



SUBSEA TECHNOLOGY

Advances in Subsea Data Harvesting Technology

OI China 2018, Qingdao

Autonomous and Remotely Operated Underwater Vehicles and Vessels Sensing Session

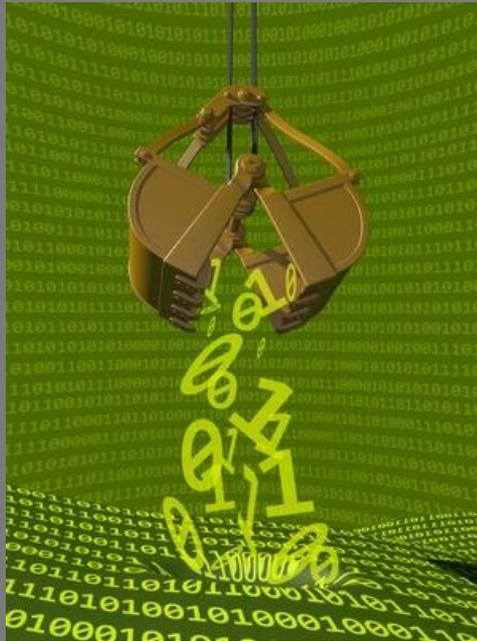
Jose M Puig

Regional Sales Manager

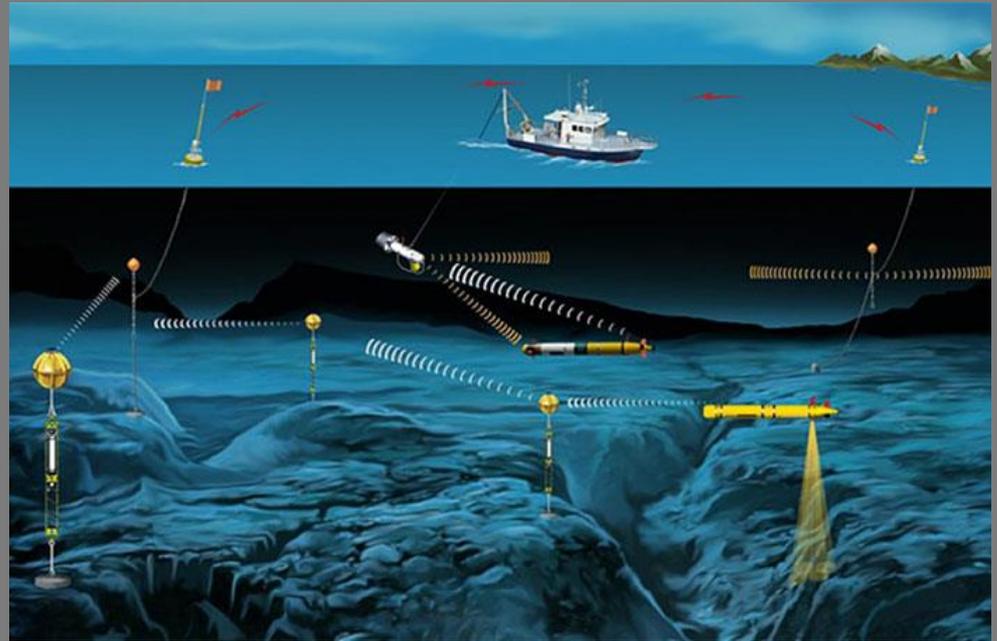
Sonardyne Asia Pte Ltd

**POSITIONING
NAVIGATION
COMMUNICATION
MONITORING
IMAGING**

What is data harvesting?



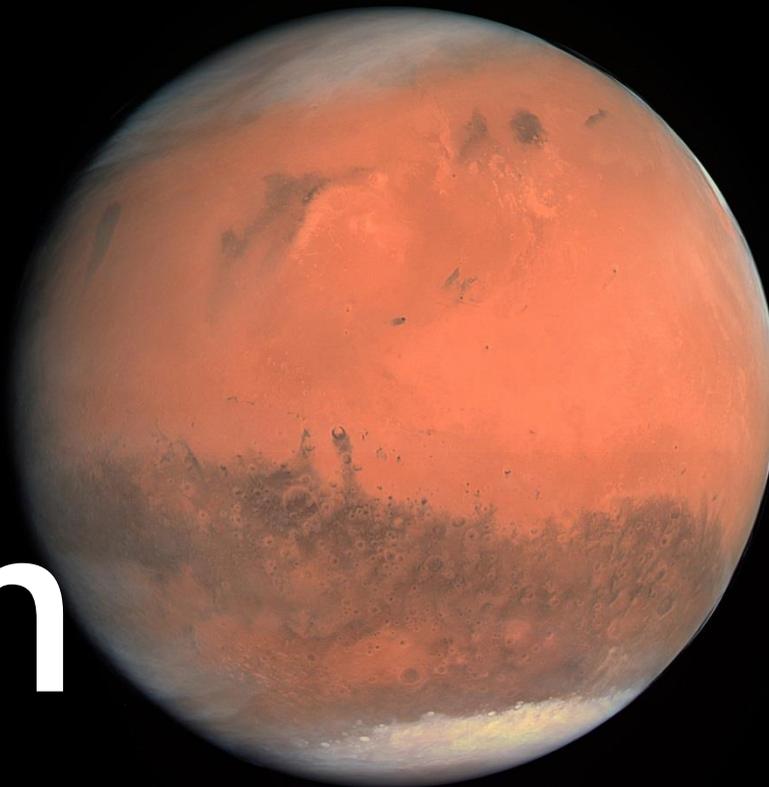
© Paul Fleet - stock.adobe.com



Credit: Woods Hole Oceanographic Institution

Why is data harvesting important?

200m



Advances in Data Harvesting Technologies. OI China 2018



The ocean depths are relatively unknown in comparison

5000m

Image Courtesy of NOAA

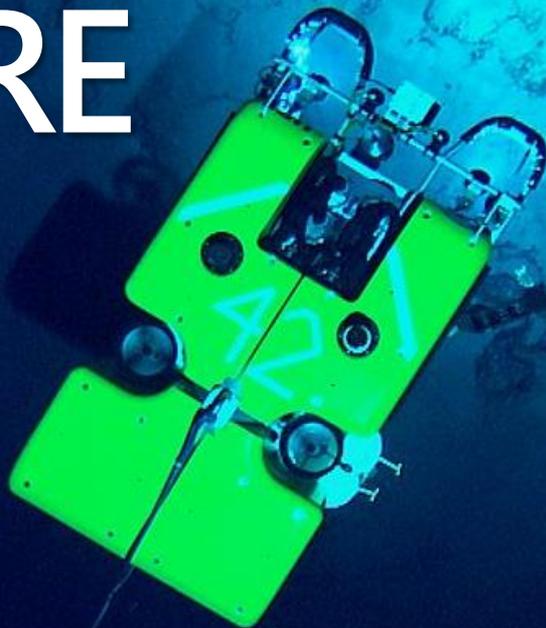


Why?



