

The background of the slide is a composite image of three satellites in space. On the left is a large satellite with a prominent orange and white structure and a large blue solar panel. On the right is a satellite with a cylindrical body and a conical antenna. In the upper right is a smaller satellite with a gold-colored body and two large purple rectangular panels. The Earth's horizon is visible as a blue arc on the right side, and a bright star is in the lower left.

COSPAS-SARSAT SYSTEM OVERVIEW AND STATUS

STEVEN LETT
HEAD OF SECRETARIAT

THREE TOPICS TO COVER

- ☐ COSPAS-SARSAT PROGRAMME STRUCTURE AND SYSTEM
- ☐ INNOVATIONS STATUS: MEOSAR AND NEXT GENERATION BEACONS (ELTs)
- ☐ ALERT DATA DISTRIBUTION



COSPAS-SARSAT PROGRAMME STRUCTURE AND SYSTEM



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SLIDE 3

INTERGOVERNMENTAL ORGANIZATION

- ☐ NON-U.N. AGENCY
- ☐ PARTY STATES ARE CANADA, FRANCE, THE RUSSIAN FEDERATION AND THE UNITED STATES
- ☐ FACILITIES CONTRIBUTED BY PARTIES AND 38 OTHER ASSOCIATED “PARTICIPANT” STATES AND AGENCIES
- ☐ ADMINISTRATIVE COSTS SHARED AMONG PARTY AND PARTICIPANT GOVERNMENTS



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COSPAS-SARSAT

PARTICIPATING COUNTRIES/AGENCIES



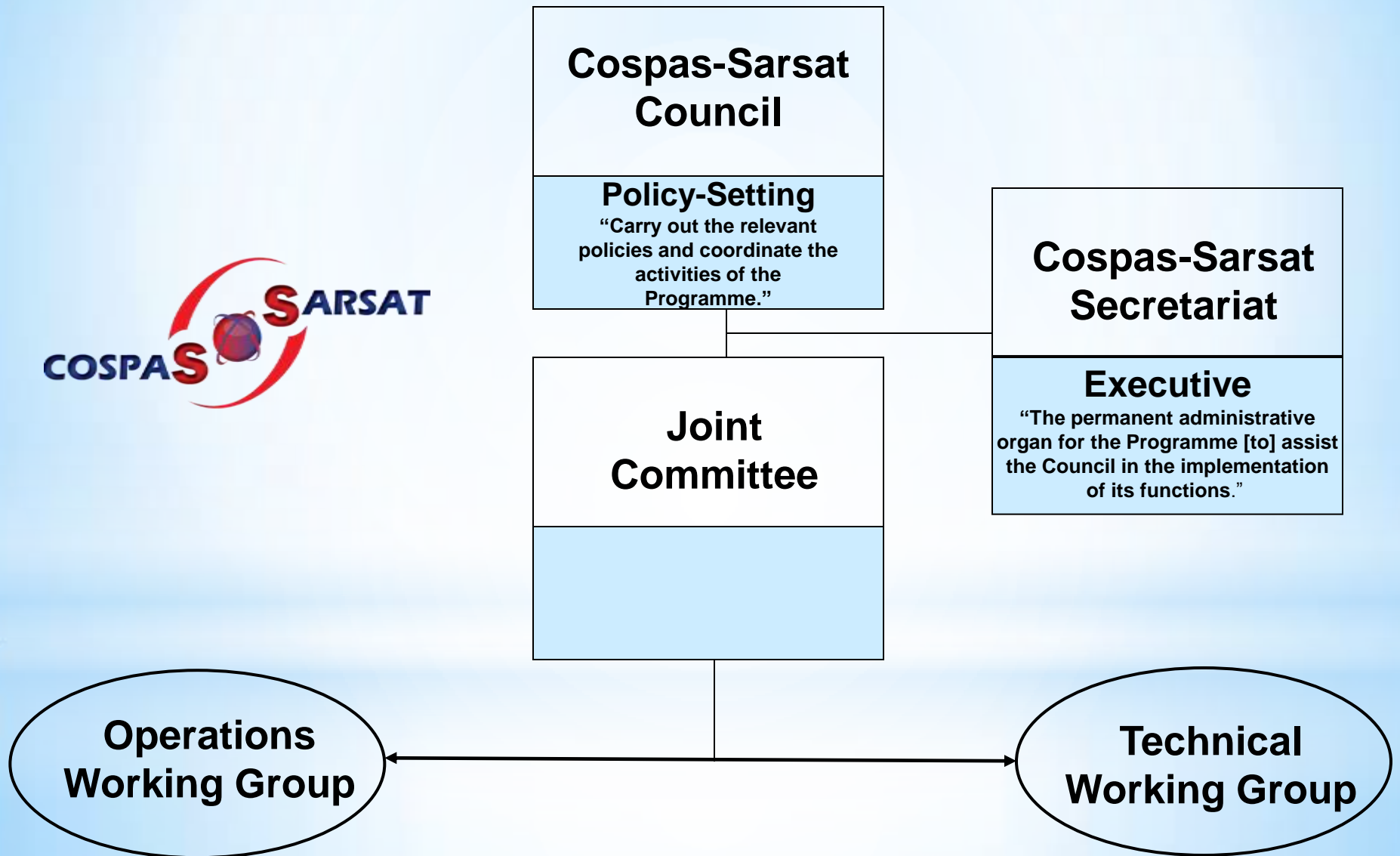
Algeria
Argentina
Australia
Brazil
Canada
Chile
China (P.R.)
Cyprus
Denmark
Finland
France
Germany
Greece
Hong Kong
India
Indonesia
Italy
ITDC
Japan
Korea (R. of)
Netherlands

New Zealand
Nigeria
Norway
Pakistan
Peru
Poland
Russia
Saudi Arabia
Serbia
Singapore
South Africa
Spain
Sweden
Switzerland
Thailand
Tunisia
Turkey
UAE
UK
USA
Vietnam



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COSPAS-SARSAT ORGANIZATION



DISTRESS ALERTS PROVIDED FREE OF CHARGE

IN **2014**, THE COSPAS-SARSAT SYSTEM PROVIDED ASSISTANCE IN RESCUING 2,354
PERSONS IN 685 SAR EVENTS
226 PERSONS IN 107 AVIATION INCIDENTS

