



Drew Marine

THE SCIENCE OF SURVIVAL

ACR Electronics, Inc.

Cospas Sarsat ELT Technology

MEOSAR and Second Generation Beacon Capabilities

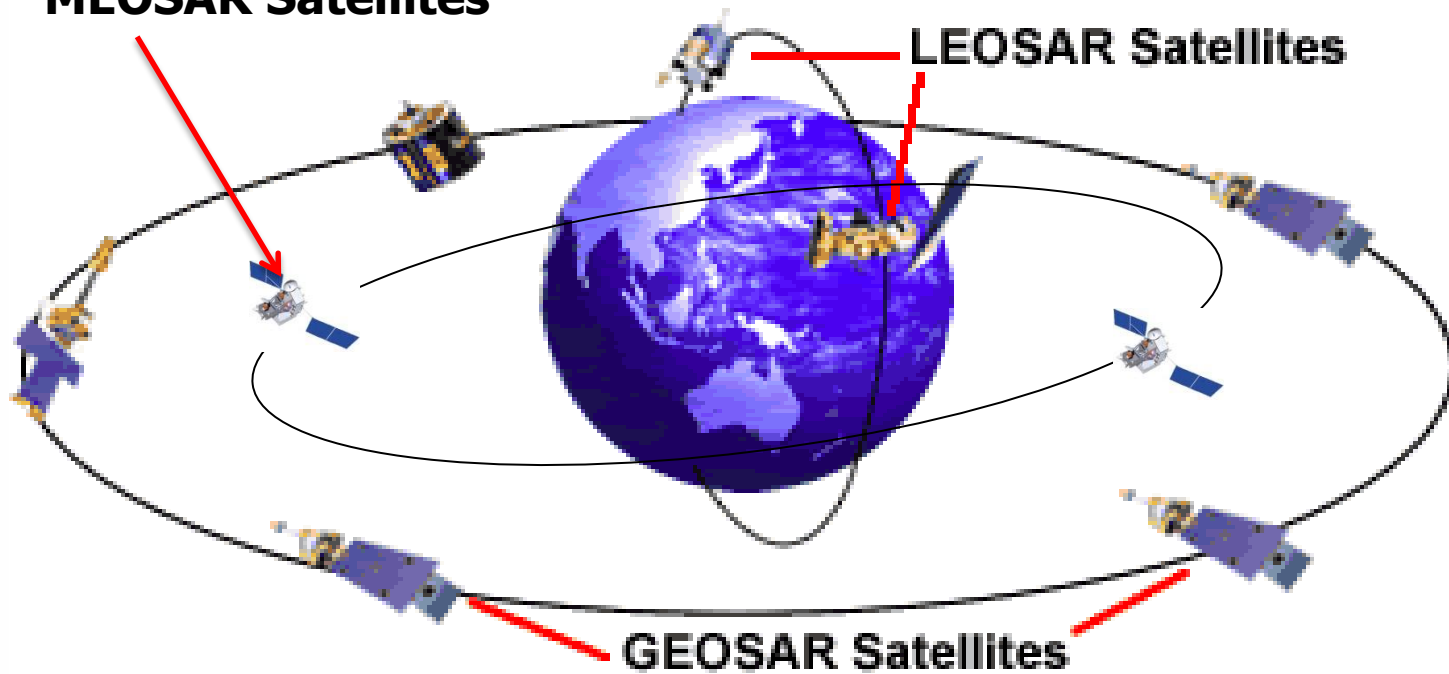
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Cospas Sarsat MEOSAR and SGB

- The current C/S is based on a system of Low Earth Orbiting Satellites (LEO) and Geostationary satellites (GEO) capable of determining the independent location of an ELT without GNSS encoded position from the beacon.
- The next generation C/S enhances performance with a system of Medium Earth Orbiting (MEO) satellites to increase speed, coverage, and reliability of ELT detection.
- Second Generation beacons will have enhanced capabilities to operate on the MEOSAR system
- The purpose of this slide deck is to introduce the C/S MEOSAR system and the capabilities of Second Generation Beacons.

