 15 - 17 NM	5.5 Seconds
PARACHUTE**	RAPID RISE SLOW DESCENT	1000 - 1200 FT	20000 – 40000 14 - 20 NM	30-40 Seconds
HAND-HELD***	STEADY	ASSUME 10 FT	500 – 15000 8 - 16 NM	50-120 Seconds
*Meteor flares have no minimum altitude requirements. **Parachute flare requirements by SOLAS: 300 meters (990') height, 30K candlepower. ***Hand-held candlepower requirements: USCG-500; SOLAS-15000.				

I.3.2.6 Angle of observation. Often the reporting source will not be able to accurately estimate the angle of elevation without some assistance. The angle of elevation is the angle measured from the horizon to the top of the trajectory.

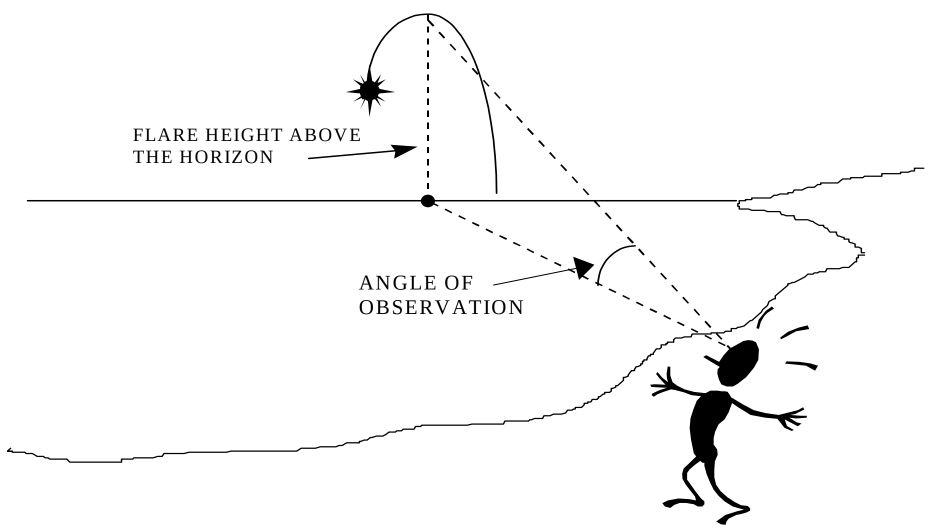

Figure I-3a Example of angle when flare origin is beyond the horizon and unobserved

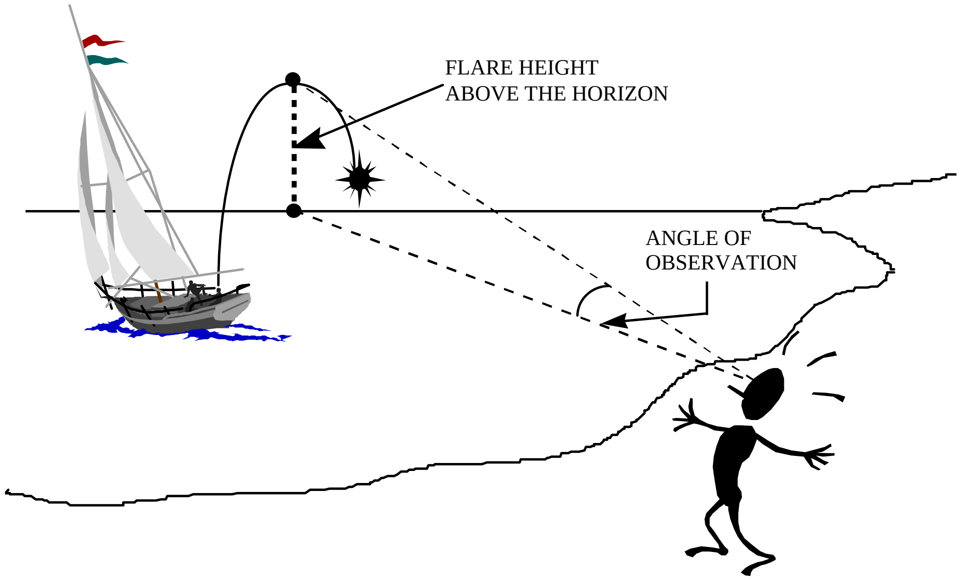

Figure I-3b Example of angle when flare origin is observed

If the origin of the flare is observed, the reporting source may measure the angle from the origin to the top of the trajectory. This method of determining the angle may be helpful when the horizon cannot be seen or used as a reference.

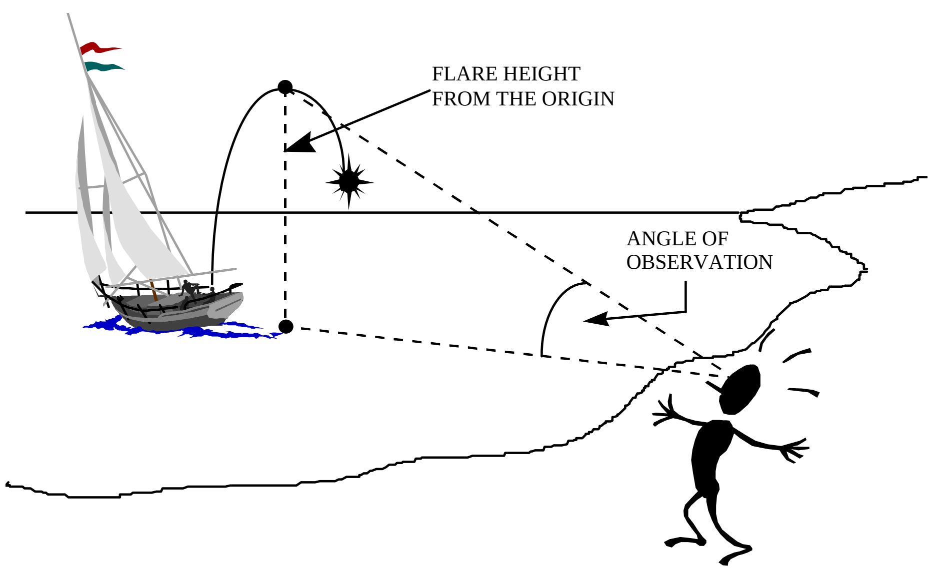

Figure I-3c Example of angle measured from flare origin to top of trajectory

The person taking the report should be sure to determine exactly what angle is measured. "Is the angle from the horizon to the top of the trajectory or from the point where you saw the flare take off to the top of the trajectory?" This distinction will become important in the planning stage.

(a) A major point to remember is that for any flare sighting with an angle of elevation of more than 8 degrees, the distance of the flare from the reporting source is less than 1.4 nm.

(b) Closed Fist Method. A closed fist held at arm's length with the thumb side up represents approximately 8 degrees of arc.

Unless the reporting source's height of eye is greater than the height of the flare at the top of its trajectory, the flare will normally appear to rise above the horizon. In this situation, when the bottom of the fist is aligned on the horizon relatively accurate estimates of small vertical angles can be made. Brief the reporting source on this reference system. "If you hold your fist at arm's length, with your thumb on top and the bottom of your fist on the horizon, was the top of the trajectory above or below the top of your fist?" If the flare was sighted below the top of the fist, have the reporting source attempt to more accurately estimate the angle with the horizon.

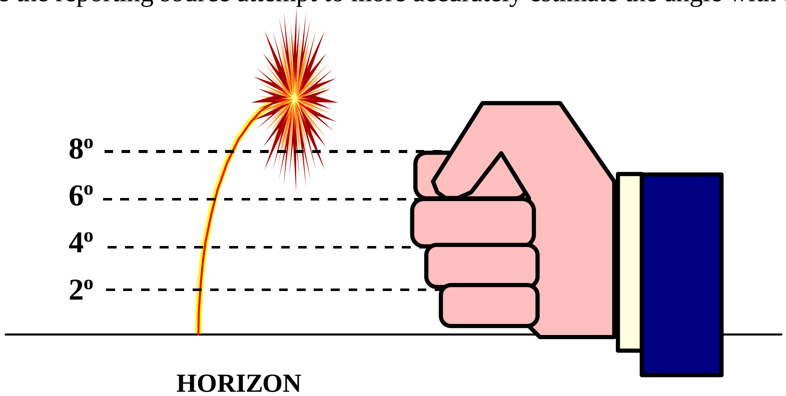

Figure I-4a Fist Method for measuring flare angles above horizon

An estimate of three fingers or half a hand can be extremely useful. Obtain the final estimate in terms such as "not less than ½ hand and not more than 1 ½ hands." Convert number of fingers or fractions of hands to degrees based on Figure I-4a above.

Estimates collected from untrained reporting sources are necessarily fraught with uncertainty. Search planners must carefully question reporting sources of flares to remove as much of the uncertainty as possible without encouraging the reporting source to report unjustifiably precise estimates. Search planners must then develop search plans that reflect the actual uncertainties. Failure to do so can result in searching either too small or too large an area and missing the target. An estimate of "definitely less than a fist, but definitely more than a quarter of a fist," translated to degrees as definitely less than 8 degrees but more than 2 degrees, can tremendously limit the datum area as compared with, "I can only say less than a fist." The objective is to "bracket" or estimate the bounds of the area containing the sighted flare without covering substantially too much or too little area.

With hand-held flares, and even meteor flares if the reporting source is high enough, the flare may not rise above the visible horizon if it originates between the reporting source and the horizon. In this case, the reporting source should be asked to align the top of the index finger with the horizon and estimate the apparent distance *below* the horizon using the fist method described above. See Figure I-4b.

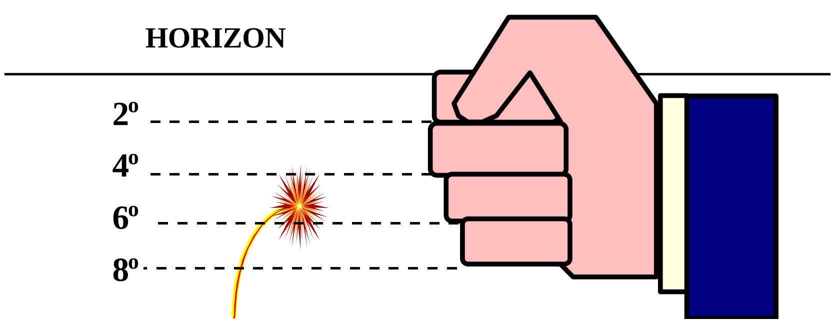

Figure I-4b Fist Method for measuring flare angles below the horizon

I.3.2.7 Bearing from the reporting source. There are several means by which a bearing may be estimated:

(a) clock method, (Figure I-5 shows how to determine the line of bearing by referring to the direction as points on a clock, with twelve o'clock being perpendicular to the reporting source in relation to the shore line or building where the reporting source is located. Most buildings along the shoreline will be aligned with the shore. If the "clock" is being referenced to a building's walls that are not aligned with the shoreline, then the search planner will need to determine the orientation of the building.)

(b) gyro/magnetic compass,

(c) reference object,

(d) seaman's eye, or

(e) a guess.

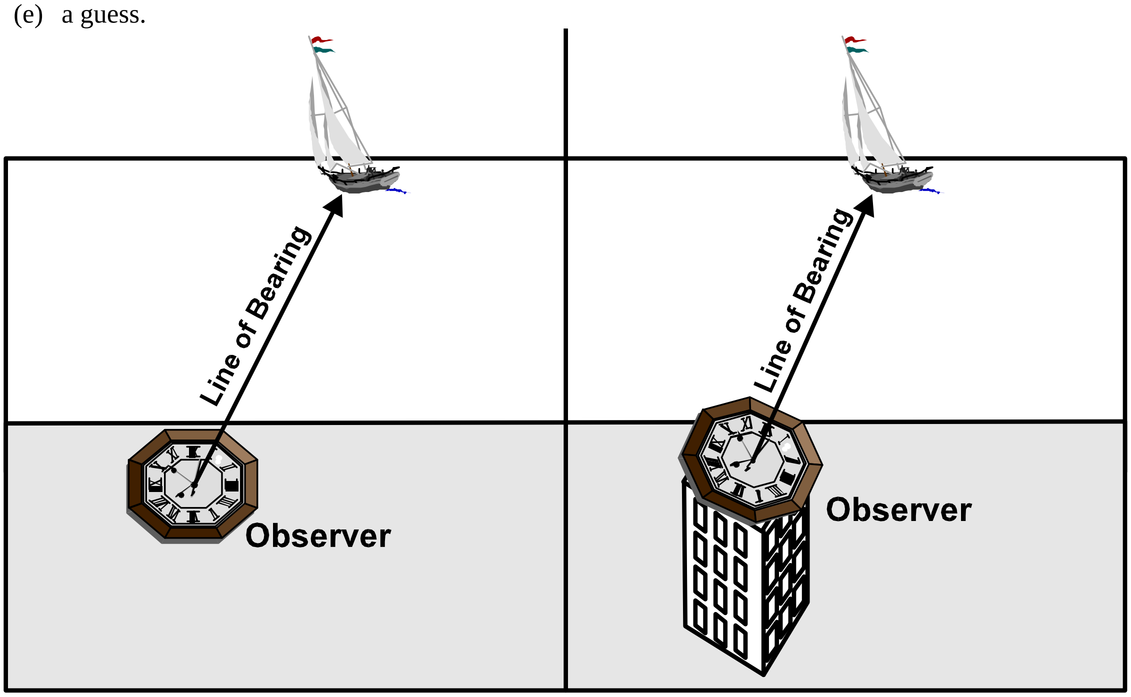

Figure I-5 Clock Method for determining bearing. Reporting source aligned with shore (left), bearing 1 o'clock; reporting source not aligned with shore (right), bearing 12 o'clock.