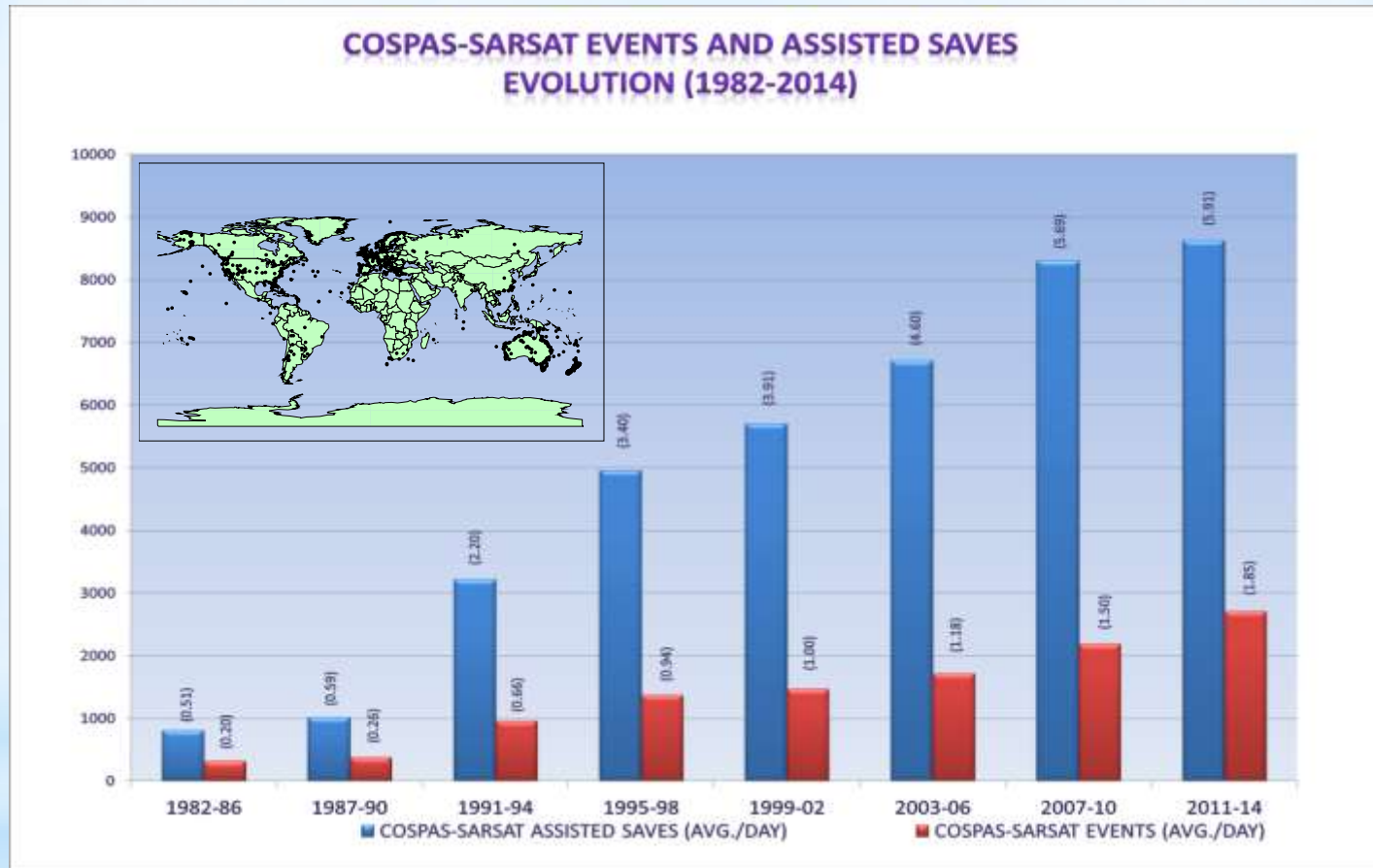
DISTRESS ALERTS ARE SENT FREE OF CHARGE TO
OVER 220 COUNTRIES AND TERRITORIES



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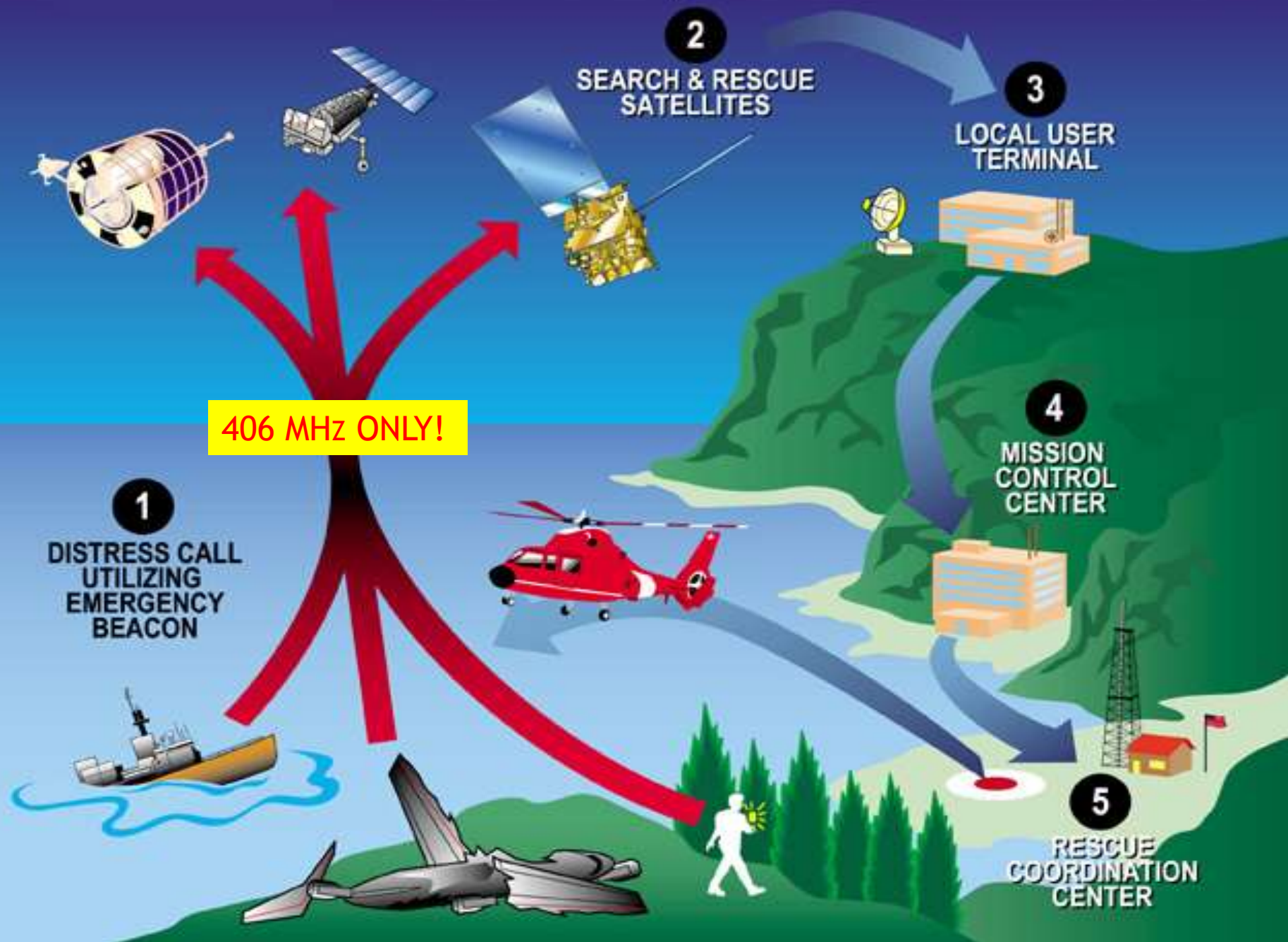
SLIDE 7

GLOBAL SYSTEM – HISTORICALLY PROVEN

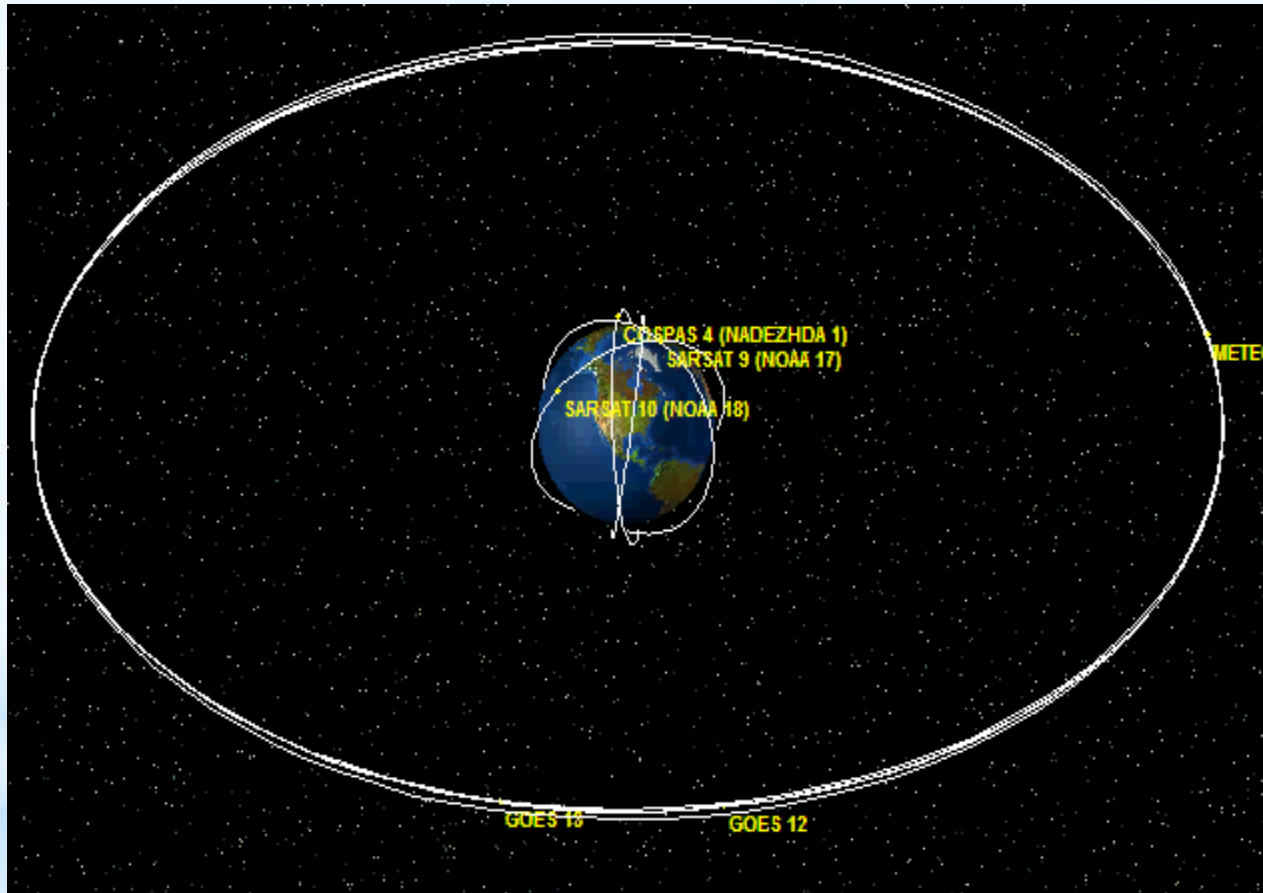


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COSPAS-SARSAT System Overview



