

# Marine & Subsea Equipment

Diving into claims arising from the deep

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# Presenters



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- Michael joined Charles Taylor Adjusting in December 2013. He has worked in the London Insurance Market for over thirty-five years in Broking, Underwriting, and Claims and, since 1996, as a Loss Adjuster in the Energy Sector.
- During his Loss Adjusting career Michael has handled claims arising from incidents at offshore and onshore locations for both upstream and downstream operations and insurances written on various standard and bespoke wordings.



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- Alasdair graduated with a BSc in Marine Geography in 2012 and joined Charles Taylor Adjusting after five years working offshore as a Hydrographic Surveyor for a leading global services provider operating in the dredging, maritime infrastructure and maritime services sector.
- He now employs his technical and intercultural communication skills adjusting global Marine Equipment losses within the Energy team.



# Marine & Subsea Equipment

- Diving Equipment
- Ploughs
- Trenchers
- Mining Tools
- Manned Submersible
- Oceanographic Survey Equipment
- Marine Seismic Acquisition Equipment
- Autonomous Underwater Vehicles (AUV)
- Unmanned Surface Vehicles (USV)
- Remotely Operated Vehicles (ROV)
- Remotely Operated Towed Vehicles (ROTV)



# Agenda

## 1. Technical Overview

- Seismic Streamers
- Remotely Operated Vehicle (ROV)
- Autonomous Underwater Vehicle (AUV)

## 2. Scope of Insurance Cover

### **Break**

## 3. Role of the Loss Adjuster

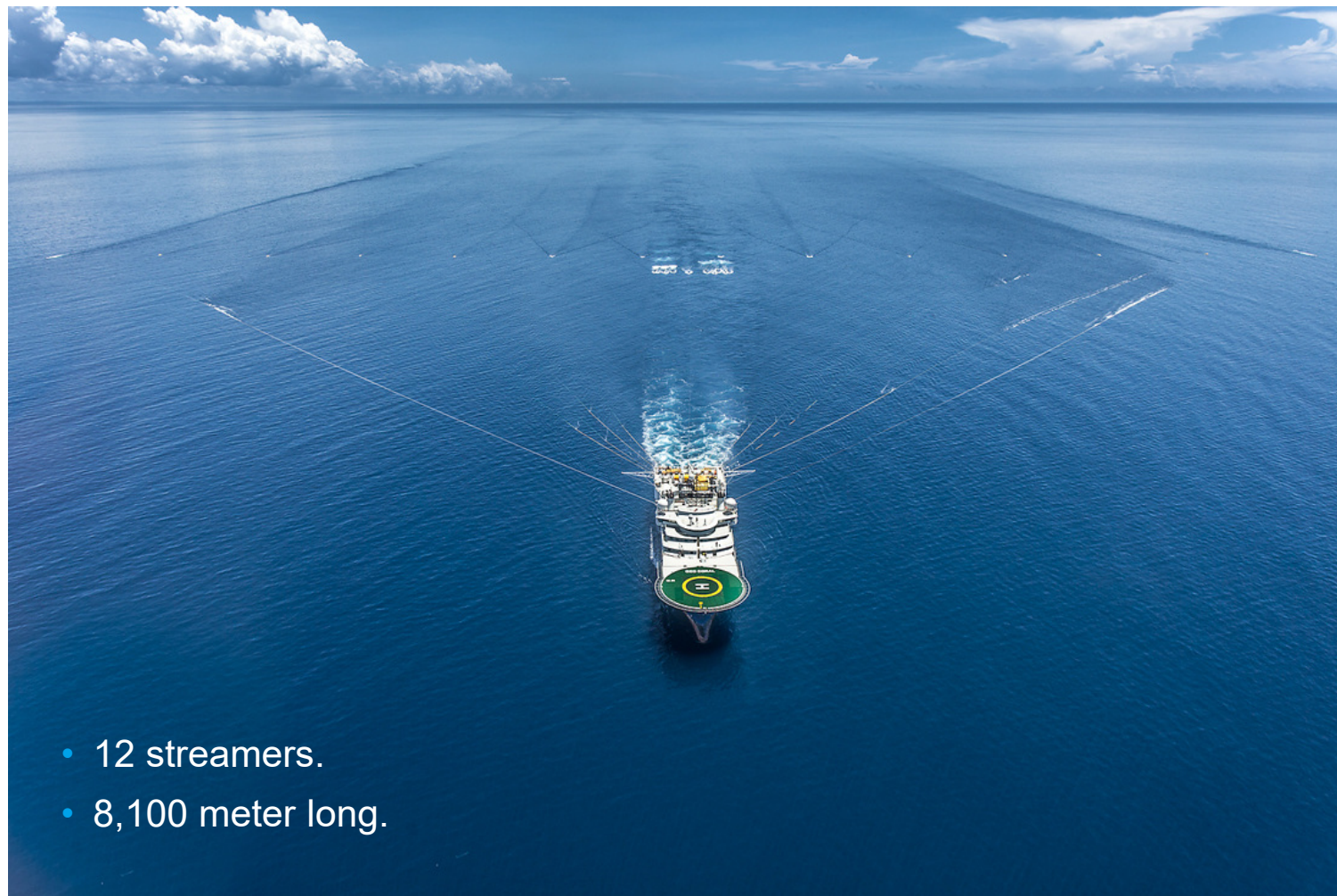
## 4. Coverage Matters

## 5. Collaborative Group Work

## 6. Disruptive Technology



# Seismic Streamers

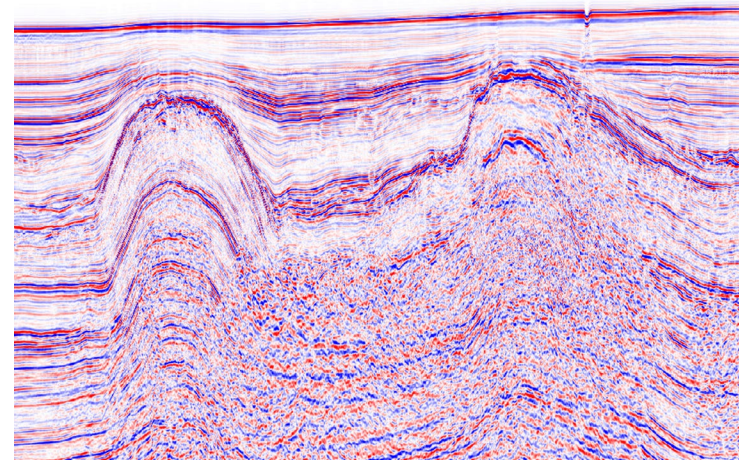
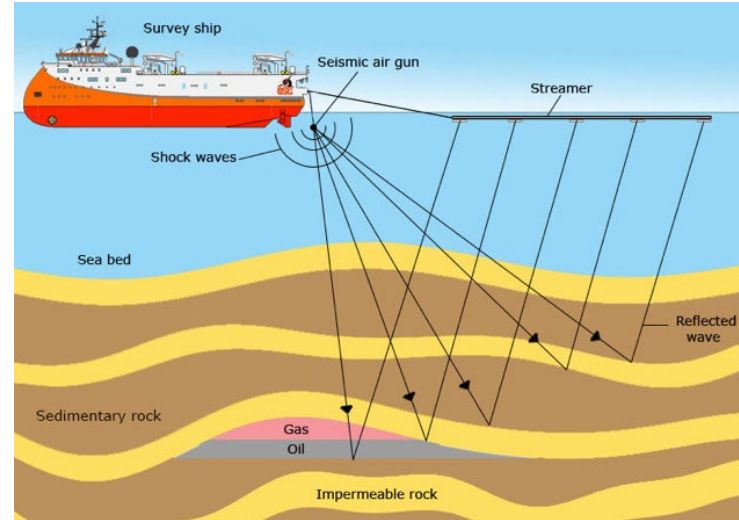


- 12 streamers.
- 8,100 meter long.



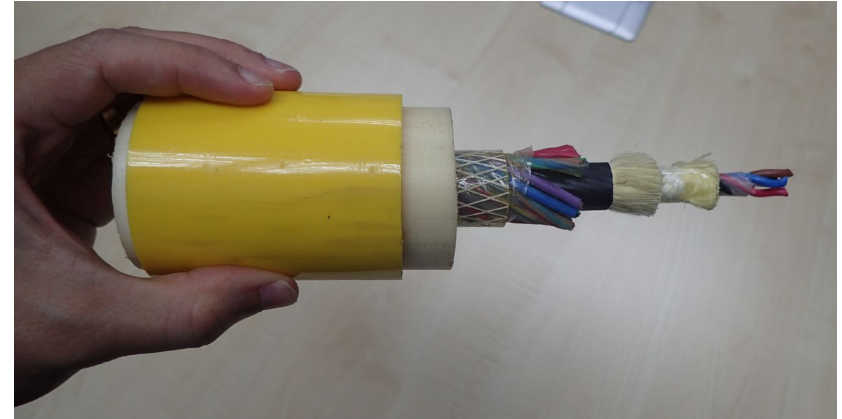
# Seismic Streamers – Applications

- Hydrocarbon Exploration.
- Hydrocarbon Reservoir Monitoring.
- Reflection seismology – estimates the properties of the subsurface from reflected seismic waves.
- Indirect hydrocarbon indicators:
  - Source rock
  - Reservoir rock
  - Cap rock
- Direct hydrocarbon indicators:
  - Flat Spots



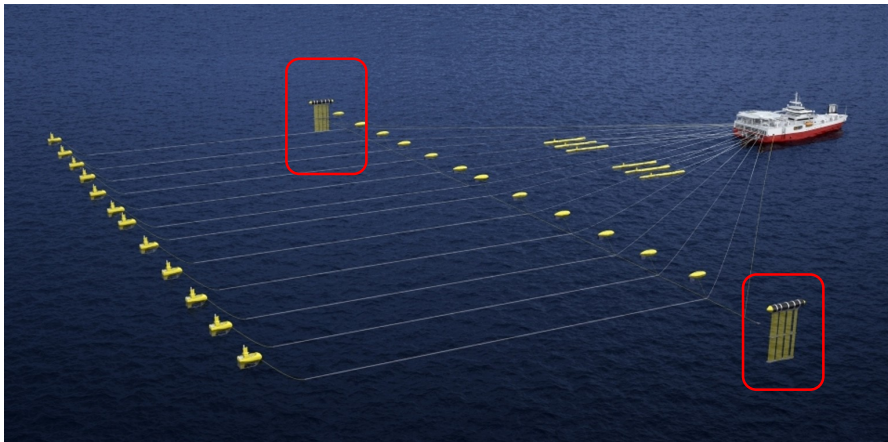
# Seismic Streamers – Active Sections

- Solid or liquid filled streamers.
- Current record for the largest seismic spread is 16 streamers, each 8.1km long.
- Some vessel are capable of towing 24 streamers.
- Some streamers can be up to 15.7 km long.
- A streamer is mainly comprised of active sections which are usually 150 meters long.
- Each active section approx. USD 50,000.
- Each active section will typically have 96 hydrophones, split over 12 groups of 8.
- Hydrophones convert the reflected seismic energy into digital form.