**70% WATER
HIGH
FREQUENCY
ATTENUATED**

PRESSURE





Challenges: ... Expensive

- Previous search
- Searched by Ocean Infinity
- Wide search area
- Final satellite communication - plane somewhere along arc



FIRST CAMPAIGN

- 60,000 km²
- \$56 Million USD

SECOND CAMPAIGN

- 106,200 km²
- \$70 Million USD

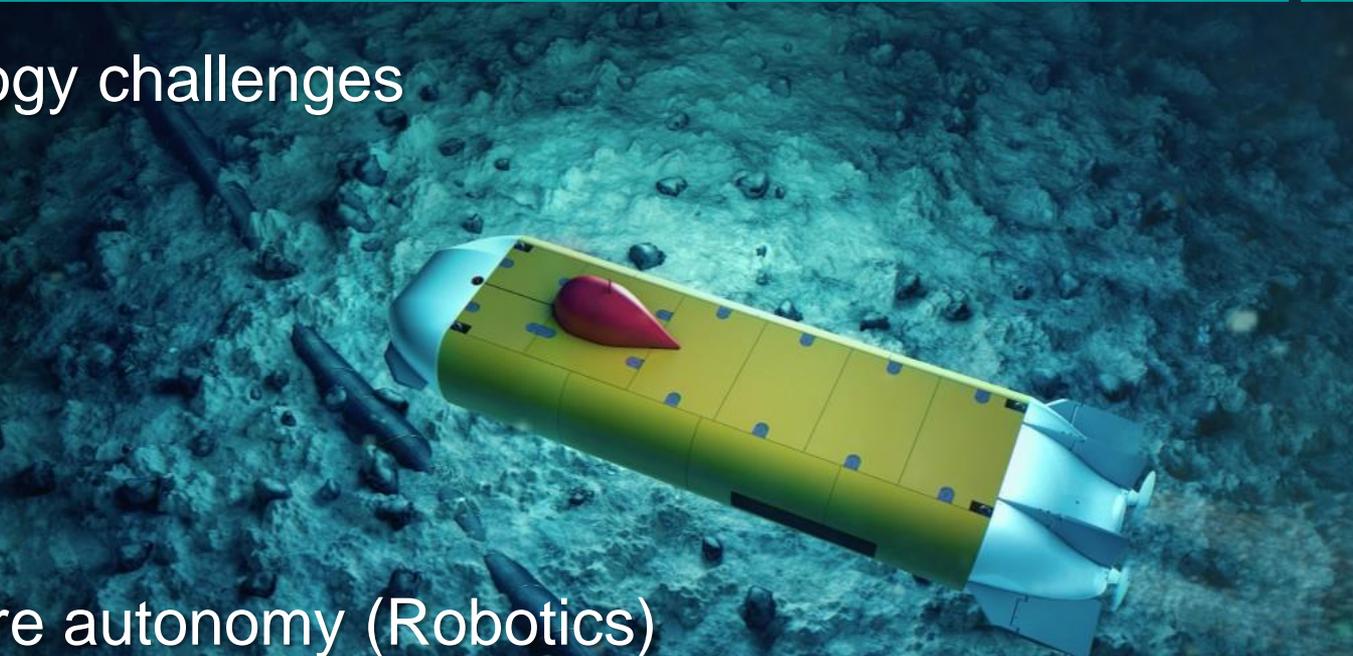
- 0.04%
- \$274,364,620,924.00 USD



Shell
OCEAN DISCOVERY **XPRIZE**[®]

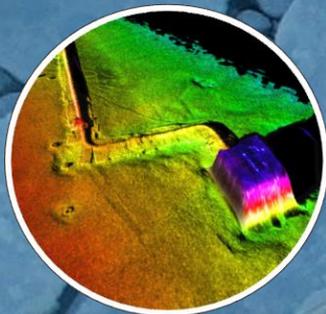
Getting to the Bottom of Our Ocean.

Technology challenges

- 
- More autonomy (Robotics)
 - Better navigation (For Robots)
 - Smarter instruments
 - Efficient and Reliable Comms (Better Data Harvesting)

DATA HARVESTING TECHNOLOGY

Current Data Harvesting Applications



SEABED MAPPING



**ENVIRONMENTAL/
OCEANOGRAPHY**



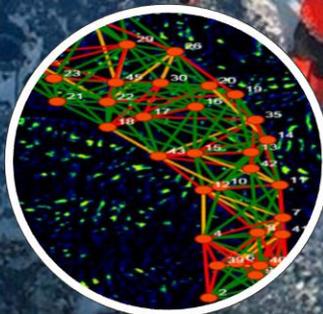
PLATE TECTONICS



**TSUNAMI EARLY
WARNING**



**SUBSEA STRUCTURE
MONITORING**



**O&G RESERVOIR
MONITORING**



DEFENCE



SUBSEA MINING

Overview

70+

The number of countries where we operate



10mm

Positioning accuracy of 6G acoustic technology

~18Mb/s

The speed we can transfer data subsea

100%

Deep water fields where Sonardyne technology is used

300+

Sonardyne employees worldwide

>45

The age of our company

10,000

Transducer manufactured each year

156,000

Total square footage of our facilities

12,000m

How deep our equipment can operate

24/7

Support any time you need it

80%

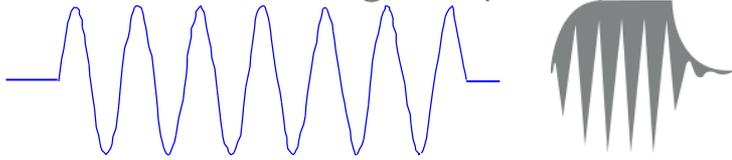
Percentage of products we export



WIRELESS COMMS

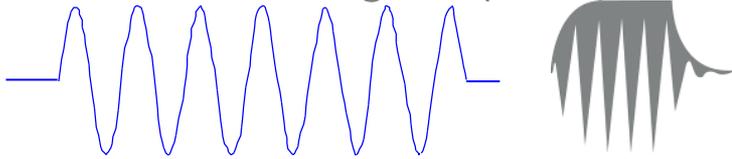
Where did we start?

