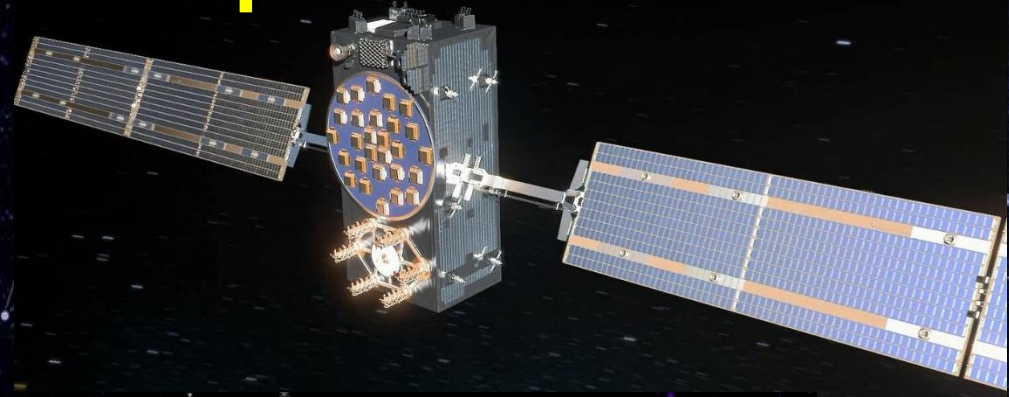


Beacon Manufacturers Workshop

Tampa, Florida, 13 May 2022



Cospas-Sarsat updates

Dany St-Pierre

Cospas-Sarsat Secretariat



Cospas-Sarsat Programme

Cospas-Sarsat Programme Status

- Overall Mission and Participants
- System segments status: Space segment, Ground Segment, Beacon population
- MEOSAR Advantages
- Assisted Saves distribution and evolution
- Main Developments
- EWG 2021 outcomes
- CSC-66 outcomes and decisions
- 2022-2023 Cospas-Sarsat Programme expectations





Cospas-Sarsat Mission

Mission Statement

The International Cospas-Sarsat Programme provides accurate, timely and reliable distress alert and location data to help search and rescue authorities assist persons in distress.

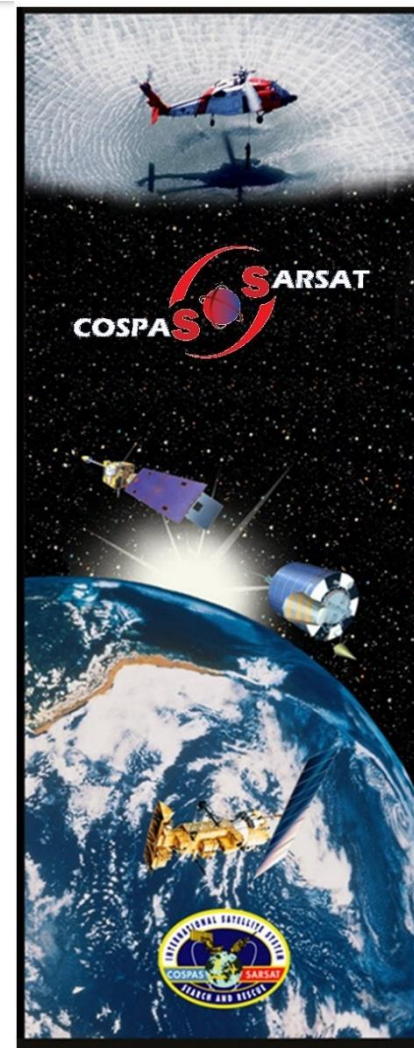
Objective

The objective of the Cospas-Sarsat system is to reduce, as far as possible, delays in the provision of distress alerts to SAR services, and the time required to locate a distress and provide assistance, which have a direct impact on the probability of survival of the person in distress at sea or on land.

Strategy

Cospas-Sarsat Participants implement, maintain, co-ordinate and operate a satellite system capable of detecting distress alert transmission from radiobeacons and of determining their position anywhere on the globe. The distress alert and location data is provided by Cospas-Sarsat Participants to the responsible SAR services.

Services are provided worldwide and free of charge for the user in distress.





Cospas-Sarsat Participants

Cospas-Sarsat Participants (45)



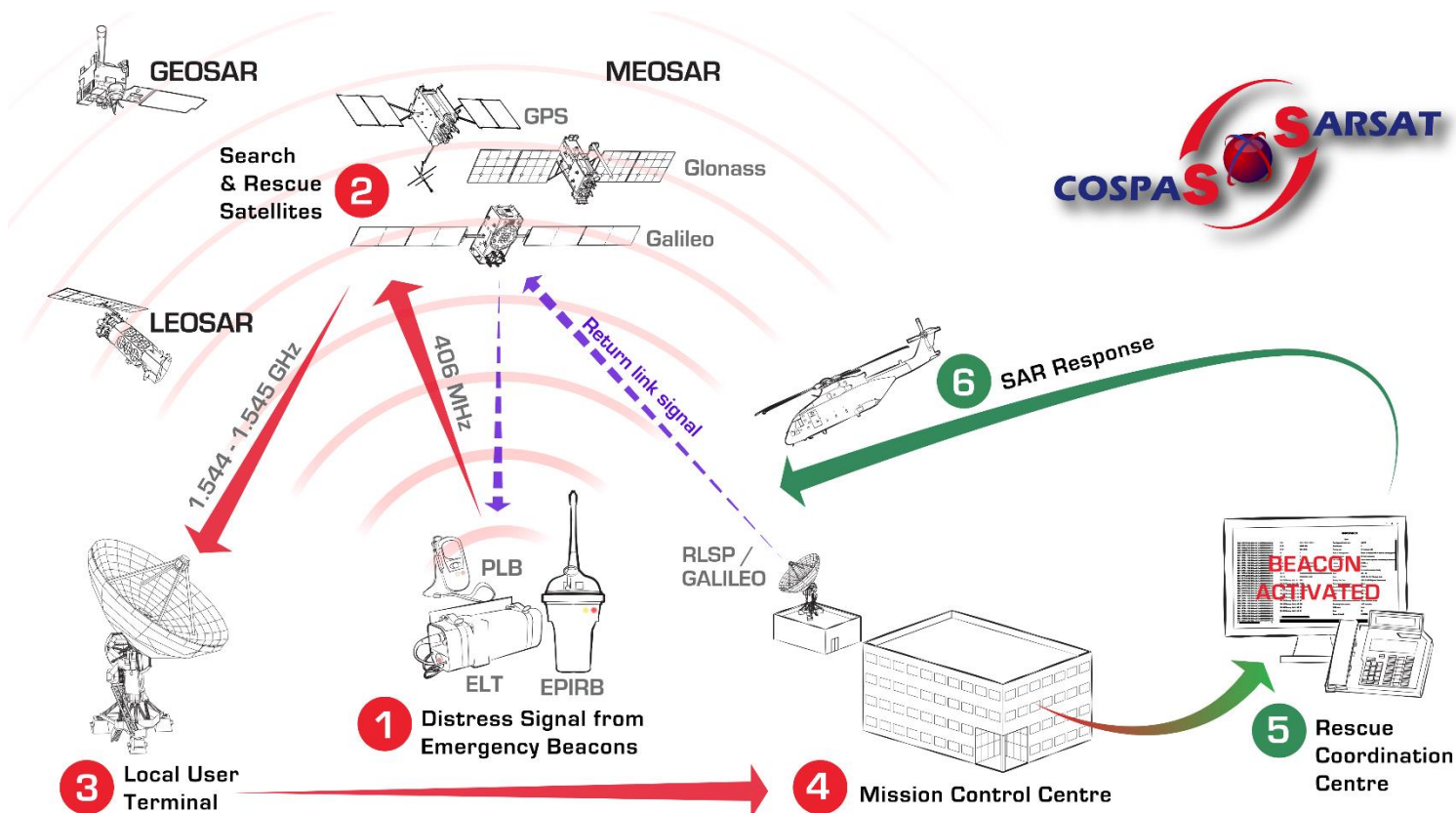
- Algeria
- Argentina
- Australia
- Brazil
- Canada
- Chile
- China (P.R.)
- Cyprus
- Denmark
- Finland
- France
- Germany
- Greece
- Hong Kong
- India
- Indonesia
- Italy
- ITDC
- Japan
- Korea (R. of)
- Malaysia
- Netherlands
- New Zealand
- Nigeria
- Norway
- Pakistan
- Peru
- Poland
- Qatar
- Russia
- Saudi Arabia
- Serbia
- Singapore
- South Africa
- Spain
- Sweden
- Switzerland
- Thailand
- Togo
- Tunisia
- Turkey
- UAE
- UK
- USA
- Vietnam

