

# Ardentia

## Wreck removal and Towing with Airbags: Santa Ana & Serenin

Borja Rey Penelas

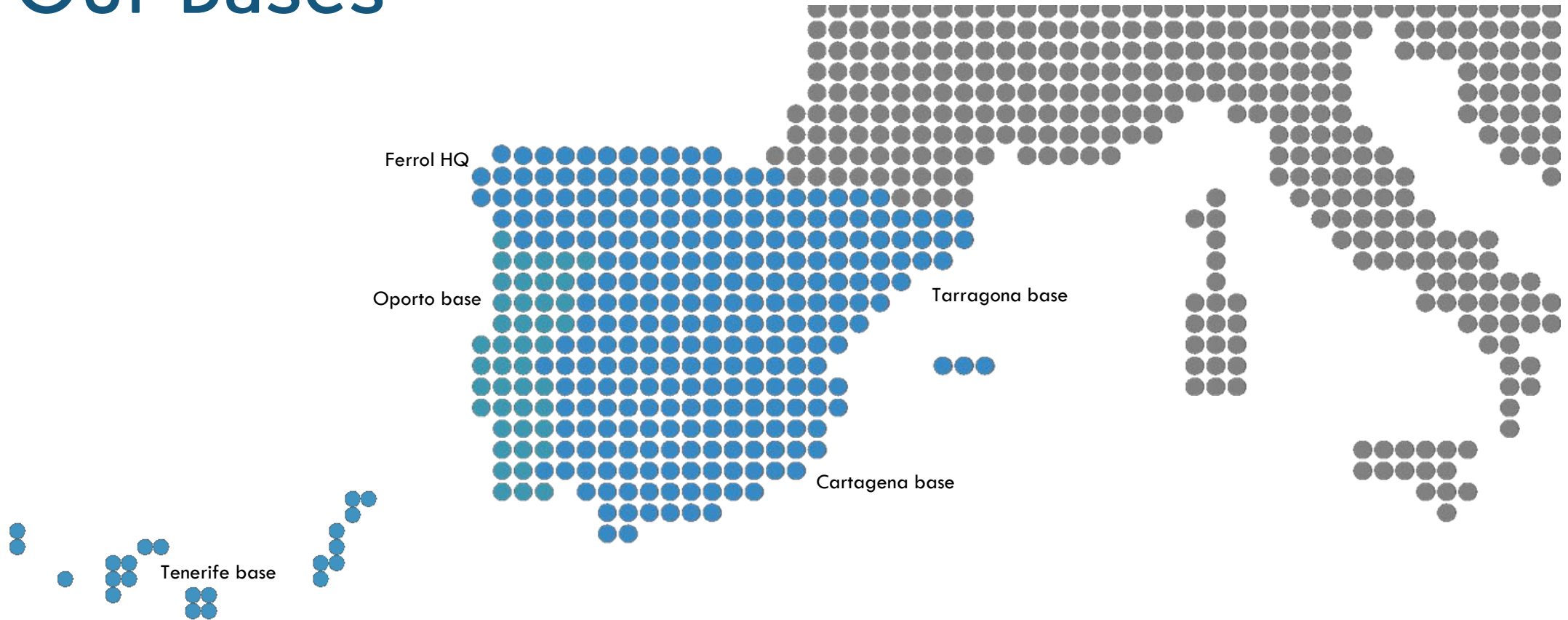
Naval architect

London, 12/Dec/2024

# ARdentia

- Founded by a group of experienced professionals in 2009, Ardentia began as a company focused on salvage but gradually expanded into other fields such as:
  - Pollution prevention
  - Maritime terminals
- Today, the company has over 100 employees, more than 20 boats, 5 anti-pollution containers, 1 oceanic anti-pollution container, and 5 survey ROVs.

