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MARINETECH 2019 ESTORIL

MBR-Maritime Broadband Radio

04/12/2019

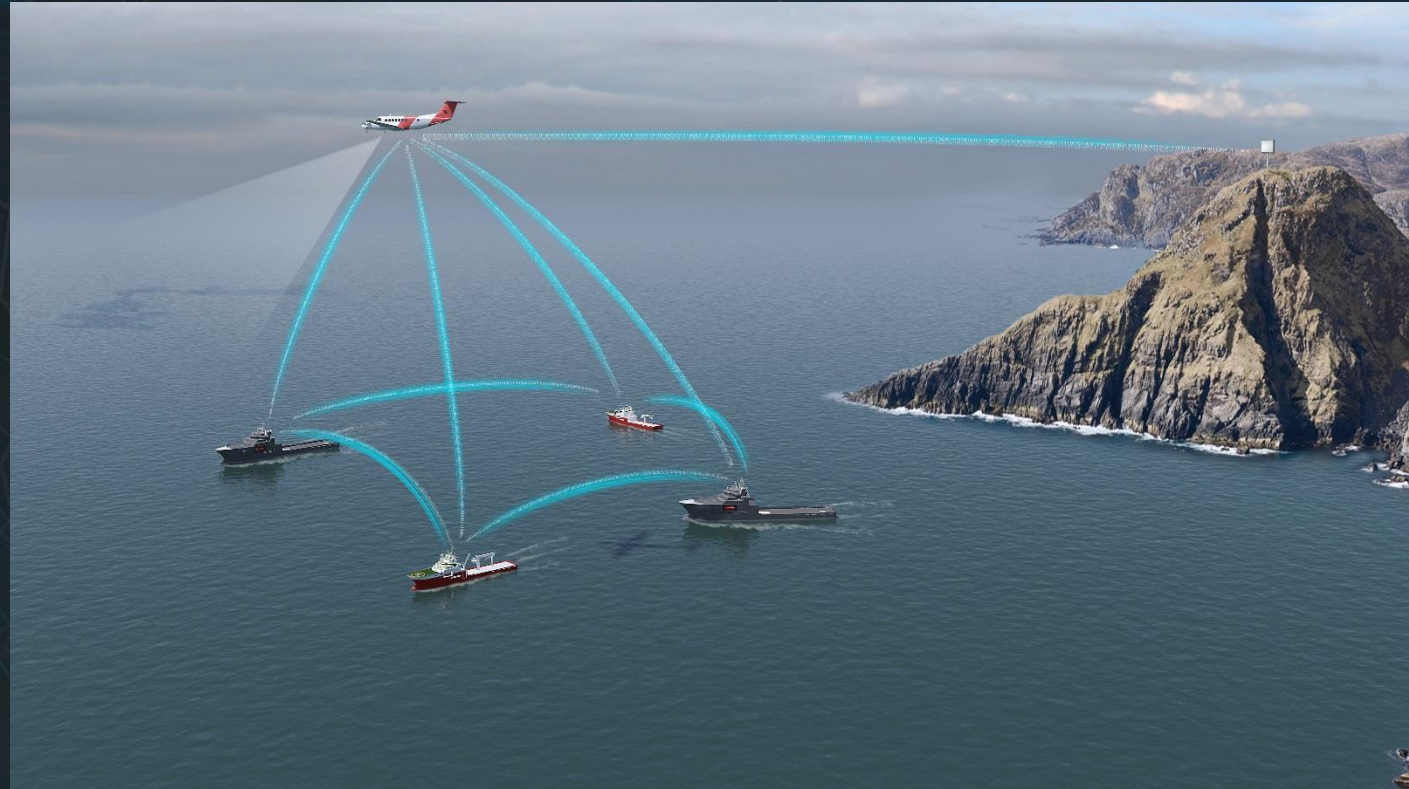
Miguel A. LLeches

AREA SALES MANAGER. SENSORS AND ROBOTICS

MARITIME BROADBAND RADIO

Operational Excellence Through Communication Performance

PHASED ARRAY FOCUSED RADIO BEAM





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Maritime Communication Requirements

A communication solution must...

... be reliable with a minimum loss of data packets

... be designed to work well in a maritime environment

... be able to communicate simultaneously over short and long distances

... work even when signal path is obstructed

... be easy to operate, maintain and install

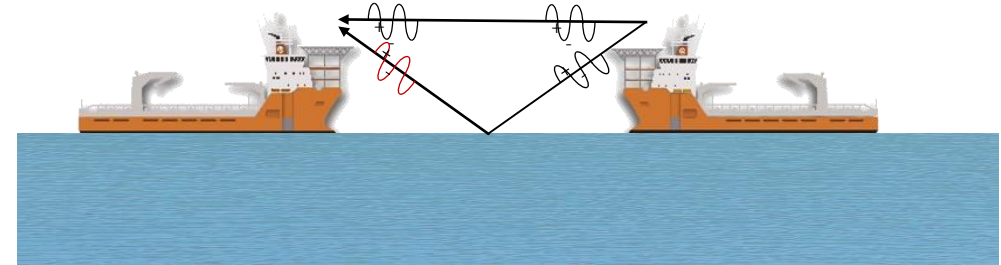




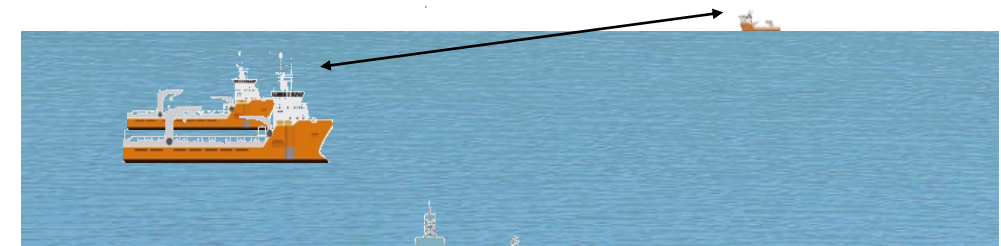
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Challenges in maritime communication

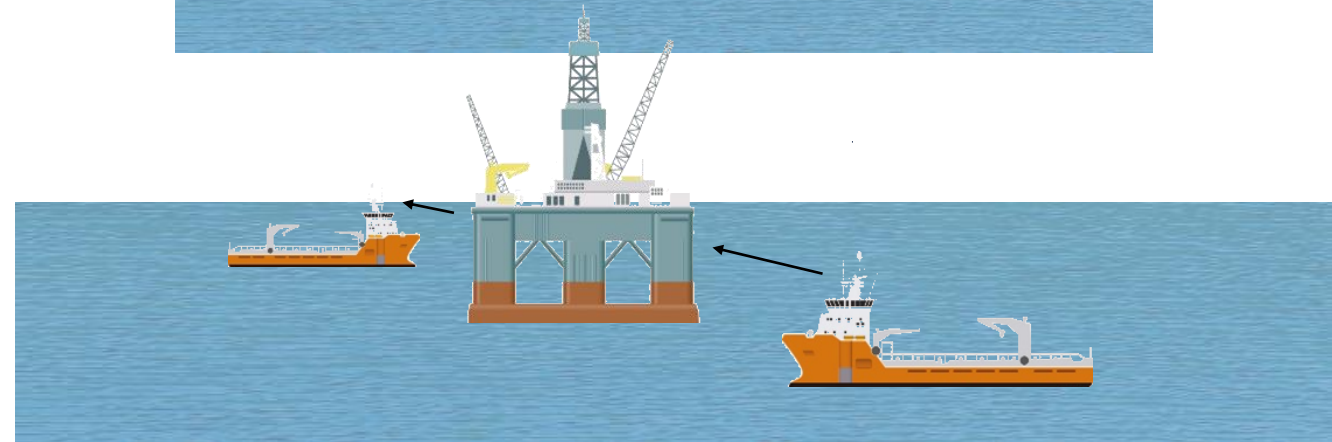
- Flat-sea fading – destructive interference



- Network topology – Near/far communication



- Moving vessels – Obstructions





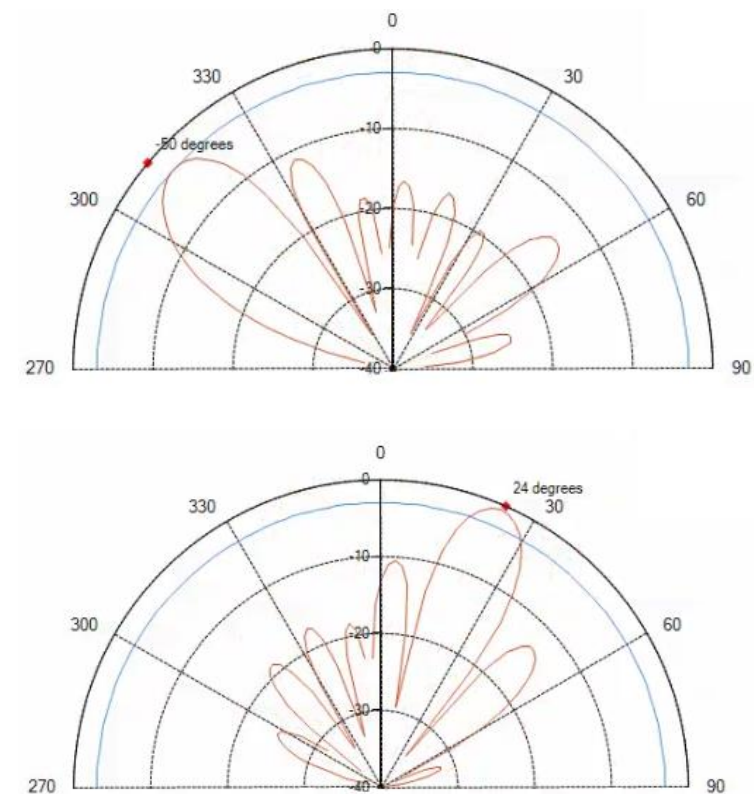
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Beam forming by antenna arrays

- 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



Example of phased array radar antenna found on the Internet



Beam forming radiation patterns



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A smart antenna

- Combining up to 60 antenna elements in one antenna panel
- Simulations and experiments used to find optimal geometry
- Enables instantaneous beam forming and spatial addressing
- Compact size
- High gain

Smart antennas are antenna arrays with signal processing used to identify spatial signal signatures such as the direction of arrival of the signal, and use it to calculate beam-forming vectors, to track and locate the antenna beam on the target.