# Seismic Streamers - Barovanes

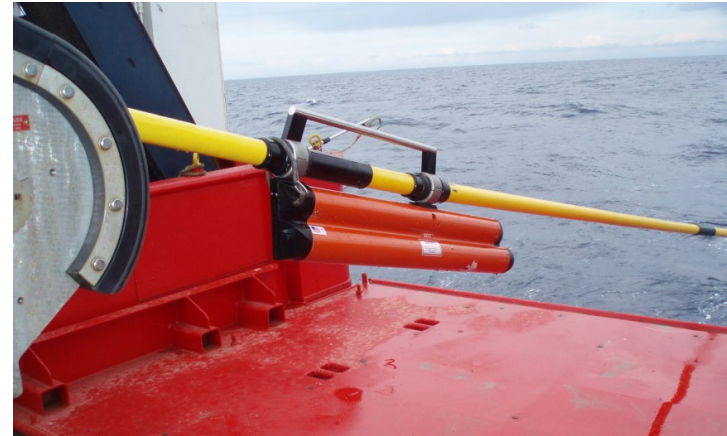
- Barovanes are used to spread the streamers anywhere between 50-100m.
- The widest seismic spread on record is 18 streamers with 100 meter separation. This makes a total spread of 1.7 km.





# Seismic Streamers - Streamer Recovery Device (SRD)

- An SRD assists in recovery of a streamer that has been accidentally severed from the tow vessel.
- In the event that a streamer is severed from the tow vessel, the streamer will start to sink as it loses momentum.
- These devices are placed at specified intervals (300 meters maximum).
- When the streamer sinks to a certain depth, the SRD is automatically activated and releases compressed CO<sub>2</sub> into a lift bag.
- Increased buoyancy raises the streamer to the surface.



# Seismic Streamers – Maintenance Measures

- Marine growth increases drag, which slows down operations, increases fuel use and adds unnecessary strain on the towing and acquisition equipment.
- The presence of marine growth can also generate noise that affects the quality of the data.
- Seismic companies have developed and are employing automated cleaning units which pass over the streamer and remove marine growth during acquisition.
- Previously, manual cleaning and scraping were often the only effective measures to mitigate barnacle related problems.



# Seismic Streamers – Incidents

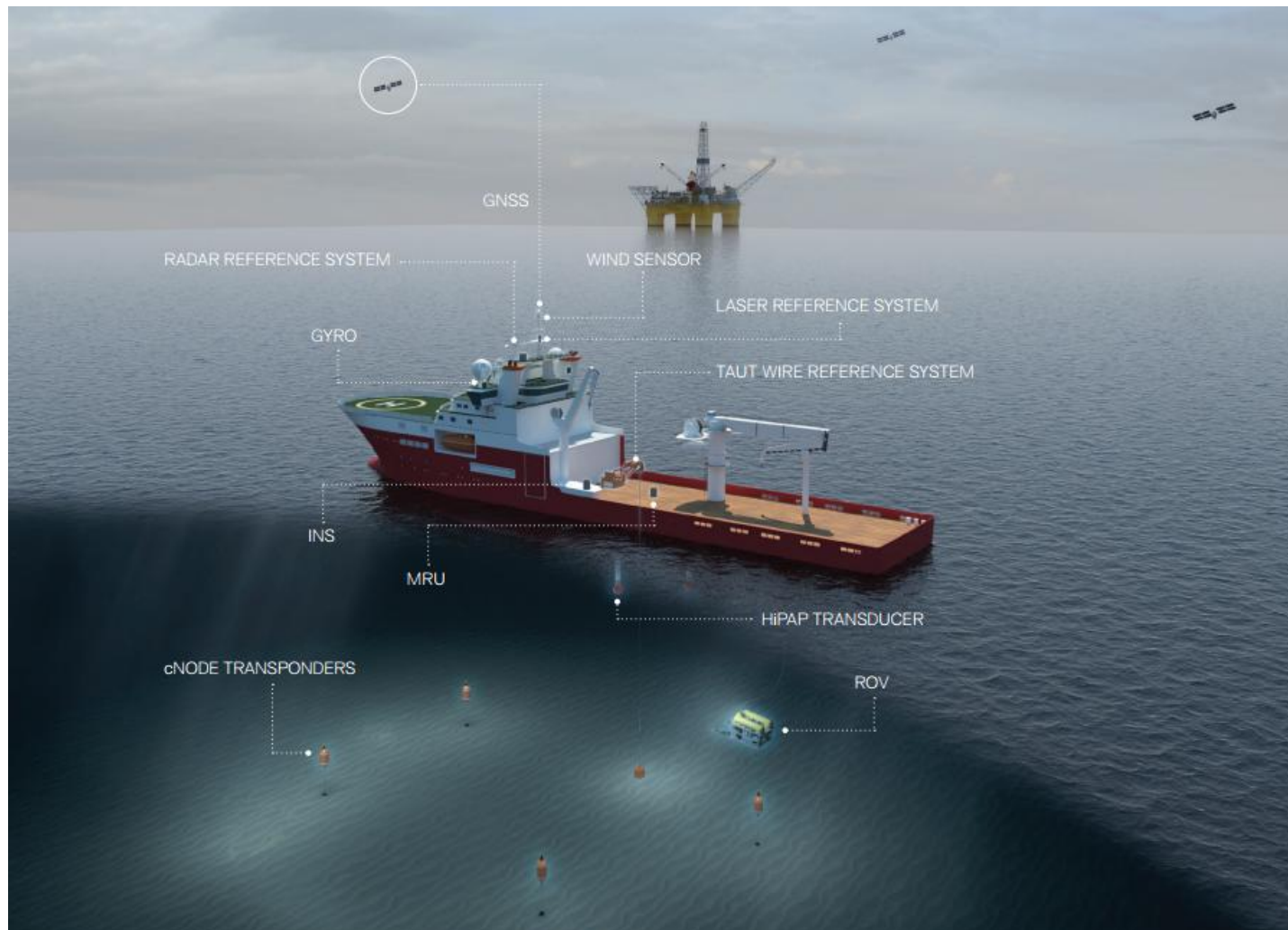
- Barovane Failures
- Contact with Floating Debris
- Spur Line Failures
- Separation Rope Failures
- Collapsing Array
- Streamer Entanglement
- Tension Induced ‘Doughnuts’
- Tension Induced Streamer Parting
- Depth Compression
- Failed Recovery