>75% of World Population
>85% of World Wealth





Cospas-Sarsat System





Cospas-Sarsat Satellite Systems

3 Types of Satellite Systems

- **LEOSAR: Legacy System** first payload deployed in 1982. Main operational system since the beginning of the Cospas-Sarsat Programme.
- **GEOSAR:** first payloads deployed in the mid-late 90s to provide early alerts and complement the LEOSAR system and in the future GEOSAR system.
- **Medium Earth Orbiting Search And Rescue (MEOSAR):** First payloads deployed in the early 2000s, first operational payload deployed in 2012 (Galileo), declared at Early Operational Capability in 2016. Initial Operational Capability anticipated to be declared in 2022 or early 2023.



Cospas-Sarsat LEO-GEO Components

- Space Segment:**
- 4 LEO payloads in operation + one temporarily shutdown (S7) to avoid ground tracking interference. One additional Cospas payload planned to be launched by the end of 2022.
 - 9 GEO payloads in operation, one additional GEOSAR at IOC status, 2 under test + 3 additional in-orbit spares (i.e., capable of being declared at FOC as needed). Additional GEOSAR payloads on MTGs, Electro-Ls and GOESs SAR payloads expected to be deployed in the upcoming years.
- Ground Segment:**
- 55 LEOLUTs in operation.
 - 27 GEOLUTs in operation
 - 30 Mission Control Centres in operation.



MEOSAR payload status

- **Galileo:** 24 SAR/Galileo payloads operational. 1 SAR/Galileo repeater at IOC+1 under test. Two additional payloads are to be launched in Q2-2022 and 8 more before the end of 2022. Galileo Second Generation payloads expected to be deployed from 2025.
- **SAR/Glonass:** Two existing L-band SAR/Glonass K1 payloads expected to be commissioned in 2022. 3 more SAR/Glonass K-1 payloads and 2 more SAR/Glonass K-2 payloads expected to be deployed from 2022.

