

Search and Rescue Satellite-Aided Tracking (SARSAT)

Program Plan



Department of Commerce

National Oceanic and Atmospheric Administration

**National Environmental Satellite, Data,
and Information Service**

Office of Satellite Data Processing and Distribution

Direct Services Division

**Search and Rescue Satellite-Aided Tracking
(SARSAT)**

June 30, 2000

Mission

The SARSAT Program's mission is to manage, coordinate, and implement the United States activities in the international Cospas-Sarsat search and rescue program

The mission of the SARSAT Program is fulfilled by:

- collecting and distributing reliable and accurate distress alert data in a timely fashion using satellite receiving stations and a mission control center;
- coordinating with national and international organizations on frequency management, satellite, emergency beacon and search and rescue issues;
- maintaining a national register for 406 MHz emergency beacons;
- serving as the lead agency within the United States, and representing the United States in the international Cospas-Sarsat Program; and

1 Introduction

1.1 System Overview

The purpose of the SARSAT program is to provide distress alert and location information to search and rescue authorities anywhere in the world for maritime, aviation and land-based users. The SARSAT program is part of the international Cospas-Sarsat System. Cospas is a Russian acronym that stands for “Cosmicheskaya Sistyema Poiska Aariynyich Sudov” which translates loosely into “Space System for the Search of Vessels in Distress.” Sarsat is an acronym for “Search and Rescue Satellite- Aided Tracking.”

The basic concept of the system involves the use of emergency beacons, satellites, and ground equipment to deliver distress alerts to search and rescue authorities. Search and rescue instruments are flown on low-earth polar orbiting (LEO) and geostationary-orbiting (GEO) satellites provided by the United States, Russia, India and EUMETSAT. These instruments are capable of detecting signals on the earth’s surface transmitted from emergency beacons referred to as Emergency Locator Transmitters (ELTs), Emergency Position Indicating Radio Beacons (EPIRBs), or Personal Locator Beacons (PLBs). ELTs are primarily used by aircraft, EPIRBs by maritime vessels and PLBs by individuals on land.

ELTs, EPIRBs and PLBs may operate on either the 121.5, 243 or 406.025 (hereafter referred to as “406”) MHz frequencies. 121.5/243 MHz beacons transmit an analog signal that does not contain any information about the beacon or user. Alternatively, the 406 MHz beacons transmit a digital code that contains information about the type of beacon. Each 406 MHz beacon in the world has a unique identifier. The unique identifier allows for additional information called registration data to be linked to each beacon. After receipt of ELT, EPIRB or PLB signals by the satellite, the satellite relays the signals to earth stations referred to as Local User Terminals (LUTs).

The LUT, after computing the location of the emergency beacon using Doppler technology, transmits an alert message to its respective Mission Control Center (MCC) via a data communication network. The MCC performs matching and merging of alert messages with other received messages, geographically sorts the data, and subsequently transmits a distress message to an appropriate search and rescue authority such as a national Rescue Coordination Center (RCC) or a foreign SAR Point of Contact (SPOC). The distress message may also be sent to another MCC. Figure 1 describes the Cospas-Sarsat System.

