



Refinement of maritime users needs, Brussels December 18, 2002

The Galileo support to the Search and Rescue Programme (SAR/Galileo)



Outline

- **How SAR/Galileo integrate with Cospas-Sarsat service?**
 - SAR/GALILEO ARCHITECTURE
 - GROUND SEGMENT CONCEPT
 - DOWNLINK COORDINATION
- **Does improvement of location of alerts imply that ship borne EPIRBs be fitted with GNSS receiver?**
 - SAR/GALILEO EXPECTED SERVICE PERFORMANCE
- **Does the implementation of the return link imply that ship borne EPIRBs be fitted with GNSS receiver?**



**SAR/Galileo MISSION REQUIREMENTS
and BENEFITS**

- **FULL BACKWARD COMPATIBILITY WITH COSPAS-SARSAT SYSTEM**
- **ENHANCEMENT OF EXISTING SAR AIDED TRACKING SYSTEM:**
 - **IMPROVEMENT OF PERFORMANCE:**
 - Multi satellite visibility
 - Quasi real-time distress detection
 - Increased distress location accuracy
 - **INTRODUCTION OF NEW SERVICES:**
 - Implementation of a return link
- **FACILITATING LOW-COST SAR USER EQUIPMENT WITH INTEGRATED GALILEO RECEIVERS (« ADVANCED BEACONS »)**



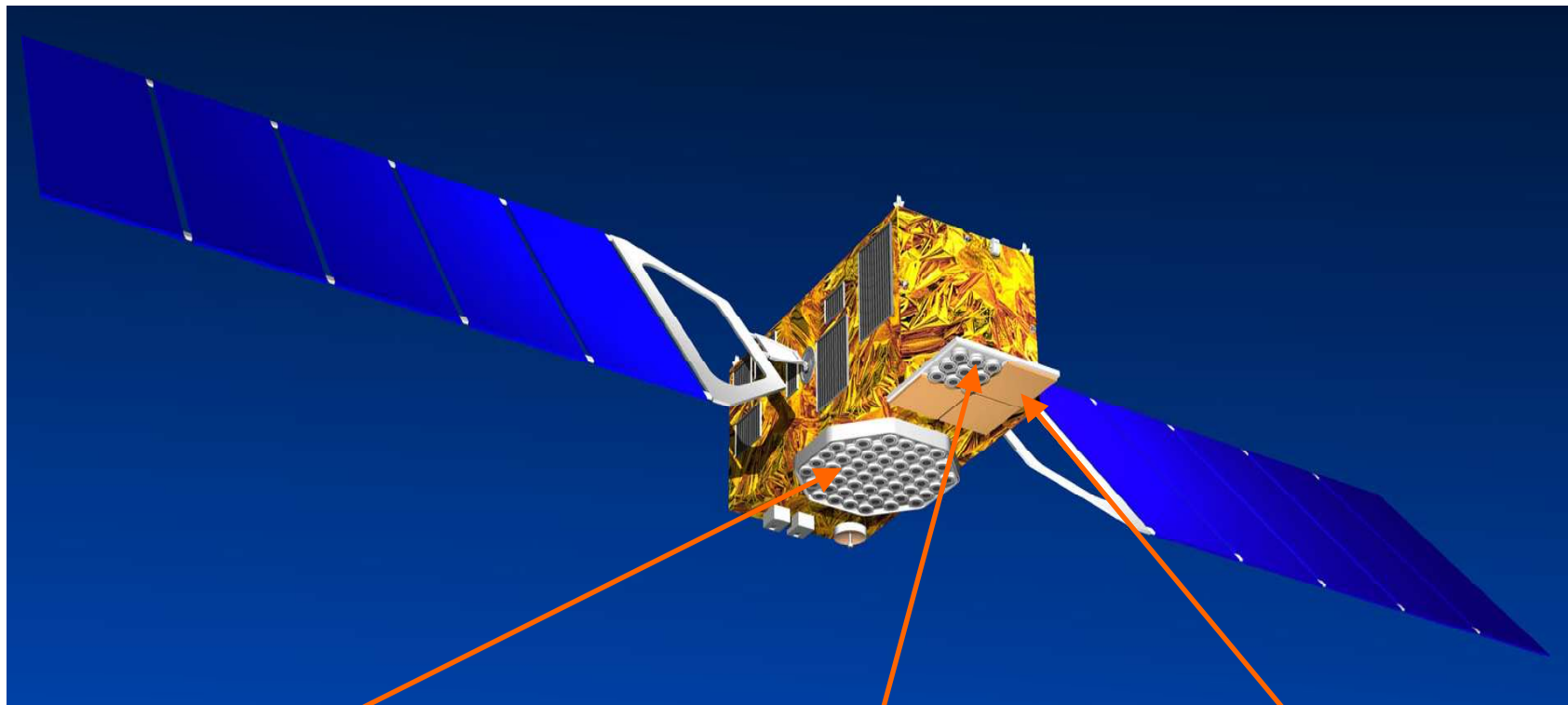
Support to Search And Rescue Services

Capacity	Each satellite capable to relay signals from 150 simultaneously active beacons
Detection Probability	Message received at MEOLUT in < 5 min with $P > 0.99$
Location Error Probability	< 5 Km with $P > 0.95$
Acknowledgement Data Rate (Return Link service)	6 messages of 100 bits each per minute
Availability	99.8%



