SeaCross
- High speed navigation -

# Navigation, reconnaisance and surveillance using unmanned vessels

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# High Speed in Littoral Waters

# vs

# Unmanned Vessels?

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# Challenges

- Collision avoidance
- Need for radar operation
- Changed plans
- Controlled remote navigation

Land, under water objects, vessels

Manual operation required

Rerouting

Spoofing and jamming

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# Solution must consist of

- Full remote vessel control (Autopilot, steering, speed)
- Real time radar control
- Real time position,speed,heading
- Full remote system control
- Real time data transfer (live video, images, targets, soundings etc.)

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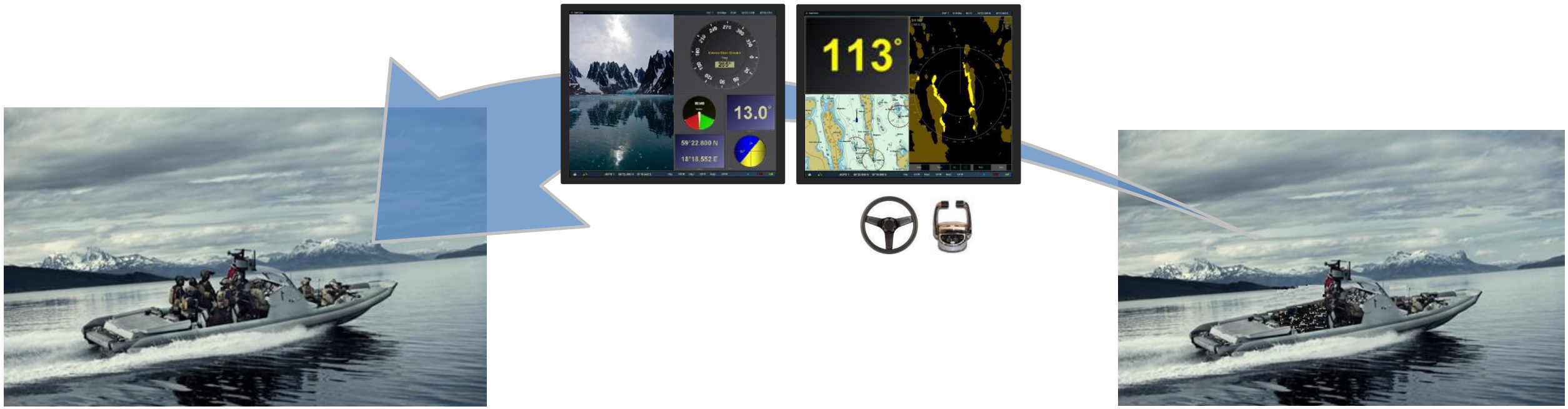
# Solution in principle



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# Solution in principle


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# Using COTS building blocks

- SeaCross® integrated platform


- Kongsberg Seatex MBR

- Simrad Autopilot


- Volvo Penta Engine

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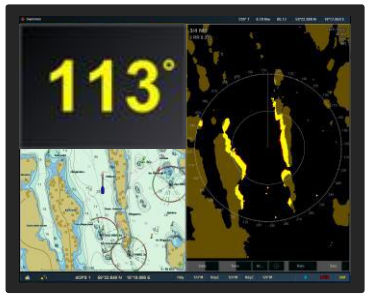
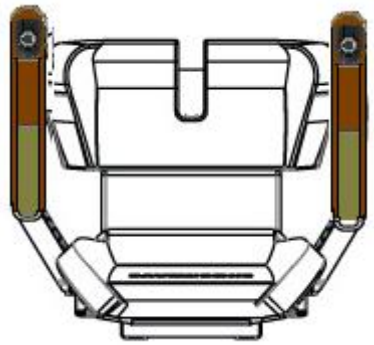
# Modular



**Modular, scalable system**

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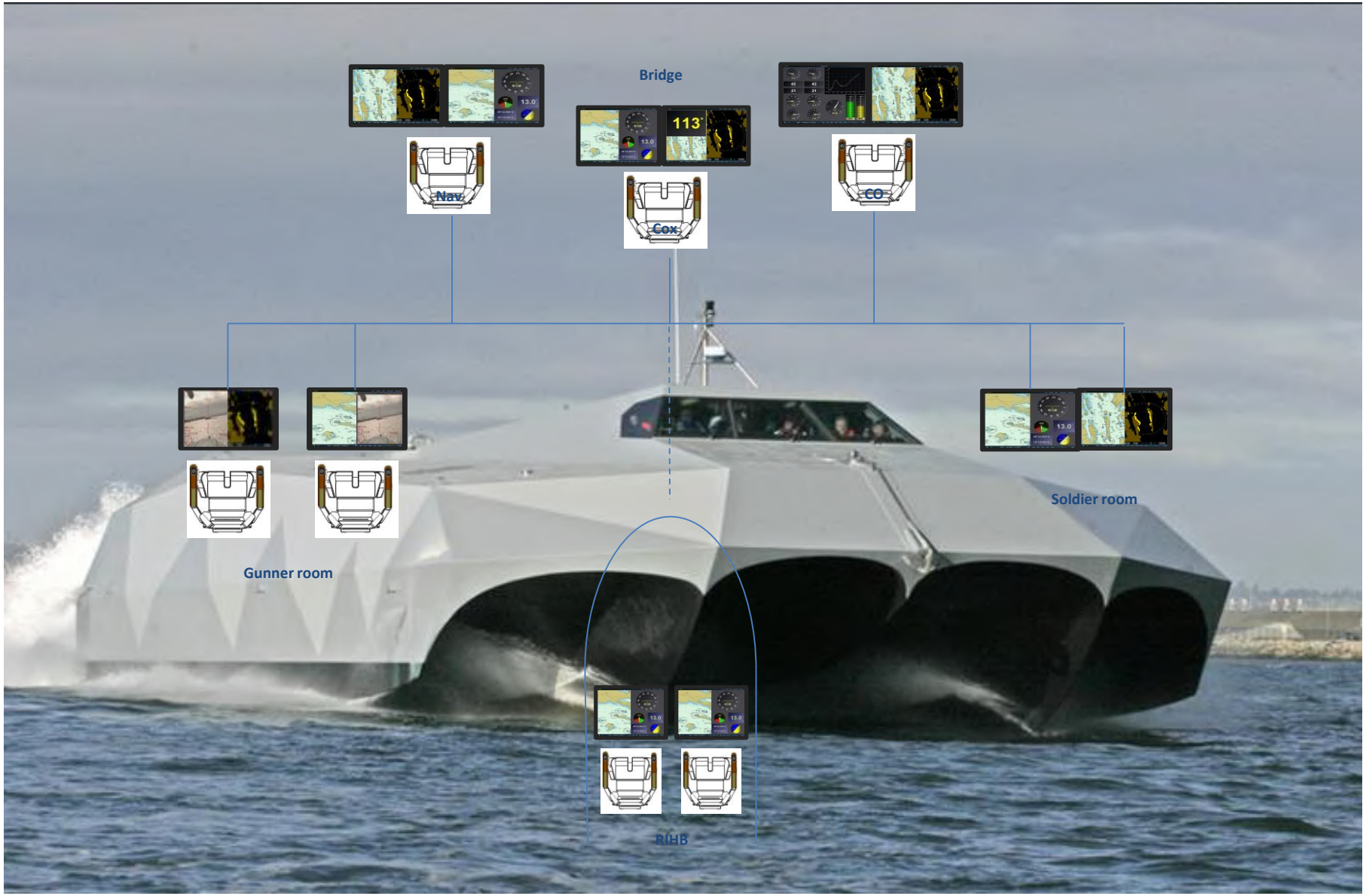
# Modular



