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Title - Sujet GROUND SEGMENT SOLUT. (MEOSAR PROJ)	
Solicitation No. - N° de l'invitation W8474-16ME03/A	**Amendment No. - N° modif.** 007
Client Reference No. - N° de référence du client W8474-16ME03	**Date** 2016-06-03
GETS Reference No. - N° de référence de SEAG PW-$$ST-005-29512	
File No. - N° de dossier 005st.W8474-16ME03	**CCC No./N° CCC - FMS No./N° VME**
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Amendment 007 – This amendment serves to publicize the draft Statement of Work for the Build and Commissioning of Medium Earth Orbit Local User terminals (MEOLUTs). Vendors are invited to provide comments on this draft document to the contracting authority before June 27, 2016.

STATEMENT OF WORK

FOR THE BUILD AND COMMISSIONING OF

MEDIUM EARTH ORBIT LOCAL USER TERMINALS

(MEOLUTs)

FOR MEDIUM EARTH ORBIT SEARCH AND RESCUE (MEOSAR) GROUND SEGMENT

May 10, 2016

TABLE OF CONTENTS

1 BACKGROUND

1.1 COSPAS-SARSAT is the international programme that provides both the Search and Rescue Satellite Aided Tracking (SARSAT) distress detection system and coordinates Search and Rescue (SAR) organizations that assist persons in distress. The SARSAT system uses both Geosynchronous Earth Orbit (GEO) satellites and Low Earth Orbit (LEO) satellites. COSPAS-SARSAT is augmenting its programme with Medium Earth Orbit (MEO) satellites equipped with Search and Rescue repeaters. This augmented system is called MEOSAR.

1.2 The Minister of National Defence (MND), through the Canadian Government and as part of his mandate, has the responsibility for all search and rescue matters in Canada. The Department of National Defence (DND) has been assigned the responsibility, on behalf of the MND, for the MEOSAR project.

1.3 The current Canadian SARSAT system receives and processes signals from all available Low Earth Orbit (LEO) and Geostationary (GEO) satellites at their respective Local User Terminals (LUTs), and sends alert data to the Canadian Mission Control Centre (CMCC) servers.

1.4 The alert information is sent to the CMCC and its servers. The primary site is located in Trenton, Ontario with the secondary site in Belleville, Ontario. Both sites are identical to provide complete redundancy, and one is always staffed on a 24/7 basis 365 days a year.

1.5 The DND has been mandated to augment its SARSAT Ground Segment (GS) system to include ground stations that will forward MEOSAR information to the operational CMCC to meet its obligations under the International COSPAS-SARSAT Programme Agreement (ICSPA).

2 OBJECTIVE

2.1 The objective is to implement a MEOSAR capable ground segment system solution to meet Canada's SAR obligations.

3 GROUND SEGMENT SCOPE

3.1 The scope of this Statement of Work (SOW) is the provision of a MEOSAR Ground Segment solution capable of covering Canada's entire SAR Area of Responsibility (AOR).

3.2 The scope includes implementation, delivery, installation, testing, training and COSPAS-SARSAT commissioning of MEOLUTs, in standalone mode, and in networked mode with all required support tools. This includes the MEOLUTs' Local Operator Interface (LOI) to operate and maintain them locally and a Remote Operator Interface (ROI) at the CMCC to operate, control, monitor and manage the MEOLUTs remotely.

3.3 These MEOLUTs, the MEOLUT Network, the operator interfaces, support tools and their connections to the CMCC must meet all the COSPAS-SARSAT related guidelines, standards and specifications, national and international standards, the CMCC Concept of Operations requirements, and all requirements and tasks as set forth in this SOW.

3.4 The installation of MEOLUTs at two sites in the following regions[1]:

- SITE 1 In western Canada, located at Riverbend, Alberta; and
- SITE 2 In eastern Canada, located at Happy Valley – Goose Bay, Newfoundland and Labrador.

Note 1: Pending completion of the site surveys, locations to be finalized prior to final RFP.

3.5 The execution of all systems engineering tasks, including:

3.5.1 Surveys, environmental studies, and civil engineering activities to support construction;

3.5.2 Delivery and installation of all mechanical, electrical and computer systems;

3.5.3 Software engineering, implementation and installation for MEOLUT signal processing;

3.5.4 Computer and network systems engineering for interfacing and networking the MEOLUTs and MEOLUT Network to the CMCC servers; and

3.5.5 Software and computer engineering for the development and implementation of a MEOLUT Coverage Area Simulation Tool (CAST).

3.6 Initial training and delivery of all associated documentation required for operation, management, and maintenance of the MEOSAR Ground Segment solution and operator interface support tools.

3.7 The contractor will not be reimbursed for any cost reimbursable travel associated with this statement of work.

4 SCHEDULE

4.1 The Schedule to meet all requirements and execute all tasks should be done in a timeframe of 30 months or less from contract award. The Schedule must contain at a minimum the following milestones:

4.1.1 The First MEOLUT and all related CMCC connections and interfaces, must be installed and tested, within 14 months of Contract Award;

4.1.2 The ROI must be implemented and installed in conjunction with the implementation and installation of the first MEOLUT, and tested before the first MEOLUT site acceptance testing process is completed;

4.1.3 The MEOLUT Network implementation and installation must start prior to the installation of the first MEOLUT, and must be completed before the first MEOLUT is commissioned;

4.1.4 The CAST and all other CMCC support tools must be implemented, installed and tested before the first MEOLUT is commissioned;

4.1.5 Initial training must occur within one month of completed installation of the first MEOLUT and must be completed before the first MEOLUT is commissioned;

4.1.6 The first MEOLUT must be commissioned within 6 months of being tested;

4.1.7 The Second MEOLUT and all related LOI, MEOLUT Network, ROI and support tool interfaces, and CMCC connections, must be installed and tested within 12 months after the installation and testing of the first MEOLUT is completed;

4.1.8 All required final training and remaining tasks, must be completed before the Second MEOLUT is commissioned; and

4.1.9 The Second MEOLUT must be commissioned within 3 months of completion of testing of the second MEOLUT and related interfaces and connections.

4.2 Table 1 is an example of a 30 month maximum timeline using the minimum number milestones provided in section 4.1. A detailed schedule with a timeline equal to or less than 30 months will need to be provided as part of the Contractor's bid identifying milestones and justifying time duration.

Item #	Para. #	Milestone Item Details	Start Date	Duration	End Date
1	4.1.1	First MEOLUT, related LOI and CMCC Connections installed and site tested	July 2017	14 months	August 2018
2	4.1.2	ROI at CMCC implemented, installed and tested for first MEOLUT	TBD	Concurrent with Item #1	August 2018
3	4.1.3	MEOLUT Network Installed and tested with First MEOLUT	TBD	Concurrent with Item #1	August 2018
4	4.1.4	CAST and support tools installed and tested	TBD	Concurrent with Item #1	August 2018
5	4.1.5	Initial training for items 1 to 4	After item 4	2 months	October 2018
6	4.1.6	First MEOLUT Commissioned	After item 4	6 months	Feb 2019
7	4.1.7	Second MEOLUT, related LOI and its MEOLUT Network interfaces and CMCC connections and support tools installed and site tested	After item 4	12 months	Sept 2019
8	4.1.8	Final round of training items for 5, 6, and 7	After item 7	1 month	Oct 2019
9	4.1.9	Second MEOLUT commissioned	After item 7	3 months	December 2020

Table 1: Example Project Schedule Milestones and Timeline

5 DOCUMENTS

5.1 Applicable Documents

Applicable documents and materials identified are in scope and will apply where they are referenced. The document version that is in force and in effect at the time of commissioning takes precedence. In the event that the same requirement is specified in different applicable documents and/or different sections of this SoW, the Contractor must satisfy the most stringent specification/requirement.

