GLS – New Technology Rising to the Challenge of Subsea lifting

Subsea 2012

Paddy Collins

ECOSSE Subsea Systems

Aubin

Introductions

Aubin

- Design, Develop and Supply own chemical technical technology
  - Cement and Stimulation
  - Pipeline products
  - Subsea
- Technology Supply

Ecosse Subsea

- Subsea Lifting
- Trenching
- Technology development
- People
- Technology Execution

ECOSSE Subsea Systems

Aubin

“Pumpable” Buoyancy

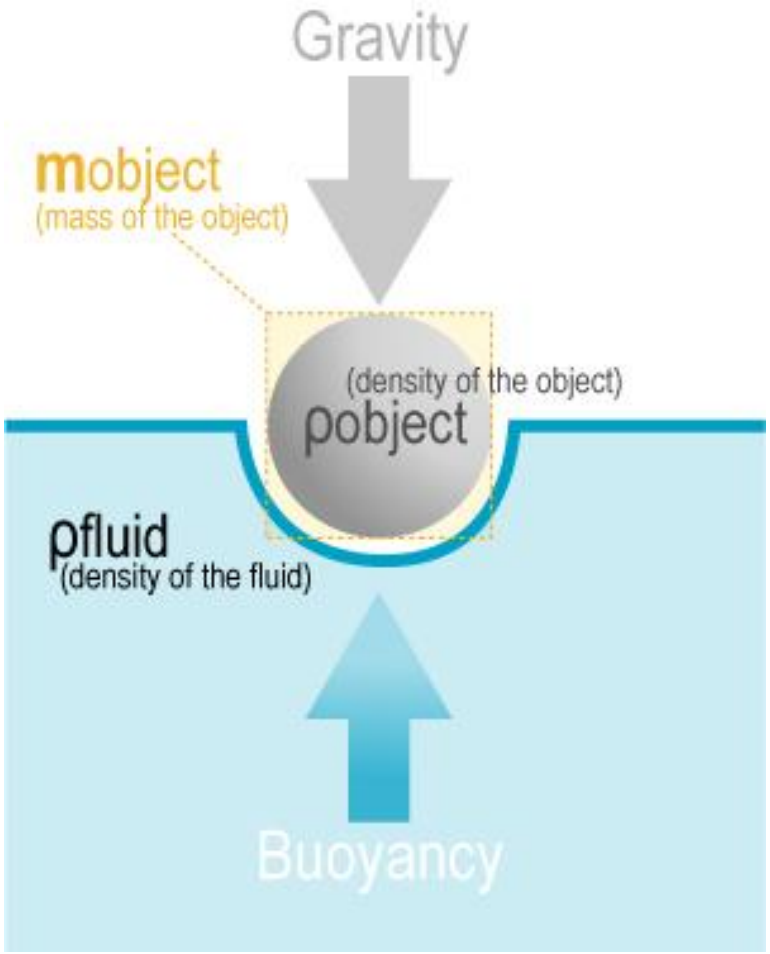
Gel Lift System

- Incompressible Low density Liquid
- Density 550 - 580 Kgs/M^3
- Rated to 150M GLS
- Rated 3000m DeepBuoy
- Tranferable “pumpable” buoyancy
- Buoyant force independant of depth (unlike air bags)
- Patented technology

ECOSSE Subsea Systems

Aubin

Buoyancy



- An object floats when its average density is lower than fluid density
- Buoyancy depends on submerged volume and density
- We can increase buoyancy by attaching a container full of air to reduce the average density of the object
- So whats wrong with Air?

Aubin

Whats wrong with Air?

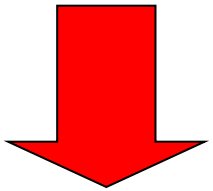
- Gas is Compressible
- Boyles Law

$$P_1 V_1 = P_2 V_2$$

As you go Deeper

Volume & Buoyancy

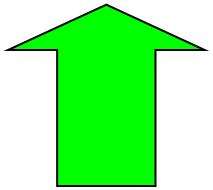
decrease



As you come from Depth

Volume & Buoyancy

Polaris Missile Effect



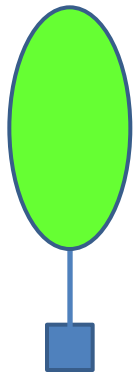
Air gives you Buoyancy
but doesn't give you Control

Robert Boyle 1627 -1691

Aubin

Standing still

Density of Steel - Kg/m3	7850
Density of Seawater -Kg/m3	1020
Density of DeepBuoy Kg/m3	585
Buoyant Force per M3 DeepBuoy Kg/m3	435
Volume of 1MT steel m3	0.1274
Weight of 1 MT Steel in Seawater Kg/m3	870
Volume of DeepBuoy M3 needed to lift 1MT steel	2.30



Bag containing 2.3m^{3}DeepBuoy provides enough lift to make 1MT neutrally buoyant

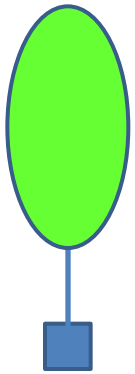
Buoyant force of gel = Weight of steel in water
Load is neutrally buoyant

ECOSSE Subsea Systems

Aubin

Going Up

Density of Steel - Kg/m3	**7850**
Density of Seawater -Kg/m3	**1020**
Density of DeepBuoy Kg/m3	**585**
Buoyant Force per M3 DeepBuoy Kg/m3	**435**
Volume of 1MT steel m3	**0.1274**
Weight of 1 MT Steel in Seawater Kg/m3	**870**
Volume of DeepBuoy M3 needed to lift 1MT steel	**2.30**



Pump 23 litres of Gel **into bag increases lift by 10 kgs object rises** in a controlled manner

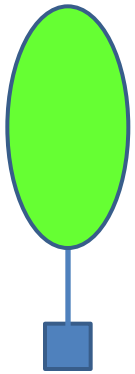
Buoyant force of gel = Weight of steel in water **plus 10 kg Load Rises** in a controlled manner

ECOSSE Subsea Systems

Aubin

Going Down

Density of Steel - Kg/m3	**7850**
Density of Seawater -Kg/m3	**1020**
Density of DeepBuoy Kg/m3	**585**
Buoyant Force per M3 DeepBuoy Kg/m3	**435**
Volume of 1MT steel m3	**0.1274**
Weight of 1 MT Steel in Seawater Kg/m3	**870**
Volume of DeepBuoy M3 needed to lift 1MT steel	**2.30**



Pump 23 litres of Gel **OUT of the bag reduces lift** by 10 kgs object **Sinks** in a controlled manner

Buoyant force of gel = Weight of steel in water **minus 10 kg Load Sinks** in a controlled manner

ECOSSE Subsea Systems

Aubin

ECOSSE
Subsea Systems

Aubin

Orkney Trial

- Placed and recovered a one tonne object on the seabed successfully
- Simple system using modified air bags and air driven diaphragm pump
- Very high level of control
- Very easy to use compared with air bags
- Has since generated considerable interest in the diving community
- Video taken and posted on YouTube
- http://www.youtube.com/watch?v=QG5ja9-AI2s