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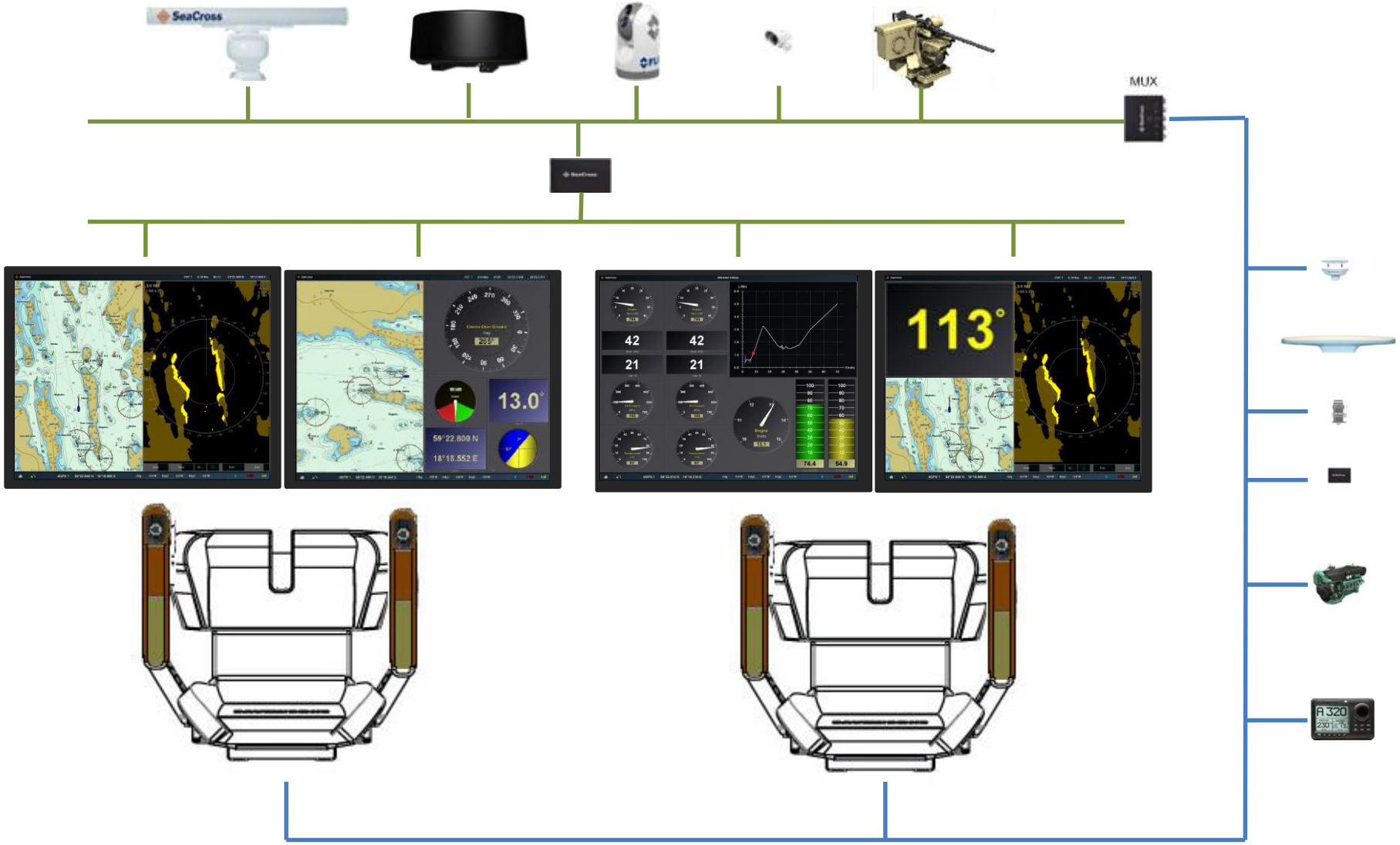
# Design principles




