

LUMA™

SCALABLE
HIGH-SPEED
WIRELESS OPTICAL
COMMUNICATION
UNDERWATER



We automate submerged asset inspections with Autonomous Underwater Drones



We built **substantial IP** in underwater communication and propulsion, all in **an extremely small form factor**



DiskDrive thruster
thin, oil-free, hub-less



LUMA optical modems
wireless, fast, power-efficient

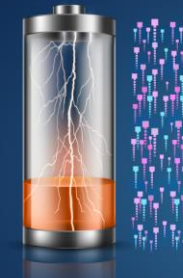
Underwater wireless communication: optical vs. acoustic

Acoustic communication is slow



LUMA X is a **thousand times faster**

LUMA runs 1000x faster



Acoustic communication
is power hungry



LUMA X is **1500 times
more power efficient**

LUMA lasts 1500x longer

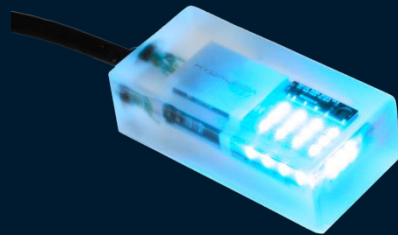
Optical communication: additional benefits

- Low latency
- Benefits from reflections
- Unaffected by (acoustic) noise
- Max transmission range \approx interference range (makes it well suited for wireless networks)
- Low probability of intercept
- From splash zones to 6'000m depth

LUMA Product Line



LUMA 100



LUMA 250LP



LUMA 500ER



LUMA X



LUMA X-UV

100 kbit/s over 2m

Range, Bandwidth



10 Mbit/s over 50m*

*can vary depending on water conditions

Application 1: Subsea construction

Application:

Installing structures onto the sea floor

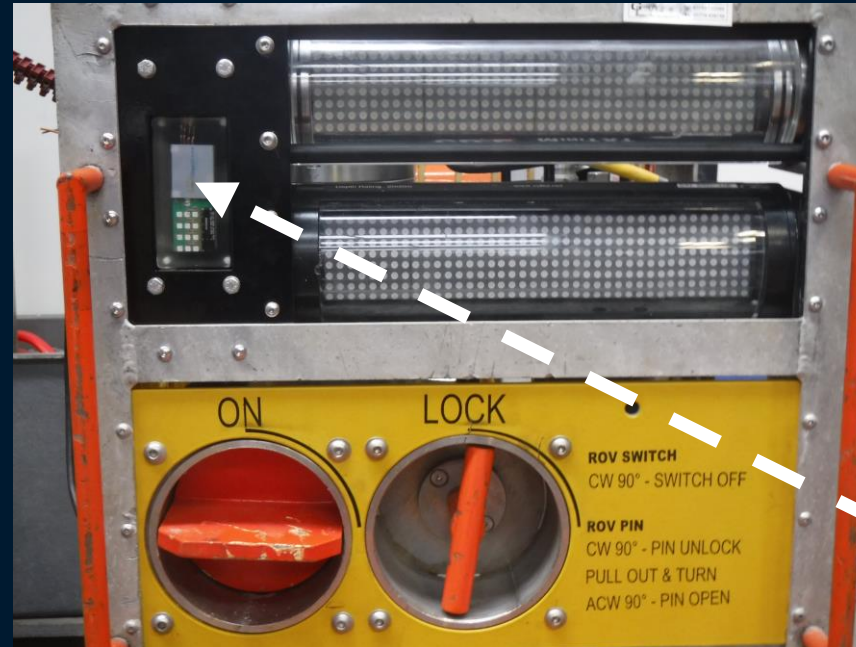
Problem:

While lowering structures, close control of the orientation of the equipment is critical.