Aubin

Possible Applications

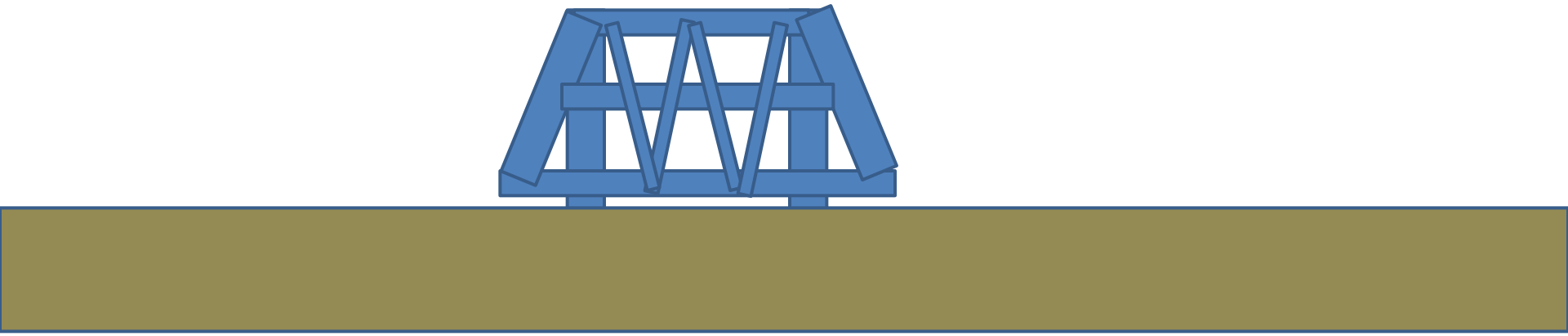
- Safety critical lifts requiring neutral buoyancy next to live lines
- Suction Pile installation
- **ROV construction work (10Te subsea crane)**
- Pipelay top tension reduction,
- Deepwater bundles
- Deepwater module removal and replacement
- Device and mooring installation for renewables
- Lateral transport of heavy loads where crane access is not possible
- **Subsea manifold installation in much larger units than currently envisioned**
- Subsea mining (transport of ore and tooling to surface)
- Renewables installation
- **Decommissioning of WHPS, manifolds, all subsea oil field bric a brac**
- Deepwater Salvage
- Mid water riser arches, deep water riser arches
- Air bag replacement for diver operations

Lifting with ROV's

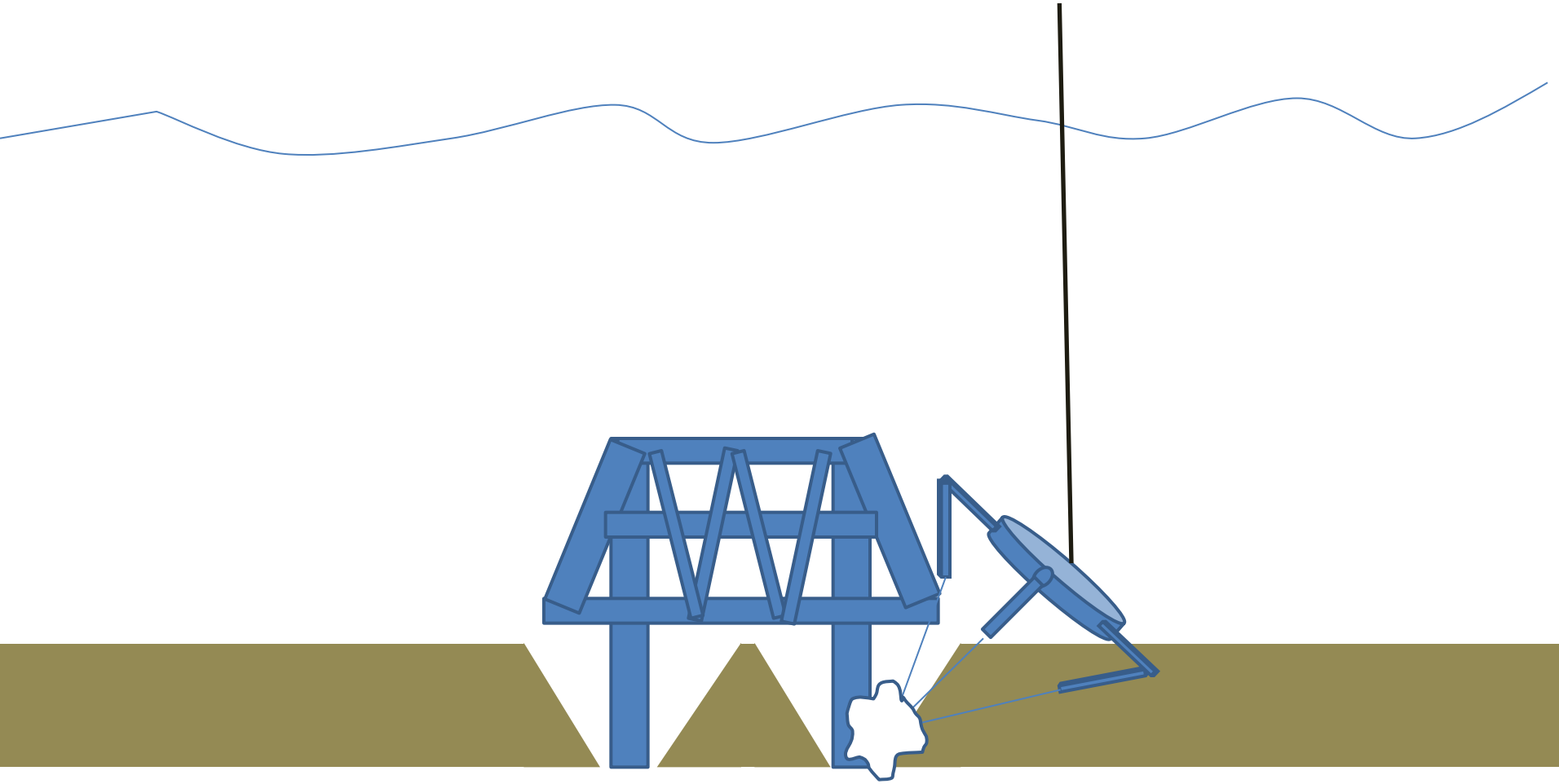
http://www.aubin.co.uk/subsea_deepbuoy.htm