**Autonomous interconnected systems**

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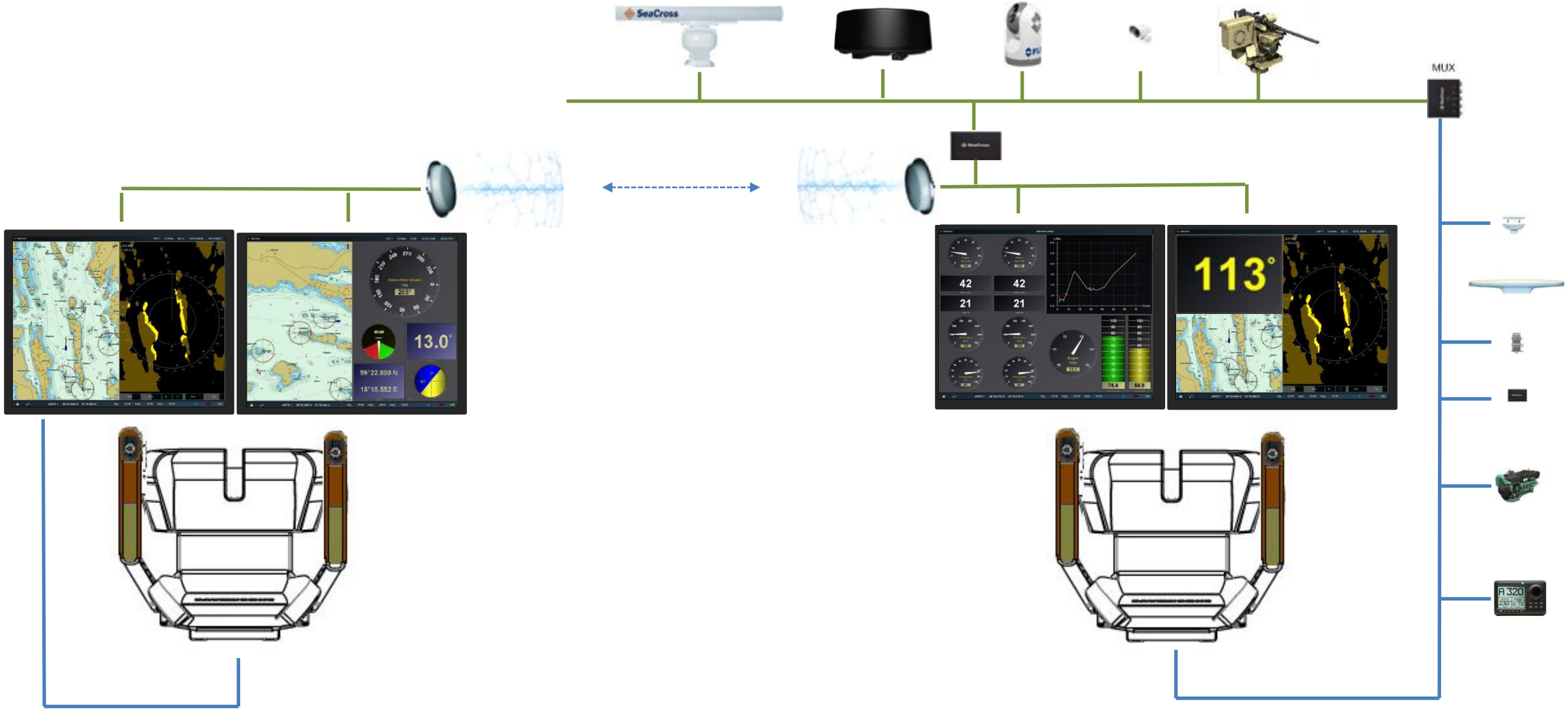
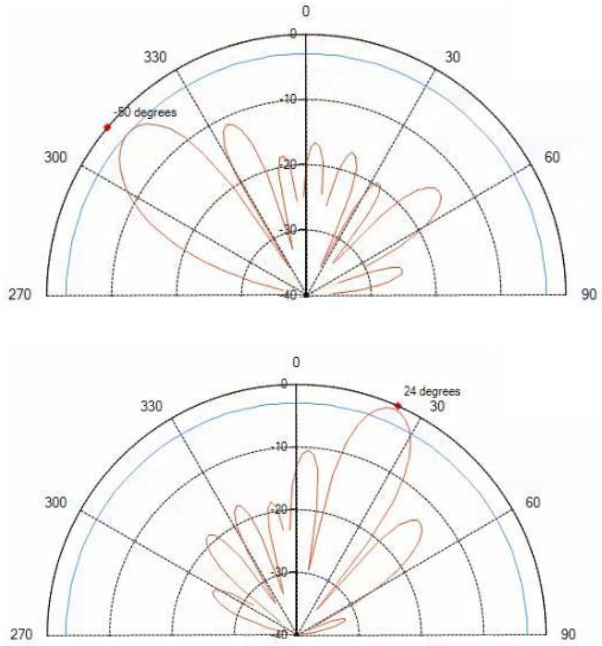
# Design principles