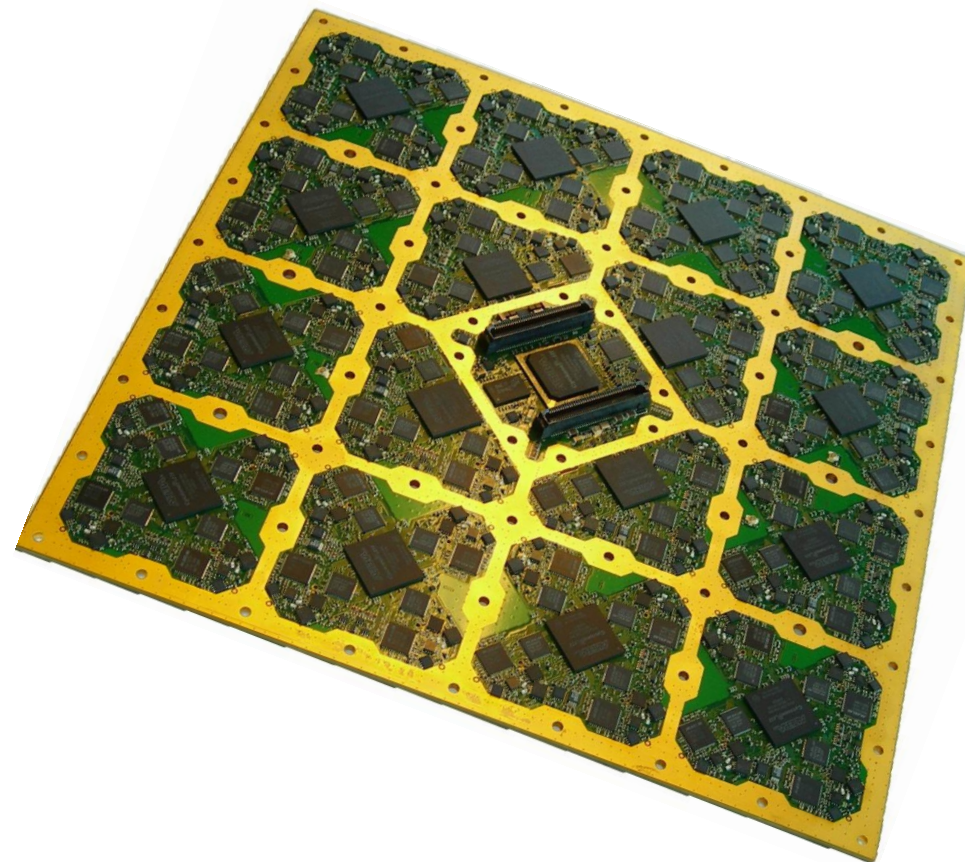




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Parallel signal processing

- Massive parallel processing by use of up to 17 FPGAs handling a real-time data stream of 40 Gbps
- Operating in 5 GHz frequency band
- Real-time signal processing
- Up to 60 independent transceivers
- Fail tolerant design





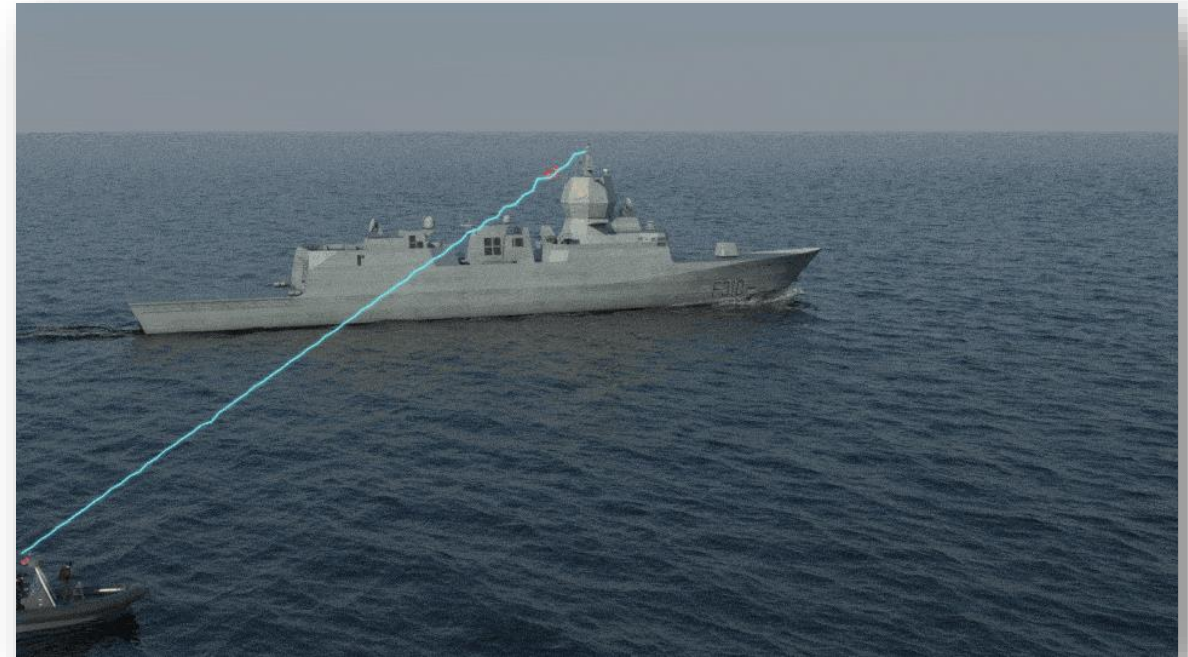
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Phased array advantage



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

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

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Phased array advantage



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

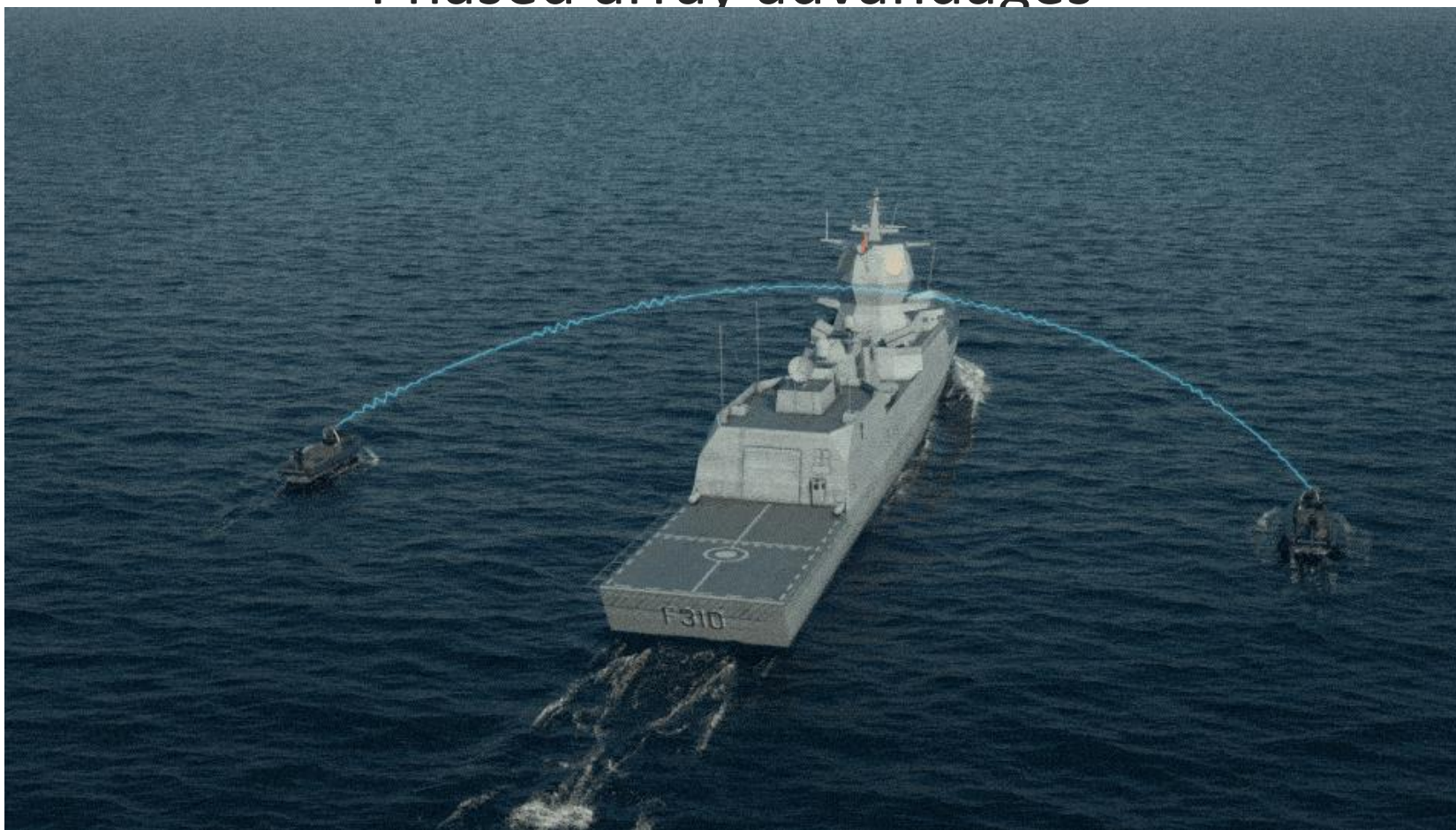


Phased array radio system. The fast switching of beam direction without any moving parts provides a point-to-multipoint system.



