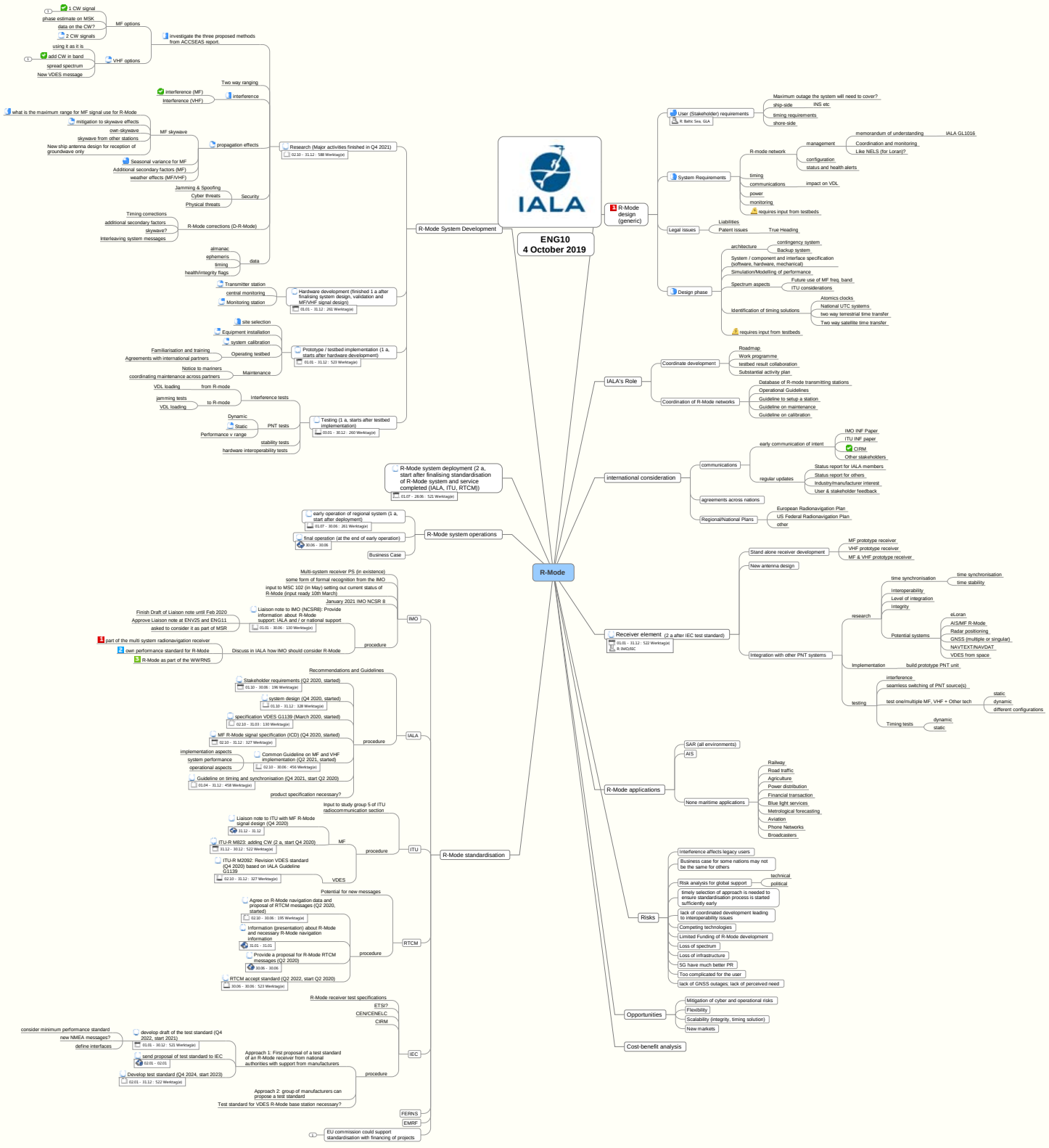
IALA
ENG10
4 October 2019
R-Mode
R-Mode System Development
Research (Major activities finished in Q4 2021)
02.10 - 31.12 : 588 Werktage(e)
MF options
1 CW signal
phase estimate on MSK
data on the CW?