PRESENT LEOSAR/GEOSAR SYSTEM ORBITS

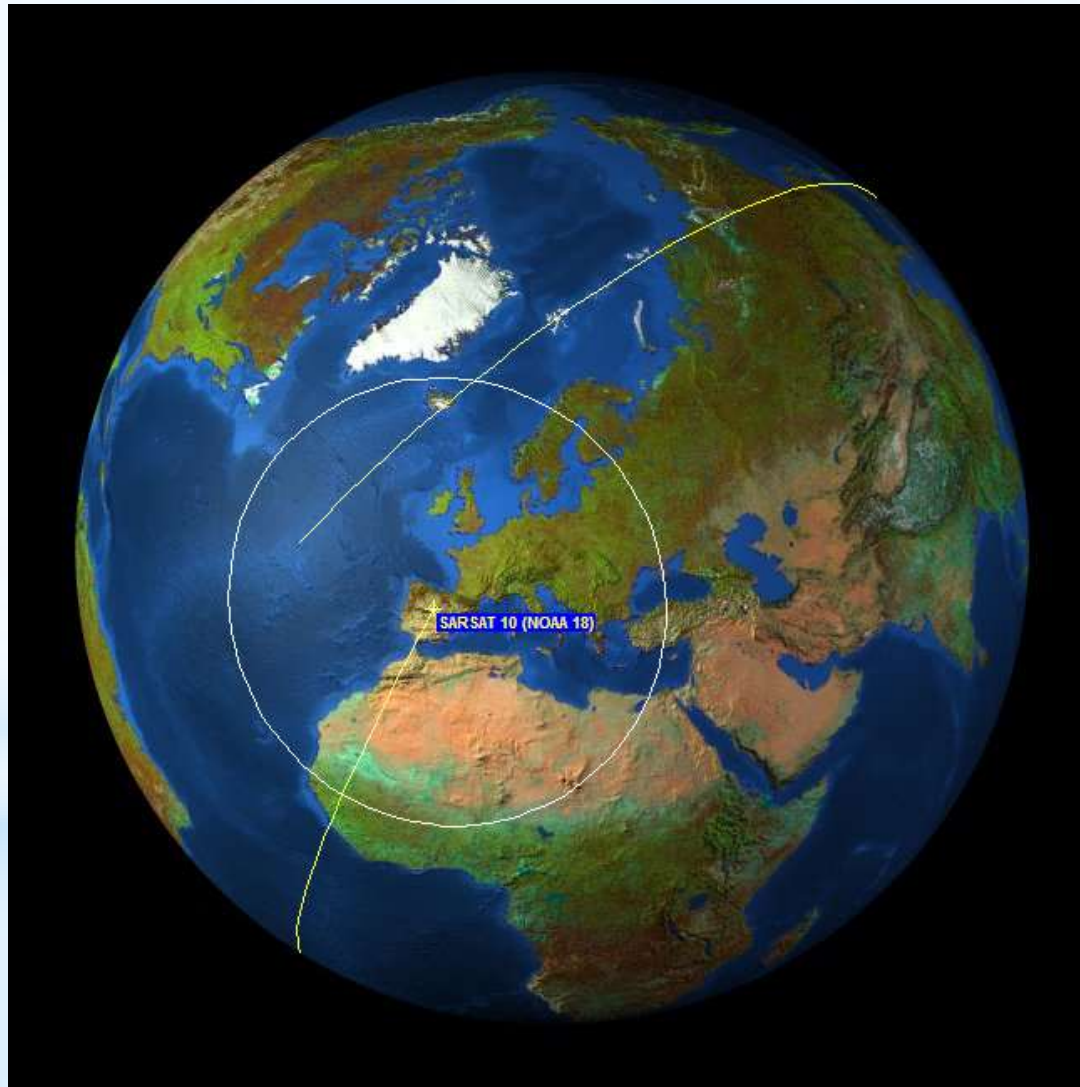


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SLIDE 10

PRESENT LEOSAR SYSTEM

EXAMPLE “MOVING FOOTPRINT” TRACK



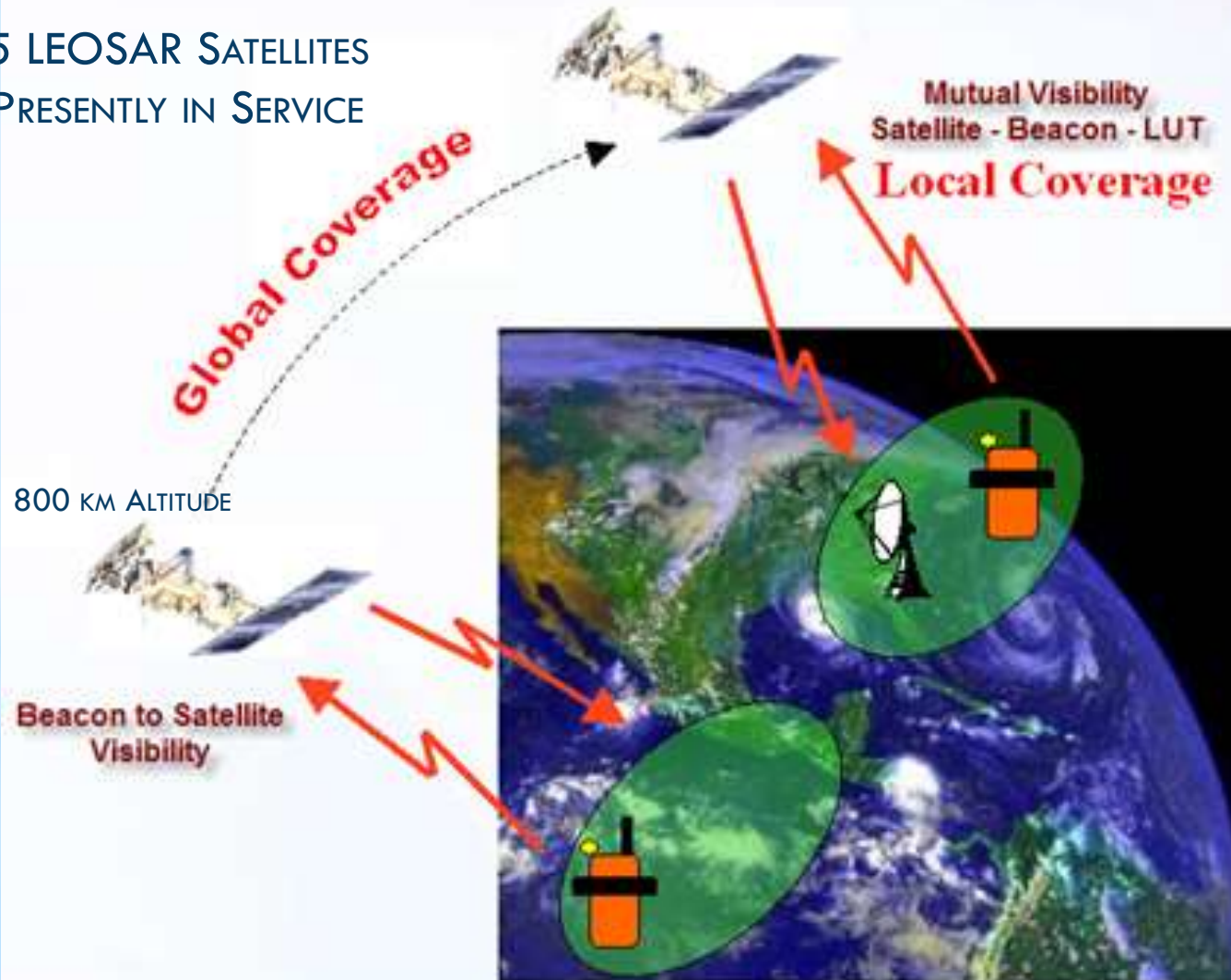
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SLIDE 11

