



# Using subsea wireless to improve safety and reduce intervention costs

Brendan Hyland  
Chairman  
WFS Technologies

FFU 2012

# WFS Background



## WFS Technologies

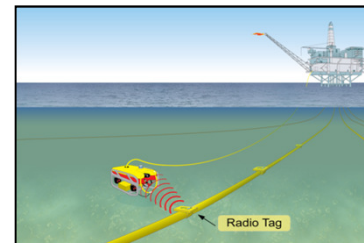
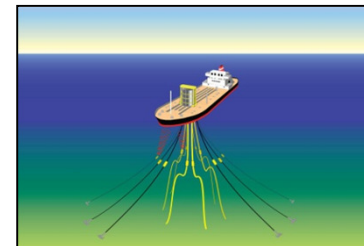
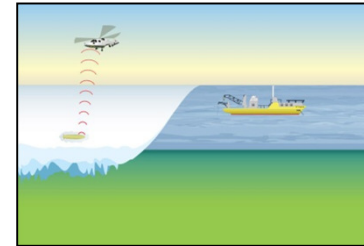
- Founded 2003
- UK & USA

## Wireless Solutions in Subsea and Defense for;

- Communications
- Navigation
- Power transfer

## Field proven product

- Field experience in N Sea and GoM



# RF Communications Through-Water



## First RF Communications

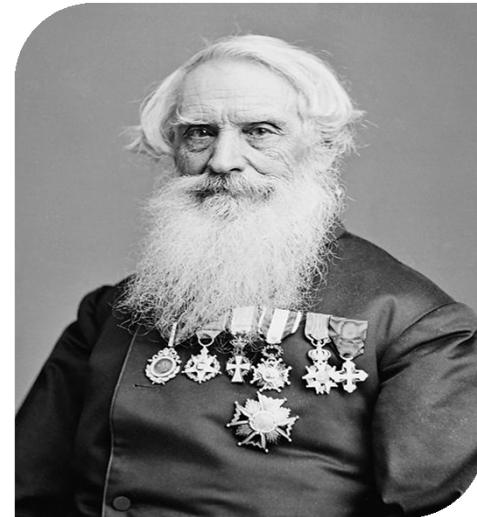
- Morse developed first experiments in 1842
- Tesla (1892): presented a submarine comms concept to US Navy
- Through-water research peaked 1950s-60s

## Technology developments

- Digital Signal Processing (DSP)
- Modelling capability
- Antenna design

## Market need

- Machine to machine communications
- Distributed networks; undersea vehicles
- Communication through water to air boundary
- Harmless to sea life