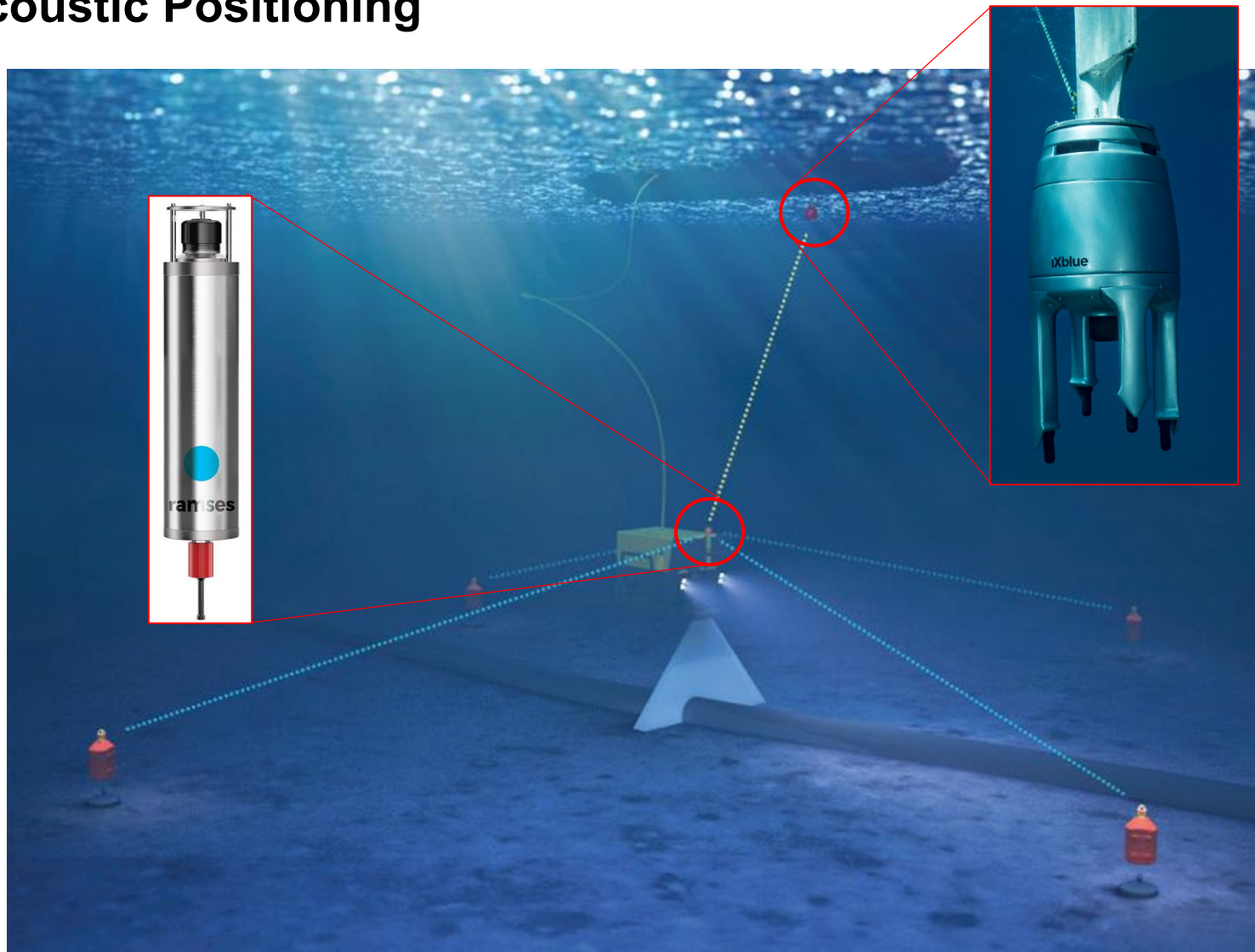


# Quiz: Round 1

# Acoustic Positioning



# Acoustic Positioning

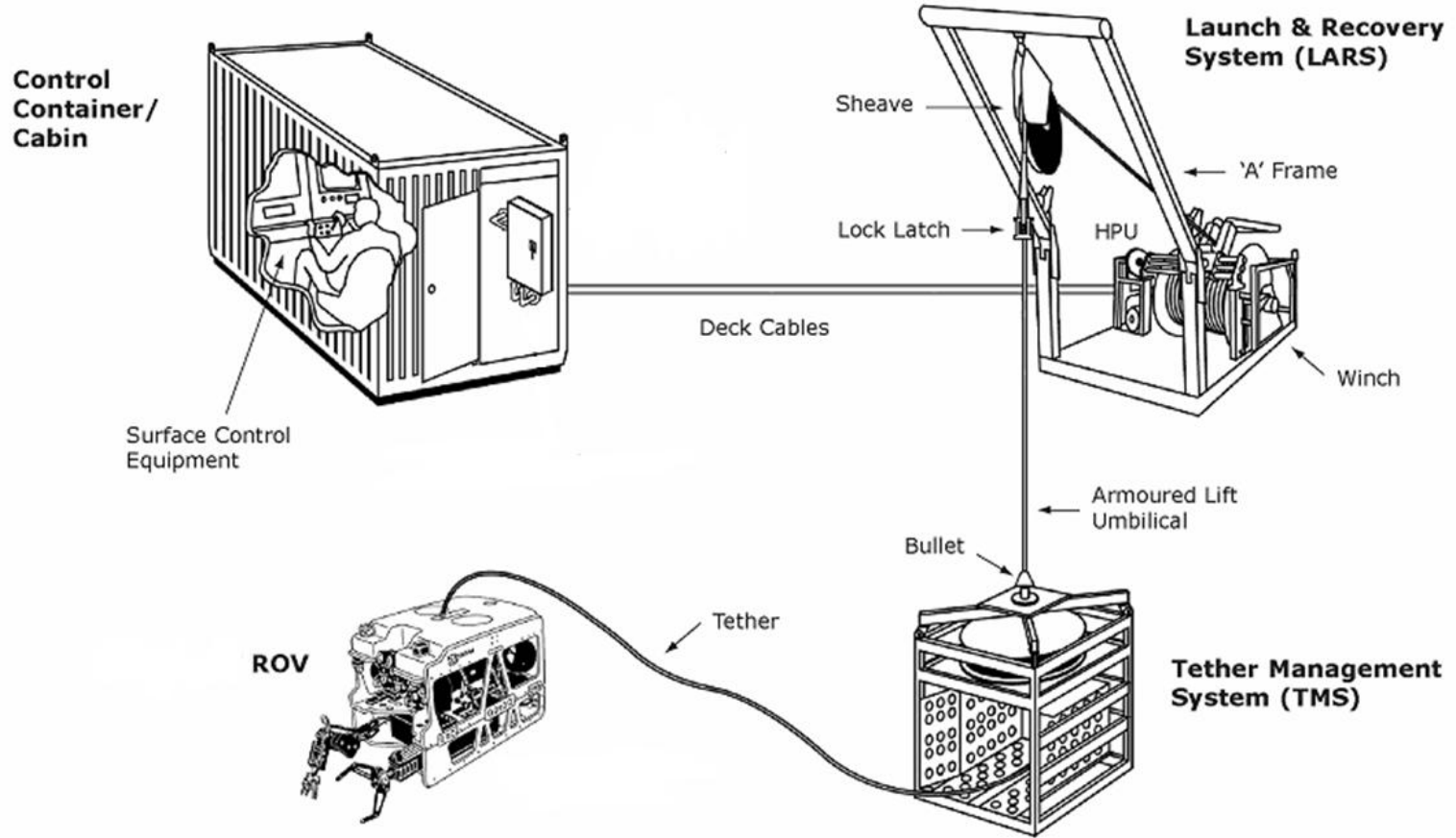


## Acoustic Positioning

*'The Insured Equipment to be fitted with an acoustic beacon and Support Vessel fitted with a compatible acoustic sensing system'*



# Basic ROV System





# ROV – System Components

## Topsides

- Control Van
- HPU/Switchgear
- LARS
- Umbilical



# ROV – System Components

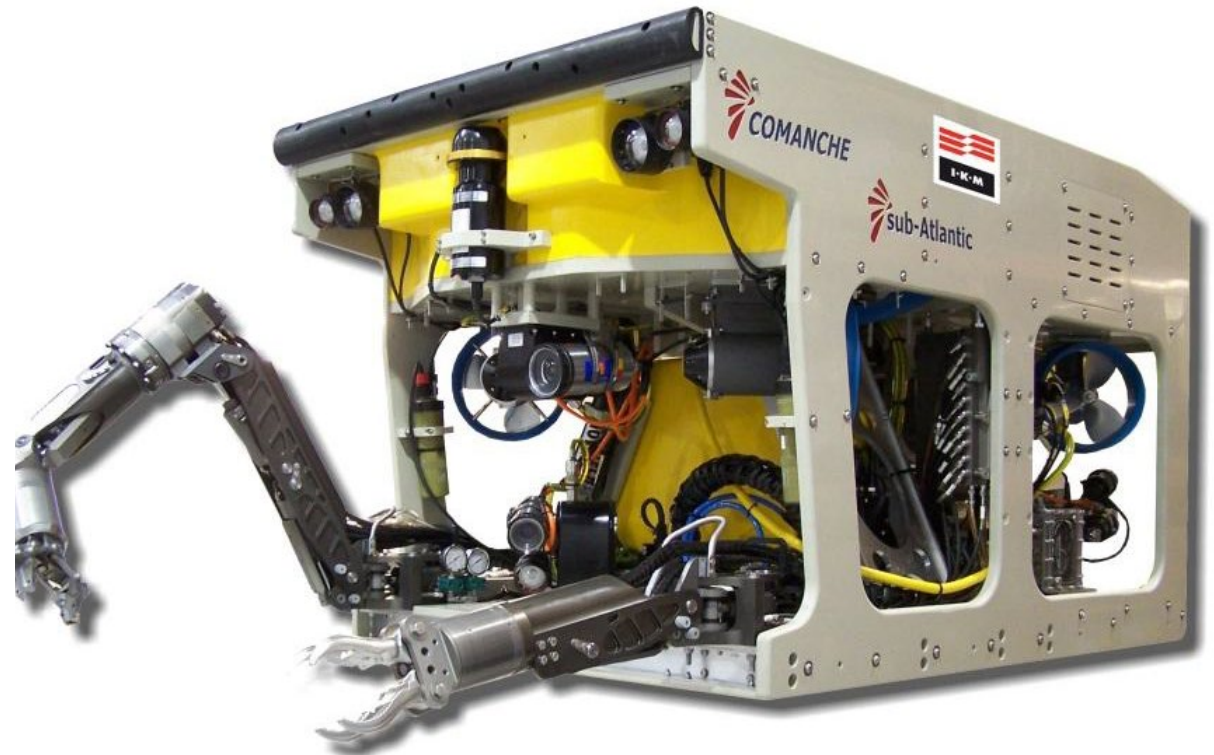
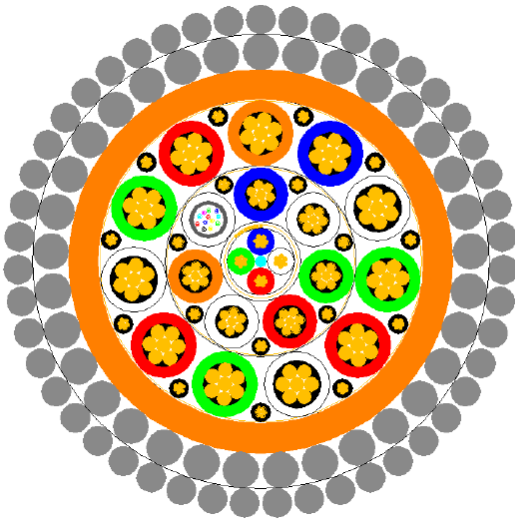
LARS



# ROV – System Components

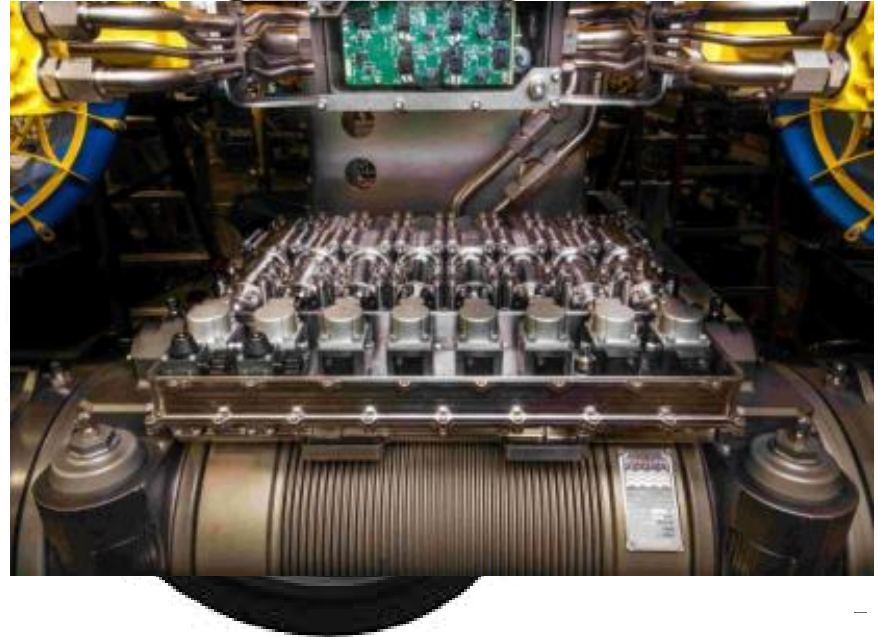
Overaside or in water equipment

- TMS
- Tether
- Vehicle



# ROV – Vehicle Components

- Chassis or frame
- Buoyancy blocks
- Hydraulic Power unit
- Thrusters
- PTZ Cameras
- Fixed Cameras
- Lights