# Our bases



+100 employees



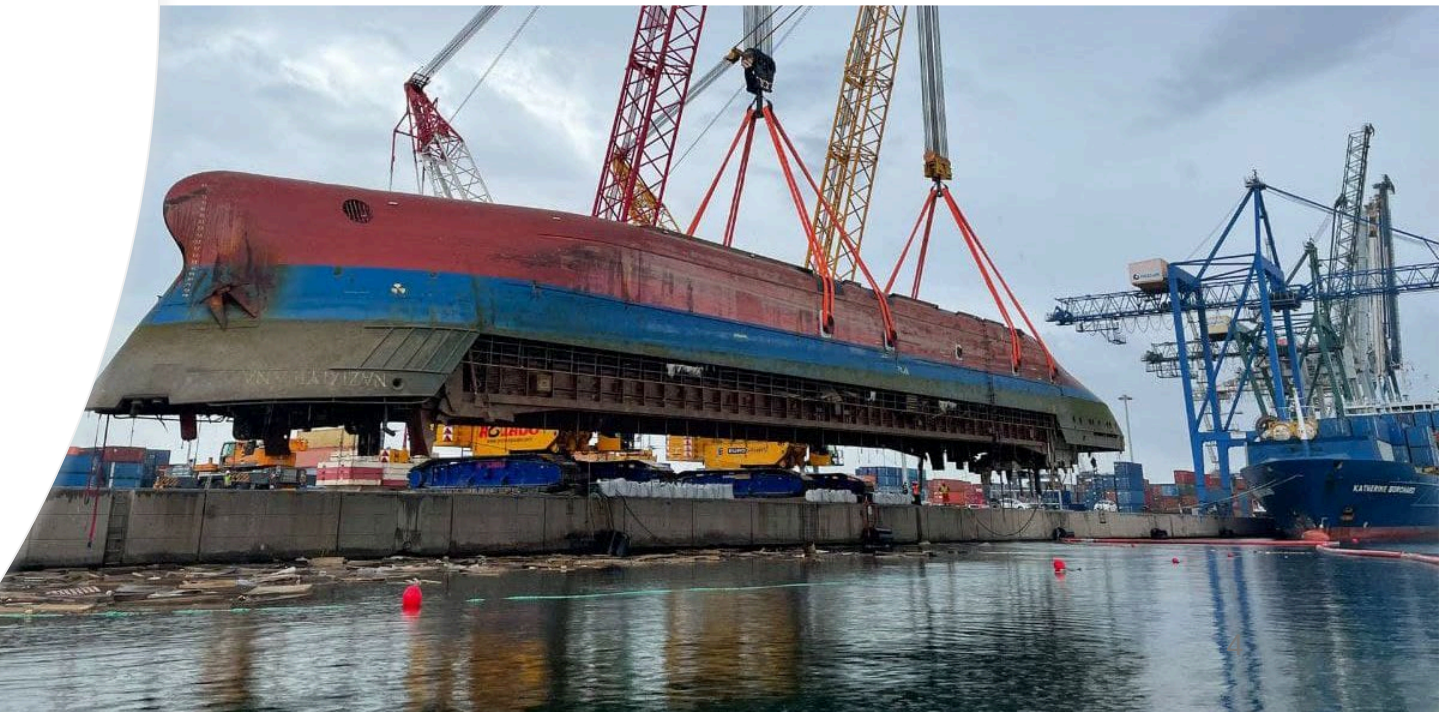
Member of the International Salvage Union



+20 Workboats

## Our units:

- Salvage:
  - Since 2009 Ardentia Marine has been the contractor for emergency response and underwater services for the Spanish Coast Guard.
  - We have carried out dozens of wrecks and bunker removals and refloating operations, mostly in Spain and Portugal.





## Our units:

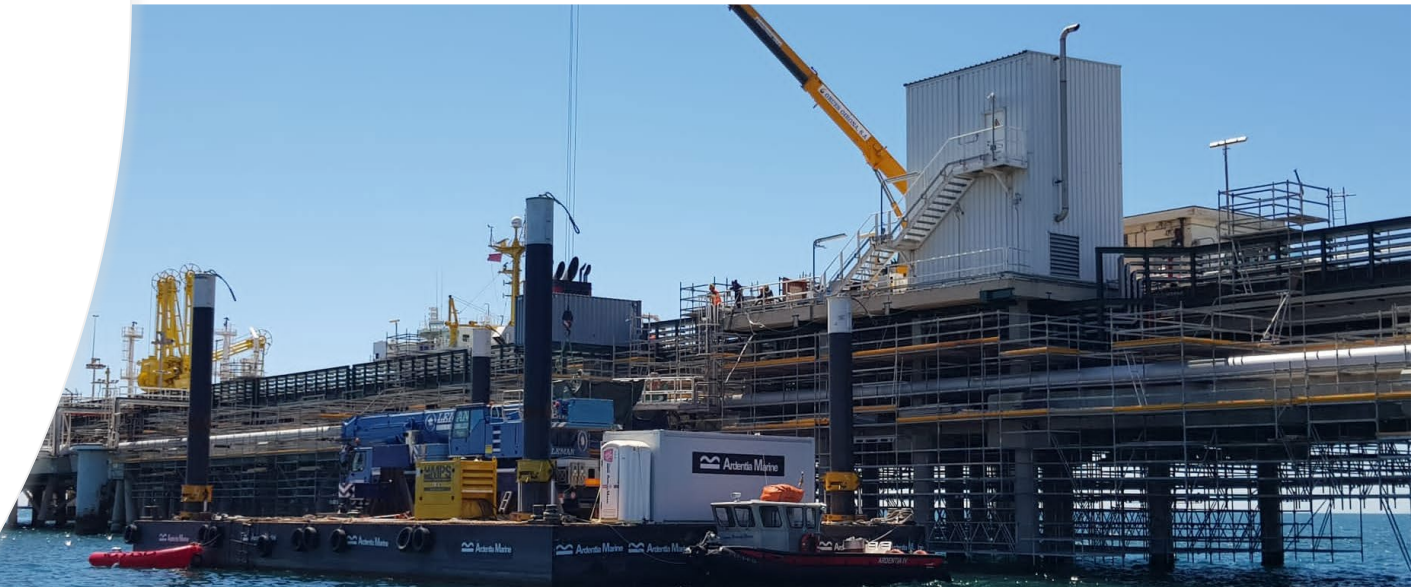
- Oil spill response:
  - Oil spill response is a key player during any salvage, however, Ardentia is also involved in pollution prevention, maintaining several anti-pollution containers on standby from Barcelona to the Ebro Delta.
  - Ardentia also performed several oil spill drills.