# Kongsberg Seatex – HSBO 2016

# 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



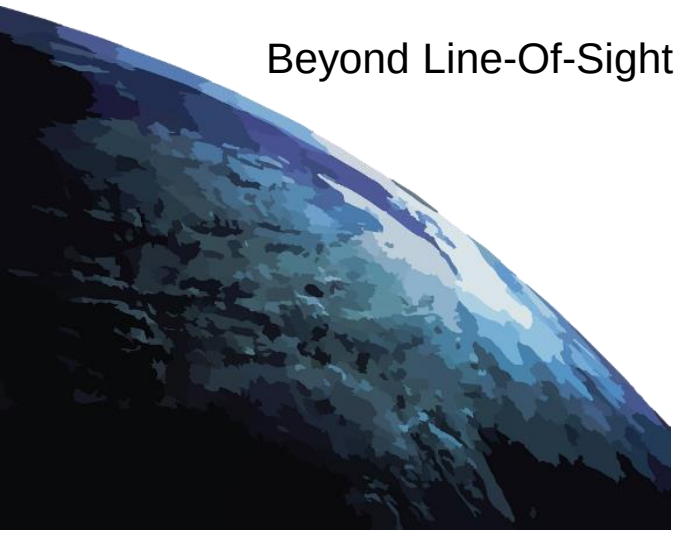

Beam forming radiation patterns

# Facts and numbers

IP- based data networking


15 Mbps Payload

Point to point and point to multipoint

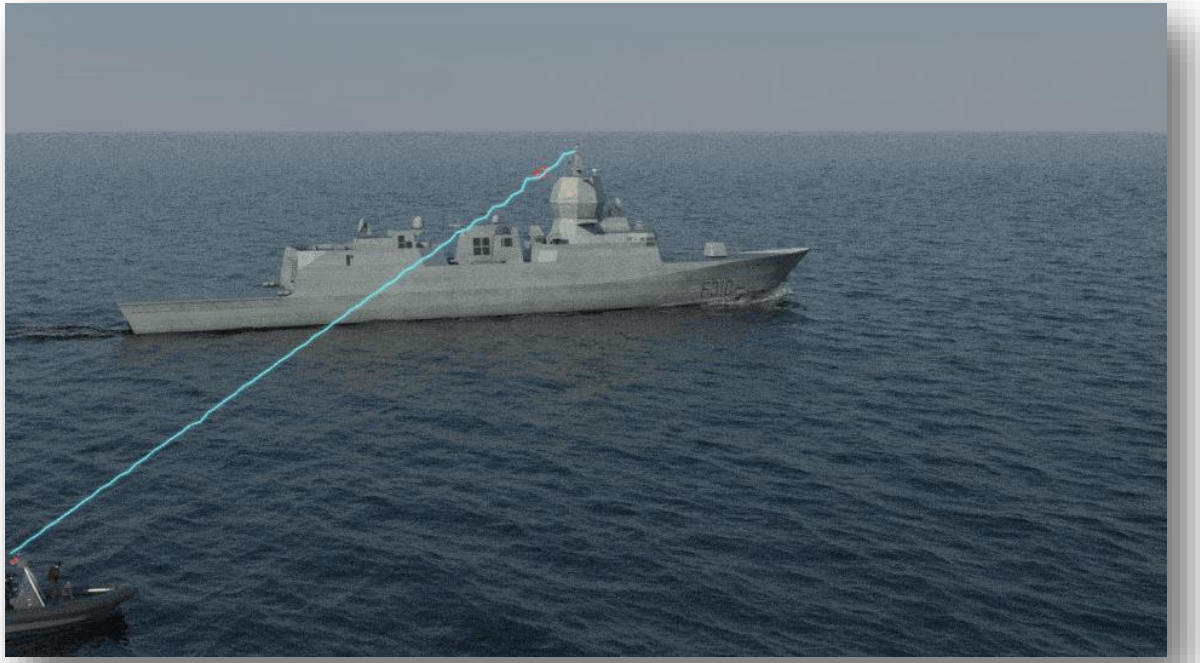


Beyond Line-Of-Sight


Deterministic Latency

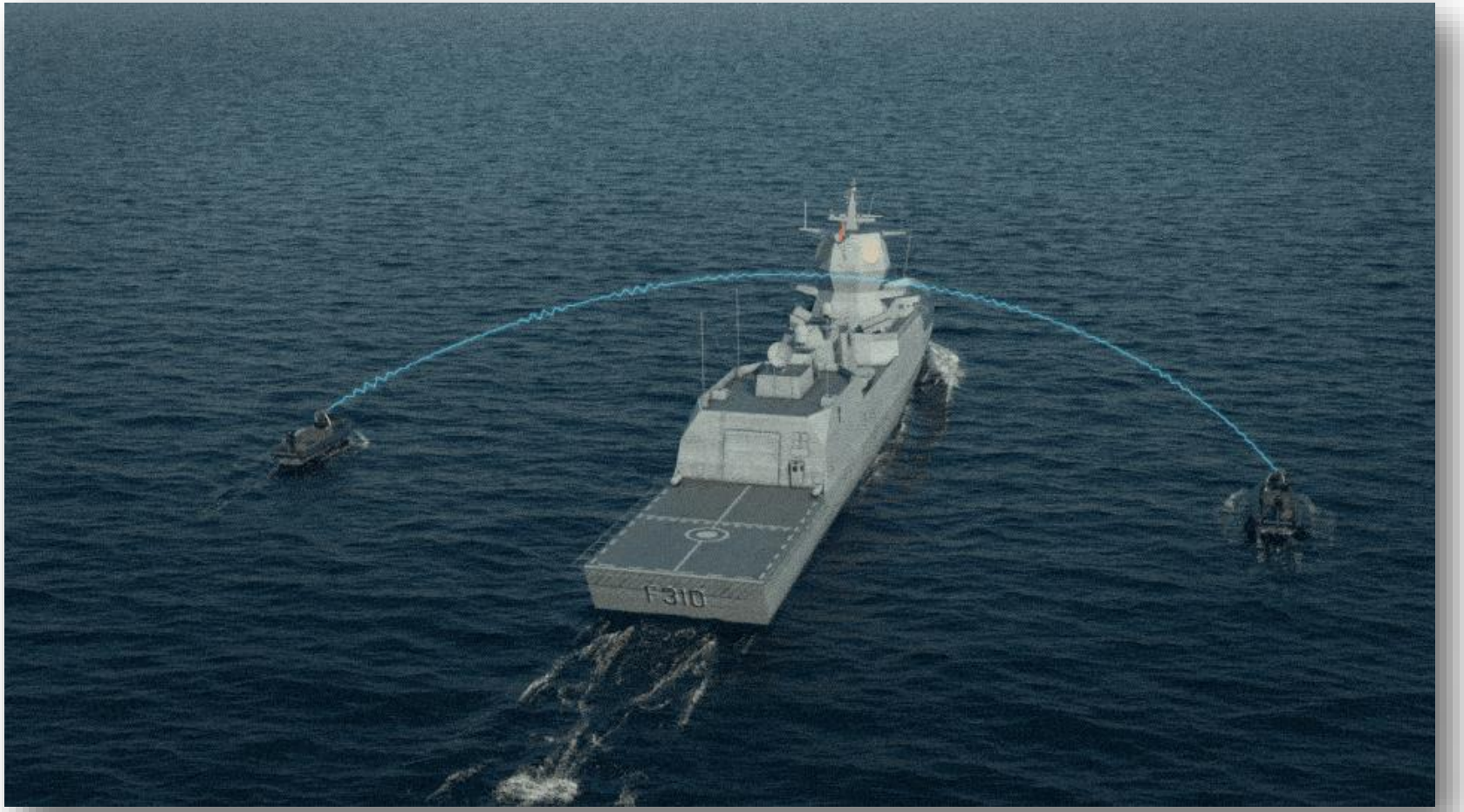
# Phased array advantage

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



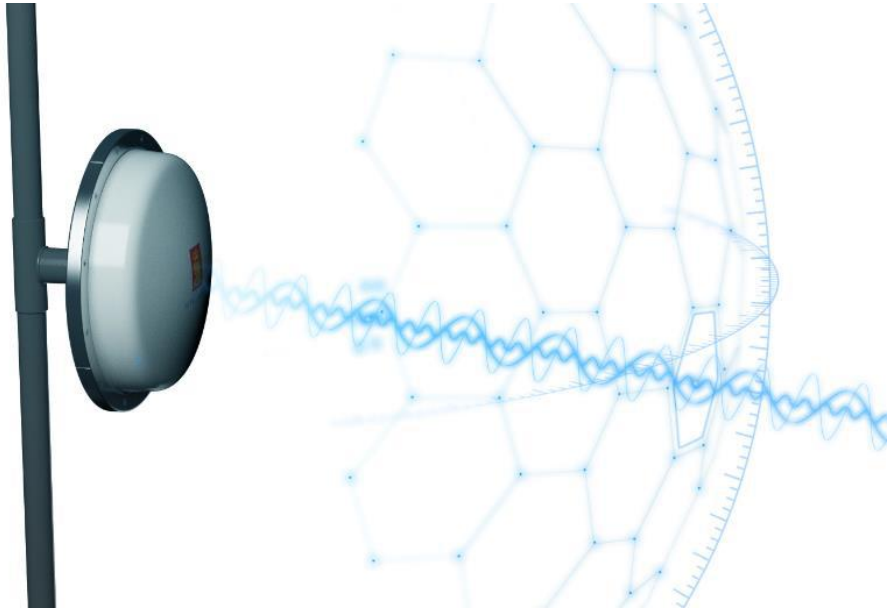
Phased array radio system. Fast moving directed beam without any moving parts. Long range, high bandwidth, difficult to monitor and jam.

# Phased array advantage



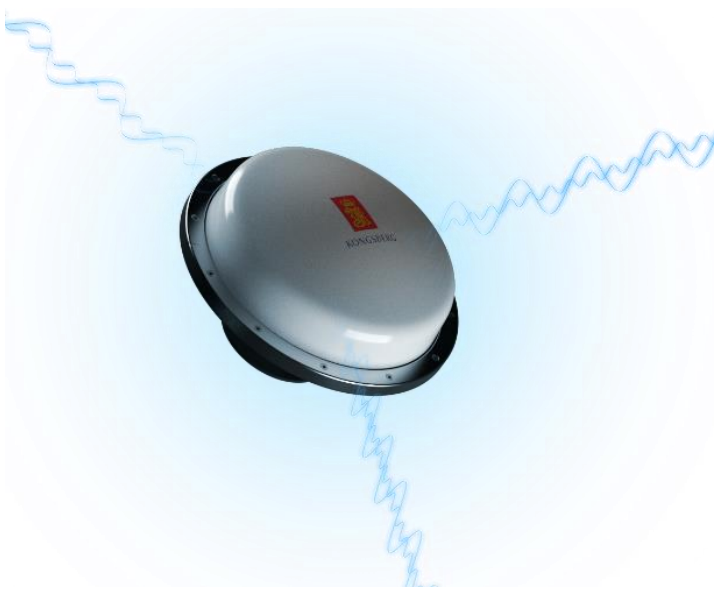

A very high link margin allows for non-line-of-sight communication even in the microwave band because of the refraction effect of radio waves.