Decommissioning Subsea

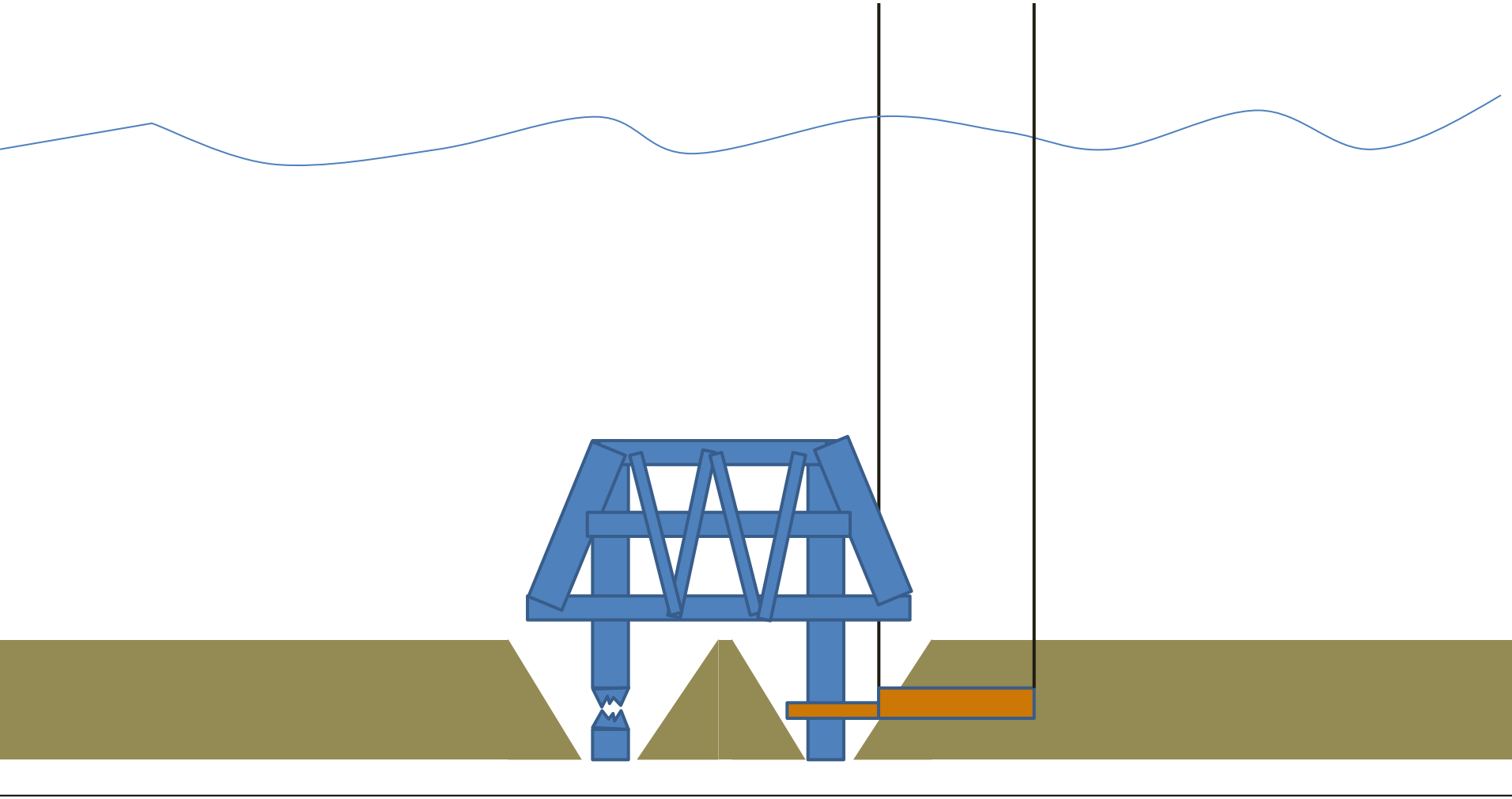
WHPS on seabed approx. 5m h x 13m x 13m
Assume WHPS piles cut 3m below bottom horizontal member



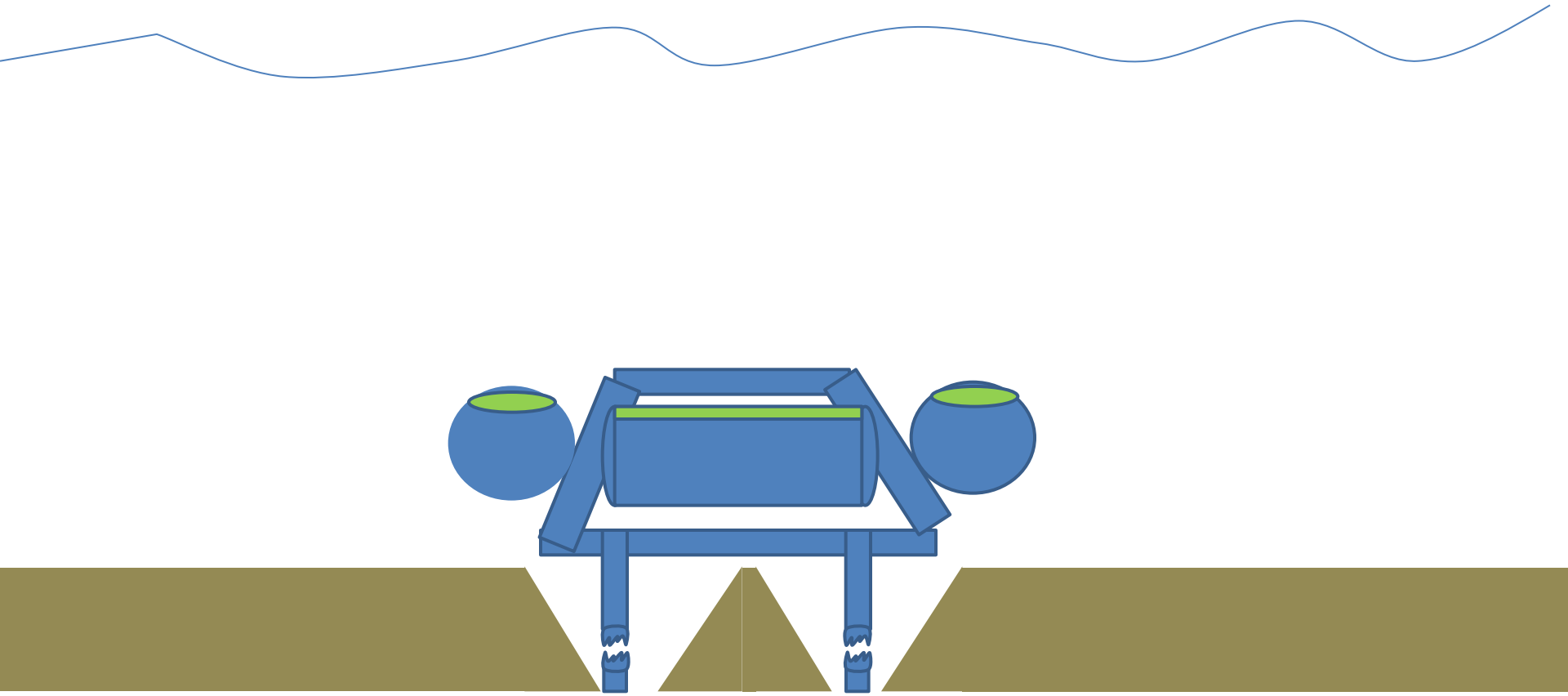
MFE Equipment Used to Clear Seabed Surrounding Pile Bases