5.1.1 COSPAS-SARSAT (C/S) MEOLUT, related Mission Control Centre (MCC), repeater and beacon technical and operational specifications, standards and guidelines[2]:

C/S T.001	Specification for COSPAS-SARSAT 406 MHz Distress Beacons
C/S T.012	COSPAS-SARSAT 406 MHz Frequency Management Plan
C/S T.015	COSPAS-SARSAT Specification and Type Approval Standard for 406 MHz Ship Security Alert System (SSAS) Beacons
C/S T.016	Description of the COSPAS-SARSAT MEOSAR Space Segment
C/S T.017	COSPAS-SARSAT MEOSAR Space Segment Commissioning Standard
C/S T.019	COSPAS-SARSAT MEOLUT Specifications and Design
C/S T.020	Guidelines
C/S T.022	COSPAS-SARSAT MEOLUT Commissioning Standard
	COSPAS-SARSAT Draft Reference Beacon Specification and Guidelines
C/S P.011	COSPAS-SARSAT Programme Management Policy
C/S P.015	COSPAS-SARSAT Quality Manual
C/S A.001	COSPAS-SARSAT Data Distribution Plan
C/S A.002	COSPAS-SARSAT MCC Standard Interface Description
C/S A.003	COSPAS-SARSAT System Monitoring and Reporting
C/S A.005	COSPAS-SARSAT Mission Control Centre (MCC) Performance Specification and Design Guidelines
C/S R.018	COSPAS-SARSAT Demonstration and Evaluation Plan for the 406MHz MEOSAR System

Note2: These documents are available from **http://cospas-sarsat.org**

5.1.2 Canadian Security Guidelines, Health and Safety Regulations and SARSAT System Description and Specifications

PGS	Policy on Government Security[3]
COHSR	Canada Occupational Health and Safety Regulations[4]
CMCC ConOps	Canadian Mission Control Centre Concept of Operations Requirements[5]

Note 3: PGS Guidelines can be found on the Treasury Board of Canada Secretariat (TBS) website http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=16578

Note 4: This document can be found at http://laws.justice.gc.ca/eng/regulations/sor-86-304

Note 5: The CMCC ConOps Requirements will be made available with the final version of this SOW.

5.2 Reference Material

5.2.1 Reference material documents are to be used as information material regarding Canadian and COSPAS-SARSAT requirements. The following reference documents are recommended[6]:

C/S T.009	COSPAS-SARSAT GEOLUT Performance Specification and Design Guidelines
C/S T.010	COSPAS-SARSAT GEOLUT Commissioning Standard
C/S T.011	Description of the 406 MHz Payloads Used in the COSPAS-SARSAT GEOSAR System
C/S A.006	COSPAS-SARSAT Mission Control Centre (MCC) Commissioning Standard
C/S G.007	Handbook on Distress Alert Messages for Rescue Coordination Centres (RCCs), Search and Rescue of Points of Contact (SPOCs) and IMO Ship Security Competent Authorities
C/S R.012	COSPAS-SARSAT 406 MHz MEOSAR Implementation Plan

Note 6: These documents are available from **http://cospas-sarsat.org**

6 REQUIREMENTS

The Ground Segment System solution must meet all the technical, functional, processing, and performance requirements as set forth in this section for the MEOLUTs, the MEOLUT Operator Interfaces, the MEOLUT Network, their interfaces and connections to the CMCC servers, and the MEOLUT Coverage Area Simulation Tool residing at CMCC.

6.1 TECHNICAL

6.1.1 Each MEOLUT must consist of the following basic components and interfaces:

6.1.1.1 A Radio Frequency (RF) front end receiver system providing multiple unique antenna-satellite beams or receive channel streams for RF reception;

6.1.1.2 Processors with associated hardware, software and operating systems for signal decoding and locating;

6.1.1.3 Network switching and control hardware and software associated to the RF front end and processor interfaces for satellite tracking, antenna management and internal communications;

6.1.1.4 Software and hardware tools required for MEOLUT calibration including reference beacons; and

6.1.1.5 Interfaces to the MEOLUT Network and CMCC servers for alert and system data and message distribution.

6.1.2 The RF front end receiver system must receive RF signals from SAR satellite repeaters and consist of the following subsystems:

6.1.2.1 Antenna subsystems including radomes; and

6.1.2.2 RF receive-chain and down-conversion subsystems.

6.1.3 The processor system must accept all signals from the RF front-end receiver system and must consist of the following subsystems:

6.1.3.1 A signal processor subsystem with all required hardware, software and associated operating systems;

6.1.3.2 A data processor subsystem with all required hardware, software and associated operating systems;

6.1.3.3 A time and frequency reference subsystem with all required hardware, software and associated operating systems;

6.1.3.4 A satellite orbit maintenance and automated tracking subsystem to control and manage the RF front end receiver system with all required hardware, software, and associated operating systems; and

6.1.3.5 A LOI accessible at each MEOLUT site and a ROI accessible at both CMCC sites.

6.1.4 Each MEOLUT is required to execute the following general functions:

6.1.4.1 COSPAS-SARSAT type approved distress beacon decoding and identification;

6.1.4.2 COSPAS-SARSAT type approved distress beacon localisation using Time Difference of Arrival and Frequency Difference of Arrival (TDOA/FDOA);

6.1.4.3 Distribution of alert data to CMCC servers;

6.1.4.4 Communicate all critical data, messages and other information to the CMCC servers;

6.1.4.5 Data exchange of Time Of Arrival /Frequency Of Arrival (TOA/FOA) measurements to/from the MEOLUT Network;

6.1.4.6 Identification and location of interferers within the operational distress band of 406.0 to 406.1 MHz;

6.1.4.7 Local and remote access, through the LOI and ROI, to operate, control, monitor the MEOLUTs and MEOLUT network and generate reports in support of operations from both Trenton and Belleville;

6.1.4.8 Distribution of inverted frame sync data related to self-test bursts to the Canadian Beacon Registry Verifier (CBRV);

6.1.4.9 Maintenance of Satellite orbit data;

6.1.4.10 Automated satellite tracking and antenna management using software tracking algorithms;

6.1.4.11 Accept externally provided satellite tracking schedules from a centralized scheduler;

6.1.4.12 Record all data and satellite tracking pass logs; and

6.1.4.13 Archive all data and all satellite tracking pass logs.

6.1.5 A MEOLUT ROI must reside at CMCC primary and secondary sites and include all associated hardware, software, graphical interfaces, and peripherals to allow CMCC to operate the MEOLUTs 24/7.

6.1.6 The ROI must meet the following requirements:

6.1.6.1 Provide hardware and software to operate, manage, control and monitor all the MEOLUTs and MEOLUT Network from the CMCC operator workstations;

6.1.6.2 Provide administrator and configurable user level permissions;

6.1.6.3 Provide a centralized satellite tracking scheduler with configurable algorithms to automatically coordinate tracking of SAR satellites by the MEOLUTs to optimize Canada's SAR AOR by default, and over any specified geographic area as requested and configured by CMCC operators;

6.1.6.4 Provide a visual display, for each of the MEOLUT sites, of the satellite positions and ground coverage being tracked in the respective MEOLUT's zone;

6.1.6.5 Provide an intuitive Graphical User Interface (GUI), using the latest Geographic Information System (GIS) tools, that allows operators to receive, view and manage alert information from detected beacons;

6.1.6.6 Provide the capability to copy any data accessible through the ROI using copy-paste and editing tools in the native data format compatible with Microsoft (MS) operating environment software applications;

6.1.6.7 Provide the capability for operators to command the manual retransmission of any type and range of messages from any MEOLUT to any configured destination; and

6.1.6.8 Provide a capability for audible and visual alarms when there is a fault at the MEOLUT with its associated hardware or software.

6.1.7 The MEOLUT Network is defined as the data transfer exchange methods of TOA/FOA and system data, and the interfaces from all MEOLUTs connected to the Network, to determine the location of distress beacons and generate alert data when in networked mode.

6.1.8 The MEOLUT Network must include all hardware and software required for the network data exchange interface to provide networked independent location capability at CMCC.