# Our units:

- Marine terminals:
  - Ardentia carries out the maintenance of the monobuoy in Tarragona, as well as other underwater and maintenance services for Repsol.
  - We provide the mooring services and underwater maintenance for CEPSA in Tenerife





# Salvage airbags

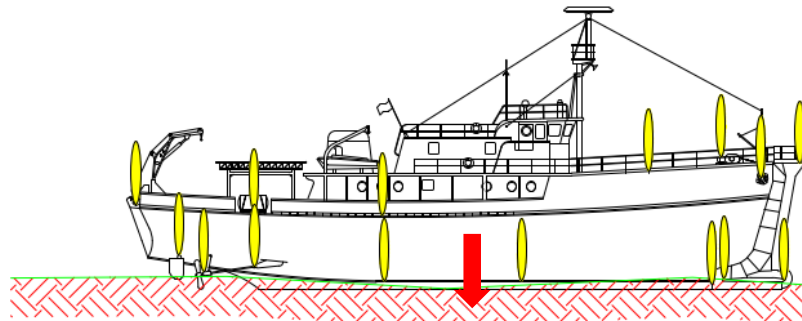
- Refloating airbags, or salvage airbags, are a specialized tool used during marine salvage operations to refloat sunken or grounded vessels.
- They also assist in the handling of heavy underwater structures.
- These devices rely on buoyancy principles to lift and stabilize submerged objects.



# Airbags technology: principles

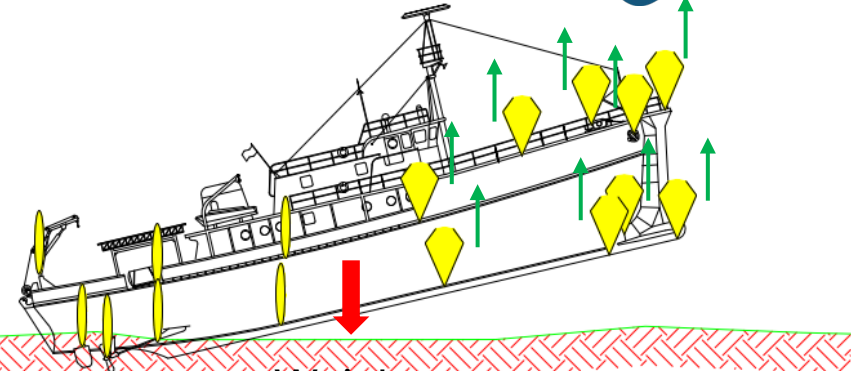
- Principle:
  - Salvage airbags work based on **Archimedes' principle**: when submerged, they displace water, creating an upward buoyant force proportional to the volume of water displaced. This buoyant force counteracts the weight of the sunken object, lifting it.