# Attributes of Low Frequency Radio



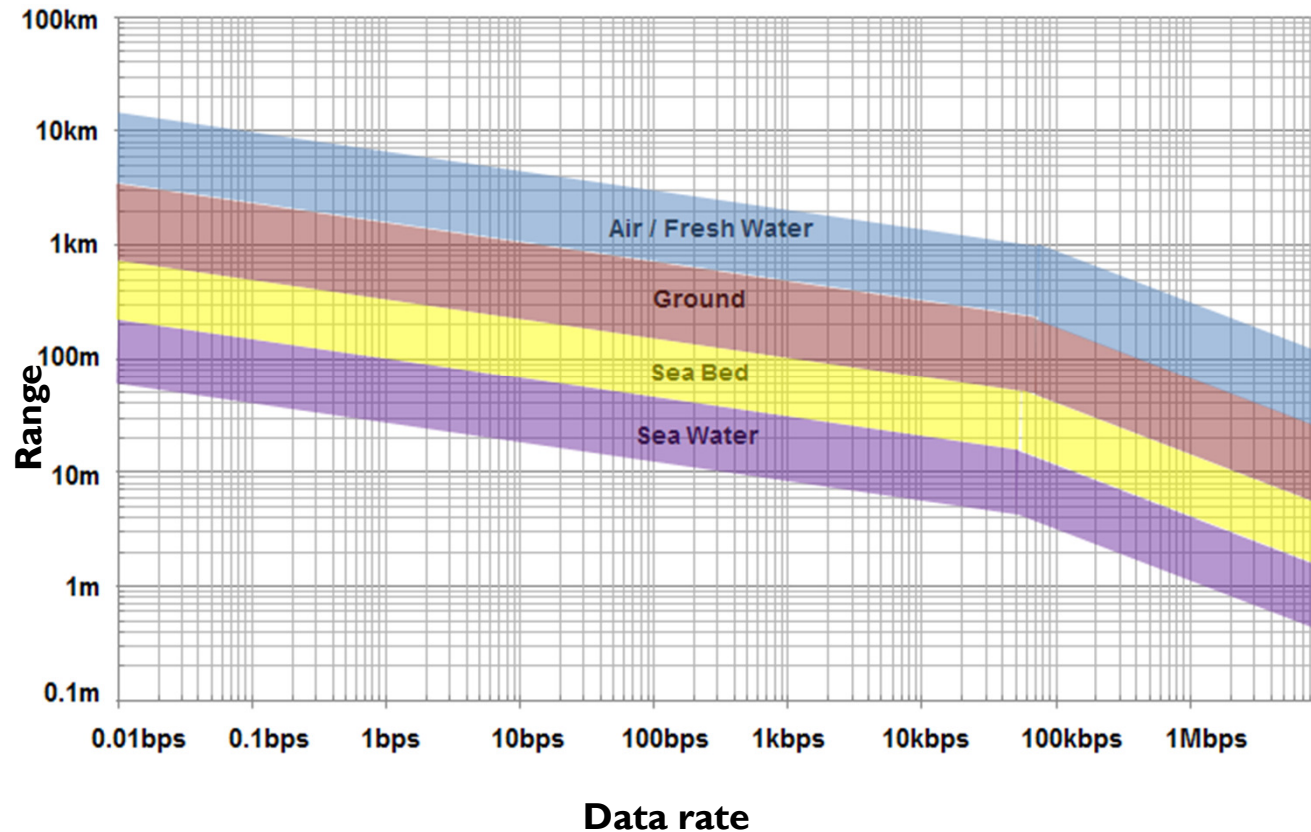
## Pros

- Unaffected by turbidity/bubbles
- Non-line-of-sight performance
- Immune to acoustic noise
- Transits water/air
- Transits water/seabed
- Unaffected by water depth
- Up to 10Mbps
- Complementary to other wireless technologies

## Cons

- Range-limited through water
- Susceptible to EMI (Electromagnetic interference)

# Range/Bandwidth Performance



## Range performance depends upon

- Conductivity
- Stratification
- Data Rate
- System parameters
  - Self Noise
  - TX power,
  - Rx sensitivity
  - Antenna Size
  - Signal processing

# Improving safety and reducing intervention costs with wireless

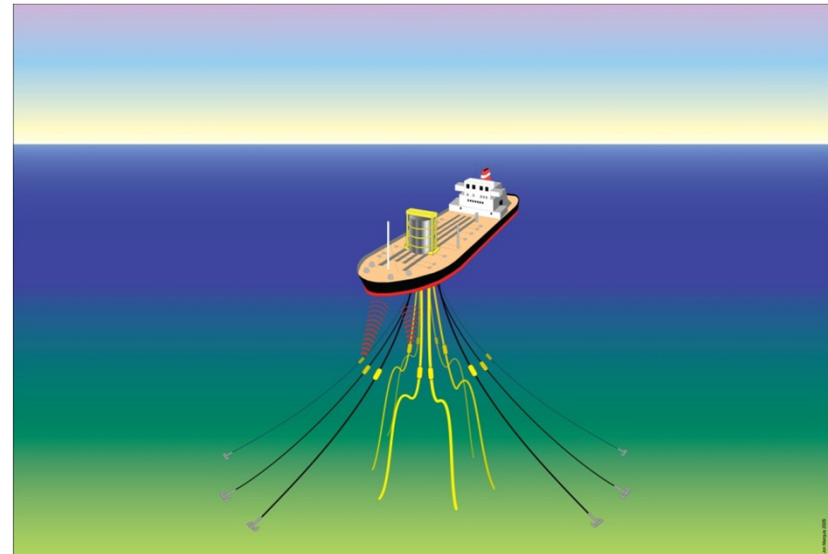
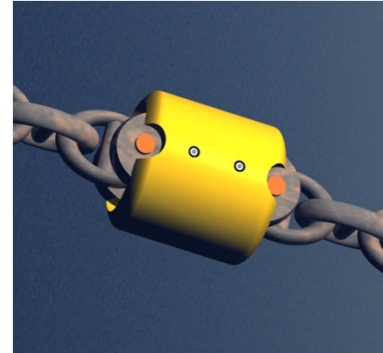


- Mooring Line Monitoring
- Wireless Black Box Recorder
- Wireless LMRP to BOP connector
- Wireless Riser Monitoring System
- Wireless Integrity Management sensors
- Wireless Camera
- Subsea Control System Maintenance
- Wireless Earth Leakage monitoring

