



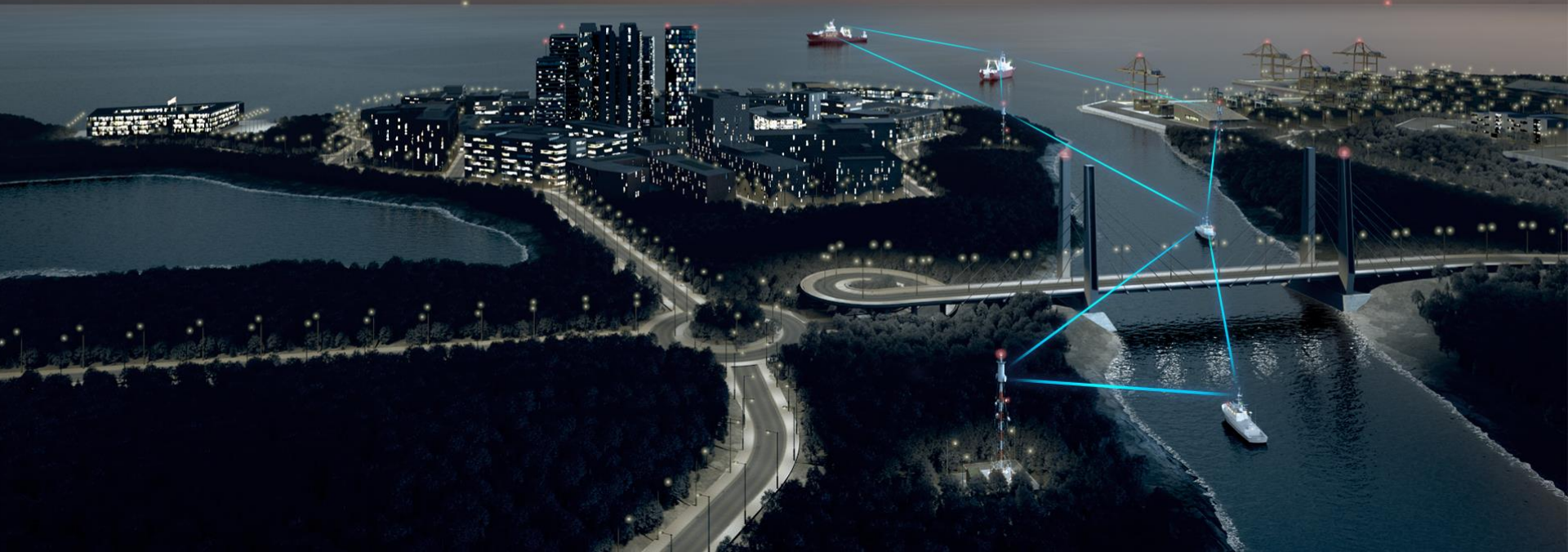
KONGSBERG

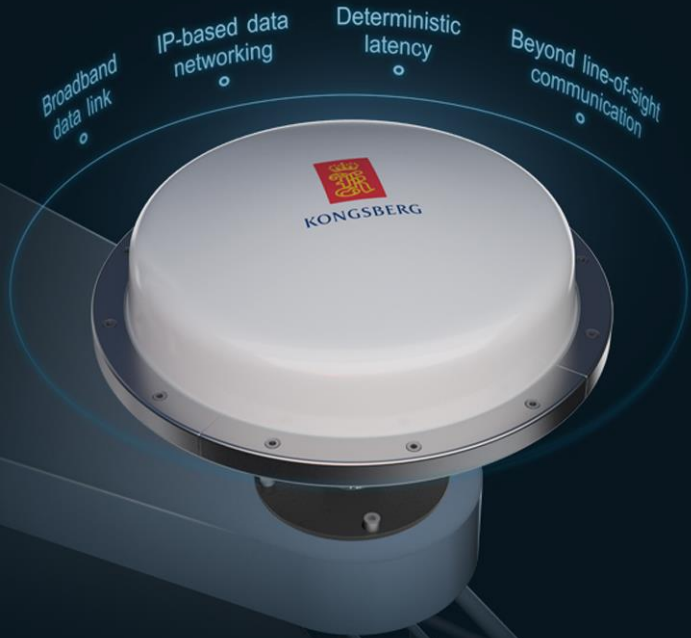
Kongsberg Seatex – MBR

Warit Decharin – Kongsberg Seatex Rep

Maritime Broadband Radio - MBR

Operational Excellence through Communication Performance





HIGH PERFORMANCE TECHNOLOGY

- **High-capacity communication**
 - Voice, video, monitoring data, & shore-based communication
- **Fast & long range communication**
 - Secure real-time information exchange
 - Up to several hundred kilometres range
- **High-performance communication infrastructure**
 - Smart configuration, more bandwidth, low latency
 - No compatibility restrictions beyond network standards

Broadband ship-to-ship communication

- Vessel-to-vessel communication
- Platform-to-vessel communication
- Coordinated operations
- Nomadic operations
- Multi-vessel operations
 - Decentralized ad-hoc network
 - Need for network topology



Typical Ranges

The IP oriented wireless connectivity system provided interoperability with existing systems and sensors.

The wireless connectivity system was able to provide several critical services in parallel and provided required quality of service for sensor data streaming in real-time.

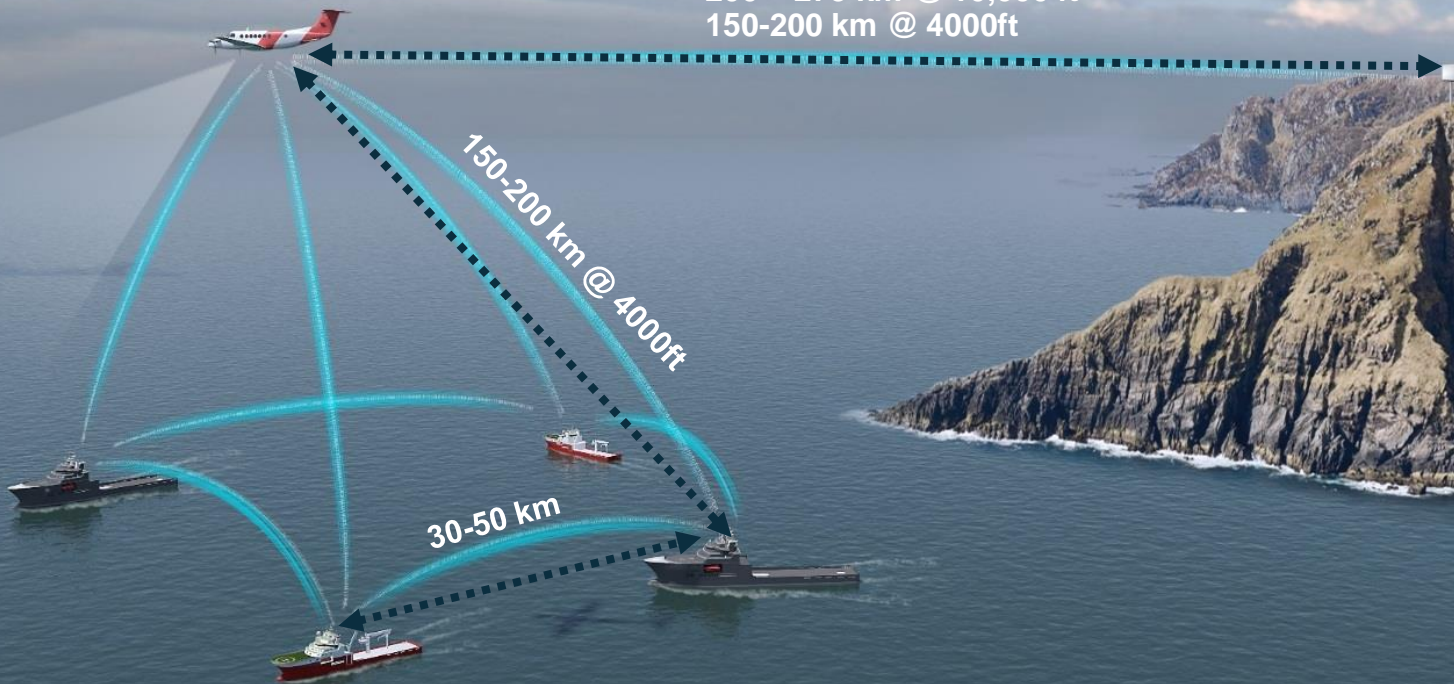
Demonstrated ranges

- 130-150 km from aircraft to vessel at 2000-4000 feet aircraft altitude
- 200 km from aircraft to vessel at 10 000 feet aircraft altitude
- 200-250 km from aircraft to ground stations at 10000-15000 feet aircraft altitude
- 40-50 km from vessel to vessel
- 60 km from aircraft to portable equipment