PRESENT LEOSAR SYSTEM

TWO MODES OF OPERATION

5 LEOSAR SATELLITES
PRESENTLY IN SERVICE

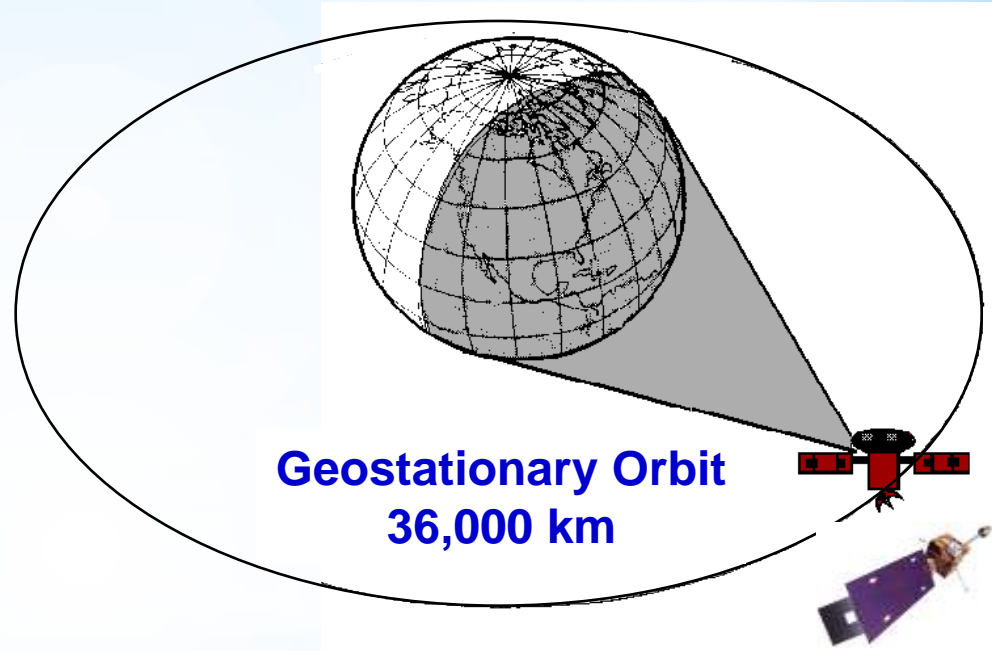


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SLIDE 12

PRESENT GEOSAR SYSTEM

- ☐ 36,000 KM HIGH: GEOSTATIONARY SATELLITES RELAY TRANSMISSIONS FROM BEACONS
- ☐ LARGE, FIXED COVERAGE AREAS
- ☐ GEOLUTs ONLY “DETECT” ALERTS AND REPEAT MESSAGE
- ☐ WITH NO RELATIVE MOTION BETWEEN BEACON AND SATELLITE THERE IS NO DOPPLER EFFECT ON SIGNAL TO USE FOR DETERMINING LOCATION
- ☐ LOCATION IS AVAILABLE ONLY IF BEACON HAS A GNSS RECEIVER CHIP AND ENCODES THE LOCATION IN THE BEACON MESSAGE

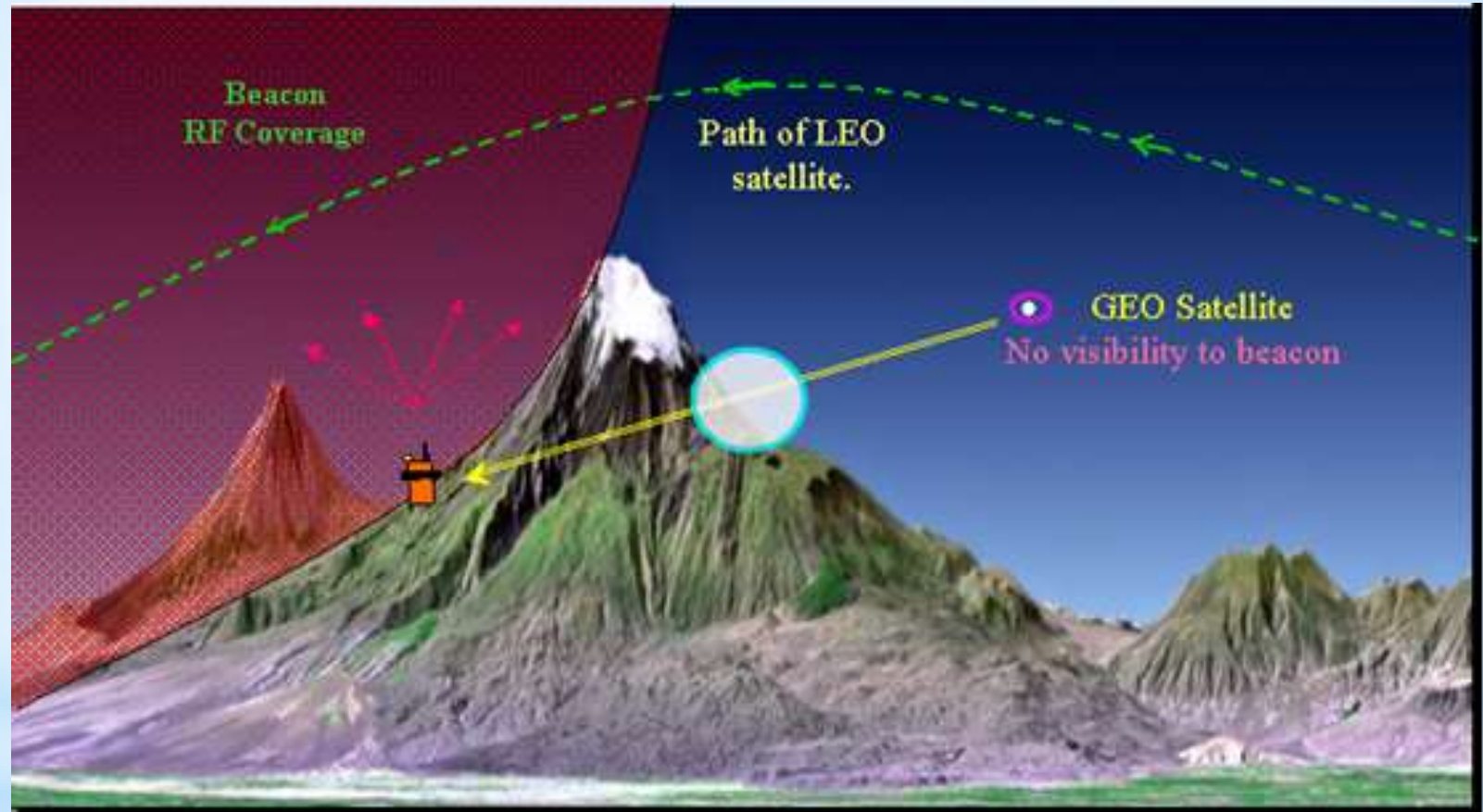


6 GEOSAR SATELLITES
PRESENTLY IN SERVICE



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TERRAIN OBSTRUCTION LIMITATIONS OF LEO/GEO



INNOVATIONS STATUS: MEOSAR



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SLIDE 15

MEOSAR SYSTEM FLEET

ON THREE NAVIGATION SATELLITE HOSTS

(FIRST OPERATIONAL USE PLANNED FOR 2016)

