

Managing Unexploded Ordnance (UXO) risks in Offshore Wind Farm Operations and Maintenance

Lewis Aldred

About Me

- My name is Lewis Aldred
- I live in Oulton Broad
- I have been at SSE since the 22nd of June and I attend 3 days a week as part of an internship
- My favorite hobby is going to the gym and I currently have a part time job at the Marina Theatre Café in Lowestoft. At home I enjoy playing video games and spending time with my family



My project at SSE

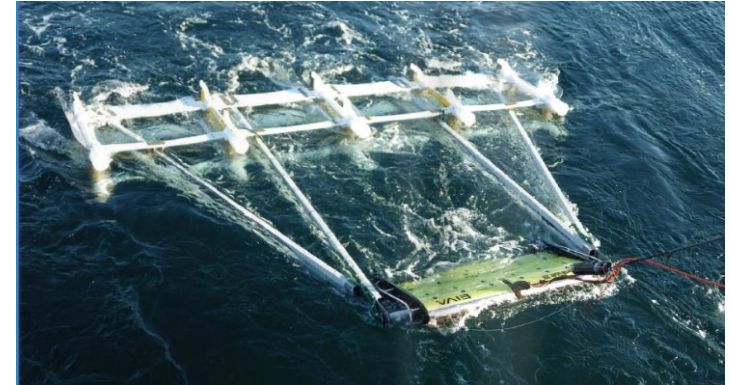


- During my time at SSE I have been learning about UXO (unexploded ordnance) and ways of detecting and removing it.
- I have researched how the UXO finds its way into the sea in the first place and how it effects us to this day.
- As well as this, I have been out to see the Fugro Orca (an uncrewed survey vessel, USV) amongst many other vessels and I have met experienced employees I never would have without this internship.
- My time here has really helped me to get a clear view of what the renewable industry has to offer, and what to expect if I was to choose this as a future career path.
- The next slide begins to show what I have studied.

TASK 1

How did WW2 activities lead to UXO In the UK?

- The Legacy of World War I and II in the UK is marked by the presence of unexploded ordnance that originated from many extensive bombing and mining campaigns.
- These bombs and mines, which failed to detonate, are most commonly found on the sea bed, and pose a risk to anything or anyone near to it.
- Because of this, we still face challenges with urban development and offshore construction projects to this day.



Poland

An infographic showing different types of WW2 ordnance found offshore.

TYPES OF WWII ORDNANCE FOUND OFFSHORE UK

During and after World War II, vast quantities of ordnance were lost, jettisoned or deliberately scuttled in UK waters. These are the most commonly encountered types.



**LIVE DANGER**

Much of this ordnance remains live and extremely dangerous. Do not touch or attempt to recover.

Report any sightings to the Coastguard (Dial 999).

1. AERIAL BOMBS  Dropped from aircraft on targets or jettisoned in emergencies. Sizes from small practice bombs to high-capacity bombs. 📍 Common throughout UK waters	2. SEA MINES  Moored mines used to protect harbours and shipping routes. Often with influence horns or contact fuzes. 📍 Common in shipping lanes, harbours and estuaries	3. DEPTH CHARGES  Anti-submarine weapons dropped from ships or aircraft. Many were practice charges but some are live. 📍 Common on continental shelf and in approaches to ports	4. NAVAL SHELLS  Fired from naval guns. Ranging from small-calibre to large shells. May still contain live explosive. 📍 Common near former bombardment areas	5. TORPEDOES  Dropped, lost or jettisoned torpedoes. Some test or practice, others live. Very hazardous if intact. 📍 Less common but found in deeper waters
6. BOMB CLUSTERS  Containers released from aircraft that scatter small bomblets over a wide area. Many fail to explode and remain lethal. 📍 Found on seabed and in fishing gear from many areas	7. ROCKETS  Air-to-ground rockets or unfired aircraft rockets. May be complete with live warhead. 📍 Occasionally found near former aircraft activity areas	8. GRENADE & FUSE ELEMENTS  Defensive grenades and detonators/fuzes. Small but extremely sensitive and dangerous. 📍 Can be found in all areas, often in debris or wrecks	9. PRACTICE ORDNANCE  Used for training. May lack explosive fill but can still contain live fuzes or pyrotechnics. 📍 Common, but still treat as live	10. MISCELLANEOUS ITEMS  Includes demolition charges, fuzes, signal devices, flares, depth charge contact gear and other equipment. 📍 Found in wrecks, dumpsites and across the seabed

**STAY SAFE**

Never disturb ordnance. Keep your distance.

**REPORT IT**

Note location if safe to do so and report to the Coastguard.

**COASTGUARD: DIAL 999**

In an emergency or to report suspicious ordnance.



Ordnance can shift over time due to tides, storms and seabed movement. Historical dumping grounds are not fixed.

Source: UKHO, RN, MOD, Historic Records



TASK 2

Different UXO Detection Methods



- Geophysical surveys are essential for identifying hazardous areas on the seafloor, including unexploded ordnance (UXO).
- These surveys utilize various techniques such as seismic methods, echo sounding, sidescan sonar and magnetometry to map the sea floor and detect UXO.
- The data collected from these surveys is crucial for the design and implementation of benthic and geotechnical surveys, generally undertaken near the beginning of the development process.
- They are also used to design windfarm layouts and infrastructure.