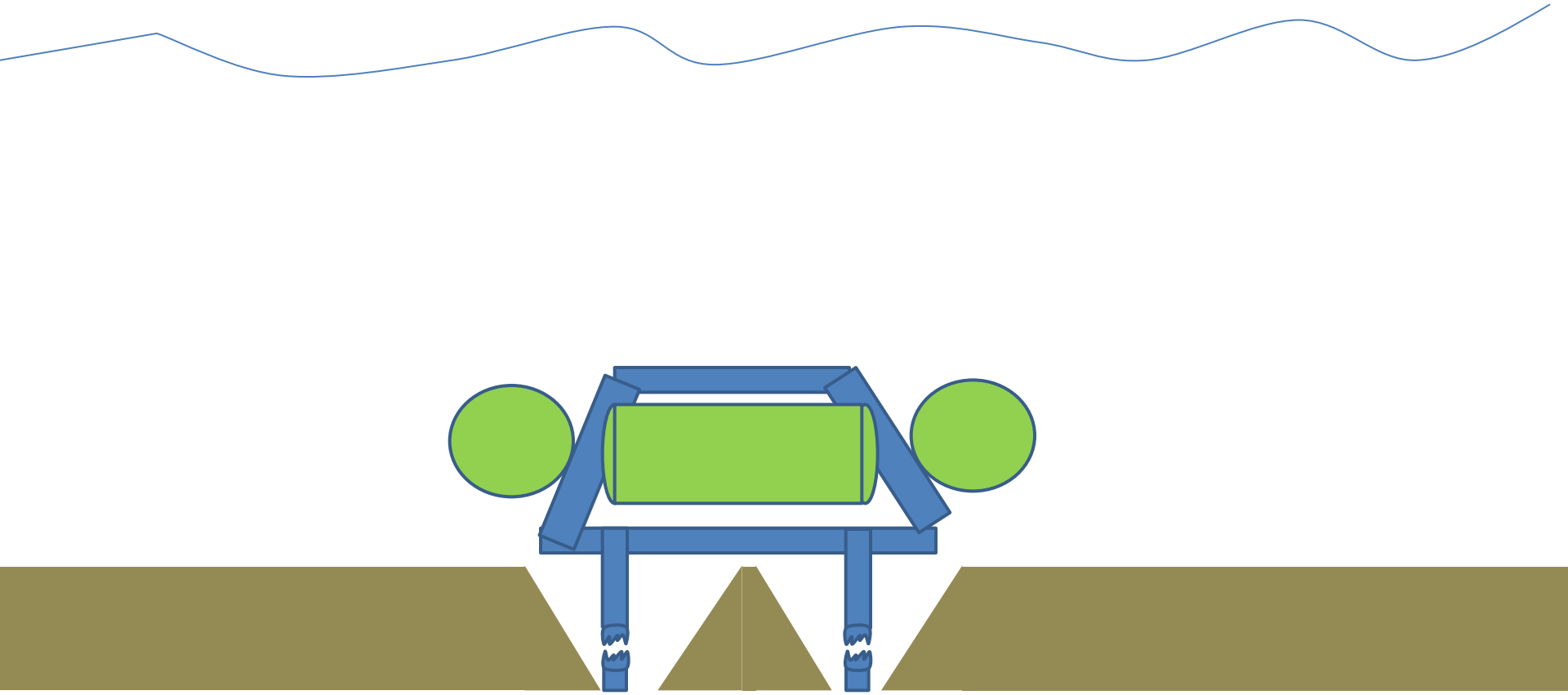
Shear Cutter Severs Piles 3m Below Seabed



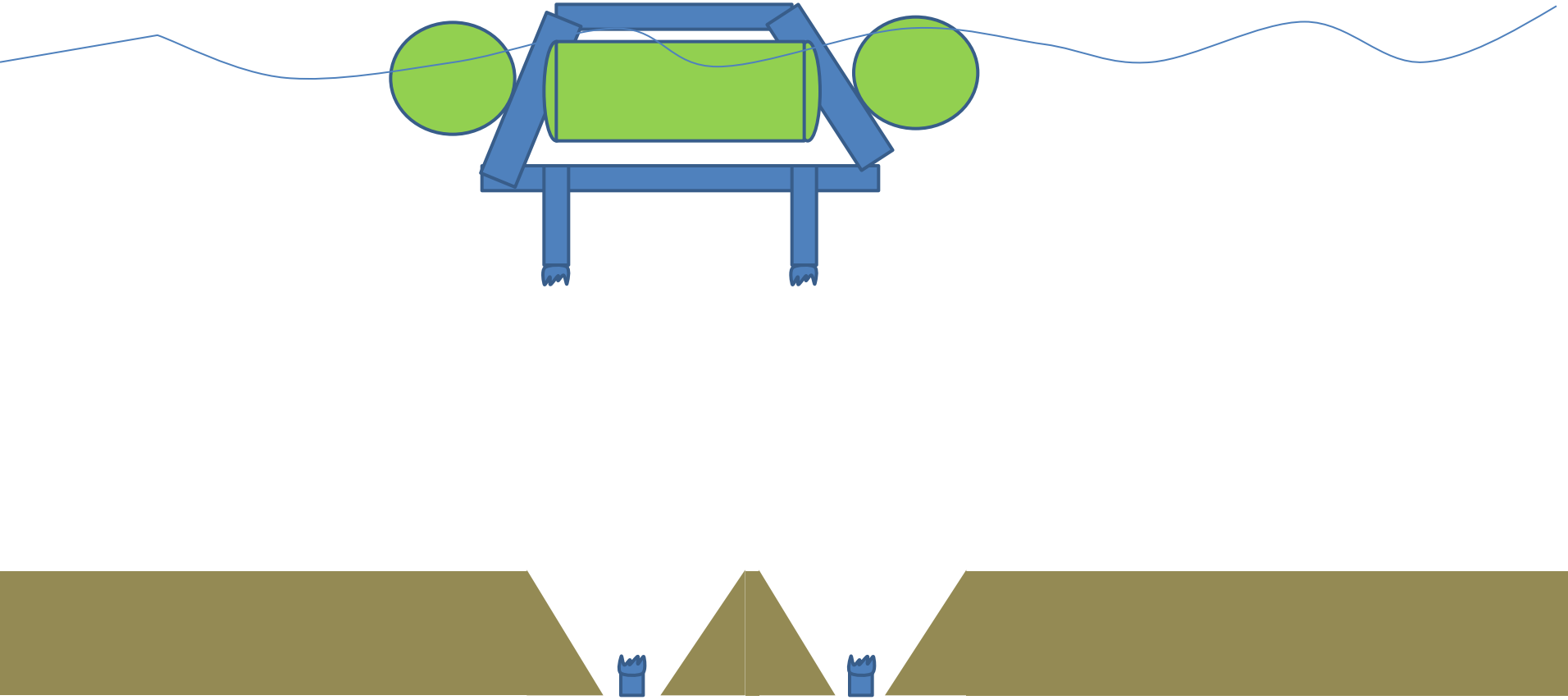
Neutrally Buoyant 4 x 8m x 3m diameter Silos Attached to Structure Lower Horizontal Members with Slings



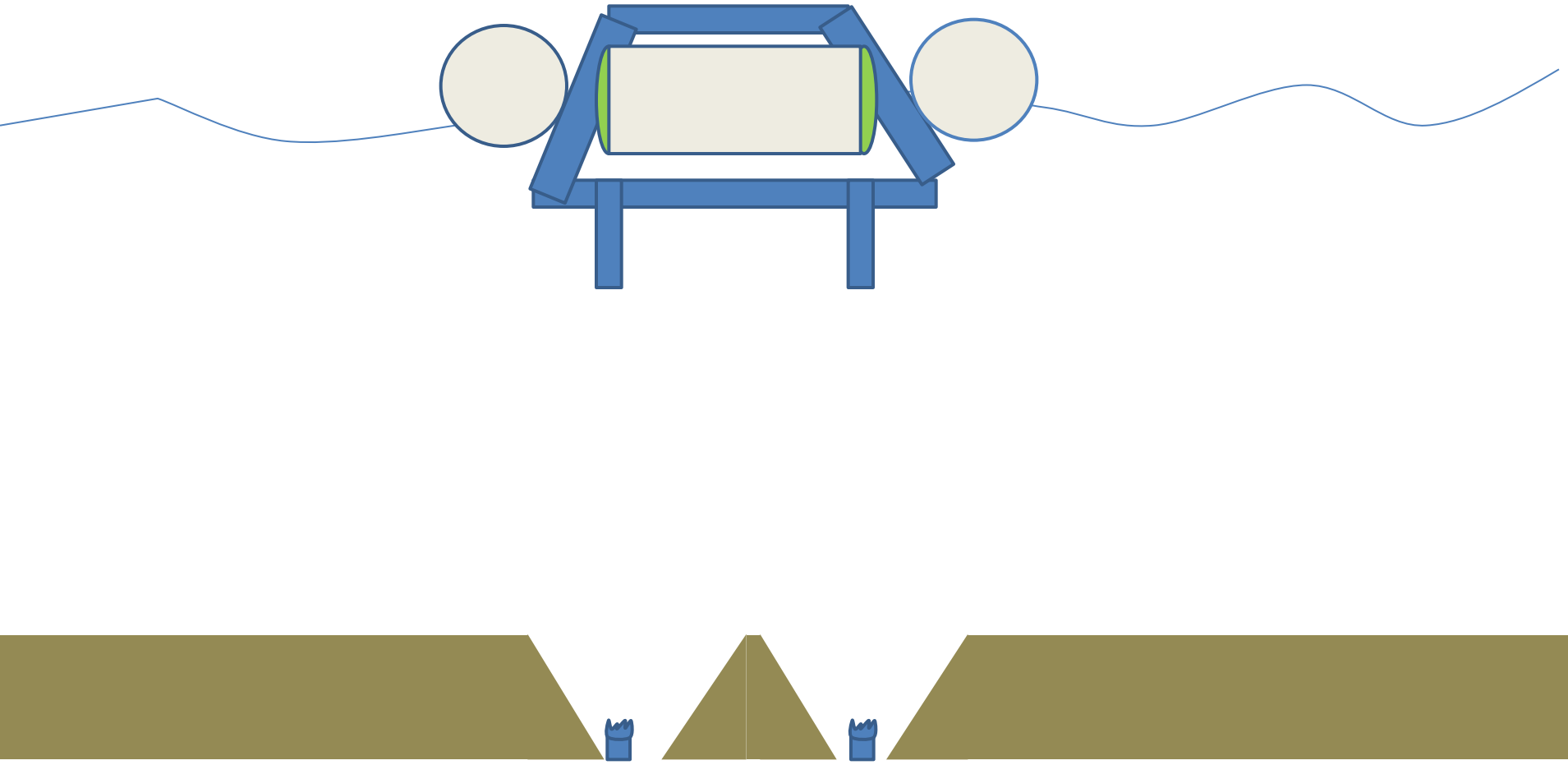
4 off. 8m x 3m Diameter Cylinders Provide up to 125Te of Lift with GLS