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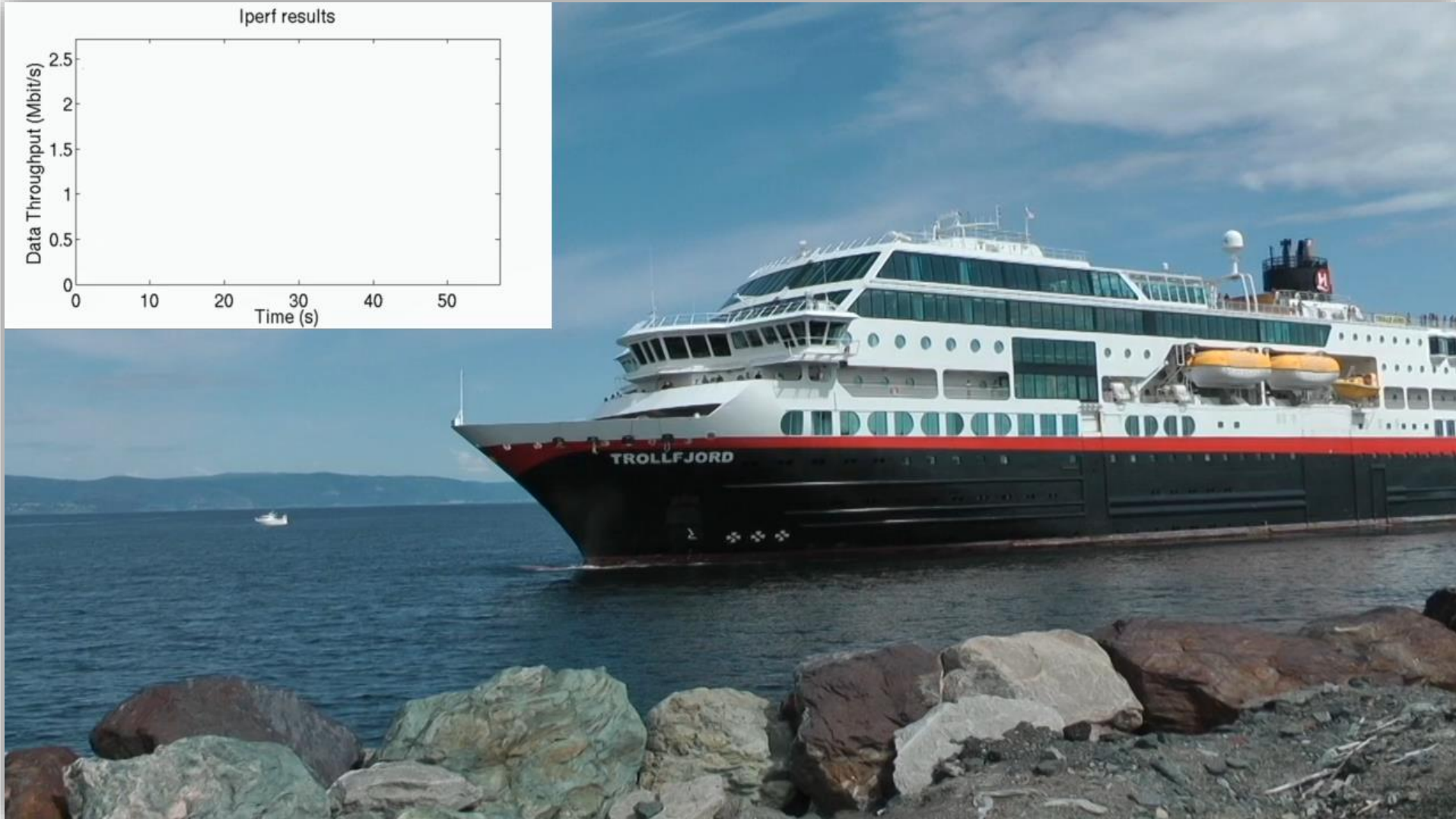
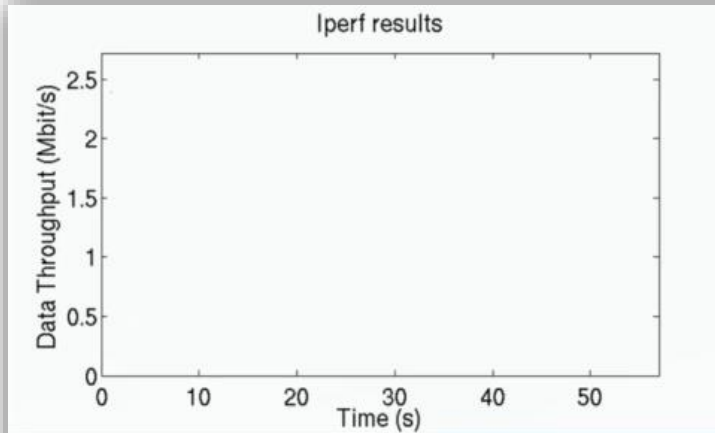
Phased array advantages



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.



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Facts and numbers

IP- based data
networking

16,5 Mbps Payload



Point to point and point to
multipoint

Beyond Line-Of-Sight

Deterministic Latency

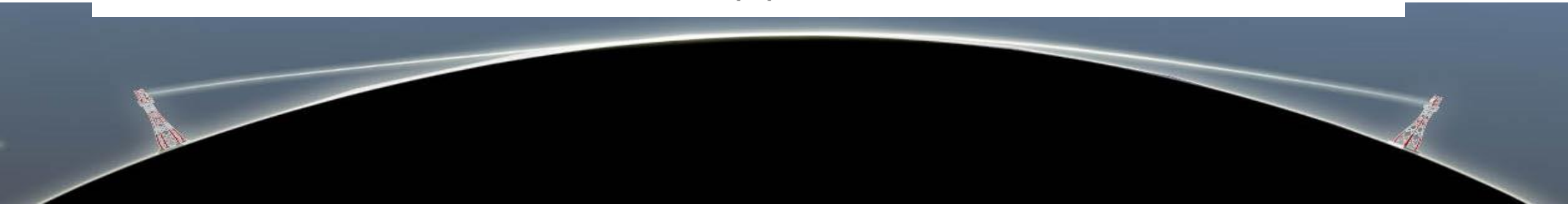
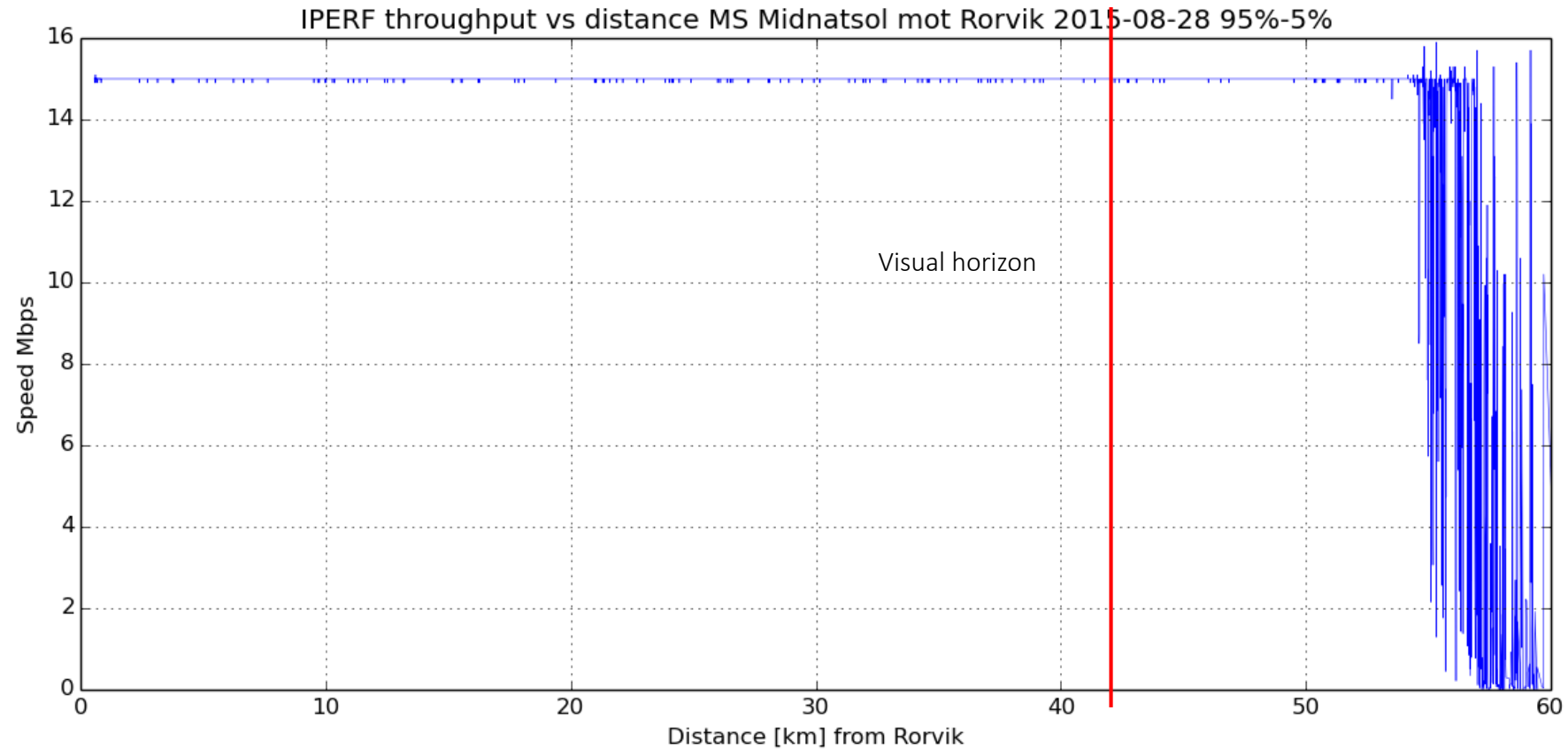