# Mooring Line Monitoring



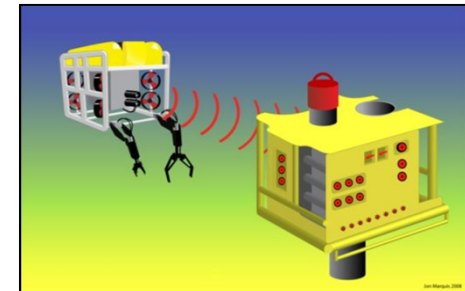
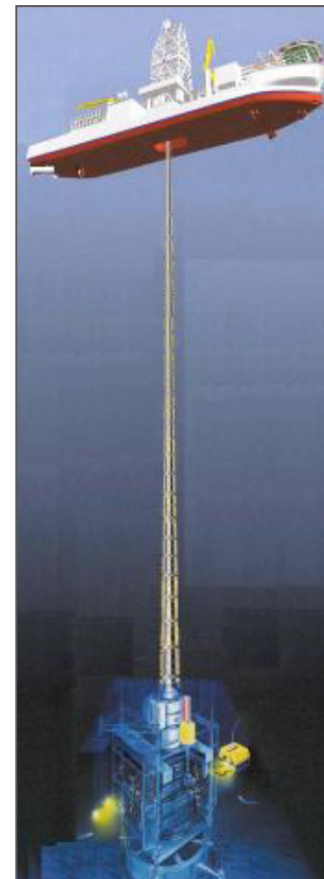
- **Problem:**
  - Conventional mooring line monitoring systems use acoustic
  - Reliability issues in adverse sea conditions
- **Solution:**
  - Radio or hybrid radio-acoustic monitoring of load cells
  - Radio immune to noise from heavy weather
  - ➔ Increased reliability of mooring line monitoring
  - ➔ Increased safety



# Wireless Black Box Recorder



- **Problem:**
  - Local recording and retrieval of critical sensor data
  - Local recording and retrieval of maintenance life history of subsea assets
  - Rapid access to critical data
- **Solution:**
  - “wireless black box recorder” to record data while attached to subsea structure
  - Data can be recorded but also transmitted wirelessly to nearby ROV
  - Signal emitted if displaced, to allow box to be located
  - ➔ Increased integrity of critical assets
  - ➔ Faster, more accurate response in emergencies

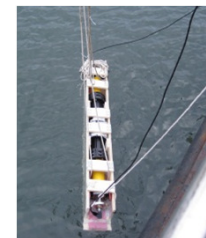




# Wireless LMRP to BOP Connector



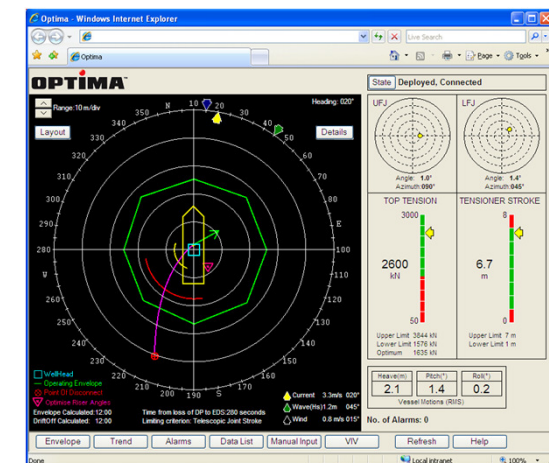
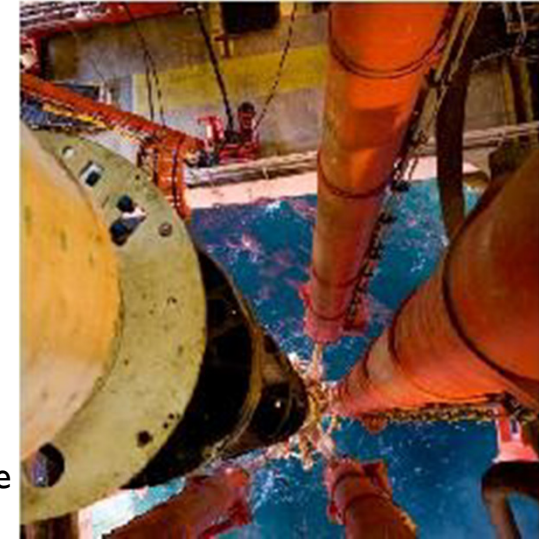
- Problem
  - Standard connection between LMRP and lower BOP stack made with wet-mate connector
  - Multiple disconnects and reconnects compromises connectors leading to failure
  - Failed connector on BOP leads to extended downtime
  - Re-mating connectors is time-consuming, precision operation
- Solution
  - Wireless data + power
  - Radio delivers reliable, non wet-mating communications
  - Comms link set up prior to re-connect
  - Power transferred by inductive coupling
  - ➔ Ultra high reliability connection
  - ➔ Increased uptime