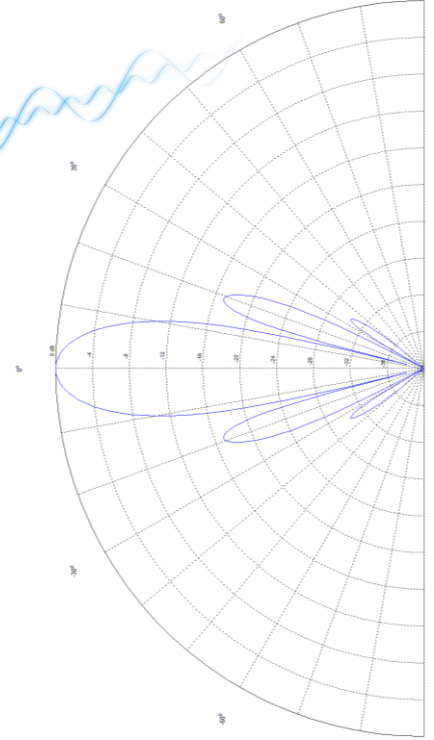


Range

200 – 275 km @ 10,000 ft
150-200 km @ 4000ft



A smart antenna solution

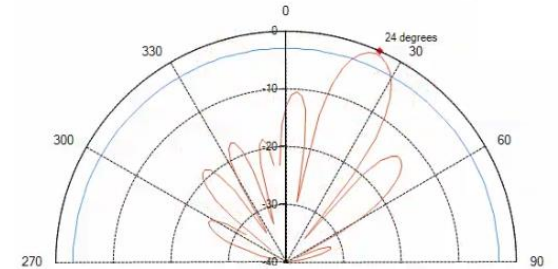
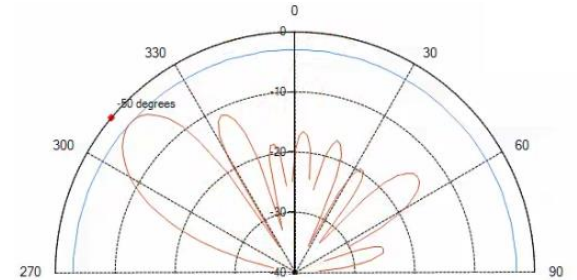


Beam forming by antenna arrays

- With a phased array a digital radio beam can be shaped to increase gain in specific directions
- The beam can be focused instantaneously by software both for transmission and reception



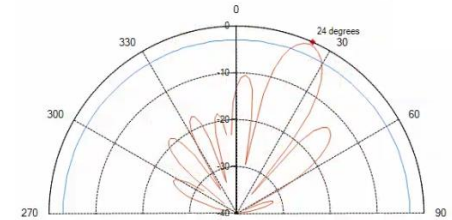
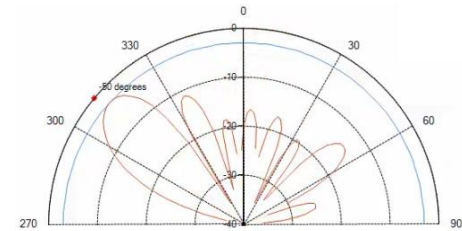
Example of phased array radar antenna



Beam forming radiation patterns

Beam forming by antenna arrays

- With a phased array antenna the radio beam can be shaped to increase gain in specific directions
- The beam can be focused instantaneously by software both for transmission and reception

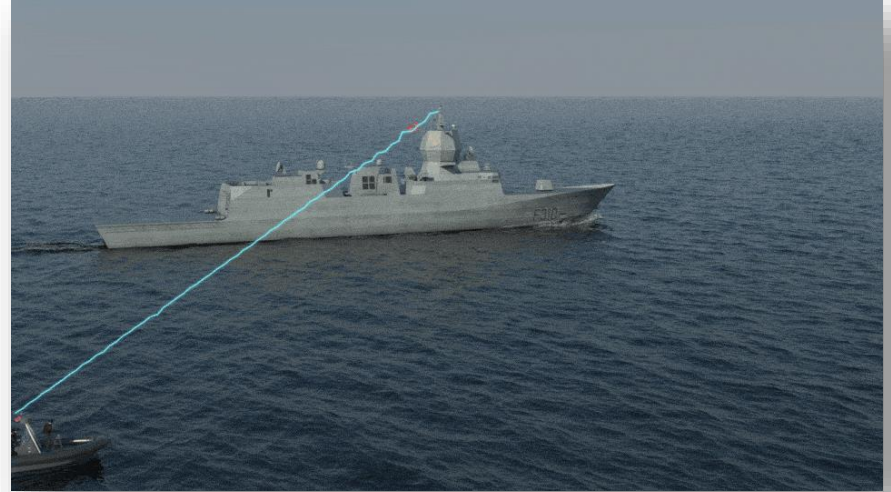


Beam forming radiation patterns

Phased array advantage



Conventional radio systems. Radiates in all directions. Limited range, limited bandwidth and easy to monitor and jam.



Phased array radio system. Fast moving directed beam without any moving parts. Long range, high bandwidth, difficult to monitor and jam.

Phased array advantage

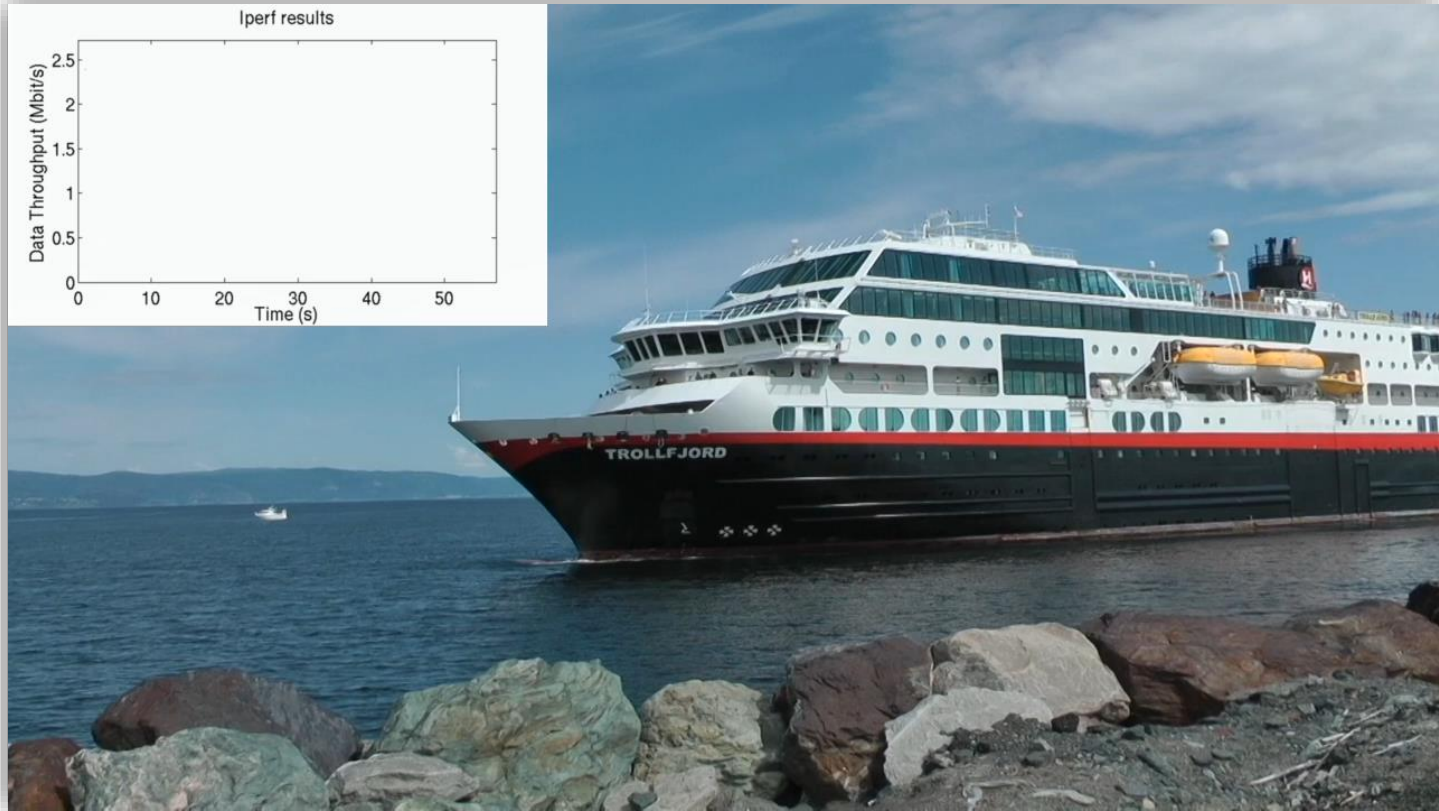


Conventional UAV ground stations. A tracking antenna provides a point-to-point data link