6.1.9 The MEOLUT Network must contain:

6.1.9.1 A File Transfer Protocol (FTP) server residing at CMCC primary and secondary sites, which are:

6.1.9.1.1 Capable of sending and receiving data to and from all MEOLUTs, using FTP, Secure FTP (SFTP), and FTP Secure (FTPS);

6.1.9.1.2 Capable of sending and receiving data to and from any other COSPAS-SARSAT administration server or MEOLUTs; and

6.1.9.1.3 Configurable to select the destination(s) where data is to be forwarded as per the CMCC ConOps requirements.

6.1.9.2 A Network Location Processor to produce location solutions based on the received data and is capable of using TDOA only, and FDOA only, and TDOA/FDOA solution algorithms. The Network Location Processor must be configurable by CMCC operators.

6.1.10 A MEOLUT Coverage Area Simulation Tool (CAST) is required at both CMCC sites to verify the expected Coverage Area of the MEOLUTs.

6.1.11 The CAST must be capable of outputting its schedules to, and accepting logged tracking schedules from, the ROI centralised tracking scheduler.

6.1.12 The CAST must be capable of simulating MEOLUT performance parameters, satellite tracking algorithm, and geographical areas to determine:

6.1.12.1 The coverage area provided by the MEOLUTs in standalone, combined standalone and networked modes; and

6.1.12.2 Satellite tracking schedule and MEOLUT parameters to maximize detection rate and location accuracy performance over any specified geographic areas on Earth.

6.1.13 The MEOLUTs, MEOLUT Network, the MEOLUT LOI and ROI, the CAST, and all hardware associated with connecting to CMCC must use Transmission Control Protocol/Internet Protocol (TCP/IP) as the underlying transport and network protocol.

6.1.14 All network equipment installed at the MEOLUT sites must use Gigabit Ethernet (GbE).

6.1.15 All remote access connections must use DND's Radmin software.

6.1.16 All hardware or software must not attempt by default, to connect to the public internet.

6.1.17 All MEOLUT and MEOLUT network systems' civil, mechanical and electrical installations must meet the local, provincial and federal engineering requirements and building codes at their installed site. In the event of conflict, the systems must meet the most stringent.

6.2 OPERATIONAL

6.2.1 Each MEOLUT must meet the operational requirements defined in section 3 of C/S T.019 document.

6.2.2 Further to the COSPAS-SARSAT document T.019 mandatory requirements, the MEOLUTs must:

6.2.2.1 Be fully operational in stand-alone mode (no shared data from any other MEOLUT or other ground segment equipment), at least 99 percent of the time calculated on a monthly basis;

6.2.2.2 Be capable of fully automatic and unattended operation; and

6.2.2.3 Operate in the most extreme weather conditions likely to be encountered at the MEOLUT sites as per section 6.3.2.17.

6.2.3 Each MEOLUT LOI and ROI must support a minimum of 10 concurrent users both locally or remotely.

6.2.4 Each MEOLUT must be remotely accessible from the CMCC operational workstations by CMCC operators through the MEOLUT ROI for command, control and management purposes as per CMCC ConOps requirements.

6.2.5 Each MEOLUT must send all information necessary for alert data processing and distribution to all CMCC servers as described in the CMCC ConOps requirements and as per document C/S A.002.

6.2.6 Each MEOLUT must provide and send all beacon self-test data for processing to CBRV as described in the CMCC ConOps requirements and must compute independent locations for these bursts as with normal message data. The computation of independent locations for beacon self-test data must take a second priority to normal alert data.

6.2.7 Each MEOLUT must provide for data exchange to the MEOLUT Network and the Network Location Processor that will reside at CMCC primary and secondary sites.

6.2.8 The MEOLUT Network Location Processor must send all information necessary for alert data processing to all CMCC servers as per the CMCC ConOps requirements and as specified in C/S T.019.

6.2.9 Each MEOLUT must provide all data necessary to characterise interfering signals in the SAR band and transmit to CMCC servers using the appropriate C/S A.002 Subject Identifier Type (SIT) message as described in the ConOps requirements.

6.2.10 All MEOLUT data channels must process 406 MHz COSPAS-SARSAT type approved distress beacon signals from MEOSAR satellites as specified in section 3 of C/S T.019 document.

6.2.11 Each MEOLUT must be capable of receiving and decoding beacon signals received through downlinks from COSPAS-SARSAT commissioned GEOSAR satellites to obtain beacon data.

6.2.12 Each MEOLUT must be capable of continuously receiving and processing all satellite data for all portions of a satellite pass above a 5 degree elevation angle, with the exception of local obstructions (site masking) as established by Canada.

6.2.13 Each MEOLUT must simultaneously track as many uniquely visible and different Global Navigation Satellite System (GNSS) satellites with MEOSAR repeaters.

6.2.14 Each MEOLUT must:

6.2.14.1 Generate an optimized pass schedule for Canada's SAR AOR by default, and when requested for specified geographic areas of as defined by CMCC operators;

6.2.14.2 Accept a tracking schedule from the centralized satellite tracking scheduler at CMCC, or other CMCC approved tracking schedule validated by the MEOLUT CAST, in CSV and XML formats, to automatically coordinate tracking of SAR Satellites by the MEOLUTs; and

6.2.14.3 Provide a schedule which must include as a minimum satellite Identification (Id), antenna Id, time of Acquisition of Satellite (AOS) and time of Loss of Satellite (LOS), and the Two Line Element set (TLE).

6.2.15 The MEOLUTs must store locally all the data required to fully describe the characteristics of received transmissions and the processing done on them including all data identified for archiving as per document C/S T.019 including:

6.2.15.1 Satellite tracking schedules;

6.2.15.2 Satellite pass log files as per C/S R.018, Annex J, Table J.3;

6.2.15.3 Status, Warnings and Alarms; and

6.2.15.4 Commands and command responses.

6.2.16 All data in 6.2.15 must be stored in separate identical databases based on age:

6.2.16.1 Less or equal to 90 days in the active database; and

6.2.16.2 Older than 90 days and for up to seven years in the archived database.

6.2.17 All data in 6.2.15 and 6.2.16 must be accessible to CMCC operations through the MEOLUT LOI and ROI.

6.2.18 All databases must be compliant with commercially available Structured Query Language (SQL) data base management tools, including support for remote access commands and services, and accessible directly by CMCC operators.

6.2.19 Through the MEOLUT LOI and ROI, the MEOLUTs must provide the capability to display graphically 406 MHz spectrum data, with signal to noise ratios, in time and frequency domains including:

6.2.19.1 Enable viewing and colour printing of the data;

6.2.19.2 Configurable and selectable frequency band and time ranges;

6.2.19.3 Filter beacons according to time, frequency and beacon IDs;

6.2.19.4 Colour code by beacon IDs;

6.2.19.5 Real time 406 MHz hexadecimal beacon Ids and points displayed and printed in matching colours;

6.2.19.6 Interferers displayed and identified with their unique assigned reference numbers; and

6.2.19.7 All information displayed must be overlaid in such a way were data fields are not blocked or obstructed by other fields.

6.2.20 The MEOLUTs must have the capability to store for a period of 30 days all raw spectrum data, in I and Q (I/Q) format, on external hard drives for spectrum monitoring and Government of Canada (GoC) archiving purposes.

6.2.21 The MEOLUTs must not radiate or emit any RF signals that will interfere with the existing COSPAS-SARSAT system or other systems operating on other radio frequencies.

6.3 FUNCTIONAL AND PROCESSING

6.3.1 Each MEOLUT must meet all the functional and processing requirements as per the Functional and Processing Requirements of section 4 of C/S T.019 document.