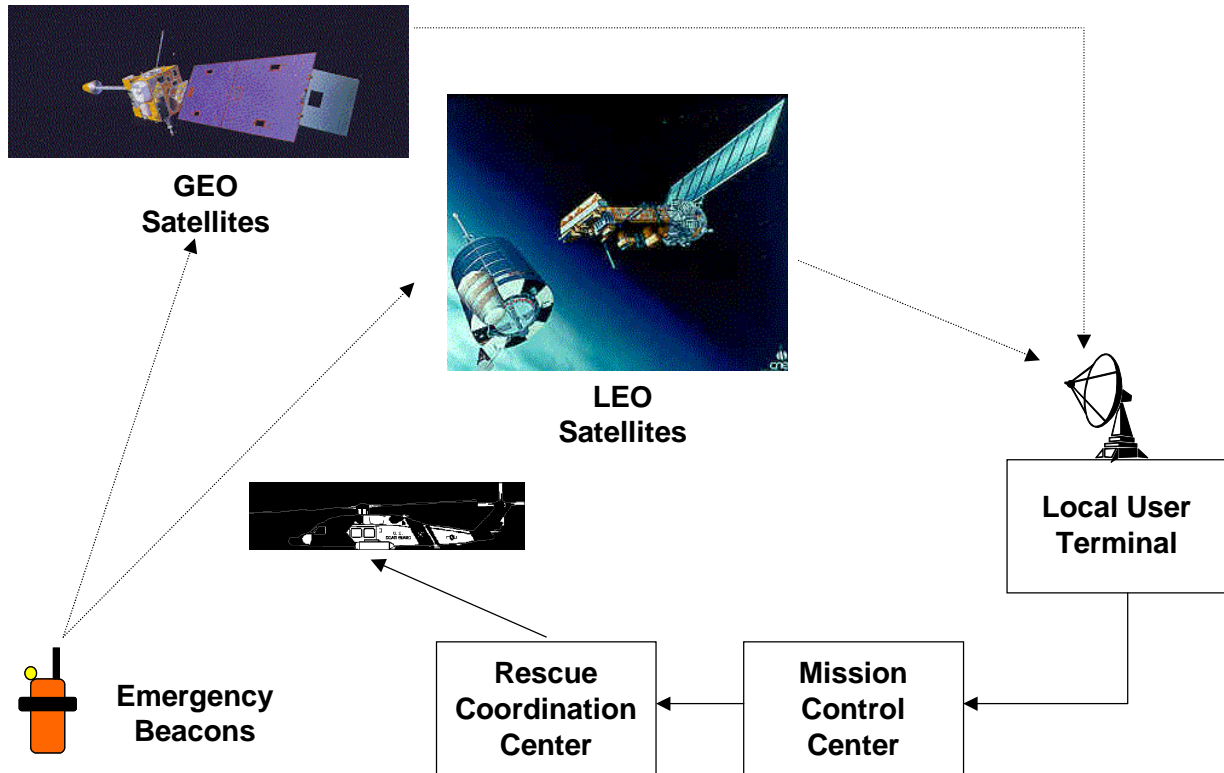


Figure 1: Overview of Cospas-Sarsat System

1.2 Purpose

The purpose of this document is to provide a high-level description of the SARSAT program, the responsibilities of the program, and its role in national search and rescue activities.

1.3 References

The following documents, or series of documents, contain more information about the SARSAT, and Cospas-Sarsat programs:

- The Cospas-Sarsat “P” series address procedural aspects of the program;
- The Cospas-Sarsat “S” series contains information on the Cospas-Sarsat Secretariat and regulations for 406 MHz and 121.5 MHz beacons;
- The Cospas-Sarsat “B” series are periodic information and system bulletins;

- The Cospas-Sarsat “G” series (C/S G.002 to G.006) contain general information and policy information;
- The Cospas-Sarsat “T” series (C/S T.001 to T.011) contain technical information on beacons, type approval, the Space Segment, and the Ground Segment;
- The Cospas-Sarsat “A” series (C/S A.001 to A.006) contain operational information; and
- The Cospas-Sarsat “R” series (C/S R.001 to R.008) contain System reports.
- Search and Rescue Satellite-Aided Tracking (SARSAT) Baseline Information Technology Architecture

The SARSAT Program maintains SARSAT specific documentation in addition to the documentation listed above. The general public can access information on SARSAT at the following Internet web site: www.sarsat.noaa.gov

- End of Section 1 -

2 Basis for Mission

The basis for the involvement of the National Oceanic and Atmospheric Administration (NOAA), National Environmental Satellite Data and Information Service (NESDIS), Office of Satellite Data Processing and Distribution (OSDPD), Direct Services Division (DSD) is contained in the following documents:

- the International Cospas-Sarsat Programme Agreement;
- the Memorandum of Agreement Concerning the SARSAT Space Segment;
- the United States National Search and Rescue Plan; and
- the interagency Memorandum of Understanding regarding responsibilities for the United States Cospas-Sarsat System.

Each of the existing agreements is described in detail in section 2.1, and the role of the National Search and Rescue Committee (NSARC) is provided in section 2.2. Section 2.3 details regulations that also affect the SARSAT program. Figure 2 summarizes the relationship between the agreements and the NSARC, as well as describes the justification for the program and this plan. The SARSAT program meets NOAA's strategic goal to "promote safe navigation."

2.1 Existing Agreements

International Cospas-Sarsat Programme Agreement

The *International Cospas-Sarsat Programme Agreement* was signed by the Governments of Canada, France, the former Soviet Union and the United States in 1988¹. It was developed to:

- assure the long term operation of the Cospas-Sarsat System;
- provide distress alert and location data on a non-discriminatory basis;
- support the objectives of the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO) concerning search and rescue; and
- define the means by which the Cospas-Sarsat System is to be managed.

¹ The International Cospas-Sarsat Programme Agreement was signed in France. The Canadian Ambassador to France signed on behalf of Canada. A Deputy Ambassador to France signed on behalf of the former USSR. A representative of the French Foreign Ministry signed on behalf of France. The NOAA Administrator signed on behalf of the United States.

In addition, the agreement describes the components of the System , the roles of the Parties to the agreement, the management structure of the Program, and the roles of other States or organizations involved with the Program.

As part of the agreement the United States, and specifically NOAA as the cooperating agency, is responsible to fulfil the responsibilities as a Party, a Space Segment Provider, and a Ground Segment Provider.