Refinement of maritime users needs, Brussels December 18, 2002

Galileo satellite with SAR Payload



Navigation antenna

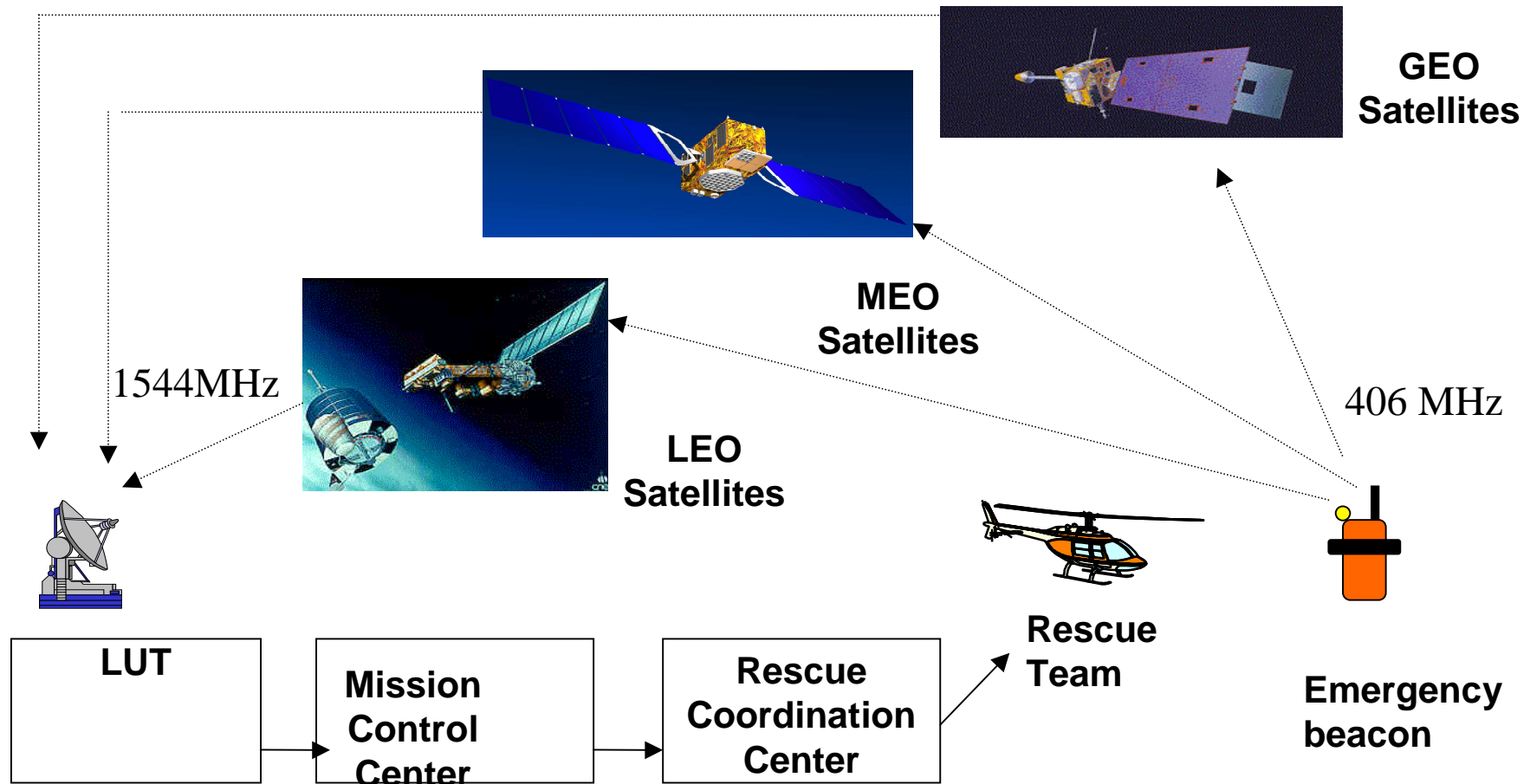
SAR Tx antenna
(L band)