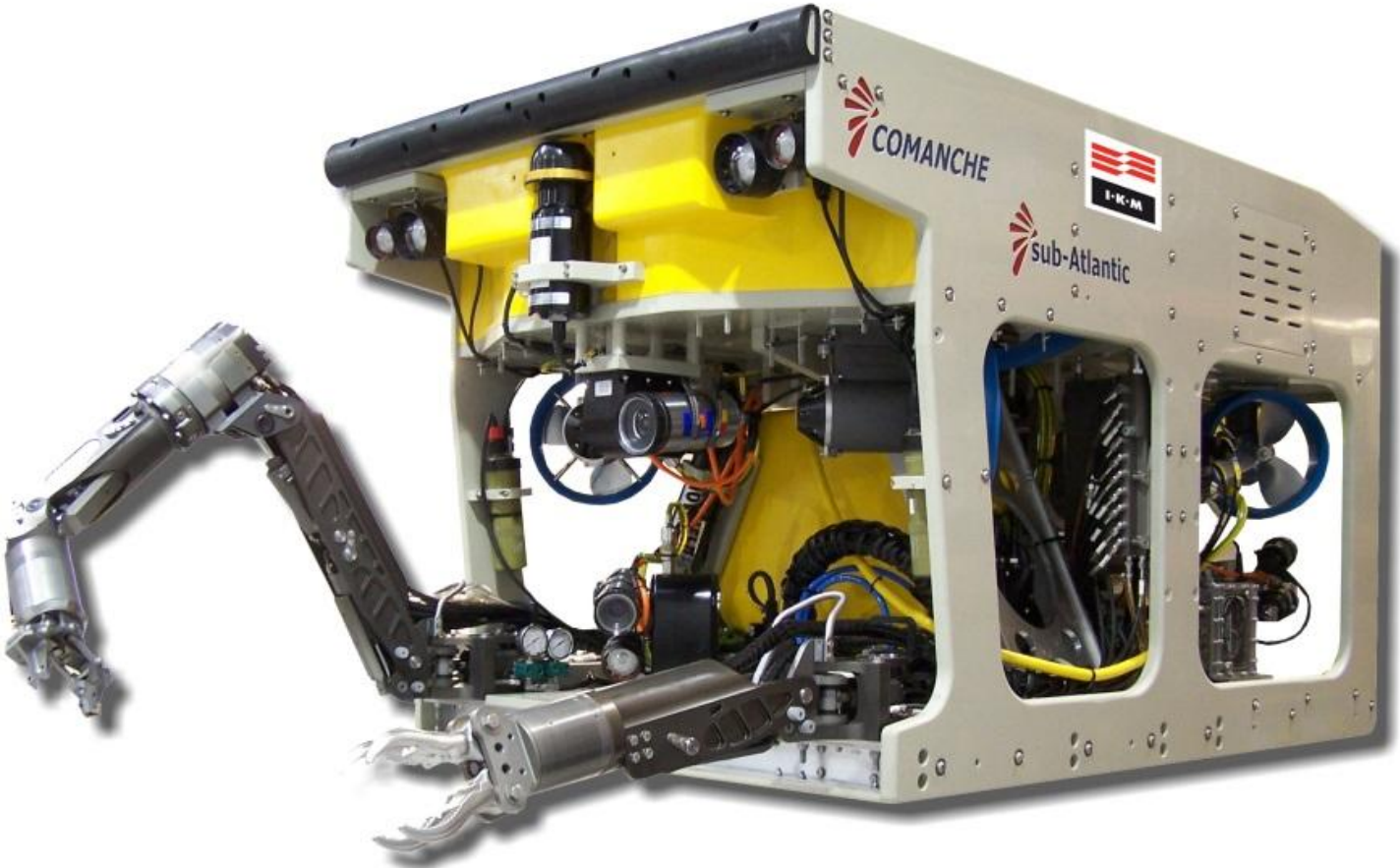


# ROV – Vehicle Components

- Sonar
- Gyrocompass
- Strobe light
- Transponder
- Manipulator



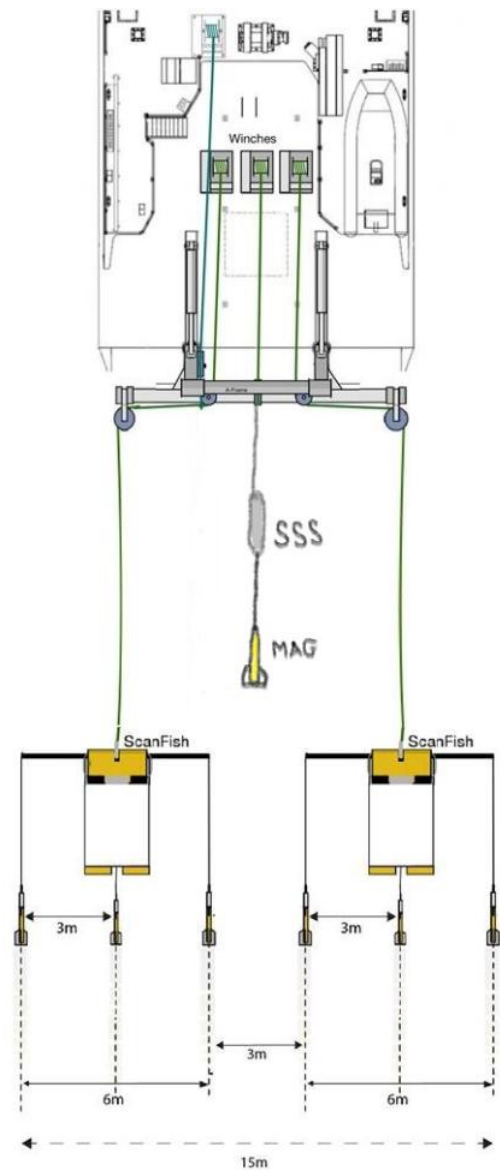
# ROV – Vehicle



# Towfish - ROTV



# Towfish Arrays



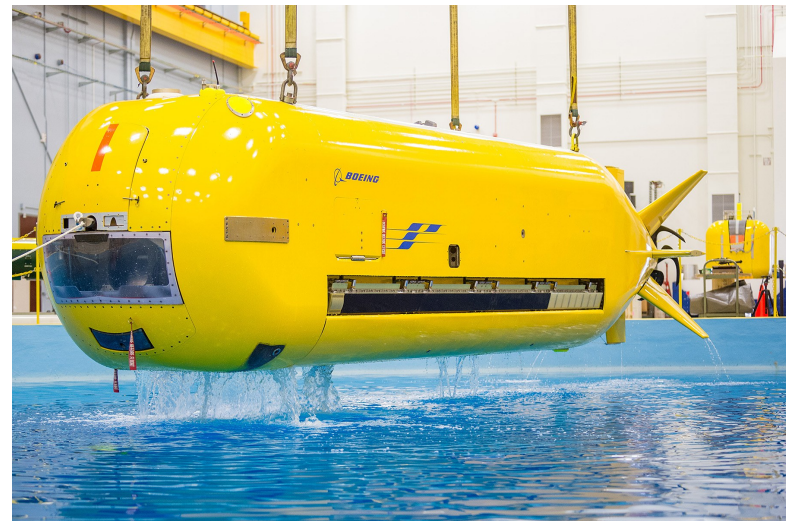
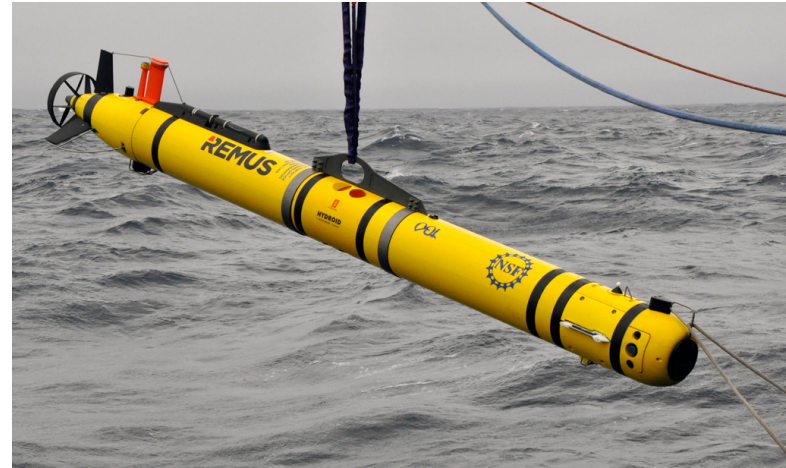




## Quiz: Round 2

# Autonomous Underwater Vehicle (AUV)

- Size Range: small handheld vehicles to large 10 meters long vehicles.
- Up to depths of 6,000 meters.
- Up to 80 hours mission duration.
- Typical cost range: USD 1-5 million.



# AUV – Applications: Search for Stellar Daisy

- Stellar Daisy sank on 31 March 2017, transporting iron ore from Brazil to China.
- Four AUVs operated over 72 hours to map 1,300 km<sup>2</sup> of seabed.
- Successfully located the missing wreck at a depth of 3,461 meters in the South Atlantic Ocean.



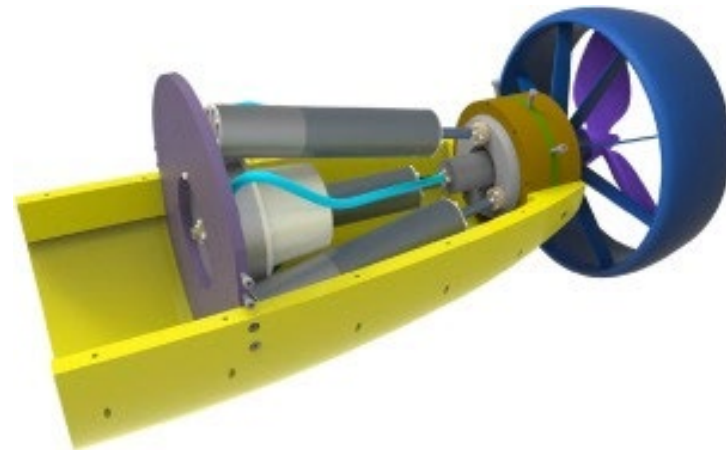
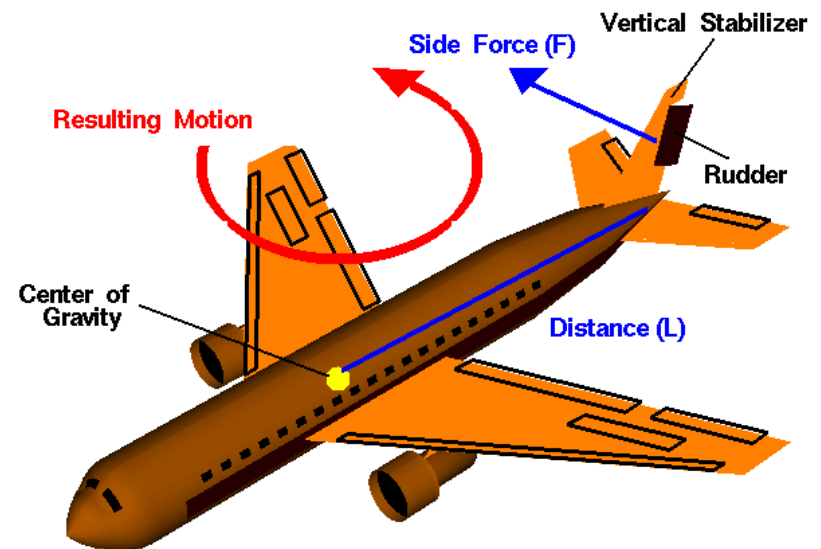
# AUV – Launching

- Lowered into water with an articulated deck crane and released.
- Launched from a stinger over the aft or side of the vessel.
- Launched from onshore.
- Launched by hand over the side of a small rib.