If the reporting source has difficulty in confidently estimating direction, amplifying information, such as the following, should be obtained:

(a) direction relative to the street direction,

(b) direction relative to a line passing through reporting source's position and another prominent landmark or reference point,

(c) identity of prominent landmarks on either side of the line of bearing from the reporting source to the flare,

(d) direction relative to the trend of the shoreline in that area, or

(e) direction relative to the line between the reporting source and the moon or a star or constellation the reporting source can confidently identify.

The search planner should estimate the degree of uncertainty in the form of bearing errors to the right and left of the reported bearing. These will establish rightmost and leftmost bearings from the reporting source. Datum estimates must reflect real doubts. Failure to reflect realistic uncertainties can lead to false confidence in a search's chances for success.

I.3.2.8 Distance. Estimating distance directly from an observation, without recourse to vertical angles and tables, is difficult for even an accomplished seaman. Data developed in research conducted by the Coast Guard Research and Development Center (Robe, R.Q., et al., 1985) has shown that in most cases reporting sources tend to underestimate distance. Most estimates of distance should not be given significant consideration unless the reporting source is basing the estimate on the distance to a known object on or near the flare's line of bearing.

I.3.3 Helpful Information to Obtain

I.3.3.1 Aircraft/vessels seen in vicinity. If the reporting source can see the vessel being illuminated by the flare then the flare is inside the horizon. If an aircraft was seen, it may be possible to correlate this report with reports, if any, from the aircraft. It may also be possible to correlate the report with aircraft positions (from radar or radar playback) at the time of the sighting.

I.3.3.2 Obstructions. Information about obstructions can be of value in several ways.

(a) **Gauging distance.** For example, a flare seen to rise/descend in front of an island clearly indicates the maximum distance to the flare is the distance to the island. If seen behind an obstruction it clearly indicates the minimum distance is the obstruction distance.

(b) **Determining direction.** Flares seen over or between identifiable obstructions give the reporting source a reference for determining direction.

(c) **Estimating angle of elevation.** For example, a flare seen over the top of a nearby stand of 60 ft trees by a reporting source standing on the ground (assuming level terrain) means the flare could not have been fired from a distance very far beyond the tree line.

I.3.3.3 On scene weather and visibility. This can be useful in limiting the area to be searched. Ascertain how visibility was determined, such as from objects that are just visible at a known range. Keep in mind that horizontal visibility factors, such as ground fog, may not limit the visibility for a meteor or parachute flare as much as for a hand-held flare.

Section I.4
Estimating Distances

Estimating the distance of the flare from the reporting source is one of the more difficult problems in search planning. Flare sightings are generally made by untrained, inexperienced reporting sources. While any information they can provide is helpful, it also has a large associated uncertainty. However, the reporting source is not the only source of uncertainty. The actual height of the observed flare at the top of its trajectory is also subject to a large uncertainty. For reports of less than 4 degrees (1/2 fist), the range of distances increases very rapidly. Planners must use all means to obtain accurate information to establish a manageable search plan.

Before presenting the actual step-by-step procedures for using the distance tables for estimating minimum and maximum distances from the reporting source, an explanation of the rationale behind these procedures and tables is in order.

I.4.1 Angle Above the Horizon

If the flare is observed above the horizon at the apex of its trajectory, then its distance from the reporting source will depend on the reporting source's height of eye, the observed angle above the horizon and the height of the flare above the surface. Assuming that information about the first two factors can be obtained from the reporting source, this leaves the height of the flare as the only "unknown." For flares that are fired into the air, the maximum height is assumed to be 1200 feet for parachute flares and 500 feet for meteor flares. The minimum height for both types of flare is assumed to be 250 feet or 10 feet above that of the reporting source for heights of eye greater than 240 feet. A flare that rises only 250 feet must be much closer to a given observer (e.g. height of eye 20 feet) in order to produce a given observed angle above the horizon (e.g. 1 degree) than a flare rising to 1200 feet which produces the same angle from the same point of observation. The distance in the first case is 2.31 nm while the distance in the second case is 10.98 nm. Therefore, the minimum distance table (Table I-3a) is based on the assumed minimum flare heights and the maximum distance tables (Tables I-2b and I-5) are based on the assumed maximum flare heights. The procedures presented later in this appendix also show how to account for realistic limitations in the ability of reporting sources to estimate vertical angles and to identify different types of flares.

Example: If a reporting source with a sextant whose height of eye is 20 feet observes a flare rise to one degree above the horizon, it would be about 11 nm away if it rose to 1200 feet but only 2.3 nm away if it rose to only 250 feet. However, if the reporting source could only estimate the angle as between 0.5 and 2 degrees, then the minimum and maximum ranges would become 1.2 nm and 19.2 nm.

I.4.2 Angle Below the Horizon

If the reporting source is high enough, and the flare is low enough at the top of its trajectory, then it will not appear to rise above the horizon. If this happens, then the flare must be between the reporting source and the horizon. However, for large heights of eye, the distance to the horizon can be quite substantial. The datum area can be reduced significantly if angles *below* the horizon can be measured or estimated. In this case, for a given height of eye and angle below the horizon, the higher the flare rises above the surface, the closer it must be. This is exactly opposite to the situation described in the preceding paragraph. Since a flare that does any rising at all and fails to cross the horizon line must be quite close, the minimum distance was computed by assuming the maximum flare height was 10 feet below that of the reporting source for heights of eye up to 240 feet and 250 feet for greater heights of eye. A minimum flare height of zero was used to determine the maximum distance from the reporting source.

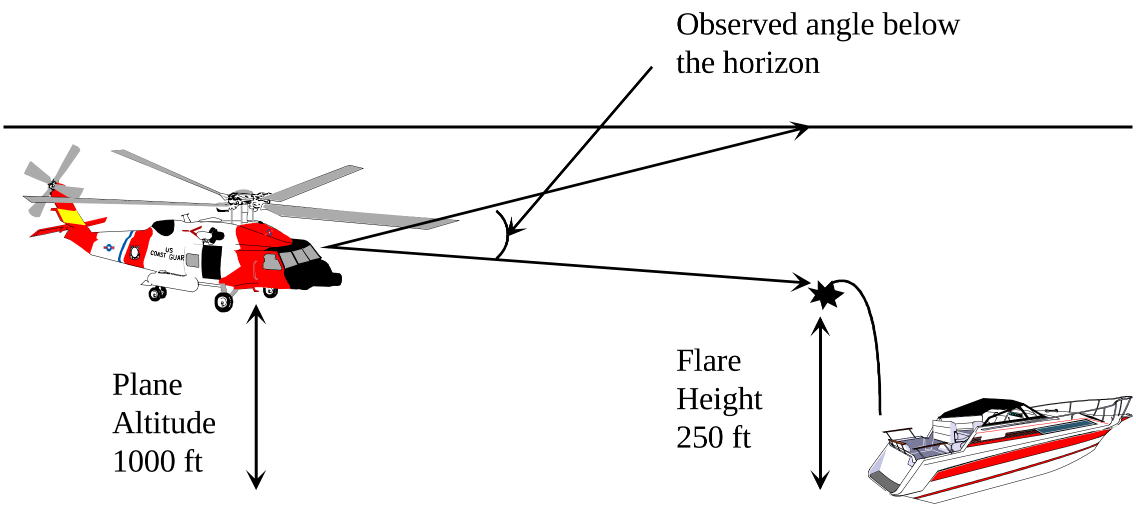

Figure I-6 Observed angle below the horizon

Example: A reporting source with a sextant and a height of eye of 300 feet observes a flare rise to within one degree of the horizon. If the flare's maximum height was 250 feet, it would be only 0.36 nm from the reporting source. If the maximum height was zero and it never actually left the surface, it would be about 2.2 nm away. However, if the reporting source could only estimate the angle as between 0.5 and 2 degrees below the horizon, then the minimum and maximum distances become 0.2 nm and 3.6 nm.

I.4.3 Angle Measured from Origin to Apex

The reporting source may not have a visible horizon to use as a reference for measuring angles, but may be able to estimate the angle between the origin and maximum height of the flare. Because the origin can be seen, the flare must be closer than the distance of the horizon, if the horizon could be seen. However, as stated before, for larger heights of eye the distance of horizon can be many miles away. To determine the maximum distance, and limit the datum area, a flare height of 1200 feet is assumed; and to determine the minimum distance, a flare height of 250 feet is assumed. The reporting source's height is not a factor in these calculations for several reasons. First, it is assumed that the earth is flat between the reporting source and the flare. Thus the horizon, which was used as a reference in the previous methods and whose distance from the reporting source varied with the reporting source's height of eye, is not a factor. Second, even though there are slight differences in the geometry and computed distances for different heights of eye, for the flat earth model and the heights and distances involved, these differences are insignificant. The solution found by using zero for the assumed height of eye and the simple trigonometry of right triangles produces sufficiently accurate results.

Example: If a reporting source with a sextant observes a flare rise to an observed angle of one degree from the flare origin to the apex, it would be about 11.3 nm away if it rose to 1200 feet but only 2.4 nm away if it rose to only 250 feet. However, if the reporting source could only estimate the angle as between 0.5 and 2 degrees, then the minimum and maximum distances become 1.2 nm and 22.6 nm. Figure I-7 illustrates this concept for several vertical angle observations.

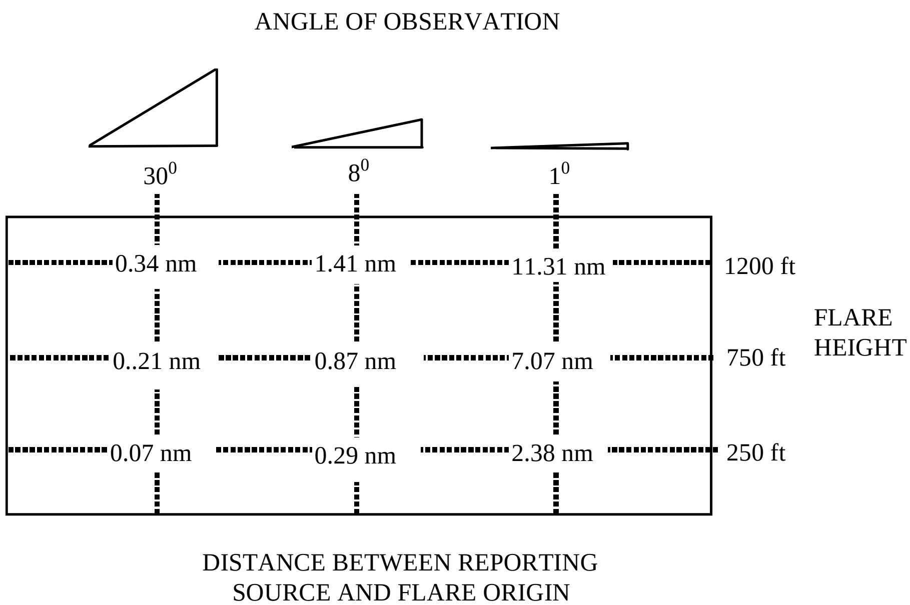

Figure I-7 Relationship of Vertical Angles to Distances (Flat Earth)

I.4.4 Limiting Factors

I.4.4.1 Geographic range. The geographic range is the absolute limiting factor for the maximum distance of all flares from the reporting source. Only rarely will flares be sighted at such an extreme range.

I.4.4.2 Luminous Range. The maximum distance may be limited by the luminous range of the flare at the time and place of the sighting. There is a complex relationship between luminous range and meteorological visibility. Because a flare is a bright source of light, it can be seen at distances greater than the meteorological visibility. As meteorological visibility decreases, so does a flare's luminous range. However, the relationship between the two changes dramatically. As shown in Figure I-8, a flare with a nominal luminous range of 20 nm may have actual luminous ranges from less than two to nearly five times the meteorological visibility. If on-scene visibility is known to be such than even the brightest flare could not be seen at a distance equal to the maximum distance estimated by other means, some portion of the far end of the datum line or area may be eliminated. For a flare having a nominal luminous range of 20 nm, the sample table below shows the actual luminous range under various visibility conditions. Figure I-14, discussed later, may be used to estimate luminous ranges in virtually all situations of practical interest.

On-scene Meteorological Visibility	Luminous Range
0.25 nm (500 yards)	1.2 nm
1 nm	3.5 nm
2 nm	6 nm
5 nm	12 nm
10 nm	20 nm
27 nm	40 nm

Figure I-8 Example of relationships between meteorological visibility and luminous range (for a flare with 20 nm nominal luminous range)

Visibility can be a significant limiting factor, but to be valid, it must be accurately determined for the immediate area of the reporting source at the time of the sighting. The average reporting source may misjudge distances to a visible object, and hence misjudge visibility, especially at night. Horizontal visibility may not have the same diminishing effect on meteor or parachute flares, as these flares may be seen above a ground fog or ground haze.