# Product family



**MBR 189**

High gain version for vertical installation



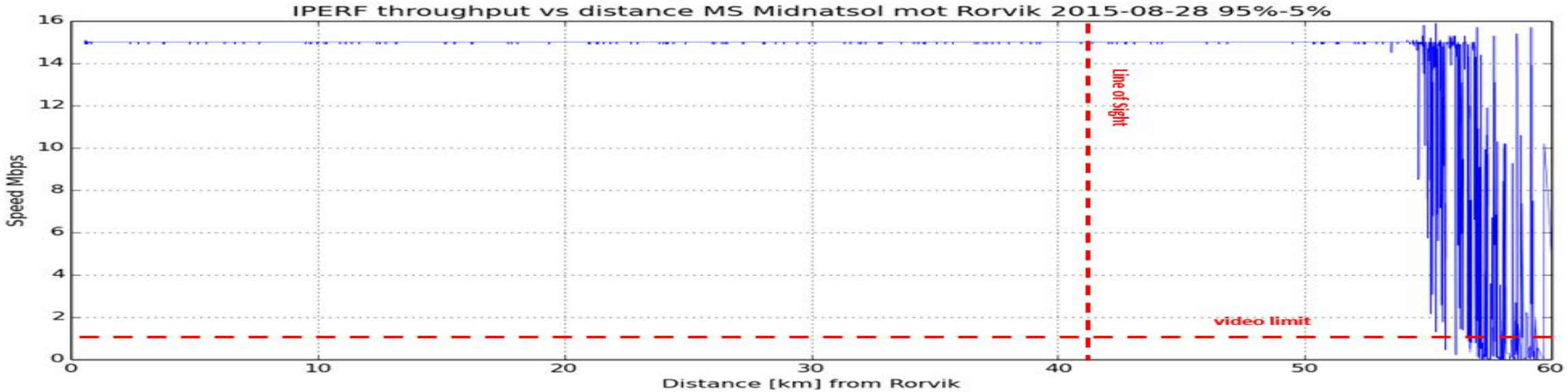
**MBR 179**

High gain version for horizontal installation

**MBR 144**

Portable mobile version (custom)

# Communication beyond line-of-sight 15Mbps



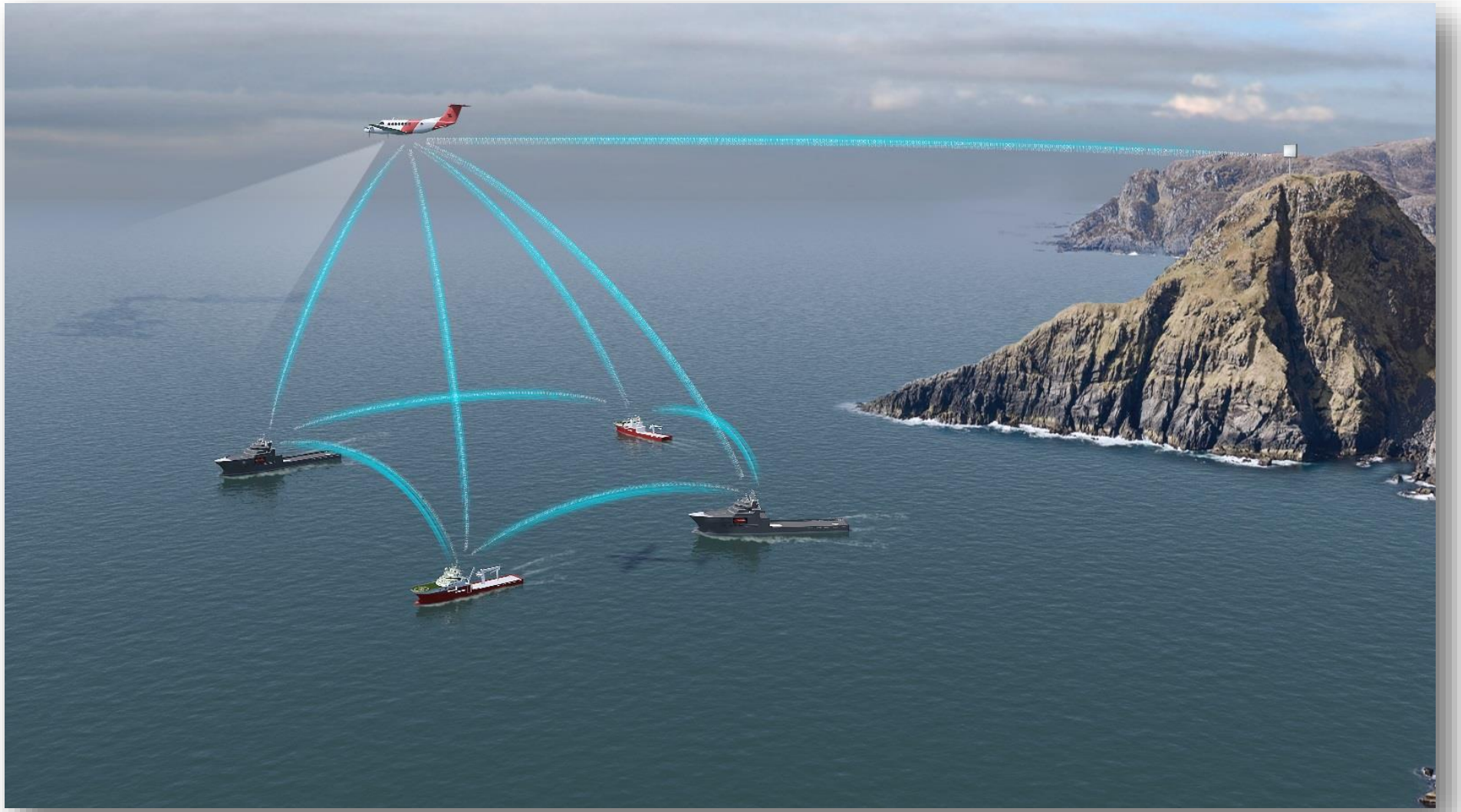

# Communication Challenges where MBR has been the solution

- Norwegian Coast Guard, Norwegian Coastal Administration (NCA) and Norwegian Clean Seas Association for Operating Companies (NOFO)