Communication beyond line-of-sight

MBR 189 vs MBR 189. Antenna height: 15m-25m



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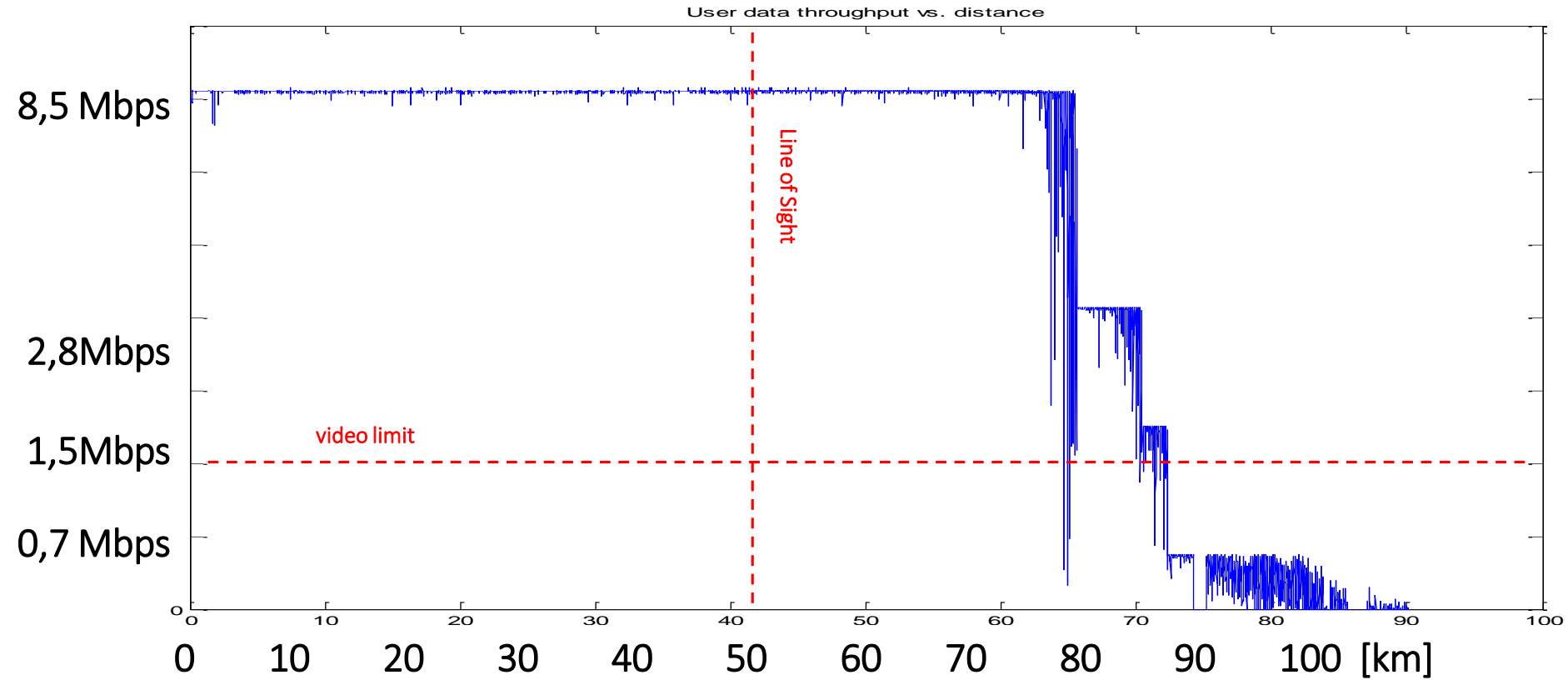




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Communication beyond line-of-sight, vessel to vessel

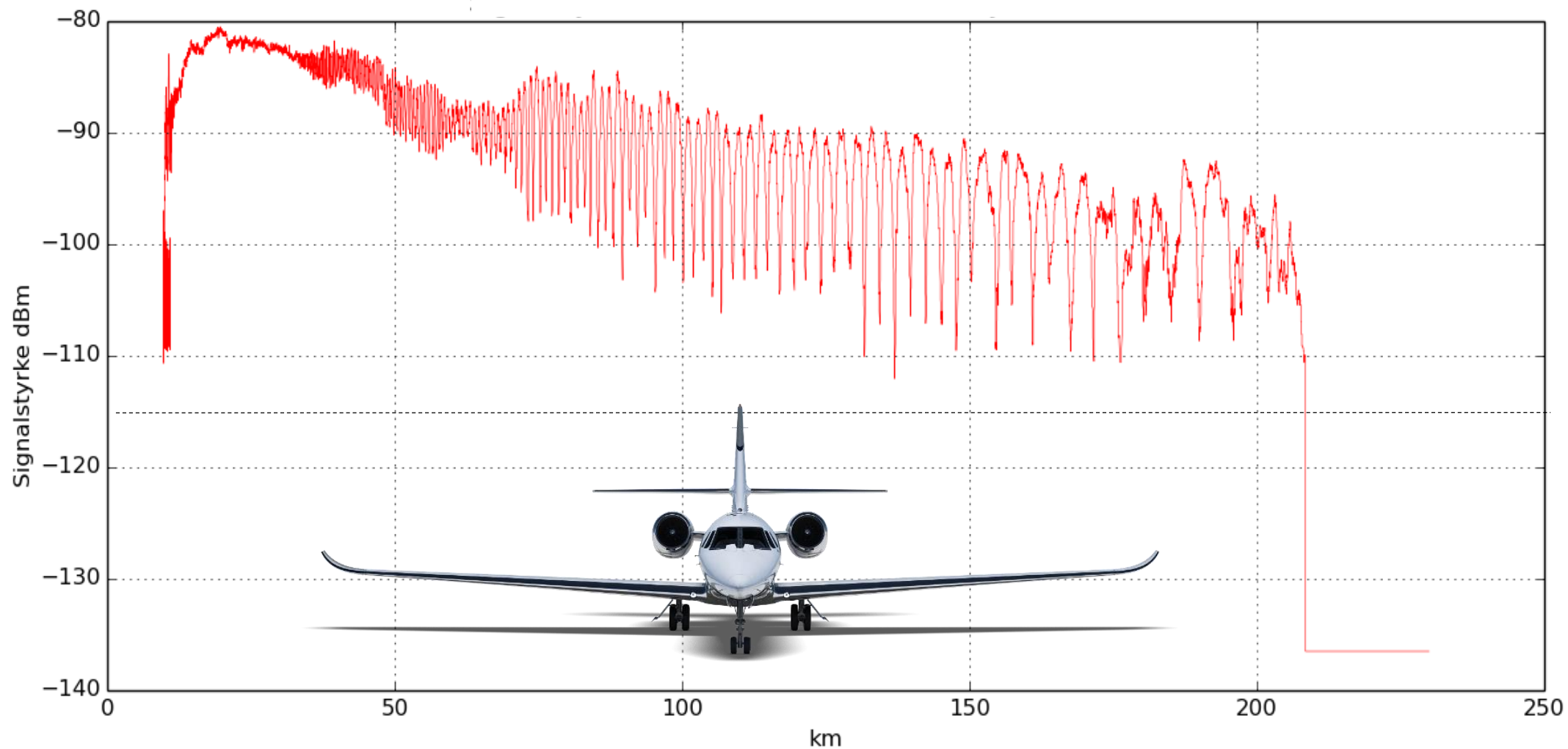
MBR 189 vs MBR 189. Antenna height: 15m-25m





Long range air to ground link performance

Flying altitude 10 000 feet. Ground station 25 meter.

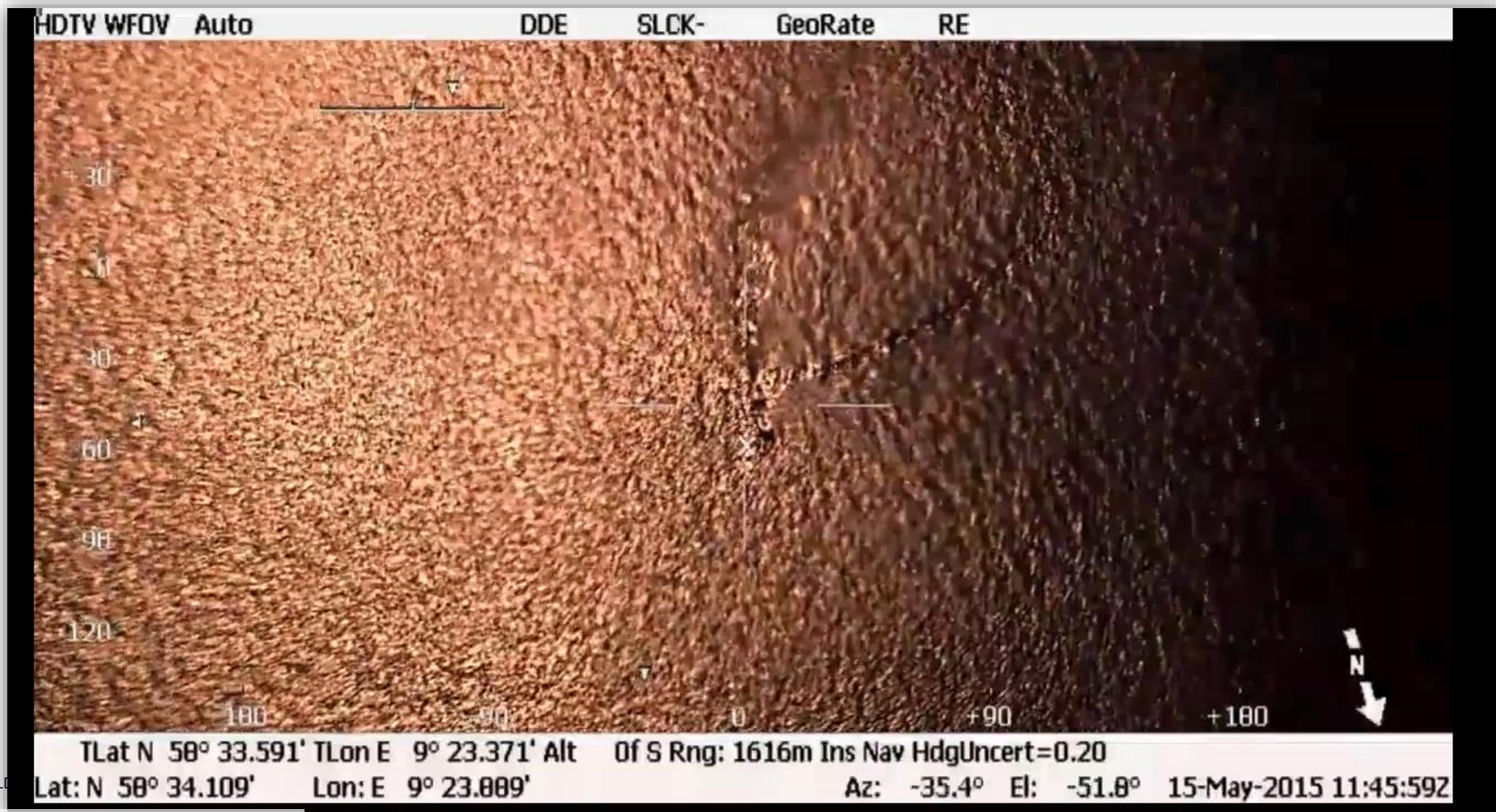




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Long range air to ground link performance

(Recorded real time on board the vessel)



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Range

What determin the range?