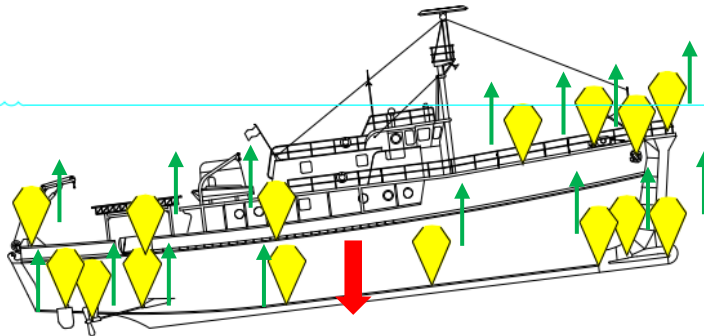
Weight

Only **Weight**



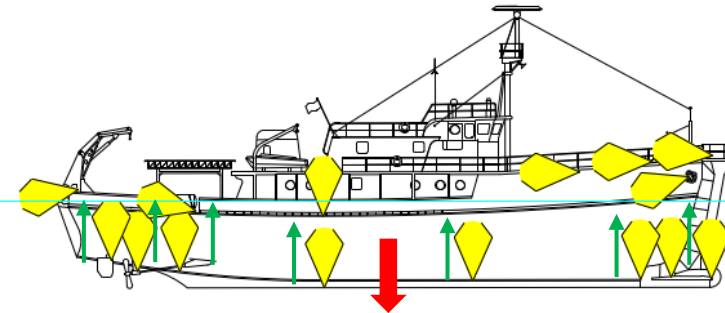
Weight

**Buoyancy** > **Weight**



Weight

**Buoyancy** > **Weight**



Weight

**Buoyancy** = **Weight**

# Different type of airbags

- Heavy duty rubber airbags (or roller bags):
  - Constructed of an out-rubber layer, multilayer heavy-duty synthetic-tire-cord layers, and an inner rubber layer vulcanized firmly.
  - Lengths from 5 to 18m and diameters from 1 to 2m
  - Buoyancy gained up to 55 ton
  - Used as well to launch vessels.





# Different type of airbags

- PVC heavy duty airbags:
  - Constructed of a heavy-duty PVC.
  - Mainly two different shapes:
    - Cylindrical
    - Parachute
  - Standard sizes up to 50t.



# Different type of airbags

- Ardentia has more than 2,000 ton of buoyancy in PVC airbags
- All of them are a combination of cylindrical and parachute.
- Advantages of PVC airbags:
  - **Resistance to Corrosion and Chemicals:**  
PVC airbags are more resistant to corrosion in marine environments.
  - **Lighter Weight**  
PVC is a lighter material than rubber, making it easier to transport, handle, and install during salvage operations.
  - **Lower Cost**  
PVC is typically more affordable than rubber in terms of both material and manufacturing processes, making PVC airbags a more cost-effective choice.



# Pros and cons of refloating with airbags

- Pros
  - Efficiency
    - Rapid installation: Airbags are quick to deploy and install, which can save valuable time in salvage operations. One diver can install 10 airbags of 5t in 1h (ideal conditions)
    - Modular approach: Multiple airbags can be used simultaneously, distributing the load evenly and making the operation more controlled.
  - Safety:
    - In most of the cases divers don't need to access to inside the casualty
    - Inflate operation can be conducted remotely
  - Cost-effectiveness:
    - Lower equipment costs: Airbags are significantly cheaper than heavy machinery like cranes or specialized salvage vessels.
    - Reusable equipment: Airbags can be reused for multiple operations, reducing long-term costs.
  - Portability:
    - Lightweight and compact: Airbags are easy to transport and store, making them suitable for remote or hard-to-reach locations. (4 airbags of 5t can be stored and transport in one open top IBC)
    - No need for heavy infrastructure: Airbags eliminate the need for large cranes, barges, or other specialized equipment.

# Pros and cons of refloating with airbags

- Cons

- Use more capacity than required and distribute them in more manifolds due to the high risk of puncture caused by sharp objects.
- Maintenance Requirements: Airbags need to be regularly inspected and maintained to ensure the reliability.
- Operational challenges:
  - Skilled personnel: Requires experienced personnel to properly design the spread, place and inflate the airbags.
  - Difficulty in rough conditions: High currents, waves, or poor underwater visibility can complicate deployment and positioning.
  - Compromised Hull Integrity: If the vessel is severely damaged, using airbags could worsen the structural integrity, leading to failure during lifting.
- Depth limitations:
  - Pressure challenges in deep water: In deep waters, the pressure may make it difficult to inflate airbags effectively. Once the refloat commenced the expansion in the air due to the change of pressure can damage the airbags even when the airbags have an overpressure valve.



# Salvage with airbags

- Over the past 15 years Ardentia has specialized in refloating vessels up to 100m and at depths of 35m using airbags.
- We have refloated vessels with airbags in port but also in open waters.



# Salvage with airbags

- Refloating of FV Virgem Dolorosa:
  - Sunk offshore Nazaré (Portugal) at 35m water depth
  - She was resting on her PS
  - Refloated “as it is” with airbags and towed to Aveiro (+- 55nm)