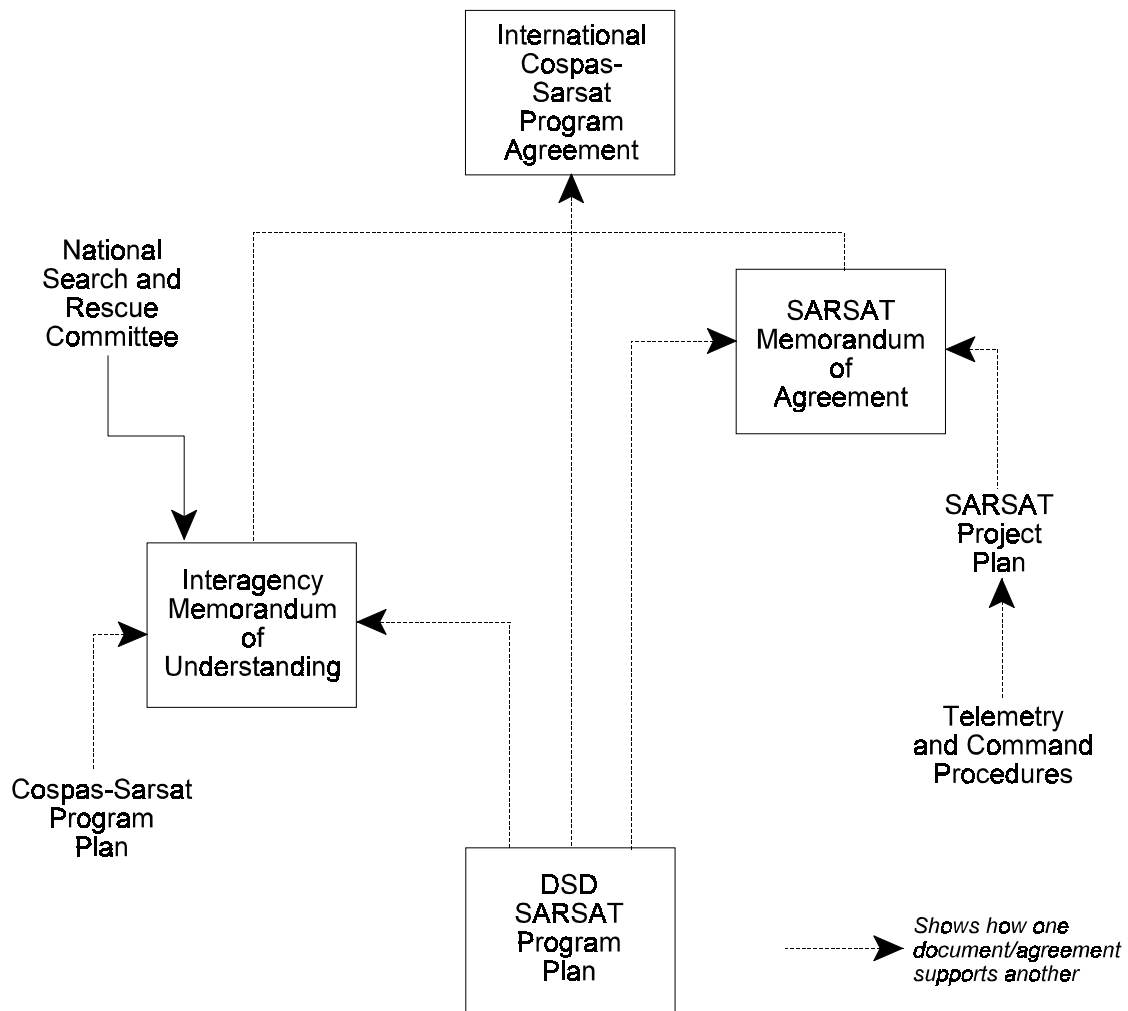


Figure 2: Basis for Mission

Memorandum of Agreement Concerning the SARSAT Space Segment

The Memorandum of Agreement Concerning the SARSAT Space Segment, or the “SARSAT Memorandum of Agreement” was signed between the Governments of Canada, France and the United States in 1995². It was developed to establish the means by which the Parties to the Memorandum of Agreement would manage the SARSAT space segment consistent with their obligations under the International Cospas-Sarsat Programme Agreement.

As portions of the SARSAT payload on the United States NOAA spacecraft are provided by the Governments of Canada and France, the agreement identifies the responsibilities and roles of the Parties as it relates to the provision of different components of the SARSAT payload and the platform or spacecraft on which the payload operates.

The SARSAT Project Plan constitutes the main instrument for the implementation of the SARSAT Memorandum of Agreement. It describes in detail the SARSAT payload design, procurement, integration, testing, commissioning and operation.

The SARSAT Telemetry and Command Procedures document contains the detailed procedures involved with exchanging satellite telemetry and instrument commands.

This agreement and the supporting plans and documents identify the responsibilities of NOAA, NESDIS and the DSD in its role as a Space Segment Provider.

United States National Search and Rescue Plan

The United States National Search and Rescue Plan identifies the roles of the signatory agencies in providing search and rescue services consistent with national policies and international commitments. The Plan provides for the coordination of search and rescue operations, effective use of available resources, mutual assistance, and efforts to improve cooperation.