I.4.4.3 Obstructions. If a flare was definitely seen to rise/fall in front of an obstruction, its distance from the reporting source can be no greater than the distance to the obstruction. Similarly, if the flare is seen behind an obstruction, it can be no closer than the obstruction.

I.4.4.4 Position of origin or point last seen relative to horizon. If the reporting source saw the flare rise and fall between his position and the horizon, and can confidently estimate whether the flare rose from the surface or fell to the surface ¼, ½, ¾, of the distance to the horizon, or near or at the horizon, this information can reinforce other datum indicators or limit the maximum distance. Table H-41 (Table 12 of The American Practical Navigator (Bowditch, ed. 1995)) provides distance of the horizon for various heights of eye. When using this method, caution should be exercised when limiting maximum distance to a value significantly less than the distance of the horizon.

Section I.5
Determining a Datum Area

I.5.1 Single Reporting Source

I.5.1.1 **Plot the reporting source's position on a chart** and draw a circle of radius equal to the reporting source's probable position error around that point.

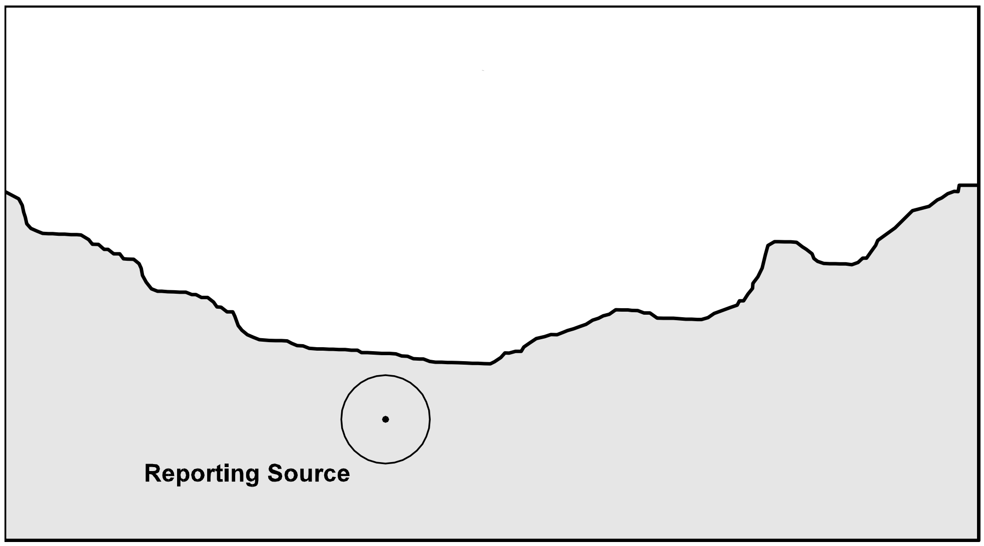

Figure I-9 Step 1: Plotting reporting source position and position error

I.5.1.2 **Draw the line of bearing (LOB) along which the reporting source sighted the flare**, with lines on either side showing the probable bearing error. The LOB should extend at least 20 nm toward the flare, and far enough behind the reporting source to intersect the position error circle on the side opposite the flare.

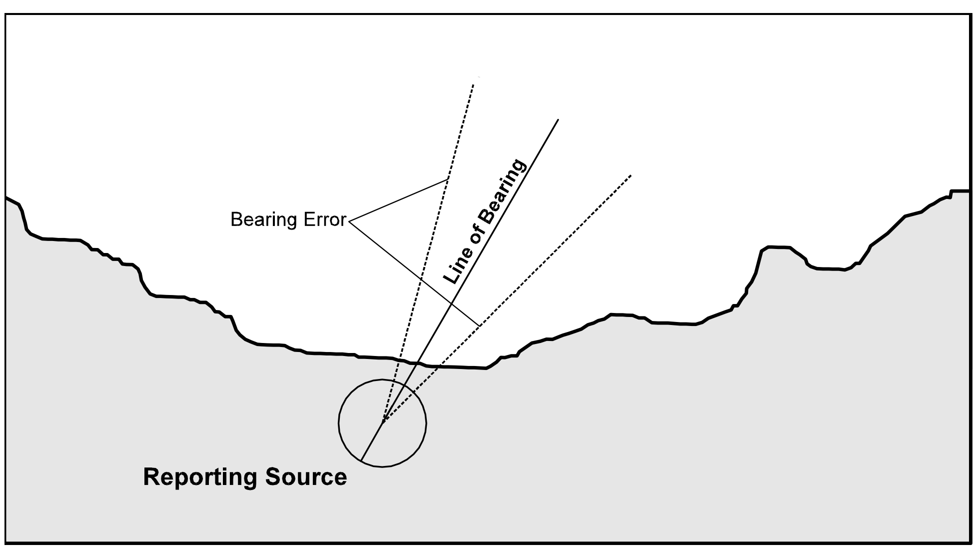

Figure I-10 Step 2: Plotting line of bearing and bearing error

I.5.1.3 Draw a line through the reporting source's position perpendicular to the flare's LOB. At each point where this line crosses the probable position error circle, draw a line parallel to the corresponding bearing error line.

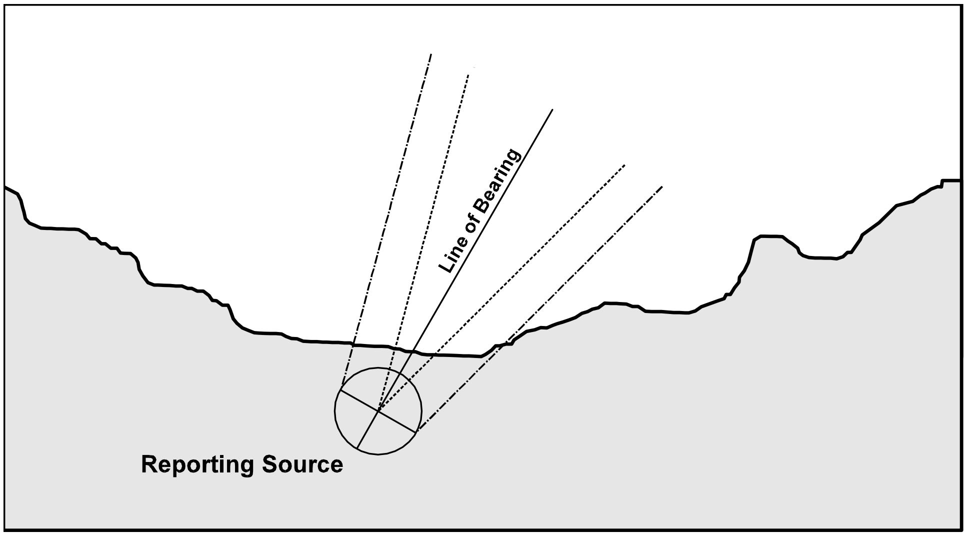

Figure I-11 Step 3: Bearing error including position error

I.5.1.4 Compute minimum and maximum distances by identifying which type of angle has been reported, convert fractions of a fist or numbers of fingers to degrees, and use these angles along with the reporting source's height to reference the appropriate set of minimum and maximum distance tables as described in (a) through (e) below. Determine if on-scene visibility can limit the maximum distance, as described in (f) below.

It is important to note that if a range has been given for the observed angle, the *maximum* angle should be used with the minimum distance table and the *minimum* angle should be used with the maximum distance table. For example, suppose the reporting source states that the flare was "definitely less than a fist, but definitely more than a quarter of a fist." This would be translated to a maximum angle of 8 degrees and a minimum angle of 2 degrees. Use 8 degrees to determine minimum distance, and 2 degrees to determine maximum distance.

(a) If the angle is reported to be **above the horizon**, use Tables I-2a and I-2b as follows:

- Table I-3a, *Minimum Distance to Flare, Angle of Observation Above the Horizon*, determines the closest distance to the flare from the reporting source. Determine the minimum distance by using the maximum observed angle above the horizon. Angles can be determined by converting fractions of a fist to degrees.

  Example: A flare seen ½ of a fist above the horizon, or at an angle of observation of 4 degrees, could be as close as 0.57 nm for a reporting source at 10ft.

- Table I-3b, *Maximum Distance to Flare, Angle of Observation Above the Horizon*, determines the maximum distance to the flare from the reporting source. Determine the maximum distance by using the minimum observed angle above the horizon, converted from fraction of a fist to degrees.

  Example: A flare seen ¼ of a fist above the horizon, or at an angle of observation of 2 degrees would have a maximum distance of 5.63 nm for a reporting source at 10ft.

Given this range of observed angles, the flare must be roughly between 0.6 nm and 5.6 nm from the reporting source - a separation of only 5 nm. A more conservative estimate, obtained by "rounding" the minimum distance down and the maximum distance up the next 0.5 nm increment, would be 0.5 to 6.0 nm from the reporting source.

(b) If the angle is reported to be **below the horizon**, use Tables I-3a and I-3b as follows:

- Table I-4a, *Minimum Distance to Flare, Angle of Observation Below the Horizon*, determines the closest distance to the flare from the reporting source. Determine the minimum distance by using the maximum observed angle below the horizon. Angles can be determined by converting fractions of a fist to degrees.

  Example: A flare seen ½ of a fist below the horizon, or at an angle of observation of 4 degrees, could be as close as 0.11nm for a reporting source at 300 ft.

- Table I-4b, *Maximum Distance to Flare, Angle of Observation Below the Horizon*, determines the maximum distance to the flare from the reporting source. Determine the maximum distance by using the minimum observed angle below the horizon, converted from fraction of a fist to degrees.

  Example: A flare seen ¼ of a fist below the horizon, or at an angle of observation of 2 degrees would have a maximum distance of 1.23 nm for a reporting source at 300 ft.

Given this range of observed angles, the flare must be roughly between 0.1 nm and 1.2 nm from the reporting source - a separation of only 1.1 nm. A more conservative estimate, obtained by "rounding" the minimum distance down and the maximum distance up the next 0.5-mile increment, would be 0.0 to 1.5 nm from the reporting source.

Caution: As angles below the horizon become small, distances increase very rapidly. For example, a flare at zero height above the water observed as 0.5 degrees below the horizon from a height of eye of 260 feet is only 3.23 nm away but such a flare on the horizon could be as far as 18.9 nm away. Only if the flare is observed to be a definite, measurable angle below the horizon should maximum distances based on Table I-4b be used. Otherwise, the distance of the horizon should be used.

(c) If the angle is reported to be **from the origin up to the flare apex**:

The methods used in the two situations above cannot be used if the angle of observation is determined to be from the flare origin to the flare apex. This angle requires a different set of computations. Table I-5, *Distance Range for Angle of Observation from Flare Origin to Apex,* should be used to calculate the distance range using the minimum and maximum angles converted from fractions of a fist.

Example: A flare seen to rise from its origin as much as one fist, or at an angle of observation of 8 degrees, could be as close as 0.29 nm for the reporting source. If the minimum angle observed was ½ of a fist, or an angle of 4 degrees, then the flare could be as much as 2.82 nm from the same reporting source. A more conservative estimate would be between 0.0 and 3.0 nm from the observer.

(d) If the flare is **determined to be a meteor flare**:

- To determine the minimum distance to the flare, Table I-3a, *Minimum Distance to Flare, Angle of Observation Above the Horizon* should be used as in a) above because the minimum height is still assumed to be 250 feet or 10 feet above that of the reporting source for heights of eye greater than 240 feet. It is only the maximum height that has changed.

  Example: A flare seen ½ of a fist above the horizon, or at an angle of observation of 4 degrees, could be as close as 0.57 nm for a reporting source at 10ft.

- If it can be determined from the description of the flare's trajectory that it is a meteor flare, Table I-6 *Maximum Distance for Meteor Flares, Angle of Observation Above the Horizon* should be used to determine the maximum distance. Using this table will significantly reduce the search area and should only be used in those cases where the flare's type is not in question. Determine the maximum distance by using the minimum observed angle above the horizon, converted from fraction of a fist to degrees.

  Example: A flare seen ¼ of a fist above the horizon, or at an angle of observation of 2 degrees would have a maximum distance of 2.35 nm for a reporting source at 10ft.

Given this range of observed angles, the flare must be roughly between 0.6 nm and 2.4 nm from the reporting source - a separation of only 1.8 nm. A more conservative estimate, obtained by “rounding” the minimum distance down and the maximum distance up the next 0.5 nm increment, would be 0.5 to 2.5 nm from the reporting source.

Note: Tables I-3a and I-3b, *Minimum and Maximum Distance to Flare,* (respectively) *Angle of Observation Below the Horizon,* should still be used if the reporting source can identify the type of flare as a meteor because these tables are not affected by flare maximum height. Maximum distances in Table I-4b were calculated using a minimum height of zero. For more information see section I.5.1.4(b) above.

(e) If the flare is **determined to be a hand-held flare**:

If it can be determined from the description of the flare’s trajectory (or lack of one) that it is a hand-held flare, Table I-7 *Distances for Hand-held Flares* should be used to determine the distance using the angle below the horizon. A flare height of 10 feet is assumed.

Example: A flare seen as much as ¾ of a fist below the horizon, or at an angle of observation of 6 degrees, could be as close as 0.14 nm for a reporting source at 100 ft. If the minimum angle observed was ¼ of a fist below the horizon, or an angle of 2 degrees, then the flare could be as much as 0.39 nm from the same reporting source. A more conservative estimate would be between 0.0 and 0.5 nm from the observer, but even this is a very small separation.