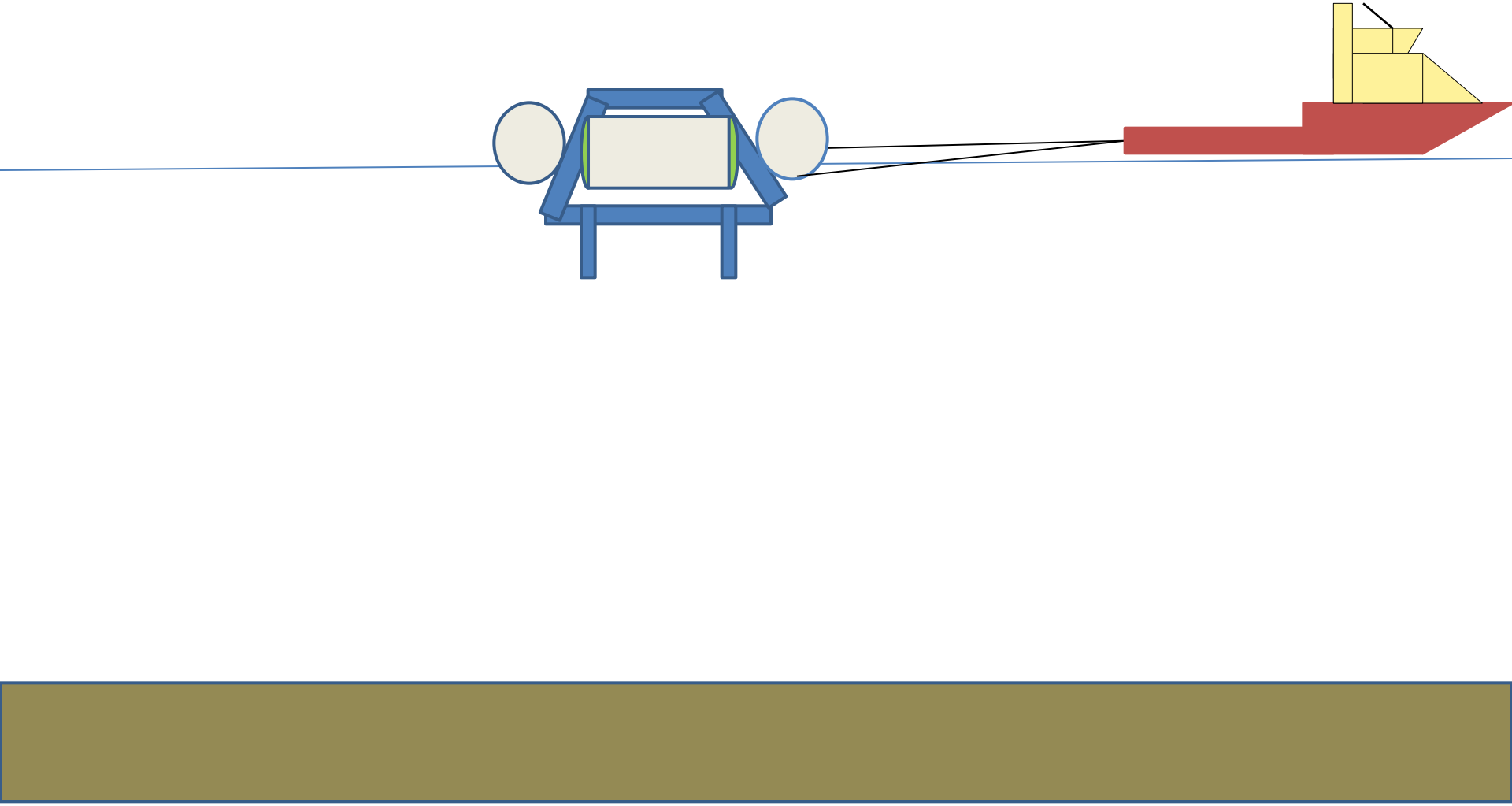
Using Gel to Control Ascent, Structure Brought to Surface. Draft Approximately 6m



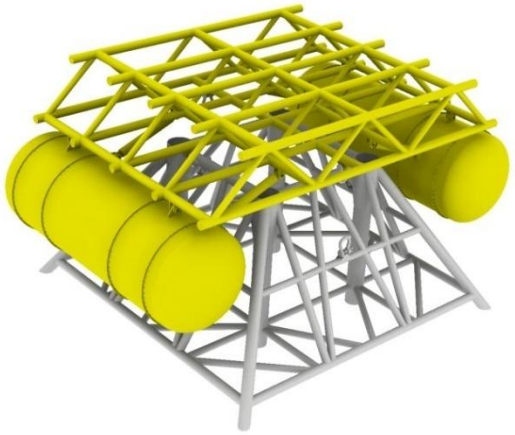
250 Tonnes of Lift by Replacing Gel with Air Reduces Draft to Approximately 4m