Narrowband signal (tone) – Legacy, no longer used

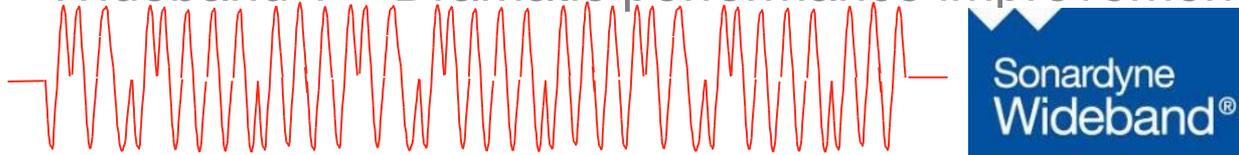


Where did we start?

Narrowband signal (tone) – Legacy, no longer used by Sonardyne

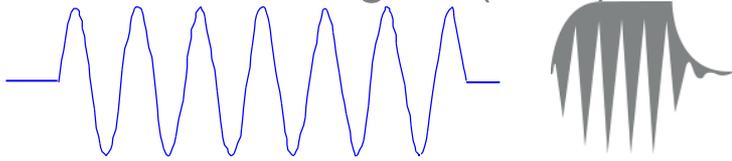


Wideband 1 – Dramatic performance improvement over tone signals

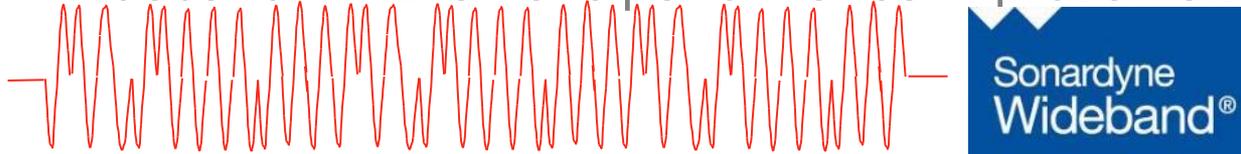


Where did we start?

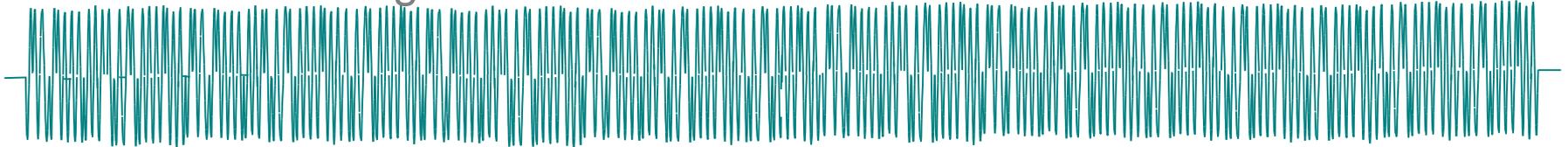
Narrowband signal (tone) – Legacy, no longer used by Sonardyne



Wideband 1 – Dramatic performance improvement over tone signals

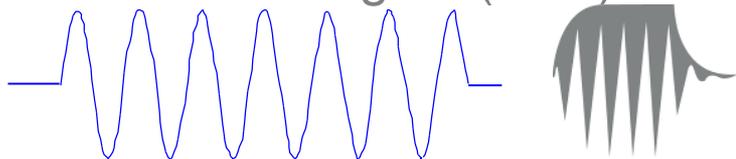


Wideband 2 - Longer codes for robust comms in harshest environments

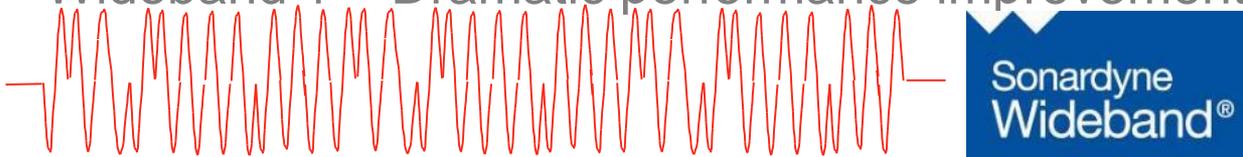


Where did we start?

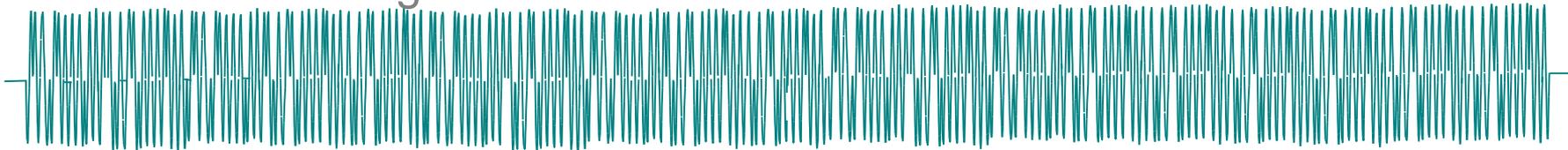
Narrowband signal (tone) – Legacy, no longer used by Sonardyne



Wideband 1 – Dramatic performance improvement over tone signals



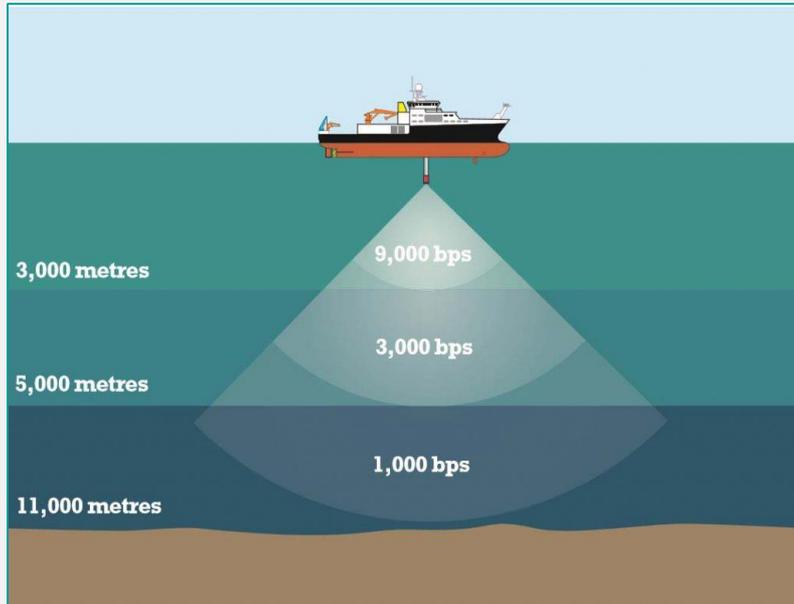
Wideband 2 - Longer codes for robust comms in harshest environments



Where are we now?