- Offshore Patrol & Surveillance
  - Ocean Shield

- Autonomous Operations

# Oil Spill Detection and Combatting



# Ground installations

Reinsfjell

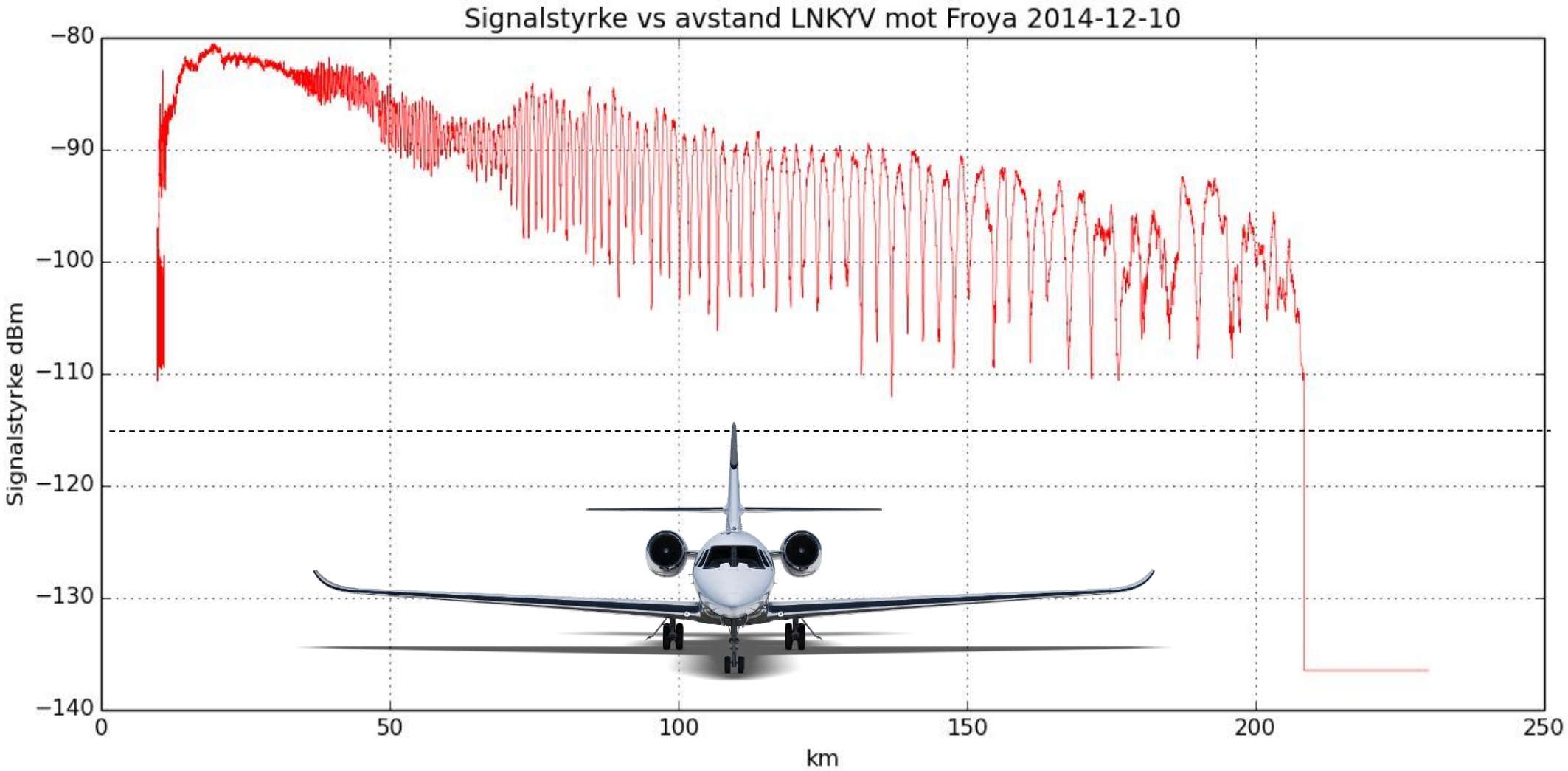
Ulriken

Gaustadtoppen

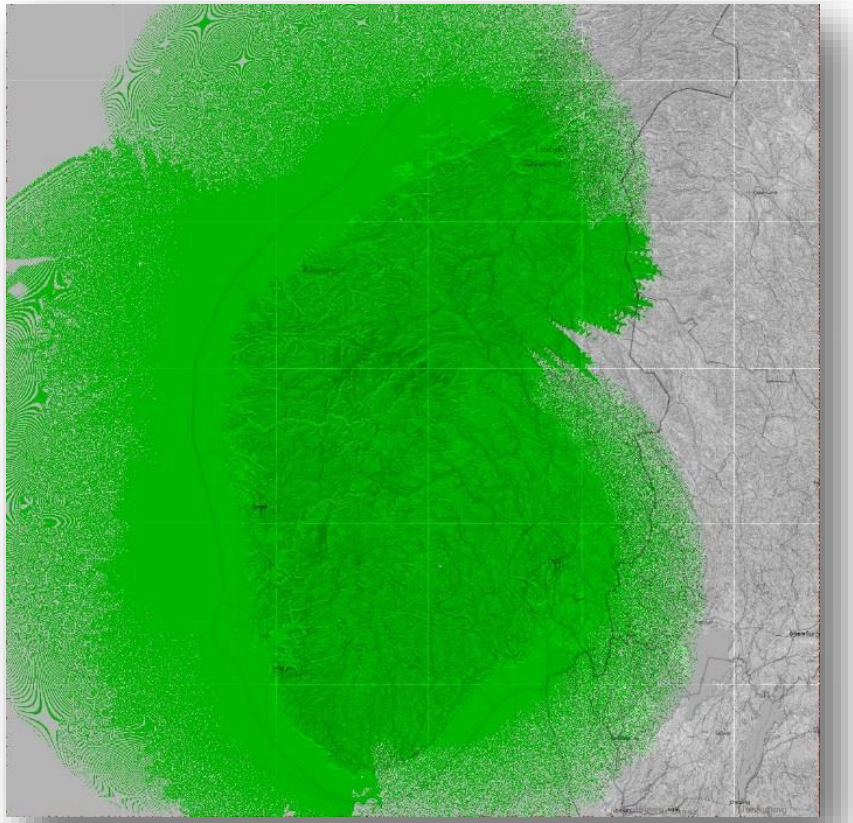

# Assets with MBR radios



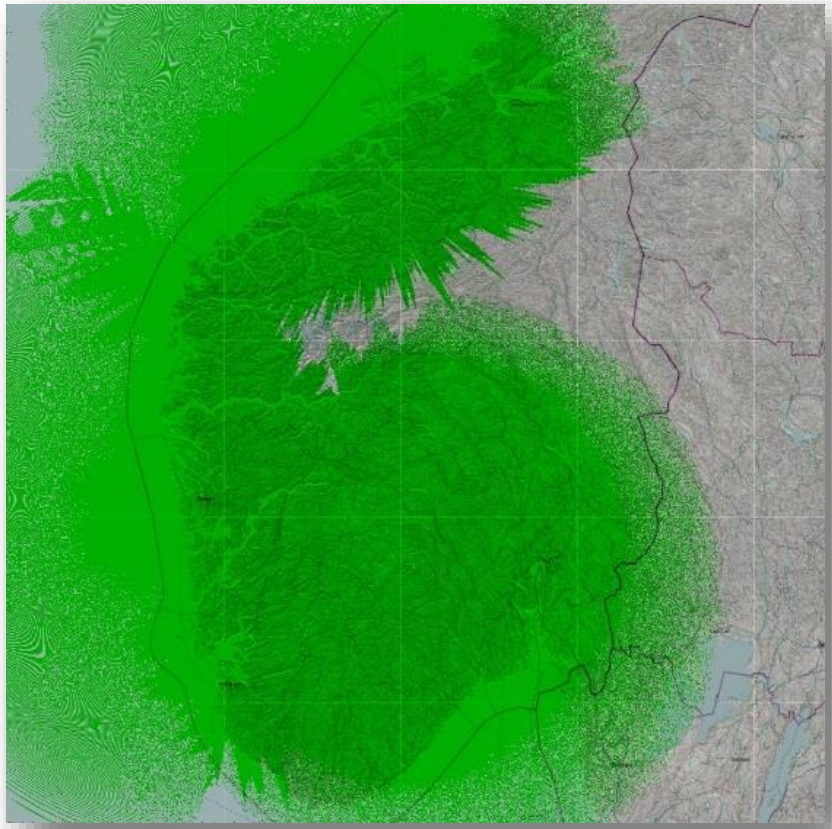
# Long range air to ground link performance