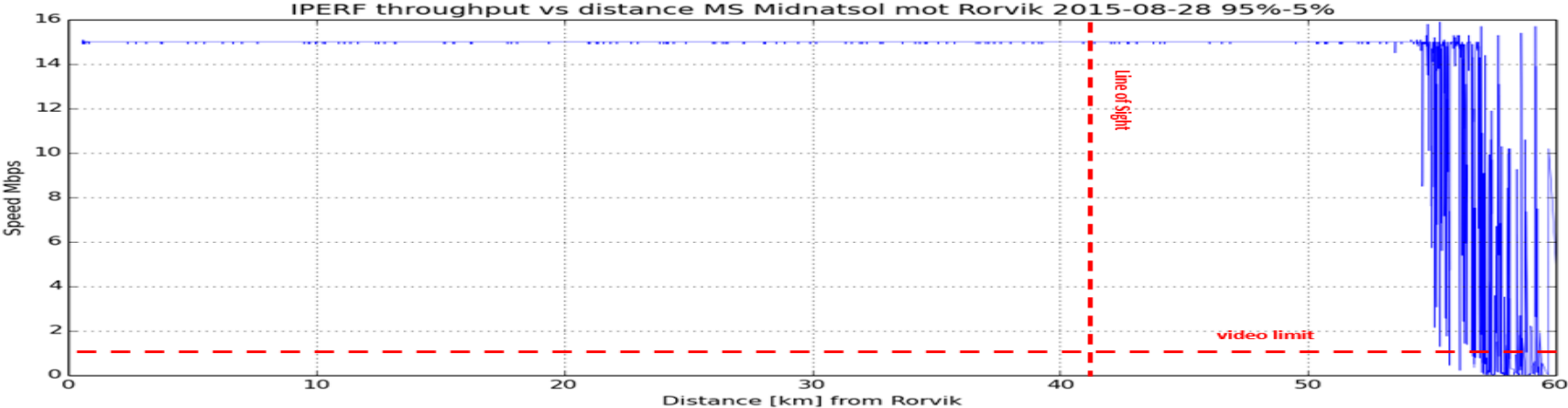


Phased array radio system. The fast switching of beam direction without any moving parts provides a point-to-multipoint system.

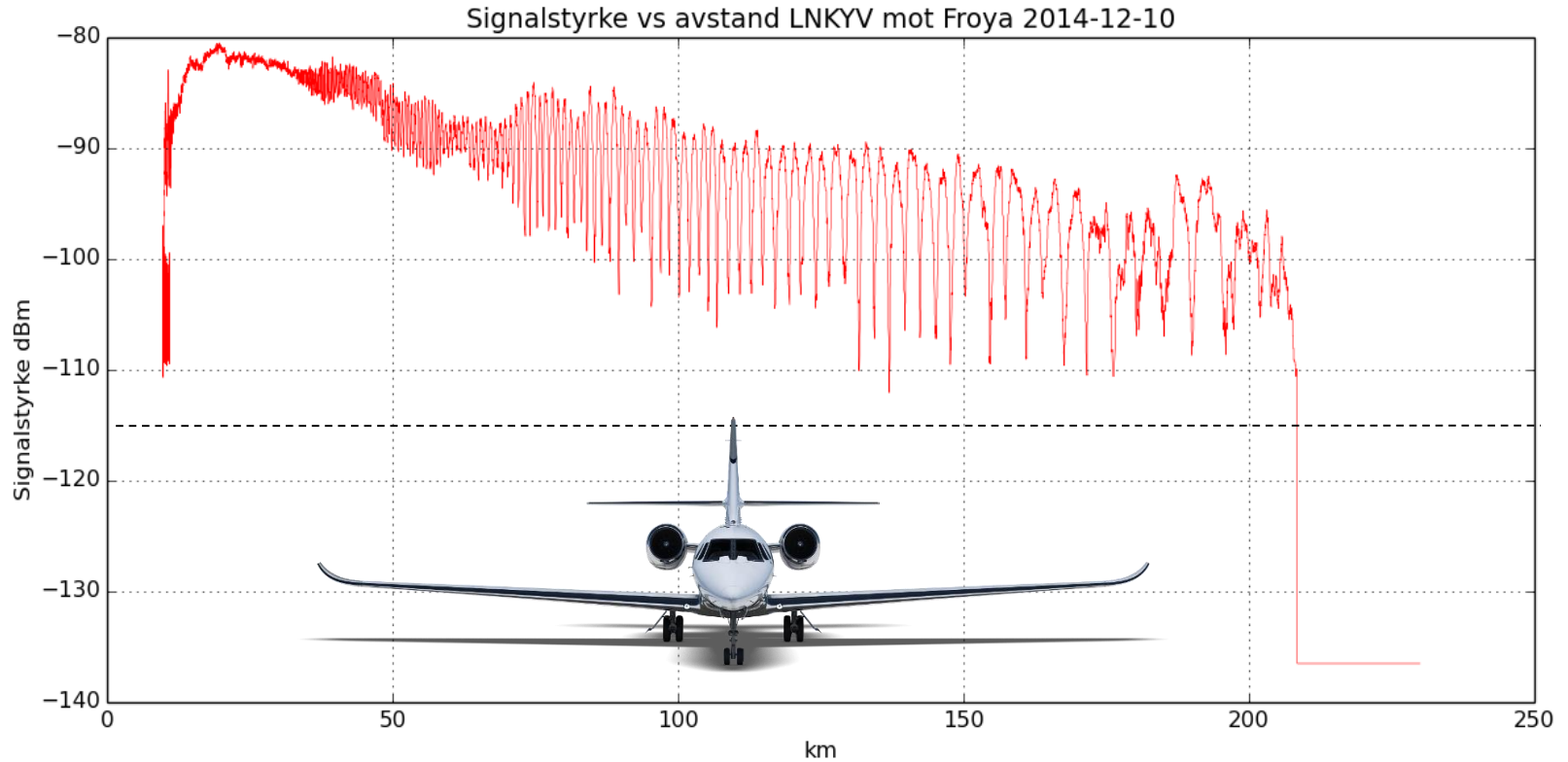
Throughput test in difficult conditions



Communication beyond line-of-sight 15Mbps



Long range, air to ground link performance



MBR Product Types

MBR Products – High Performance Line

- MBR 189
- MBR 189 MK2
- MBR 179
- MBR 179 MK2



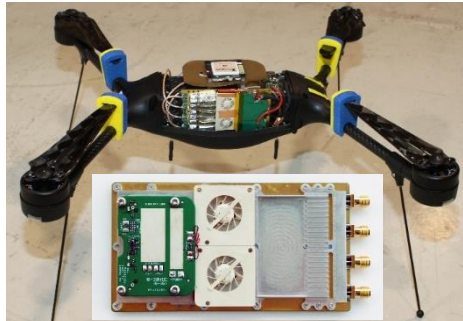
MBR Products - Compact High Performance Line

- MBR 144
- MBR 144 OEM
- MBR 144 Personal
- MBR 144 Submersible
- MBR 144 UAV



MBR 144 Product Types

- MBR 144 OEM
- MBR 144 Personal
- MBR 144 Fixed
- MBR 144 UAV
- MBR 144 Submersible