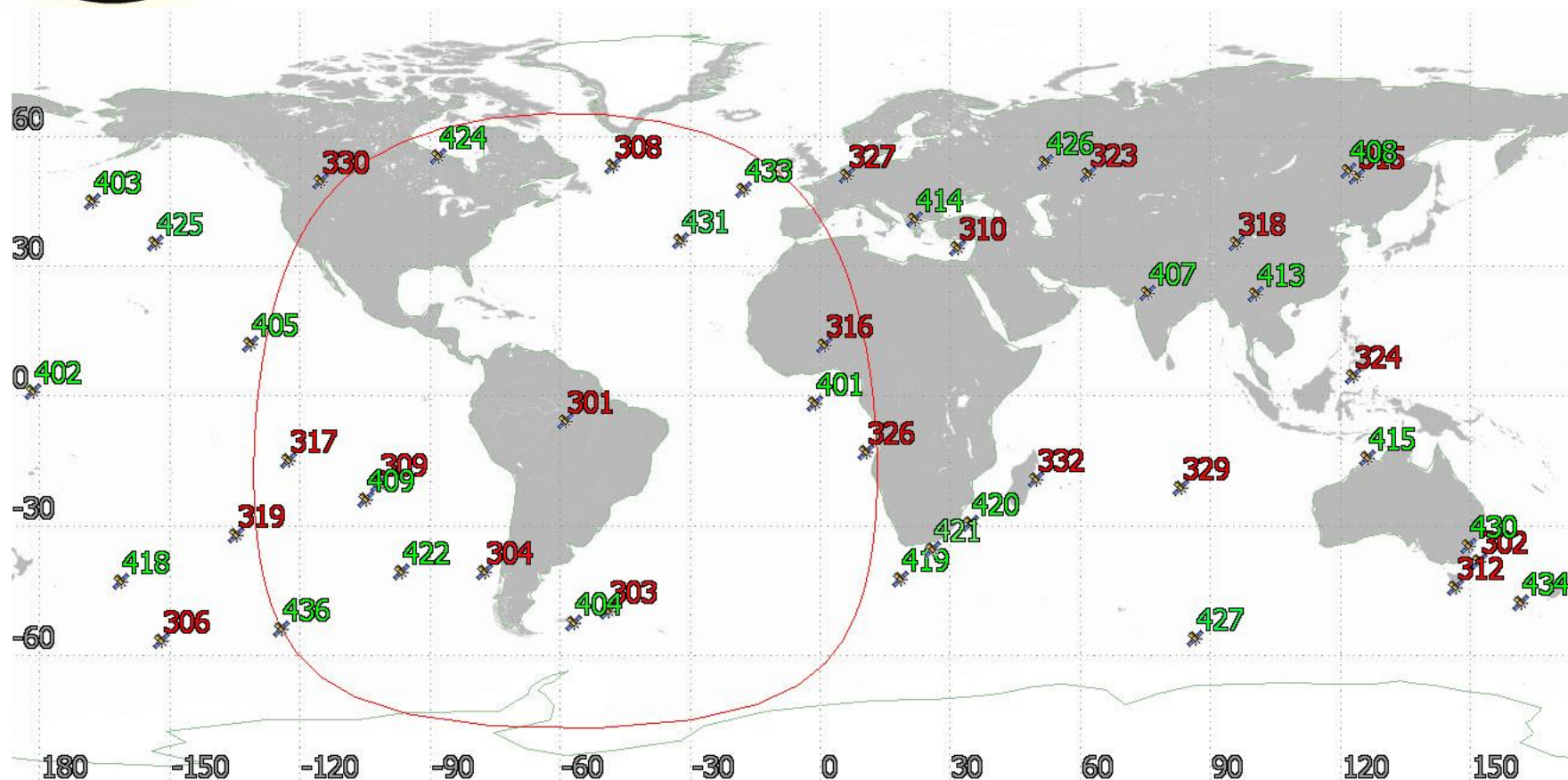


MEOSAR payloads status

- 22 DASS payloads used operationally (18 on DASS/GPS II 4 on DAS/GPS III), Additional DASS/GPS III to be deployed in the upcoming years. First L-band payload on GPS III to be deployed no earlier than 2026.
- Chinese BEIDOU: Six BDS payloads commissioned in 2021-2022. The integration of the BDS payloads into the Cospas-Sarsat MEOSAR Space segment is contingent upon a MOU being put in place between China and Cospas-Sarsat (in progress).
- **By the end of 2022, more than 56 MEOSAR payloads are expected to be made available for SAR operations.**



MEOSAR payloads (as of now)





MEOSAR Ground Segment status

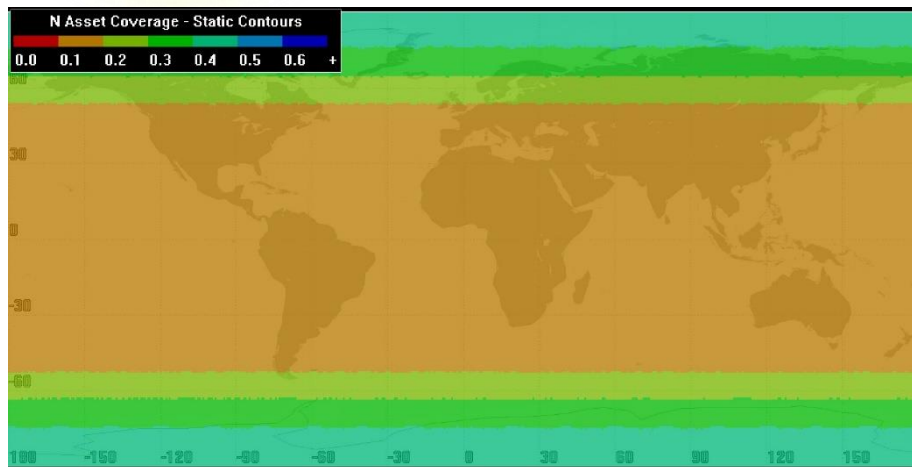
- 19 MEOLUTs commissioned to EOC standards
- 7 MEOLUTs commissioned to IOC/FOC standards, one additional MEOLUT IOC/FOC commissioning report to be reviewed at JC-36
- 12 MEOLUTs with commissioned FGB ELT(DT) capability
- 14 MCCs with commissioned LGM capability, 2 additional commissioning reports to be reviewed at JC-36. 16 more MCCs expected to be commissioned at LGM in 2022.
- 2 MEOLUTs with SGB handling capability fully tested



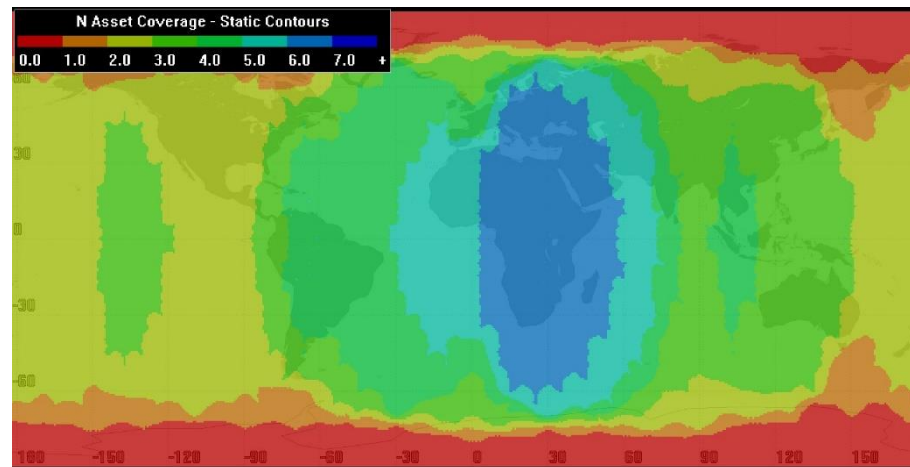


LEOSAR & GEOSAR

Space Segment assets in visibility



Average space assets in visibility
LEOSAR (Current configuration)



Average space assets in visibility
GEOSAR (Current configuration)