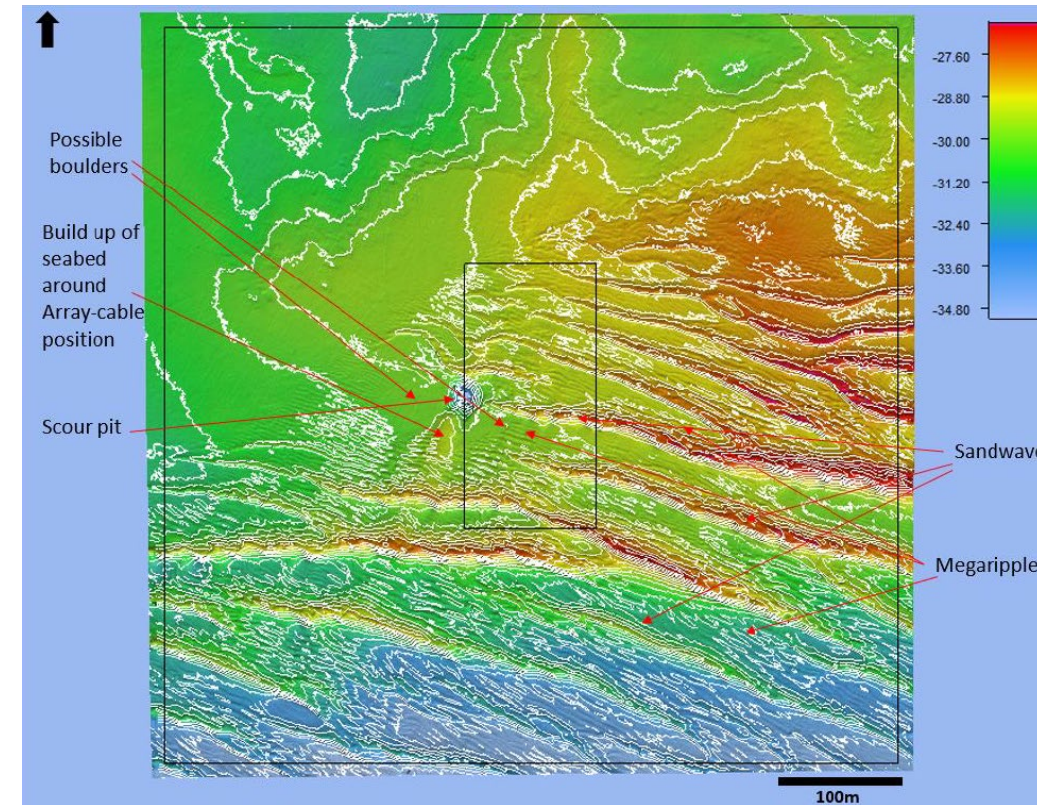
Why are ROVs preferred for underwater investigation?

- ROVs are mostly preferred based on the amount of advantages they provide;
 - Safety, less danger to humans
 - Visibility, murky water
 - Efficiency
 - Cost-Effectiveness
 - Data Collection



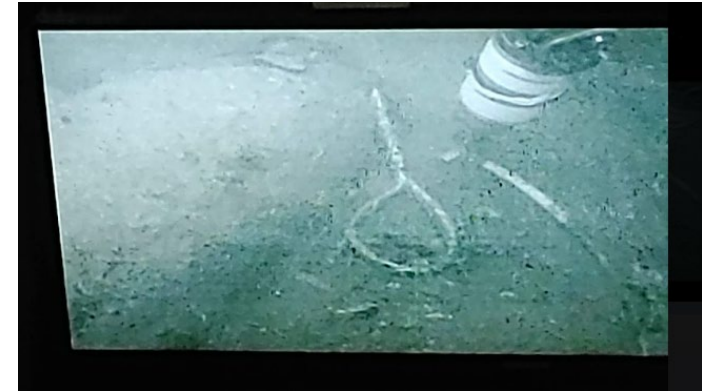
Task 3- Greater Gabbard Case Study

- During an inspection of IGG02 on Sunday 25th June, an object was noticed below approximately 1 metre from the North cable (IGG01-IGG02) close to the foundation.
- On 7th July, this object has been identified as WW2 Air Drop Ordnance:
 - 1.3m in length, 0.3m diameter
 - British in origin
 - 500-1000lb in weight, of which 50% will be explosives
- The UXO was identified on the north-west side of the WTG, just outside of the jacking zone. The UXO is 11m from the WTG monopile and 1 metre from the northern inter-array cable.
- UXO co-ordinates are: E 429217.0; N 5757246.0.