The Department of Commerce participates in, or supports search and rescue operations through NOAA. NOAA has the responsibility to provide satellite services for detecting and locating aircraft, ships or individual in potential or actual distress.

Memorandum of Understanding regarding responsibilities for the United States Cospas-Sarsat System

The Memorandum of Understanding regarding responsibilities for the United States Cospas-Sarsat System, or the “Interagency Memorandum of Understanding” was signed by the Assistant Administrator for Satellite and Information Services of NOAA, the Associate

² The SARSAT Memorandum of Agreement was signed by the NOAA Administrator, the French Ambassador to the United States, and the Deputy Chief of the Canadian Mission to the United States.

Administrator for Space Flight for the National Aeronautics and Space Administration (NASA), the Director of Operations Policy for the United States Coast Guard (USCG), and the Director for Air Force National Security Preparedness for the United States Air Force (USAF). The latest version went into effect in 1998. The memorandum defines the roles, responsibilities, and financial obligations of the four United States agencies involved with the implementation of the Cospas-Sarsat Program at a national level.

The United States Cospas-Sarsat Program Plan implements the Memorandum of Understanding between the four agencies and describes the management structure of the program at a national level. The Cospas-Sarsat Program Plan also contains details on the schedules, objectives and priorities as they relate to the national Cospas-Sarsat program.

This Memorandum of Understanding and the associated Program Plan outlines the role of NOAA, NESDIS, OSDPD, and the DSD in implementing the Cospas-Sarsat Program at a national level.

Other Agreements

DSD has entered into agreements with Federal and State governments to coordinate on special programs. These programs were established to provide distress alerting capabilities for special or sensitive national users. A partial list of agreements is provided at Annex 1.

Agreements made by other agencies at a national or international level also affect the DSD SARSAT Program. Although these agreements may not directly refer to the DSD or NOAA, they may indirectly affect the mission of DSD. Important agreements that should be taken into consideration are listed at Annex 2.

2.2 National Search and Rescue Committee

The National Search and Rescue Committee (NSARC) is a federal interagency standing committee chartered to accomplish the following objectives:

- oversee the National Search and Rescue Plan and coordinate development of interagency policies and positions on SAR Matters;
- provide an interface with other national agencies involved with emergency services; and
- provide a forum for coordinated development of compatible procedures and equipment to increase the effectiveness and standardization of SAR operations.

The NSARC is comprised of representatives from the Department of Defense, Department of Interior, Department of Commerce, Department of Transportation, the Federal Communications Commission, and the National Aeronautics and Space Administration.

2.3 Regulations

Federal

The carriage of emergency beacons is documented in the Code of Federal Regulations (CFR). Specifically, Title 46, Subpart 25.26 of the CFR deals with the carriage requirements for 406 MHz EPIRBs, and Title 14, Subpart 91.207 deals with the carriage of 121.5 and 406 MHz ELTs.

The Federal Communications Commission (FCC) has adopted rules authorizing the use of the 406.025 MHz frequency for EPIRBs in the Maritime Radio Services (CFR Title 47, Part 80). The FCC has also authorized the use of 406.025 for ELTs in the Aviation Radio Services (CFR Title 47, Part 87). Both these regulations require 406.025 MHz emergency beacons to be registered with NOAA.

International

The International Civil Aviation Organization (ICAO) was founded through the Convention on International Civil Aviation signed on 7 December 1944. It is the United Nations Specialized Agency responsible for establishing international standards, recommended practices and procedures covering the technical, economic and legal fields of international civil aviation operations. As part of its efforts to promote safety of civil aircraft operations, ICAO requires the carriage of 406 MHz ELTs on certain international flights that fall under the ICAO Convention

The International Maritime Organization (IMO) is the United Nations' specialized agency responsible for improving maritime safety and preventing pollution from ships. IMO, through the Global Maritime Distress and Safety System (GMDSS), requires the carriage of EPIRBs for vessels that fall under the Safety for Life at Sea Convention.

The International Telecommunications Union has allocated the 406.025 MHz frequency for the exclusive use of low-power, earth-to-space emergency position indicating radiobeacons (International Radio Regulation No. 2997A)

- End of Section 2 -

3 SARSAT Overview and Objectives

SARSAT is an operational program. It supports two primary customers; search and rescue authorities, and emergency beacon users. The SARSAT Program has four functions, of which two involve the use of information technology (IT). The four functions are further divided into eight functional areas. The SARSAT Program employees government and contractor staff to complete its mission. The current staffing and contracts are provided in Annex 3.

Figure 3 provides a business view of the SARSAT Program, and Figure 4 shows the relationship between the SARSAT program and the various functional areas. Tasks within each functional area are described below in section 3.1 to 3.8.