SAR Rx antenna
(406 MHz)



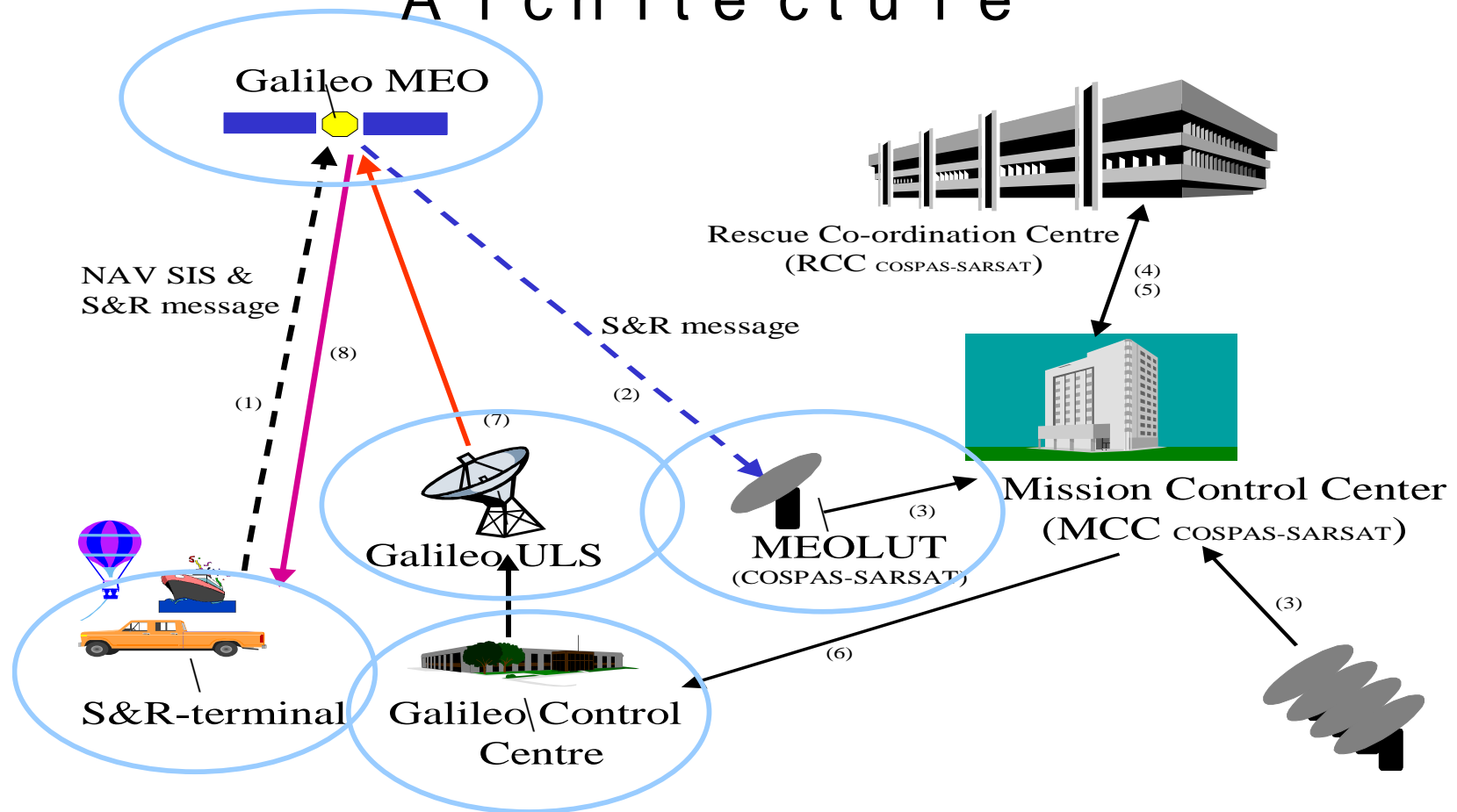
Refinement of maritime users needs, Brussels December 18, 2002