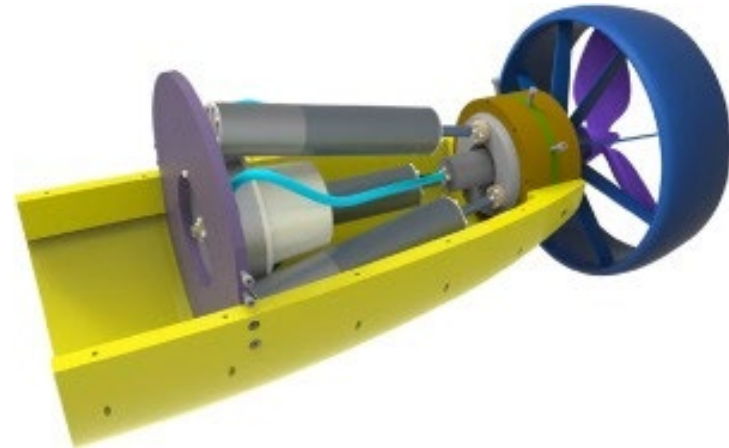
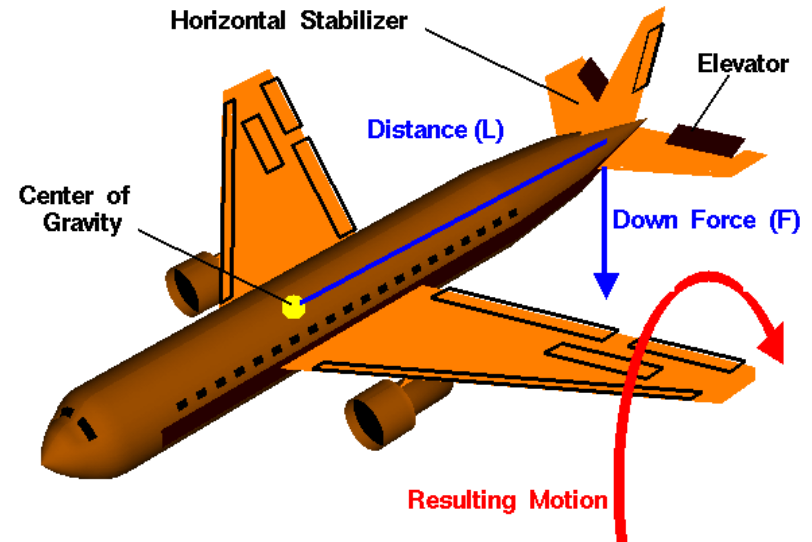
## AUV – Horizontal Control

- Vertical stabilisers prevent side-to-side, or yawing motion of the AUV.
- Vertical elevators are used to generate yawing of the AUV.
- Horizontal control can also be achieved with a vector thruster.



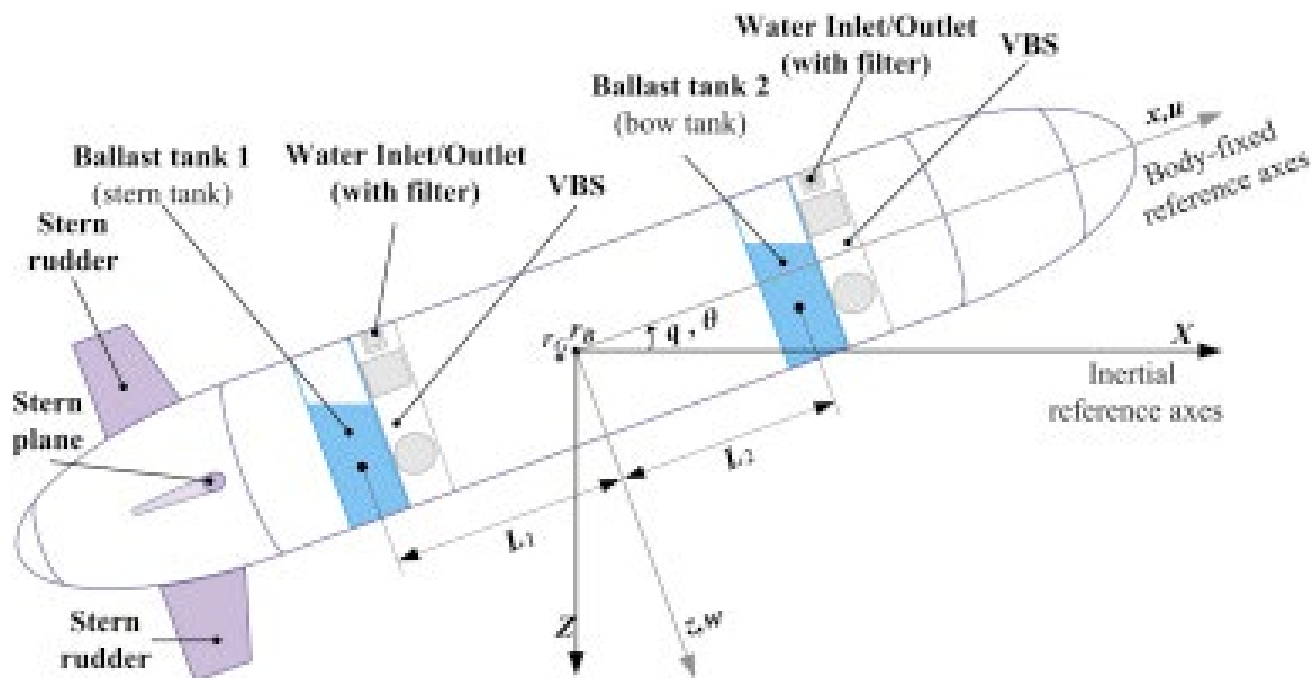
## AUV – Vertical Control

- Horizontal stabilisers prevent up-and-down, or pitching motion of the AUV.
- Horizontal elevators are used to generate pitching of the AUV.
- Vertical control can also be achieved with a vector thruster.



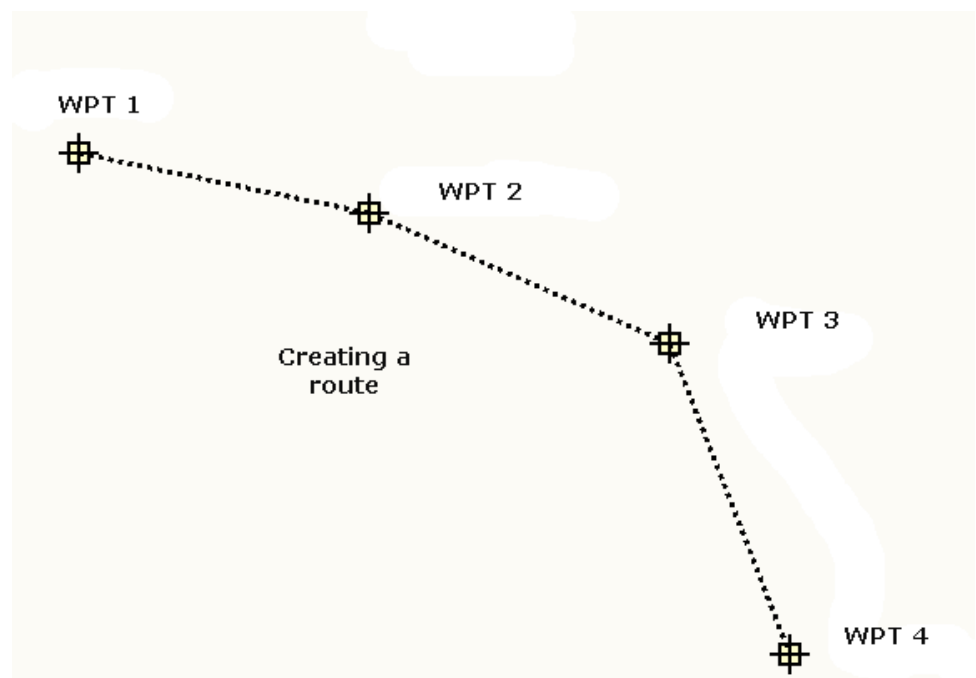
## AUV – Vertical Control cont.

- Most AUVs use adjustable ballast to control buoyancy.
- Ballast Tanks take in water to reduce the AUVs buoyancy and vice versa.
- Variable ballast tanks can alter the pitch.



# AUV – Navigation

- Pre-defined waypoints.
- The AUVs onboard computer will continuously calculate the distance and bearing to the next waypoint, from its current position.
- The AUVs position is updated by acoustic positioning when underwater or satellite when at the surface.
- In between position updates, the AUV estimates its position using DVL-aided Inertial Navigation System:
  - Attitude and Heading Reference System (AHRS).
  - Doppler Velocity Log (DVL).
- Accuracy: 0.1 of distance travelled.





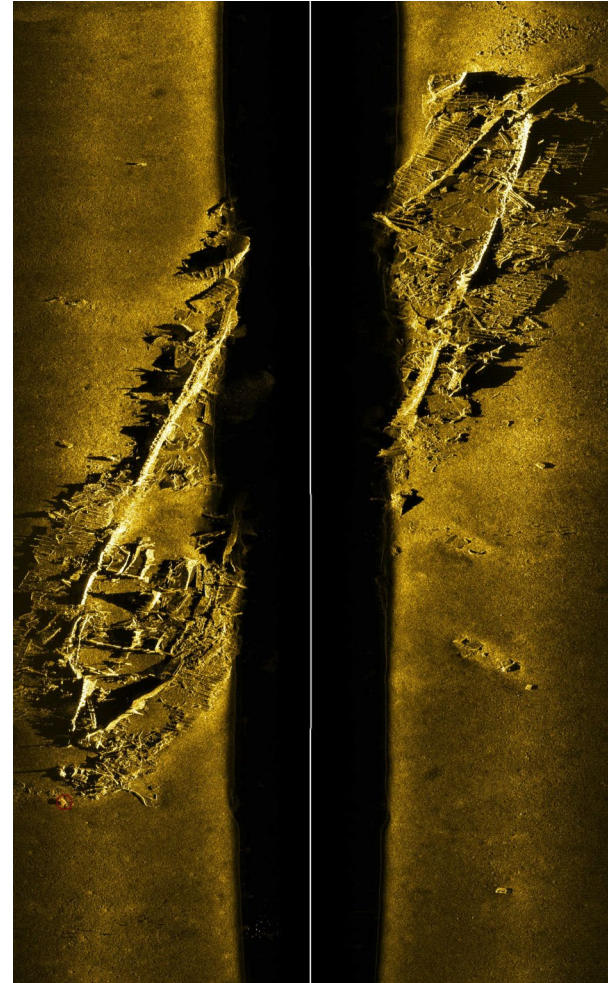
## AUV – Safety Systems

- Drop Weight – Released in emergency situations when the AUV cannot drive to the surface.
- Emergency Buoyancy System (EBS) – Increases buoyancy by releasing compressed air into a ballast tank or air bladder.
- Avoidance Sonar – images the seabed ahead of the AUV to detect potential underwater hazards.
- Iridium Satellite Beacon – provides global coverage designed for locating and tracking the AUV once surfaced.
- Flashing Beacon – provides a visual relocation of AUV.