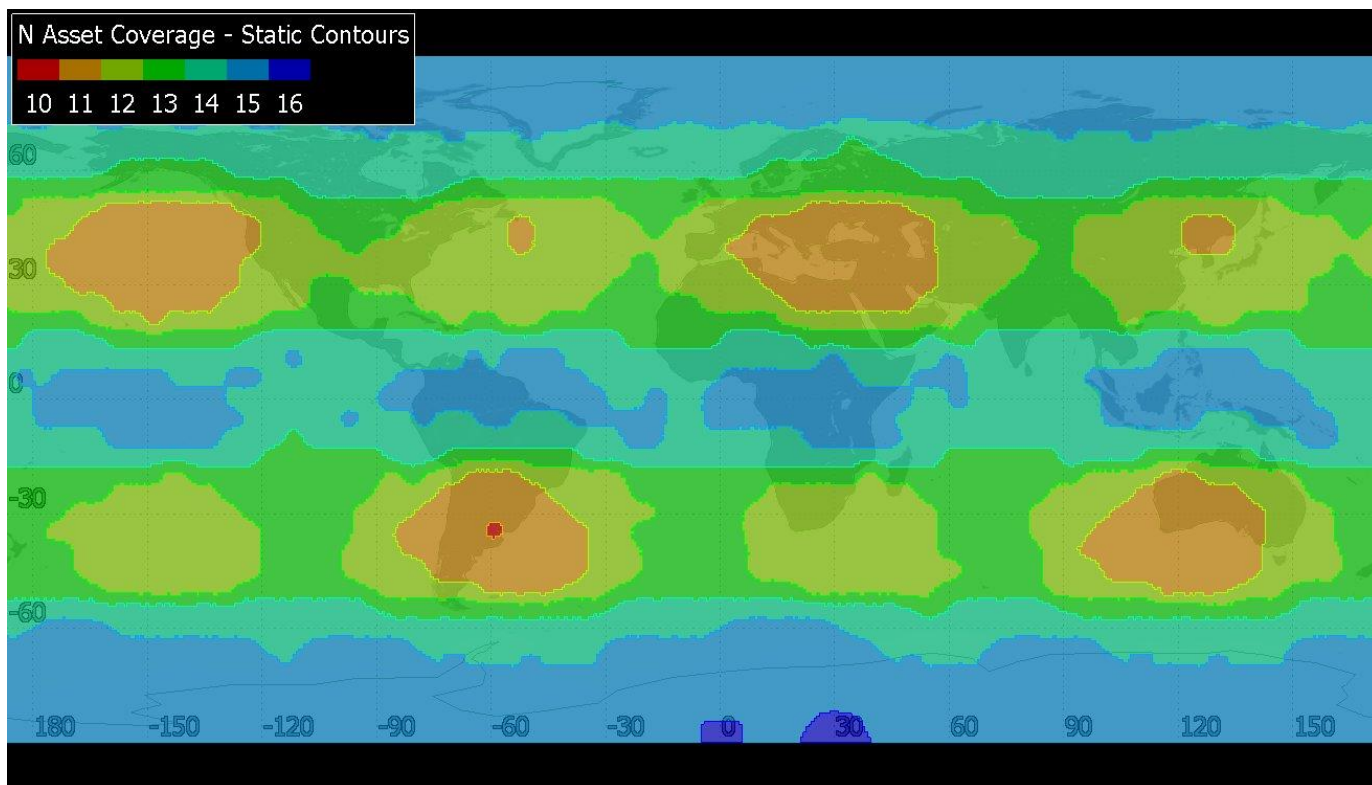
MEOSAR

Space Segment Assets in visibility

Average space
assets in visibility
95% of time

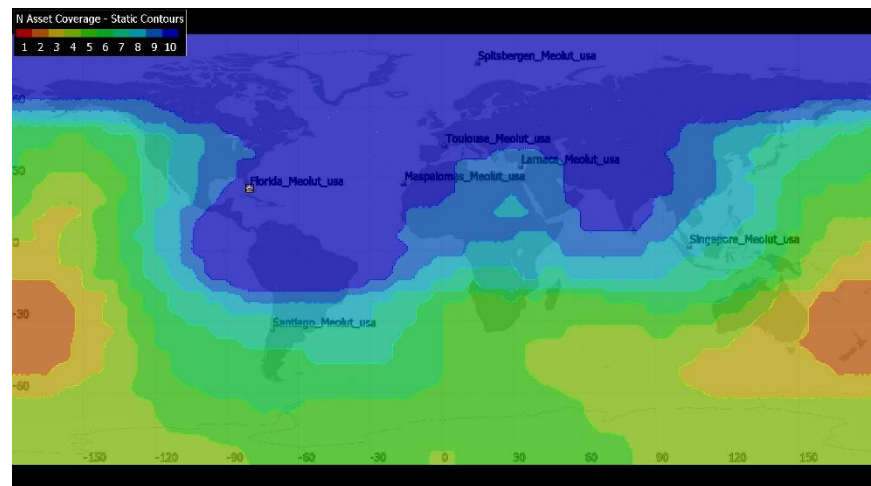
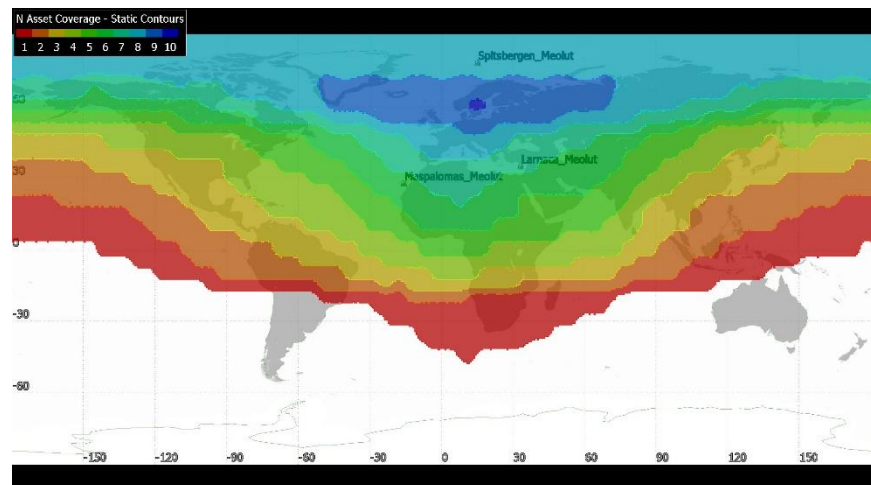
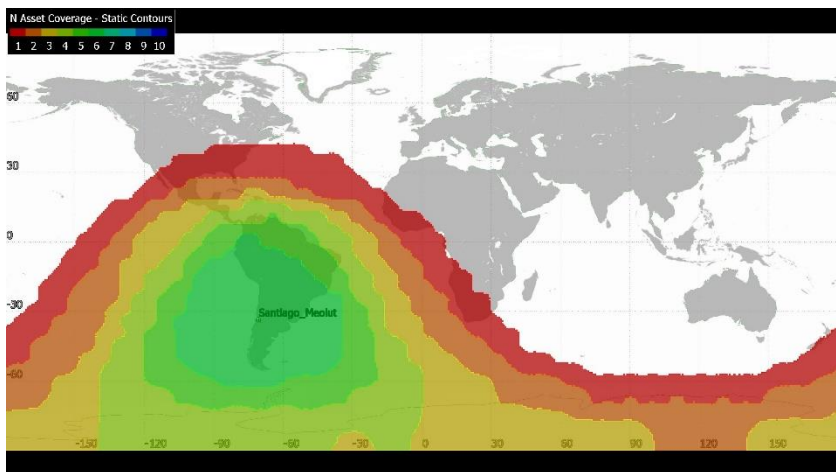
MEOSAR (Current
configuration)

Between 10 and 15 assets
anywhere on Earth!





MEOSAR Space assets tracked 95% of the time (as a function of MEOLUTs used)





MEOSAR Takeaways

- MEOSAR payloads are hosted by navigation satellites, this provides intrinsically a high number of satellites in visibility anywhere on Earth with a very good spatial diversity. The use of several GNSS constellations further enhance this capability.
- The MEOSAR System would provide an unmatched capability to detect distress signals (among GMDSS providers) in the most challenging environments such as:
 - Beacons activated in mountainous areas
 - Beacons activated in non-nominal conditions (e.g. after a crash when an antenna could be tilted or blocked by debris)
 - Beacons activated in aircraft flying in abnormal flight attitudes