Integration of the MEOSAR component in the International SAR Satellite System





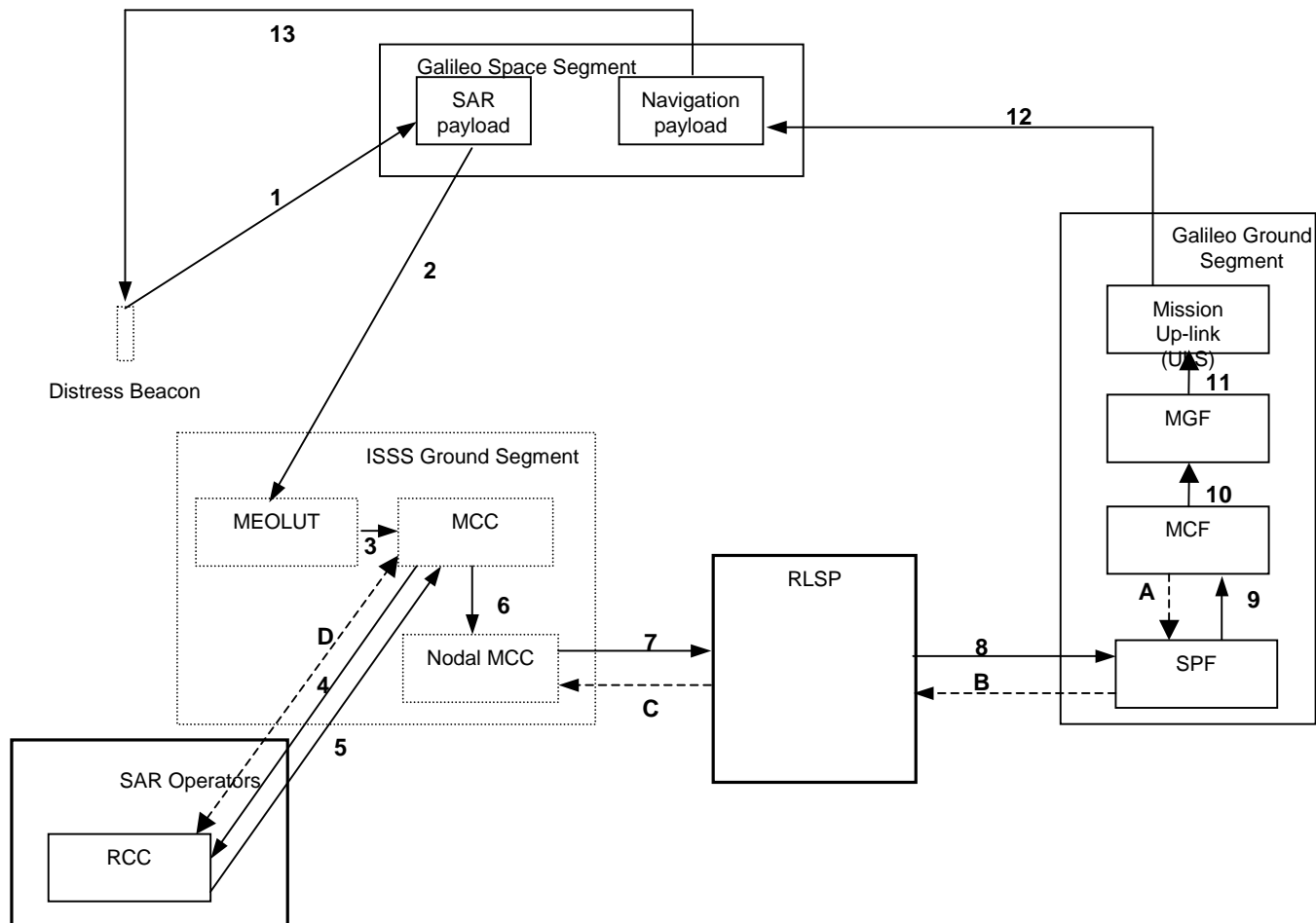
Search & Rescue Architecture





Refinement of maritime users needs, Brussels December 18, 2002

SAR/Galileo Interfaces and Data Flow





Refinement of maritime users needs, Brussels December 18, 2002

SAR/Galileo Ground Segment concept

- **SAR/Galileo CONCEPT WILL FACILITATE INTERNATIONAL COOPERATION FOR THE PROVISION OF THE GROUND SEGMENT:**

- **MEOLUT COVERAGE:**

Six MEOLUTs are sufficient for global coverage