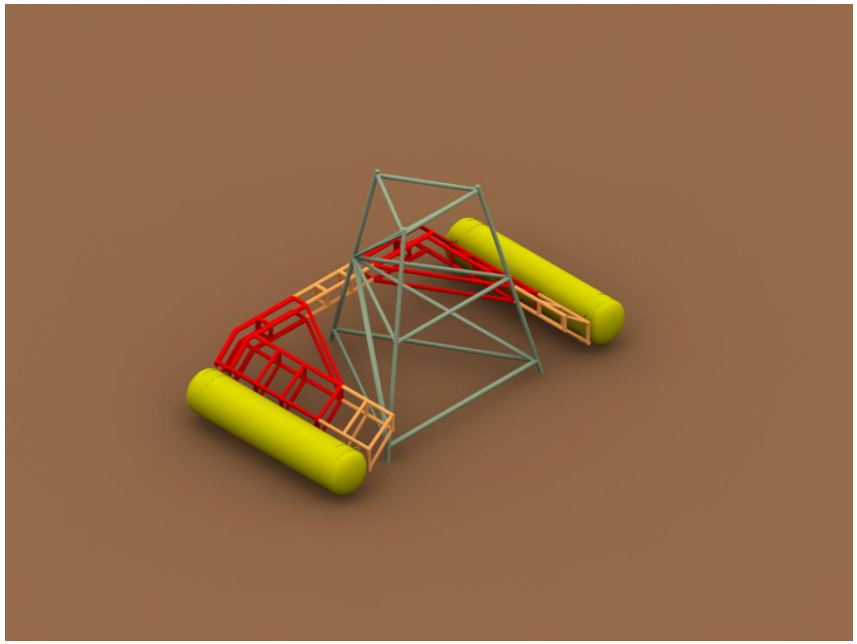


Tow Structure to Port of Choice



Lifting frame designs





ECOSSE Subsea Systems

Aubin

Opportunity

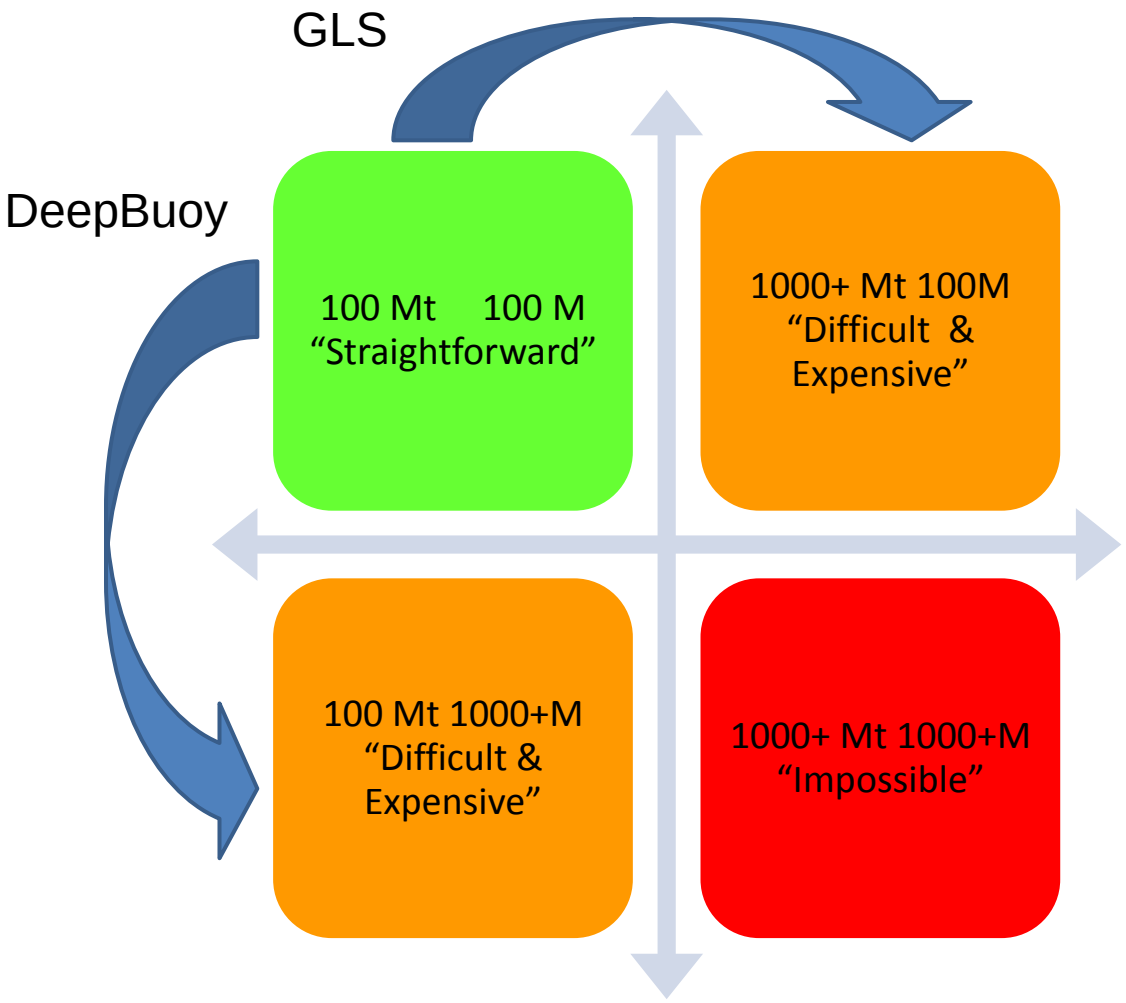
Market Segmentation
Subsea Installation

Cost is determined by depth and size of object to install.

Vessel availability / competition diminishes as you go deeper and heavier.

Barriers to Entry increase as you go deeper and heavier

The move to subsea processing means there is an Increasing need to put bigger objects to greater depths

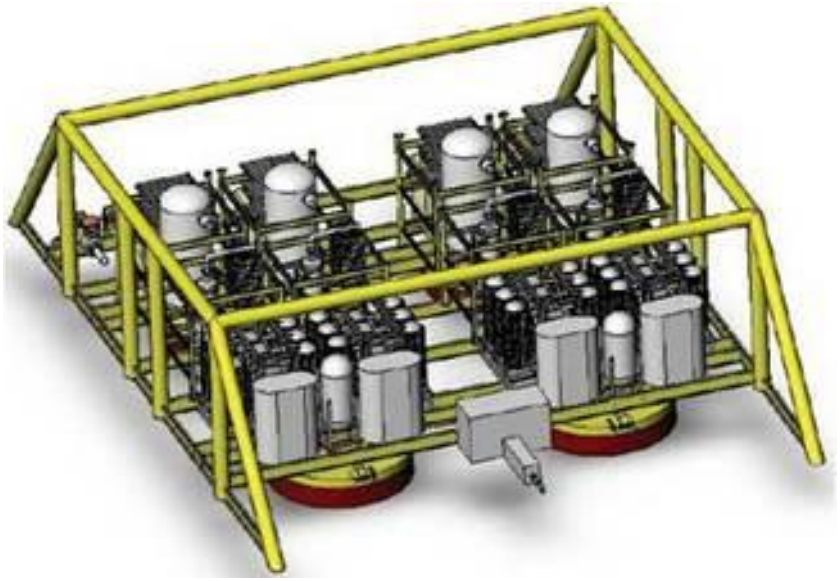


ECOSSE Subsea Systems

Aubin

Doing the Impossible
Installation of large structures at depth

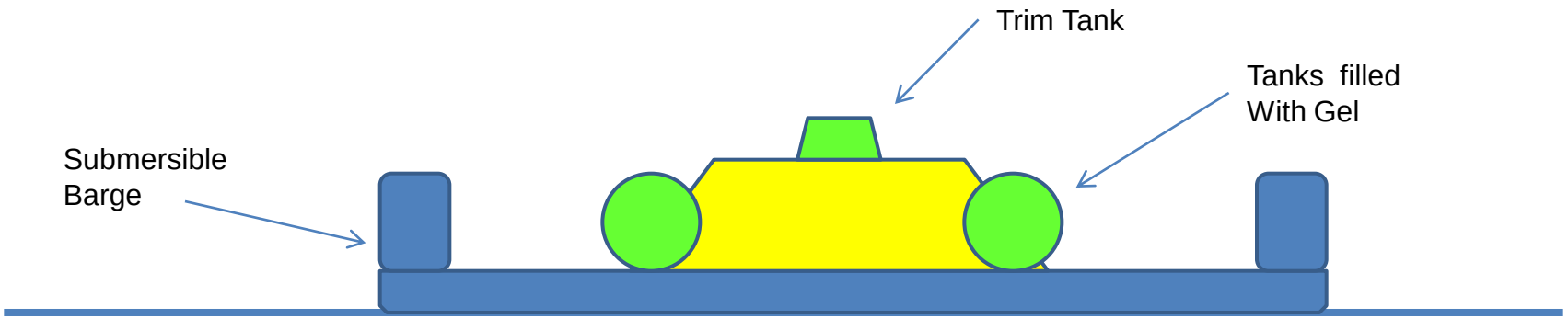
- Subsea compressor - a very large very heavy structure
- Need to be installed in pieces
- Big benefits from making the whole thing at surface and installing it in one piece improving reliability by building and testing the full system on the beach.
- But how to do it?