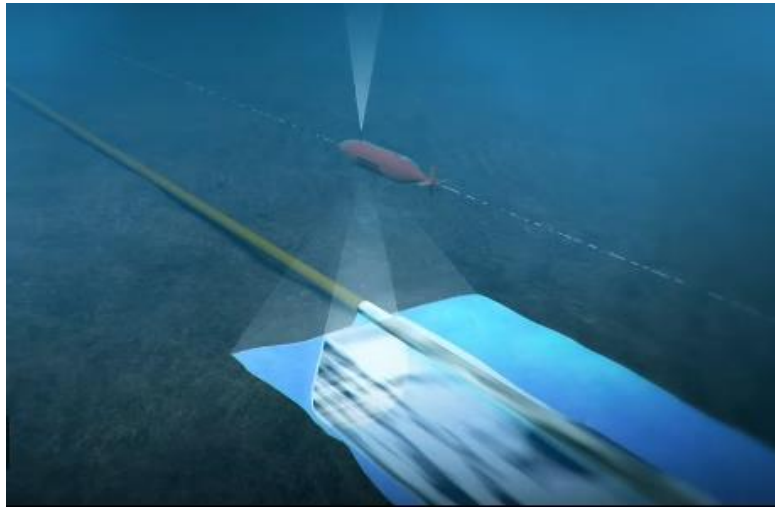
1. Type of antenna (MBR 189/179/144?).
2. Installation height
3. throughput



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Worlds first fully autonomus pipeline inspection.

Assets



Hugin UUV

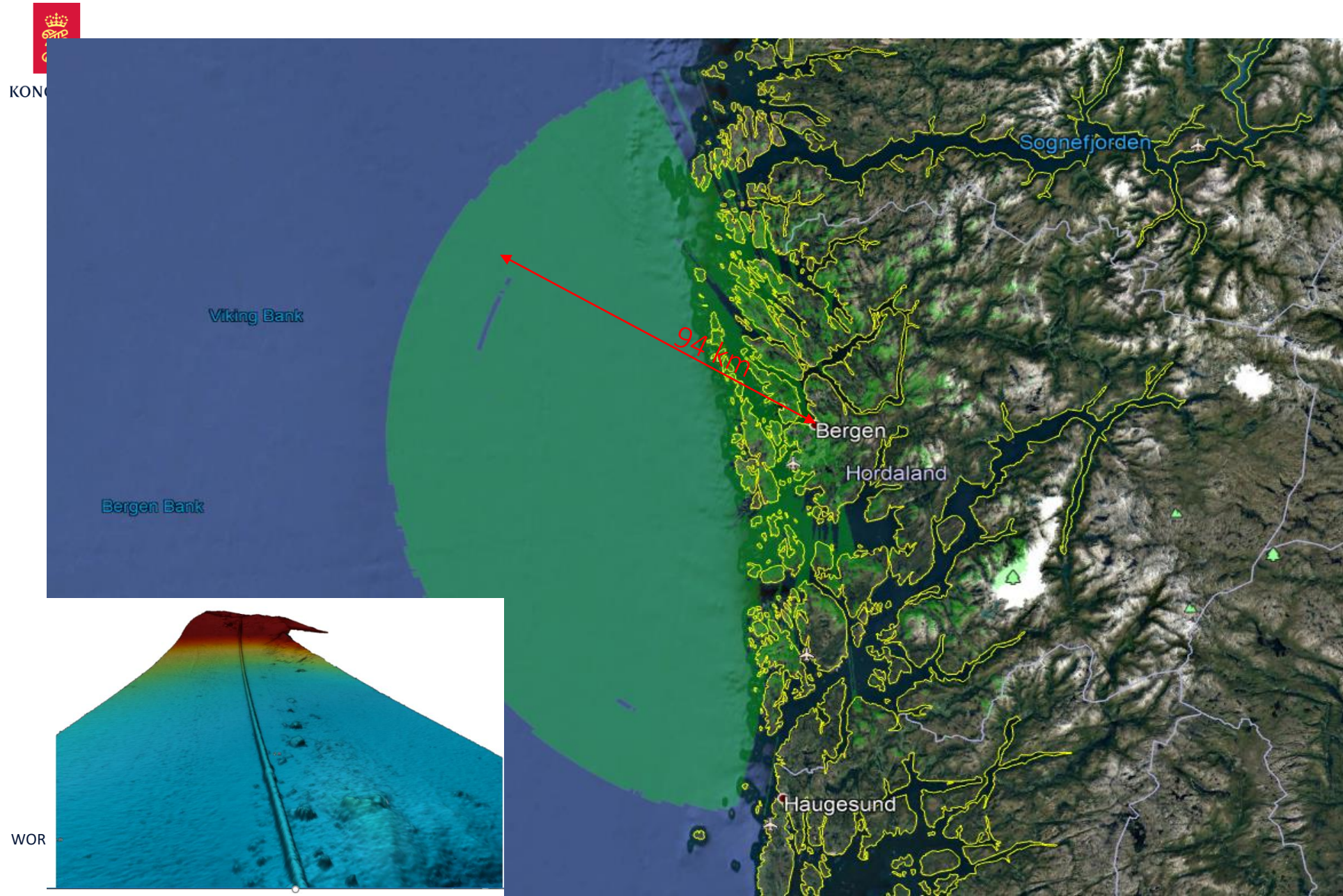


Simrad Echo used as «USV». MBR 179 installed together with HIPAP for coms with Hugin



MBR 189 installed on the mountain Ulriken. (640 meter antenna height)

Area of operation.



Coverage of the MBR marked with green.

Distance for operation marked in red.

Operation conducted twice.

MBR at Ulriken connected to internet/VPN to operation room.

Whole operation monitored in near real time at an office down town



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Kongsberg Seatex Radio Product Range

IEC. standard



MBR 189



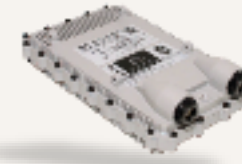
MBR 179



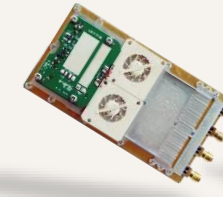
MBR 144



MBR 144 OEM



MBR 144 Personal

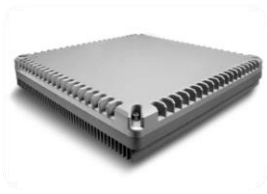


MBR 144 UAV



MBR Submersible

Mil. standard



CRE2-179



CRE2-189



CRE2-179-AM-POD



CRE2-144-ETH-M2



CRE2-144-LW



CRE2-179-UAV



CRE2-144-OEM



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Portable MBR 189/179



Technology and dedication

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Dual boarding team pack, MBR 144



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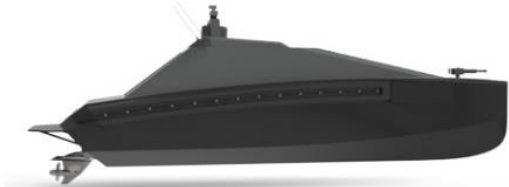
Real time common operational picture, anywhere!