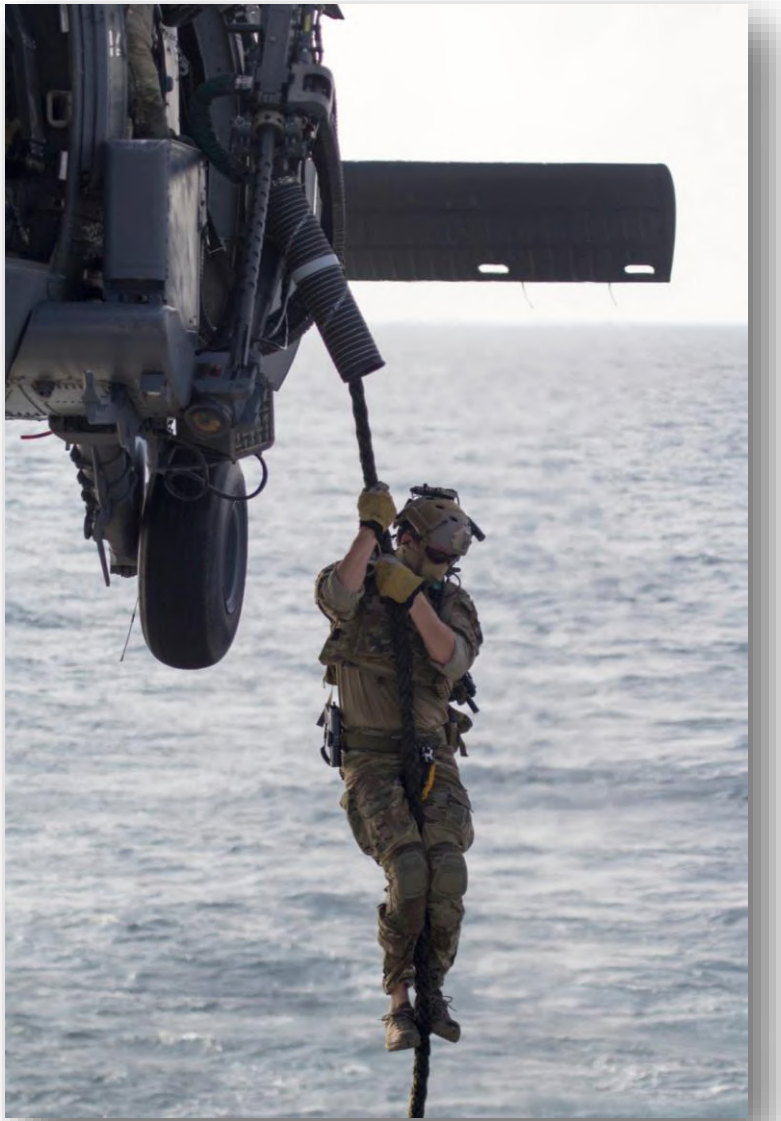
# Ground installations, air to ground coverage



Coverage at 15 000 feet AGL

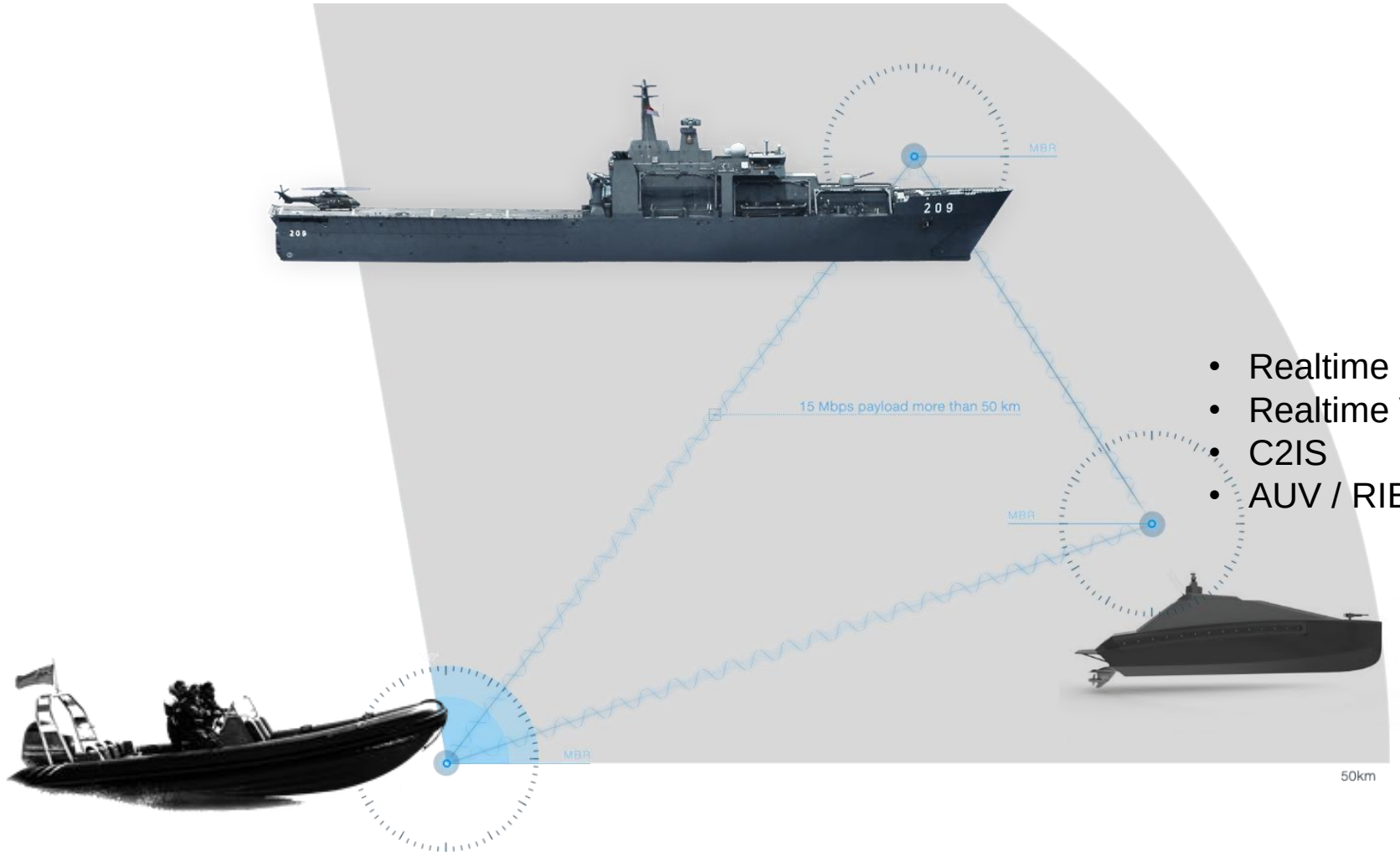


Coverage at 4 000 feet AGL
(Standard mission altitude)