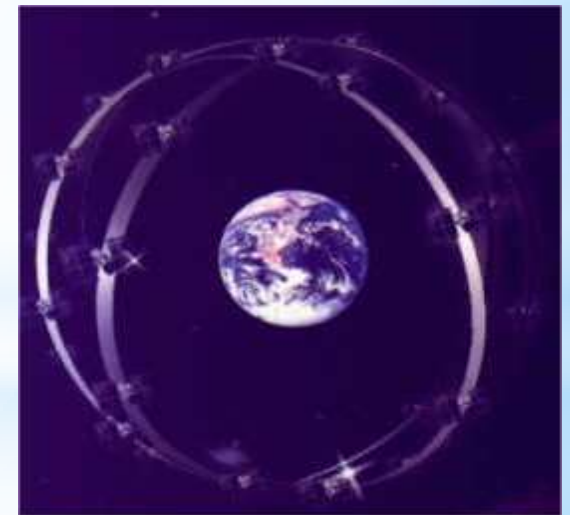
GPS / USA



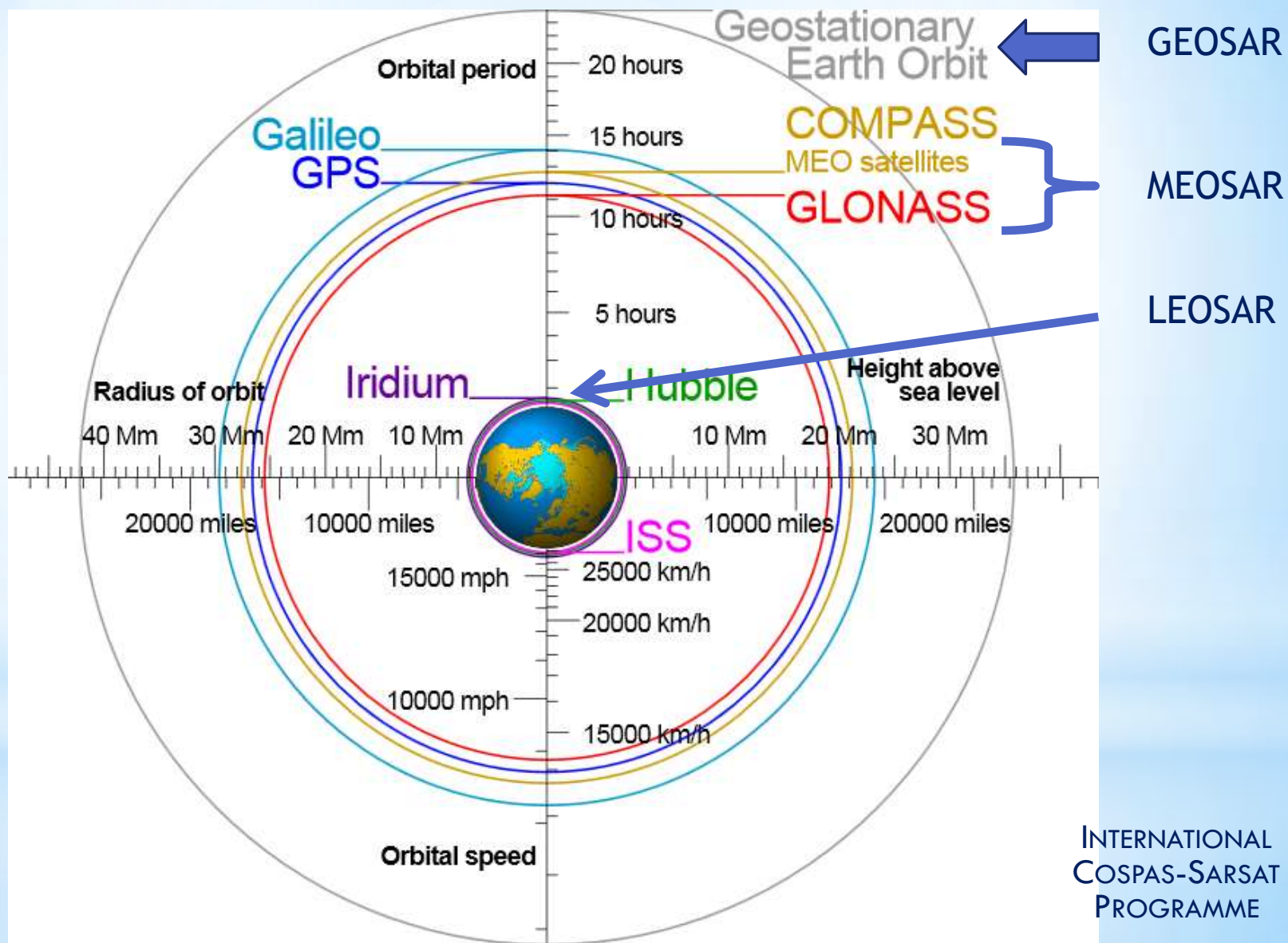
Galileo / Europe



Glonass / Russia



MEOSAR ORBIT COMPARISON



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MEOSAR: AN IMPROVED SYSTEM CONCEPT

MEOSAR SATELLITE

AT 20,000 KM

LEOSAR SATELLITE

AT 800 KM

- ☐ MEO FOOTPRINT LARGER THAN LEO
- ☐ SIMILAR SIZE TO GEO FOOTPRINT, BUT SLOWLY MOVING
- ☐ CONTINUOUS GLOBAL COVERAGE (INCLUDING POLES)



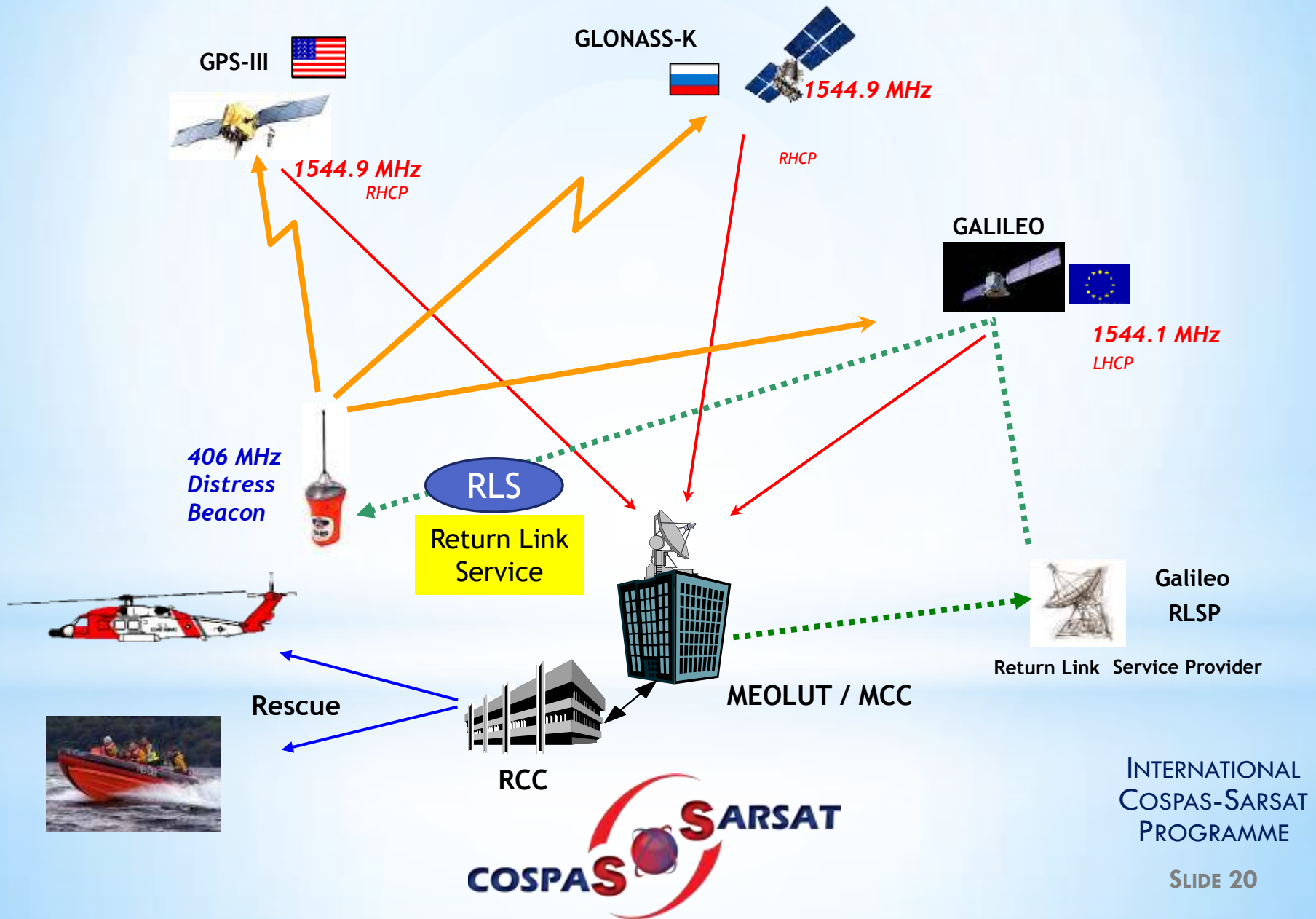
EXAMPLE OF COVERAGE OF A SINGLE MEO FOOTPRINT