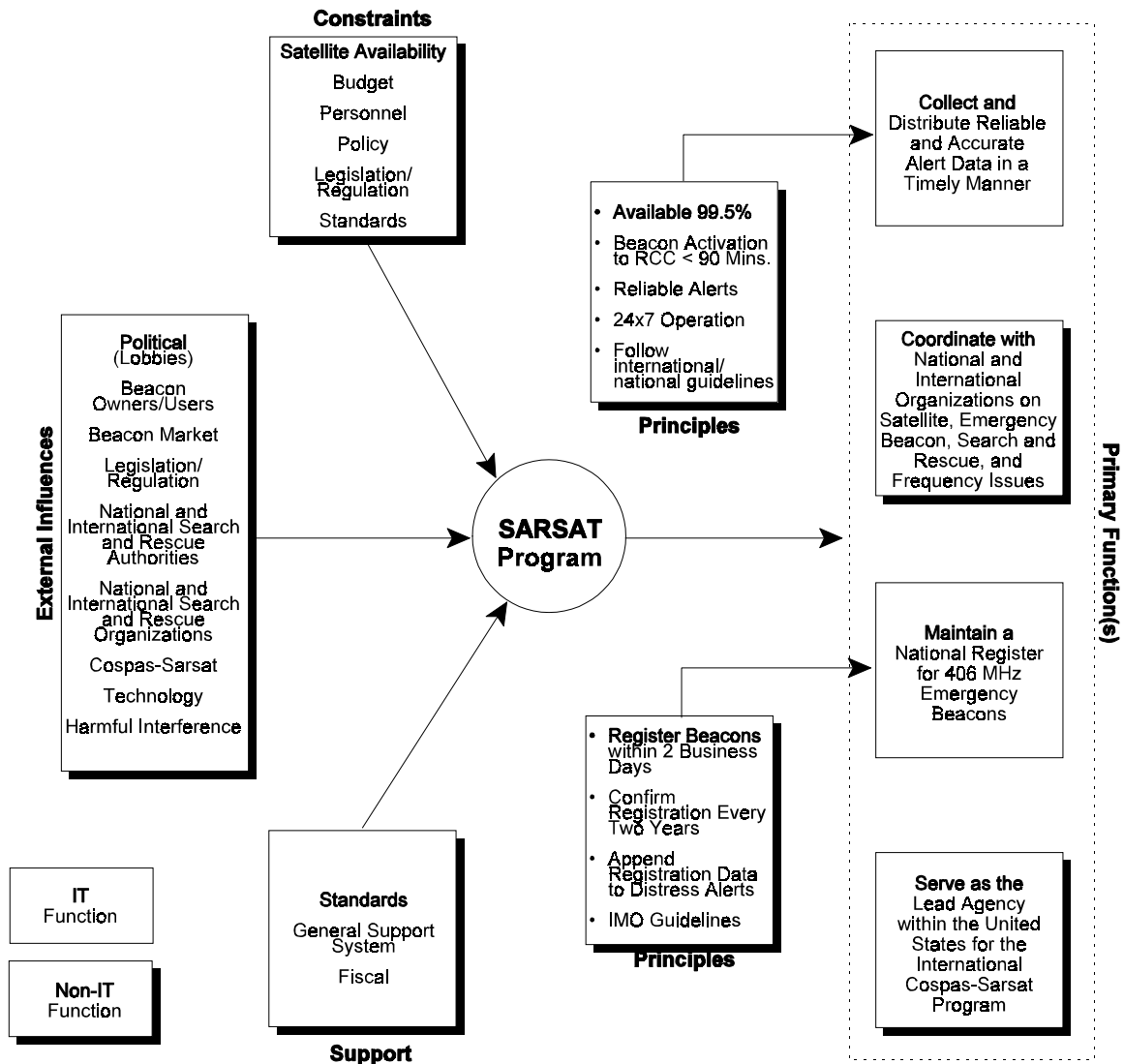


Figure 3: SARSAT Business View

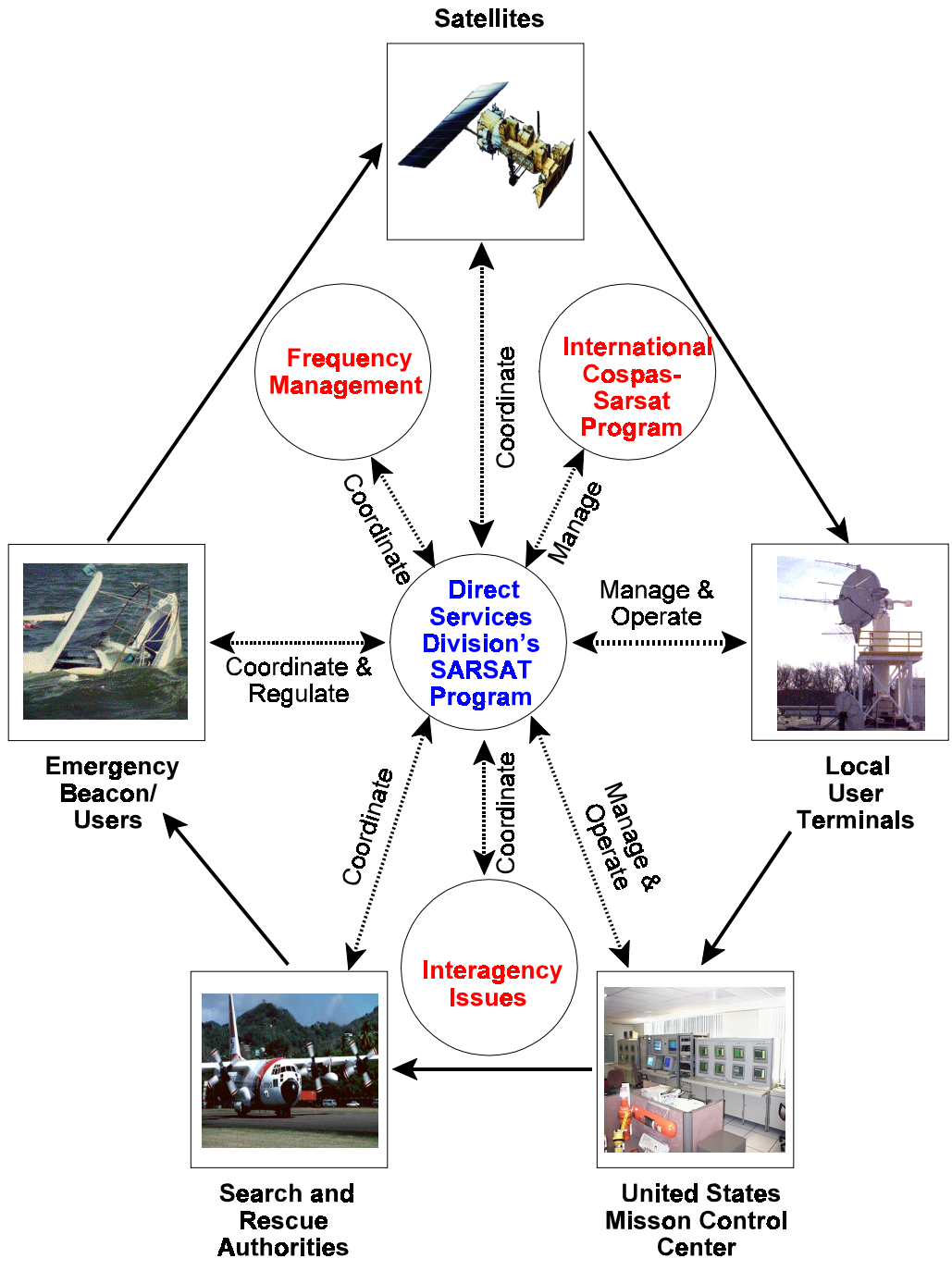


Figure 4: SARSAAT Functional Areas

3.1 International Cospas-Sarsat Program

Objective

Manage and coordinate activities of the International Cospas-Sarsat Program

The DSD manages, and coordinates activities for the International Cospas-Sarsat Program by:

- sharing in the common costs associated with the organization, administration and coordination of the Program;
- representing the United States as a Party to the agreement and to the Cospas-Sarsat Council;
- overseeing the implementation of the International Cospas-Sarsat Programme Agreement;
- coordinating the Space Segment contribution of the United States;
- coordinating the Ground Segment contribution of the United States;
- preparing, considering and adopting technical and operational specifications;
- coordinating with other Space Segment and Ground Segment Providers, as well as Users States on Cospas-Sarsat issues;
- directing the activities of the Cospas-Sarsat Secretariat;
- promoting the International Cospas-Sarsat Program;
- chairing and attending Council, Joint Committee, Working Group, or Task Group meetings as appropriate;
- heading United States delegations to Cospas-Sarsat meetings;
- accepting international Cospas-Sarsat actions on be-half of the United States; and
- maintaining relationships with other international organizations as appropriate.

3.2 Satellites

Objective

Coordinate on NOAA satellite and SARSAT payload issues

The DSD coordinates on satellite and payload issues by:

- coordinating on the implementation of the SARSAT Project Plan;
- submitting satellite and payload assessment and commissioning reports;
- coordinating the decommissioning of SARSAT payloads;
- notifying Cospas-Sarsat partners and users on the status of satellites and payloads;
- coordinating with non-Cospas-Sarsat partners on satellite and payload issues;
- receiving, processing and providing satellite and payload telemetry to the respective payload providers;
- receiving and generating commands for SARSAT payloads;
- maintaining the required telemetry databases;
- generating and distributing satellite ephemeris to Cospas-Sarsat users and partners; and
- distributing time calibration for SARSAT satellites.

3.3 Frequency Management

Objective

Coordinate frequency management issues

The DSD coordinates on frequency management issues by:

- actively monitoring distress frequency bands using satellites;
- reporting on interfering transmitters to national and international organizations;

- developing frequency management plans as appropriate; and
- promoting national and international efforts to protect frequency bands allocated to satellite search and rescue from harmful interference.