Previous solution:

- Gyro box attached to structure measures roll/pitch/yaw and displays it on LED display
- Operator reads off display to crane operator

→ **slow, error-prone**



Ashtead's AMS with LED display for roll/pitch/yaw



observing AUV

Application 1: Subsea construction

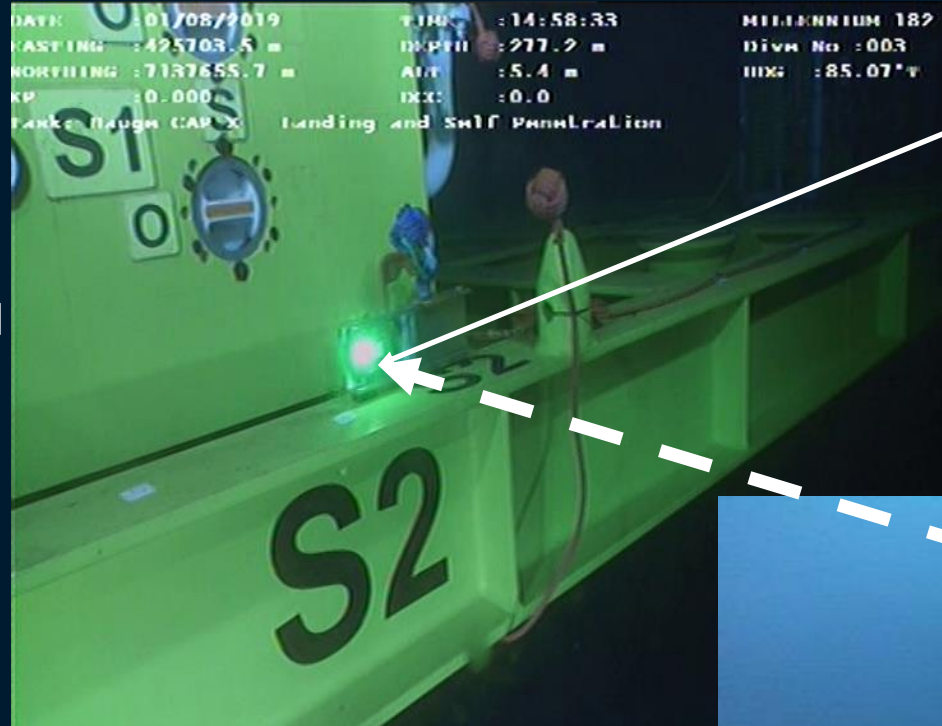
Free-space optical communication solution:

AMS (Autonomous Monitoring System) system is fitted with an optical modem which transmits the data wirelessly and error free to modem installed on observing ROV

→ high update rate, error-free

Applications:

- gyro boxes
- filling level sensors



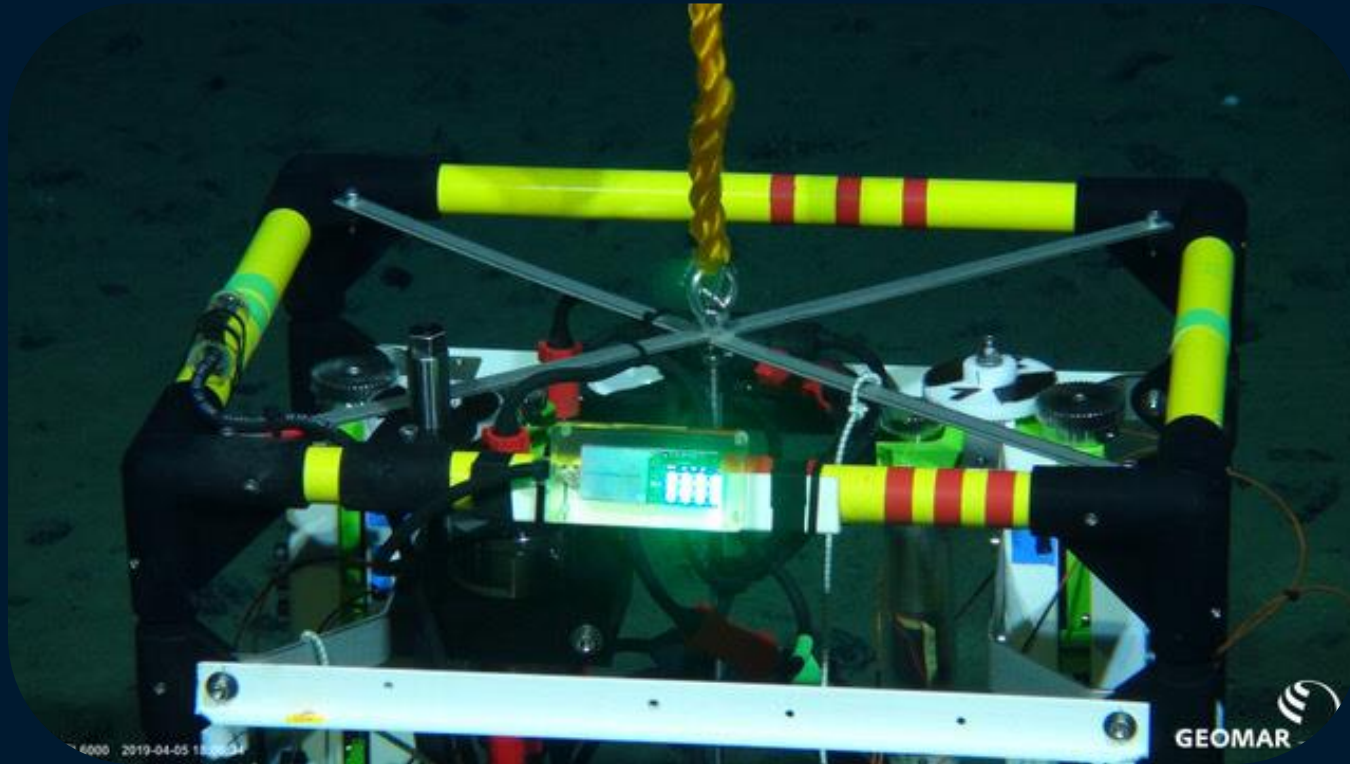
moving template
during construction
Images courtesy of Ashtead



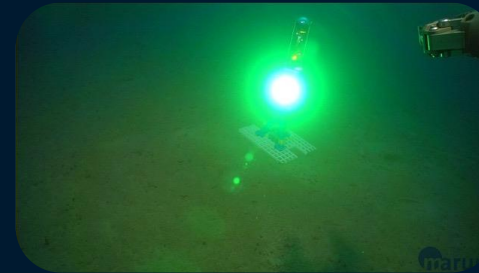
Ashtead's AMS gyro box with
LUMA 250LP



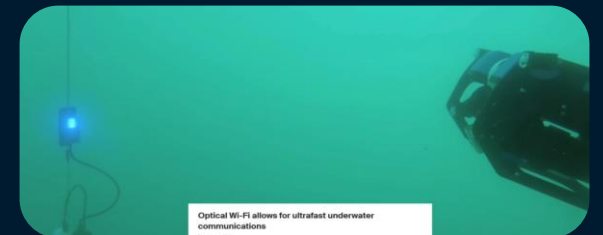
Application 2: Wireless Data Download



Live sensor status check at 4300m



MARUM's SQUID ROV offloading photos



Data download from a logger using a BlueROV

Application 3: Wireless ROVs (AUVs)

- all the benefits of an ROV without the tether
- enables resident ROVs

Next gen optical communication:

- Speed: >1 Mbps (for compressed HD video)
- Range: >50m



Bluecomm+SAAB (2016)



Houston Mechatronics (now Nauticus)
"Aquanaut"



Hydromeae "ExRay"