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SLIDE 19

MEOSAR SYSTEM CONFIGURATION WITH RLS



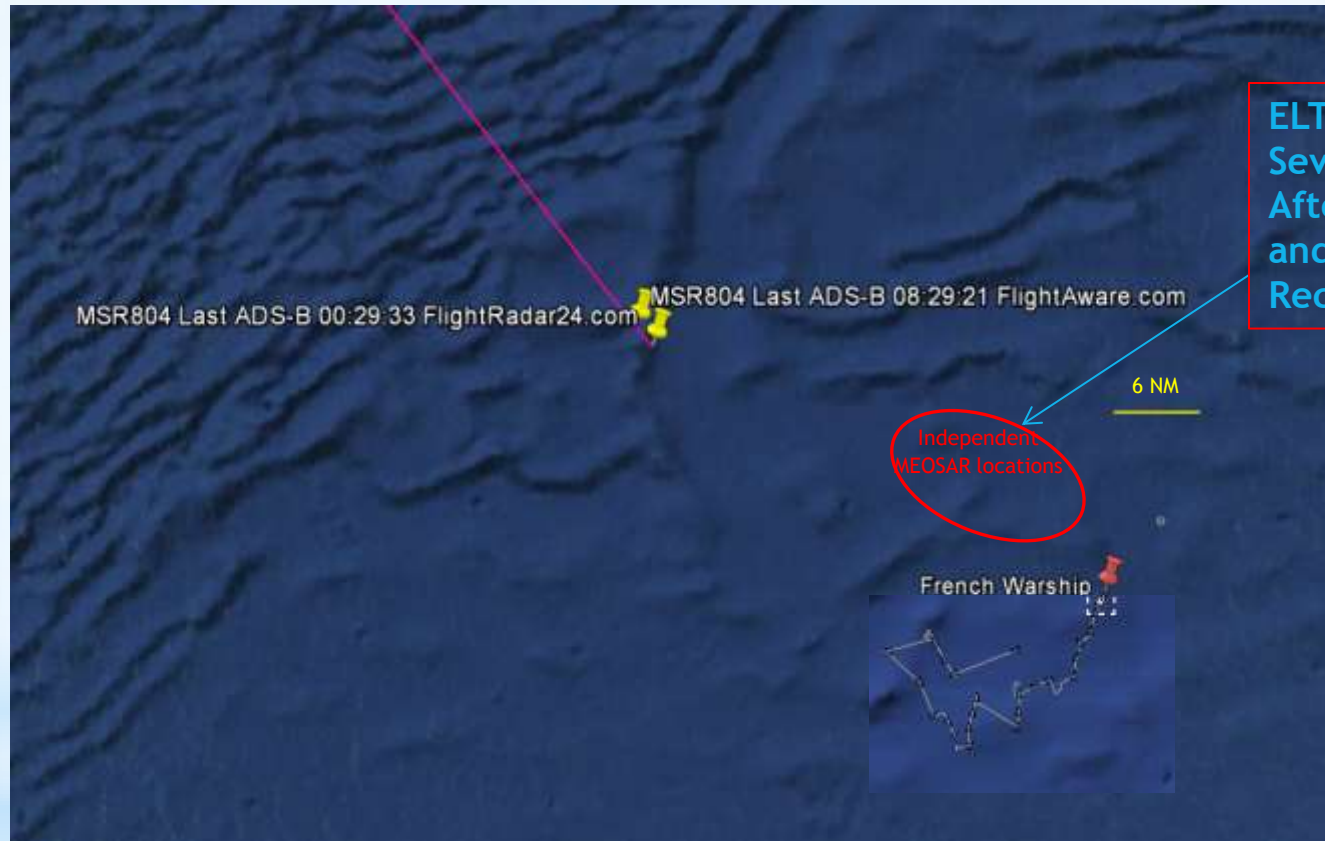
MEOSAR ADVANTAGES

- ❑ NEAR INSTANTANEOUS WORLDWIDE DETECTION AND INDEPENDENT LOCATION DETERMINATION (INDEPENDENT OF BEACON-REPORTED NAVIGATION DATA) OF 406-MHz BEACONS
- ❑ SIGNIFICANTLY REDUCED EFFECT OF TERRAIN/WRECKAGE OBSTRUCTIONS
- ❑ EXTENSIVE REDUNDANCY/RELIABILITY IN SPACE AND GROUND SEGMENTS
- ❑ IMPROVED LOCATION ACCURACY
- ❑ IMPROVED BEACONS AND FEATURES, INCLUDING:
 - RETURN LINK SERVICE (RLS)
 - REDUNDANT LOCALIZATION OF ELT-DTs (VALIDATING OR BACK-UP LOCATIONS THROUGH REPORTED NAVIGATION DATA AND INDEPENDENT CALCULATIONS, EVEN AT HIGH SPEEDS)



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MEOSAR USED TO CALCULATE LOCATION OF EGYPTAIR FLIGHT MS 804



ELT Received
Seven Minutes
After Last ADS-B
and ACARS
Receptions

MEOSAR ESTIMATED TIMEFRAME

- ❑ 2016 – EARLY OPERATIONAL CAPABILITY – ALL NODAL MCCs OR BACKUPS ABLE TO MANAGE DATA FROM ONE OR MORE EARTH STATIONS (MEOLUTs)
- ❑ 2017 – INITIAL OPERATIONAL CAPABILITY – SUFFICIENT “L-BAND” SATELLITES FOR GOOD COVERAGE (ESTIMATED TO BE ≥ 14) AND GROUND SEGMENT OPERATING WITHIN NOMINAL SPECIFICATIONS
- ❑ 2018-2021 – FULL OPERATIONAL CAPABILITY – GLOBAL, REAL-TIME COVERAGE USING OPERATIONAL SATELLITE FLEETS AND COMMISSIONED MEOSAR-CAPABLE GROUND SEGMENT (ALL MCCs CONVERTED TO MANAGE MEOSAR, AS WELL AS LEOSAR AND GEOSAR DATA)

DOCUMENT C/S R.012, SECTION 10 AND ANNEX I



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SLIDE 23

INNOVATIONS STATUS: NEXT GENERATION BEACONS



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ELTs FOR DISTRESS TRACKING (ELT-DTs)

- ☐ IMPROVED DISTRESS ALERTING BY AUTOMATIC ACTIVATION PRIOR TO POSSIBLE DAMAGE OR BLOCKAGE (DEBRIS, SUBMERSION, ETC.) IN A CRASH
- ☐ ACTIVATION UPON DETECTION OF ABNORMAL FLIGHT CONDITIONS (ON COMMAND FROM AIRCRAFT AVIONICS) IN ADDITION TO POSSIBLE MANUAL ACTIVATION BY PILOTS
- ☐ RLS FACILITATES POSSIBILITY OF ACTIVATION BY GROUND COMMAND
- ☐ CAPABILITY FOR POSITION TO BE REDUNDANTLY DETERMINED USING MEOSAR CALCULATIONS AND AIRCRAFT GNSS POSITIONS
- ☐ SPECIFIED FOR COMPLIANCE WITH FUTURE PARAGRAPH 6.18 OF ANNEX 6 OF THE ICAO CONVENTION (LOCATION OF AN AIRCRAFT IN DISTRESS) AND TO FUTURE GLOBAL AERONAUTICAL DISTRESS AND SAFETY SYSTEM (GADSS) AUTONOMOUS DISTRESS TRACKING REQUIREMENTS

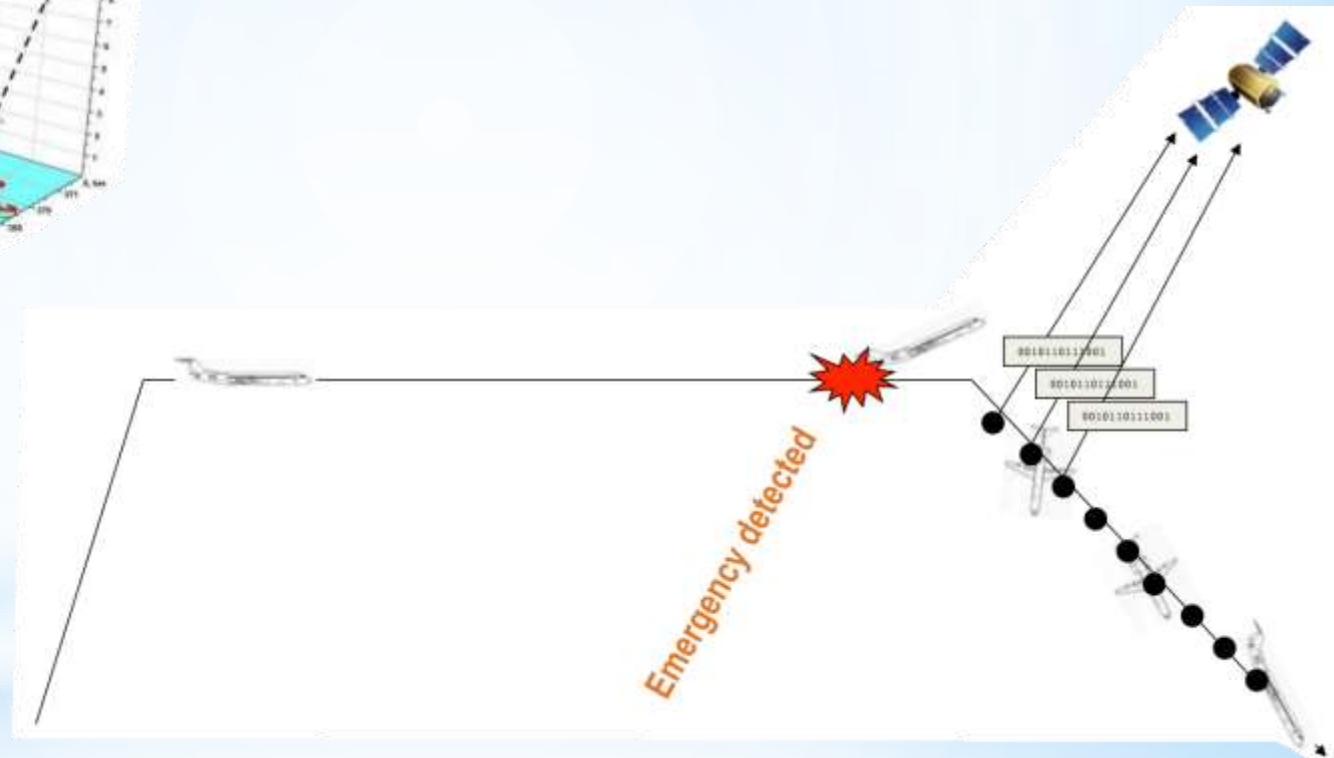
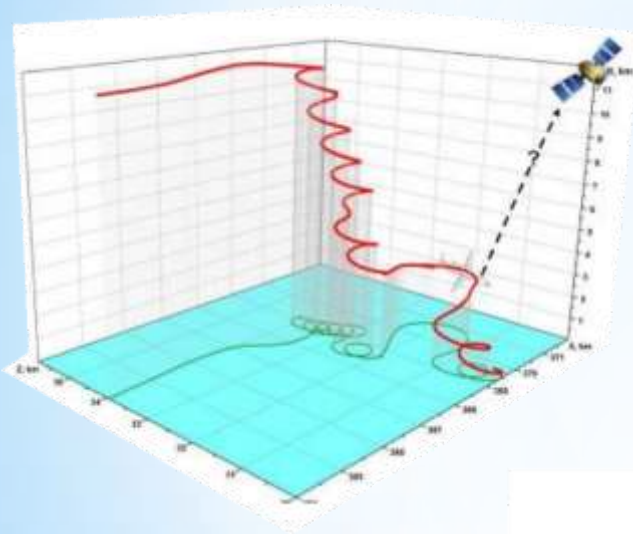