Sophisticated coding techniques **BUT** still limited to 18kbps due to Physics

Effective Bandwidth Use



Digital

Combine Telemetry
& Tracking

18000 bps

From 200bps to
9000bps effective
bandwidth

Vessel, USV & AUV

Choose the right platform for your
harvest (or hop from shore)

HD VIDEO

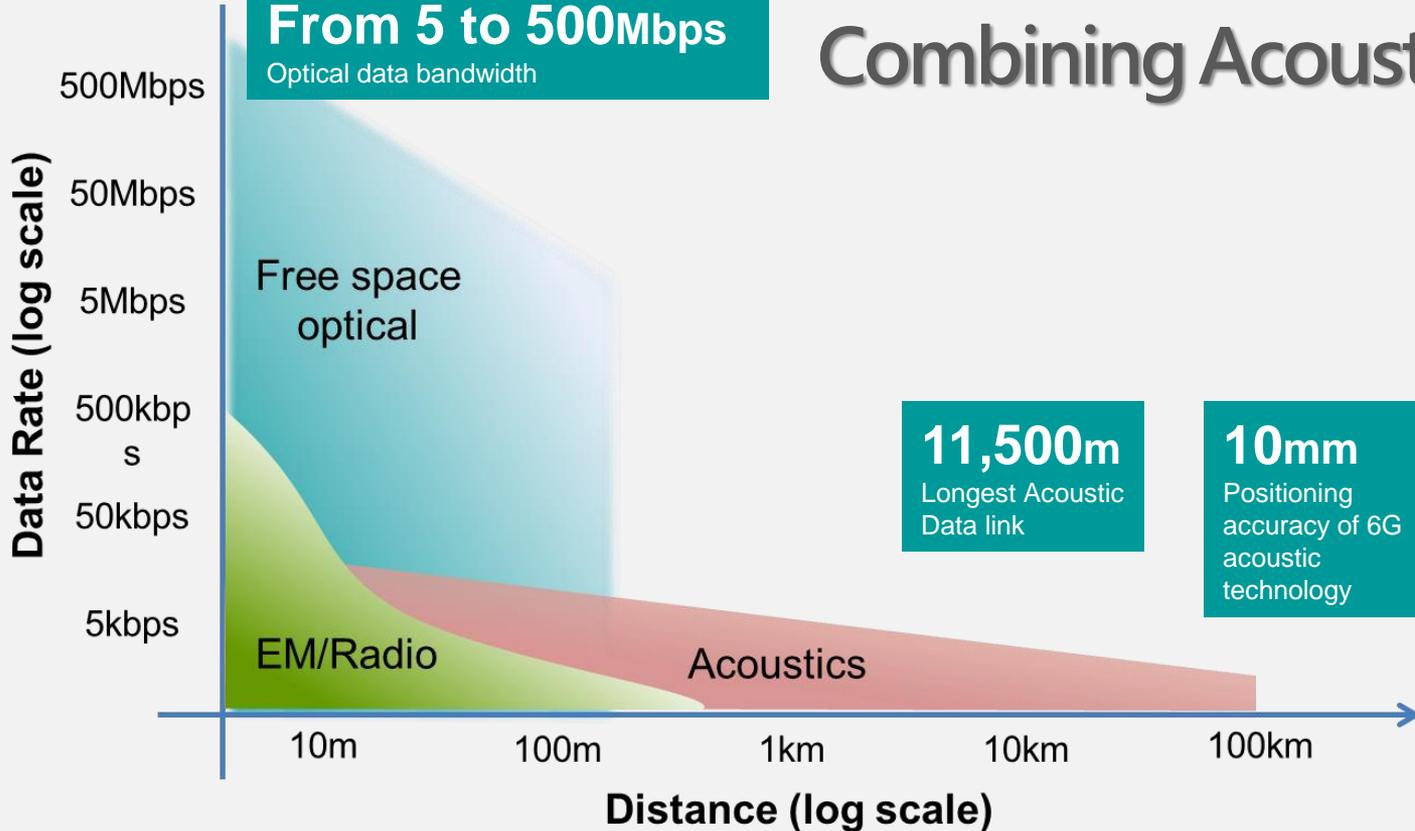
2 MINS IN > 34 hrs

Free Space Optics

From 5 to 500Mbps

Optical data bandwidth

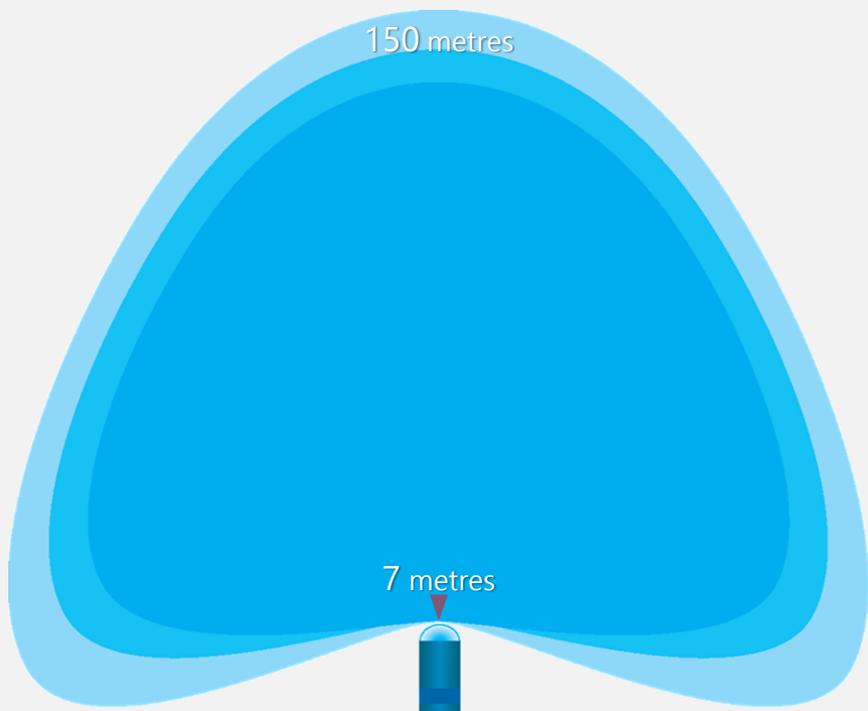
Combining Acoustics & Optical



11,500m
Longest Acoustic Data link

10mm
Positioning accuracy of 6G acoustic technology

9kbps
6G effective user bandwidth



Effective Bandwidth Use

Large Bandwidth

Use optical modulation to enable larger data transfers

500 Mbps

10Mbps at >100m
500Mbps at <7m

AUV or ROV

Choose the right platform for your harvest

HD VIDEO

2 MINS IN < 2 MINS

SMART SENSORS

Smart Sensors

On board
Processing



Integrated MF
Transducer/Modem

FFT spectral, Statistic
and bespoke

Dual 32GB Cards
• Optional 200 GB

Future Optical Comms

Different
Form
Factors and
Battery
Pack Opt

Range of
Internal
Sensors
External
Input Also



10
YEAR
BATTERY

Modem
9Kbs

UPTO
6000_M
RATED

APPLICATIONS

Tsunami Detection

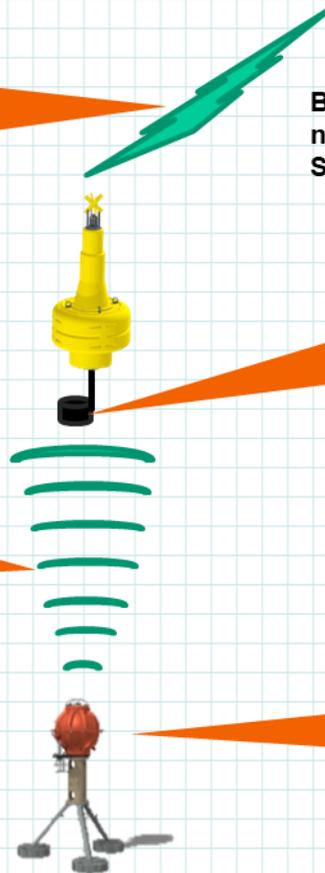
- 2-way satellite comms link
- Direct control of acoustic transceiver