# Wireless Riser Monitoring System



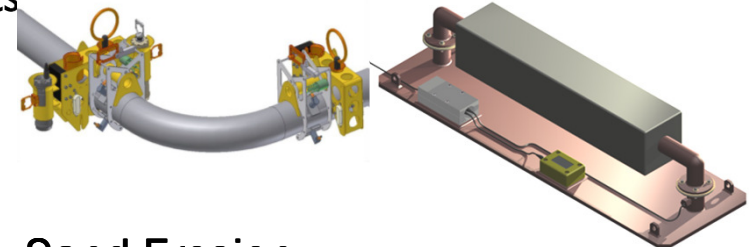
- **Problem:**
    - Riser life reduced when insufficient data from sensors in critical locations to determine condition
    - Challenging and/or expensive to use umbilicals in optimum locations
  - **Solution:**
    - Deploy wirelessly enabled sensors
    - Harvest data to nearby ROVs or via wireless networks to surface
    - Wood Group Integrity Management (MCSKenny), Fugro, WFS
      - jointly developed Optima Wireless to monitor deep water risers and fatigue
      - Response monitored in **real-time** to predict signs of early failure
      - Tracking of **real-time** load on system allows an accurate estimate of “safe working life”
      - Low cost installation on green and brown field sites
      - Sensors can be fitted in ‘hard to reach’ locations
- ➔ Extend equipment life
- ➔ Reduction risk of environmental incidents



# Wireless Integrity Management Sensors

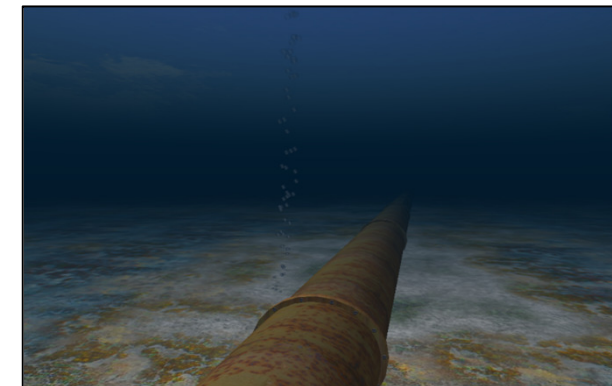


- **Problem:**
  - Lack of local power or data : expensive to retrofit integrity management sensors on ageing infrastructure
  - Lack of reliable data can lead to environmental incidents and significant down-time
- **Solution:**
  - ‘sealed for life’ integrity management sensors
    - WiSPureCP: cathodic protection system with integrated data logger
    - ClampOn DSP Corrosion-Erosion Monitor
  - Wireless retrieval of data using broadband radio comms to ROV or AUV
  - Wireless recharging by ROV or AUV
- ➔ Extended life of asset;
- ➔ lower maintenance costs;
- ➔ lower risk of major incident



Sand Erosion Monitor

Cathode Monitor



# Wireless Camera



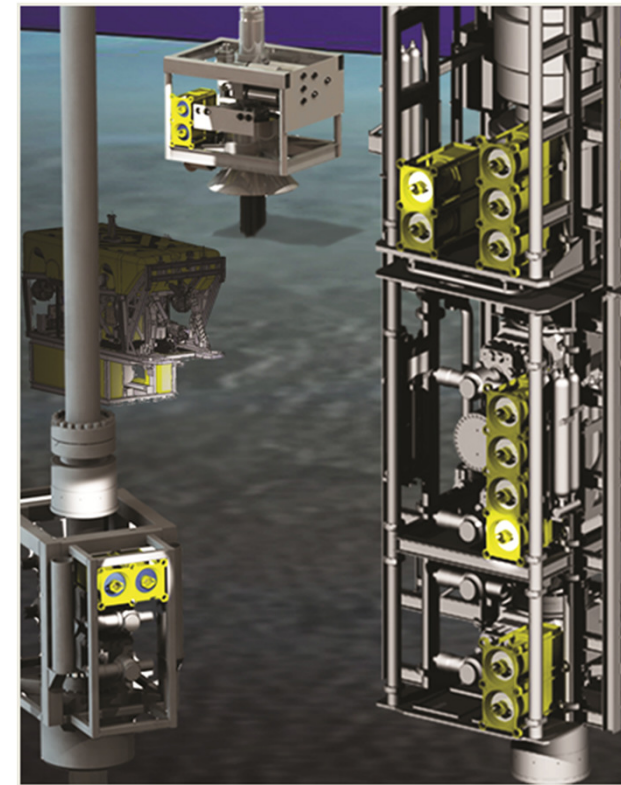
- **Problem**
  - 'perspective' when undertaking complex ROV tasks
    - Hot stabs
    - Construction
  - Avoid 2<sup>nd</sup> ROV in the water
  - Avoid jumpers
- **Solution**
  - Wireless camera clamped near to target
  - Real time streaming video during precision operation
  - ➔ Increased ROV safety
  - ➔ Reduced operating times