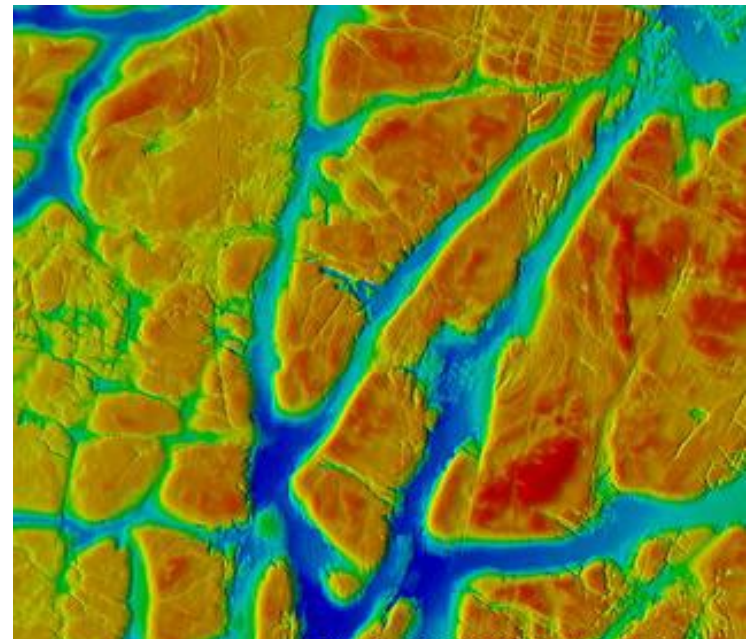
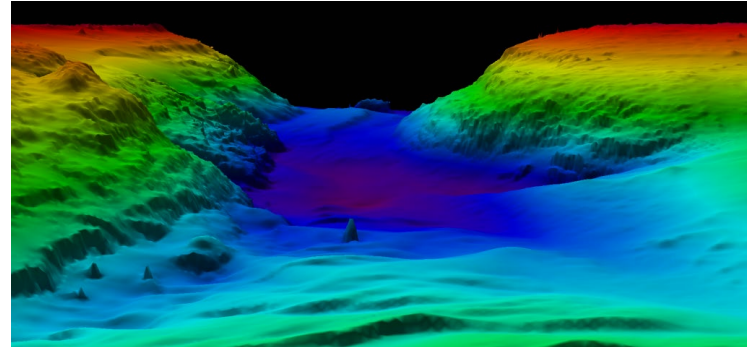
## AUV – Payload Sensors

- Side Scan Sonar.
- Side scan sonars generate an image of the sea floor by measuring the strength of the returning acoustic echo.
- Hard areas of the sea floor like rocks reflect more sound and have a stronger return signal than softer areas like sand.
- Objects or features that rise above the sea floor also cast shadows in the sonar image where no sound hit.
- The size of the shadow can be used to guess the size of the feature.



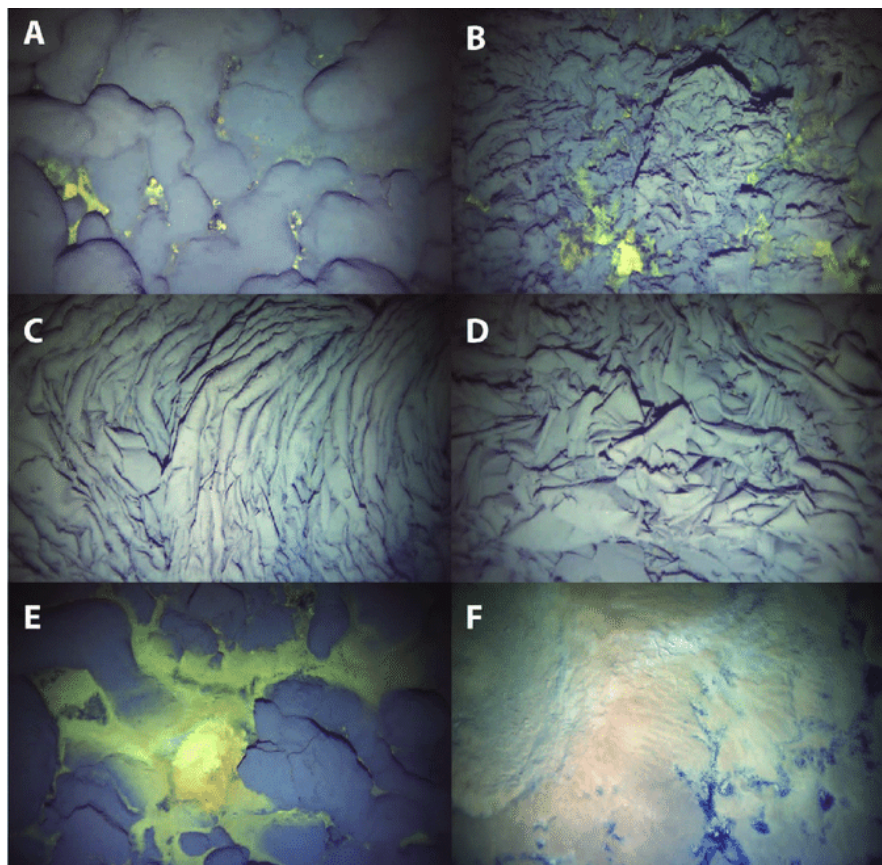
# AUV – Payload Sensors

- Multibeam Echosounder.
- The transducer transmits an array of acoustic beams towards the seabed.
- Depth is calculated from the time taken for each acoustic beam to return to the transducer.



# AUV – Payload Sensors

- Underwater Camera.
- Photographs collected by AUV Sentry during low altitude part of mission 168.
- Hydrothermal sediment at 4,980m



# AUV – Recovery



## AUV – Incident

- Nose Release – nose is released at surface with recovery line attached.
- Recovery line is pulled into vessel propeller, along with AUV.





## Quiz: Round 3

## 2. Scope of Cover – Overview

- All risks of physical loss of or damage to the insured equipment.
- Exclusions.
- Conditions Precedent and/or Warranties.
- Extensions to Cover:
  - Continuing Hire Charges
  - Debris Removal
  - Freight Charges
  - Loss of Revenue
  - Search and Rescue
  - Sue and Labour
  - Wreck Removal
- Deductibles





# Insuring Clause

- *‘Underwriters agree to indemnify the Insured against direct physical loss of or damage to Subject Matter Insured as defined within the schedule or any liability or expense incurred in connection with any physical loss of damage in the manner and to the extent provided for by this insurance.’*

vs.

- *‘This Policy covers all risks of physical loss of or damage to the subject-matter insured whilst in transit, storage and whilst operating.’*



## Exclusions

- *‘Ordinary wear and tear and gradual deterioration of the Insured Equipment.’*
- *‘Damage caused by or as a direct result of insufficient or unsuitable packing and/or stowage of the goods unless such packing or stowage was carried out by a party other than You and/or Your Employees and the insufficiency or unsuitability arose entirely without Your privity or knowledge.’*
- *‘Excluding mechanical and/or electrical and/or electro magnetic derangement unless caused by an external source and a risk insured against.’*



## Extensions to Cover – Removal of Wreck

- *‘Costs and expenses reasonably and necessarily incurred by You for the attempted or actual raising, removal and/or disposal of the wreck and/or debris of the Subject Matter Insured as a result of Damage for which We have admitted liability under this Section of the policy. Subject to a Sub-limit of £1,000,000 in the aggregate.’*

vs.

- *This Policy includes the expense of removal of wreck where required by any relevant governmental or other authorities. Maximum indemnity under this Wreck Removal Cover any one loss GBP 100,000 and GBP 100,000 in the aggregate any one policy year.’*



## Deductibles

- *‘Subject to a topside deductible of...’*
- *‘Subject to a transit deductible of...’*
- *‘Subject to a storage deductible of...’*
- *‘Subject to a subsea and/or operational deductible of...’*
  
- *‘5% of the amount exposed overside...’*
  
- *‘In respect of operational AUV’s, a deductible of USD 100,000 each and every loss shall be applicable, except during Launch and Recovery where a deductible of USD 350,000 applies while the unit is in the LARS for the first 15 minutes post launch and within 100 yards of the Mother Vessel during recovery until safely on board.’*



## Basis of Valuation

- *'In respect of equipment up to five years old at the time of loss or damage: replacement as new basis.'*
- *'In respect of equipment over five years old at the time of loss or damage: current market value.'*
- Or values declared in the schedule as agreed by Underwriters prior to attachment of risk or at inception.





**Break**

### 3. Role of the Loss Adjuster

“An impartial intermediary operating between the Insured and the Insurer who investigates the circumstances, cause and quantum, reviews contractual arrangements and advises on the merits of the claim under the terms of the policy.”

Investigate the circumstances of an incident and adjust any claim that may arise ...

A fair and equitable settlement within the boundaries of the insurance contract.



### 3. Role of the Loss Adjuster

A Loss Adjuster has many facets,

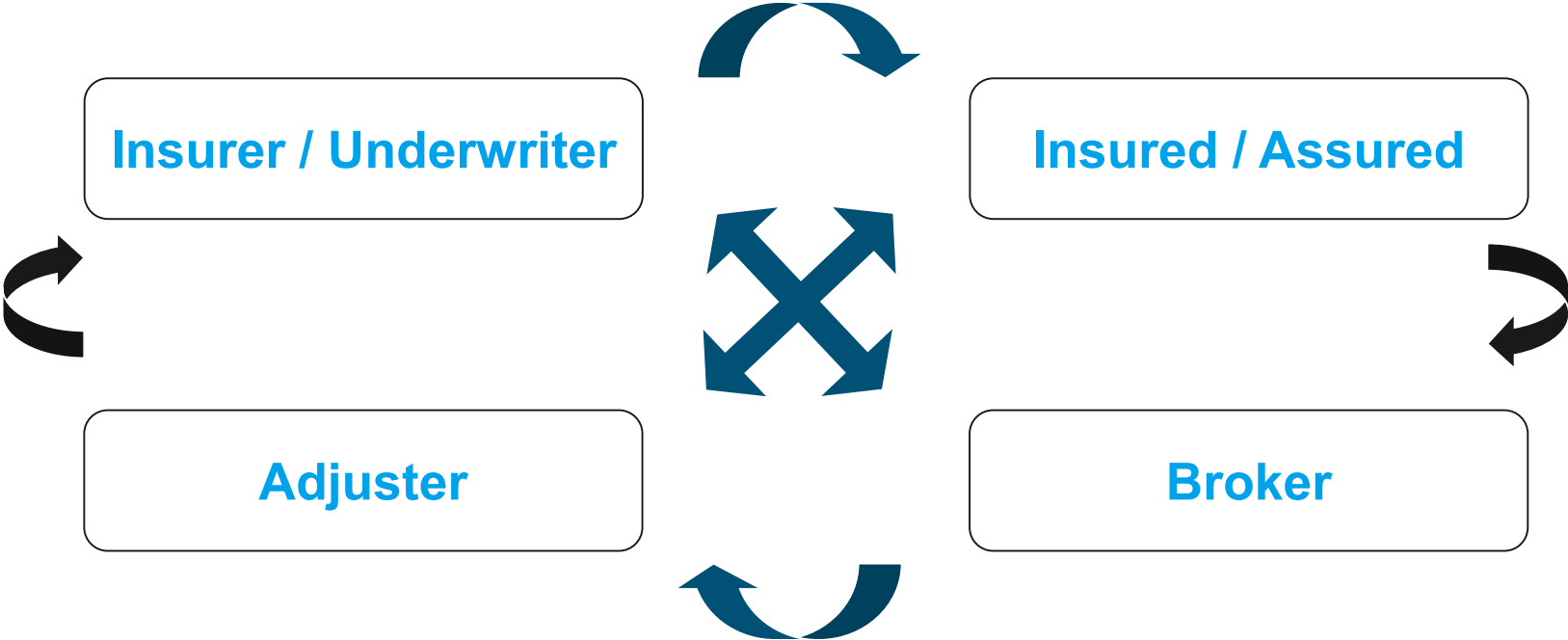
- he must have knowledge of insurance, law, engineering, business, management, accounting, medicine, languages, economics,
- have an understanding of human nature, culture, negotiation, horse trading ...