6.3.2 Further to the C/S document T.019 mandatory functional and processing requirements, the MEOLUTs must:

6.3.2.1 Process and recover 406 MHz beacon message data as per the processing sequence and message recovery requirements of document C/S T.019 for all satellite data channels using the formats described in documents C/S T.001 and C/S T.015;

6.3.2.2 Detect and correct bit errors in, and apply validation to, the beacon messages received through the MEOLUT's satellite data channels and forwarded by the MEOLUT Network;

6.3.2.3 Meet all the beacon message burst and message association requirements as specified in document C/S T.019;

6.3.2.4 Transmit beacon message data including "self-test" burst data to the CBRV as specified in the CMCC ConOps requirements and in accordance with C/S T.019;

6.3.2.5 Provide all alert data as per the C/S T.019 to CMCC servers in accordance with the CMCC ConOps requirements;

6.3.2.6 Further to calculating independent locations, the MEOLUTs must:

6.3.2.6.1 Always generate a 2D independent location based on a received burst from the same beacon when three or more unique satellites have relayed valid data for that burst;

6.3.2.6.2 Not generate an independent location when two or fewer unique satellites have relayed valid data for the same beacon;

6.3.2.6.3 Generate additional locations using multiple bursts that are received within a configurable time limit range of one to 10 minutes, from the same beacon from 3 or more unique satellites;

6.3.2.6.4 Produce an Expected Horizontal Error (EHE) for every independent location that meets the requirements as defined in the Performance section of C/S T.019 document;

6.3.2.6.5 Produce a Quality Factor (QF) derived from the EHE that meets the requirements as defined in the Performance section of C/S T.019 document;

6.3.2.6.6 Map its EHE and QF to a Confidence Factor (CF) for operational use and information, as per the examples provided the Performance section of C/S T.019 document;

6.3.2.6.7 Indicate if a solution was TDOA only, FDOA only, or a merge of TOA/FOA calculations through a field in the database table of locations, and show this graphically through the MEOLUT LOI and ROI; and

6.3.2.6.8 Be capable of processing combined data with non-MEOSAR Satellites as per C/S T.019 document for decoding and locating. This capability must be a configurable feature that can be enabled or disabled by CMCC operators through the MEOLUT LOI and ROI.

6.3.2.7 Maintain system time accurate to within 50 nanoseconds or less of Universal Time Coordinated (UTC);

6.3.2.8 Provide timestamps to a resolution of +/- 10 nanoseconds or less;

6.3.2.9 Maintain system frequencies accurate to 2×10^{-12} or better;

6.3.2.10 Measure frequency to a resolution of ± 0.001 Hz or better;

6.3.2.11 Maintain tracking schedules and satellite orbital elements for all MEOSAR satellites accurate to within 10 centimetres and 50 nanoseconds;

6.3.2.12 Receive satellite health status and orbital elements directly from the broadcast GNSS ephemerides hosting the MEOSAR payloads and:

6.3.2.12.1 Send an alarm to CMCC if no GNSS signal is available; and

6.3.2.12.2 Implement satellite orbital elements as per C/S A.001 from online sources provided by CMCC in accordance with approved COSPAS-SARSAT sources;

6.3.2.13 Be capable of tracking a new pass, and stopping the older pass, within five minutes of a newly self-generated pass schedule, or receiving a new pass schedule from the centralized satellite tracking scheduler or CMCC;

6.3.2.14 Send an alarm to CMCC, if the MEOLUT does not completely track any pass on the schedule; and

6.3.2.15 Be capable of calculating the location of interfering signals operating in the 406.0 to 406.1 MHz band, and provide the resultant data to the CMCC servers as per document C/S T.019 and C/S A.002.

6.3.2.16 The MEOLUT Network must:

6.3.2.16.1 Meet the requirements specified for MEOLUT Network data exchange as per document C/S T.019 and in accordance with the requirements of sections 6.2.7, 6.2.8, and 6.3.2.1-6.3.2.6 of this document;

6.3.2.16.2 Provide a Network Location Processor at CMCC primary and secondary sites; and

6.3.2.16.3 The Network Location Processor must function as a MEOLUT Processor as per C/S T.019 and must:

6.3.2.16.3.1 Provide 2D independent location solutions with a single burst using TDOA only, and FDOA only, and TDOA/FDOA location algorithms;

6.3.2.16.3.2 Provide 3D (includes altitude) independent location solutions with a single burst using TDOA only, and FDOA only, and TDOA/FDOA location algorithms; and

6.3.2.16.3.3 Permit the above features to be enabled or disabled by the CMCC operators through the ROI and Network Location Processor LOI.

6.3.2.17 Each MEOLUT RF front-end receiver system including antenna subsystem must:

6.3.2.17.1 Acquire, track and receive the downlink signal in the correct polarization from any COSPAS-SARSAT MEOSAR satellite as described in document C/S T.016;

6.3.2.17.2 Acquire, track and receive signals in the correct polarisation from non-GNSS SAR satellites as described and C/S T.011;

6.3.2.17.3 Have sufficient gain and adequate sensitivity to ensure the RF receive-chain can discern the received distress signals as per C/S T.019;

6.3.2.17.4 Be able to operate with less than 0.5 dB degradation in boresight gain for sustained winds of 100 km/h;

6.3.2.17.5 Be able to survive the most extreme weather conditions (wind and precipitation) expected to be encountered at the MEOLUT sites, based on historical weather data over the past 80 years as recorded by Environment Canada, and return to normal operation at cessation of survival wind velocity; and

6.3.2.17.6 Be capable of operating in the extreme ambient temperatures and relative humidity expected to be encountered at the MEOLUT sites, based on historical weather data over the past 80 years as recorded by Environment Canada.

6.3.2.18 The RF Receive Chain Subsystem must condition and down-convert all received signals from the antenna subsystem, to the correct frequency range and power levels required by the MEOLUT Processor system hardware specifications.

6.3.2.19 The RF Front-End receiver system must have built–in–test capability to monitor its health and performance, including Gain over Temperature (G/T), Carrier to Noise ratio (C/No), Bit Error Rate (BER), processing gain, and signal level from the down-converter output, using reference beacon IDs that will be selected by CMCC Operators through the ROI.

6.3.2.20 The Processor System, including all subsystems, must meet all the Functional and Processing requirements as per document C/S T.019 and in accordance with the CMCC ConOps requirements.

6.3.2.21 The centralized satellite tracking scheduler residing at CMCC and available through the ROI must include tracking and scheduling optimization algorithms capable of generating a master tracking schedule nationally for all the MEOLUTs to optimize Canada's SAR AOR coverage, and specific regions of Canada's AOR when required by CMCC.

6.3.2.22 All MEOLUT satellite tracking and schedule optimization algorithms must:

6.3.2.22.1 Automatically generate tracking schedules even when the number of antenna beams or receive streams is reduced below the standard operational configuration; and

6.3.2.22.2 Factor in the separation angle between satellites transmitting on the same centre frequency to reduce interference artifacts due to antenna pattern effects.

6.3.2.23 The MEOLUTs must be capable of being started, shut down, and restarted through the MEOLUT LOI and ROI. These functionalities must involve two levels:

- MEOLUT applications software (warm start, stop, restart) with underlying operating systems software active and running; and
- Entire operating environment including all application and operating system software (cold start).

6.3.2.23.1 Be accomplished in the least time possible and within five minutes upon availability of electrical power for cold starts and within one minute for warm starts and restarts;

6.3.2.23.2 Allow for individual MEOLUT components (including antenna sub-systems) to be restarted without affecting other MEOLUT functions; and

6.3.2.23.3 Automatically include build-in-tests as per 6.3.2.19 to verify readiness after any cold start or RF Receive Chain system restart.

6.3.2.24 The MEOLUTs must immediately respond to each command from the MEOLUT LOI and ROI and:

6.3.2.24.1 The message response must be sent or communicated to all users within one minute of receipt of all interface commands and provide the identifier (message number and source) of the command, the disposition of the command and the time the command was processed.

6.3.2.25 If the MEOLUTs do not execute a MEOLUT Operator Interface command, the MEOLUTs must automatically send a message to all users once the MEOLUT determines (either by error or timeout) that the command was not executed.