# Subsea Control System Maintenance



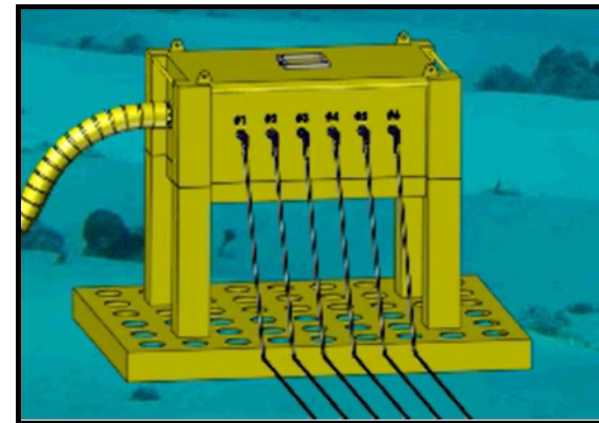
- Problem
    - Subsea systems with CPUs require maintenance
      - Remote on/off switch
      - Re-flash memory
      - Interrogate and troubleshoot
  - Solution
    - Integrated radio to provide switch and high speed 2-way data download
- ➔ Reduced commissioning and maintenance costs



# Wireless Earth Leakage Monitoring



- **Problem:**
  - Conventional earth leakage systems are unable to monitor cables through a subsea transformer
  - Time consuming and expensive to locate and repair earth leakages
- **Solution:**
  - Install wirelessly enabled subsea earth leakage monitoring system on far side of transformer
  - ROV interrogates earth leakage monitor
  - ➔ Earth leaks located more rapidly and at reduced cost
  - ➔ Reduced down-time



V-Slim  
Subsea Earth Leakage Monitor

# Subsea Wireless Group (SWiG)



WFS is part of the Subsea Wireless Group (SWiG), a not-for-profit organization, established to promote and direct the use of through water communication technologies within the oil and gas sector.



Monitor Systems  
Scotland Limited



SAFETY  
NONSTOP



[www.subseawirelessgroup.com](http://www.subseawirelessgroup.com)

# Subsea Wireless Group (SWiG)



- SWiG members are working together to define standards that facilitate interoperability between users subsea wireless technologies
- SWiG will engage with relevant standards bodies, encourage the integration of wireless technologies, and promote best practices across the industry
- SWiG provides a forum for new ideas to be shared, and for business connections to be made
- Formally known as Subsea Radio Users Group (SRUG) but focus shifted after substantial industry interest.



[membership@subseawirelessgroup.com](mailto:membership@subseawirelessgroup.com)



Thank You!



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## Product Specification

### Operating Range/Environment:

<b>Range</b>	<ul style="list-style-type: none"><li>• internal antenna: to 1.5m through seawater</li><li>• external antenna: to 3m through seawater</li></ul>
<b>Depth Rating</b>	<ul style="list-style-type: none"><li>• 100m (standard)</li><li>• 350m—4000m (option)</li></ul>
<b>Operating Temperature</b>	-10 to + 35°C
<b>Storage Temperature</b>	-20 to + 50°C

### Interfaces:

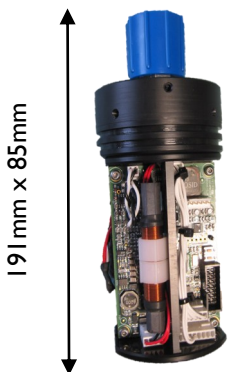
<b>I/Os</b>	2 x 4-20mA inputs 4 x Digital outputs 2 x Digital inputs
<b>Data Interfaces</b>	RS232, RS485, RS422, Analogue (standard) Ethernet (optional)
<b>Data Rate</b>	2400 kbaud
<b>Power Supply</b>	Choice of 24V external power supply or rechargeable internal batteries
<b>Power Consumption</b>	<ul style="list-style-type: none"><li>• 0.05W - 0.18W Rx</li><li>• 0.6W Tx</li><li>• 0.05W Idle</li></ul>

### Physical Characteristics:

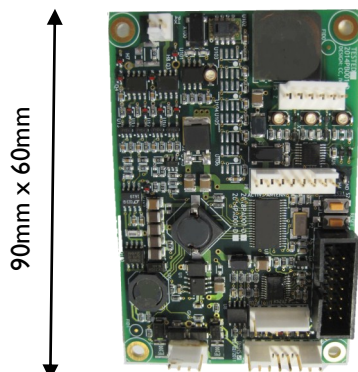
#### Dimensions

PCB Board size: 90mm x 60mm or 78mm x 53mm  
100m—350m enclosure: 191mm x 85mm  
4000m enclosure: 465mm x 170mm