3.4 Local User Terminals (LUTs)

Objective
*Manage and operate United States
Local User Terminals*

The DSD manages and operates the Local User Terminals (LUTs) by:

- procuring/developing the necessary equipment and software to track Cospas-Sarsat satellites, recover and process distress and interfering signals, and provide alert and location information to the United States Mission Control Center;
- ensuring that LUT(s) are sited to minimize waiting time and to provide real-time coverage for the United States Areas of Responsibilities (AOR) concerning search and rescue;
- ensuring that adequate security is provided to allow the LUTs to meet their mission;
- operating the LUT(s) on a 24-hour, 7-days-a-week basis;
- actively monitoring the LUT function and taking corrective action as appropriate; and
- enhancing the LUT function to meet international standards or national requirements.

3.5 United States Mission Control Center

Objective
*Manage and operate the
United States Mission Control Center*

The DSD manages and operates the United States Mission Control Center (USMCC) by:

- procuring/developing the necessary equipment and software to receive, process, and distribute data for search and rescue purposes;

- ensuring that adequate security is provided to allow the USMCC to meet its mission;
- operating the USMCC on a 24-hour, 7-days-a-week basis;
- actively monitoring the USMCC function and taking corrective action as appropriate; and
- enhancing the USMCC function to meet international standards or national requirements.

3.6 Search and Rescue Authorities

Objective
Coordinate with Search and Rescue authorities

The DSD coordinates on civil and military search and rescue activities by:

- providing distress alert data to internationally recognized, as well as special purpose, rescue coordination centers or points of contact;
- providing equipment necessary to receive distress alerts from the USMCC;
- coordinating and establishing procedures for the transmission of distress alert data;
- participating in tests and exercises;
- providing training and documentation necessary to allow search and rescue authorities to complete their mission; and
- responding to requests for data and/or data analysis to support search and rescue activities.

3.7 Interagency Issues

Objective
Coordinate with national agencies on issues related to Search and Rescue

In addition to the provision of distress alert data to search and rescue authorities, DSD

coordinates with national agencies on:

- national and international positions on search and rescue;
- regulatory matters concerning carriage, registration, and use of emergency beacons;
- accident investigations;
- provision of distress alert data to specific government programs as identified in Annex 1; and
- implementation of the national Cospas-Sarsat program;

3.8 Emergency Beacons/Users

Objective

Coordinate on issues related to emergency beacons and emergency beacon users.

The DSD coordinates on issues related to emergency beacons and users by:

- registering 406 MHz emergency beacons in a national database;
- coordinating with the Radio Technical Commission for Maritime Services (RTCM) and the Radio Technical Commission for Aeronautics (RTCA) on national 406 MHz beacon specifications;
- educating users about the Cospas-Sarsat System; and
- promoting the use of 406 MHz emergency beacons, and educating users on the termination of 121.5/243 MHz satellite alerting services

- End of Section 3 -

4 Alliances and Partnerships

The DSD forms alliances and partnerships with other agencies and organizations to provide services that support national interests in terms of civil and/or military search and rescue, and to help promote or educate users regarding the system. Examples are:

- the United States Air Force Auxiliary Civil Air Patrol which can help educate aircraft owners on the termination of 121.5/243 MHz satellite alerting and on the advantages of 406 MHz ELTs;
- the Boat/US Foundation for Boating Safety which promotes the SARSAT program through its EPIRB loaner program;
- the United States Coast Guard Commercial Fishing Vessel Safety which heads a 406 MHz beacon testing program; and
- the Aircraft Owners and Pilots Association (AOPA) Air Safety Foundation to promote the use of 406 MHz beacons and educate the aviation community.

- End of Section 4 -

5 Information Technology (IT)

The SARSAT Program relies on IT to complete its primary functions. IT is used extensively in LUTs and the USMCC in order to collect and distribute reliable and accurate alert data in a timely fashion. Additional IT capabilities are integrated into the USMCC in order to maintain a national register for 406 MHz emergency beacons. Two distinct systems are identified as IT; the LUTs, and the USMCC. The LUTs use IT to:

- track and acquire data from the Cospas-Sarsat satellites;
- perform error detection and correction on 406 MHz beacon messages;
- perform geo-locating of beacon signals using Doppler technology; and
- generate alert messages to the USMCC.

The USMCC uses IT to:

- receive data from national LUTs and foreign MCCs;
- match beacon signals coming from the same source;
- merge beacon signals from the same source to improve position accuracy;
- geographically sort data to determine the appropriate recipient;
- transmit alert data;
- filter redundant alert data; and
- perform system support and monitoring functions.

The IT systems are comprised of personal computers, local area networks, data bases, proprietary and non-proprietary applications software, commercial off-the-shelf software, and interfaces to packet networks for data communications. Information Technology is documented in the SARSAT IT Architecture Plan.