ELTs FOR DISTRESS TRACKING (ELT-DTs)

- ❑ DEVELOPMENT UNDERWAY USING TECHNOLOGIES BASED ON BOTH:
 - EXISTING BEACON SPECIFICATIONS, MODIFIED TO MEET ICAO REQUIREMENTS (USING GNSS DATA TO MEET ICAO ACCURACY SPECIFICATIONS)
 - “SECOND-GENERATION” SIGNAL AND MESSAGE SCHEMES TO ALLOW REDUNDANT LOCATION DETERMINATION (GNSS AND INDEPENDENT)
- ❑ INITIAL TESTING HAS BEGUN



TRIGGERABLE-IN-FLIGHT (T-ELT) CONCEPT



ICAO CONVENTION ANNEX 6, NEW PARAGRAPH 6.18

MAIN REQUIREMENTS

- ☐ ALLOW THE LOCATION OF AN AIRPLANE ACCIDENT SITE WITHIN 6 NAUTICAL MILES
(COSPAS-SARSAT PROVIDES REDUNDANT GNSS (ENCODED) AND INDEPENDENTLY-CALCULATED POSITIONS)
- ☐ ALLOW THE POSITION OF AN AIRCRAFT IN DISTRESS TO BE DETERMINED AT LEAST ONCE EVERY MINUTE
(COSPAS-SARSAT WILL EXCEED THIS REPORTING-FREQUENCY REQUIREMENT)
- ☐ ABLE TO OPERATE IN THE EVENT OF AIRCRAFT POWER LOSS
(ALL ELTs HAVE BUILT-IN BATTERY POWER SUPPLY)
- ☐ COMMENCE NO MORE THAN 5 SECONDS AFTER DETECTION OF ABNORMAL FLIGHT CONDITIONS
(COSPAS-SARSAT WILL MEET OR EXCEED THIS SPECIFICATION)



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FUTURE “SECOND GENERATION” BEACONS



- ☐ NEXT GENERATION OF BEACONS CAN BE OPTIMIZED TO TAKE BEST ADVANTAGE OF THE MEOSAR SYSTEM
- ☐ SIGNIFICANTLY IMPROVED INDEPENDENT-LOCATION AND ENCODED-LOCATION ACCURACY (INCL. 3D)
- ☐ MORE DISTRESS RELATED INFORMATION SENT TO RCCs
- ☐ REDUCED BATTERY CONSUMPTION AND/OR SMALLER SIZE AND/OR ADDED FEATURES
- ☐ EXPANDED “HOMING” OPTIONS



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ALERT DATA DISTRIBUTION



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SLIDE 30

DATA DISTRIBUTION COMPONENTS

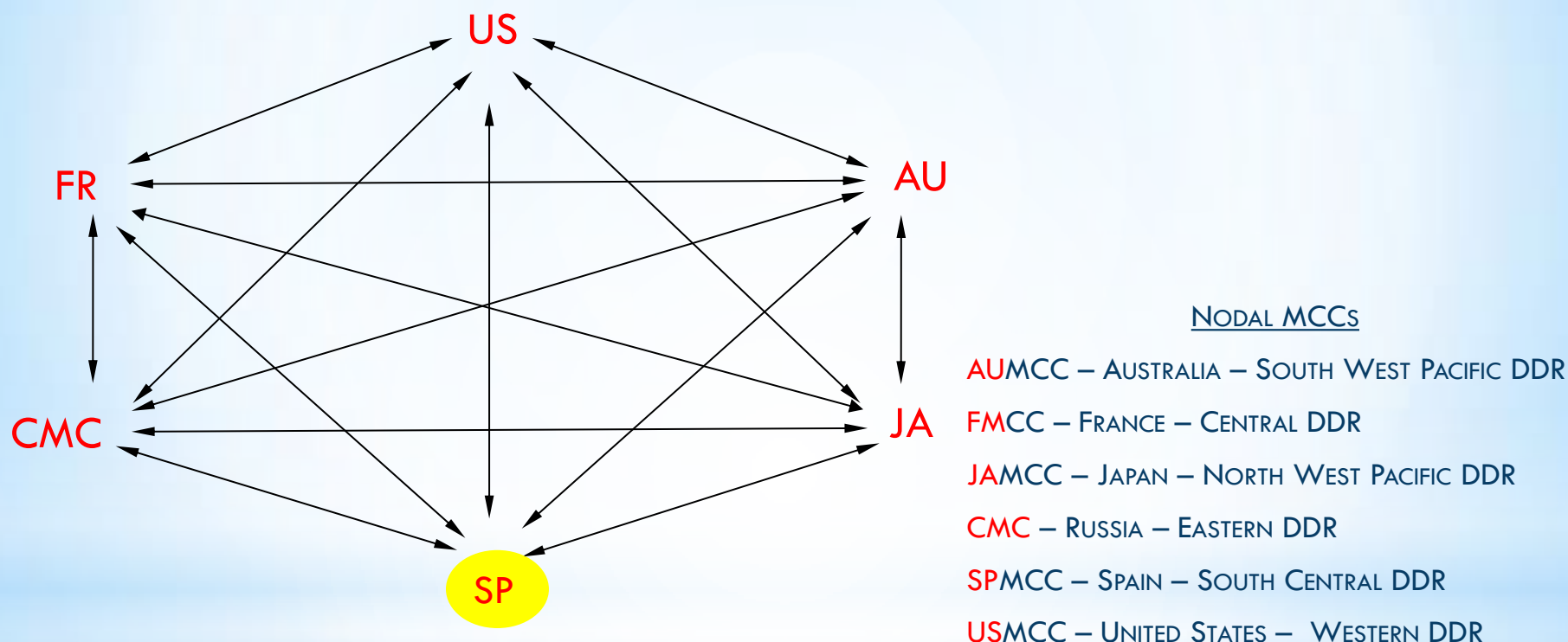
DISTRESS ALERT SIGNALS ARE RECEIVED BY ONE OR MORE “LOCAL USER TERMINAL” (LUT) EARTH STATIONS THAT CALCULATE AN ESTIMATED LOCATION FOR THE BEACON AND SEND THAT INFORMATION, TOGETHER WITH THE BEACON MESSAGE (IDENTIFICATION, ETC.) TO A MISSION CONTROL CENTRE (MCC) ASSOCIATED WITH THE LUT:

- ❑ MCC – MISSION CONTROL CENTRE – TAKES INFORMATION FROM A LUT OR ANOTHER MCC AND ROUTES IT TO THE PROPER DESTINATION. COSPAS-SARSAT HAS 32 MCCs.
- ❑ DDR – DATA DISTRIBUTION REGION – A REGION COMPRISED OF TWO OR MORE SERVICE AREAS, EACH SUPPORTED BY AN MCC, WHERE INFORMATION IS EXCHANGED BETWEEN MCCs. COSPAS-SARSAT HAS SIX DDRs.
- ❑ NODAL MCC (SIX) – SERVES AS A HUB FOR MESSAGE ROUTING BETWEEN DDRs (MCCs ARE ALLOWED TO ADDITIONALLY HAVE BILATERAL ARRANGEMENTS WITH MCCs IN ADJACENT DDRs).
- ❑ SPOC – SEARCH-AND-RESCUE POINT-OF-CONTACT – THE FIRST ENTRY POINT FOR A COSPAS-SARSAT ALERT PROVIDED TO A COUNTRY OR TERRITORY. THE SPOC IS RESPONSIBLE FOR DELIVERING THE ALERT DATA TO SAR AUTHORITIES WHO CAN TAKE ACTION.