Vessel



RIB



ASV



UUV

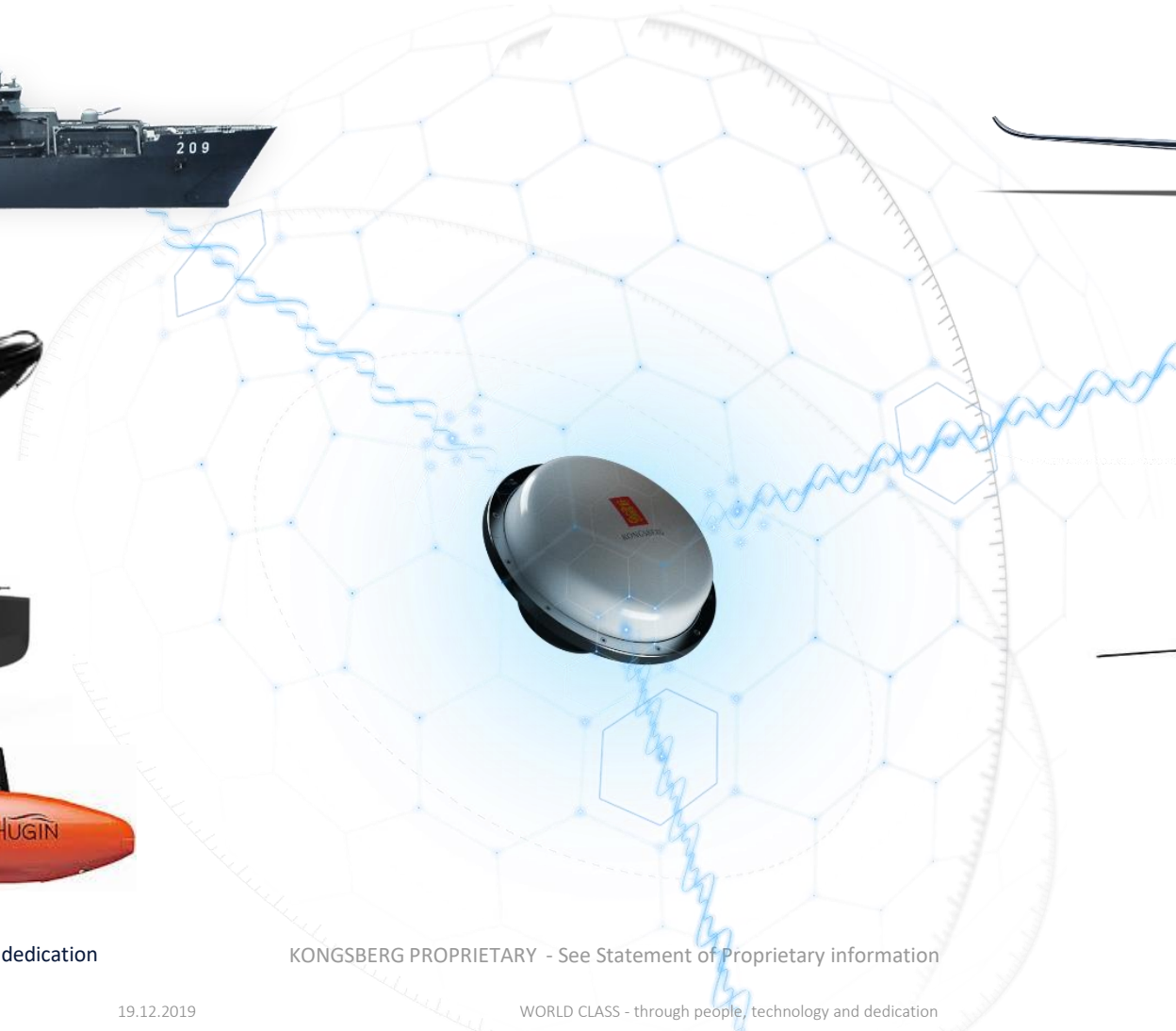
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Aircraft



UAV

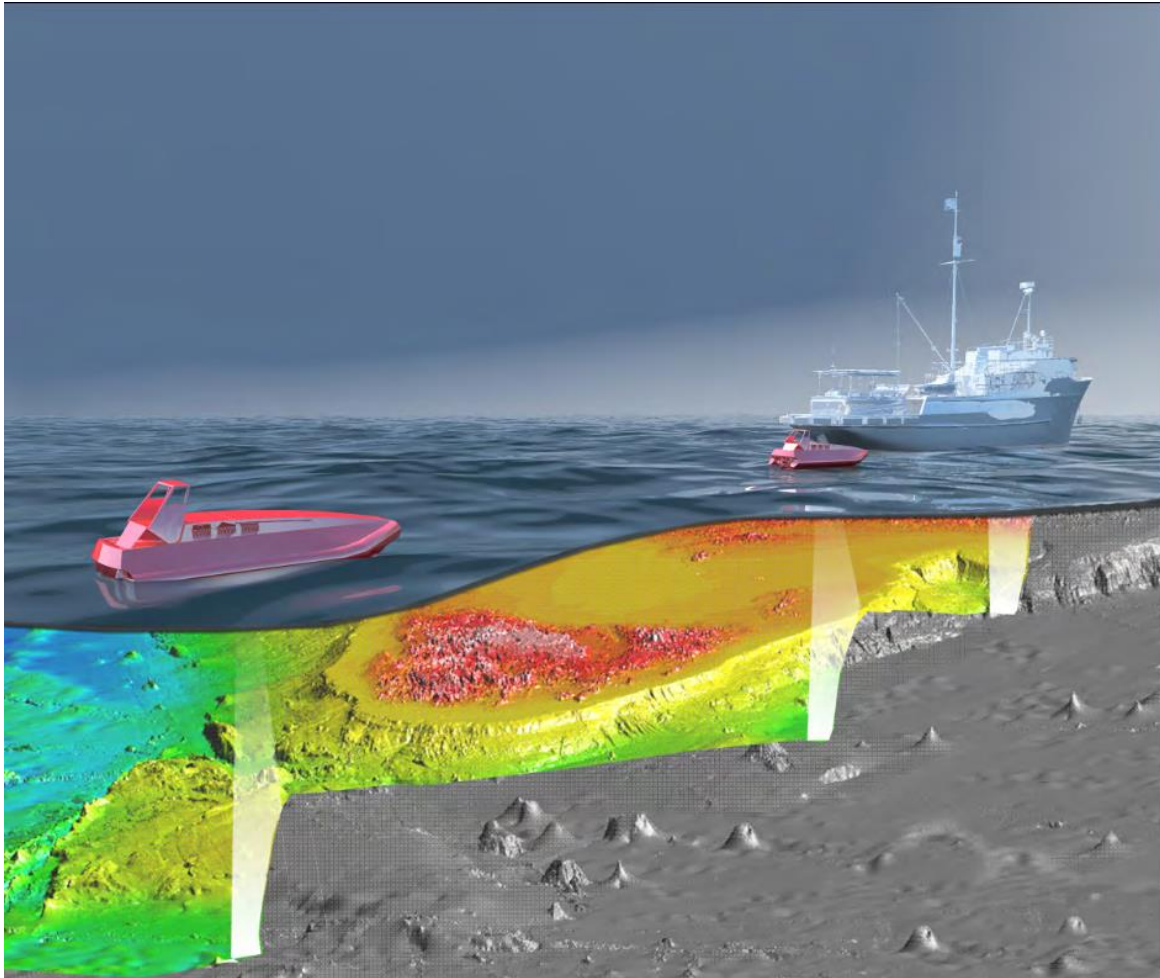


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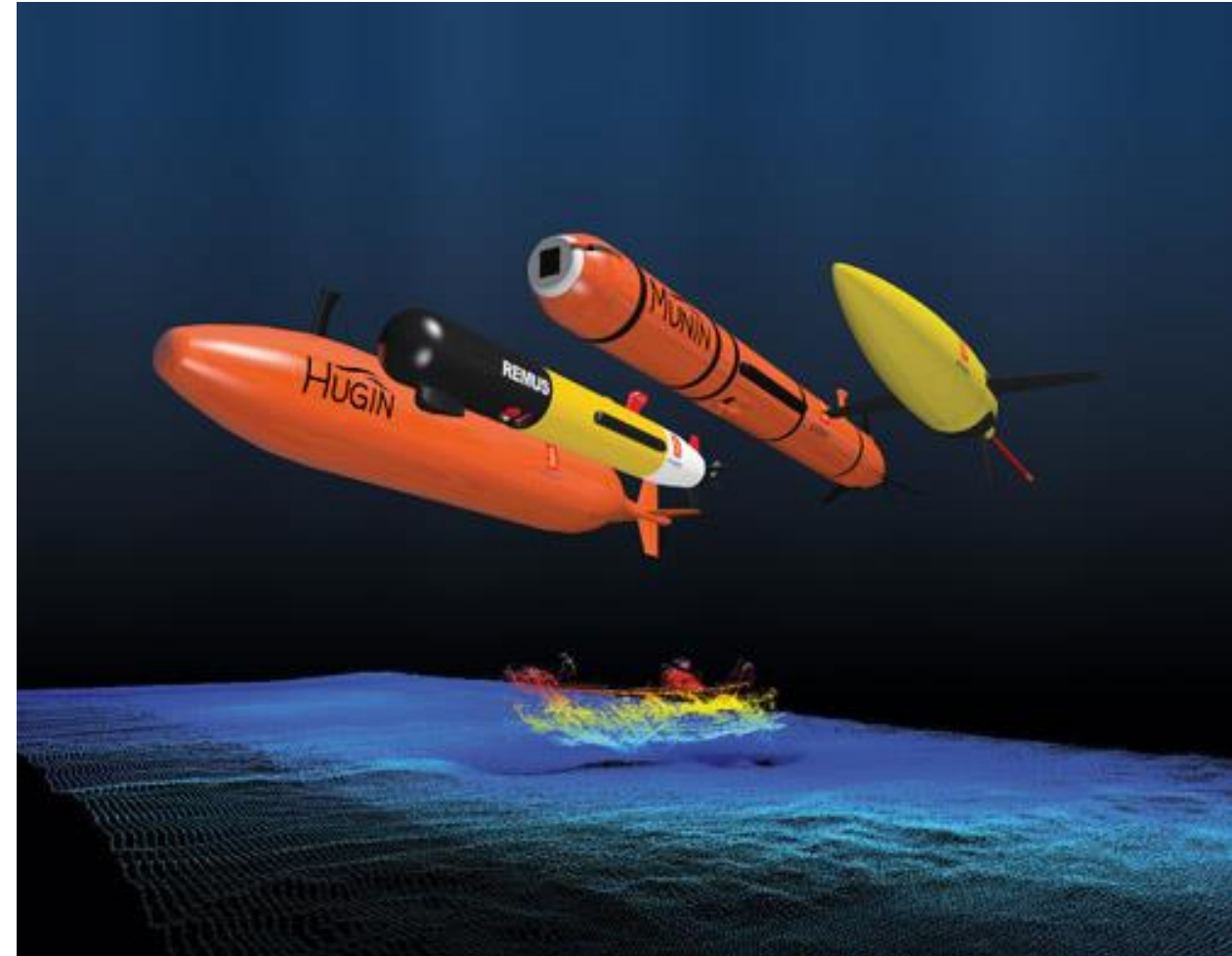


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Autonomous Operations



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«Normal» use of AUV

- The traditional way of using UUV is to follow the UUV with the mother vessel.
- These operations can be more effective and cost efficient using the MBR as a communications carrier