Dual boarding team pack, MBR 144

Oil Spill
Response
Thailand
2019



Portable MBR 189/179

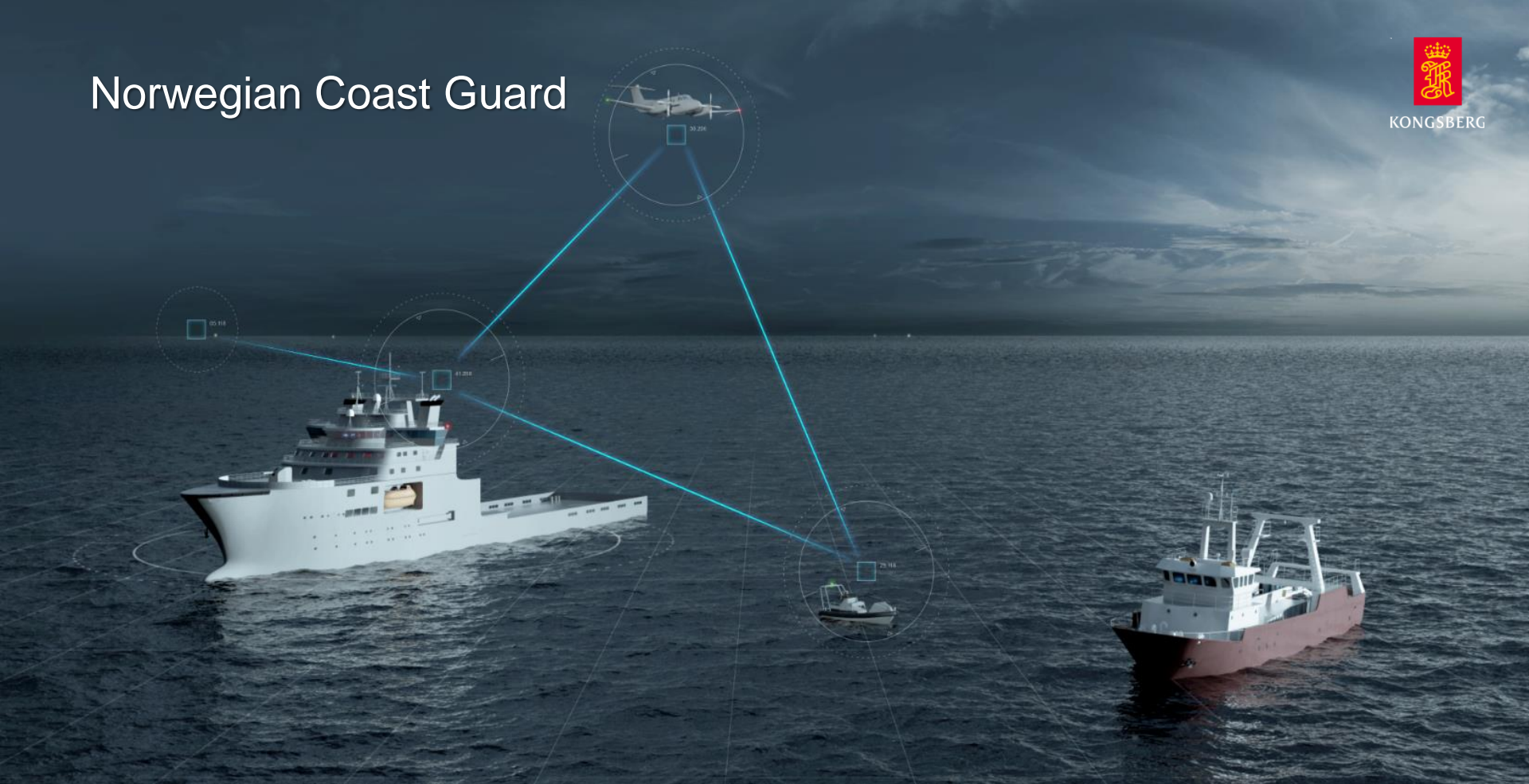
Oil Spill
Response
Thailand
2019



Norwegian Coast Guard



KONGSBERG

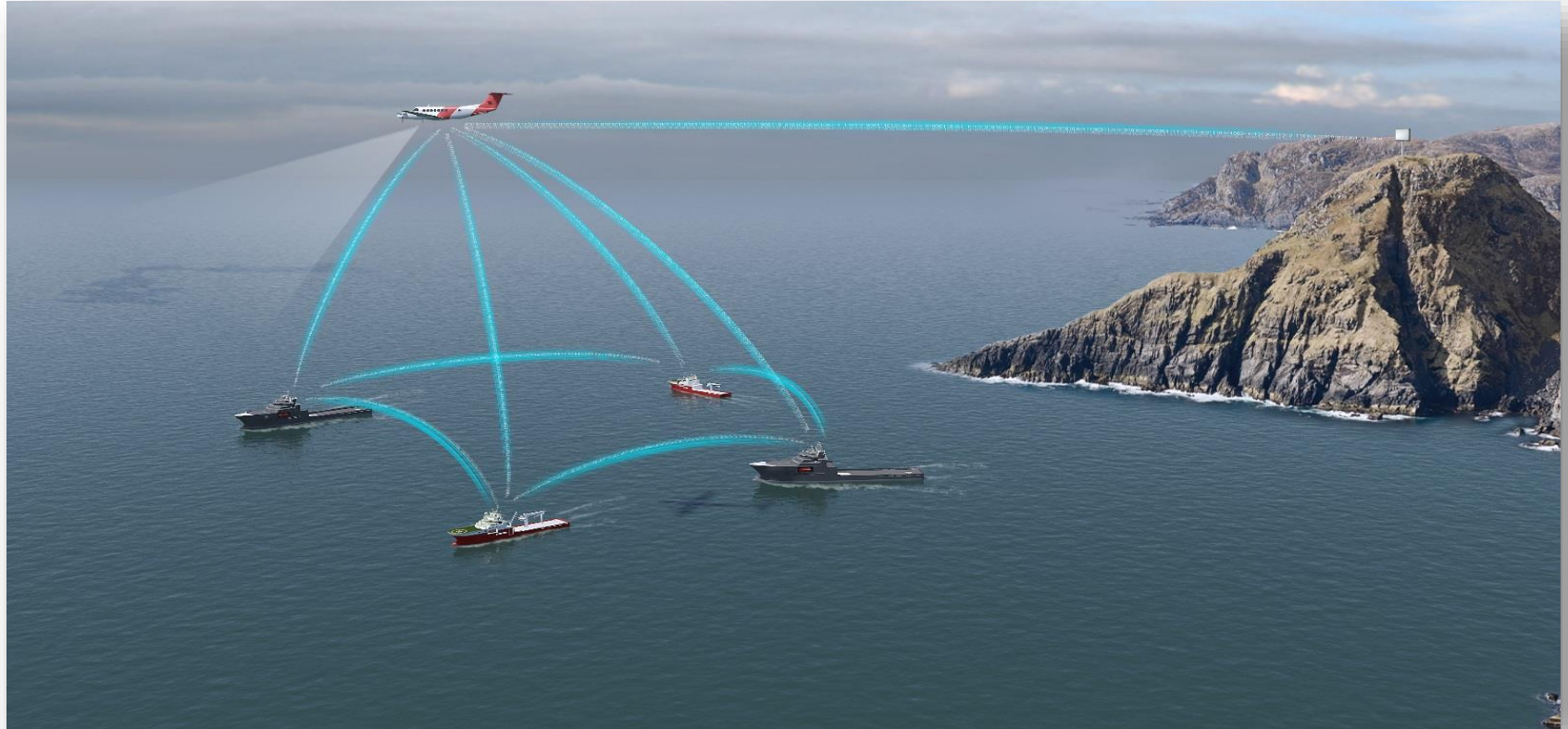


The Norwegian set-up

Oil Spill
Response
Thailand
2019



MBR for the Norwegian Coast Guard and the Norwegian Coastal Administration





78° 15' 23" N
13° 9' 43" E

Ground installations

Reinsfjell



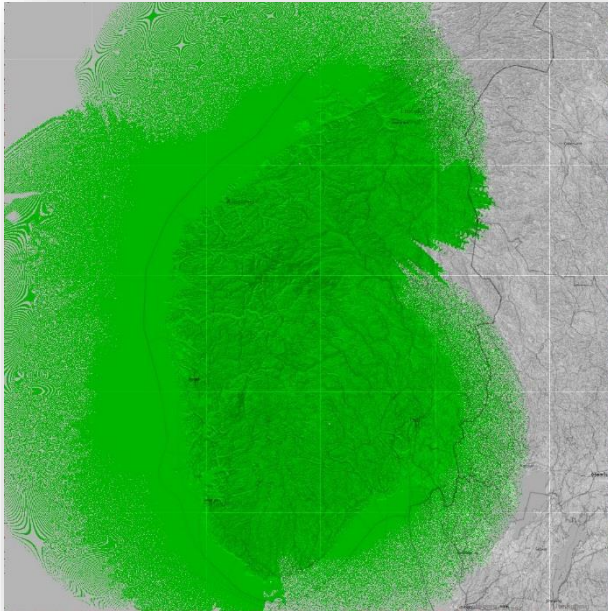
Ulriken



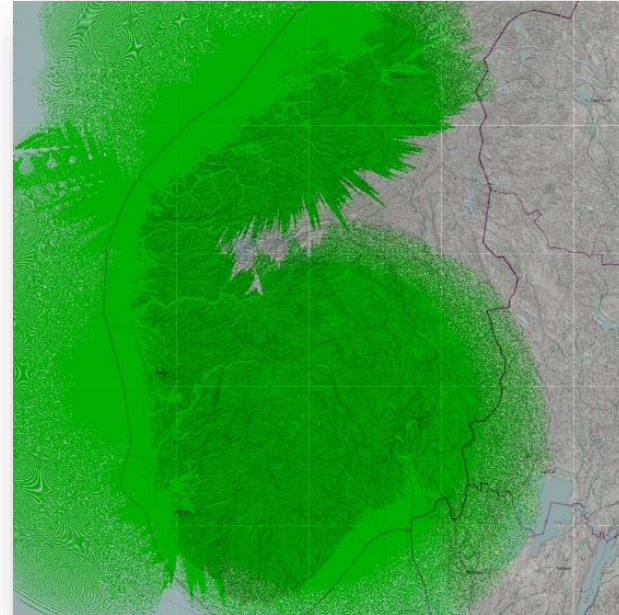
Gaustadtoppen



Ground installations, air to ground coverage



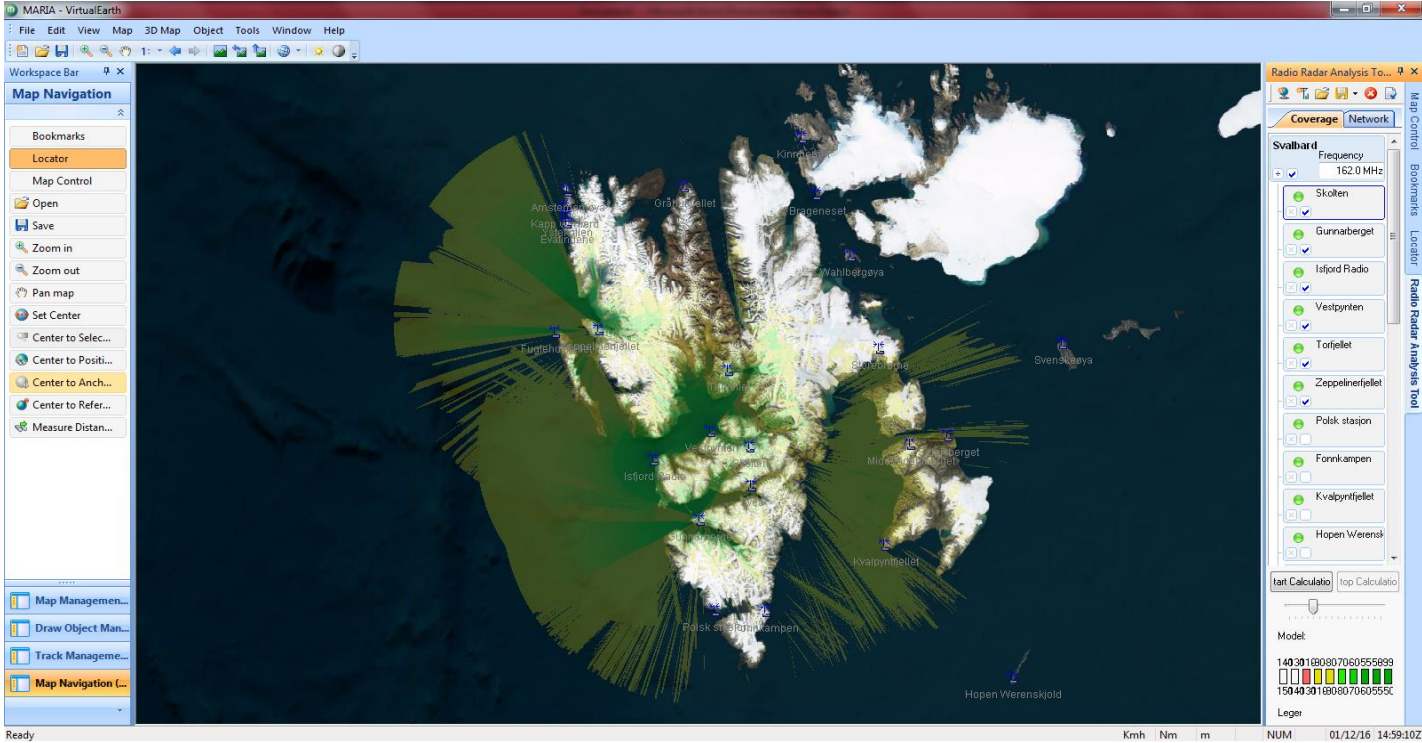
Coverage at 15 000 feet AGL



Coverage at 4 000 feet AGL
(Standard mission altitude)

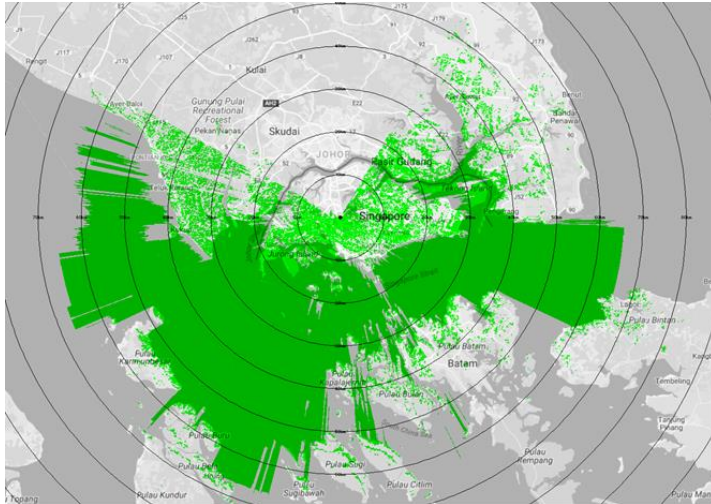
New infrastructure Spitsbergen

Coverage towards ships

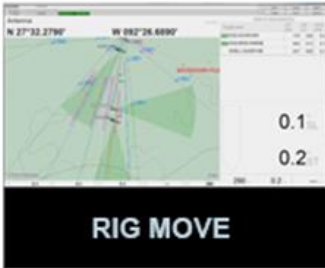