- **OMNI DIRECTIONAL ANTENNA MEOLUT:**

Simple concept, should reduce implementing costs and facilitate operations

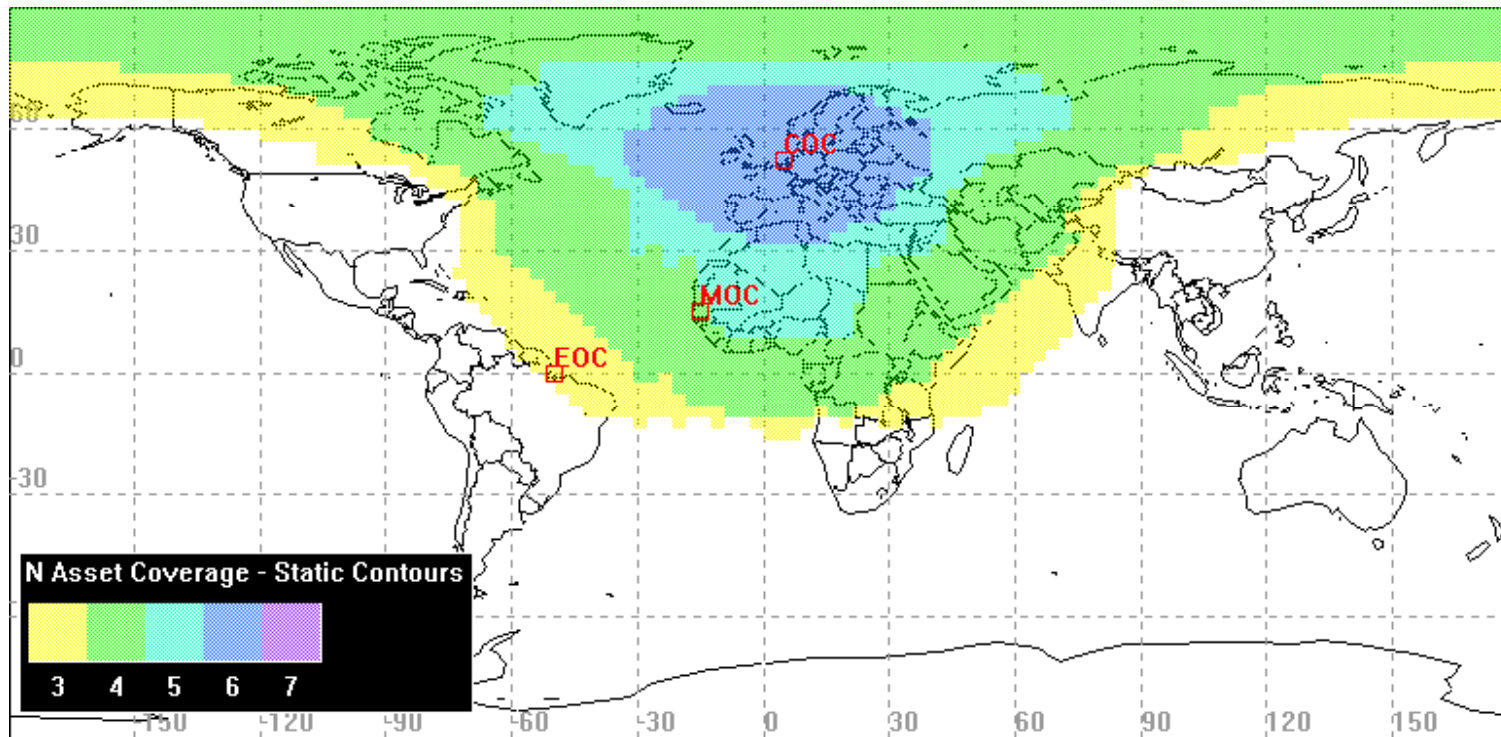
- **SAR/Galileo RETURN LINK OPERATIONS REQUIRE THE DETAILED DEFINITION OF INTERFACES BETWEEN THE GALILEO GROUND SEGMENT AND THE SAR OPERATIONAL GROUND SEGMENT**



Refinement of maritime users needs, Brussels December 18, 2002

Coverage area of a MEOLUT

Common visibility between the beacon and the MEOLUT for 100% of the time of at least N satellites