Caution: As angles below the horizon become small, distances increase very rapidly. For example, a hand-held flare at a height of 10 feet above the water observed as 0.5 degrees below the horizon from a height of eye of 100 feet is only 1.27 nm away but such a flare on the horizon could be as far as 15.4 nm away (the geographic range found by adding the distances of the horizon from 100 feet and 10 feet). Only if the flare is observed to be a definite, measurable angle below the horizon should maximum distances based on Table I-6 be used. Otherwise, the geographic range should be used at this point.

f) Determine if on-scene visibility can limit the maximum distance by using the largest appropriate nominal range from Figure I-2 and the on-scene visibility with Figure I-14 to determine the luminous range of the flare. Enter the Luminous Range Diagram (Figure I-14) from the right or left vertical scale using the flare’s nominal range. Follow the corresponding horizontal line across to the curve representing the meteorological visibility. Move vertically to read the luminous range from the top or bottom horizontal scale. For example, a flare with a nominal range of 15 nm has a luminous range of 28 nm when the meteorological visibility is 27 nm.

I.5.1.5 Show the minimum and maximum distances as arcs extending to the bearing error lines on either side of the LOB. The center point used to draw the maximum distance arc should be where the LOB intersects the position error circle on the side toward the flare. The center point used to draw the minimum distance arc should be where the LOB intersects the position error circle on the side away from the flare.

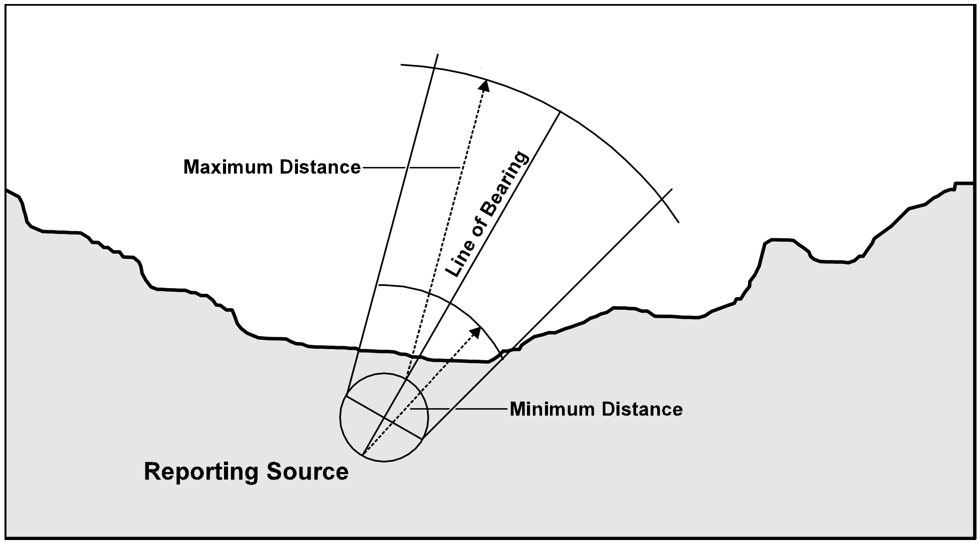

Figure I-12 Step 5: Plotting maximum and minimum arcs

I.5.1.6 Enclose the resulting area in a rectangle as shown in Figure I-13. Multiply the rectangle's length and width by the appropriate safety factor (1.1 for the first search) and draw a second, larger rectangle around the first. This will be the initial datum area and the initial search area.

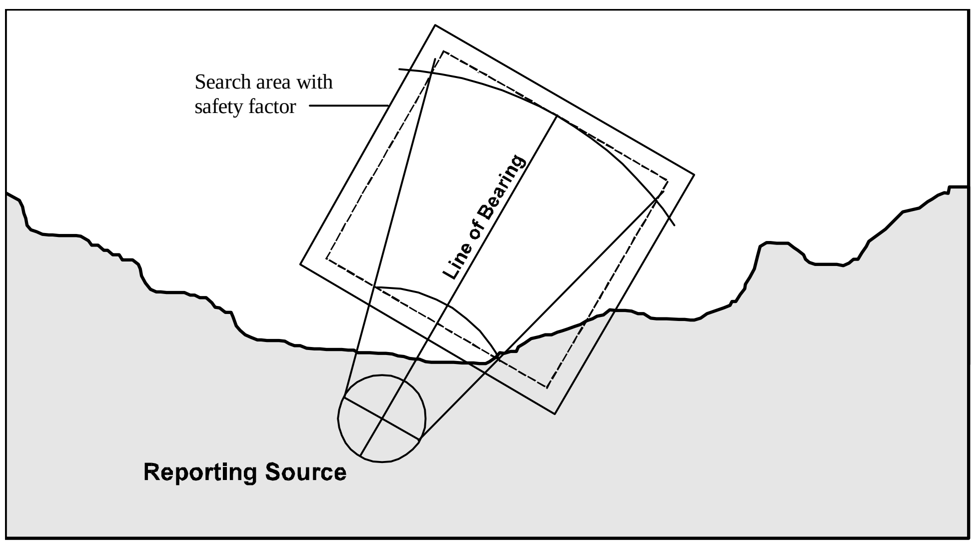

Figure I-13 Step 6: Enclosing the search area, including the safety factor

I.5.1.7 Check with local military and civilian authorities for the presence of operations, including possible fireworks displays. If the position of the sighting plots within a warning or restricted area, contact the controlling authority for possible correlation with activities in that area.

Caution: Although these procedures are designed to produce reasonably conservative results, search planners should not hesitate to expand the size of the search area if they feel it is too small or they have other reasons to believe the plotted area may have a less than 50% chance of containing the flare's origin.

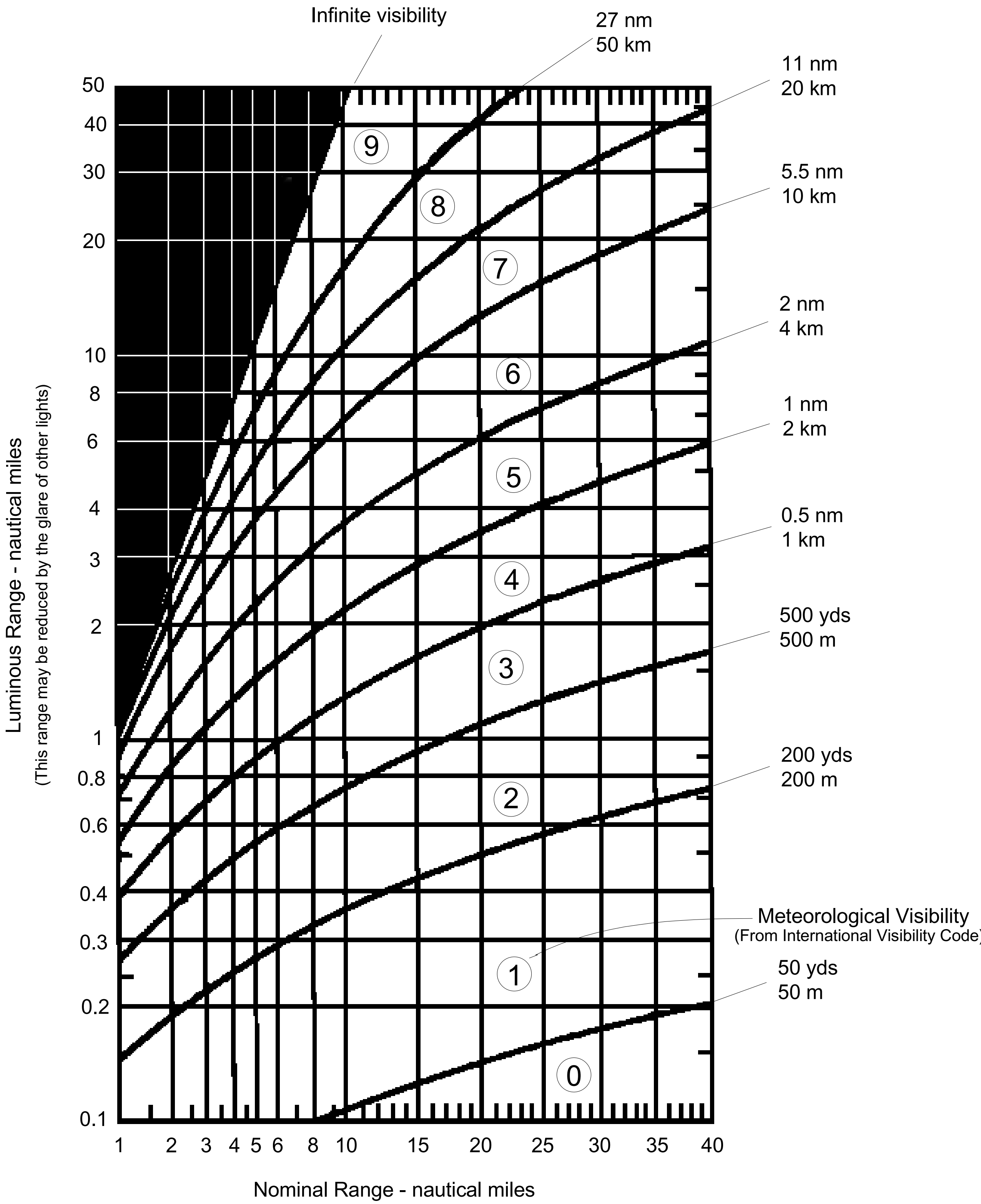

Figure I-14 Luminous Range Diagram (The American Practical Navigator, Bowditch, 1995)

I.5.2 Multiple Reporting Sources

When two or more reliable reporting sources provide good lines of bearing with good crossing angles, determining datum can be accomplished as in Figure I-15. For multiple report cases, determine which three reports are best and use these three reports to complete minimum and maximum calculations. Any time multiple reports are received, even from approximately the same location, the possibility of multiple flares must be considered.

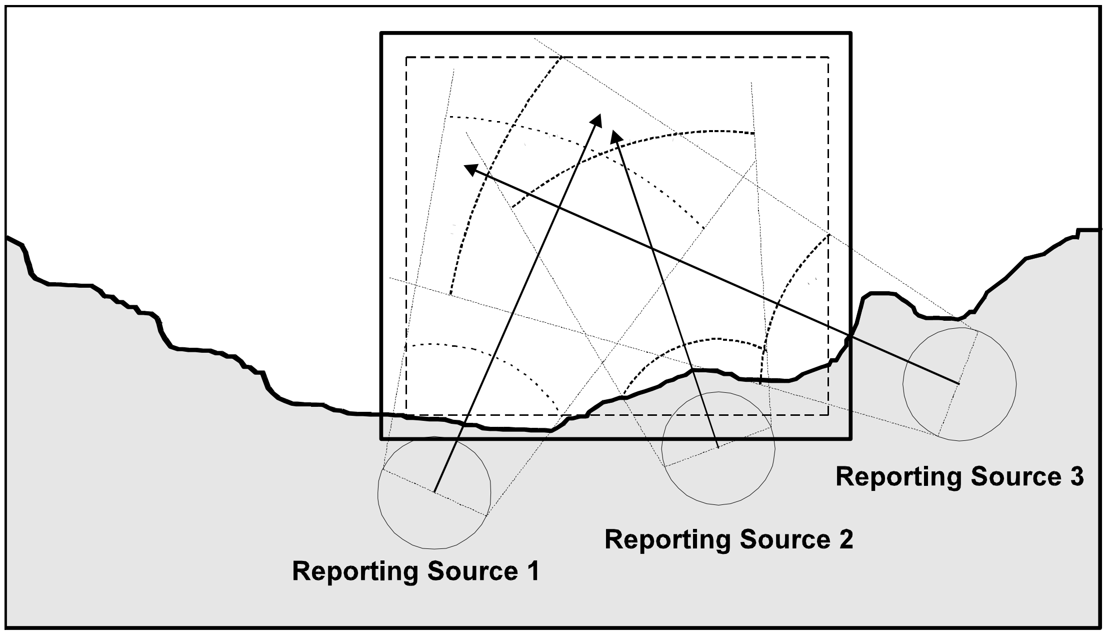

Figure I-15 Reporting sources with different positions

I.5.2.1 Reporting Sources have approximately the same position: Plot each individual reporting source's estimated range and bearing to the flare, properly accounting for the uncertainties in the reporting source's position, bearing estimate and vertical angle estimate. Once all reports are plotted, draw a rectangle that includes all of them, or at least all those that appear to be in reasonable agreement, and expand it by an appropriate safety factor to get the initial datum area and first search area.

I.5.2.2 Reporting Sources have significantly different positions: In this case if all reporting sources saw the same flare, there is a good chance of obtaining a reasonably accurate location for the flare by means of cross bearings. Again, plot each individual report as if it was a single report. Draw a rectangle that includes all of the points where bearing error lines cross and expand it by an appropriate safety factor to get the initial datum area and first search area. To be more conservative, include all the distance uncertainties as well, as shown in Figure I-15.