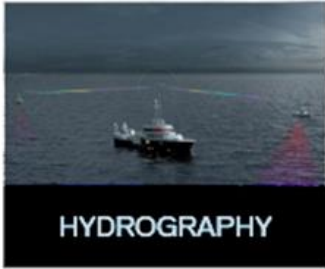


Coverage Singapore

- One MBR Base Station centrally located on Singapore (150 m height) could cover an radius of at least 150 km towards an aircraft in standard operation altitude (4.000 ft) *picture to the right.*
- Normal coverage towards a vessels is > 50 km (20m antenna height)



MBR Product Website <http://connectingvessels.com>



Enhanced Maritime Domain Awareness

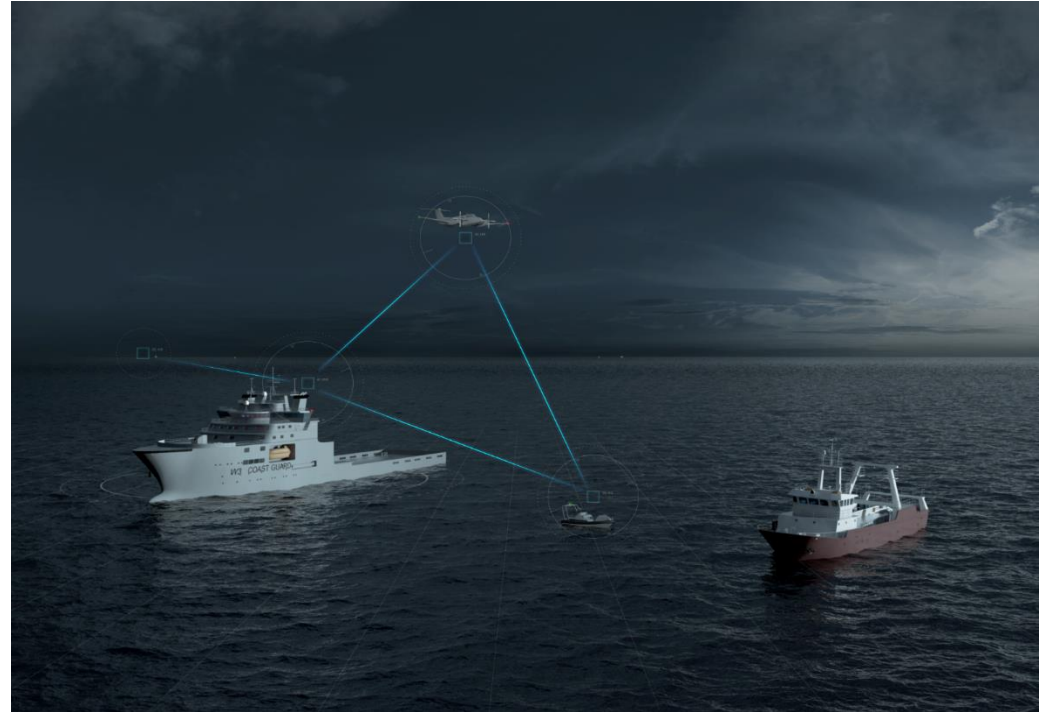
Applications for MBR

- Fishery Inspection, visitations, SAR
 - *Norwegian Coast Guard*
 - Offshore Patrol & Surveillance
 - *Ocean Shield, anti piracy*
 - Territorial Surveillance
 - Oil Spill Detection and Combatting
 - *Norwegian Coast Guard, NCA and NOFO*
 - Port Security and asset protection
- Remote survey operations
 - Hydrographic Services
 - Autonomous Operations
 - ASV, MMCM, drones