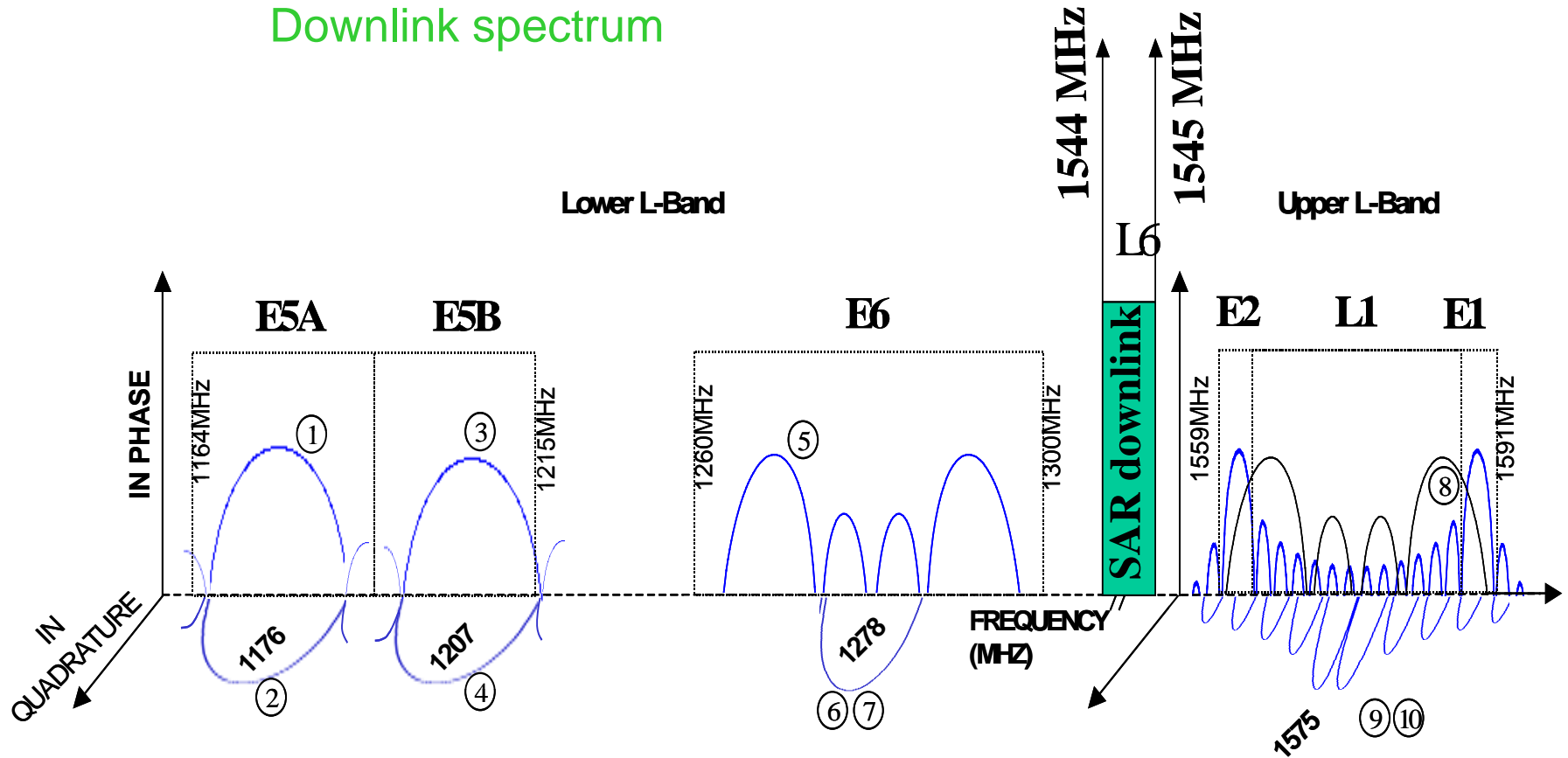


Coverage: localisation inside REQs \Rightarrow 5,000 Km radius



Refinement of maritime users needs, Brussels December 18, 2002

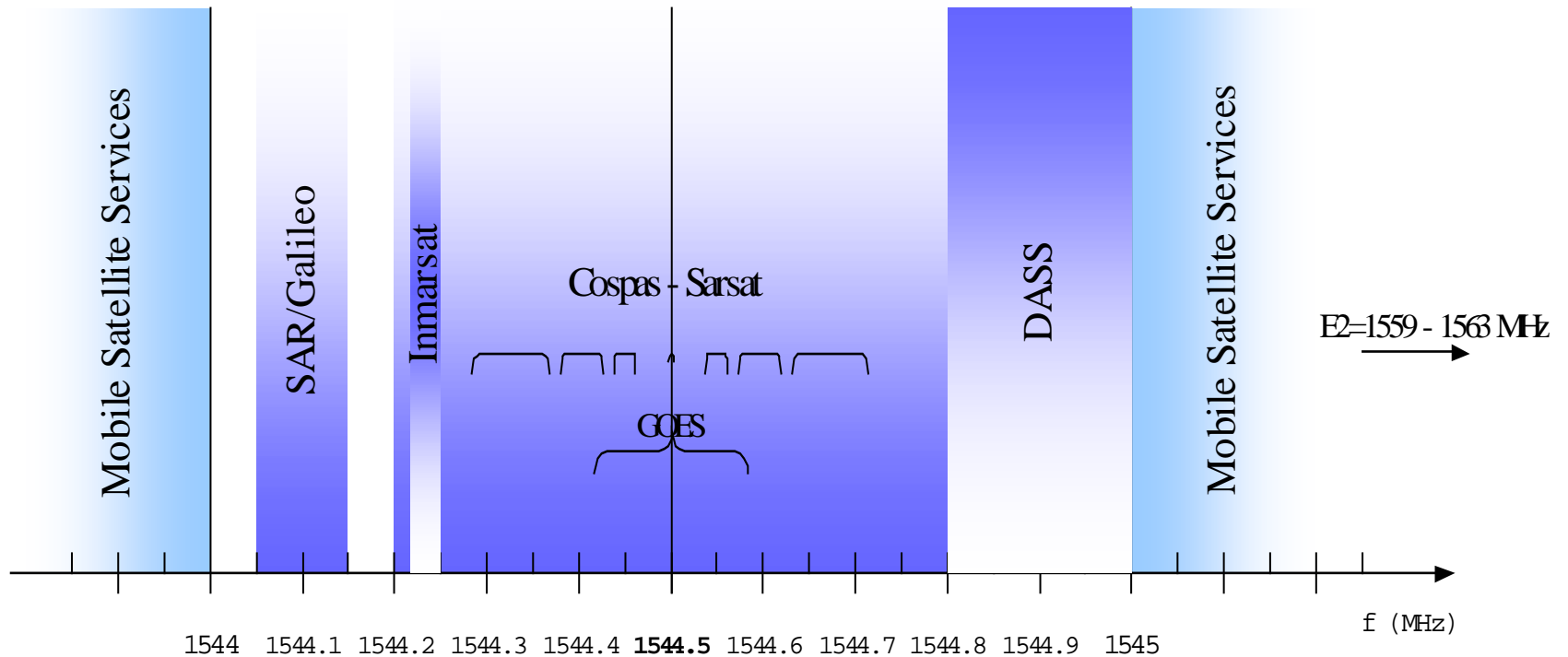
Downlink spectrum