I.5.3 Search Planning

After establishing a datum area using the procedures outlined above, it will be necessary to plan a search based on this datum. Often it will be necessary to make assumptions about the type of search object based on the sighting report, local knowledge of typical craft and activities in the area, and correlation with other concurrent incidents, overdues, etc. If the difference between the time of the sighting and the SRU's time of arrival on-scene is short, and the search object's drift is likely to be slow, then the rectangle enclosing the datum area may also be used as the search area. The search planner may then proceed with the remainder of the search planning and execution process. However, in areas of high drift rates, when there will be a significant delay in the SRU's arrival on-scene, or a second (e.g., first light) search is planned, the search planner may need to compute a new datum area for the SRU's projected arrival time that accounts for search object drift. This may be accomplished by drifting each corner of the datum area as if it were an initial point datum. This will often result in twice as many datums (8) as corner points (4) due to leeway divergence. When using the manual search planning method or JAWS, draw a probable error circle around each datum and enclose the entire set of circles in a rectangle to obtain the search area. In the event a corner point of the initial datum area falls on shore and it is virtually certain that the flare originated from a position on the water, choose initial datum points that are close to the corner points but in the water. CASP is actually a better tool for handling datum areas, although it is advisable for the search planner to provide case dependent wind and current data for the area of interest rather than rely on CASP's system files when near shore.

Section I.6
Mission Conclusion

I.6.1 Considerations.

Usually, the same challenges and uncertainties experienced throughout the case cumulate one last time as case resolution is sought. Concluding a flare incident also has a great deal in common with concluding other types of incidents.

I.6.2 Suspending Active Search Pending Further Developments

If the incident cannot be definitively resolved and closed, all of the data, information, assumptions, and search results must be carefully reviewed to ensure the search plans were prudent and reasonable in hindsight. The review should ensure:

- All assigned areas were searched;
- PRE and EXCOM searches, if conducted, were completed;
- Cumulative Probability of Detection is as high as possible;
- Compensations were made for weather conditions and any other difficulties encountered during the search.

Also review any other unresolved or pending cases, including:

- Uncorrelated mayday calls;
- Overdue or unreported cases;
- EPIRB or ELT alerts;
- Any other flare sightings.

If any new clues or information develop, consider reopening the case.

I.6.3 Closing a Case

If the source of the flare is located and it can be confirmed with the person(s) involved that they did in fact launch the flare(s) that initiated the case, then the case may be closed. Even if a distressed vessel is located, confirming that the person(s) on board launched the flare(s) is required to ensure that the flares did not come from some other source. In the absence of such confirmation, the possibility of another incident must be considered.

Report taken by: ____ Date: ______________

FLARE SIGHTING CHECKSHEET	
OBTAIN A CLEAR MENTAL PICTURE OF WHAT THE R/S OBSERVED	
Flare color: **RED AMBER WHITE GREEN OTHER** Number observed:_____ Type of flares: **PARACHUTE HANDHELD METEOR OTHER** Time interval between flares: ___________ Duration of burn: __________ Trajectory: **RISE FALL ARC STEADY OTHER**	
R/S position: Position uncertainty: +/- _________NM	
Determining The Angle Of Elevation	
To determine the angle of elevation, particularly from the inexperienced R/S, ask the R/S to hold his/her arm at arm's length, make a fist, and place the bottom of the fist on the horizon. If the elevation of the flare is ABOVE the fist, the angle is greater than 8 degrees. Any elevation above 8 degrees can be approximated as the distance to the flare is within 1 NM. If the elevation is BELOW the top of the fist, ascertain how high up the fist, i.e. ¼, ½, ¾ or number of fingers. The distance to the source of the flare is much greater for any angle below 8 Degrees. Refer to the CG Addendum to NSS for conversion table.	
Angle of elevation: _____DEG NLT _____DEG NMT _____DEG How determined: ____ Distance from R/S based on angle of elevation (as per NSM): NLT _____NM +/-_____NM NMT _____NM +/-_____NM Bearing from R/S: _____ DEG T/M +/- _____DEG	
Apparent origin of flare: **SURFACE AIR OTHER** Relation to the horizon: **ABOVE BELOW ON OTHER** R/S height of eye _____FT Any VSLS/ACFT sighted in vic: _______ Obstruction in line of sight: Trees Bldgs Other:__________________________________ Orientation of Flare to shoreline: deg / o'clock	
Reporting Source Response/Amplifying Info	
<u>If R/S is on a Vessel</u>: Will R/S respond to sighting: Y N ETA O/S: _________ Intended action by R/S:	<u>If R/S is on Land:</u> Will R/S remain on phone (or O/S) to vector SRU: Y N Advise R/S of Coast Guard intentions:
R/S Name:	Callback Number:
Action To Be Taken By Coast Guard	
<u>Determine if flare sighting corresponds to</u>: Other flare sightings: Y N Known SAR cases: Y N Known Exercises in progress: Y N Known Overdues: Y N Warning Area Location: __________________________ Exercise Time: ____________ Is there Correlating SAR?: Y N Describe:	
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FLARE SIGHTING CHECKSHEET
****ALWAYS treat RED and ORANGE flares as DISTRESS SAR cases ! !**
Brief GROUP/DISTRICT. DISRICT IS TO BE NOTIFIED IMMEDIATELY ON ALL F/S.

Evaluate EMERGENCY SAR PHASE: **DISTRESS ALERT UNCERTAINTY**

Issue UMIB: Y N Time issued: __________

First light search: Y N (If No reason why)

Additional information:

Obtain a clear mental picture of what the reporting source observed.

Draw Sketch Here:

1 fist --
3/4 fist --
Angle above horizon 1/2 fist --
1/4 fist --
HORIZON --
1/4 fist --
Angle below horizon 1/2 fist --
3/4 fist --
1 fist --

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Table I-3a Angle of Observation Above the Horizon; Minimum Distance to the Flare (nm)

Reporting Source Height ft	0.50°	1.00°	1.50°	2.00°	2.50°	3.00°	3.50°	4.00°	5.00°	6.00°	7.00°	8.00°	10.00°	12.00°	14.00°	16.00°
10	4.68	2.35	1.55	1.16	0.92	0.77	0.65	0.57	0.46	0.38	0.32	0.28	0.23	0.19	0.16	0.14
20	4.71	2.31	1.51	1.12	0.89	0.74	0.63	0.55	0.44	0.36	0.31	0.27	0.22	0.18	0.15	0.13
30	4.69	2.25	1.46	1.08	0.86	0.71	0.61	0.53	0.42	0.35	0.30	0.26	0.21	0.17	0.15	0.13
40	4.64	2.18	1.41	1.04	0.83	0.68	0.58	0.51	0.40	0.33	0.29	0.25	0.20	0.16	0.14	0.12
50	4.57	2.11	1.36	1.00	0.79	0.65	0.56	0.49	0.39	0.32	0.27	0.24	0.19	0.16	0.13	0.12
60	4.47	2.03	1.30	0.96	0.76	0.62	0.53	0.46	0.37	0.30	0.26	0.23	0.18	0.15	0.13	0.11
70	4.37	1.95	1.24	0.91	0.72	0.59	0.50	0.44	0.35	0.29	0.25	0.21	0.17	0.14	0.12	0.10
80	4.25	1.87	1.19	0.87	0.68	0.56	0.48	0.42	0.33	0.27	0.23	0.20	0.16	0.13	0.11	0.10
90	4.12	1.78	1.12	0.82	0.64	0.53	0.45	0.39	0.31	0.26	0.22	0.19	0.15	0.13	0.11	0.09
100	3.97	1.69	1.06	0.77	0.61	0.50	0.42	0.37	0.29	0.24	0.21	0.18	0.14	0.12	0.10	0.09
110	3.81	1.59	1.00	0.72	0.57	0.47	0.40	0.35	0.27	0.23	0.19	0.17	0.13	0.11	0.09	0.08
120	3.64	1.50	0.93	0.68	0.53	0.44	0.37	0.32	0.25	0.21	0.18	0.16	0.12	0.10	0.09	0.08
130	3.46	1.40	0.87	0.63	0.49	0.40	0.34	0.30	0.24	0.19	0.17	0.14	0.11	0.09	0.08	0.07
140	3.26	1.29	0.80	0.58	0.45	0.37	0.31	0.27	0.22	0.18	0.15	0.13	0.10	0.09	0.07	0.06
150	3.05	1.19	0.73	0.53	0.41	0.34	0.29	0.25	0.20	0.16	0.14	0.12	0.10	0.08	0.07	0.06
160	2.83	1.08	0.66	0.48	0.37	0.30	0.26	0.22	0.18	0.15	0.12	0.11	0.09	0.07	0.06	0.05
170	2.59	0.97	0.59	0.43	0.33	0.27	0.23	0.20	0.16	0.13	0.11	0.10	0.08	0.06	0.05	0.05
180	2.34	0.86	0.52	0.37	0.29	0.24	0.20	0.18	0.14	0.11	0.10	0.08	0.07	0.06	0.05	0.04
190	2.07	0.74	0.45	0.32	0.25	0.20	0.17	0.15	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03
200	1.78	0.62	0.38	0.27	0.21	0.17	0.14	0.13	0.10	0.08	0.07	0.06	0.05	0.04	0.03	0.03
220	1.15	0.38	0.23	0.16	0.13	0.10	0.09	0.08	0.06	0.05	0.04	0.04	0.03	0.02	0.02	0.02
240	0.41	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
260	0.43	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
280	0.45	0.13	0.08	0.06	0.04	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
300	0.48	0.14	0.08	0.06	0.04	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
320	0.50	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
340	0.53	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
360	0.56	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
380	0.59	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
400	0.62	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
420	0.66	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
440	0.70	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
460	0.75	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
480	0.80	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
500	0.85	0.16	0.09	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
520	0.91	0.16	0.09	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
540	0.98	0.16	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
560	1.05	0.16	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
580	1.14	0.16	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
600	1.24	0.17	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
620	1.35	0.17	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
640	1.47	0.17	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
660	1.62	0.17	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
680	1.78	0.17	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
700	1.98	0.18	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
720	2.20	0.18	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
740	2.45	0.18	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
760	2.74	0.18	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
780	3.07	0.19	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
800	3.44	0.19	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
820	3.84	0.19	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
840	4.27	0.19	0.10	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
860	4.74	0.20	0.10	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
880	5.24	0.20	0.10	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
900	5.76	0.20	0.10	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
920	6.29	0.20	0.10	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
940	6.85	0.21	0.10	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
960	7.41	0.21	0.10	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
980	7.98	0.21	0.10	0.07	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
1000	8.56	0.21	0.10	0.07	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01

Table I-3b Angle of Observation Above the Horizon; Maximum Distance to the Flare (nm)