2 CW signals
using it as it is
VHF options
add CW in band
spread spectrum
New VDES message
investigate the three proposed methods from ACCSEAS report.
Two way ranging
interference
interference (MF)
interference (VHF)
propagation effects
what is the maximum range for MF signal use for R-Mode
mitigation to skywave effects
MF skywave
own-skywave
skywave from other stations
New ship antenna design for reception of groundwave only
Seasonal variance for MF
Additional secondary factors (MF)
weather effects (MFV/HF)
Jamming & Spoofing
Security
Cyber threats
Physical threats
R-Mode corrections (D-R-Mode)
Timing corrections
additional secondary factors
skywave?
Interleaving system messages
data
almanac
ephemeris
timing
health/integrity flags
Hardware development (finished 1 a after finalising system design, validation and MF/VHF signal design)
01.01 - 31.12 : 261 Werktage(e)
Transmitter station
central monitoring
Monitoring station
Prototype / testbed implementation (1 a, starts after hardware development)
01.01 - 31.12 : 523 Werktage(e)
site selection
Equipment installation
system calibration
Operating testbed
Familiarisation and training
Agreements with international partners
Maintenance
Notice to mariners
coordinating maintenance across partners
Testing (1 a, starts after testbed implementation)
03.01 - 30.12 : 260 Werktage(e)
Interference tests
VDL loading
from R-mode
jamming tests
VDL loading
to R-mode
PNT tests
Dynamic
Static
Performance v range
stability tests
hardware interoperability tests
R-Mode system deployment (2 a, start after finalising standardisation of R-Mode system and service completed (IALA, ITU, RTCM))
01.07 - 28.06 : 521 Werktage(e)
R-Mode system operations
early operation of regional system (1 a, start after deployment)
01.07 - 30.06 : 261 Werktage(e)
final operation (at the end of early operation)
30.06 - 30.06
Business Case
R-Mode standardisation
IMO
Multi-system receiver PS (in existence)
some form of formal recognition from the IMO
input to MSC 102 (in May) setting out current status of R-Mode (input ready 10th March)
January 2021 IMO NCSR 8
Provide
Liaison note to IMO (NCSR8): information about R-Mode support: IALA and / or national support
01.01 - 30.06 : 130 Werktage(e)
Finish Draft of Liaison note until Feb 2020
Approve Liaison note at ENV25 and ENG11
asked to consider it as part of MSR
part of the multi system radionavigation receiver
own performance standard for R-Mode
R-Mode as part of the WWRNS
Discuss in IALA how IMO should consider R-Mode
procedure
IALA
Recommendations and Guidelines
Stakeholder requirements (Q2 2020, started)
01.10 - 30.06 : 196 Werktage(e)
system design (Q4 2020, started)
01.10 - 31.12 : 328 Werktage(e)
specification VDES G1139 (March 2020, started)
02.10 - 31.03 : 130 Werktage(e)
MF R-Mode signal specification (ICD) (Q4 2020, started)
02.10 - 31.12 : 327 Werktage(e)
Common Guideline on MF and VHF implementation (Q2 2021, started)
02.10 - 30.06 : 456 Werktage(e)
Guideline on timing and synchronisation (Q4 2021, start Q2 2020)
01.04 - 31.12 : 458 Werktage(e)
implementation aspects
system performance
operational aspects
product specification necessary?
procedure
ITU
Input to study group 5 of ITU radiocommunication section
Liaison note to ITU with MF R-Mode signal design (Q4 2020)
31.12 - 31.12
ITU-R M823: adding CW (2 a, start Q4 2020)
31.12 - 30.12 : 522 Werktage(e)
MF
ITU-R M2092: Revision VDES standard (Q4 2020) based on IALA Guideline G1139
02.10 - 31.12 : 327 Werktage(e)
VDES
procedure
RTCM
Potential for new messages
Agree on R-Mode navigation data and proposal of RTCM messages (Q2 2020, started)
02.10 - 30.06 : 195 Werktage(e)
Information (presentation) about R-Mode and necessary R-Mode navigation information
02.01 - 31.01
Provide a proposal for R-Mode RTCM messages (Q2 2020)
30.06 - 30.06
RTCM accept standard (Q2 2022, start Q2 2020)
30.06 - 30.06 : 523 Werktage(e)
procedure
IEC
R-Mode receiver test specifications
ETSI?