UXO Relocation and Disposal

- The UXO (bomb) was moved using an ROV
- Captured with a net
- Lifted off the seabed by 5 meters and towed to the IG sandbank
- Then lowered to the seabed checking for Saballaria (a protected species)
- But placing a charge on the UXO could not be completed as the ROV's main manipulator hydraulics failed
- The marine license expired (end of March 2024)
- Because of this, the area is surveyed twice a year and subsequent surveys revealed that the UXO was buried



The Future

- As time goes on, the power generated by offshore wind is multiplying rapidly.
- By 2030 it is expected that there will be 205GW of power generated by Offshore Wind Farms globally.
- The industry aims to play a big part in helping the world meet net-zero targets, by reducing the use of fossil fuels.



Highlights

Here are two examples of the vessels I went out to see.

The Fugro Orca, at the bottom right, has been in and out of the Lowestoft port many times whilst I've been here...

But I didn't just see it, we were also allowed to climb aboard and the friendly crew gave us a tour. We looked at the vessel itself, the multiple engines and an ROV (shown on next slide).

And for the top right picture, I was lucky to have been out at the time it was in port, and we took pictures from a distance.



Highlights

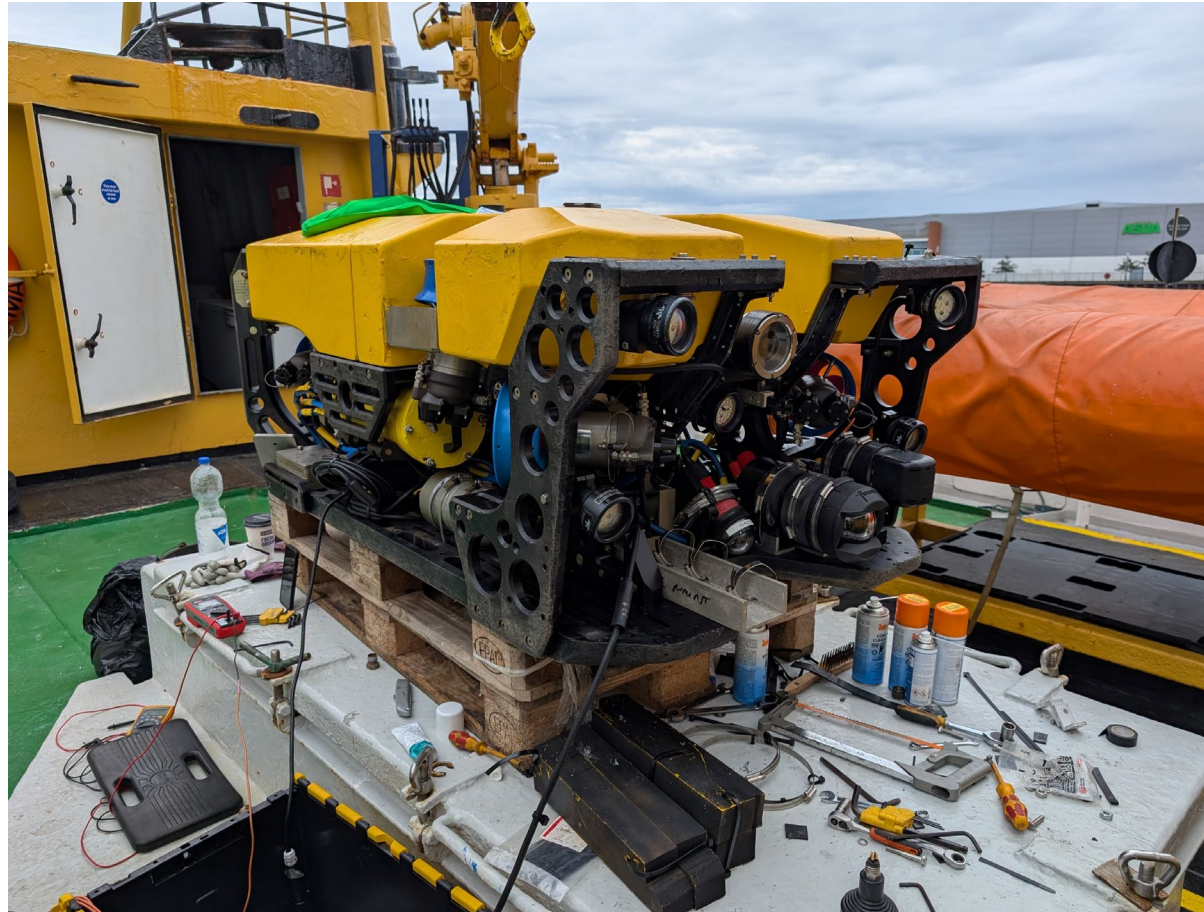
Very early on, in my second week, it was SSE'S annual volunteering day and I was given the opportunity to go out with the team and help a local farm.

They had an open space which wasn't in use so we were asked to build an area for a sort of campsite. The task consisted of digging, cutting wood, making cement and of course eating dominos.

It was a great experience for me and everybody there was kind and made it easy to get involved. It was really nice to take part in something which doesn't happen often and it is one I will remember.



Fugro Orca ROV



Conclusion

- I would like to thank everyone here for your time and kindness, and being at SSE has been an amazing opportunity, learning curve, and an overall great experience. It is something I will never forget and has provided me with nothing but benefits and great experiences.
- Thank you for listening, and thank you for having me.

Lewis Aldred