In the final reckoning Loss Adjuster must satisfy the policy holder, the underwriter, the broker and, probably most importantly, himself.





### 3. Role of the Loss Adjuster – Claim Interaction



### 3. Role of the Loss Adjuster

- Responsiveness and Flexibility
- Investment
- Infrastructure
- People and Systems
- A multi-disciplined staff – relevant knowledge and experience
- Quality standards / assurance
- Communication – clear lines of reporting
- Integrity, objectivity and sensitivity
- Initiative – established reputation for resolving claims
- Free to travel at a moments notice



### 3. Role of the Loss Adjuster – Internal Expertise

- Civil Engineers
- Electrical Engineers
- Mechanical Engineers
- Chemical Engineers
- Metallurgists
- Geologists
- Process Engineers / Refinery Managers
- Chartered Surveyors
- Forensic Accountants / Chartered Accountants
- Project Management
- Language Skills
- IT Skills
- Financial Modelling
- Legal



### 3. Role of the Loss Adjuster – External Expertise

#### Appointed Experts / Consultants

- Cause Investigation
- Damage Assessment, Scoping, Estimating,
- Programme Scheduling
- Forensic Accounting
- Linear Programming
- Project Management and Construction
- Subrogation Counsel
- Local Fire Department & Technical Safety Authority
- Independent Metallurgists



### 3. Role of the Loss Adjuster – Communicating with Insurers

- Ad hoc communications – telephone calls, emails, face to face meetings.
- Initial Advice – issued within 30 days of receipt of instruction.
- Preliminary Report – to be issued within 90 days of receipt of instruction.
  - Background and Circumstances
  - Damage
  - Cause
  - Remedial Measures
  - Claim
  - Insurance
  - Potential Exposure
  - Recovery
- Interim / Status reports should be issued after major developments and at a maximum of 90 day intervals
- Final Report
- Drafting Proofs of Loss / Forms of Acceptance



## 4. Coverage Matters

4.1 Breach of Warranty

4.2 Recovery Costs – late notification

4.3 Recovery Costs – immediate notification

4.4 Multiple Deductibles





## Warranties

*Warranties are clauses setting out information provided by the Assured as to the current or future state of affairs, requiring steps to be taken (or not taken) by the Assured and based upon which Underwriters have chosen to underwrite this risk. If you breach a Warranty in this Policy, Underwriters may have no liability in respect of any loss which happens after the breach has occurred but before it is remedied. Underwriters may elect to waive the breach but such waiver must be expressly communicated to you in writing.*





## *Warranty No. 1*

*Special precautions are to be taken when operating from dynamically positioned vessels to ensure that all ROVs are kept clear of thrusters and taut wires.*

*With uncaged ROVs where the umbilical is not very heavy in water Underwriters would expect a clump weight to be utilised to keep the umbilical vertical to at least 10m below thruster level. The weight should be suspended on a separate rope. Care must be taken to minimise the possibility of a bight of umbilical/tether rising into the proximity of thrusters.*







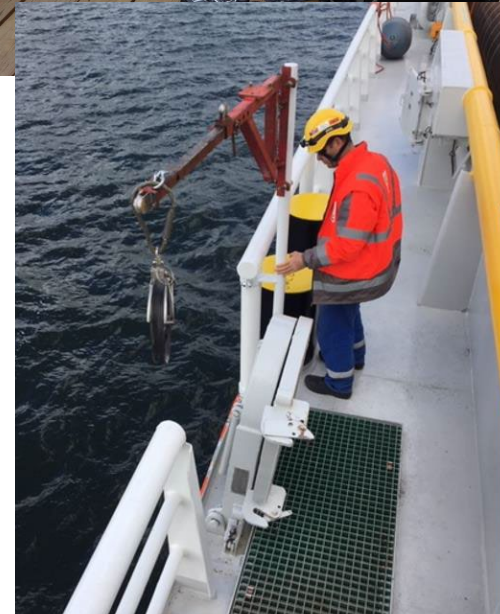
## *Warranty No. 2*

*The Insured Equipment to be fitted with an acoustic beacon and Support Vessel fitted with a compatible acoustic sensing system when the Insured Equipment is negatively or neutrally buoyant. A flashing light with no daylight sensor cut off is to be fitted to the Insured Equipment if it is positively buoyant.*



# Case Study – Breach of Warranty

- An uncaged ROV with a positively buoyant tether was being operated from onboard a dynamically positioned vessel.
- The ROV Pilot did not deem it necessary to install a clump weight to the tether.
- The tether drifted towards the aft of the vessel and was severed by the vessel's thrusters, leaving the ROV bobbing in the water.
- The ROV had neither an acoustic beacon or flashing beacon installed.
- The vessel crew eventually lost sight of the ROV and it was lost to sea never to be found.
- Are Underwriters Liable?





Policy states:

*...it is expressly agreed and declared that all of the terms, conditions, warranties and other matters contained within the Marine Insurance Act 1906 (as amended by the Insurance Act 2015) shall still be applicable to this Policy.*

Marine Insurance Act 1906 states:

*33(3) A warranty, as above defined, is a condition which must be exactly complied with, whether it be material to the risk or not.*

*34 When breach of warranty is excused. (omitted by virtue of Insurance Act 2015)*

Insurance Act 2015 states:

*10 Breach of warranty*

*(2) An insurer has no liability under a contract of insurance in respect of any loss occurring, or attributable to something happening, after a warranty (express or implied) in the contract has been breached but before the breach has been remedied.*





## *Search and Recovery Clause*

*Cover is extended to include the costs associated with search and recovery operations immediately following the loss of subsea equipment, irrespective of whether such search and recovery operations are successful or not. The Assured, exercising reasonable discretion, will be the sole judge as to when search and recovery operations are required.*

*Provided always that in no case shall Insurers' liability in respect of search and recovery costs exceed 50% of the insured value of the missing equipment, without Insurer's approval.*



# Case Study – Recovery Costs and Late Notification

- A seabed corer was dropped to the seabed after the lifting rigging failed.
- Approx. worth USD 100,000.
- Successfully recovered the corer, at a cost of USD 420,000.
- At no point did the Assured seek Insurers approval when costs exceeded 50% of the insured value.
- Extent of damage to be confirmed.
- *'...in no case shall Insurers' liability in respect of search and recovery costs exceed 50% of the insured value of the missing equipment, without Insurer's approval.'*
- What is Insurers' liability in respect of recovery costs?





## *Sue and Labour*

*Underwriters will Indemnify the assured for any charges properly and reasonably incurred by the Insured or their servants or agents, in respect of any loss recoverable under this policy, in pursuance of their duties to take such measures as may be reasonable for the purpose of averting or minimising such loss.*

*The sum recoverable under Clause 6 shall be In addition to the loss otherwise recoverable under this insurance but in no circumstances shall it exceed 25% of the insured value of the equipment that is the subject of the claim.*



# Case Study – Recovery Costs and Immediate Notification

- Over side survey equipment was forced off the mounting pole by a spread mooring line.
- The survey equipment valued at GBP 160,000 was dropped to the seabed.
- A subsea inspection immediately following the incident had identified the location of the survey equipment on the seabed.
- Insurers/Adjusters were notified immediately.
- 4 methods of recovery (GBP 40,000 – 70,000), extent of current damage (high), likelihood of success (5% - 90%) and probability of exerting further damage (low – very high).
- Search and recovery not pursued.
- Claim settled for GBP 160,000.
- Insurers less GBP 40,000.
- Assured less recovery costs above GBP 40,000, new equipment and a speedy claim resolution.





*Deductible – USD 25,000 each and every occurrence.*

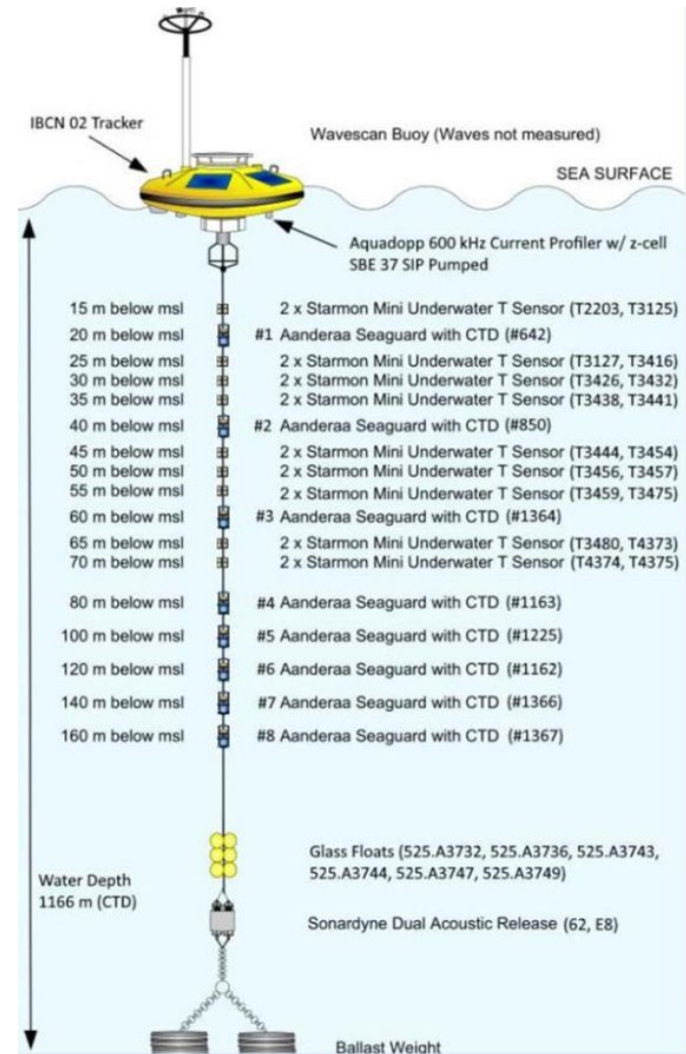
*The term "Occurrence" as used herein shall mean any one loss or a series of losses arising out of an event which commences during the term of this Policy and which causes loss damage or expense as covered by this Policy.*