Refinement of maritime users needs, Brussels December 18, 2002

Sharing the available downlink spectrum

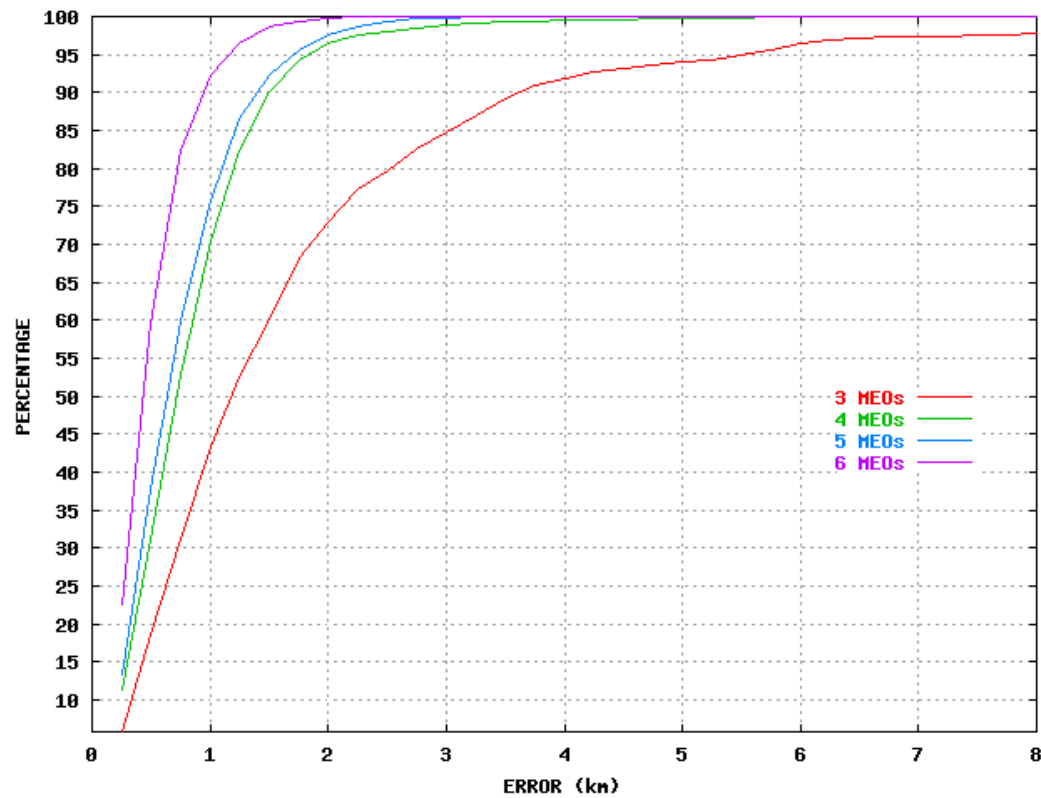




Refinement of maritime users needs, Brussels December 18, 2002

SAR/Galileo expected performance (number of satellites in view)