ECOSSE Subsea Systems

Aubin

Application placing 1000 tonnes to 1000 metres



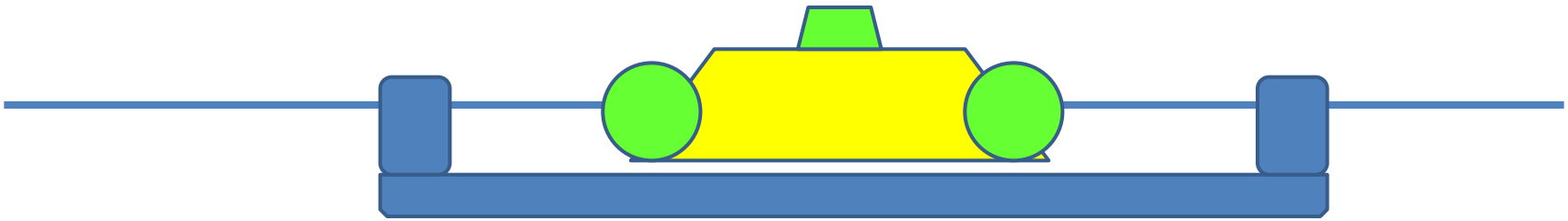
ECOSSE Subsea Systems

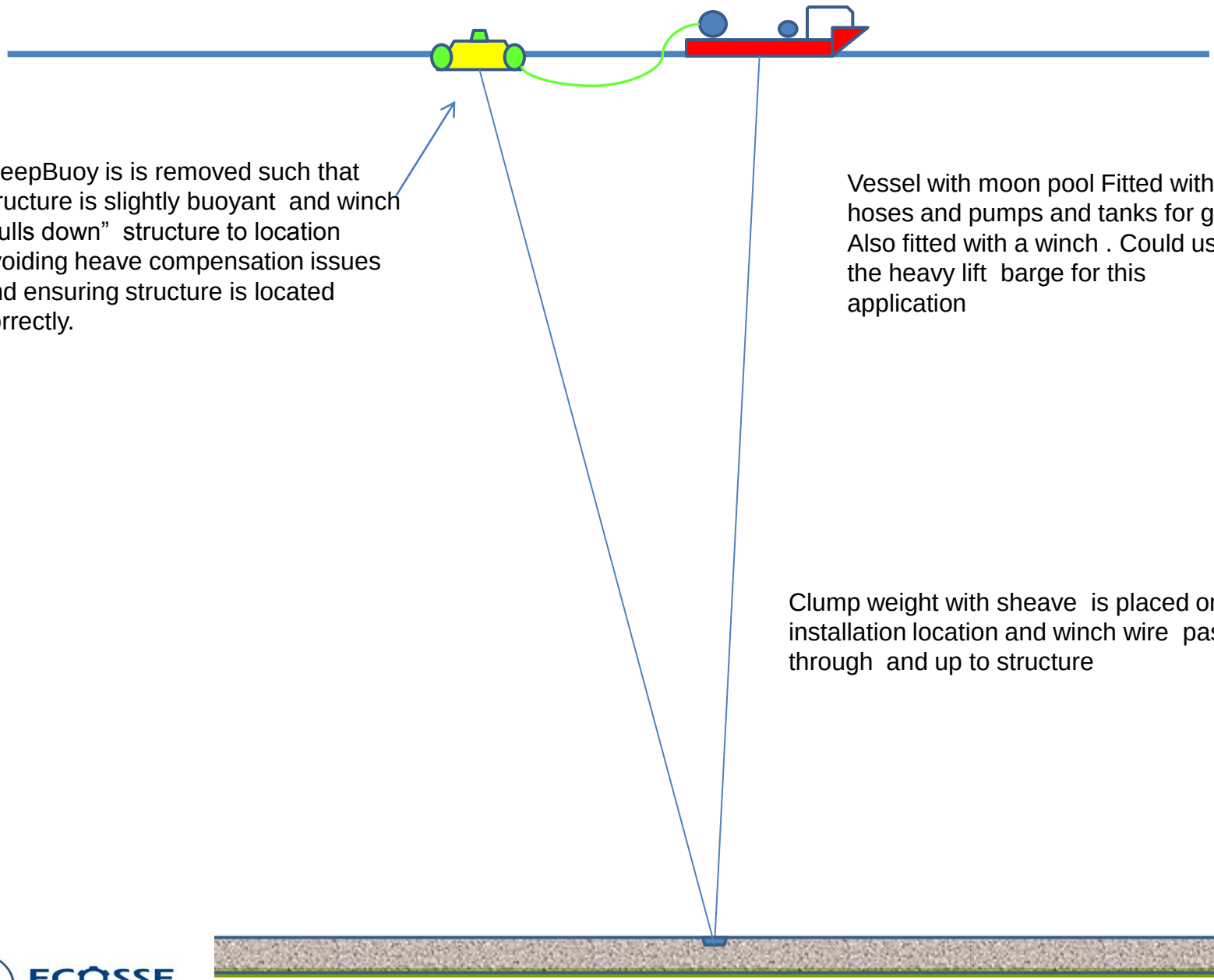
Aubin

Submersible Heavy lift Barges

- Barges can be unpowered or powered
- Multiple units commercially available
- Can lift very large loads and take to site and unload
- Unloaded by controlled “sinking”