MEOSAR Takeaways

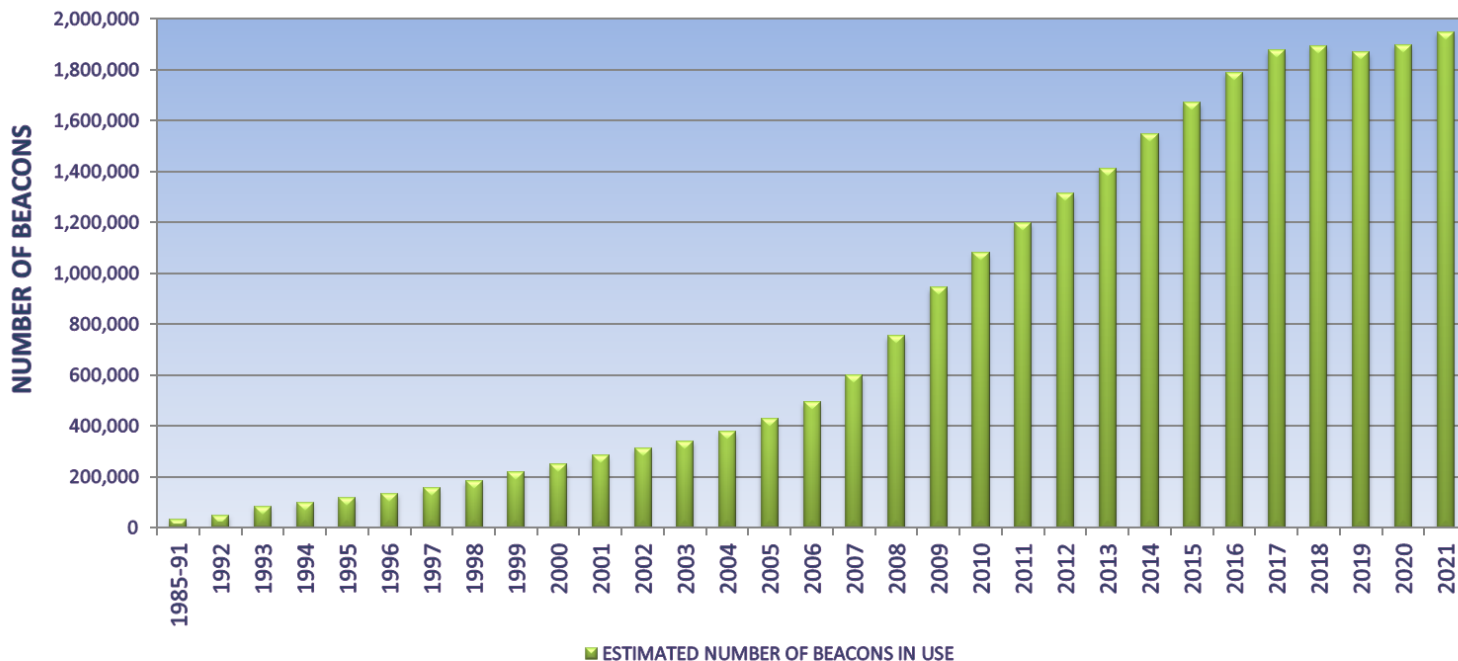
- The MEOSAR System allows for the provision of positions (independent locations and encoded locations) in a quasi-instantaneous way anywhere on Earth. This represents a reduction of approximately one hour (at the equator) on average compared with the LEOSAR System in the provision of a location
- The MEOSAR System uses repeaters for its SAR payloads. This provides significant flexibility in the type of signal which could be relayed via the payloads (hence SGBs)
- The MEOSAR System requires a solid ground infrastructure with ground stations widely spread around the world to provide global coverage. To take the maximum advantage of the space infrastructure each MEOSAR payloads needs to be tracked by at least one MEOLUT antenna at all time.



Beacon Population Evolution



406 MHz BEACON POPULATION





Cospas-Sarsat SAR Events and Assisted Saves

2021 (preliminary)

SAR Events: 1147

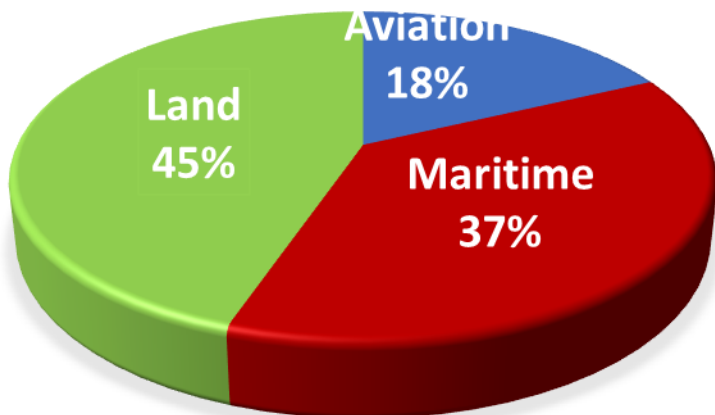
P. Rescued: 3623

SAR Events (1982 / 2021): 17663 (TBC)

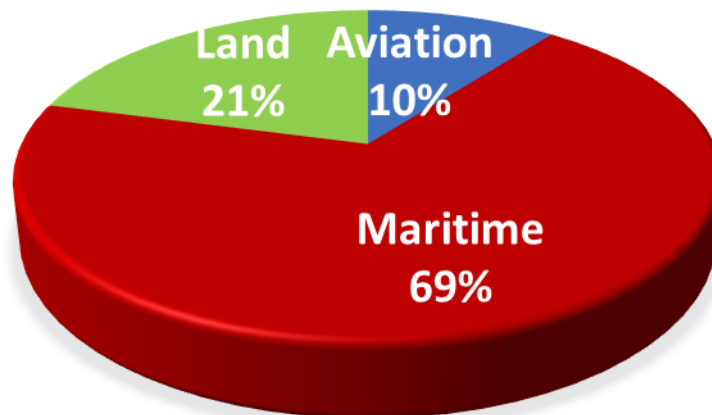
P. Rescued (1982 / 2021): 57413 (TBC)



2021 C/S EVENTS DISTRIBUTION



2021 C/S SAVES DISTRIBUTION





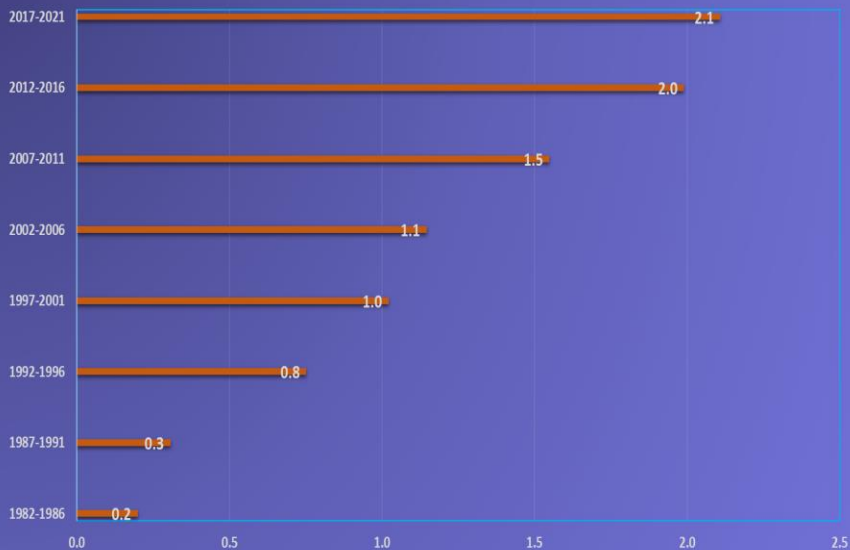
Cospas-Sarsat SAR Events and Assisted Saves