MEOSAR Satellites

LEOSAR Satellites

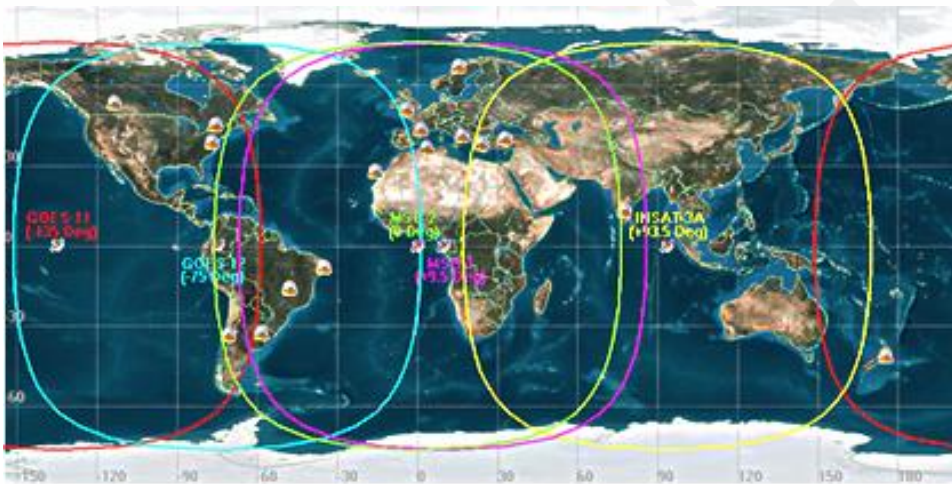


C/S Satellite Coverage

GEOSAR Coverage

MEOSAR Coverage

LEOSAR Coverage

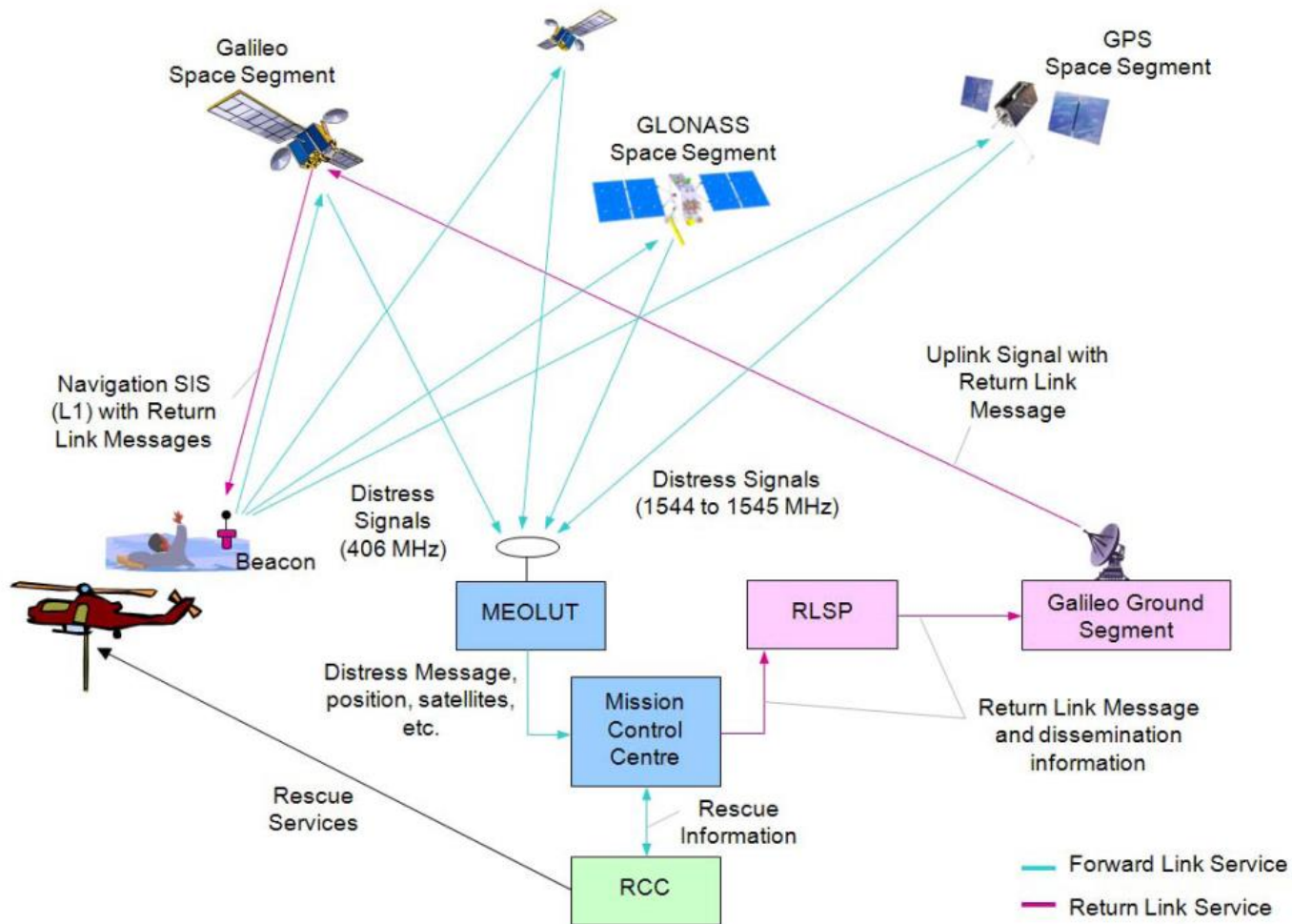


Fixed Coverage



Moving Coverage

MEOSAR System



MEOSAR Satellite System

	LEOSAR	MEOSAR	GEOSAR
# Satellites	5	~75	7
Satellite Orbit	Polar	55-65° planes about equator	GeoStationary Equatorial
Altitude	1000km (620mi)	19,140-22,300km (11,900-14,400mi)	35,900km (22,300mi)
Earth Orbit Time	~90 min	11-14 hr	N/A
Maximum Latency	~45-60 min	1-2 Minutes	1-2 Minutes
Earth Footprint	6%	37-39%	43%
Satellite Instruments	Store and Forward ¹	Bent Pipe ²	Bent Pipe
Independent Location	Doppler	TDOA ³ FDOA	N/A
GNSS Msg	Y	Y	Y

1.Holds data until satellite is within view of a ground station.

2.Relays data immediately, data is lost if ground station is not within view.

3. TDOA – Time Difference of Arrival FDOA – Frequency Difference of Arrival

Beacon Performance

• First Generation Beacons

- Performance specifications and Type Approval Requirements outlined in C/S T.001 and T.007.
- Narrow band frequency Modulation
- Primary Location is detection of the Doppler shift of the beacon signal as the satellites pass over.
- Multiple Satellite pass latency
- Locate accuracy ~ few kilometers
- Compatible with MEOSAR with reduced performance

• Second Generation Beacons

- Performance specifications and Type Approval Requirements outlined in C/S T.018 and T.021
- Spread Spectrum Modulation for better noise and interference immunity.