Fishery Inspection, visitations, SAR

- Detection and identification from aircraft
 - Aircraft – vessel
 - Video, AIS
- Inspection by boarding team / inspector
 - Vessel – boarding team
 - Video/pictures/files
 - Video documentation
 - Effective decisions
 - Vessel – shore
 - Legal advises
 - High command decisions



Offshore Patrol & Surveillance

NATO Counter- Piracy Mission:
Operation Ocean Shield

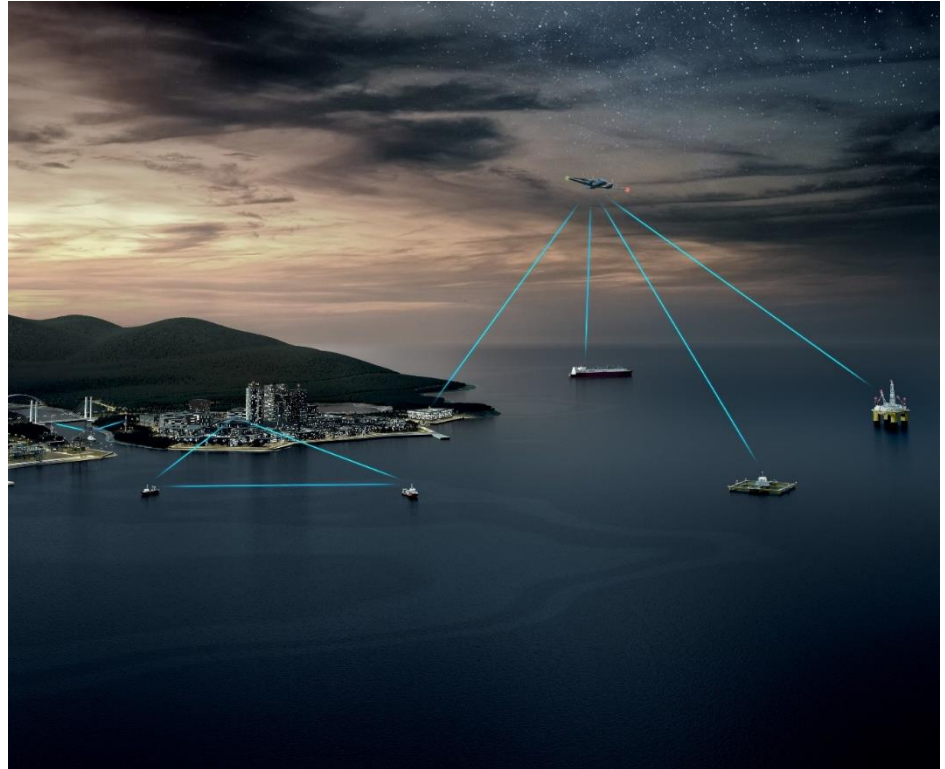
Real time video, boarding-team, frigate

- Safety
- Effectiveness
- Report/documentation



Territorial surveillance

- Platform independent
 - Drones, vessels, fixed wing, helicopter etc.
- Up to 250 km range towards aircraft at 10.000 ft altitude
- Applications
 - Oil-spill detection
 - Border Control
 - Piracy
 - Illegal fishing
 - Inspection of suspect vessels, detected because of strange behaviour
 - Monitoring of approaches and anchorage areas



Oil spill detection and recovery

- Detection by satellite (SAR) or aircraft
- Coordination of available assets from shore
- Local coordination from On Scene Commander (OCS)
 - UAV, vessels of opportunity, dedicated assets, personnel
 - Sensor data sharing
 - Effective coordination



Port security and asset protection

- Monitoring of approaches and anchorage areas
- Fast detection of anomalies by real time sensor data feeds from remote sensor platforms
- Inspection of suspect vessels, detected because of strange behaviour
- Asset control and monitoring
- Real time sensor data sharing with manned assets in the port
- Video conferencing with moving assets everywhere within the port



Enhanced Maritime Domain Awareness by linking the sensor infrastructure and mobile sensor platforms with the operation centre, and the assets (on-scene commanders) accomplishing the operation!

Real time common operational picture (COP), anywhere!



Vessel



RIB



ASV



UUV



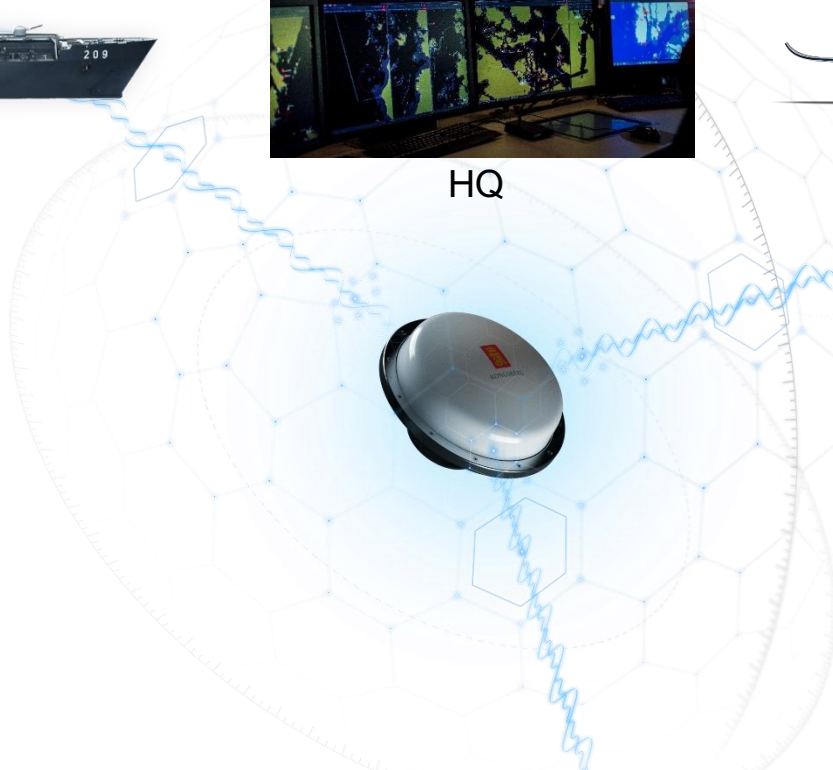
HQ



Aircraft



UAV



NAVSEA – NSCW Carderock – Stiletto



KONGSBERG



MBR Package for Stiletto

- Stiletto Craft
 - 4x MBR 189
- NSW 11M RHIB
 - 1 x MBR 179
 - 1 x MBR 144 Personal (RHIB Crew)
- TOC
 - 1x MBR 189
 - 1x MBR 179 portable for Mobile TOC

MBR 144 Personal

- Body worn
- Absolute positioning



MBR 189

- Sector Antenna
- High gain steerable in azimuth and elevation
- Relative and absolute positioning
- Built-in multi-sectoring functionality for expanding coverage
- Suitable for maritime land stations and UAV ground stations



MBR 179

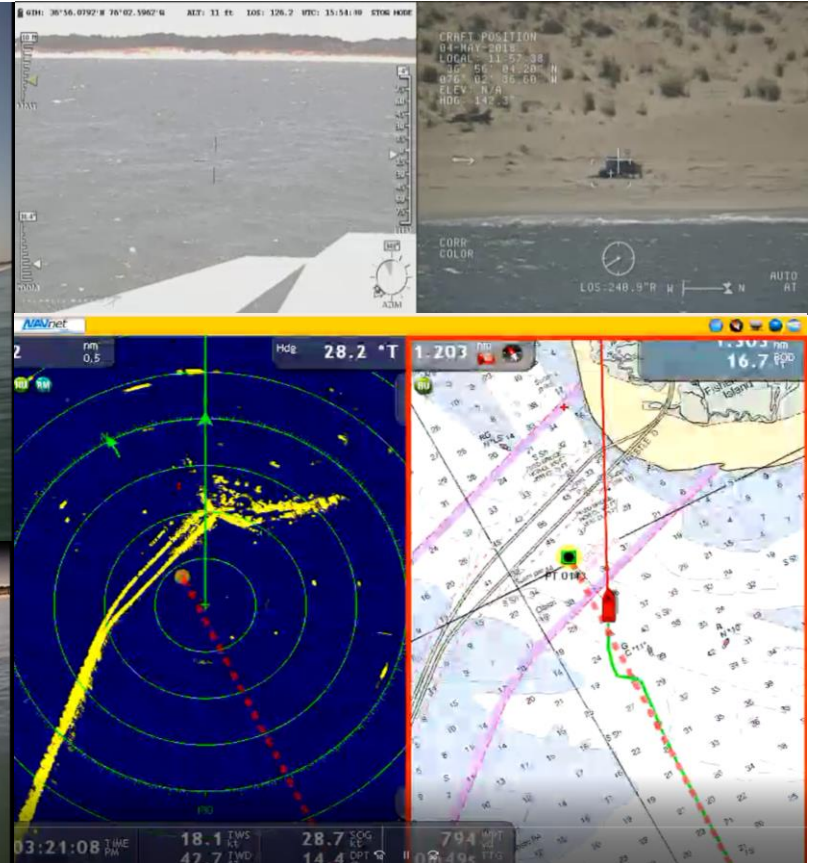
- Omnidirectional
- High gain steerable in azimuth
- Absolute positioning
- Suitable for medium to large vessels