100m—350m enclosure



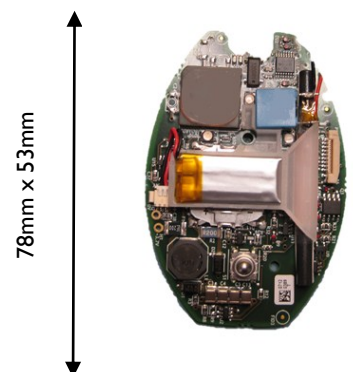
OEM version of S100  
(Analogue inputs)

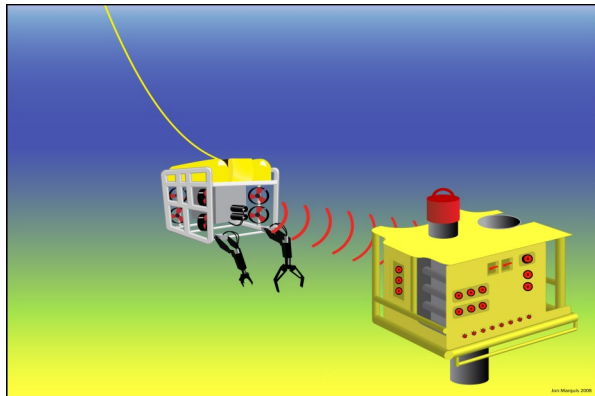


4000m version of S100



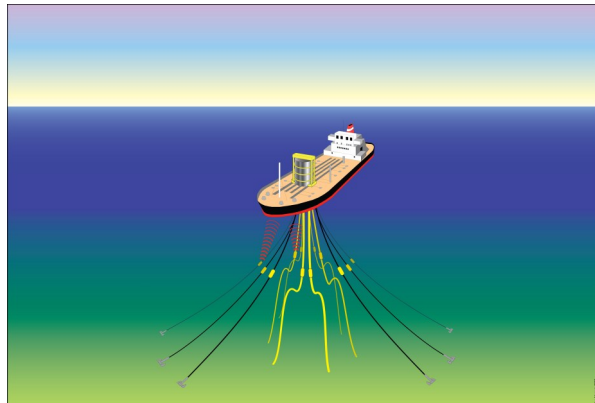
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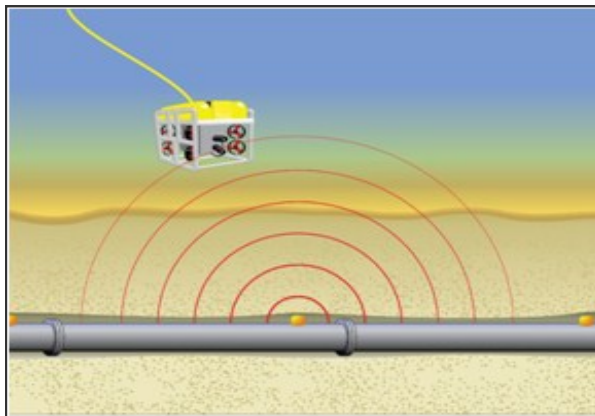
## Safety: Wireless Backup

- Control maintained in the event of equipment failure
- Real time, low latency control signals
- Wireless initiation of an alarm, an emergency disconnect sequence or valve actuation
- Additional layer of redundancy for challenging operations
- Unaffected by turbidity, aeration or acoustic noise



## Improved Efficiency: Subsea Monitoring

- Remote monitoring on subsea equipment (e.g. load, strain)
- Sensors can be located in “hard to reach” areas
- No hard cabling, simple deployment and retrofit
- More data for operational decision-making
- Extend working lifetime of deployed assets



## Integrity Management: Wireless Sensors

- Standard interfaces for wireless data communication with underwater vehicles
- Wireless harvest of data from subsea sensors
- Simple and flexible deployment of wireless subsea sensors
- More frequent and easier access to data — no wet mate connectors
- Reduced cost of intervention, surface support not required