- Allows acoustic commands to be sent to subsea unit
 - to alter set-up parameters
 - diagnostics
 - to Force or Cancel Events

**Buoy System:-
not supplied by
Sonardyne**

- Wideband signal technology
- Lightweight - 9kg in water
- Low power - 1W at 24V
- Acoustic baffle
- 5km+ acoustic range
- Armoured cable to buoy

- LMF – 15kHz
- High speed 100-9,000 bps
- Forward Error Correction (FEC)
- Wideband technology

- 6000m rated housing
- Lithium battery pack for ~8 year deployment from dual battery pack
- Optional acoustic release



Systems deployed around the world



USA - A deployed Tsunami Compatt recorded a small meteo-tsunami event during technology trials

Ecuador – Tsunami detection buoys deployed in the Ring of Fire protect Ecuador’s coastal communities from tsunami threats



Mediterranean - Bottom Pressure Recorders have been integrated into an undersea cabled warning system for the region



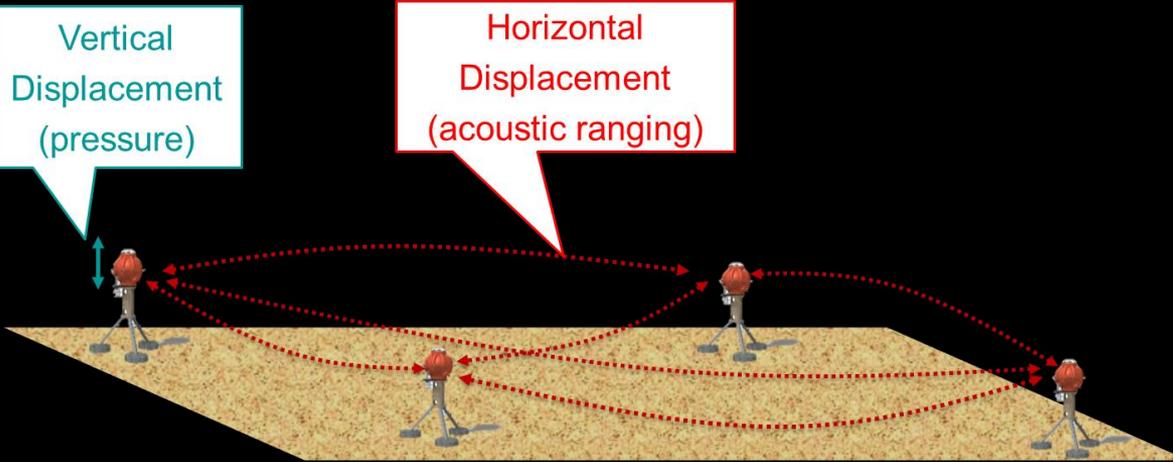
India - A wide area network of Tsunami Compatts in the Indian Ocean provide early tsunami warnings for the Bay of Bengal



Subsidence Measurement

Shell's Ormen Lange field in the Norwegian North Sea

- 220 seabed transponders spread over an area of 50km x 20km
- >600 million observations
- Ca. 1 Gb of data uploaded acoustically
- Recently recovered after 6 years deployment