MBR 179 Portable

- Portable kit
- Omnidirectional
- High gain steerable in azimuth
- Absolute positioning
- Suitable for medium to large vessels
- Suitable for quick and temporary deployment



Live video from Stiletto and Rhib – recorded in TOC





MBR 179
UAV

16,5 Mbps
Range –
20KM

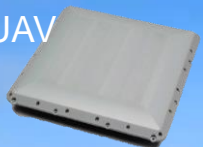
MBR 144
CAM



Artist's Concept



MBR 179
UAV



16,5 Mbps
Range up to 100 KM



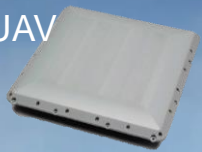
MBR 179
UAV



Artist's Concept



MBR 179
UAV



16,5 Mbps
Range up to 100 KM



MBR 179
UAV



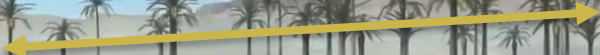
MBR 144
CAM
GPS and Wifi
Artist's Concept



MBR 144
CAM
GPS and Wifi



Range - Line of sight
Up to 10 km
2,8 Mbps

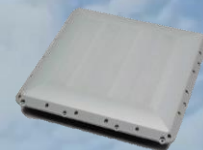


MBR 144
CAM
GPS and Wifi

Artist's Concept



MBR 144
CAM



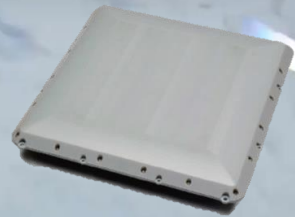
MBR 179
UAV

2.8 Mbps
Range up to 40KM at
100meters antenna height on
Talon

Artist's Concept

DARPA

FLERE VIDEOER



MBR 179
UAV

Wired ethernet down to ship



Artist's Concept



MAPC



MBR DEMO Package for SIS

- TOC
 - 1x MBR 189 at 80 feet – V47
- USV #1
 - 1x MBR 179
- USV #1
 - 1 X MBR 144 (helmetcam)

MBR 189

- Sector Antenna
- High gain steerable in azimuth and elevation
- Relative and absolute positioning
- Built-in multi-sectoring functionality for expanding coverage
- Suitable for maritime land stations and UAV ground stations