## CONTACT US

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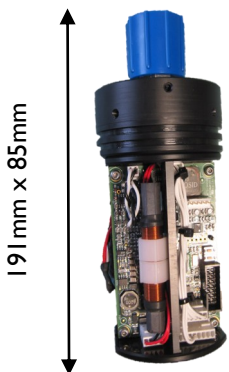
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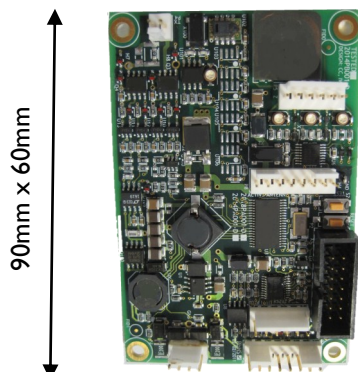
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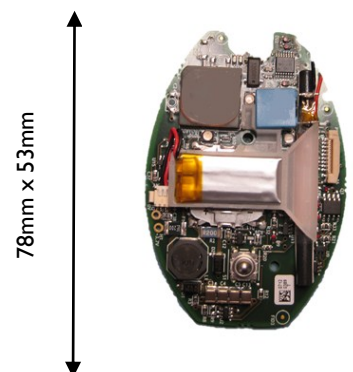
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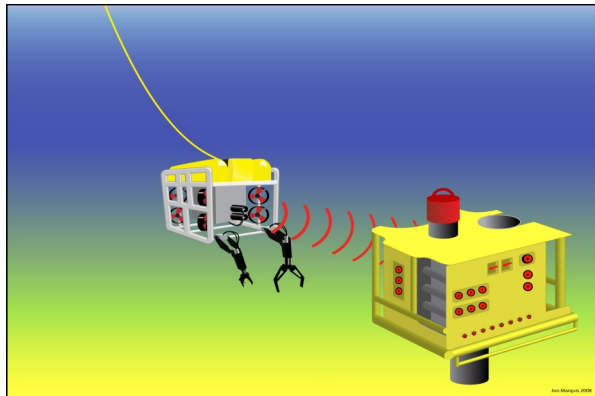


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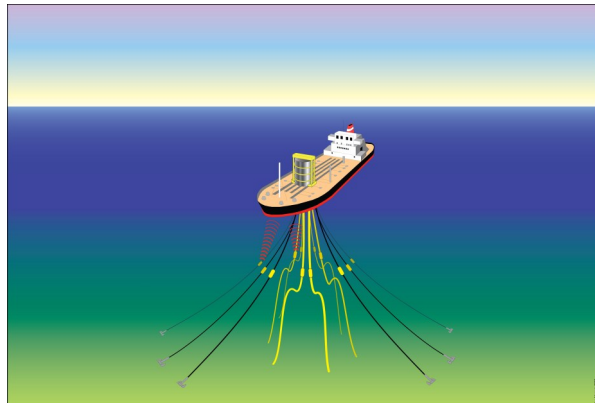
OEM version of S100





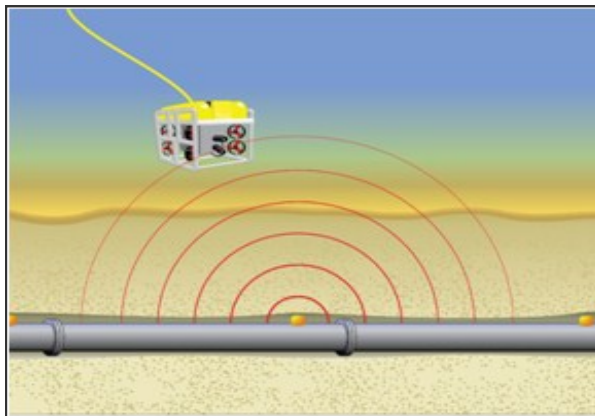
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## Through-water broadband radio data link

**seatooth® S300** uses the latest patented radio frequency (RF) technology to enable high data rate transmission over a short range, through-water and ground and highly accurate navigation at short range.

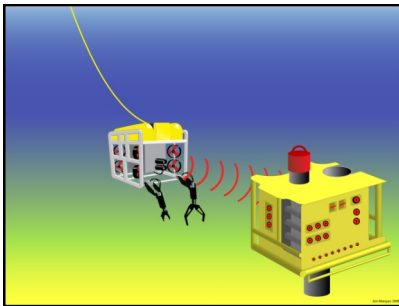
Applications include high speed data transfer between underwater sensors and unmanned underwater vehicles (ROVs and AUVs).



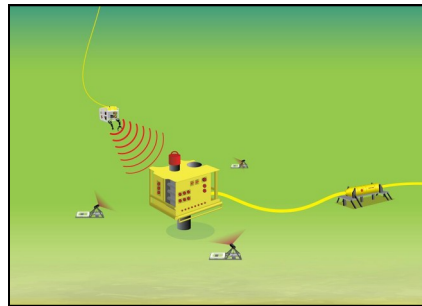
### TARGET APPLICATIONS

- UUV data harvesting
- UUV communications
- Wireless camera
- Inter-asset communications
- AUV docking solutions
- Inspection of ocean energy devices
- Test tank communications