Reporting Source Height ft	0.50 ^{0}	1.00 ^{0}	1.50 ^{0}	2.00 ^{0}	2.50 ^{0}	3.00 ^{0}	3.50 ^{0}	4.00 ^{0}	5.00 ^{0}	6.00 ^{0}	7.00 ^{0}	8.00 ^{0}	10.00 ^{0}	12.00 ^{0}	14.00 ^{0}	16.00 ^{0}
10	18.69	10.84	7.44	5.63	4.52	3.77	3.23	2.82	2.25	1.87	1.60	1.40	1.12	0.92	0.79	0.68
20	19.16	10.98	7.49	5.65	4.52	3.76	3.22	2.81	2.25	1.87	1.60	1.39	1.11	0.92	0.78	0.68
30	19.50	11.08	7.52	5.65	4.51	3.75	3.21	2.80	2.23	1.86	1.59	1.38	1.10	0.91	0.78	0.68
40	19.77	11.14	7.53	5.65	4.50	3.74	3.20	2.79	2.22	1.85	1.58	1.37	1.09	0.91	0.77	0.67
50	20.01	11.19	7.54	5.64	4.49	3.73	3.18	2.78	2.21	1.83	1.57	1.37	1.09	0.90	0.77	0.66
60	20.22	11.23	7.53	5.62	4.47	3.71	3.17	2.76	2.20	1.82	1.55	1.36	1.08	0.89	0.76	0.66
70	20.40	11.26	7.53	5.61	4.45	3.69	3.15	2.74	2.18	1.81	1.54	1.35	1.07	0.89	0.75	0.65
80	20.57	11.28	7.51	5.59	4.43	3.67	3.13	2.73	2.17	1.80	1.53	1.34	1.06	0.88	0.75	0.65
90	20.73	11.29	7.50	5.57	4.41	3.65	3.11	2.71	2.15	1.78	1.52	1.33	1.05	0.87	0.74	0.64
100	20.87	11.30	7.48	5.54	4.39	3.63	3.09	2.69	2.14	1.77	1.51	1.31	1.04	0.86	0.73	0.64
110	21.00	11.31	7.46	5.52	4.37	3.61	3.07	2.67	2.12	1.76	1.50	1.30	1.04	0.86	0.73	0.63
120	21.12	11.30	7.44	5.49	4.34	3.59	3.05	2.65	2.10	1.74	1.49	1.29	1.03	0.85	0.72	0.63
130	21.23	11.30	7.41	5.47	4.32	3.56	3.03	2.64	2.09	1.73	1.47	1.28	1.02	0.84	0.72	0.62
140	21.33	11.29	7.39	5.44	4.29	3.54	3.01	2.62	2.07	1.71	1.46	1.27	1.01	0.83	0.71	0.62
150	21.43	11.28	7.36	5.41	4.27	3.52	2.99	2.60	2.06	1.70	1.45	1.26	1.00	0.83	0.70	0.61
160	21.52	11.27	7.33	5.38	4.24	3.49	2.97	2.58	2.04	1.69	1.44	1.25	0.99	0.82	0.70	0.61
170	21.61	11.25	7.30	5.35	4.21	3.47	2.94	2.56	2.02	1.67	1.42	1.24	0.98	0.81	0.69	0.60
180	21.69	11.23	7.26	5.32	4.18	3.44	2.92	2.54	2.01	1.66	1.41	1.23	0.97	0.81	0.68	0.59
190	21.77	11.21	7.23	5.29	4.15	3.42	2.90	2.52	1.99	1.64	1.40	1.22	0.97	0.80	0.68	0.59
200	21.84	11.18	7.20	5.25	4.12	3.39	2.88	2.50	1.97	1.63	1.39	1.21	0.96	0.79	0.67	0.58
220	21.97	11.13	7.12	5.19	4.06	3.34	2.83	2.45	1.94	1.60	1.36	1.18	0.94	0.78	0.66	0.57
240	22.09	11.06	7.04	5.11	4.00	3.28	2.78	2.41	1.90	1.57	1.34	1.16	0.92	0.76	0.65	0.56
260	22.19	10.99	6.96	5.04	3.94	3.23	2.73	2.37	1.87	1.54	1.31	1.14	0.90	0.75	0.63	0.55
280	22.28	10.91	6.87	4.97	3.88	3.17	2.68	2.33	1.83	1.51	1.29	1.12	0.88	0.73	0.62	0.54
300	22.35	10.83	6.79	4.89	3.81	3.12	2.64	2.28	1.80	1.48	1.26	1.09	0.87	0.71	0.61	0.53
320	22.42	10.73	6.69	4.81	3.74	3.06	2.58	2.24	1.76	1.45	1.23	1.07	0.85	0.70	0.59	0.52
340	22.47	10.64	6.60	4.73	3.68	3.00	2.53	2.19	1.72	1.42	1.21	1.05	0.83	0.68	0.58	0.50
360	22.52	10.53	6.50	4.65	3.61	2.94	2.48	2.15	1.69	1.39	1.18	1.03	0.81	0.67	0.57	0.49
380	22.56	10.42	6.40	4.56	3.54	2.88	2.43	2.10	1.65	1.36	1.15	1.00	0.79	0.65	0.55	0.48
400	22.58	10.30	6.29	4.48	3.47	2.82	2.38	2.06	1.61	1.33	1.13	0.98	0.77	0.64	0.54	0.47
420	22.60	10.18	6.18	4.39	3.39	2.76	2.33	2.01	1.58	1.30	1.10	0.96	0.75	0.62	0.53	0.46
440	22.61	10.06	6.07	4.30	3.32	2.70	2.27	1.96	1.54	1.27	1.07	0.93	0.74	0.61	0.52	0.45
460	22.61	9.92	5.96	4.21	3.25	2.64	2.22	1.92	1.50	1.23	1.05	0.91	0.72	0.59	0.50	0.44
480	22.60	9.78	5.85	4.12	3.17	2.57	2.17	1.87	1.46	1.20	1.02	0.89	0.70	0.58	0.49	0.42
500	22.59	9.64	5.73	4.03	3.10	2.51	2.11	1.82	1.43	1.17	0.99	0.86	0.68	0.56	0.48	0.41
520	22.56	9.49	5.61	3.93	3.02	2.45	2.06	1.77	1.39	1.14	0.97	0.84	0.66	0.54	0.46	0.40
540	22.53	9.34	5.48	3.84	2.94	2.38	2.00	1.72	1.35	1.11	0.94	0.81	0.64	0.53	0.45	0.39
560	22.49	9.18	5.36	3.74	2.86	2.32	1.95	1.68	1.31	1.08	0.91	0.79	0.62	0.51	0.44	0.38
580	22.44	9.01	5.23	3.64	2.79	2.25	1.89	1.63	1.27	1.04	0.88	0.77	0.60	0.50	0.42	0.37
600	22.39	8.84	5.10	3.54	2.71	2.19	1.83	1.58	1.23	1.01	0.86	0.74	0.59	0.48	0.41	0.35
620	22.32	8.66	4.97	3.44	2.63	2.12	1.78	1.53	1.19	0.98	0.83	0.72	0.57	0.47	0.40	0.34
640	22.25	8.48	4.83	3.34	2.54	2.05	1.72	1.48	1.15	0.95	0.80	0.69	0.55	0.45	0.38	0.33
660	22.17	8.29	4.69	3.24	2.46	1.99	1.66	1.43	1.11	0.91	0.77	0.67	0.53	0.43	0.37	0.32
680	22.08	8.09	4.55	3.13	2.38	1.92	1.60	1.38	1.08	0.88	0.75	0.65	0.51	0.42	0.36	0.31
700	21.98	7.89	4.41	3.03	2.30	1.85	1.55	1.33	1.04	0.85	0.72	0.62	0.49	0.40	0.34	0.30
720	21.87	7.68	4.27	2.92	2.21	1.78	1.49	1.28	1.00	0.82	0.69	0.60	0.47	0.39	0.33	0.28
740	21.75	7.47	4.12	2.81	2.13	1.71	1.43	1.23	0.96	0.78	0.66	0.57	0.45	0.37	0.31	0.27
760	21.63	7.25	3.97	2.70	2.04	1.64	1.37	1.18	0.92	0.75	0.63	0.55	0.43	0.36	0.30	0.26
780	21.49	7.02	3.82	2.59	1.96	1.57	1.31	1.12	0.88	0.72	0.61	0.52	0.41	0.34	0.29	0.25
800	21.34	6.79	3.66	2.48	1.87	1.50	1.25	1.07	0.83	0.68	0.58	0.50	0.39	0.32	0.27	0.24
820	21.18	6.54	3.50	2.37	1.78	1.43	1.19	1.02	0.79	0.65	0.55	0.47	0.37	0.31	0.26	0.23
840	21.01	6.29	3.34	2.25	1.69	1.36	1.13	0.97	0.75	0.62	0.52	0.45	0.35	0.29	0.25	0.21
860	20.82	6.04	3.18	2.14	1.61	1.29	1.07	0.92	0.71	0.58	0.49	0.43	0.33	0.28	0.23	0.20
880	20.62	5.77	3.02	2.02	1.52	1.21	1.01	0.87	0.67	0.55	0.46	0.40	0.32	0.26	0.22	0.19
900	20.41	5.50	2.85	1.90	1.43	1.14	0.95	0.81	0.63	0.51	0.43	0.38	0.30	0.24	0.21	0.18
920	20.18	5.21	2.68	1.79	1.34	1.07	0.89	0.76	0.59	0.48	0.41	0.35	0.28	0.23	0.19	0.17
940	19.94	4.92	2.51	1.67	1.24	0.99	0.83	0.71	0.55	0.45	0.38	0.33	0.26	0.21	0.18	0.15
960	19.68	4.62	2.33	1.54	1.15	0.92	0.76	0.65	0.51	0.41	0.35	0.30	0.24	0.19	0.17	0.14
980	19.39	4.31	2.15	1.42	1.06	0.84	0.70	0.60	0.46	0.38	0.32	0.28	0.22	0.18	0.15	0.13
1000	19.09	3.99	1.97	1.30	0.97	0.77	0.64	0.55	0.42	0.35	0.29	0.25	0.20	0.16	0.14	0.12

Table I-4a Angle of Observation Below the Horizon; Minimum Distance to the Flare (nm)

Reporting Source Height ft	0.50°	1.00°	1.50°	2.00°	2.50°	3.00°	3.50°	4.00°	5.00°	6.00°	7.00°	8.00°	10.00°	12.00°	14.00°	16.00°
10	0.17	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
20	0.16	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
30	0.16	0.09	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
40	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
50	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
60	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
70	0.15	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
80	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
90	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
100	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
110	0.14	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
120	0.14	0.08	0.06	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
130	0.13	0.08	0.06	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
140	0.13	0.08	0.06	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
150	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
160	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
170	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
180	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
190	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
200	0.13	0.08	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
220	0.12	0.07	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
240	0.12	0.07	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
260	0.12	0.07	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
280	0.36	0.22	0.16	0.12	0.10	0.09	0.07	0.07	0.05	0.04	0.04	0.03	0.03	0.02	0.02	0.02
300	0.59	0.36	0.26	0.20	0.17	0.14	0.12	0.11	0.09	0.07	0.06	0.06	0.05	0.04	0.03	0.03
320	0.81	0.50	0.36	0.28	0.23	0.20	0.17	0.15	0.12	0.10	0.09	0.08	0.06	0.05	0.05	0.04
340	1.04	0.64	0.47	0.36	0.30	0.25	0.22	0.20	0.16	0.13	0.12	0.10	0.08	0.07	0.06	0.05
360	1.26	0.78	0.57	0.44	0.37	0.31	0.27	0.24	0.19	0.16	0.14	0.12	0.10	0.08	0.07	0.06
380	1.47	0.92	0.67	0.52	0.43	0.37	0.32	0.28	0.23	0.19	0.17	0.15	0.12	0.10	0.08	0.07
400	1.68	1.05	0.76	0.60	0.50	0.42	0.37	0.32	0.26	0.22	0.19	0.17	0.14	0.11	0.10	0.08
420	1.89	1.18	0.86	0.68	0.56	0.48	0.41	0.37	0.30	0.25	0.22	0.19	0.15	0.13	0.11	0.10
440	2.10	1.32	0.96	0.76	0.62	0.53	0.46	0.41	0.33	0.28	0.24	0.21	0.17	0.14	0.12	0.11
460	2.30	1.45	1.06	0.83	0.69	0.59	0.51	0.45	0.37	0.31	0.27	0.23	0.19	0.16	0.13	0.12
480	2.50	1.58	1.15	0.91	0.75	0.64	0.56	0.49	0.40	0.34	0.29	0.26	0.21	0.17	0.15	0.13
500	2.70	1.70	1.25	0.99	0.81	0.69	0.60	0.54	0.44	0.37	0.32	0.28	0.22	0.19	0.16	0.14
520	2.89	1.83	1.34	1.06	0.88	0.75	0.65	0.58	0.47	0.40	0.34	0.30	0.24	0.20	0.17	0.15
540	3.08	1.96	1.44	1.14	0.94	0.80	0.70	0.62	0.50	0.42	0.37	0.32	0.26	0.22	0.19	0.16
560	3.27	2.08	1.53	1.21	1.00	0.86	0.75	0.66	0.54	0.45	0.39	0.34	0.28	0.23	0.20	0.17
580	3.46	2.21	1.62	1.29	1.06	0.91	0.79	0.70	0.57	0.48	0.42	0.37	0.30	0.25	0.21	0.18
600	3.65	2.33	1.72	1.36	1.13	0.96	0.84	0.74	0.61	0.51	0.44	0.39	0.31	0.26	0.22	0.20
620	3.83	2.45	1.81	1.43	1.19	1.01	0.88	0.78	0.64	0.54	0.47	0.41	0.33	0.28	0.24	0.21
640	4.02	2.58	1.90	1.51	1.25	1.07	0.93	0.83	0.67	0.57	0.49	0.43	0.35	0.29	0.25	0.22
660	4.20	2.70	1.99	1.58	1.31	1.12	0.98	0.87	0.71	0.60	0.52	0.45	0.37	0.31	0.26	0.23
680	4.38	2.82	2.08	1.65	1.37	1.17	1.02	0.91	0.74	0.62	0.54	0.48	0.38	0.32	0.27	0.24
700	4.55	2.94	2.17	1.73	1.43	1.22	1.07	0.95	0.77	0.65	0.56	0.50	0.40	0.33	0.29	0.25
720	4.73	3.05	2.26	1.80	1.49	1.28	1.11	0.99	0.81	0.68	0.59	0.52	0.42	0.35	0.30	0.26
740	4.91	3.17	2.35	1.87	1.55	1.33	1.16	1.03	0.84	0.71	0.61	0.54	0.44	0.36	0.31	0.27
760	5.08	3.29	2.44	1.94	1.61	1.38	1.21	1.07	0.87	0.74	0.64	0.56	0.45	0.38	0.32	0.28
780	5.25	3.40	2.53	2.01	1.67	1.43	1.25	1.11	0.91	0.77	0.66	0.58	0.47	0.39	0.34	0.29
800	5.42	3.52	2.62	2.09	1.73	1.48	1.30	1.15	0.94	0.79	0.69	0.61	0.49	0.41	0.35	0.31
820	5.59	3.64	2.70	2.16	1.79	1.54	1.34	1.19	0.97	0.82	0.71	0.63	0.51	0.42	0.36	0.32
840	5.76	3.75	2.79	2.23	1.85	1.59	1.39	1.23	1.01	0.85	0.74	0.65	0.52	0.44	0.37	0.33
860	5.92	3.86	2.88	2.30	1.91	1.64	1.43	1.27	1.04	0.88	0.76	0.67	0.54	0.45	0.39	0.34
880	6.09	3.98	2.97	2.37	1.97	1.69	1.48	1.31	1.07	0.91	0.78	0.69	0.56	0.47	0.40	0.35
900	6.25	4.09	3.05	2.44	2.03	1.74	1.52	1.35	1.11	0.93	0.81	0.71	0.58	0.48	0.41	0.36
920	6.42	4.20	3.14	2.51	2.09	1.79	1.57	1.39	1.14	0.96	0.83	0.73	0.59	0.50	0.43	0.37
940	6.58	4.31	3.22	2.58	2.15	1.84	1.61	1.43	1.17	0.99	0.86	0.76	0.61	0.51	0.44	0.38
960	6.74	4.42	3.31	2.65	2.21	1.89	1.66	1.47	1.20	1.02	0.88	0.78	0.63	0.52	0.45	0.39
980	6.90	4.53	3.39	2.71	2.26	1.94	1.70	1.51	1.24	1.05	0.91	0.80	0.64	0.54	0.46	0.40
1000	7.06	4.64	3.48	2.78	2.32	1.99	1.74	1.55	1.27	1.07	0.93	0.82	0.66	0.55	0.48	0.41