Cospas-Sarsat Daily Assisted Saves Evolution



Cospas-Sarsat Daily Assisted Events Evolution





Cospas-Sarsat main development (goals and progress status)

Activity	Goals	Progress since BMW 2021
MEOSAR	<ul style="list-style-type: none"> • Reduced time to deliver distress alerts and positions • Allow a better tracking of moving beacons • More flexibility in beacon design and allowing more services to be provided (ELT(DT)s, SGBs) 	<ul style="list-style-type: none"> • New Galileo and DASS SAR payloads put in operation • New MEOLUTs commissioned, now 7 at IOC/FOC level • New MCCs commissioned at LGM FOC • MEOSAR IOC Coverage Evaluation (continued)
ELT(DT)s	<ul style="list-style-type: none"> • Enhance the likelihood of locating an aircraft accident site • Compliance with the new ICAO and EU regulations for large aircraft from 2023 	<ul style="list-style-type: none"> • Improvement to beacon specifications and type approval procedures • ELT(DT) System tests (completed) • ELT(DT) Coverage Evaluation (continued) • 12 MEOLUT commissioned with ELT(DT) capability • First FGB ELT(DT) test facility provided with an interim acceptance to undertake the type approval of FGB ELT(DT)s • First FGB ELT(DT) type approval request submission
SGBs	<ul style="list-style-type: none"> • Allow beacon independent location determination positions to be more accurately determined (one order of magnitude compared with FGBs) • More accurate encoded locations • More information possibly conveyed to RCCs (longer and more flexible message content) 	<ul style="list-style-type: none"> • Improvement to beacon specification and type approval procedure • SGB System tests (completed) • SGB Coverage Evaluation (continued) • First SGB test facility provided with an interim acceptance to undertake the type approval tests of SGBs (non-ELT (DT)s) • First SGB type approval request submission. • First MEOLUT undertaking SGB commissioning tests
RLS	<ul style="list-style-type: none"> • New service aimed at enhancing the beacon user feedback 	<ul style="list-style-type: none"> • CSC-66 approved the operational use of RLS FGBs coded with MMSI • ≈10 RLS-capable beacons typed approved





Cospas-Sarsat 2021 Expert Working Groups

- **Experts Working Group Meeting on Second-Generation Beacons (SGBs) and FGB/SGB ELT(DT)s**
 - **Main outcomes: Proposed amendments to documents C/S A.001, T.001, T.007, T.009, T.010, T.018, T.020, and T.021, and proposed ELT(DT) Development Chart and Key Milestones.**
- **Experts Working Group Meeting on Evaluation of MEOSAR Global Coverage:**
 - **Main outcomes: Coverage assessments provided to CSC-66 for MEOSAR IOC FGB capability, MEOSAR IOC SGB capability, FGB ELT(DT) capability and SGB ELT(DT) capability.**
- **Experts Working Group Meeting on Commissioning of MCCs**
 - **Main outcomes: Review of LGM MCC commissioning reports for the CHMCC and GRMCC and provision of recommendations to CSC-66.**



Cospas-Sarsat 2021 Expert Working Groups

- **Experts Working Group Meeting on Commissioning of LUTs**
 - **Main outcomes:** Review of commissioning reports for Canada Goose Bay and Edmonton MEOLUTs (FGB IOC/FOC capability), USA Florida MEOLUTs (FGB and SGB IOC/FOC capability), updates to the commissioning report of the Singapore MEOLUT (FGB EOC capability) and provision of recommendations to CSC-66
- **Experts Working Group Meeting on Commissioning of Space Segment Assets**
 - **Main outcomes:** Review of commissioning reports for the four new USA DASS/GPS MEOSAR repeaters and the Electro-L No.3 GEOSAR repeater commissioning and of updates to the commissioning reports for the six BDS MEOSAR repeaters