Beacon localisation error for 3 to 6 MEOs in common view



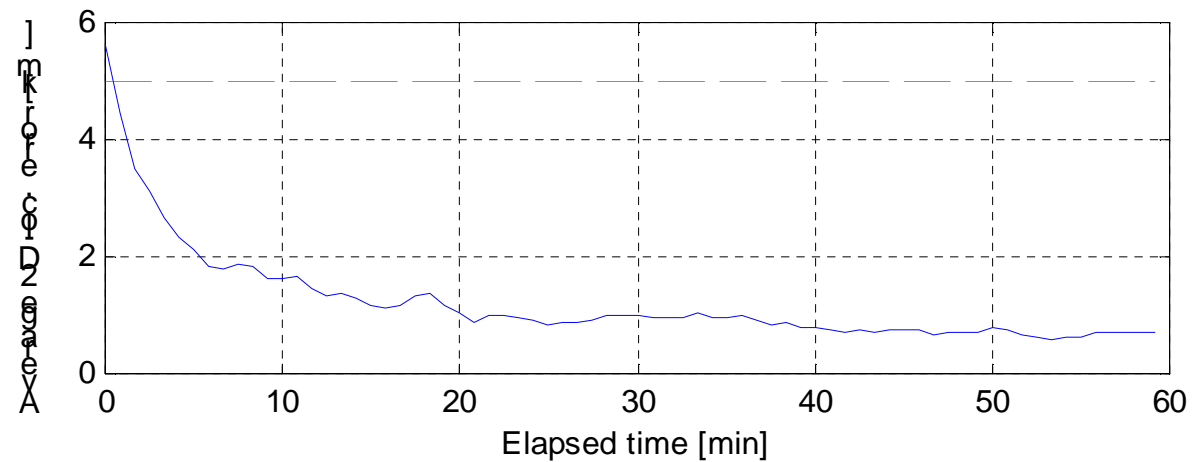
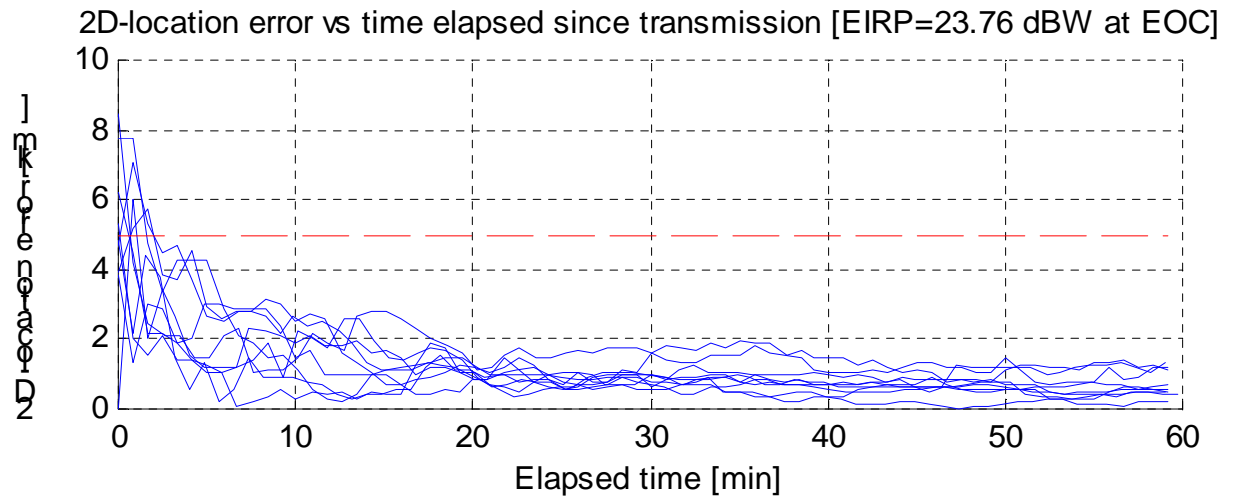


Refinement of maritime users needs, Brussels December 18, 2002

SAR/Galileo expected performance (evolution with time)

Localisation
of non-GNSS
equipped
Beacons

(red line
is the current
requirement)





Summary and conclusion (1/2)

- SAR/Galileo will be the European MEOSAR component for the support to the International Search and Rescue Programme
- The MEO constellation is a unique opportunity to improve the existing international SAR system : permanent availability of space segment; favourable space to Earth geometric configurations, synergy with the navigation information.
- Several MEO initiatives are being considered alongside Galileo: GPS / SAR and GLONASS/ SAR



Summary and conclusions (2/2)

- SAR/Galileo service will provide an enhanced support by:
 - Near real-time alert localisation and message detection
 - Higher beacon localisation error (below 2 Km average in less than 5 min)
 - Return link service (false alert rate reduction)
 - High availability
 - Global coverage
 - Ground segment concept will simplify operations