'Fetch' transponders on the seabed

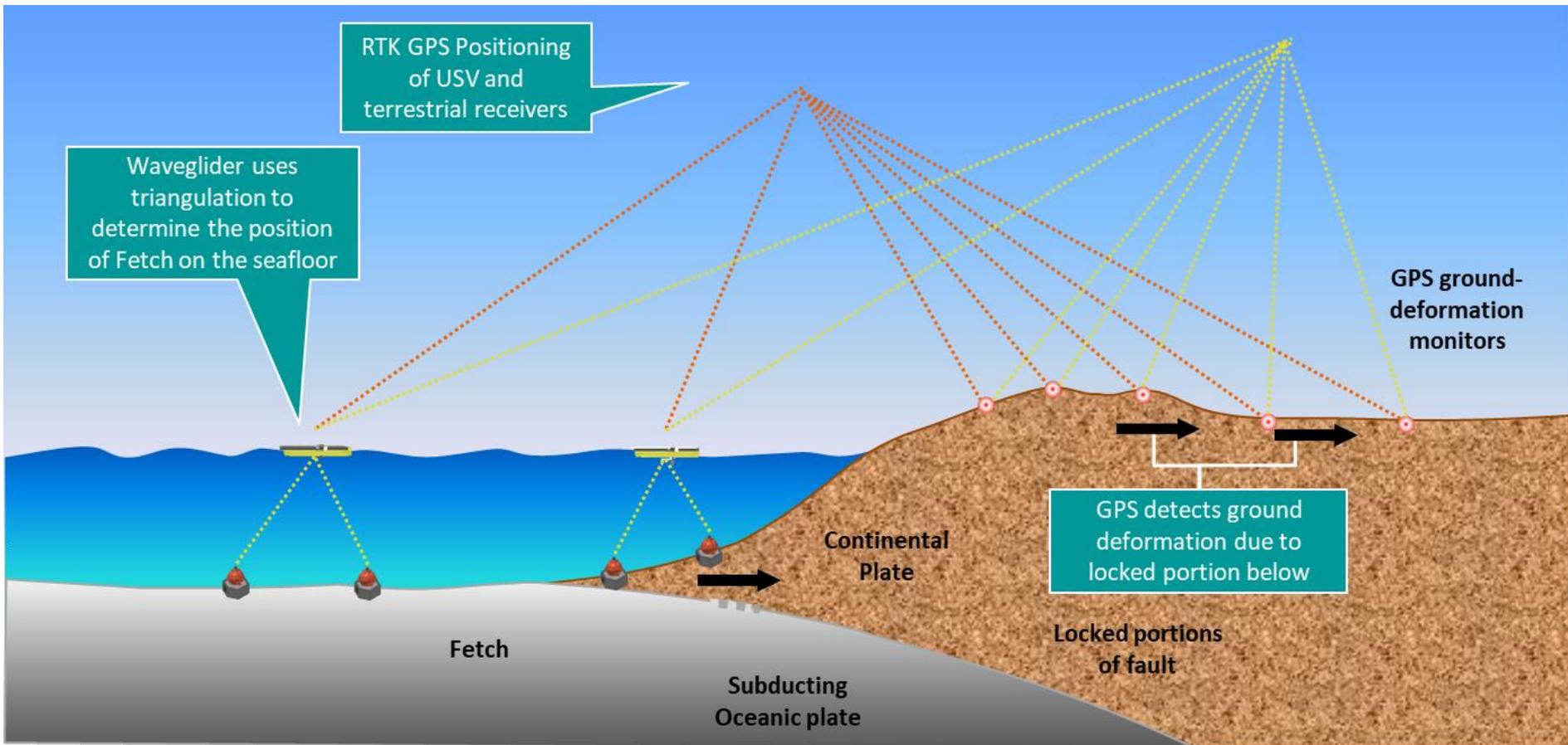


An Autonomous Seafloor System for Monitoring Reservoir Deformation

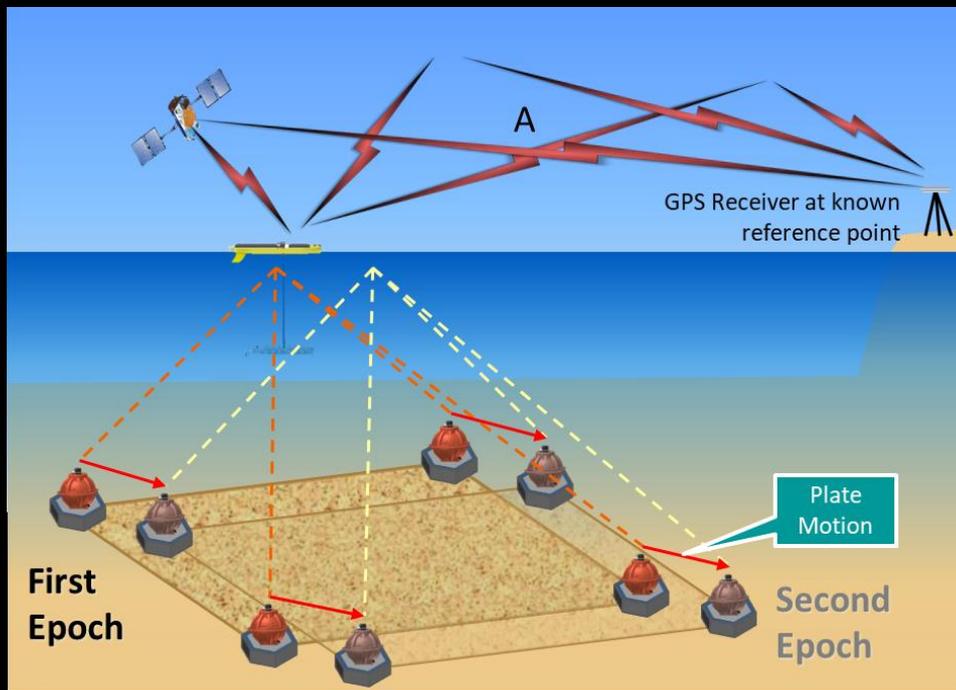
Stephen Bourne, Paul Hatchell, Chris Leaf, Hanno Klemm, Stefan Kampshoff, Andrew Cook - (SHELL), Simon Partridge - (Sonardyne International)