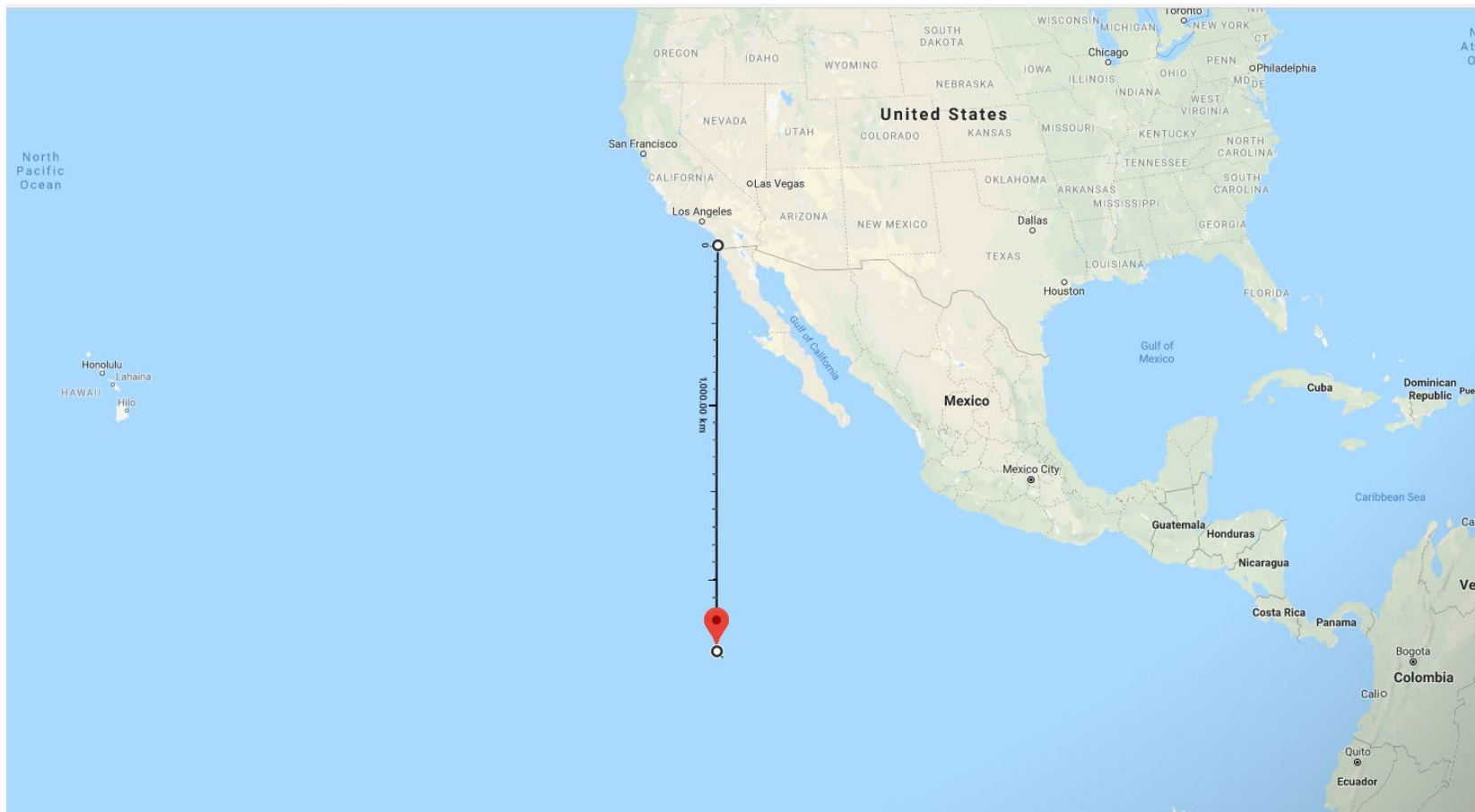


# Case Study – Multiple Deductibles

- All 8 off CTDs filled with water and damaged beyond further use.
- Claim for USD 800,000 (8 x USD 100,000)
- Deductible USD 25,000 each occurrence.
- Cause of water ingress is use of incorrect lubricant on seals prior to deployment.
- Settlement?
  - USD 775,000 net
  - USD 600,000 net
  - Something else?
- ‘...series of losses arising out of an event ...’



## 5. Collaborative Group Work



2,600 Nautical Mile round-trip voyage, equivalent to 14-days at approx. 8 Knots.



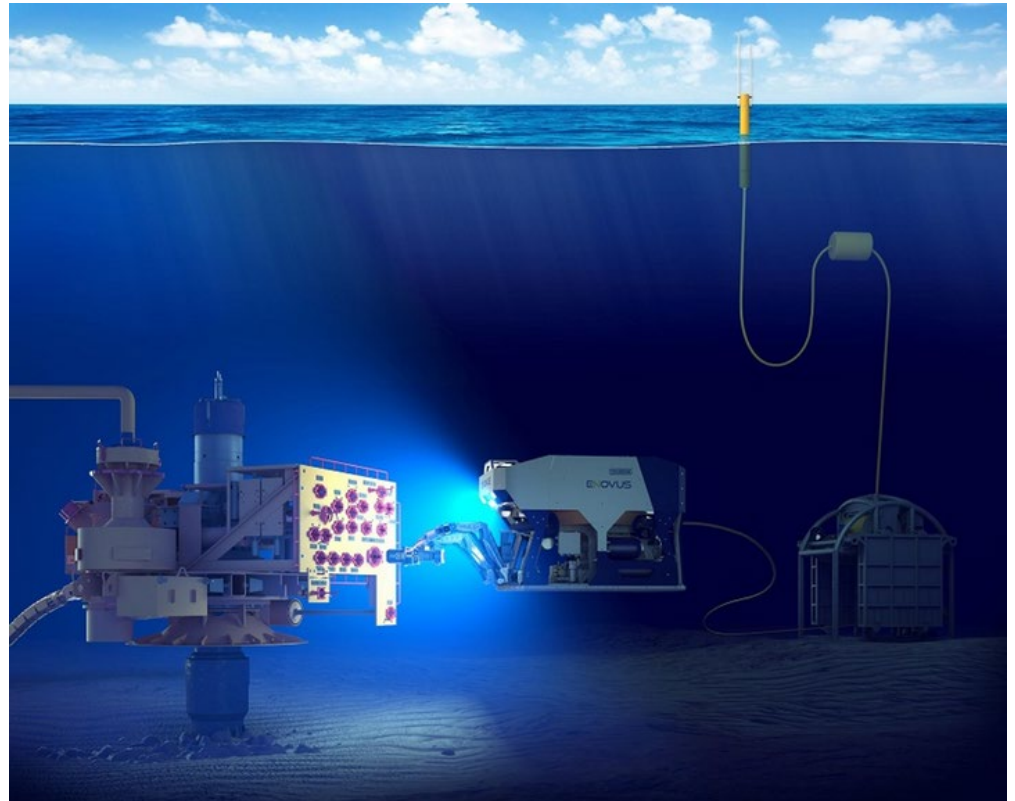
## 5. Collaborative Group Work

- Was a spare camera onboard? **No**
- Did the Assured explore other methods of transport? **Yes – a plane drop. Utilising a vessel that was already sailing from Hawaii to site.**
- Why was the plane drop not considered? **It was too expensive.**
- Was the Tugboat delivering other consignments to the Mother Vessel? **Yes – stores.**
- Why didn't the Mother Vessel sail to San Diego to collect the new camera? **She stayed on site so the AUV could continue survey operations in order to avoid late completion penalties.**
- Why didn't the Mother Vessel sail halfway to meet the Tugboat? **Same as above.**



## 6. Disruptive Technology

- Battery-powered remotely operated vehicle (ROV).
- Piloted from onshore control centre via a 4G network.
- Encrypted VPN channel.
- What does this mean for Insurance?
  - Probability of successful search and recovery?
  - Increased repair/replacement costs?
  - Cyber risks?
  - Insufficient wordings?



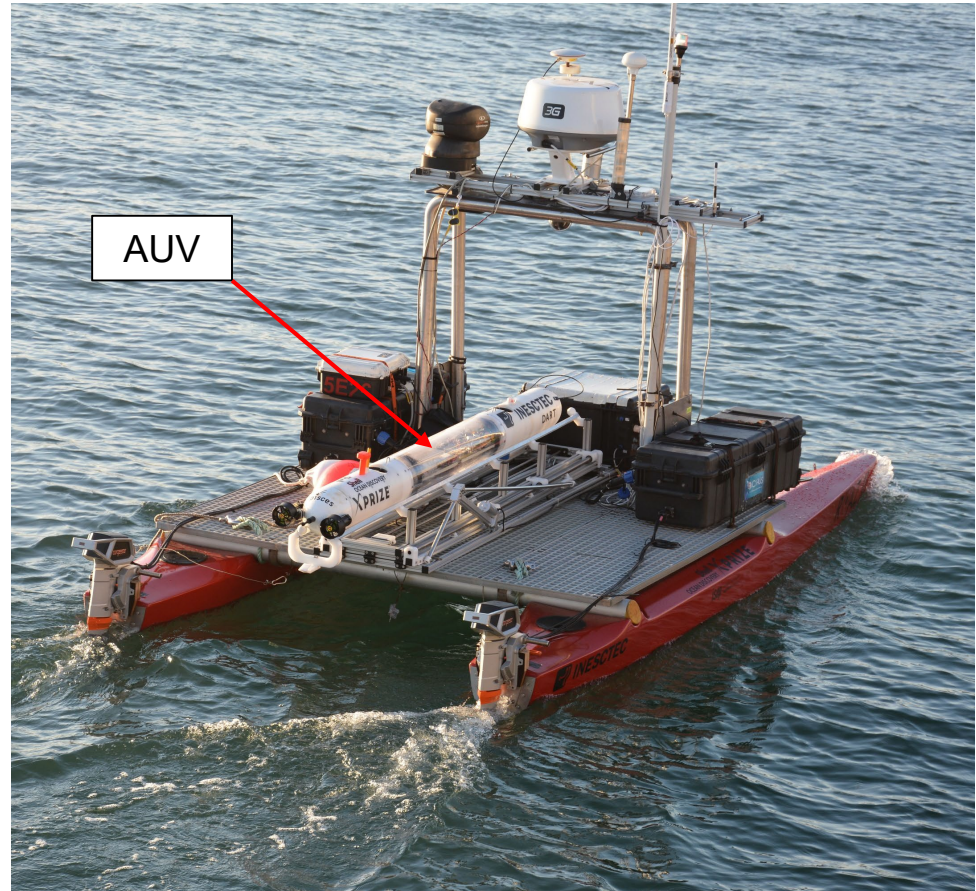
## 6. Disruptive Technology

- Cyber-attacks against data integrity.
- Cyber-attacks against the availability of AUVs.



## 6. Disruptive Technology

- Ocean Discovery X-PRIZE competition sponsored by Shell for \$7 million.
- Participants have to develop rapid, unmanned and high resolution technologies to map the underwater environment.
- Rules prohibit manned support vessels and so the recovery of the underwater vehicles must be carried out autonomously.
- An autonomous vehicle launched, operated and recovered by an autonomous vehicle...



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