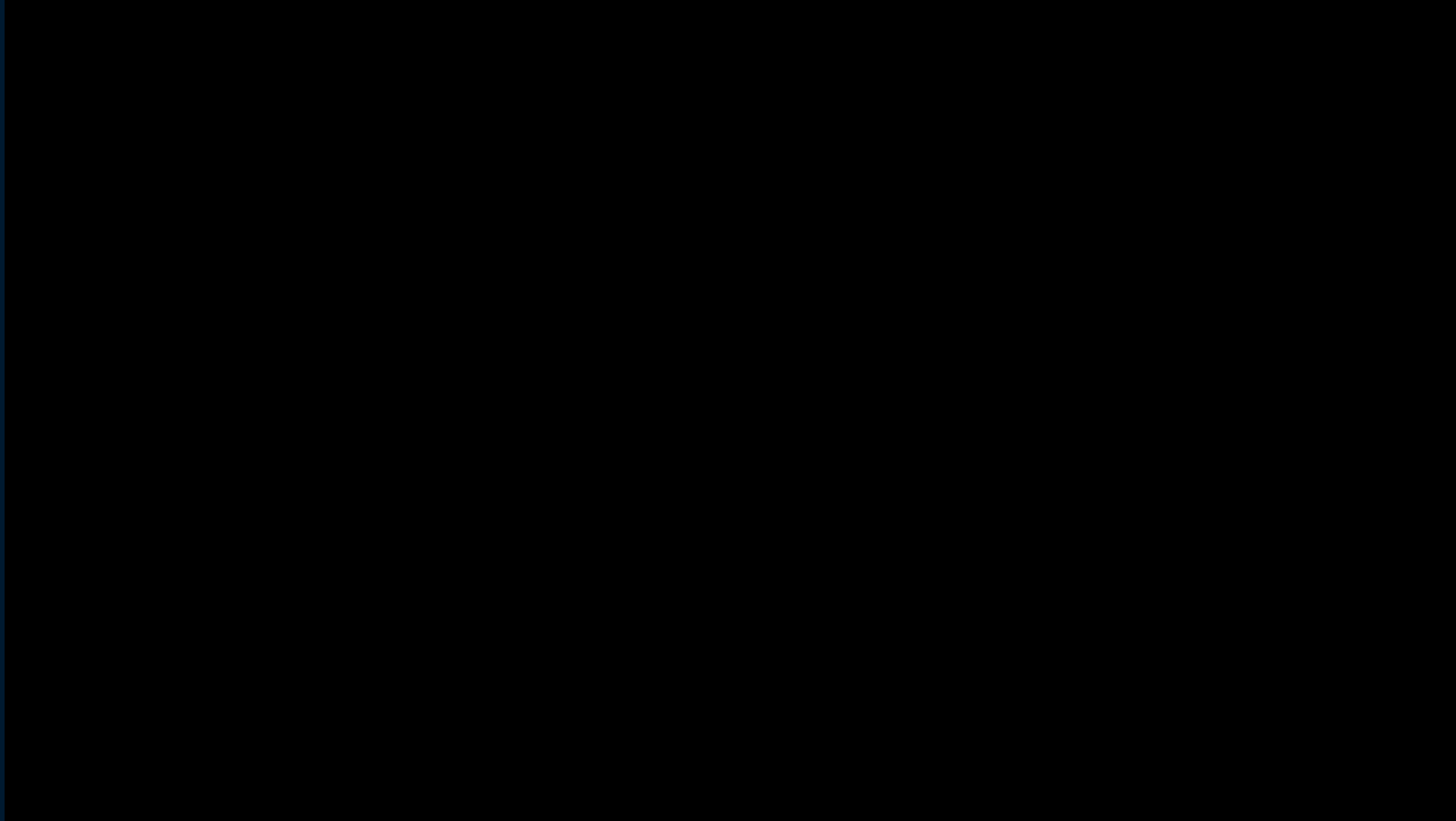


MARUM "Fly-out ROV"