Float off structure DeepBuoyGel
Provides buoyancy structure
floats





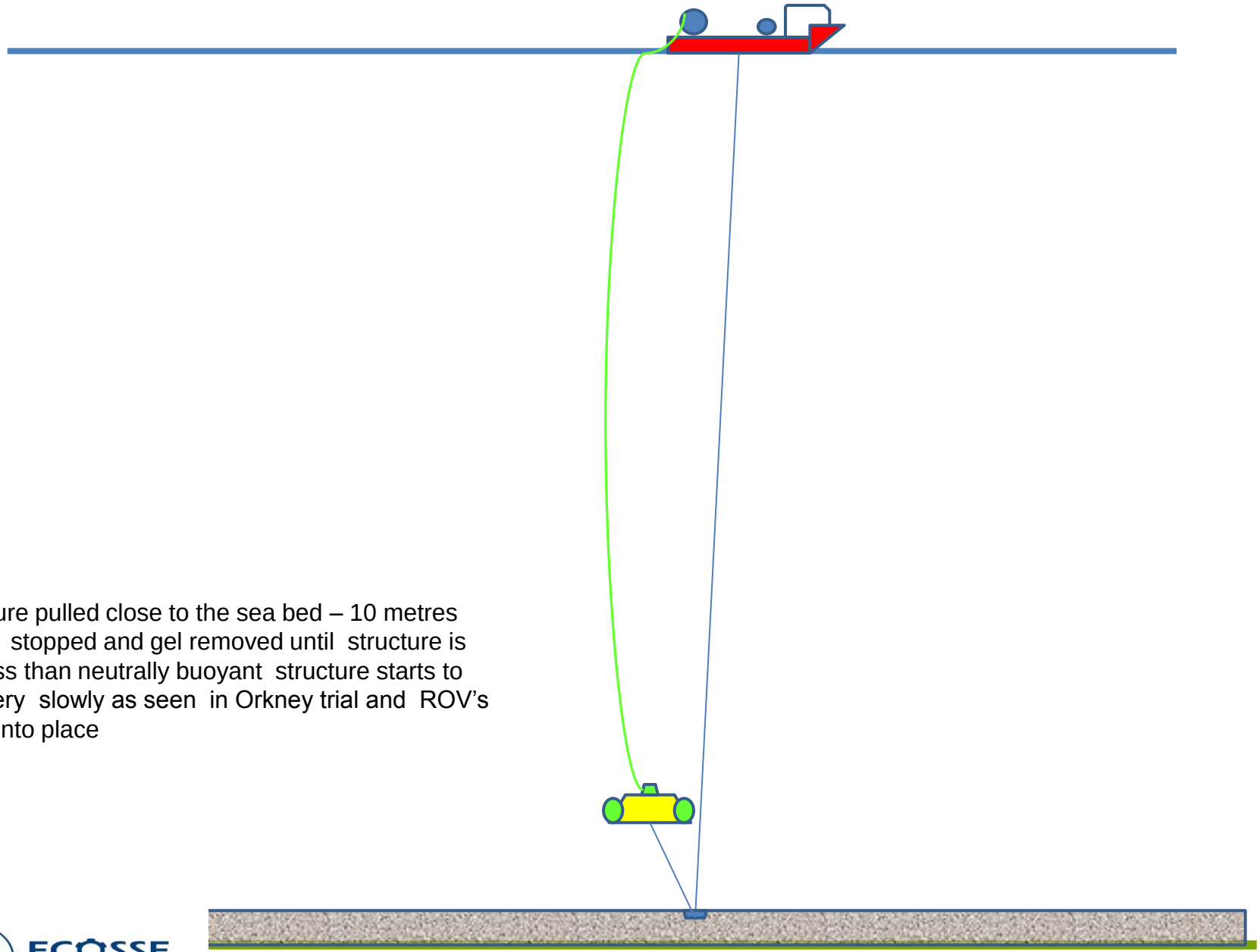
DeepBuoy is is removed such that structure is slightly buoyant and winch “pulls down” structure to location avoiding heave compensation issues and ensuring structure is located correctly.

Vessel with moon pool Fitted with hoses and pumps and tanks for gel. Also fitted with a winch . Could use the heavy lift barge for this application

Clump weight with sheave is placed on installation location and winch wire passed through and up to structure

ECOSSE Subsea Systems

Aubin

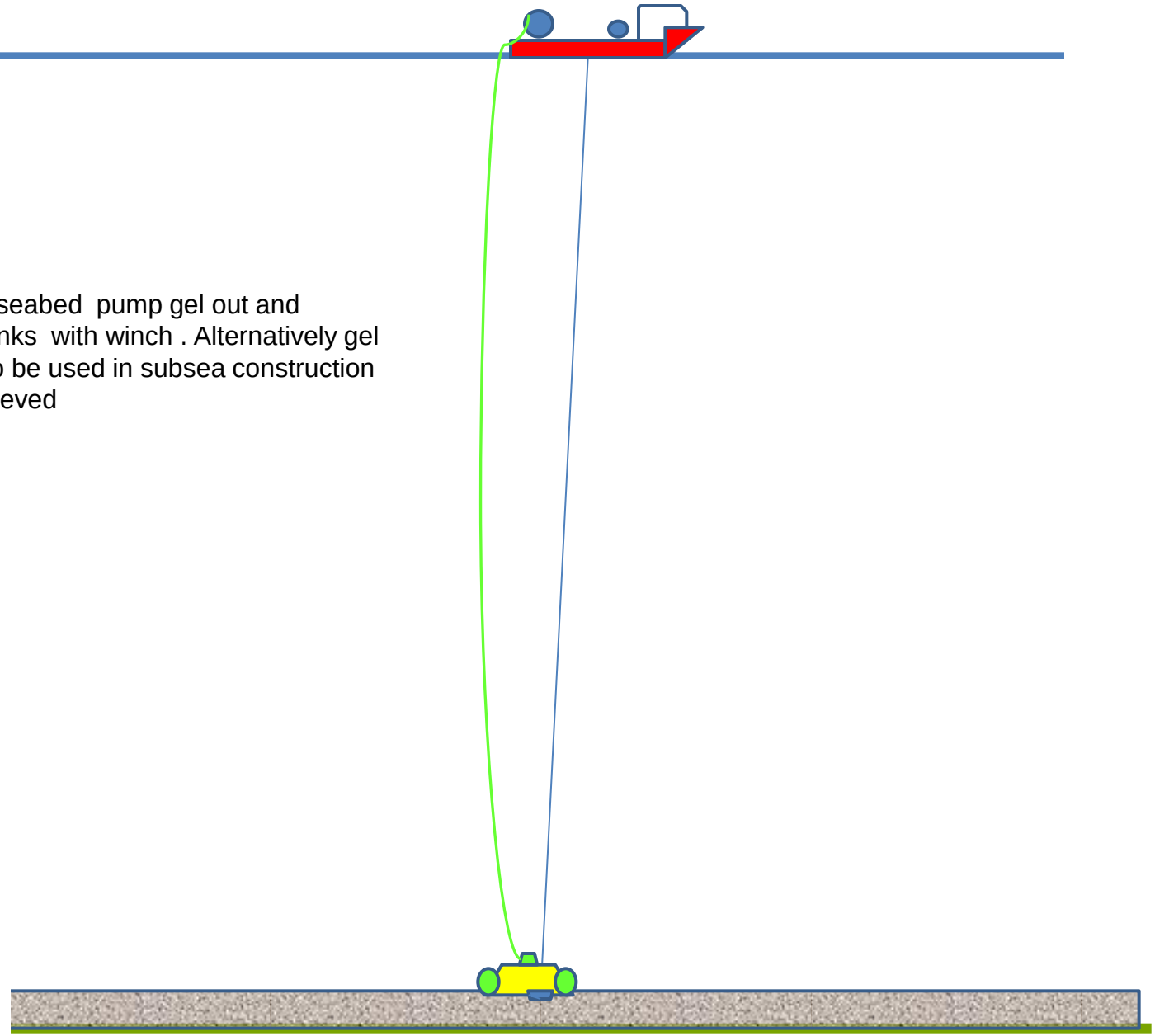


Structure pulled close to the sea bed – 10 metres
Winch stopped and gel removed until structure is just less than neutrally buoyant structure starts to sink very slowly as seen in Orkney trial and ROV's guide into place

ECOSSE Subsea Systems

Aubin

Once on the seabed pump gel out and remove lift tanks with winch . Alternatively gel can remain to be used in subsea construction and then retrieved



ECOSSE Subsea Systems

Aubin

Any questions ?

Thank You

Please come at visit us at the show stand A42

We have lots more to show you

ECOSSE Subsea Systems

Aubin