Table I-4b Angle of Observation Below Horizon; Maximum Distance to the Flare (nm)

Reporting Source Height ft	0.50°	1.00°	1.50°	2.00°	2.50°	3.00°	3.50°	4.00°	5.00°	6.00°	7.00°	8.00°	10.00°	12.00°	14.00°	16.00°
10	0.17	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
20	0.33	0.17	0.12	0.09	0.07	0.06	0.05	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01
30	0.48	0.26	0.18	0.13	0.11	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02
40	0.62	0.34	0.23	0.18	0.14	0.12	0.10	0.09	0.07	0.06	0.05	0.05	0.04	0.03	0.03	0.02
50	0.76	0.42	0.29	0.22	0.18	0.15	0.13	0.11	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.03
60	0.90	0.50	0.35	0.26	0.21	0.18	0.16	0.14	0.11	0.09	0.08	0.07	0.06	0.05	0.04	0.03
70	1.03	0.58	0.40	0.31	0.25	0.21	0.18	0.16	0.13	0.11	0.09	0.08	0.06	0.05	0.05	0.04
80	1.16	0.65	0.46	0.35	0.28	0.24	0.21	0.18	0.15	0.12	0.10	0.09	0.07	0.06	0.05	0.05
90	1.29	0.73	0.51	0.39	0.32	0.27	0.23	0.20	0.16	0.14	0.12	0.10	0.08	0.07	0.06	0.05
100	1.42	0.80	0.56	0.43	0.35	0.30	0.26	0.23	0.18	0.15	0.13	0.11	0.09	0.08	0.07	0.06
110	1.54	0.88	0.62	0.47	0.39	0.33	0.28	0.25	0.20	0.17	0.14	0.13	0.10	0.08	0.07	0.06
120	1.66	0.95	0.67	0.52	0.42	0.35	0.31	0.27	0.22	0.18	0.16	0.14	0.11	0.09	0.08	0.07
130	1.78	1.03	0.72	0.56	0.45	0.38	0.33	0.29	0.23	0.20	0.17	0.15	0.12	0.10	0.08	0.07
140	1.90	1.10	0.77	0.60	0.49	0.41	0.36	0.31	0.25	0.21	0.18	0.16	0.13	0.11	0.09	0.08
150	2.02	1.17	0.83	0.64	0.52	0.44	0.38	0.33	0.27	0.23	0.19	0.17	0.14	0.11	0.10	0.08
160	2.13	1.24	0.88	0.68	0.55	0.47	0.40	0.36	0.29	0.24	0.21	0.18	0.15	0.12	0.10	0.09
170	2.25	1.31	0.93	0.72	0.59	0.50	0.43	0.38	0.31	0.26	0.22	0.19	0.15	0.13	0.11	0.10
180	2.36	1.38	0.98	0.76	0.62	0.52	0.45	0.40	0.32	0.27	0.23	0.20	0.16	0.14	0.12	0.10
190	2.47	1.45	1.03	0.80	0.65	0.55	0.48	0.42	0.34	0.29	0.25	0.22	0.17	0.14	0.12	0.11
200	2.59	1.52	1.08	0.84	0.69	0.58	0.50	0.44	0.36	0.30	0.26	0.23	0.18	0.15	0.13	0.11
220	2.80	1.66	1.18	0.92	0.75	0.64	0.55	0.49	0.39	0.33	0.28	0.25	0.20	0.17	0.14	0.12
240	3.02	1.80	1.28	1.00	0.82	0.69	0.60	0.53	0.43	0.36	0.31	0.27	0.22	0.18	0.16	0.14
260	3.23	1.93	1.38	1.08	0.88	0.75	0.65	0.57	0.46	0.39	0.33	0.29	0.24	0.20	0.17	0.15
280	3.44	2.06	1.48	1.15	0.95	0.80	0.70	0.61	0.50	0.42	0.36	0.32	0.25	0.21	0.18	0.16
300	3.64	2.19	1.58	1.23	1.01	0.86	0.74	0.66	0.53	0.45	0.38	0.34	0.27	0.23	0.19	0.17
320	3.84	2.32	1.67	1.31	1.07	0.91	0.79	0.70	0.57	0.48	0.41	0.36	0.29	0.24	0.21	0.18
340	4.04	2.45	1.77	1.38	1.14	0.96	0.84	0.74	0.60	0.50	0.44	0.38	0.31	0.26	0.22	0.19
360	4.24	2.58	1.86	1.46	1.20	1.02	0.88	0.78	0.63	0.53	0.46	0.40	0.32	0.27	0.23	0.20
380	4.43	2.71	1.96	1.53	1.26	1.07	0.93	0.82	0.67	0.56	0.49	0.43	0.34	0.29	0.24	0.21
400	4.62	2.83	2.05	1.61	1.32	1.13	0.98	0.87	0.70	0.59	0.51	0.45	0.36	0.30	0.26	0.22
420	4.81	2.96	2.14	1.68	1.39	1.18	1.03	0.91	0.74	0.62	0.53	0.47	0.38	0.32	0.27	0.24
440	4.99	3.08	2.24	1.76	1.45	1.23	1.07	0.95	0.77	0.65	0.56	0.49	0.40	0.33	0.28	0.25
460	5.18	3.20	2.33	1.83	1.51	1.29	1.12	0.99	0.80	0.68	0.58	0.51	0.41	0.34	0.30	0.26
480	5.36	3.32	2.42	1.91	1.57	1.34	1.16	1.03	0.84	0.71	0.61	0.54	0.43	0.36	0.31	0.27
500	5.54	3.44	2.51	1.98	1.63	1.39	1.21	1.07	0.87	0.73	0.63	0.56	0.45	0.37	0.32	0.28
520	5.72	3.56	2.60	2.05	1.69	1.44	1.26	1.11	0.91	0.76	0.66	0.58	0.47	0.39	0.33	0.29
540	5.90	3.68	2.69	2.12	1.75	1.50	1.30	1.15	0.94	0.79	0.68	0.60	0.48	0.40	0.35	0.30
560	6.07	3.80	2.78	2.20	1.82	1.55	1.35	1.19	0.97	0.82	0.71	0.62	0.50	0.42	0.36	0.31
580	6.25	3.92	2.87	2.27	1.88	1.60	1.39	1.24	1.01	0.85	0.73	0.64	0.52	0.43	0.37	0.32
600	6.42	4.04	2.96	2.34	1.94	1.65	1.44	1.28	1.04	0.88	0.76	0.67	0.54	0.45	0.38	0.33
620	6.59	4.15	3.05	2.41	2.00	1.70	1.48	1.32	1.07	0.90	0.78	0.69	0.55	0.46	0.40	0.35
640	6.76	4.27	3.14	2.48	2.06	1.75	1.53	1.36	1.11	0.93	0.81	0.71	0.57	0.48	0.41	0.36
660	6.93	4.38	3.22	2.55	2.12	1.81	1.58	1.40	1.14	0.96	0.83	0.73	0.59	0.49	0.42	0.37
680	7.10	4.50	3.31	2.62	2.17	1.86	1.62	1.44	1.17	0.99	0.85	0.75	0.61	0.51	0.43	0.38
700	7.26	4.61	3.40	2.69	2.23	1.91	1.67	1.48	1.20	1.02	0.88	0.77	0.62	0.52	0.45	0.39
720	7.43	4.72	3.48	2.76	2.29	1.96	1.71	1.52	1.24	1.04	0.90	0.80	0.64	0.54	0.46	0.40
740	7.59	4.84	3.57	2.83	2.35	2.01	1.75	1.56	1.27	1.07	0.93	0.82	0.66	0.55	0.47	0.41
760	7.75	4.95	3.66	2.90	2.41	2.06	1.80	1.60	1.30	1.10	0.95	0.84	0.68	0.56	0.48	0.42
780	7.91	5.06	3.74	2.97	2.47	2.11	1.84	1.64	1.34	1.13	0.98	0.86	0.69	0.58	0.50	0.43
800	8.07	5.17	3.83	3.04	2.53	2.16	1.89	1.68	1.37	1.16	1.00	0.88	0.71	0.59	0.51	0.44
820	8.23	5.28	3.91	3.11	2.59	2.21	1.93	1.72	1.40	1.18	1.02	0.90	0.73	0.61	0.52	0.46
840	8.39	5.39	4.00	3.18	2.64	2.26	1.98	1.76	1.43	1.21	1.05	0.92	0.74	0.62	0.53	0.47
860	8.54	5.50	4.08	3.25	2.70	2.31	2.02	1.80	1.47	1.24	1.07	0.95	0.76	0.64	0.55	0.48
880	8.70	5.61	4.16	3.32	2.76	2.36	2.07	1.83	1.50	1.27	1.10	0.97	0.78	0.65	0.56	0.49
900	8.85	5.71	4.25	3.39	2.82	2.41	2.11	1.87	1.53	1.29	1.12	0.99	0.80	0.67	0.57	0.50
920	9.01	5.82	4.33	3.45	2.87	2.46	2.15	1.91	1.56	1.32	1.14	1.01	0.81	0.68	0.58	0.51
940	9.16	5.93	4.41	3.52	2.93	2.51	2.20	1.95	1.60	1.35	1.17	1.03	0.83	0.70	0.60	0.52
960	9.31	6.03	4.50	3.59	2.99	2.56	2.24	1.99	1.63	1.38	1.19	1.05	0.85	0.71	0.61	0.53
980	9.46	6.14	4.58	3.66	3.05	2.61	2.28	2.03	1.66	1.41	1.22	1.07	0.87	0.72	0.62	0.54
1000	9.61	6.25	4.66	3.72	3.10	2.66	2.33	2.07	1.69	1.43	1.24	1.09	0.88	0.74	0.63	0.55

Table I-5 Angle of Observation from Flare Origin to Apex; Minimum and Maximum Distance (nm)

Observed angle	Minimum Distance to flare	Maximum Distance to flare
0.50	4.71	22.63
1.00	2.36	11.31
1.50	1.57	7.54
2.00	1.18	5.66
2.50	0.94	4.52
3.00	0.79	3.77
3.50	0.67	3.23
4.00	0.59	2.82
5.00	0.47	2.26
6.00	0.39	1.88
7.00	0.34	1.61
8.00	0.29	1.41
10.00	0.23	1.12
12.00	0.19	0.93
14.00	0.17	0.79
16.00	0.14	0.69
20.00	0.11	0.54
24.00	0.09	0.44
28.00	0.08	0.37
32.00	0.07	0.32

Table I-6 Maximum Distance for Meteor Flares, Angle of Observation Above the Horizon (nm)