GPS-A



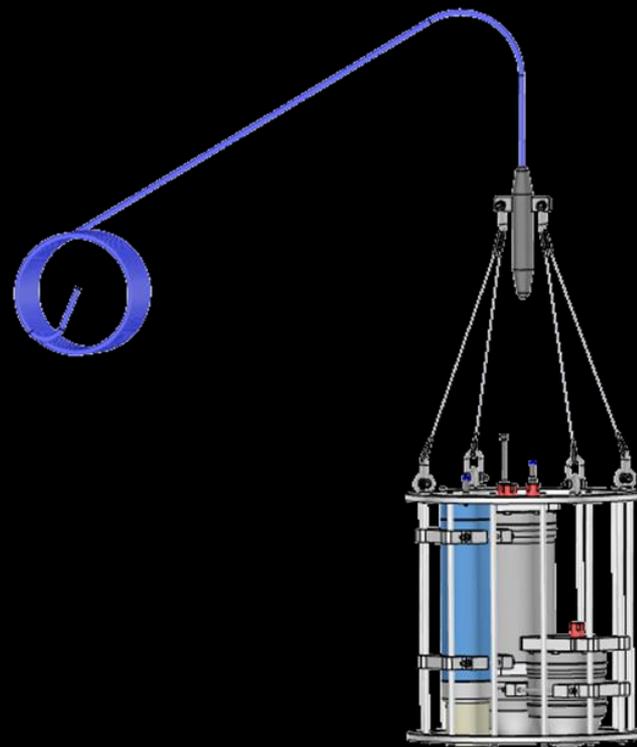
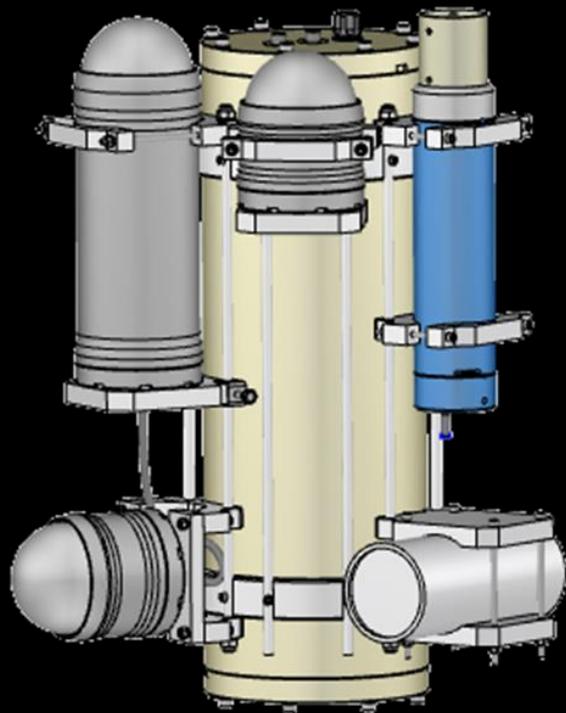
GPS-A



Chadwell and Spiess, 2008

Plate motion at the ridge-transform boundary of the south Cleft segment of the Juan de Fuca Ridge from GPS-Acoustic data. Article in *Journal of Geophysical Research Atmospheres*

BLUECOMM DUNKER



Optical communication system expands CORK seafloor observatory's bandwidth

N. Farr, J. Ware, C. Pontbriand, T. Hammar
Applied Ocean Physics and Engineering
M. Tivey
Geology and Geophysics
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 USA

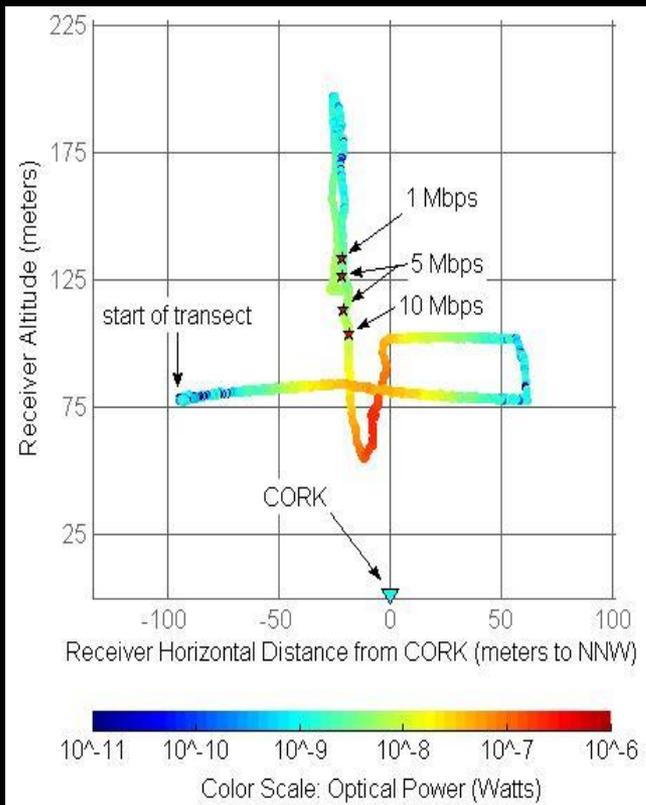
Max Range (meters) Data transfer rate (mbps)

108 1, 5, 10

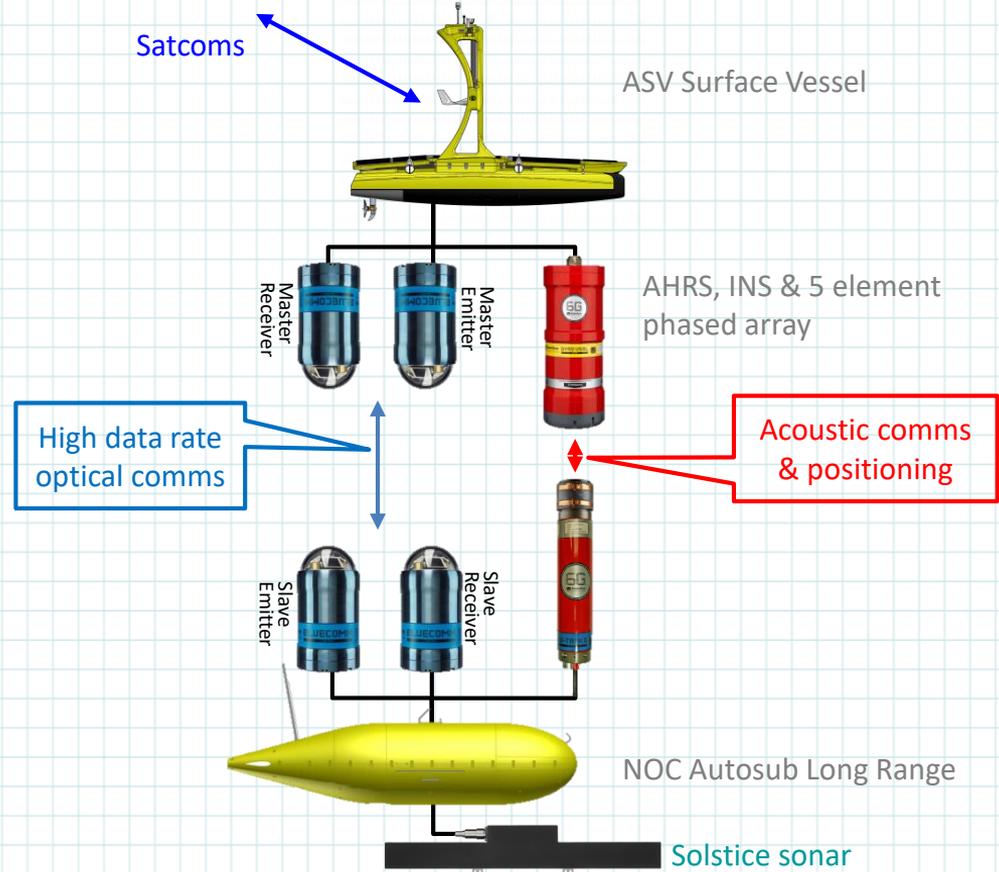
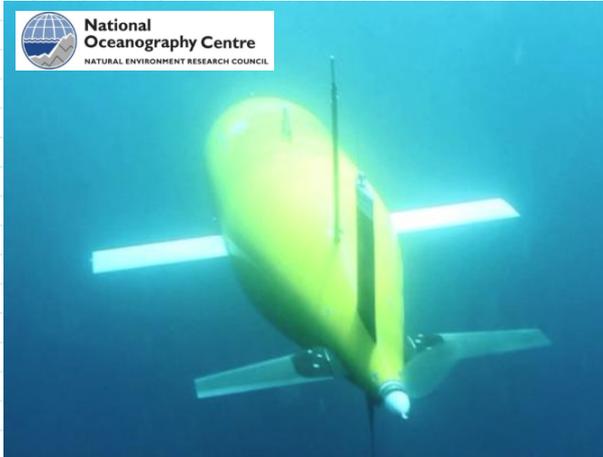
118 1,5