6.3.2.26 The MEOLUTs must record, store and make available through the LOI and ROI at time intervals that are configurable through the MEOLUT LOI and ROI, with a default setting of 10 minutes:

6.3.2.26.1 Environmental conditions (including temperature, wind speed, atmospheric pressure, and relative humidity) for each site;

6.3.2.26.2 Temperature and relative humidity readings in enclosed spaces, shelters, and radomes, as well as sealed antenna components under pressurization and humidity control;

6.3.2.26.3 Data to determine antenna tracking accuracies and strength of the received RF signal; and

6.3.2.26.4 Warning messages and alarm messages, either in the near future (warnings) or immediately (alarms) using a C/S A.002 defined SIT 915. The messages must be generated automatically and sent immediately CMCC servers.

6.3.2.27 Upon any start-up, the MEOLUTs must automatically send a message to the CMCC on its status indicating that it has restarted and include the software version and release number of the software, along with a status message that includes all data fields described in 6.3.2.24 and 6.3.2.26.

6.3.2.28 The MEOLUTs must provide alarms, warnings and status messages to the CMCC in text formats and transmit these messages through e-mail as per the CMCC ConOps requirements.

6.3.2.29 All MEOLUTs and networking hardware must:

6.3.2.29.1 Support Simple Network Management Protocol (SNMP) , SFTP, and FTPS; and

6.3.2.29.2 Exchange messages with the CMCC, the MEOLUT LOI and ROI and the MEOLUT Network using File Transfer Protocol (FTP) through a Virtual Private Network (VPN) and must comply with all requirements of documents C/S T.019 and A.002 relative to FTP and VPN communications (i.e. FTPV).

6.4 PERFORMANCE

6.4.1 The MEOLUTs must meet all performance requirements stated in section 5 of C/S document T.019.

6.4.2 Further to the C/S document T.019 baseline performance requirements, the MEOLUTs must:

6.4.2.1 Maximize sensitivity, limit noise and optimize filtering of the down-converted received signal so as to exceed RF Signal Margin performance requirements as per C/S document T.019.

6.4.2.2 Maintain positive link margins with the space segment transmitters that are sufficient to ensure that the individual channel or stream link RF availability, at each MEOLUT site, is equal to or greater than 99.0% for S-band and 99.5% for L-band.

6.4.2.3 Exceed the Beacon Detection Probability requirement in standalone mode as defined in C/S T.019 of 99.999% or better within the Minimum Performance Area (MPA) and 99.9% or better within the coverage area of radius 5000 km or greater from the site.

6.4.2.4 Meet or exceed the Beacon Detection Probability requirement as defined in C/S T.019 as combined standalones or in networked mode of 99.999% over Canada's entire SAR AOR.

6.4.2.5 Meet single channel throughput performance, as defined in C/S R.018, over a coverage area of radius 5000km or greater from the MEOLUT site of 30% or better for GPS S-band; and 40% or better for GNSS L-Band;

6.4.2.5.1 To determine the single channel throughputs, known reference and test beacons over Canada's AOR, and reference and orbitography beacons from North America and Europe will be used.

6.4.2.6 Meet in standalone mode all of the probability requirements to obtain FDOA/TDOA locations as specified in C/S document T.019 over a coverage area equal to or greater than a radius of 5000km from the site.

6.4.2.7 Meet as combined standalones or in networked mode all the probability requirements to obtain FDOA/TDOA locations as specified in C/S document T.019 over Canada's entire SAR AOR.

6.4.2.8 Meet in standalone mode all the location accuracy requirements as specified in document C/S T.019 over a coverage area equal to or greater than a radius of 5000km from the site.

6.4.2.9 Meet as combined standalones or in networked mode all the location accuracy requirements as specified in C/S T.019 over Canada's entire SAR AOR.

6.4.2.10 Provide TOA and FOA data that meets or exceeds measurement accuracy ranges as specified in section 5.8 of document C/S T.019 in standalone mode.

6.4.2.11 Successfully process, under nominal operating conditions and within the minimum Processing Bandwidth as specified in C/S T.019, one hundred C/S T.001 type 406 MHz distress beacons that are active simultaneously within the COSPAS-SARSAT 406 MHz operational channels as defined in T.012.

6.4.2.12 Process 406 MHz beacon message burst data received from its RF Front Ends and send the associated alert data to all CMCC servers, as per the performance requirements for transmitting data to an MCC of document C/S T.019, and in accordance with the CMCC ConOps requirements.

6.4.2.13 Processing anomaly rate, as defined in C/S T.019, at a ratio of 1×10^{-5} or better.

6.4.2.14 Meet all performance requirements and constraints as specified in the processing combined data with non-MEOSAR Satellites section of C/S T.019.

6.4.3 <u>Degraded Performance in Failure Condition</u>

6.4.3.1 When any element of the COSPAS-SARSAT Ground Segment system cannot meet the requirements in accordance with this document, and with document C/S P.015, the Ground Segment is considered to be in a failure condition.

6.4.3.2 When in a failure condition, the MEOLUT must:

6.4.3.2.1 Continue to operate with degraded performance; and

6.4.3.2.2 Send an alarm through the MEOLUT LOI and ROI to all CMCC servers and e-mail the CMCC operators to indicate the degraded level of performance and its effect on both detection rate and location accuracy.

6.5 TESTING

6.5.1 Factory Acceptance Testing (FAT)

6.5.1.1 All FAT procedures must be executed as per the approved Master Test Plan (MTP) as detailed in section 7 of this document.

6.5.1.2 All elements that are under FAT provisions, must meet the expected technical and functional requirements as defined in the approved in the MTP.

6.5.2 Site Acceptance Testing (SAT)

6.5.2.1 All Ground systems SAT procedures must be executed as per the approved MTP.

6.5.2.2 All systems installed at their respective sites, must be tested as outlined in the approved MTP and must meet all the technical, operational, functional, processing, and performance requirements of this document.

6.6 COSPAS-SARSAT COMMISSIONING

6.6.1 MEOLUT

6.6.1.1 All MEOLUTs must be commissioned in standalone mode as per C/S T.020 and as detailed in the approved MTP.

6.6.1.2 All MEOLUTs and their connections to the CMCC must pass all C/S T.020 tests and all related COSPAS-SARSAT MCC and MEOLUT applicable standards and commissioning documents as outlined in the approved MTP.

6.6.2 MEOLUT Network

6.6.2.1 The MEOLUT Network and its connections to the CMCC including the Network Location Processors must pass all C/S T.020 tests related to networking, MEOLUT data exchange, location processing, and all related COSPAS-SARSAT MCC and MEOLUT applicable documents as outlined in the approved MTP.

7 TASKS & DELIVERABLES

7.1 PROGRAMMATICS

7.1.1 The Contractor must provide and deliver all electronic copies of manuals, reports and design documents in Microsoft (MS) Office 2010 and/or PDF format.

7.1.2 The Contractor must provide and deliver the following documentation:

7.1.2.1 All standalone technical and operational manuals for all equipment, systems, interfaces, and software that are supplied and integrated by the contractor as part of the MEOLUTs, the MEOLUT LOI and ROI, the MEOLUT Network and associated Network Location Processor, and the MEOLUT CAST electronically and hard copies in both of Canada's official languages (English and French) .

7.1.2.2 All meetings and meetings' related correspondence, documentation, and project administrative documents in English.

7.1.2.3 All technical reports and design documents in English as electronic copies.

7.1.2.4 Existing commercial manuals for off-the-shelf equipment as part of the Contractor supplied documentation in English in electronic copies.

7.1.3 The Contractor must provide:

7.1.3.1 All training sessions in English, with the option of training in French if and when requested by DND; and

7.1.3.2 All training materials in electronic format in both English and French.

7.1.4 The Contractor must develop, submit and update the Project Management Plan (PMP) providing an overview of the project processes and how they fit together to form an integrated management system for the project.

7.1.4.1 The PMP must be the master planning document, integrating, summarizing and referencing all project plans and documents required to complete the activities identified in this Statement of Work.

7.1.5 The Contractor must develop, submit and update a Master Schedule using MS Project describing the Contractor's planned sequence of activities, milestones and decision points to ensure the requirements of this document can be met.