CEN/CENELEC
CIRM
consider minimum performance standard
new NMEA messages?
define interfaces
develop draft of the test standard (Q4 2022, start 2021)
01.01 - 30.12 : 521 Werktage(e)
send proposal of test standard to IEC
02.01 - 02.01
Develop test standard (Q4 2024, start 2023)
02.01 - 31.12 : 522 Werktage(e)
Approach 1: First proposal of a test standard of an R-Mode receiver from national authorities with support from manufacturers
Approach 2: group of manufacturers can propose a test standard
Test standard for VDES R-Mode base station necessary?
procedure
FERNS
EMRF
EU commission could support standardisation with financing of projects
R-Mode design (generic)
User (Stakeholder) requirements
R. Baltic Sea, GLA
Maximum outage the system will need to cover?
ship-side
INS etc
timing requirements
shore-side
System Requirements
R-mode network
management
memorandum of understanding
IALA GL1016
Coordination and monitoring
Like NELS (for Loran)?
configuration
status and health alerts
timing
communications
impact on VDL
power
monitoring
requires input from testbeds
Legal issues
Liabilities
Patent issues
True Heading
Design phase
architecture
contingency system
Backup system
System / component and interface specification (software, hardware, mechanical)
Simulation/Modelling of performance
Spectrum aspects
Future use of MF freq. band
ITU considerations
Identification of timing solutions
Atomics clocks
National UTC systems
two way terrestrial time transfer
Two way satellite time transfer
requires input from testbeds
IALA's Role
Coordinate development
Roadmap
Work programme
testbed result collaboration
Substantial activity plan
Coordination of R-Mode networks
Database of R-mode transmitting stations
Operational Guidelines
Guideline to setup a station
Guideline on maintenance
Guideline on calibration
international consideration
communications
early communication of intent
IMO INF Paper
ITU INF paper
CIRM
Other stakeholders
regular updates
Status report for IALA members
Status report for others
Industry/manufacturer interest
User & stakeholder feedback
agreements across nations
Regional/National Plans
European Radionavigation Plan
US Federal Radionavigation Plan
other
Receiver element (2 a after IEC test standard)
01.01 - 31.12 : 522 Werktage(e)
R IMO/IEC
Stand alone receiver development
MF prototype receiver
VHF prototype receiver
MF & VHF prototype receiver
New antenna design
Integration with other PNT systems
research
time synchronisation
time synchronisation
time stability
Interoperability
Level of integration
Integrity
Potential systems
eLoran
AIS/MF R-Mode
Radar positioning
GNSS (multiple or singular)
NAVTEXT/NAVDAT
VDES from space
Implementation
build prototype PNT unit
testing
interference
seamless switching of PNT source(s)
test one/multiple MF, VHF + Other tech
static
dynamic
different configurations
Timing tests
dynamic
static
R-Mode applications
SAR (all environments)
AIS
None maritime applications
Railway
Road traffic
Agriculture
Power distribution
Financial transaction
Blue light services
Metrological forecasting
Aviation
Phone Networks
Broadcasters
Risks
Interference affects legacy users
Business case for some nations may not be the same for others
Risk analysis for global support
technical
political
timely selection of approach is needed to ensure standardisation process is started sufficiently early
lack of coordinated development leading to interoperability issues
Competing technologies
Limited Funding of R-Mode development
Loss of spectrum
Loss of infrastructure
5G have much better PR
Too complicated for the user
lack of GNSS outages; lack of perceived need
Opportunities
Mitigation of cyber and operational risks
Flexibility
Scalability (integrity, timing solution)
New markets
Cost-benefit analysis