# Salvage with airba



# Salvage with airbags

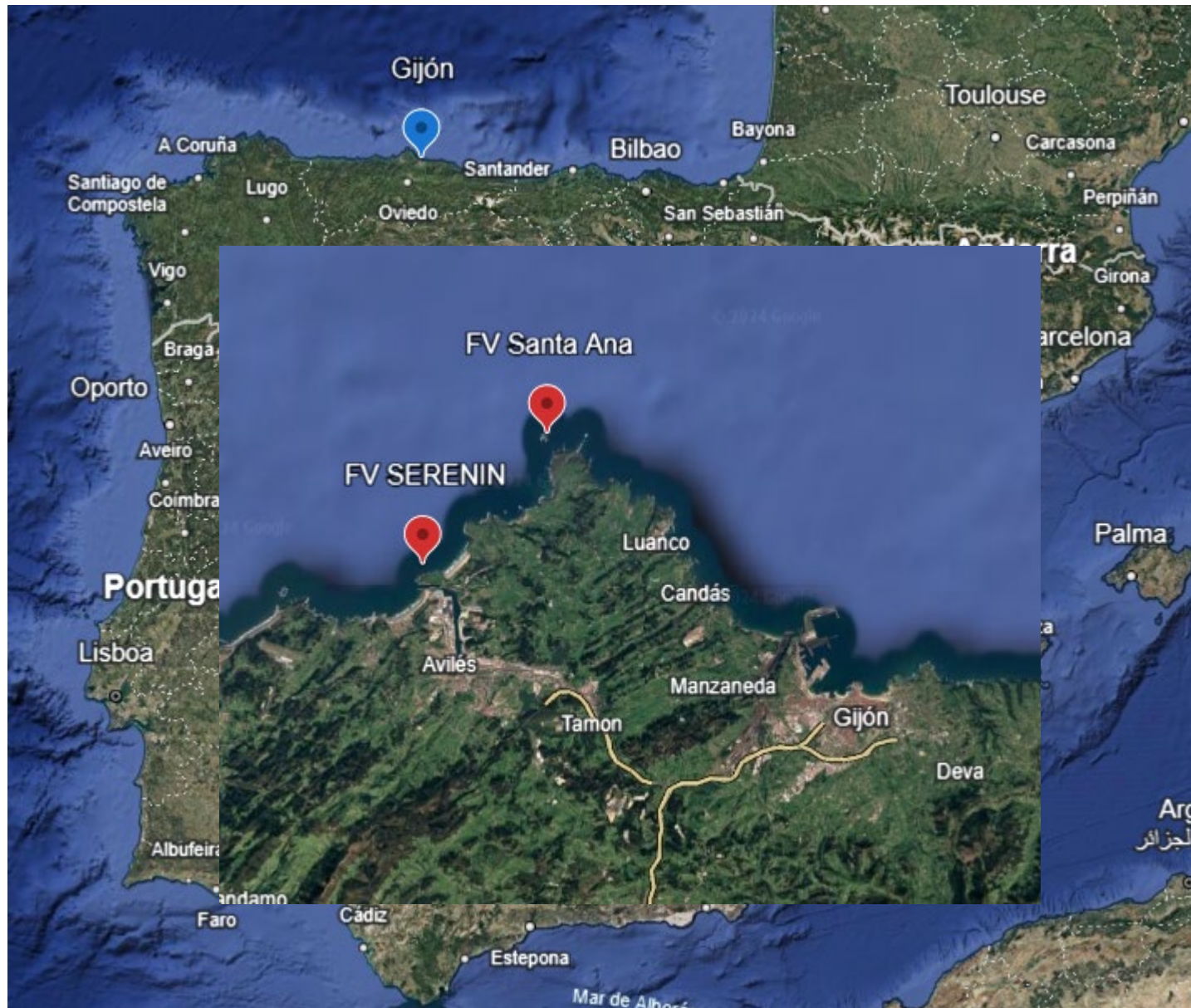
- We use the airbags not only for refloat sunk casualty but also parbuckle them.
- Casualty FV Baffin Bay
  - Sunk at Vigo port after a fire in 2021
  - Parbuckled force – 250mt
  - Installed more than 700mt to stabilize the casualty and absorb the FSM





# Cases Study: Santa Ana & Serenin

- FV Santa Ana – sunk on 10<sup>th</sup> March 2014 Cabo de Peñas, Asturias, Spain
- FV Serenin - sunk on 7<sup>th</sup> January 2022 Cabo de Peñas, Asturias, Spain



# FV SANTA ANA

- Particulars:
  - Type – Trawler
  - Length: 35m
  - Beam: 7,8m
  - Depth: 5,7
  - LSW – 350t
  - Steel
  - Flag - Portugal
  - Built – 1980
  - Shipyard – FOZNAVE (Portugal)





# FV SANTA ANA

- Incident:

- In the early vessel (F/V half a mile
- The impac vessel.
- Only one o a liferaft, fr
- During the



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ear Erbosa Island,

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l to reach safety in  
essel.

re recovered.

# FV SANTA ANA



- Wreck removal:
  - On 18th April, Ardentia mobilized the workboat “Latero”, however the operations didn’t commence until beginning of May due to bad weather conditions and permits.
  - On 19<sup>th</sup> May, less than three weeks after commenced the preparations, the Santa Ana was refloated



# FV SANTA ANA

- Towage and lift:
  - On 20<sup>th</sup> May the convoy arrives to Gijon Port
  - On 21<sup>st</sup> May the Santa Ana was lifted out on water and landed it in the designated area for disposal





# FV SERENIN

- Particulars:
  - Type – Trawler
  - Length: 30m
  - Beam: 7,5m
  - Depth: 3,5
  - LSW : 305 ton
  - Steel
  - Flag : Spain
  - Built : 1999
  - Shipyard – Armon Burela (Galicia, Spain)



# FV SERENIN

- Incident:
  - For unknown reasons, in the early hours of January 7, 2022, the FV SERENIN lost control and began drifting towards the rocks, where it eventually sank.
  - All the 8 crew members on board managed to reach safety in a liferaft, from which they were rescued by the local pilot boat.
  - In 2022, a diving company was hired for the wreck removal. After several unsuccessful attempts, they decided to abandoned the project.