The SARSAT Program secures its IT systems against physical and cyber attacks. The IT systems include the LUTs and the USMCC (to be considered collectively as a "Major Application"), and the general computing environment (to be considered as the "General Support System"). Security plans and policies are documented in two security plans. One for the Major Application and one for the General Support System. The security plans meets the requirements in Appendix III to OMB Circular No. A-130, and were developed following guidelines provided in NIST Special Publication 800-18 *"Guide for Developing Security Plans for Information Technology Systems"*

- End of Section 5 -

6 Quality Assurance/Process Improvement

The SARSAT program performs IT related and non-IT related functions. Therefore, guidelines that specifically address software development and maintenance, as well as general quality management and assurance standards are required. Elements from the SEI's Capability Maturity Model provides guidance related to software quality management and elements from the ISO 9000 series provide general guidance on process quality management.

The objectives of the SARSAT program in terms of quality assurance and process improvement are to reach a level of software maturity consistent with Level 2 as described in the SEI's CMM, and to implement elements of the ISO 9000 standards appropriate for the SARSAT program.

The key processes that have to be implemented in order to meet SARSAT's objectives are provided below.

- Requirements are managed for the LUT and USMCC systems.
- Software projects are planned so that resource estimates and activities are documented, and affected groups are notified.
- Software projects are tracked and adequate oversight provided so that actual results are tracked against project plans, and corrective action is taken when actual results deviate from plans.
- Services and products are procured to improve the productivity, efficiency, and effectiveness of the SARSAT program while adhering to relevant standards or guidelines published by the Federal government.
- Software quality assurance ensures that quality assurance activities are planned, and software activities follow applicable standards and requirements.
- Configuration management is used to maintain the integrity of the LUT and USMCC systems.
- Processes and procedures are well documented.
- Documents are controlled and updated as necessary.
- Internal audits of management controls are carried out periodically to ensure that resources are used effectively and the objectives of the program are met.
- Government and contractor staff are trained to perform the tasks required.

- End of Section 6 -

7 Strategic Plan

This section outlines SARSAT's vision for the first decade of the new century, and the goals and objectives that will fulfil the SARSAT vision.

Vision

Continue to build on the success of the SARSAT program by providing satellite related services to improve the efficiency of search and rescue operations.

In order to fulfil its vision the SARSAT program will:

- Establish the funding and the technological improvements necessary to maintain the current level of service provided to search and rescue authorities.
- Look for opportunities to leverage resources by working with other agencies and organizations.
- Work with national and international partners to protect the 406 MHz frequency band from harmful interference.
- Procure new LUTs to track polar and geostationary orbiting satellites.
- Develop a target IT architecture plan for the LUT and USMCC systems.
- Conduct business with the public electronically.
- Coordinate with national and international partners to integrate SAR transponders on seven³ different series of satellites.
- Educate the user community to reduce false alerts, promote the use of 406 MHz beacon technology and inform them about the phase-out 121.5/243 MHz satellite alerting.

- End of Section 7 -

³ This includes the carriage of the SARSAT package on the NOAA Tiros satellites, EUMETSAT's MetOp satellites, NOAA's NPOESS satellites, NOAA's GOES satellites, India's INSAT satellites, EUMETSAT's MSG satellites, and the carriage of the COSPAS package on Russian satellites.

Annex 1

List of Special Agreements

- 1) Memorandum of Understanding with the Department of Agriculture's Forest Service
- 2) Memorandum of Understanding with the Department of Defense's Naval Support Forces Antarctica
- 3) Letter of Agreement with the Department of Energy's Sandia National Laboratories
- 4) Letter of Agreement with the State of Alaska and the 11th Rescue Coordination Center
- 5) Memorandum of Understanding with the Department of Justice's Drug Enforcement Administration
- 6) Memorandum of Understanding with Department of Defense's 9th Reconnaissance Wing
- 7) Memorandum of Understanding with the National Aeronautics and Space Administration's Astronaut Office
- 8) Memorandum of Agreement with the Department of Defense's Space and Missile Systems Center regarding the Combat Survivor Evader Locator (CSEL) System
- 9) Memorandum of Agreement with the National Security Agency's Special Support Activity
- 10) Letter of Agreement with the Department of Defense's Naval Undersea Warfare Division
- 11) Memorandum of Understanding with the Department of Treasury's United States Secret Service
- 12) Letter of Agreement with the Department of Defense's 160th Special Operations Aviation Regiment (*Not yet signed*)
- 13) Letter of Agreement with the Department of Defense's Naval Air Warfare Center (*Not yet signed*)

Annex 2

Other Applicable Agreements

- 1) "Agreement Between the Government of the United States of America and the Government of the United Mexican States on Maritime Search and Rescue"

- 2) "Memorandum of Understanding for Co-operation among the Canadian Forces, the Canadian Coast Guard, the United States Coast Guard, the United States Air Force, the Coast Guard Agency and the Civil Aviation Directorate of the United Kingdom of Great Britain and Northern Ireland, and the Ministry of Defense of the United Kingdom of Great Britain and Northern Ireland on Search and Rescue"

Other References

- 1) International Aeronautical and Maritime Search and Rescue Manual

- 2) National Search and Rescue Supplement

Annex 3

Organization Chart

[To be developed]