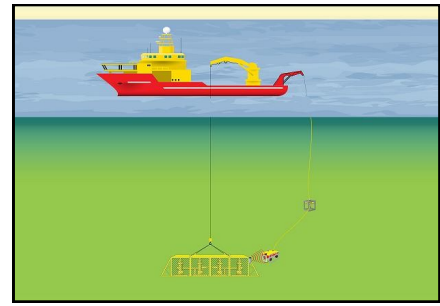
#### CONDITION MONITORING



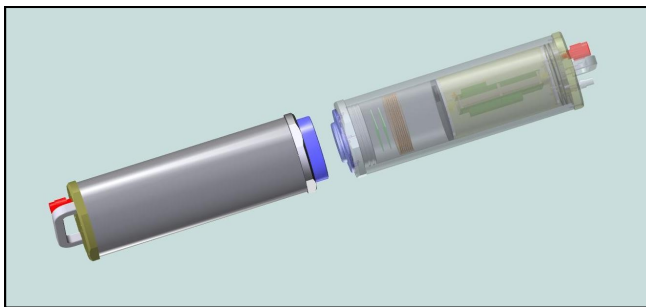
#### WIRELESS CAMERA



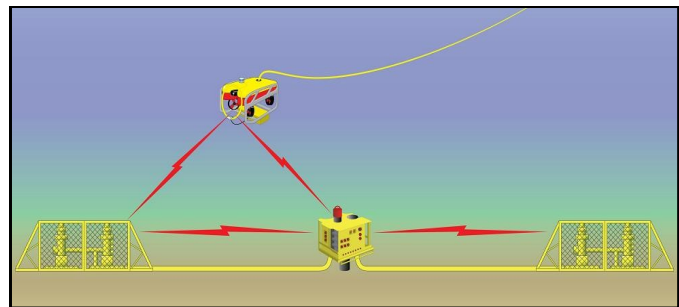
#### CONSTRUCTION SUPPORT



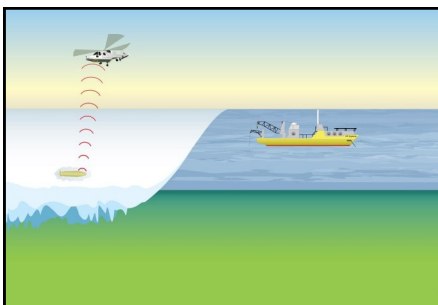
#### WIRELESS DATA AND POWER



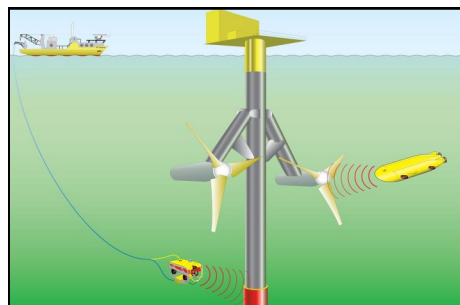
#### INTER-ASSET COMMUNICATIONS



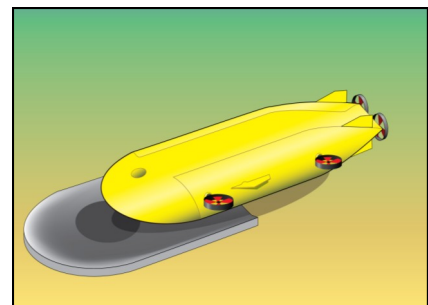
#### THROUGH-ICE COMMS



#### INSPECTION: OCEAN ENERGY DEVICES



#### AUV DATA & POWER



# Through-water broadband radio data link

## FEATURES

- Two-way communication
- Crosses water/air interface
- Low latency
- High data transfer rate
- Supports mesh networking
- Easy integration with third party systems

## BENEFITS

### FLEXIBLE DEPLOYMENT

- In littoral waters or near offshore facilities and vessels generating acoustic noise
- In shallow/congested environments such as harbours or estuaries
- In high turbidity or shallow water
- Immunity to multi-path
- Immunity to thermal layers/refraction
- Negligible Doppler shift

### LOW IMPACT

- Avoid wet-mating of connectors at depth or complex vehicle docking
- Unobtrusive and covert
- Does not interfere with acoustic sensors or sonar

### IMPROVED OPERATIONAL PERFORMANCE

- Reduced operating costs and time
- Reduced power consumption
- Shorter download times, and faster access to data
- Connects to existing communications infrastructure (GSM, GPRS, VHF, UHF, Web)

## TECHNICAL SPECIFICATIONS

### SYSTEM PERFORMANCE

- Range: 2m - 10m through seawater
- Data Rate: 156 kbps
  - 1 mbps option available on request

### ANTENNA

- 0.5 m Squariel (standard)
- 0.1m - 1m (custom)

### DATA

- Interface Transparent Ethernet
- Compatible with TCP/IP & UDP packets

### POWER REQUIREMENTS

- Each unit
  - Transmitting 24Vdc, 660mA
  - Receiving 24Vdc, 190mA
- Supply can be from external battery packs or from interface to third party supply

### ENVIRONMENTAL

- Depth rated to 350m
  - 4000m available on request
- Temp. operating -10 to + 35°C
- Temp. storage -20 to + 50°C

### PHYSICAL

- Size: 250mm x 150mm



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