# FV SERENIN

- Wreck removal:
  - In 2023 Ardentia was awarded with wreck removal.
  - A dive inspection carried out in February 2023, showed that the wreck was heavily damaged due to the damage caused during previous refloating attempts and rough sea conditions during the winter.
  - The wreck was lying on her SB at 18m depth.

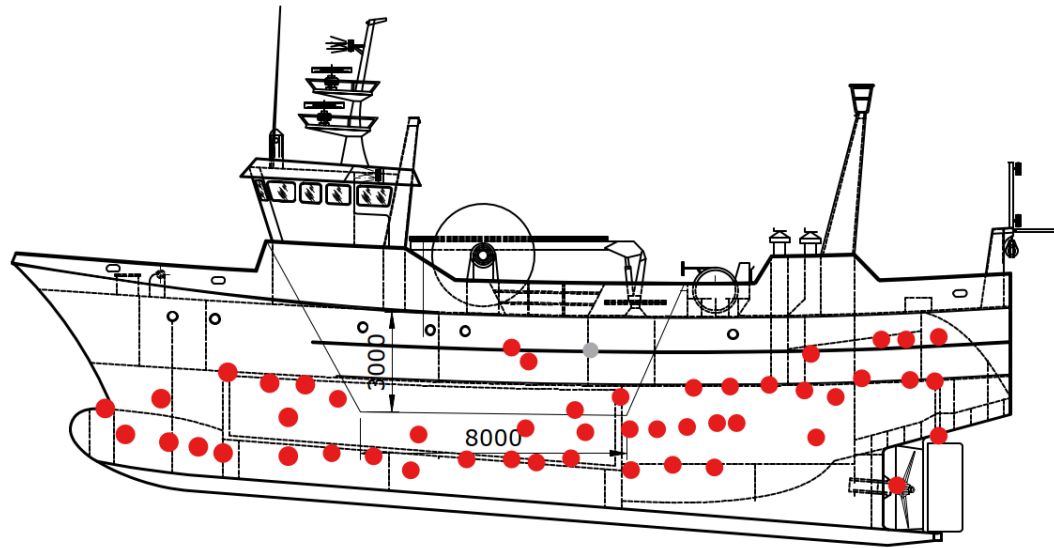


# FV SERENIN

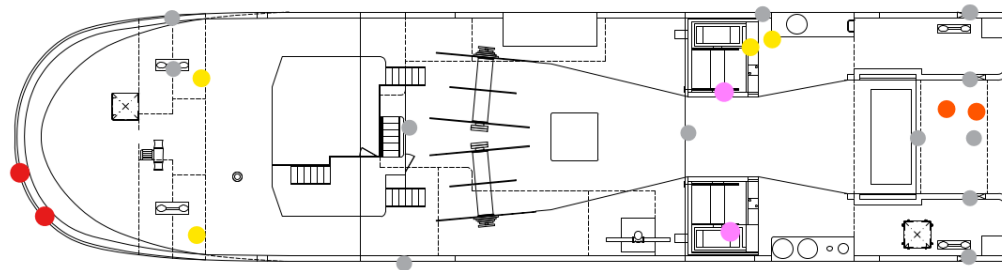
- Wreck removal:
  - Ardentia proposed the same proven method as the SANTA ANA:
    - Refloat using airbags
    - Tow to Gijon Port
    - Lift with crane
    - Piecemeal the wreck on site and transport in manageable sections to the recycling facility.
  - Due to the wreck's exposure to the sea, the months with the best weather conditions for salvage operations are from late June to mid-August. However, due to conflicts between authorities, the salvage operation could not begin until mid-August, significantly shortening the window.

# FV SERENIN

- Wreck removal:
  - Wreck removal con
  - 70 strongpoints we
  - We had to wait mor
  - install the airbags, i



Window to



# FV SERENIN

- Wreck removal:
  - On 7<sup>th</sup> September, the airbags and hoses installation commenced.
  - On 9<sup>th</sup> September the refloat operation started at 20.00 after install 120 airbags.