7.1.6 The Contractor must prepare and submit a Contract Work Breakdown Structure (CWBS).

7.1.7 The Contractor must prepare, submit and update a Summary of Documents Matrix to verify all documentation has been submitted.

7.1.8 The Contractor must prepare and submit System Design (SD) documents for the MEOLUTs, MEOLUT Network and Network Location Processor, and the Coverage Area Simulation Tool (CAST).

7.1.8.1 The Contractor must prepare and submit a Requirements Verification and Validation Matrix as part of the System Design.

7.1.9 The Contractor must prepare and submit a Software Description Document (SWDD) that describes the operation of the systems' software and interfaces to and from all software components including the operational concept, architecture and signal flow of all software.

7.1.10 The Contractor must prepare and submit Hardware Description Documents (HDD) defining the hardware used in the MEOLUT, the MEOLUT Network and Network Location Processor, and hardware for all CMCC support tools with complete sets of schematic diagrams of all components, subsystems, cabling and interfaces. The HDD must include:

7.1.10.1 Mechanical drawings, parts location and component layout drawings, and a detailed parts list including manufacturers' names, part numbers, electrical value, and ratings of all components used; and

7.1.10.2 Information on the hardware used for the Centralized Satellite Tracking Scheduler and the Coverage Area Simulation Tool (CAST).

7.1.11 The Contractor must prepare and submit Site Installation Plans (SIP) including all site installation drawings and detail all civil and electrical engineering tasks needed to ensure site installation requirements are met.

7.1.12 The Contractor must prepare and submit System Specification Documents (SSD) detailing their technical and performance specifications for:

7.1.12.1 The MEOLUTs in standalone mode using automated individual tracking scheduler and centralized tracking scheduler;

7.1.12.2 The MEOLUT Network and the associated Network Location Processor;

7.1.12.3 The Coverage Area Simulation Tool;

7.1.12.4 The Centralized Satellite Tracking Scheduler;

7.1.12.5 Uplink and Downlink (Beacon to Satellite to MEOLUT) RF Link Budget and Availability analysis; and

7.1.12.6 A Performance Verification and Validation Matrix for all systems.

7.1.13 The Contractor must prepare and submit the Master Test Plan (MTP) containing all test cases and procedures, verification, validation and compliance matrices and Configuration Items (CIs), including software, firmware and hardware, to perform and evaluate:

7.1.13.1 All FAT and SAT of the MEOLUTs, the MEOLUT LOI and ROI, the MEOLUT Network and associated Network Location Processor;

7.1.13.2 All SAT of the MEOLUT CAST; and

7.1.13.3 All COSPAS-SARSAT Commissioning for the MEOLUTs and its interfaces in standalone and networked modes.

7.1.14 The Contractor must prepare, submit and correct the Commissioning Documentation and Data (CDD) information and documentation required by COSPAS-SARSAT for MEOLUT commissioning.

7.1.15 The Contractor must produce, submit and update a Risk Assessment and Mitigation Plan (RAMP) for the project, identifying risks associated with the SD, SWDD, HDD, SSD, SIP, MTP, CDD, technology obsolescence, and all other risks that impact the contractor Master Schedule and the PMP.

7.1.16 The Contractor must prepare and submit a Recommended Spare Pars List (RSPL) that includes all the spare parts required to maintain the MEOLUTs in accordance with the COSPAS-SARSAT availability requirements and specifications and the In Service Support (ISS) Contract for the MEOSAR Ground Segment.

7.1.17 The Contractor must prepare and submit the Availability Analysis document that supports the RSPL in identifying the critical components of the system, their Mean Time Between Failure (MTBF) and Mean Time to Repair (MTTR), and the MEOLUT availability as a whole entity.

7.1.18 The Contractor must prepare and provide an Operations and Maintenance Training Plan (OMTP) that includes all training material required to train the operators, users and maintainers of the system.

7.1.19 The Contractor must prepare and submit Operations, Management, Maintenance, User Configuration and Interface Description manuals containing all information required to operate, manage, maintain, and configure the complete Ground Segment System including as a minimum:

7.1.19.1 MEOLUT Hardware and Software Description Manual;

7.1.19.2 MEOLUT Operator, User Configuration and Interface Manual;

7.1.19.3 MEOLUT Management and Maintenance Manual;

7.1.19.4 MEOLUT Remote Operator Interface (ROI) Manual;

7.1.19.5 MEOLUT to CMCC Interfaces Description and Configuration Manual;

7.1.19.6 Warnings, Alarms and Messages Description and Configuration Manual;

7.1.19.7 MEOLUT Network and Network Location Processor Hardware and Software Manual;

7.1.19.8 MEOLUT Network and Network Location Processor Operator and User Configuration Manual;

7.1.19.9 MEOLUT Network and Network Location Processor Management and Maintenance Manual;

7.1.19.10 Centralized Satellite Tracking Scheduler User Manual; and

7.1.19.11 Coverage Area Simulation Tool (CAST) Description and User Manual.

7.2 MEETINGS

7.2.1 **Kick-Off Meeting (KOM):**

7.2.1.1 The Contractor must host a KOM, at its facilities, 20 working days after Contract Award to review the contractor Master Schedule and the initial PMP.

7.2.2 **Systems Requirements Review (SRR):**

7.2.2.1 The Contractor must host a SRR, at its facilities, no later than the first Progress Review Meeting (PRM). The Contractor may choose to host the SRR in conjunction with the KOM; otherwise, then the Contractor must hold the SRR in conjunction with the first PRM.

7.2.3 **Progress Review Meetings/Teleconferences:**

7.2.3.1 The Contractor must hold monthly Progress Review Meeting/Teleconference (PRM/T) starting 30 working days following the KOM. The first PRM must be held at a Contractor's facilities and will include an initial System Design Review (SDR);

7.2.3.2 Subsequent PRMs are recommended to be held by teleconference. The Contractor must provide conference call numbers and any video conference capability as required. Should the Contractor or DND decide that a face-to-face PRM is required, the PRM must be held in Ottawa, Ontario, Canada;

7.2.3.3 The Contractor must submit a Project Status Reports (PSR) five working days before each PRM. The PSRs will be discussed at the PRMs and must provide information about the items to be presented or discussed at the PRMs;

7.2.3.4 All PRM/T must review and update the Risk Assessment and Mitigation Plan (RAMP) and record any newly identified risks; and

7.2.3.5 The final PRM/T will also serve as the review of all the test reports, address any unresolved issues, summary of intellectual property developed and recommendations for closure of the contract.

7.2.4 **Meeting Agenda:**

7.2.4.1 The meeting agenda must provide information about the items to be presented or discussed at the PRMs; and

7.2.4.2 The Contractor must provide a draft agenda 10 working day prior to each PRM for DND comments; DND will provide comments (if any) five working days prior to the PRMs.

7.2.5 **Meeting Minutes:**

7.2.5.1 The Meeting Minutes must provide detailed record of the discussions, Action Items, and decisions taken during the meeting; and

7.2.5.2 The Contractor must provide the draft meeting minutes of each PRM five working days after each PRM is held; DND will provide comments (if any) five working days after receipt of the minutes.

7.2.6 **Meeting Decisions:**

7.2.6.1 If decisions made at any meeting require changes to the contract, these decisions must be executed through a formal contract amendment.

7.3 IMPLEMENTATION

7.3.1 The Contractor must implement all system designs of the MEOLUTs, the MEOLUT Local and Remote Operator Interface (LOI and ROI), the MEOLUT Network, their connections to the CMCC servers, de Network Location Processor, and the MEOLUT Coverage Area Simulation Tool (CAST) as outlined in the approved System Design (SD) plan and meeting all the requirements as outlined in this document.