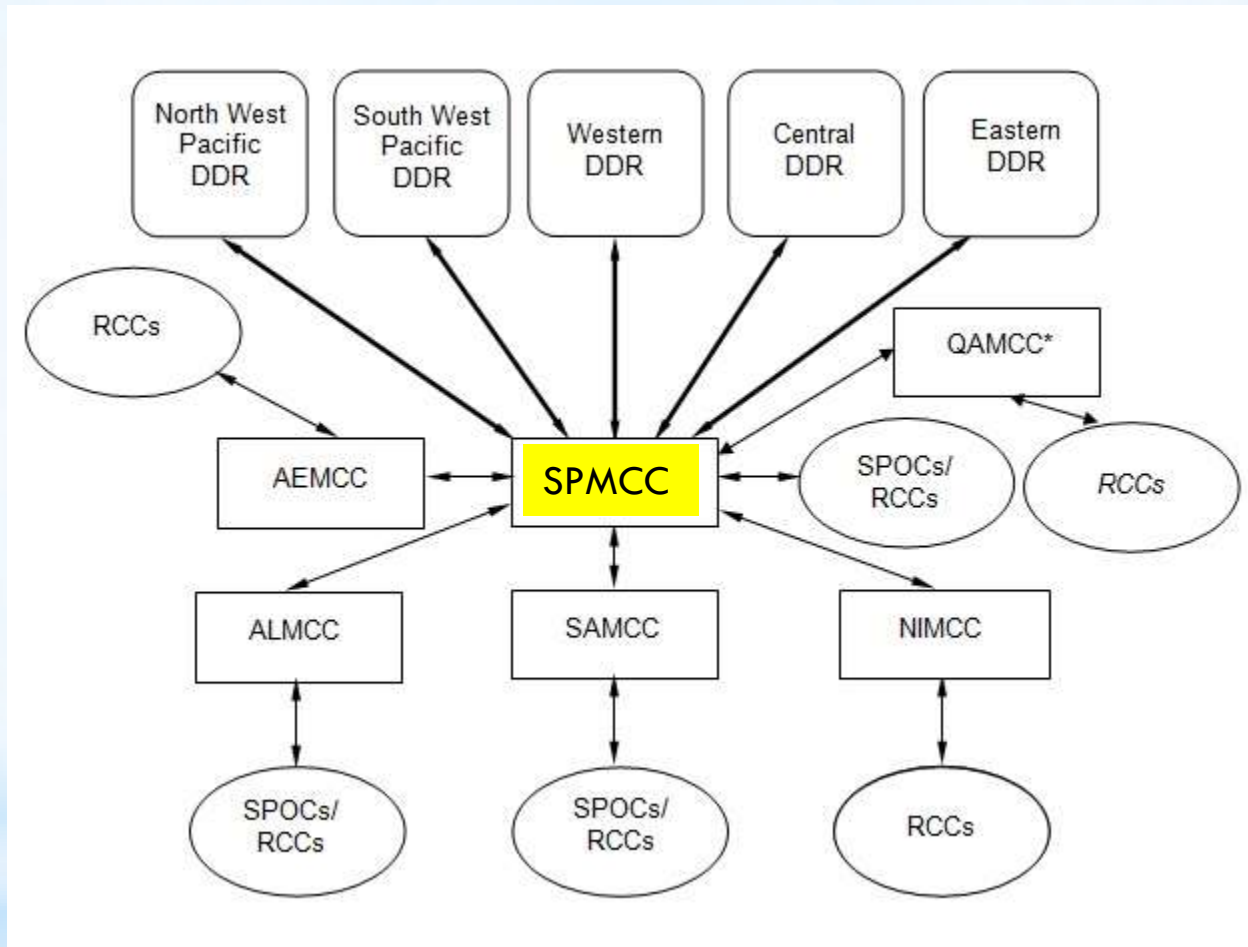
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DATA DISTRIBUTION REGIONS



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EXAMPLE OF DATA EXCHANGE (SCDDR)



AUTOMATED DATA INTERCHANGE

- ❑ ALERT MESSAGES ARE EXCHANGED BETWEEN MCCs USING STANDARD FORMATS WHICH PERMIT AUTOMATIC PROCESSING AND RETRANSMISSION OF ALL DATA.
- ❑ ALL COSPAS-SARSAT MESSAGES ARE IDENTIFIED BY A SUBJECT INDICATOR TYPE (SIT) NUMBER ACCORDING TO THE SUBJECT MATTER BEING TRANSMITTED.

121	DOPPLER INTERFERER NOTIFICATION
141	DOA INTERFERER NOTIFICATION
122	INCIDENT (NO DOPPLER)
142	INCIDENT (NO DOA)
123	POSITION CONFLICT (LEOSAR/MEOSAR/ GEOSAR; ENCODED ONLY)
143	
124	POSITION CONFIRMATION (LEOSAR; ENCODED ONLY)
144	POSITION CONFIRMATION (MEOSAR; ENCODED ONLY)
125	INCIDENT (LEOSAR)
145	INCIDENT (MEOSAR)
126	POSITION CONFLICT (LEOSAR)
146	POSITION CONFLICT (MEOSAR)
127	POSITION CONFIRMATION (LEOSAR)
147	POSITION CONFIRMATION (MEOSAR)



AUTOMATED DATA INTERCHANGE

132	NOTIFICATION OF COUNTRY OF REGISTRATION (LEOSAR/GEOSAR ENCODED ONLY)
136	NOTIFICATION OF COUNTRY OF REGISTRATION (MEOSAR; ENCODED ONLY)
133	NOTIFICATION OF COUNTRY OF REGISTRATION (LEOSAR)
137	NOTIFICATION OF COUNTRY OF REGISTRATION (MEOSAR)
134	NOTIFICATION OF RETURN LINK SERVICE PROVIDER (LEOSAR/GEOSAR; ENCODED ONLY)
138	NOTIFICATION OF RETURN LINK SERVICE PROVIDER (MEOSAR; ENCODED ONLY)
135	NOTIFICATION OF RETURN LINK SERVICE PROVIDER (LEOSAR/GEOSAR)
139	NOTIFICATION OF RETURN LINK SERVICE PROVIDER (MEOSAR)
185	COSPAS-SARSAT ALERTS
215	ORBIT VECTORS
216	ORBIT VECTORS
217	ORBIT VECTORS
415	SARP CALIBRATION
416	SARP TELEMETRY
417	SARP-3 CALIBRATION
425	SARP OUT OF LIMIT
435	SARP COMMAND
445	SARP COMMAND VERIFICATION
510	406 MHz SARR FREQUENCY CALIBRATION OFFSET
515	SARR TELEMETRY
525	SARR OUT OF LIMIT
535	SARR COMMAND
545	SARR COMMAND VERIFICATION
605	SYSTEM STATUS TO ALL MCCs
915	FOR MCC INFORMATION TRANSMISSION TO A SINGLE MCC
925	406 BEACON REGISTRATION INFORMATION



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SLIDE 35

TAKE-AWAYS

- ❑ 406-MHZ ALERTS ARE PROVIDED FREE OF CHARGE
- ❑ MEOSAR EARLY OPERATIONAL CAPABILITY WILL BEGIN THIS YEAR
- ❑ SPECIFICATIONS FOR NEXT-GENERATION BEACONS ARE BEING FINALIZED:
 - IN-FLIGHT TRIGGERING FOR DISTRESS TRACKING
 - RETURN LINK SERVICE
 - “SECOND-GENERATION” SIGNAL AND MESSAGING SCHEME
- ❑ COSPAS-SARSAT CAPABILITIES IN A MEOSAR ENVIRONMENT EVIDENCED BY LOCATION DATA SUCCESSFULLY BEING USED IN EGYPTAIR MS 804 INCIDENT (ACCURATE LOCALIZATION OF A CONVENTIONAL ELT)
- ❑ COMMITMENT OF THE COSPAS-SARSAT PROGRAMME TO MEET THE NEEDS AND DEFINED REQUIREMENTS OF KEY “CLIENT” ICAO



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