# FV SERENIN

- Towage to Gijon:
  - The casualty was afloat at 20.40, and after few minutes of stabilization, the convoy headed to Gijon





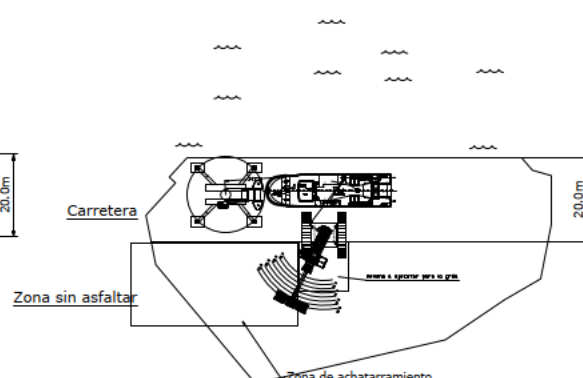
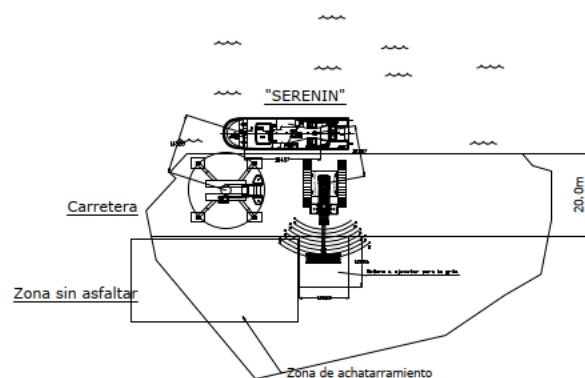
# FV SERENIN

- Arrival to Gijon and lift operation:
  - The convoy arrived to Gijon after 12h of towage.
  - Since the cranes were not ready, it was decided to deflate the airbags in a controlled manner and wait until the cranes were ready to refloat the wreck again.

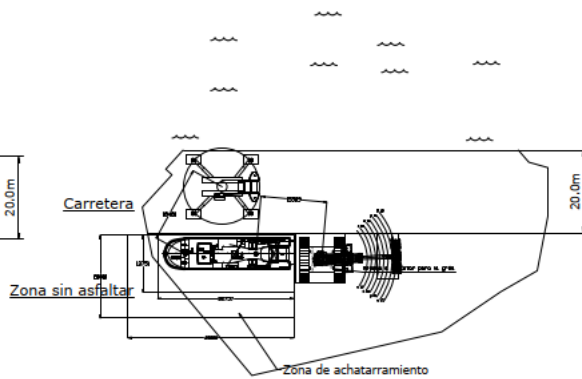
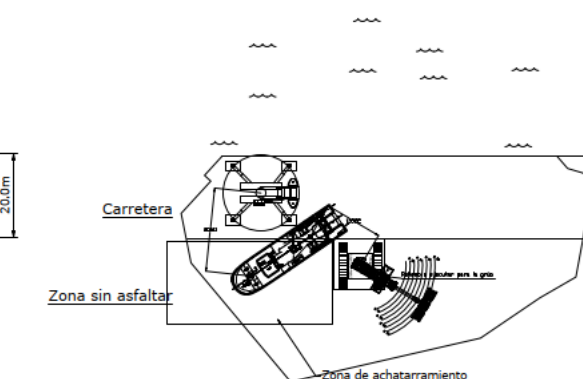
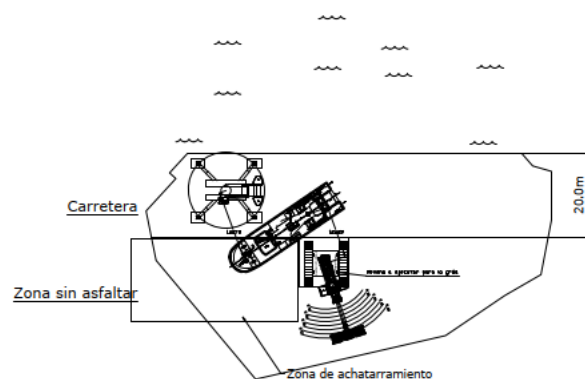
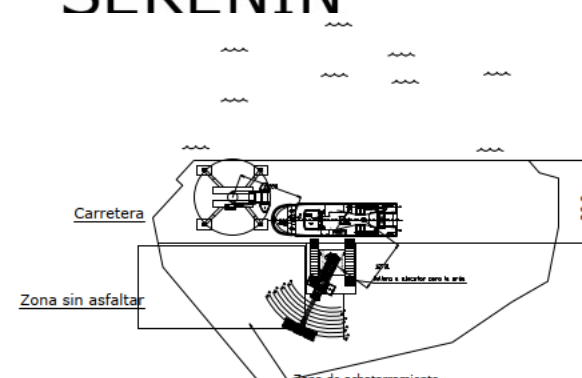


# FV SERENIN

- Lift



## "SERENIN"



pad  
:00



# FV SERENIN

- Lift operation:
  - The cranes were ready on 13<sup>th</sup> September.
  - At 1900, the wreck was refloated again as planned.