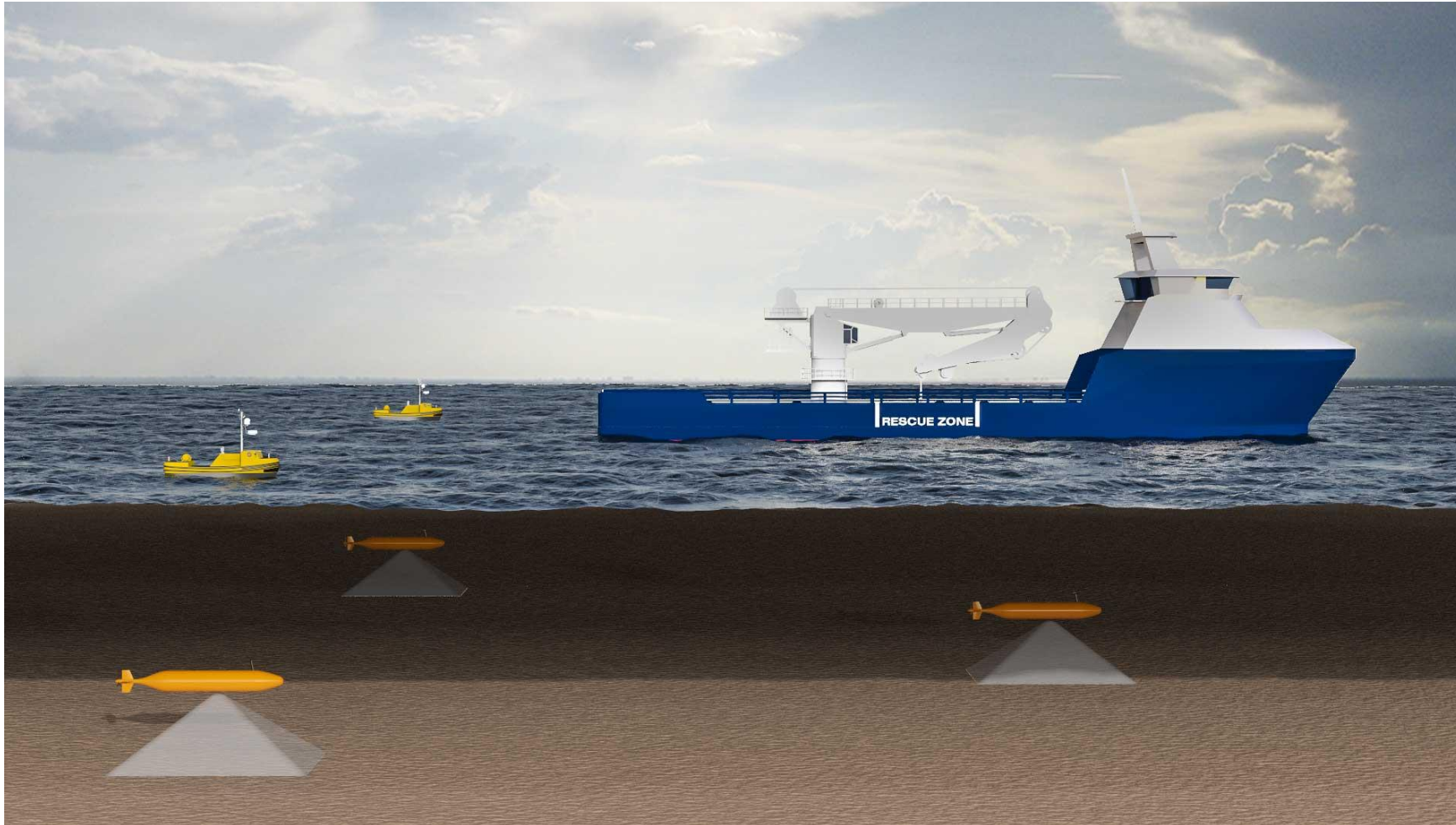


MBR 144



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AUV – ASV scenario



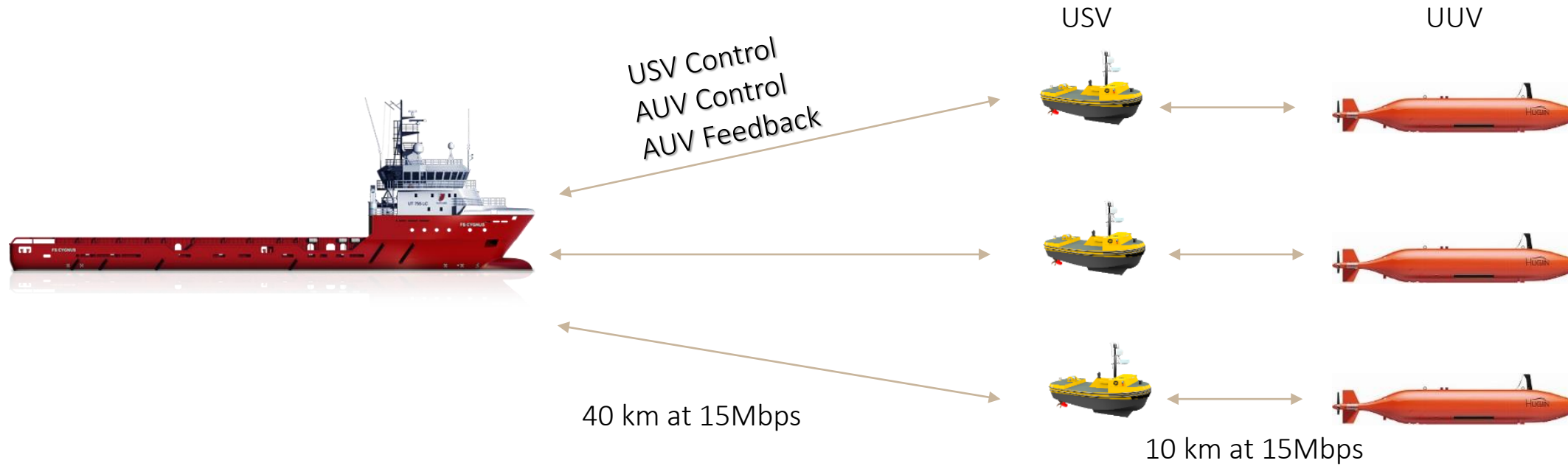
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USV and AUV



MBR 179

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MBR 179

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uPAP

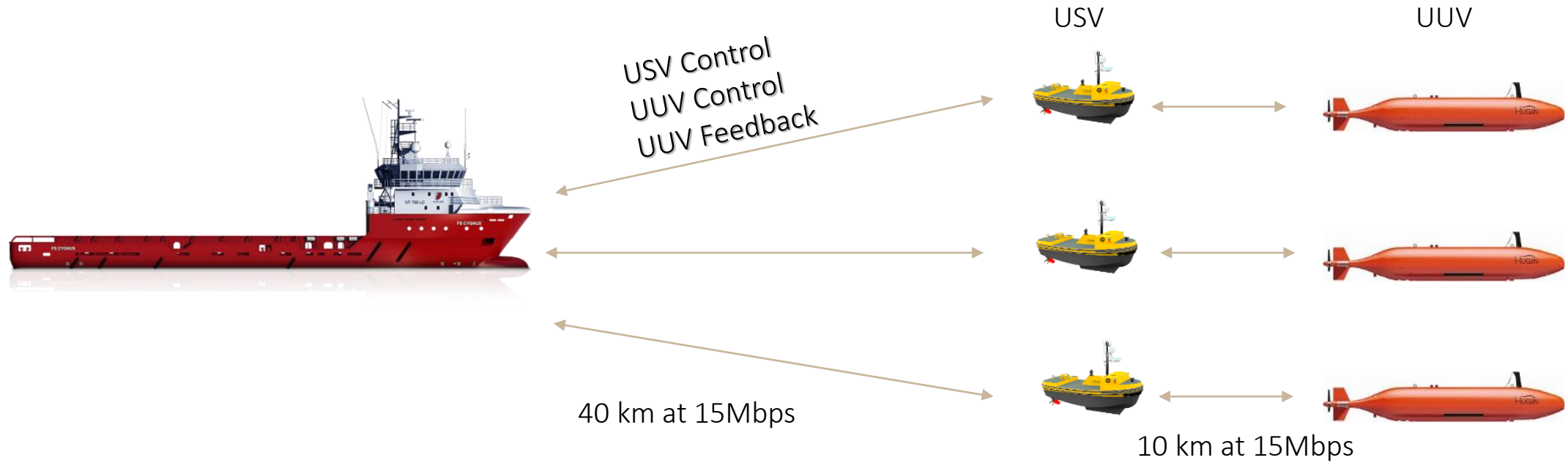


cNODE



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USV and UUV



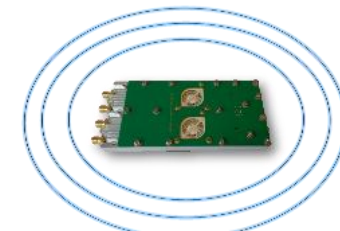
MBR 179

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MBR 179

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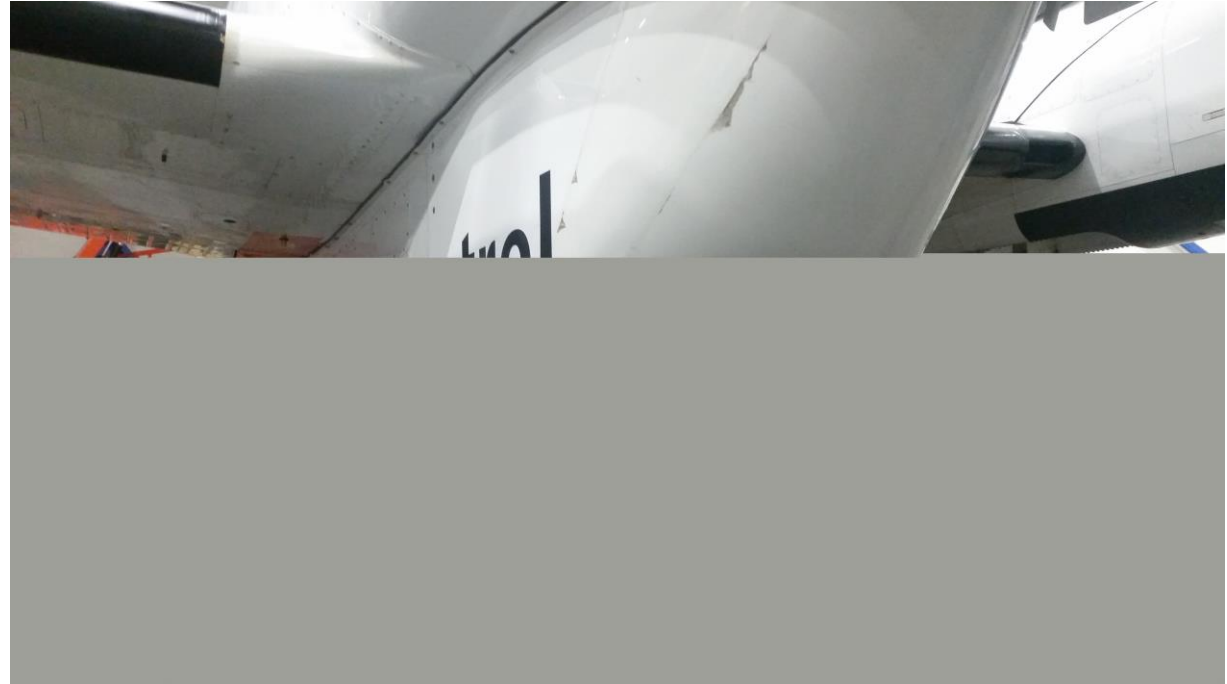