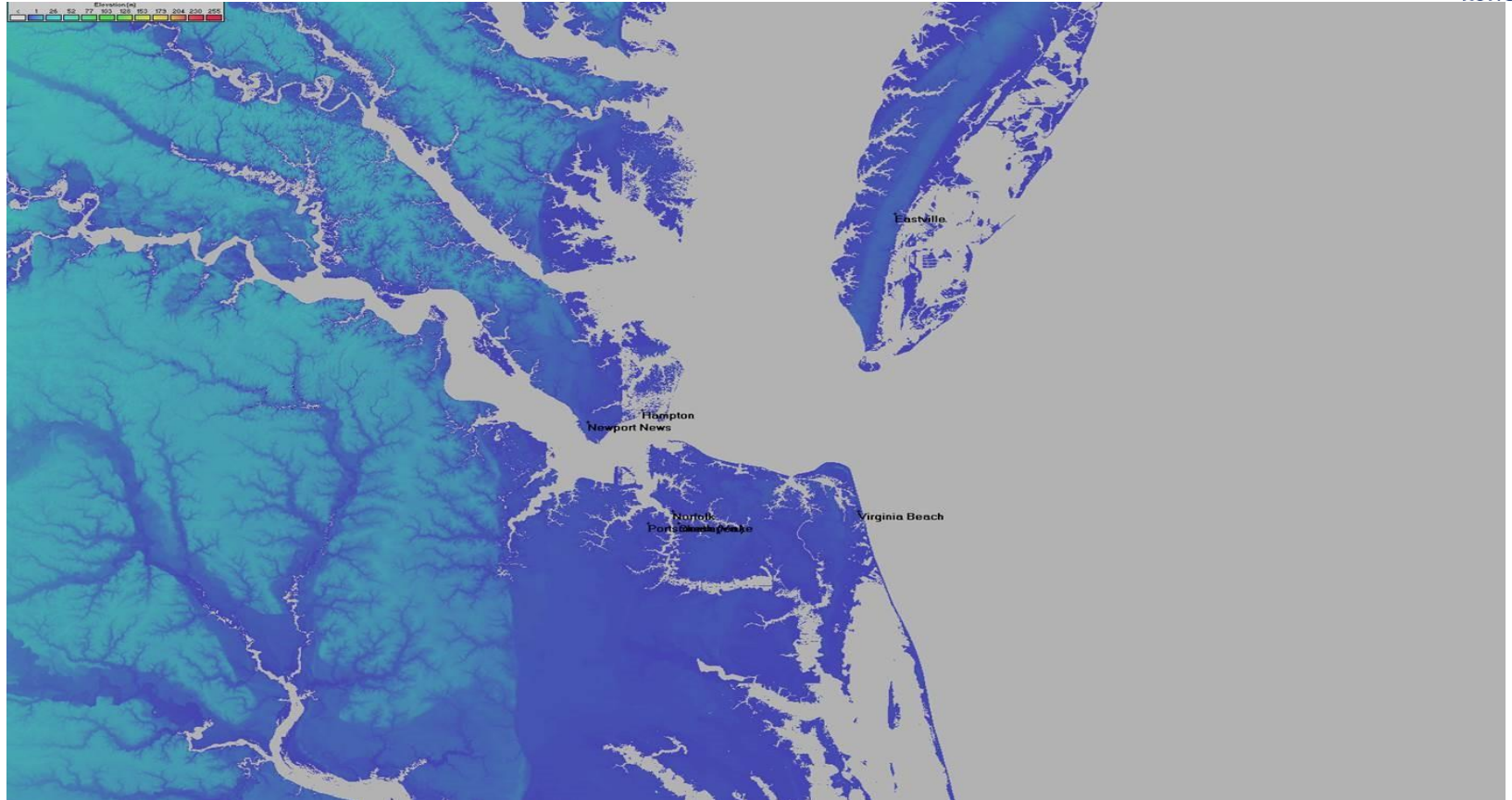


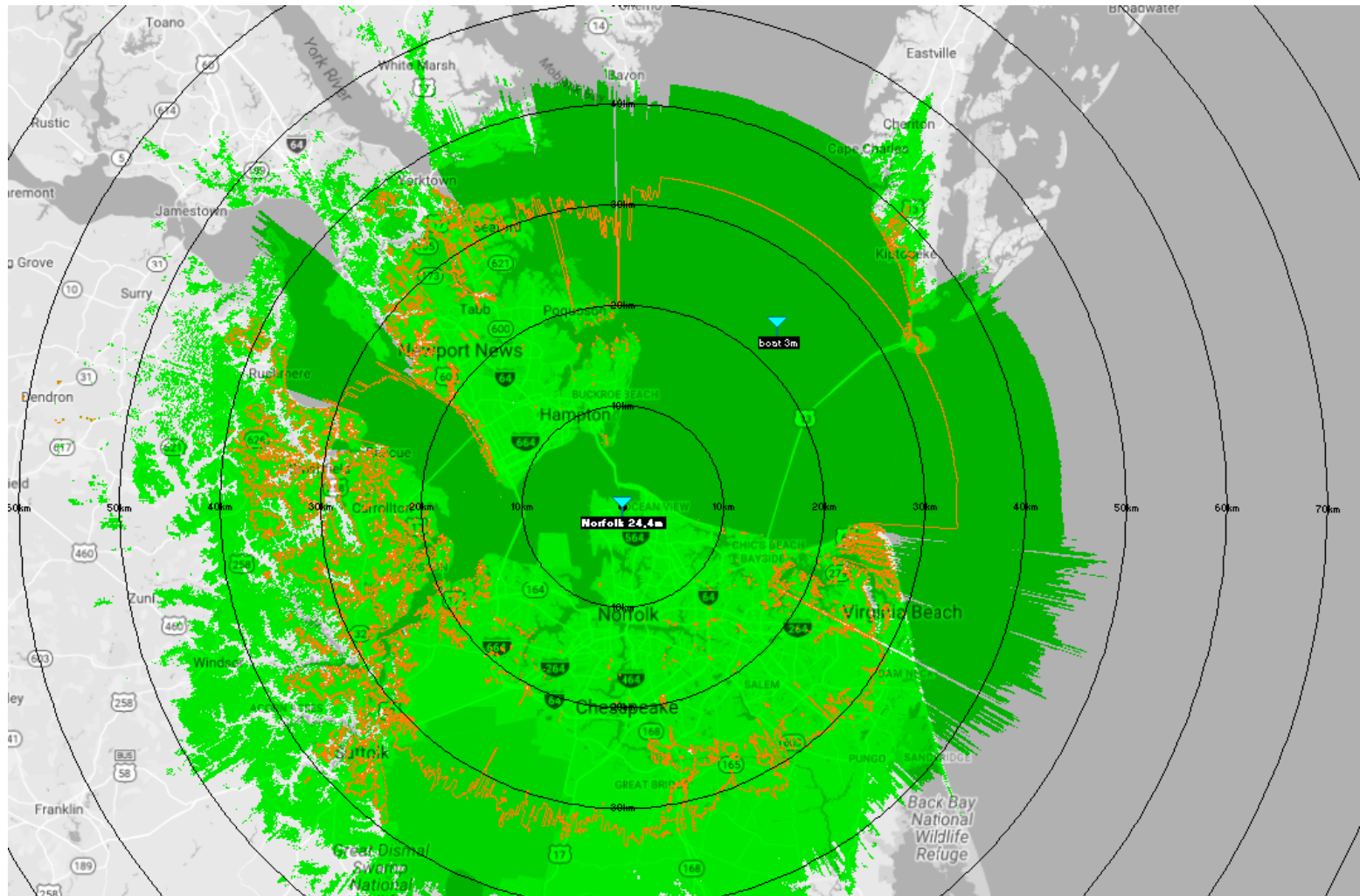
MBR 179

- Omnidirectional
- High gain steerable in azimuth
- Absolute positioning
- Suitable for medium to large vessels



MBR coverage estimate before test

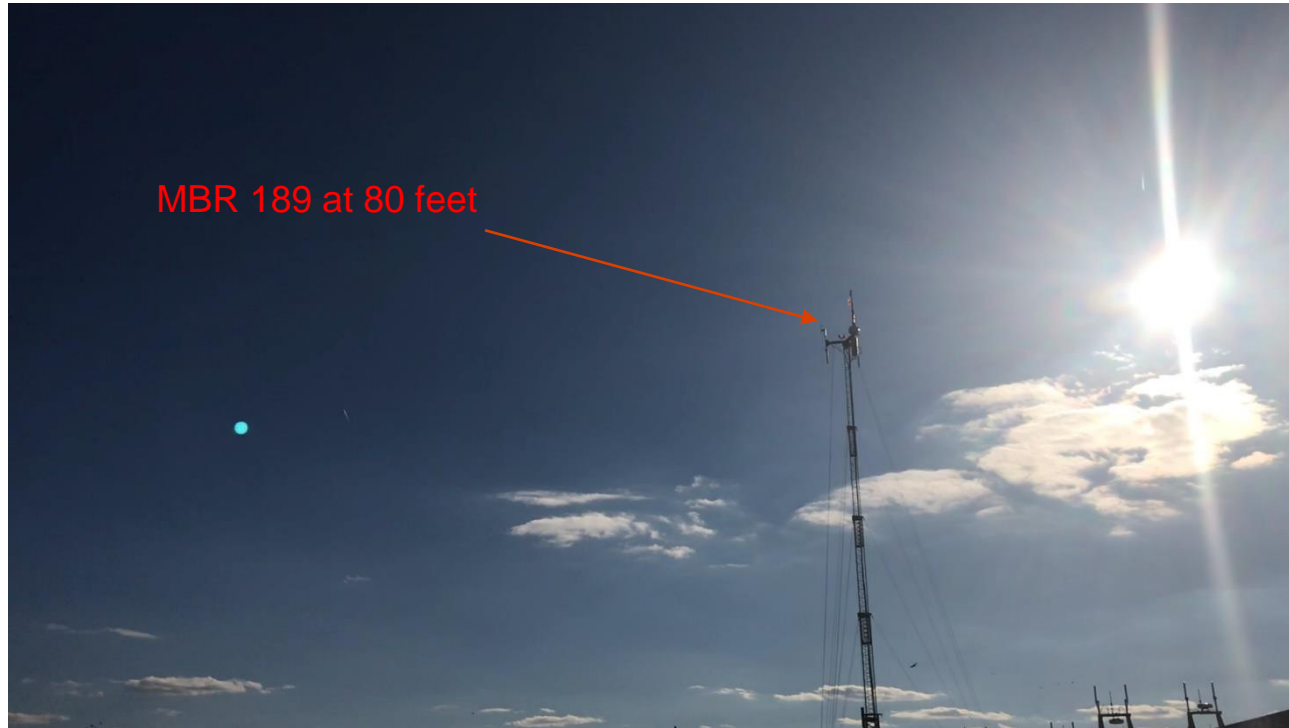




USV



TOC



DEMO

- Spatial Integrated Systems are currently working with ONR on Autonomous Swarms
- Have switched to MBR for data comms between mothership and autonomous vessels.



- test MBR for their AQS-24B Minehunting Systems
- Current datalink is not having the range or bandwidth that they need for remote control of RHIB, and data transmission from AQS-24B to Mother Vessel
- Proposed Setup for demo
 - 1 X MBR 179 on mothervessel
 - 1 x MBR 179 on RHIB
 - Transmission of data to Command Center



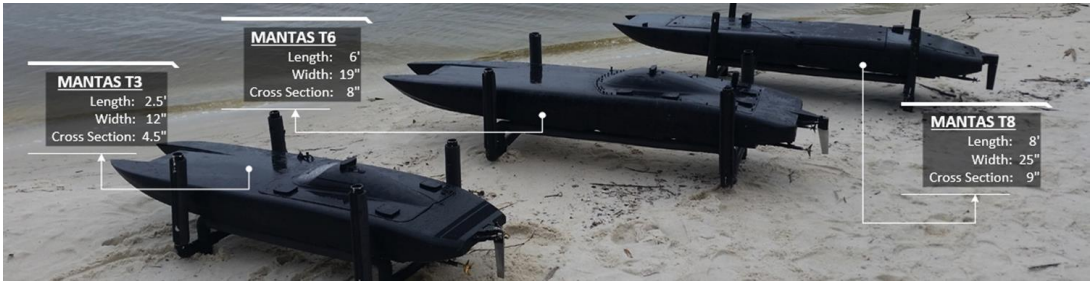
- If possible to get data from ASV, directly to Remote Operations Command and Control Center (OCCC)
- MBR for NGC to MCM



CUSV



- MBR demo for Textron ongoing
- Potential for a program of record vehicle
- 2 CUSV for every LCS



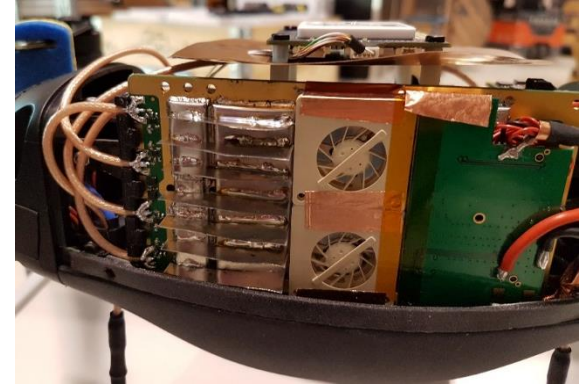
Tested MBR on Valiant Shield (Guam) and swarm exercise.
Customer will use MBR as primary comms on their vessels

UAV market opportunities



MBR for compact drones

- 85g communication link for 50+ km LOS
- Data transfer of command and control and payload data
- MBR platform can provide GNSS / IMU data to autopilot and payload sensors



MBR for full-scale drones

- 2 kg communication link for 100+ km LOS – MBR 179 UAV
- Data transfer of command and control and payload data



CybAero demonstration



Purple Nectar 2016



UAV ground station transceiver

NATO Situation picture



NATO Helmet camera



NATO Situation picture





NATO Helmet camera



NATO Situation picture