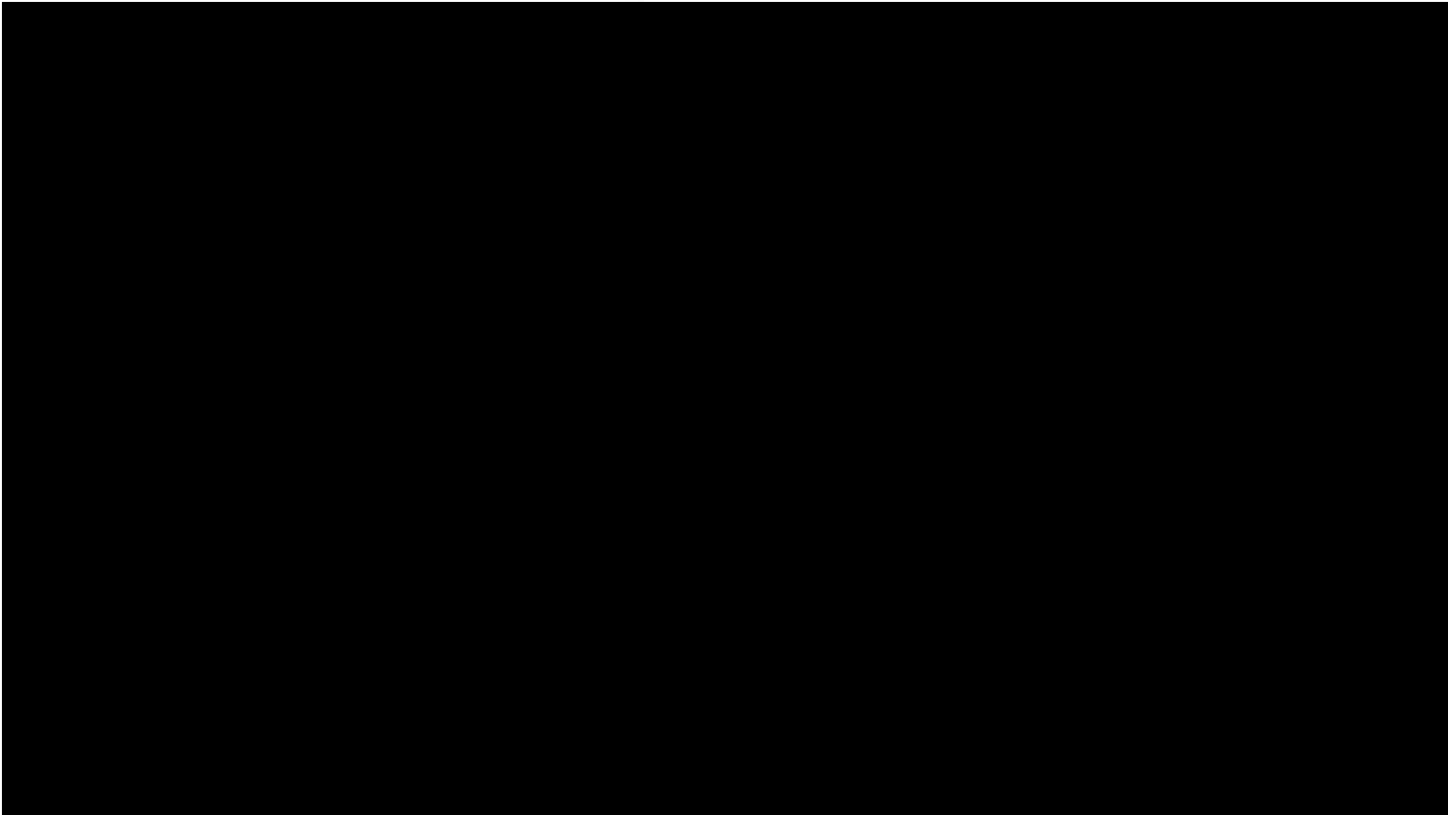


# FV SERENIN

- Lift operation:
  - On the 14th, the divers connected the rigging and lift operation was carried out as planned.







# Differences and similarities

Similarities
Type of vessel and dimensions
Location
Final destination
Water depth

Differences
Position on the seabed
Urgency

# Why Ardentia used the same methodology 10 years apart

- Even though the Serenin was a wreck removal and the Santa Ana an emergency, due to the exposure of the location, the effective working time onsite was reduced.
- In both cases, the damage to the vessels was so extensive that refloating through pressurization/pumping was not possible.
- The use of a crane barge or sheerlegs was not selected due to mob/demob cost, the site's exposure to the sea and the associated high costs.
- In 2023, considering the precedent set by the Santa Ana case and analyzing the factors outlined above, refloating with airbags is the most cost-effective and operationally efficient solution.

# Conclusion

- Over the past 15 years, Ardentia has demonstrated that one of the best solutions for refloating small to medium-sized vessels is using airbags, even in areas where working conditions are challenging due to adverse weather.