MBR 144



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Norwegian Coast Guard



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Ground installations

Reinsfjell



Ulriken



Gaustadtoppen



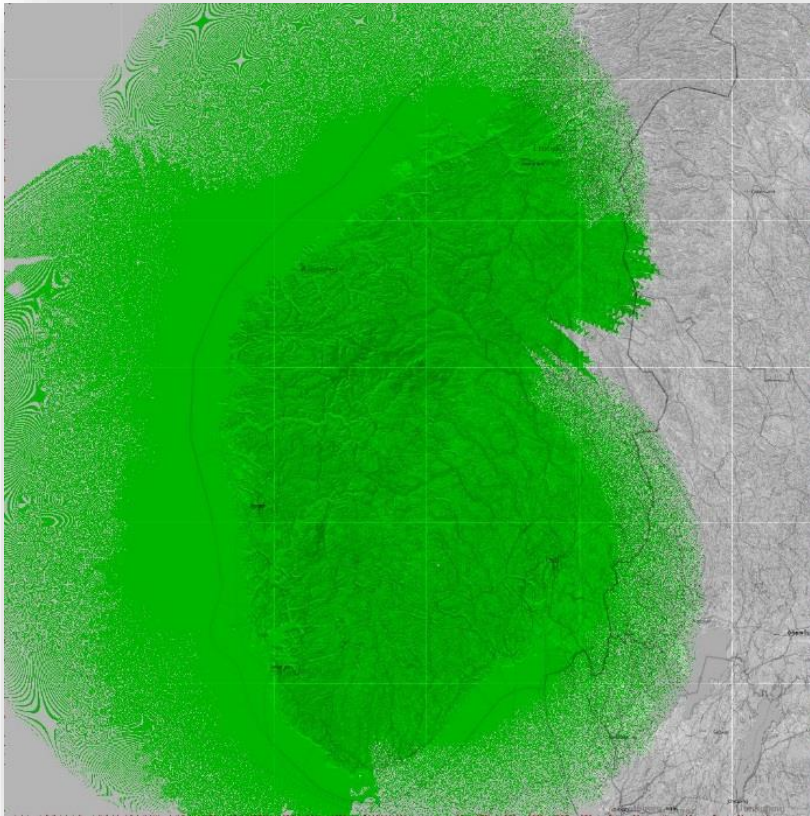
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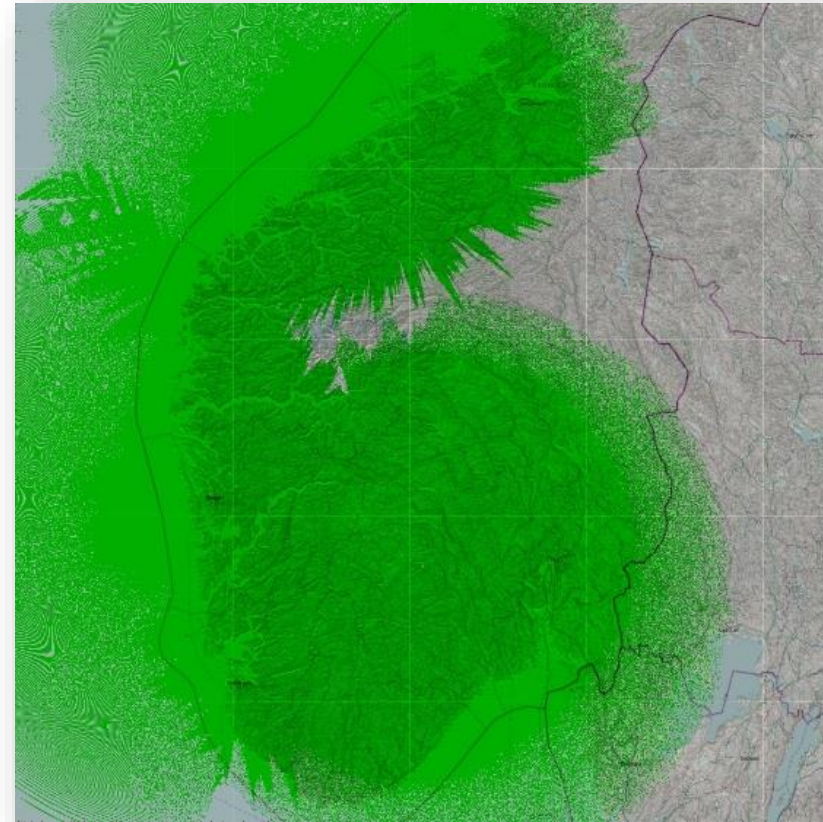


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Ground installations, air to ground coverage



Coverage at 15 000 feet AGL



Coverage at 4 000 feet AGL
(Standard mission altitude)

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Demonstrated ranges.

- Up to 70 km from vessel to vessel
- 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
- 200-275 km from aircraft to ground stations at 10000-15000 feet aircraft altitude
- 70 km from aircraft to portable equipment



"The wireless network tested in the pilot project has demonstrated outstanding range, stability and bandwidth. The positive operational effects from sharing sensor data in coordinated operations have been significant."

*Commander Ole Thorsen,
The Norwegian Coast
Guard*

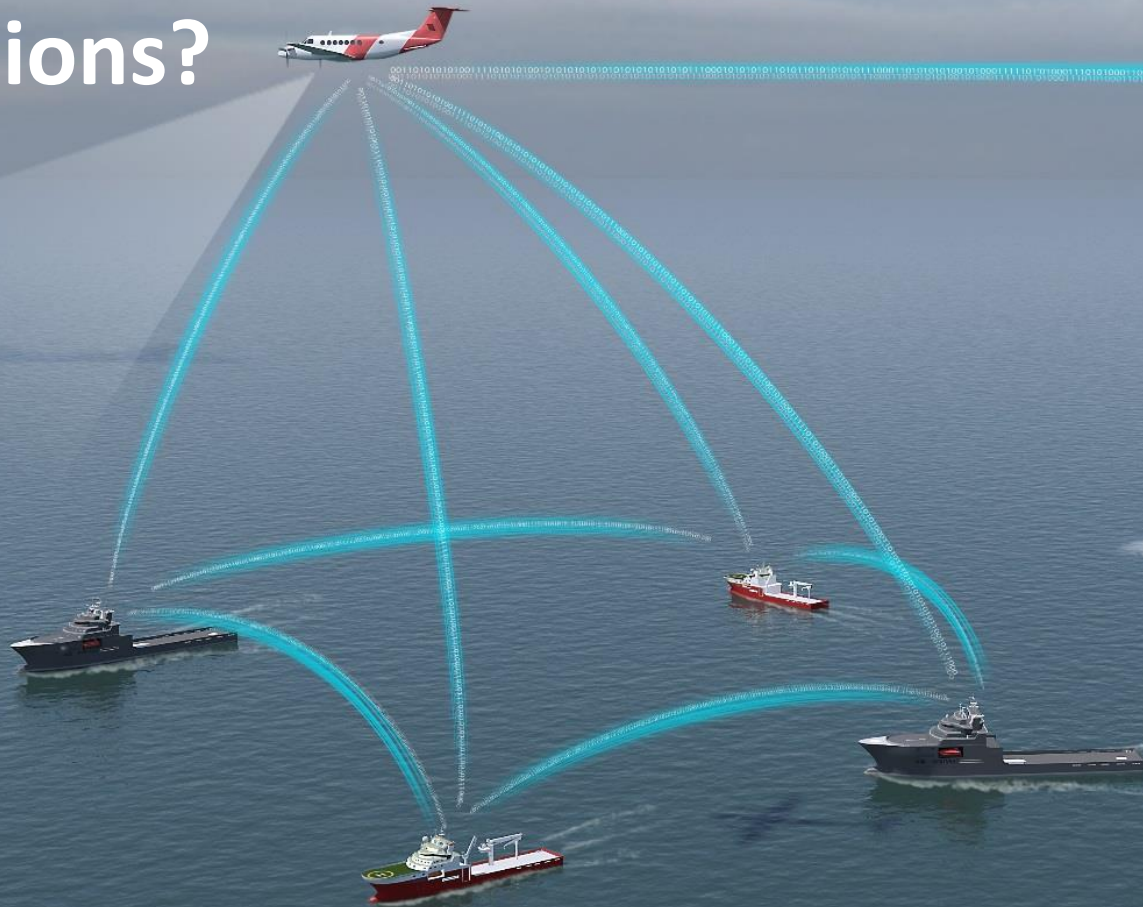


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Conclusion

- Reliable and robust Maritime Broadband Radio beyond line of sight
- IP oriented
- Small and compact, easy to install
- For all type of applications

Thanks for your attention... Questions?



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www.connectingvessels.com