# Reference from Norwegian Armed Forces can be provided

# Military Scenario




- Realtime Sensordata sharing
- Realtime Video stream
- C2IS
- AUV / RIB Control

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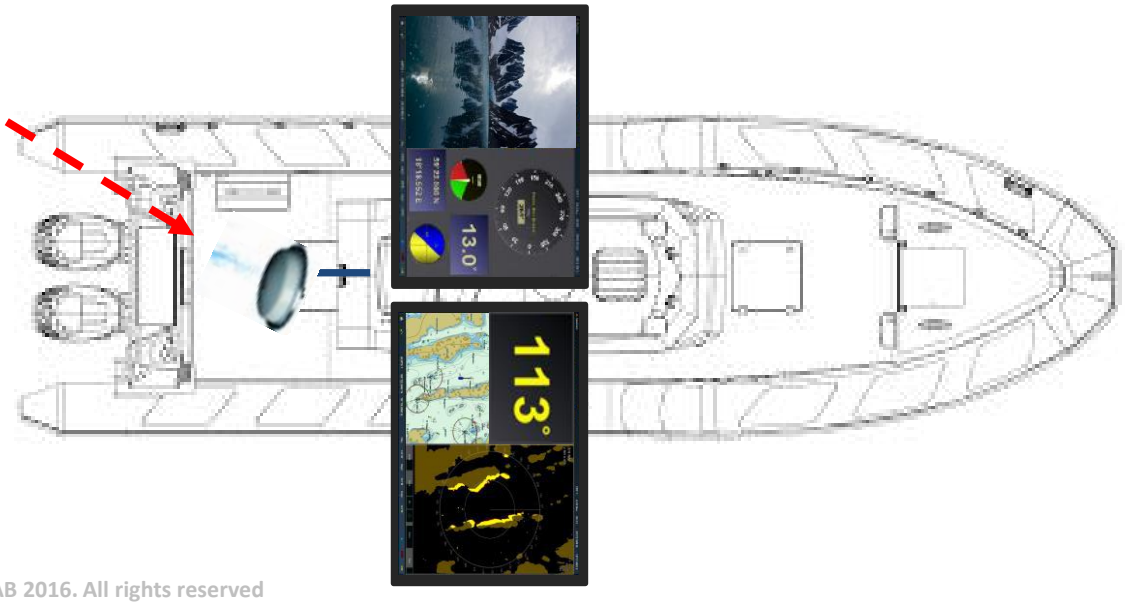
# Solution

5 – 400 km



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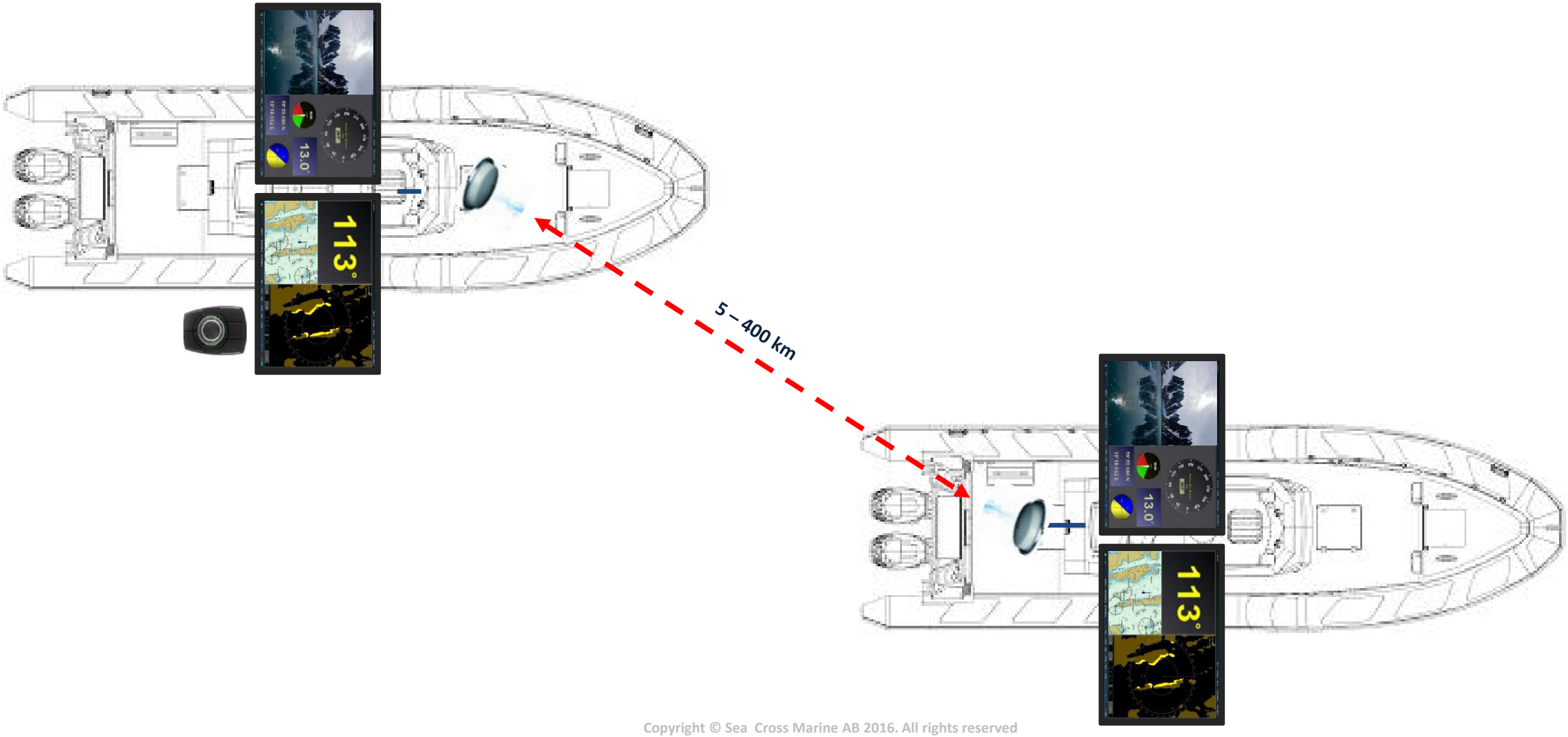
# Solution



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# Capabilities

+ Full real time steering and engine control (including autopilot)

+ ”Drone mode” – Scout a route (and return) autonomously or under remote control

+ Full radar and EOS control with tracking

+ Real time data transfer (live video, images, targets, soundings etc.)

= ”As if on board”

# Demonstration

# Realtime data transfer and remote control of vessel