7.3.2 The Contractor must assist Canada in the Security Assessment & Authorization (SA&A) process of their Information Technology (IT) solutions in accordance with the Treasury Board of Canada Secretariat (TBS) Policy on Government Security and Department of National Defence (DND) Security Assessment and Authorization Guideline (SAAG) and must:

7.3.2.1 Ensure that the overall design of the IT systems complies with GoC TBS and DND IT security guidelines;

7.3.2.2 Produce a Systems Security Design and Systems Security Architecture documentation for all new and existing infrastructure in support of the SA&A process; and

7.3.2.3 Support the SA&A process for all infrastructures stated above which will include the Information System Security Officer (ISSO) development of the SA&A deliverables and plans. The deliverables include, but are not limited to, System requirements specification including Information Technology Security (ITSEC) requirements, IT Security Concept of Operation, Statement of Sensitivity (SOS), Preliminary Privacy Impact Assessment, System Design Specification, Threat Risk Analysis, Certification & Authorization (C&A) checklist, Service Interface Requirement, Configuration Management Plan, Contingency plan and Security Test & Evaluation.

7.4 DELIVERY

7.4.1 **MEOLUT Sites**

7.4.1.1 The Contractor is responsible for:

7.4.1.1.1 Delivering all equipment to implement the MEOLUT designs and connections for complete installation of all systems to each MEOLUT site; and

7.4.1.1.2 Providing additional fences, shelters, and storage to safeguard and protect the delivered parts and installed systems from the elements.

7.4.2 **CMCC Sites**

7.4.2.1 The Contractor is responsible for delivering all equipment to implement the MEOLUT Network, LOI and ROI, Network Location Processor, and CAST designs and connections for complete installation of all systems to each CMCC site.

7.5 INSTALLATION

7.5.1 **MEOLUT Sites**

7.5.1.1 The Contractor must be responsible for all aspects of the MEOLUT installation, at all sites including:

7.5.1.1.1 The supply, storage, and installation of all software, hardware, equipment, components, and materials;

7.5.1.1.2 All tasks needed to obtain all required local, provincial and federal building permits including interfacing with appropriate DND base authorities regarding additional DND required site permissions and authorization forms;

7.5.1.1.3 Site surveys including Environmental Assessments (EA) and Electro-Magnetic Interference (EMI);

7.5.1.1.4 Radio apparatus licenses and all related fees;

7.5.1.1.5 Civil, electrical, mechanical and environmental tasks for infrastructure design and construction of any enclosed buildings, shelters, radomes, towers, and other structures at the two chosen sites;

7.5.1.2 The Contractor must provide suitable buildings and enclosed spaces to:

7.5.1.2.1 House the MEOLUTs processors, antenna pressurization equipment, and any other required equipment including all equipment racks to house any computing and network devices at both sites;

7.5.1.2.2 Meet the safe operating temperature and humidity ranges of the MEOLUT equipment including heating, cooling, humidity control, and air exchange and filtering; and

7.5.1.2.3 Allow space for future expansion of up to 50% of provisioned number of racks.

7.5.1.3 Any buildings, pre-existing or new, used to accommodate MEOLUT equipment must contain an enclosed and securable room for storage and workspace which must:

7.5.1.3.1 Be at least 200 square feet, be rectangular in shape, where the smallest dimension must be at least 10 feet;

7.5.1.3.2 Contain shelving to store RF related spare parts;

7.5.1.3.3 Contain a securable storage locker that is at least four feet wide, eight feet high, two feet deep, and contains four shelves;

7.5.1.3.4 Contain a work bench that is at least six feet long by two feet deep with a work surface at standing height above the floor level as per Canada Occupational Health and Safety Regulations (COHSR) guidelines and recommendations;

7.5.1.3.5 Contain two chairs of a height appropriate for the height of the work bench as per COHSR guidelines and recommendations;

7.5.1.3.6 Have a minimum six network jacks (1000 base network); and

7.5.1.3.7 Have a minimum four duplex NEMA 5-20R power receptacles (that also accept NEMA 5-15 plugs) located over the work bench. These receptacles must be protected by a dedicated Uninterruptable Power Supply (UPS) and the sites backup power source.

7.5.1.4 The Contractor must:

7.5.1.4.1 Protect all enclosed buildings, shelters and other structures, from vermin, pests, dust and dirt;

7.5.1.4.2 Install additional electrical power outlets in all enclosed spaces, equipment shelters and towers;

7.5.1.4.3 Provide working space around all MEOLUT equipment, as per COHSR guidelines and recommendations;

7.5.1.4.4 Provide interior general and localized lighting for all enclosed spaces and shelters as per COHSR guidelines and recommendations;

7.5.1.4.5 Provide lightning and electromagnetic surge arrestors to protect the MEOLUT equipment at all enclosed buildings, shelters, radomes, towers and other structures as per national telecommunication and power system installation codes;

7.5.1.4.6 Provide and install fire alarms and extinguishers for all enclosed spaces and equipment shelters as per local fire codes;

7.5.1.4.7 Provide and install UPS for all equipment at the MEOLUT sites in case of power failures and for switch over to backup power;

7.5.1.4.8 Provide chain link fencing and gates with a minimum height of 1.5 meters at the MEOLUT sites to protect all the buildings, equipment shelters and radomes;

7.5.1.4.9 Ensure the radome entrances, equipment shelter doors and fenced gates have locks with keys; and

7.5.1.4.10 Ensure combinations of materials and finishes for all equipment are selected to resist and reduce corrosion in a marine atmosphere.

7.5.1.5 The Contractor must install all the MEOLUT systems as described in section 6 of the SoW including:

7.5.1.5.1 Installing and connecting all antenna subsystem parts to the RF receive chain subsystem;

7.5.1.5.2 Installing and connecting the RF Front End System to the respective MEOLUT processor system at both MEOLUT sites;

7.5.1.5.3 Installing and connecting all time and frequency subsystems required by the MEOLUTs at both MEOLUT sites;

7.5.1.5.4 Installing all networking equipment needed to connect the MEOLUTs to the MEOLUT Network and to CMCC, and required interfaces to the Search and Rescue Network (SARNET) as defined by the DND and Shared Services Canada (SSC); and

7.5.1.5.5 Ensuring all tubing, power and communication cables to the antennas are trenched below the frost line and are as per the local building codes at the MEOLUT sites.

7.5.2 **CMCC SITES**

7.5.2.1 The Contractor must connect the MEOLUTs to the CMCC servers and must install required equipment and interfaces at the CMCC sites as per the CMCC ConOps requirements including required Graphical User Interfaces (GUI), displays and related hardware and software.

7.5.2.2 The Contractor must install all required servers and related hardware and software for the implementation of the MEOLUT LOI and ROI, the MEOLUT Network, the Network Location Processor and the CAST at CMCC as per the requirements in section 6.

7.5.3 **Contractor Sites**

7.5.3.1 The Contractor must provide an Electronic Information Environment (EIE) to electronically exchange customer service support data relating to all DND and CMCC operator requests on matters of operation, management, maintenance, repair and warranty of all installed systems.

7.5.3.2 The EIE must provide a ticket and tracking system to document all requests from initial call to final resolution and archive all resolved tickets.

7.6 TESTING

7.6.1 **MEOLUT and MEOLUT LOI Testing**

7.6.1.1 The Contractor must provide FAT and SAT documentation and testing procedures as per the approved MTP. Test plans must include a requirements traceability matrix and performance verification and validation matrix based on section 6 of this document.

7.6.1.2 The Contractor must provide the FAT and SAT reports within one month after completion of testing.

7.6.1.3 The Contractor must identify their Quality Assurance Representative (QAR) for acceptance testing, and when acceptance testing will be scheduled, in the project plans described in section 7.1.

7.6.1.4 All the MEOLUTs and their LOIs must undergo FAT by the Contractor in the presence of their QAR; the Contractor must invite DND's Technical Authority (TA) and delegated QAR to witness the FAT at least 30 days prior to the FAT.

7.6.1.5 All the MEOLUTs and their LOIs must undergo SAT by the Contractor in the presence of their QAR and DND's TA and QAR; the Contractor must invite DND's TA and QAR at least 30 days prior to the SAT.