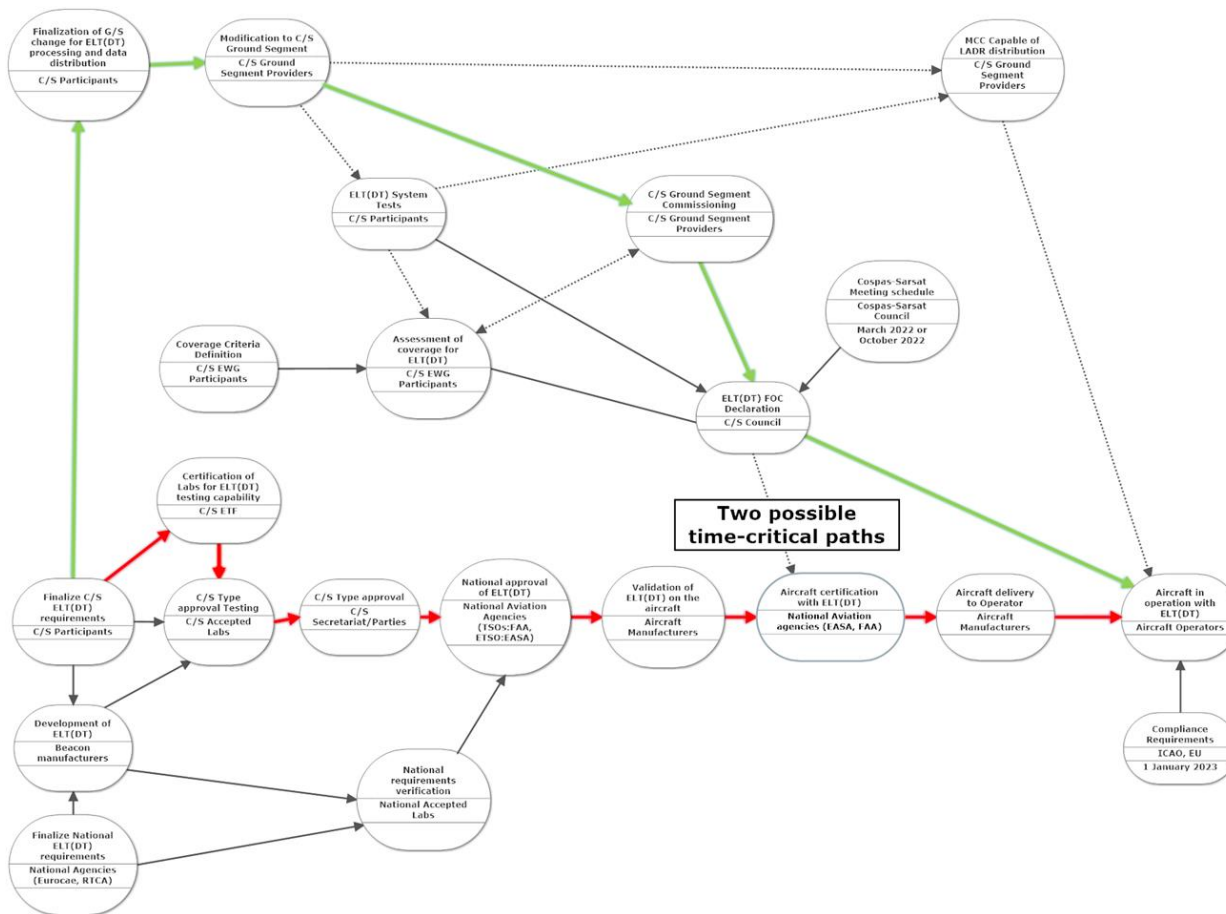


Cospas-Sarsat 2021 Expert Working Groups outcomes

- **Experts Working Group Meeting on FGB and SGB ELT(DT) and SGB System Test (and associated CWG):**
 - **Main outcomes: Review the results of the System and Capacity Tests undertaken by Cospas-Sarsat Participants, determine the System capability to receive, process, and distribute messages from FGB ELT(DT)s and SGBs, and provision of performance assessments to CSC-66**
- **Extended Test Facility Capabilities and New Beacon Types Expert Group**
 - **Main outcomes: Review of submissions for extended capability from TUV SUD for FGB ELT(DT) type approval and from EPG for SGB (non-ELT(DT)s) type approval and provision of recommendations wrt these submissions to C/S Council.**



ELT(DT) Development (from a Cospas-Sarsat Perspective)





CSC-66 Main Outcomes

- Approved amendments to 12 T-Series documents, 4 O-Series documents and 2 G-Series documents
- Approved Terms of Reference for 2022 Experts Working Group Meeting on:
 - SGB System Testing (EWG-1C/2022)
 - Evaluation of MEOSAR Global Coverage (EWG-2C/2022, Closed Council)
 - Commissioning of MCCs (EWG-3C/2022)
 - Commissioning of LUTs (EWG-4C/2022)
 - Commissioning of Space Segment Assets (EWG-5C/2022)
- Approved Guidance for a Correspondence Working Group (CWG) to Monitor Progress Toward ELT(DT) Readiness
- Approved ELT(DT) Development Phases and Criteria (Requirements)



Key CSC-66/CLD Decisions

- During the Closed Meeting of the Council's CSC-66 Session, the Parties reviewed matters of MEOLUT performance (EWG-4C/2021 Chair), System coverage (EWG-2C/2021), and System tests for new beacon types (EWG-6C/2021)
- The Council concluded that the Cospas-Sarsat System had not yet sufficiently evolved for the Council to declare new operational phases for:
 - MEOSAR (not yet ready for Initial Operational Capability (IOC)),
 - ELT(DT)s, neither FGB nor SGB-based, are yet ready for Full Operational Capability (FOC), nor
 - SGBs other than ELT(DT)s
- However, the Council Parties concluded that the Cospas-Sarsat System had effectively demonstrated the capability to receive, process and distribute messages from FGB ELT(DT)s, SGB ELT(DT)s and other SGBs but the necessary ground segment still had to be completed to reach a global capability and, thus, additional commissioned ground-segment equipment would be required to enable such declarations.





Key CSC-66/CLD Decisions

- Taking note of the ICAO expectations placed on the Programme for the declaration of an operational phase for ELT(DT)s to meet equipage deadlines for autonomous distress tracking (ADT), the inability to declare these new operational phases at the CSC-66 Session, and the Council's next session anticipated only for November 2022, the Parties:
 - planned, as needed, for an extraordinary decision-making process for new operational-phase declarations for ELT(DT)s (taken in consideration feedback from JC-36 and, potentially, Experts Working Groups)
 - anticipated that their extraordinary decision-making process for new operational-phase declarations for ELT(DT)s would occur by correspondence as soon as possible after JC-36, and preferably before the end of July, with the Parties making every effort to reach that goal
 - invited the support of Ground Segment Providers for the implementation and commissioning of the necessary ground-segment equipment.



ELT(DT) Development and Criteria (Requirements)

ELT(DT) DEVELOPMENT PHASES AND CRITERIA (REQUIREMENTS)

PHASE 1 – Development

- Proof of Concept
- Development of ELT(DT) Type Approval Standards and Acceptance of Test Facilities
 - Test Facilities Prepare for ELT(DT) Type Approval
 - Progress the acceptance of Type Approval Test Facilities for ELT(DT) Type Approval – Currently in progress, but only partially completed and moved as priority to Phase 2
- Documentation Revisions and Finalizations for ELT(DT)s
 - A-Docs including MCC Specifications and Commissioning Standards for ELT(DT) Processing
 - LUT Specifications and Commissioning Standards for ELT(DT) Processing
- Estimated Global Detection Coverage for ELT(DT)s
 - Planned MEOLUT Implementations with ELT(DT) Capability
 - Planned Commissioned ELT(DT) Capable LGM MCCs
 - Supporting MEOSAR Coverage Simulations based on planned Ground Segment
- Proven ELT(DT) End-to-End Connectivity
 - End-to-End Test Plans Network of Development ELT(DT)-Capable MEOLUTs
 - Prototype LADR Connectivity at Nodal MCCs – Checked by one Nodal MCC
 - ELT(DT) Narrative Traffic Capability to support all Non-ELT(DT)-Capable Nodals and MCCs
 - ELT(DT) Ground Segment End to End Test System Testing

PHASE 2 – Transition to Operations

- Global Detection Coverage and Data Distribution of ELT(DT) alerts by commissioned MEOLUTs associated with commissioned LGM/ELT(DT) MCCs, including the necessary intermediary commissioned ELT(DT) capable Nodal MCCs
- Confirm that baseline versions of documentation for ELT(DT)s are complete
- Acceptance of Test Facilities for ELT(DT) Type Approval
- Type approved ELT(DT)s available to the aircraft manufacturers
- Two Nodal MCCs
 - Cross-Commissioned for ELT(DT)s
 - LADR Connectivity
- ELT(DT) Narrative Traffic Capability to support all Non-ELT(DT)-Capable MCCs (i.e., unable to handle automated traffic)

PHASE 3 – Continued Implementation

- Increased redundancy, and resiliency of Global Detection Coverage for ELT(DT)s
- All Nodal MCCs
 - Commissioned for ELT(DT)s
 - LADR Connectivity
- Majority of MCCs Commissioned for ELT(DT)s
- ELT(DT) Narrative Traffic Capability to support remaining Non-ELT(DT)-Capable MCCs (i.e., unable to handle automated traffic)
- ELT(DT)s integrated into Annual System Testing
- Sufficient Complement of Test Facilities accepted for ELT(DT) type-approval
- Type-approved ELT(DT) beacons