- Primary Location is based on multi-satellite detection; "Reverse GPS"
- Location determination within seconds.
- Location accuracy ~100m target
- Increased System Reliability and Redundancy
- Increased Detection Probability – Especially Fast Moving Objects

Parameter	Current First Gen Beacons			SGBs
	LEO	GEO	MEO	MEO
Detection Time	Up to 2 Hrs	Within mins	Within mins	Within secs
Independent Location Capability	Yes	No	Yes	Yes
Independent Location Accuracy	5 km	N/A	5 km	100 m
Encoded Location Capability	Optional	Optional	Optional	Optional
Encoded Location Resolution	4 sec (120m)	4 sec (120m)	4 sec (120m)	0.00003° (3.4m)
Time to First 406 Tx	50 sec to 5 min	50 sec to 5 min	50 sec to 5 min	Within 3 sec
Beacon Identity	15 Hex	15 Hex	15 Hex	23 Hex
SGB Added Features	N/A	N/A	N/A	Increased Detection Probability Increased Reliability (less False Alerts) Improved Crash Site Detection Added Message Features

Development and Regulatory Timelines

	2016	2017	2018	2019	2020	2021
ICAO			Normal Flight Tracking			Distress Flight Tracking
EASA			Normal Flight Tracking			Distress Flight Tracking
FAA	No ruling					
MEOSAR	Early Operation*		Initial Operation		Full Operation*	
C/S SGB		Standards Published	Ready to Test and Certify (4Q)			
T.001 T-ELT	Standards Published	Ground Segment Updated	T-ELT T.001 Beacons on Market			
Beacon MFG		Start SGB Development		Submit SGB to Test and Certification	1 st SGB on the Market (3Q)	
Airframe MFG	* Estimated			Airframer needs a TSO (1Q)		