Reporting Source Height ft	0.50^{0}	1.00^{0}	1.50^{0}	2.00^{0}	2.50^{0}	3.00^{0}	3.50^{0}	4.00^{0}	5.00^{0}	6.00^{0}	8.00^{0}	10.00^{0}	12.00^{0}	14.00^{0}	16.00^{0}
10	8.91	4.70	3.14	2.35	1.88	1.56	1.33	1.17	0.93	0.77	0.58	0.46	0.38	0.32	0.28
20	9.11	4.71	3.13	2.33	1.86	1.54	1.32	1.15	0.92	0.76	0.57	0.45	0.37	0.32	0.28
30	9.23	4.70	3.10	2.30	1.83	1.52	1.30	1.13	0.90	0.75	0.56	0.44	0.37	0.31	0.27
40	9.31	4.68	3.07	2.27	1.80	1.49	1.27	1.11	0.88	0.73	0.55	0.43	0.36	0.31	0.27
50	9.36	4.64	3.03	2.24	1.77	1.47	1.25	1.09	0.87	0.72	0.53	0.43	0.35	0.30	0.26
60	9.40	4.60	2.99	2.20	1.74	1.44	1.23	1.07	0.85	0.70	0.52	0.42	0.34	0.29	0.25
70	9.42	4.55	2.94	2.17	1.71	1.41	1.20	1.05	0.83	0.69	0.51	0.41	0.34	0.29	0.25
80	9.42	4.50	2.90	2.13	1.68	1.39	1.18	1.03	0.81	0.67	0.50	0.40	0.33	0.28	0.24
90	9.41	4.45	2.85	2.09	1.65	1.36	1.15	1.00	0.80	0.66	0.49	0.39	0.32	0.27	0.24
100	9.40	4.39	2.80	2.05	1.61	1.33	1.13	0.98	0.78	0.64	0.48	0.38	0.31	0.27	0.23
110	9.37	4.32	2.75	2.01	1.58	1.30	1.10	0.96	0.76	0.63	0.47	0.37	0.31	0.26	0.23
120	9.33	4.26	2.70	1.96	1.54	1.27	1.08	0.94	0.74	0.61	0.46	0.36	0.30	0.25	0.22
130	9.29	4.19	2.64	1.92	1.51	1.24	1.05	0.91	0.72	0.60	0.44	0.35	0.29	0.25	0.22
140	9.23	4.11	2.59	1.88	1.47	1.21	1.03	0.89	0.71	0.58	0.43	0.34	0.28	0.24	0.21
150	9.17	4.04	2.53	1.83	1.44	1.18	1.00	0.87	0.69	0.57	0.42	0.33	0.28	0.23	0.20
160	9.11	3.96	2.47	1.79	1.40	1.15	0.97	0.85	0.67	0.55	0.41	0.32	0.27	0.23	0.20
170	9.03	3.88	2.41	1.74	1.36	1.12	0.95	0.82	0.65	0.54	0.40	0.32	0.26	0.22	0.19
180	8.95	3.80	2.35	1.70	1.33	1.09	0.92	0.80	0.63	0.52	0.39	0.31	0.25	0.21	0.19
190	8.86	3.71	2.29	1.65	1.29	1.06	0.89	0.78	0.61	0.51	0.37	0.30	0.24	0.21	0.18
200	8.77	3.63	2.23	1.60	1.25	1.02	0.87	0.75	0.59	0.49	0.36	0.29	0.24	0.20	0.17
220	8.55	3.44	2.10	1.51	1.17	0.96	0.81	0.70	0.56	0.46	0.34	0.27	0.22	0.19	0.16
240	8.31	3.26	1.97	1.41	1.10	0.90	0.76	0.66	0.52	0.43	0.32	0.25	0.21	0.18	0.15
260	8.04	3.06	1.84	1.31	1.02	0.83	0.70	0.61	0.48	0.39	0.29	0.23	0.19	0.16	0.14
280	7.74	2.85	1.70	1.21	0.94	0.76	0.65	0.56	0.44	0.36	0.27	0.21	0.17	0.15	0.13
300	7.40	2.64	1.56	1.11	0.86	0.70	0.59	0.51	0.40	0.33	0.24	0.19	0.16	0.13	0.12
320	7.02	2.41	1.42	1.00	0.77	0.63	0.53	0.46	0.36	0.30	0.22	0.17	0.14	0.12	0.11
340	6.60	2.18	1.27	0.90	0.69	0.56	0.47	0.41	0.32	0.26	0.20	0.15	0.13	0.11	0.09
360	6.14	1.94	1.12	0.79	0.61	0.49	0.42	0.36	0.28	0.23	0.17	0.14	0.11	0.09	0.08
380	5.61	1.69	0.97	0.68	0.52	0.43	0.36	0.31	0.24	0.20	0.15	0.12	0.10	0.08	0.07
400	5.03	1.43	0.82	0.57	0.44	0.36	0.30	0.26	0.20	0.17	0.12	0.10	0.08	0.07	0.06
420	4.35	1.17	0.66	0.46	0.35	0.29	0.24	0.21	0.16	0.13	0.10	0.08	0.06	0.05	0.05
440	3.58	0.89	0.50	0.35	0.27	0.21	0.18	0.16	0.12	0.10	0.07	0.06	0.05	0.04	0.04
460	2.65	0.60	0.34	0.23	0.18	0.14	0.12	0.10	0.08	0.07	0.05	0.04	0.03	0.03	0.02
480	1.51	0.31	0.17	0.12	0.09	0.07	0.06	0.05	0.04	0.03	0.02	0.02	0.02	0.01	0.01
500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table I-7 Distances for Hand-held Flares (nm)

Reporting Source Height ft	0.50 ^{0}	1.00 ^{0}	1.50 ^{0}	2.00 ^{0}	2.50 ^{0}	3.00 ^{0}	3.50 ^{0}	4.00 ^{0}	5.00 ^{0}	6.00 ^{0}	7.00 ^{0}	8.00 ^{0}	10.00 ^{0}	12.00 ^{0}	14.00 ^{0}	16.00 ^{0}
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.16	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
30	0.32	0.17	0.12	0.09	0.07	0.06	0.05	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01
40	0.46	0.25	0.18	0.13	0.11	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02
50	0.61	0.34	0.23	0.18	0.14	0.12	0.10	0.09	0.07	0.06	0.05	0.05	0.04	0.03	0.03	0.02
60	0.75	0.42	0.29	0.22	0.18	0.15	0.13	0.11	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.03
70	0.88	0.49	0.34	0.26	0.21	0.18	0.15	0.14	0.11	0.09	0.08	0.07	0.06	0.05	0.04	0.03
80	1.01	0.57	0.40	0.31	0.25	0.21	0.18	0.16	0.13	0.11	0.09	0.08	0.06	0.05	0.05	0.04
90	1.14	0.65	0.45	0.35	0.28	0.24	0.21	0.18	0.15	0.12	0.10	0.09	0.07	0.06	0.05	0.05
100	1.27	0.72	0.51	0.39	0.32	0.27	0.23	0.20	0.16	0.14	0.12	0.10	0.08	0.07	0.06	0.05
110	1.40	0.80	0.56	0.43	0.35	0.30	0.26	0.22	0.18	0.15	0.13	0.11	0.09	0.08	0.07	0.06
120	1.52	0.87	0.61	0.47	0.38	0.32	0.28	0.25	0.20	0.17	0.14	0.13	0.10	0.08	0.07	0.06
130	1.64	0.95	0.67	0.51	0.42	0.35	0.31	0.27	0.22	0.18	0.16	0.14	0.11	0.09	0.08	0.07
140	1.76	1.02	0.72	0.56	0.45	0.38	0.33	0.29	0.23	0.20	0.17	0.15	0.12	0.10	0.08	0.07
150	1.88	1.09	0.77	0.60	0.49	0.41	0.35	0.31	0.25	0.21	0.18	0.16	0.13	0.11	0.09	0.08
160	2.00	1.16	0.82	0.64	0.52	0.44	0.38	0.33	0.27	0.23	0.19	0.17	0.14	0.11	0.10	0.08
170	2.11	1.23	0.87	0.68	0.55	0.47	0.40	0.36	0.29	0.24	0.21	0.18	0.15	0.12	0.10	0.09
180	2.23	1.31	0.93	0.72	0.59	0.49	0.43	0.38	0.31	0.26	0.22	0.19	0.15	0.13	0.11	0.10
190	2.34	1.38	0.98	0.76	0.62	0.52	0.45	0.40	0.32	0.27	0.23	0.20	0.16	0.14	0.12	0.10
200	2.45	1.45	1.03	0.80	0.65	0.55	0.48	0.42	0.34	0.29	0.25	0.22	0.17	0.14	0.12	0.11
220	2.67	1.58	1.13	0.88	0.72	0.61	0.53	0.46	0.38	0.31	0.27	0.24	0.19	0.16	0.14	0.12
240	2.89	1.72	1.23	0.96	0.78	0.66	0.57	0.51	0.41	0.34	0.30	0.26	0.21	0.17	0.15	0.13
260	3.10	1.85	1.33	1.03	0.85	0.72	0.62	0.55	0.44	0.37	0.32	0.28	0.23	0.19	0.16	0.14
280	3.31	1.99	1.43	1.11	0.91	0.77	0.67	0.59	0.48	0.40	0.35	0.30	0.24	0.20	0.17	0.15
300	3.51	2.12	1.52	1.19	0.98	0.83	0.72	0.63	0.51	0.43	0.37	0.33	0.26	0.22	0.19	0.16
320	3.72	2.25	1.62	1.27	1.04	0.88	0.77	0.68	0.55	0.46	0.40	0.35	0.28	0.23	0.20	0.17
340	3.92	2.38	1.72	1.34	1.10	0.94	0.81	0.72	0.58	0.49	0.42	0.37	0.30	0.25	0.21	0.19
360	4.11	2.51	1.81	1.42	1.17	0.99	0.86	0.76	0.62	0.52	0.45	0.39	0.32	0.26	0.23	0.20
380	4.31	2.63	1.91	1.49	1.23	1.04	0.91	0.80	0.65	0.55	0.47	0.41	0.33	0.28	0.24	0.21
400	4.50	2.76	2.00	1.57	1.29	1.10	0.95	0.84	0.69	0.58	0.50	0.44	0.35	0.29	0.25	0.22
420	4.69	2.88	2.09	1.64	1.35	1.15	1.00	0.89	0.72	0.61	0.52	0.46	0.37	0.31	0.26	0.23
440	4.88	3.01	2.19	1.72	1.42	1.20	1.05	0.93	0.75	0.63	0.55	0.48	0.39	0.32	0.28	0.24
460	5.06	3.13	2.28	1.79	1.48	1.26	1.09	0.97	0.79	0.66	0.57	0.50	0.40	0.34	0.29	0.25
480	5.24	3.25	2.37	1.87	1.54	1.31	1.14	1.01	0.82	0.69	0.60	0.52	0.42	0.35	0.30	0.26
500	5.43	3.37	2.46	1.94	1.60	1.36	1.19	1.05	0.85	0.72	0.62	0.55	0.44	0.37	0.31	0.27
520	5.60	3.49	2.55	2.01	1.66	1.42	1.23	1.09	0.89	0.75	0.65	0.57	0.46	0.38	0.33	0.28
540	5.78	3.61	2.64	2.08	1.72	1.47	1.28	1.13	0.92	0.78	0.67	0.59	0.47	0.40	0.34	0.30
560	5.96	3.73	2.73	2.16	1.78	1.52	1.32	1.17	0.95	0.80	0.70	0.61	0.49	0.41	0.35	0.31
580	6.13	3.85	2.82	2.23	1.84	1.57	1.37	1.21	0.99	0.83	0.72	0.63	0.51	0.43	0.36	0.32
600	6.31	3.97	2.91	2.30	1.90	1.62	1.42	1.25	1.02	0.86	0.74	0.65	0.53	0.44	0.38	0.33
620	6.48	4.08	3.00	2.37	1.96	1.68	1.46	1.29	1.05	0.89	0.77	0.68	0.54	0.45	0.39	0.34
640	6.65	4.20	3.09	2.44	2.02	1.73	1.51	1.34	1.09	0.92	0.79	0.70	0.56	0.47	0.40	0.35
660	6.82	4.31	3.17	2.51	2.08	1.78	1.55	1.38	1.12	0.95	0.82	0.72	0.58	0.48	0.41	0.36
680	6.98	4.43	3.26	2.59	2.14	1.83	1.60	1.42	1.15	0.97	0.84	0.74	0.60	0.50	0.43	0.37
700	7.15	4.54	3.35	2.66	2.20	1.88	1.64	1.46	1.19	1.00	0.87	0.76	0.61	0.51	0.44	0.38
720	7.32	4.66	3.44	2.73	2.26	1.93	1.69	1.50	1.22	1.03	0.89	0.78	0.63	0.53	0.45	0.39
740	7.48	4.77	3.52	2.80	2.32	1.98	1.73	1.54	1.25	1.06	0.92	0.81	0.65	0.54	0.46	0.41
760	7.64	4.88	3.61	2.87	2.38	2.03	1.78	1.58	1.29	1.09	0.94	0.83	0.67	0.56	0.48	0.42
780	7.80	4.99	3.69	2.94	2.44	2.08	1.82	1.62	1.32	1.11	0.96	0.85	0.68	0.57	0.49	0.43
800	7.96	5.10	3.78	3.00	2.50	2.13	1.86	1.66	1.35	1.14	0.99	0.87	0.70	0.59	0.50	0.44
820	8.12	5.21	3.86	3.07	2.55	2.18	1.91	1.70	1.38	1.17	1.01	0.89	0.72	0.60	0.51	0.45
840	8.28	5.32	3.95	3.14	2.61	2.24	1.95	1.73	1.42	1.20	1.04	0.91	0.74	0.62	0.53	0.46
860	8.44	5.43	4.03	3.21	2.67	2.29	2.00	1.77	1.45	1.23	1.06	0.93	0.75	0.63	0.54	0.47
880	8.59	5.54	4.12	3.28	2.73	2.34	2.04	1.81	1.48	1.25	1.08	0.96	0.77	0.64	0.55	0.48
900	8.75	5.65	4.20	3.35	2.79	2.39	2.09	1.85	1.51	1.28	1.11	0.98	0.79	0.66	0.56	0.49
920	8.90	5.76	4.28	3.42	2.84	2.43	2.13	1.89	1.55	1.31	1.13	1.00	0.81	0.67	0.58	0.50
940	9.05	5.86	4.36	3.48	2.90	2.48	2.17	1.93	1.58	1.34	1.16	1.02	0.82	0.69	0.59	0.52
960	9.21	5.97	4.45	3.55	2.96	2.53	2.22	1.97	1.61	1.36	1.18	1.04	0.84	0.70	0.60	0.53
980	9.36	6.08	4.53	3.62	3.01	2.58	2.26	2.01	1.64	1.39	1.20	1.06	0.86	0.72	0.61	0.54
1000	9.51	6.12	4.61	3.69	3.07	2.63	2.30	2.05	1.68	1.42	1.23	1.08	0.87	0.73	0.63	0.55

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