Oceanering "Freedom" ROV

Thank You



www.hydromeia.com

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Non-commercial Free-space Optical (FSO) Modems

Early military trials
(since 1980s)

Academic projects
(since 1990s)

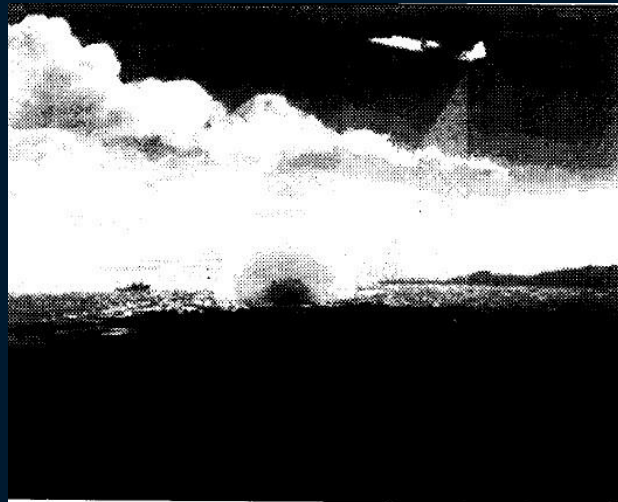


Figure 1. ADORE System Concept



WHOI, USA, 2004



MIT, USA, 2011



NCSU, USA, 2012



IFREMER, France 2017

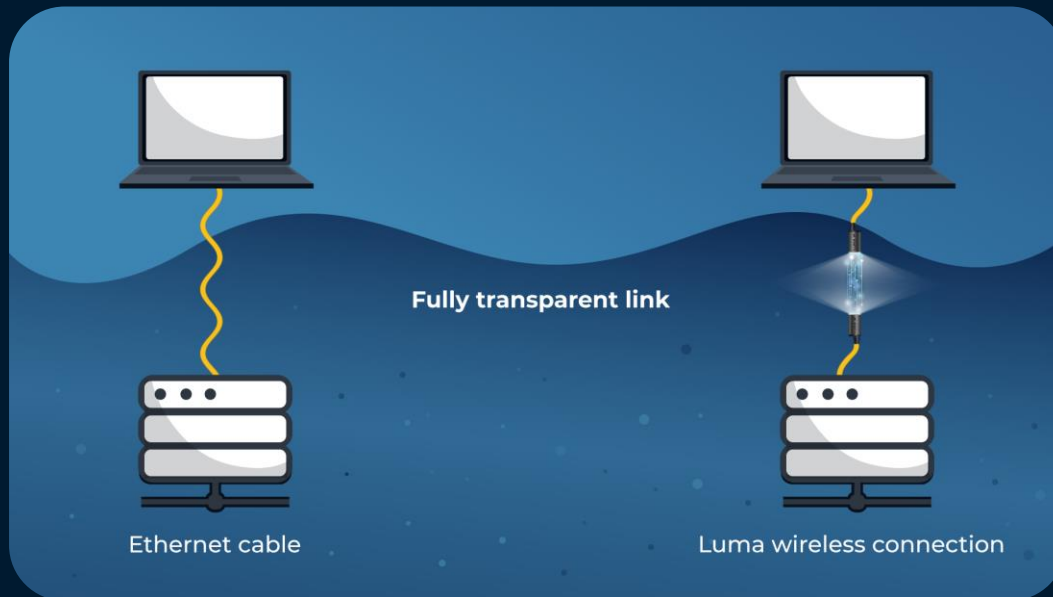


ISR, Portugal, 2018



SVEmbedded 2020

Plug & Play – Fully Transparent Link



- Just as if you would plug in a cable
- No firmware/API required

From Military and Academia to commercial off-the-shelf

Since 2010s



Subsea Wireless Group

[...] to define standards that facilitate interoperability between users of subsea wireless technologies [...]

Leading
FSO Standard Development @



<https://subseawirelessgroup.com/>