Legend: Completed Not completed



2022-2023 Cospas-Sarsat Programme Expectations

- A significant increase in the number of MEOLUTs commissioned at IOC/FOC capability
- A significant increase in the number of MEOLUTs commissioned with SGB capability
- Nearly all MCCs commissioned at LGM capability
- More MCCs commissioned with ELT(DT) capability
- More MEOSAR payloads being deployed and commissioned
- More accepted test labs made available for the type approval of ELT(DT)s and SGBs
- Council to reassess the evolution of the Cospas-Sarsat System and determine the appropriateness of declaring new operational phases
- **Another year with significant challenges to be addressed**



For More Information

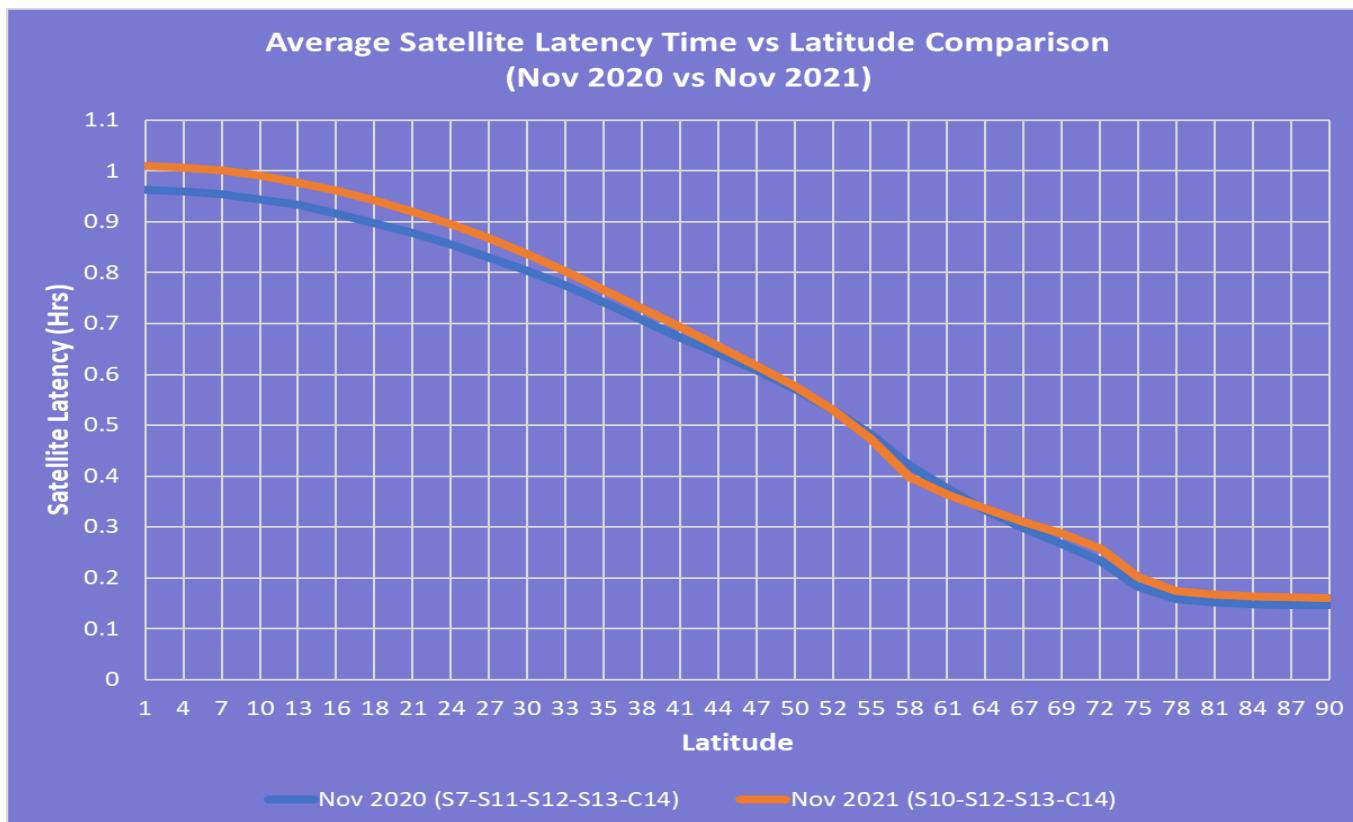
**International Cospas-Sarsat Programme
1250 Rene-Levesque West Suite 4215
Montréal, Québec H3B 4W8 CANADA**

Email: dstpierre@cospas-sarsat.int



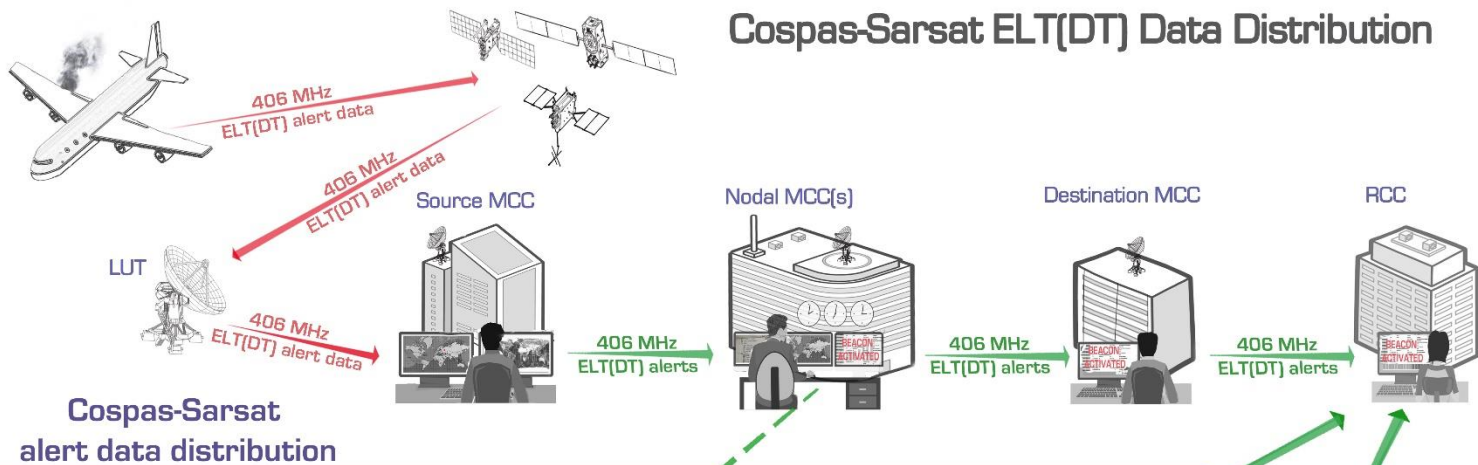


Leosar performance (Nov 2020 versus Nov 2021)





Cospas-Sarsat System



Cospas-Sarsat alert data distribution

"GADSS - Compliant" data distribution