128 1,5

138 1



Autonomous Surface/Sub-surface Survey (ASSS) Project



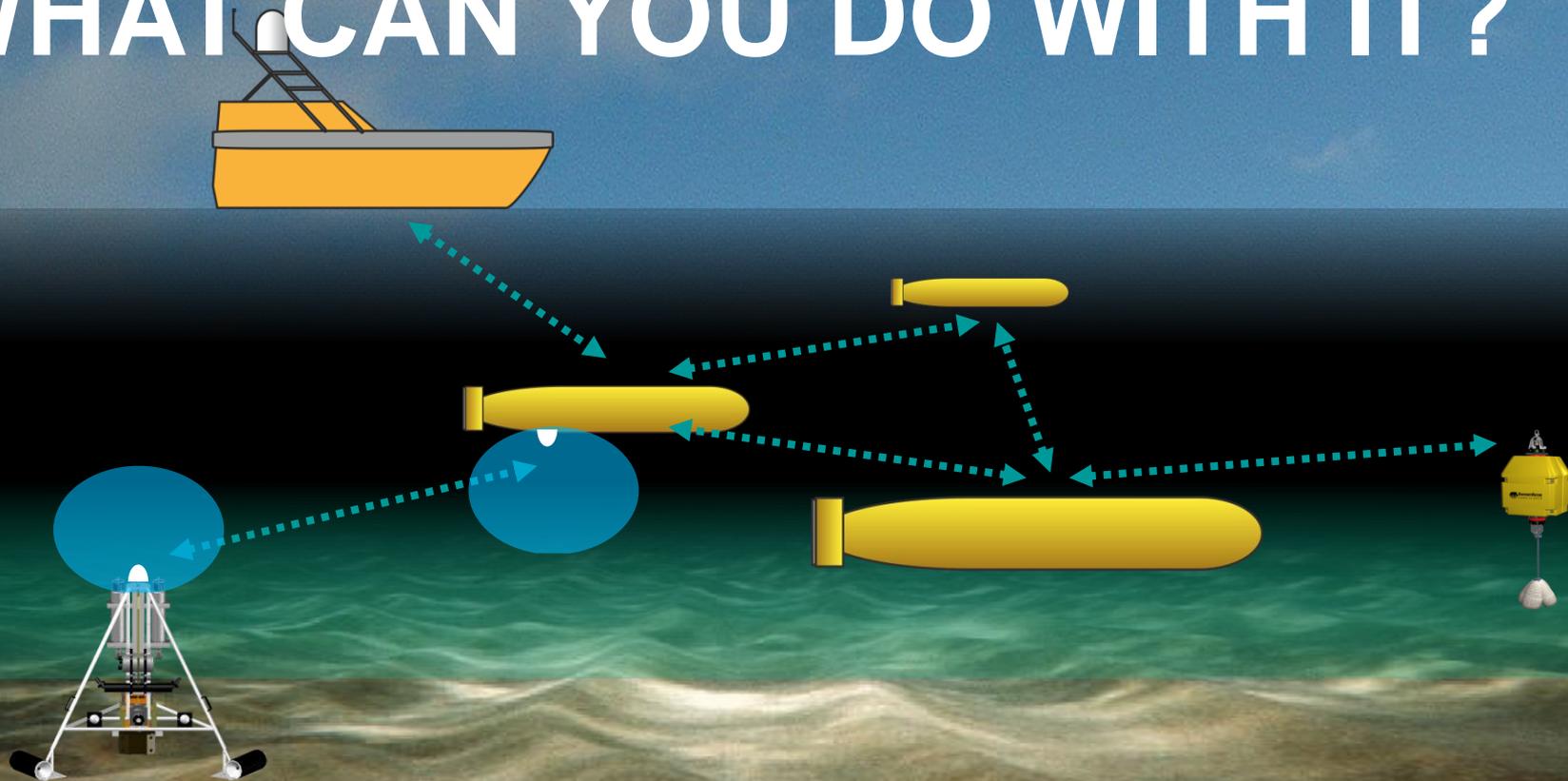
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AUV Intervention using Bluecomm Link

WORLDS FIRST AUV INTERVENTION @ NASA NEUTRAL BOUYANCY TANK

Video available at <https://www.youtube.com/watch?v=RaV9ZFGilBc>

WHAT CAN YOU DO WITH IT?





SUBSEA TECHNOLOGY

**Thank you for your time today
Any questions?**

SONARDYNE.COM



**POSITIONING
NAVIGATION
COMMUNICATION
MONITORING
IMAGING**