7.6.2 **MEOLUT ROI, Network and Network Location Processor and CAST Testing**

7.6.2.1 The Contractor must provide SAT procedures and documentation of the MEOLUT LOI and ROI, the MEOLUT Network and the Network Location Processor and CAST as per the approved MTP. Test plans must include a requirements traceability matrix and performance verification and validation matrix based on section 6 of this document.

7.6.2.2 The Contractor must provide the SAT reports within one month after completion of testing.

7.6.2.3 The Contractor must identify their QAR for acceptance testing, and when acceptance testing will be scheduled, in the project plans described in section 7.1.

7.6.2.4 The MEOLUT ROI, Network and Network Location Processor must undergo SAT by the Contractor in the presence of their QAR, DND's TA and QAR, CMCC staff or their delegated representatives. The Contractor must provide DND's TA, QAR and CMCC staff with possible meeting dates, which CMCC must approve, at least 30 days prior to MEOLUT LOI and ROI, MEOLUT Networking and Network Location Processor SAT.

7.6.2.5 The MEOLUT CAST must undergo SAT by the Contractor in the presence of DND's TA, CMCC staff, or their delegated representatives. The Contractor must provide DND's TA and CMCC staff with possible meeting dates, which CMCC must approve, at least 30 days prior to MEOLUT CAST SAT.

7.7 COSPAS - SARSAT COMMISSIONING

7.7.1 The Contractor must describe and perform all commissioning procedures and complete all documentation required for COSPAS-SARSAT commissioning of its MEOLUTs in accordance with C/S T.020 and C/S P.011 documents.

7.7.2 The Contractor must present all commissioning procedures and submit test results for review and evaluation by DND TA, QAR and CMCC operators before submitting the commissioning documentation to the COSPAS-SARSAT Secretariat.

7.7.3 The Contractor must demonstrate that the each MEOLUT complies with the appropriate COSPAS-SARSAT commissioning standards and guidelines for both Standalone and Network modes and as per the approved MTP.

7.7.4 The Contractor must provide all necessary software and documentation required to facilitate the commissioning process including:

7.7.5 Operation of a Government Furnished Beacon Simulator or third party Beacon Simulator in view of the MEOLUT for commissioning tests; and

7.7.6 Implementation and execution of all necessary beacon simulator scripts needed to perform all C/S T.020 tests using the Beacon Simulator.

7.7.7 The MEOLUTs and associated interfaces will be accepted as commissioned only after the submitted commissioning report to the COSPAS-SARSAT Secretariat has been reviewed by the COSPAS-SARSAT Joint Committee and formally approved by the COSPAS-SARSAT Council (CSC). The contractor must be present at the Joint Committee session/meeting to support Canada in presenting its Commissioning report.

7.8 TRAINING

7.8.1 After completion of the SAT, the Contractor must provide all training on operation, management, and maintenance of the MEOLUTs, and MEOLUT LOI to DND staff for each MEOLUT site on an agreed upon dates as per the Master Schedule and the agreed Operation and Maintenance Training Plan (OMTP).

7.8.2 The Contractor must provide all training on operation, management, and maintenance of the MEOLUT LOI and ROI, MEOLUT Network and Network Location Processor, and the MEOLUT CAST to CMCC operators at an agreed upon date at the CMCC Sites after SAT completion on three different occasions as per the Master Schedule and the agreed OMTP.

7.8.3 The Contractor must provide all training by qualified instructors as per the OMTP in English and if and when requested in French.

7.9 WARRANTIES

7.9.1 The Contractor must warrant all equipment and labour of the MEOLUT systems, including infrastructure and hardware, for a period of three years after successful completion of the SAT.

7.9.2 The Contractor must warrant all equipment and labour of all other systems, including infrastructure and hardware for a period of three years after successful completion of the SAT for the MEOLUT LOI and ROI, the MEOLUT Network, the Network Location processor and the MEOLUT CAST.

7.9.3 The Contractor must warrant all software of the systems delivered for a period of 120 days after successful completion of related SATs.

APPENDIX A – List of Acronyms

AOR	Area of Responsibility
AOS	Acquisition of Satellite
ASCII	American Standard Code For Information
BER	Bit Error Rate
C/S	COSPAS-SARSAT
C&A	Certification & Authorization
CAST	Coverage Area Simulation Tool
CBRV	Canadian Beacon Registry Verifier
CDD	Commissioning Documentation and Data
CF	Confidence Factor
CI	Configuration item
CMCC	Canadian Mission Control Centre
C/No	Carrier Noise Ratio
ConOps	Concept of Operation
COHSR	Canada Occupational Health and Safety Regulations
COTS	Commercial Off-The-Shelf
CSV	Comma Separated Values
CWBS	Contractor Work Breakdown Structure
DND	Department of National Defence
DND TA	DND Technical Authority
DWAN	DND Wide Area Network
EA	Environmental Assessment
EHE	Expected Horizontal Error
EIE	Electronic Information Environment
EMI	Electro-Magnetic Interference
FAT	Factory Acceptance Testing
FDOA	Frequency Difference of Arrival
FOA	Frequency of Arrival
FTP	File Transfer Protocol
FTPS	FTP Secure
FTPV	FTP and VPN communications
G/T	Gain over Temperature
GDOP	Geometric Dilution of Precision
GEO	Geosynchronous Earth Orbit
GEOLUT	Geosynchronous Earth Orbit Local User Terminal
GEOSAR	Geosynchronous Earth Orbit Search And Rescue
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
GoC	Government of Canada
GPS	Global Positioning System
GS	Ground Segment

G/T	Gain over Temperature
GUI	Graphical User Interface
HDD	Hardware Description Document
Hex	Hexadecimal
ICSPA	International COSPAS-SARSAT Programme Agreement
ISS	In-Service-Support
IT	Information Technology
ITSEC	IT Security
JRCC	Joint Rescue Coordination Centre
KOM	Kick-Off Meeting
LEO	Low Earth Orbit
LEOSAR	Low Earth Orbit Search And Rescue
LOI	Local Operator Interface
LOS	Loss of Satellite
LUT	Local User Terminal
MCC	Mission Control Centre
MEO	Medium Earth Orbit
MEOLUT	Medium Earth Orbit Local User Terminal
MEOSAR	Medium Earth Orbit Search And Rescue
MHz	Mega-Hertz
MND	Minister of National Defence
MPA	Minimum Performance Area
MRSC	Maritime Rescue Sub-Centre
MTBF	Mean Time Between Failure
MTP	Master Test Plan
MTTR	Mean Time to Repair
NLP	Networked Local Processor
OI	Operator Interface
OMTP	Operations and Maintenance Training Plan
OS	Operating System
PGS	Policy on Government Security
PMP	Project Management Plan
POC	Point of Contact
PRM	Project Review Meeting
PRM/T	PRM Teleconference
PSR	Project Status Report
QAR	Quality Assurance Representative
QF	Quality Factor
RF	Radio Frequency
RFP	Request for Proposal
ROI	Remote Operator Interface
RSPL	Recommended Spare Pars List
SA&A	Security Assessment & Authorization

SAAG	Security Assessment and Authorization Guideline
SAR	Search And Rescue
SARNET	SAR Network
SARSAT	Search And Rescue Satellite Aided Tracking
SAT	Site Acceptance Testing
SD	System Design
SDR	System Design Review
SFTP	Secure FTP
SIP	Site Installation Plans
SIT	Subject Identifier Type
SNMP	Simple Network Management Protocol
SOW	Statement of Work
SPOC	SAR Point of Contact
SQL	Structured Query Language
SRR	Search and Rescue Regions of Responsibility
SSAS	Ship Security Alert System
SSC	Shared Services Canada
SWDD	Software Description Document
TBS	Treasury Board of Canada Secretariat
TCP/IP	Transmission Control Protocol/Internet Protocol
TDOA	Time Difference of Arrival
TOA	Time of Arrival
UPS	Uninterrupted Power Supply
UTC	Universal Time Coordinated
UTF	Unicode Transformation Format
VPN	Virtual Private Network
XML	Extensible Markup Language