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GERMAN OFFSHORE SPACEPORT ALLIANCE (GOSA)

A EUROPEAN OFFSHORE SPACEPORT FOR MICROLAUNCHERS

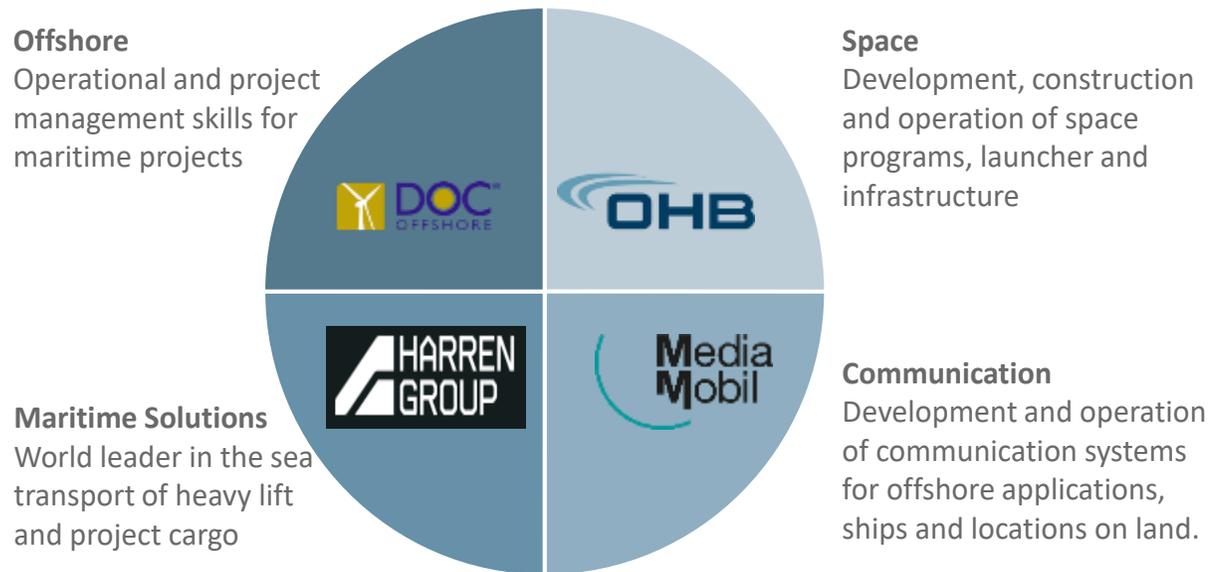


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INTRODUCTION

GOSA - GERMAN OFFSHORE SPACEPORT ALLIANCE

An industrial consortium joining complementary skills and capabilities to develop the European Offshore Spaceport (EOS) concept.



Strategic Partners:



Terminal Operator
Bremen / Bremerhaven



Insurance



GOSA - GERMAN OFFSHORE SPACEPORT ALLIANCE

- GOSA founded 2020, based in Bremen
- Plan to offer efficient launch options for small launch vehicles
- Enable launch of payloads of up to about 1 ton
- Develop mobile launch pad for an offshore vessel or barge – launcher and vessel agnostic!



ADVANTAGES

- Easily accessible launch opportunity in the center of Europe
- Less impact on third parties by smart selection of launch location
- Minimal disruption of the public
- Flexibility to change locations depending on mission needs
- Low fixed costs due to mobile-launch pad approach



POTENTIAL

- Worldwide interest in offshore launch capabilities, also as support of existing spaceports
- Worldwide interest in offshore capabilities for landing and recovery scenarios of reusable launchers
- GOSA is investigating with potential partners collaborations, also hybrid spaceport solutions
- The multi-crises scenario did change the view on the necessity of resilience and European launch autonomy





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THE EUROPEAN OFFSHORE SPACEPORT (EOS) MID-TERM OUTLOOK

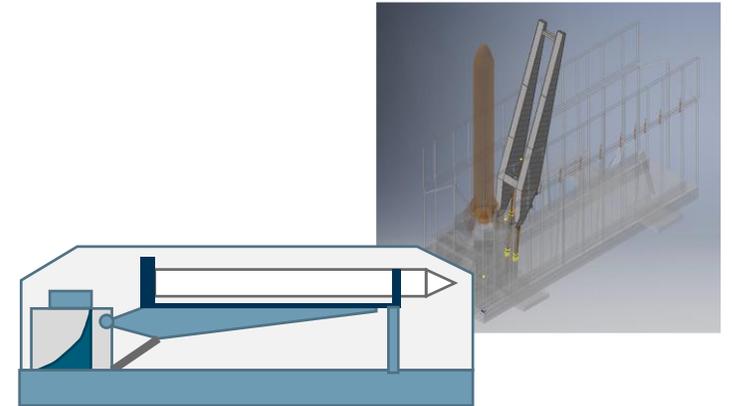
ONSHORE OPERATIONS



Launcher & Payload arrive in Bremerhaven



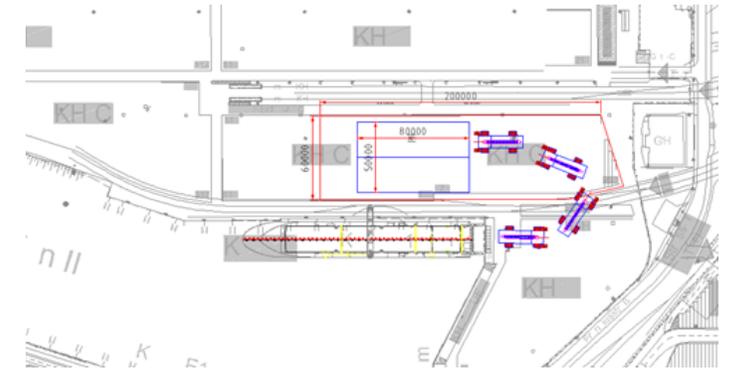
Joint Payload & Launcher Preparation at Integration Facility



Full Integration of Launcher in Mobile Launch Box



Launch Box Roll-on in Port



Transfer to Launch vessel

OFFSHORE OPERATIONS



Transit to Launch Site – 1 day



Preparation, Erection, Fueling, Evacuation



Transit to Port - 1 day

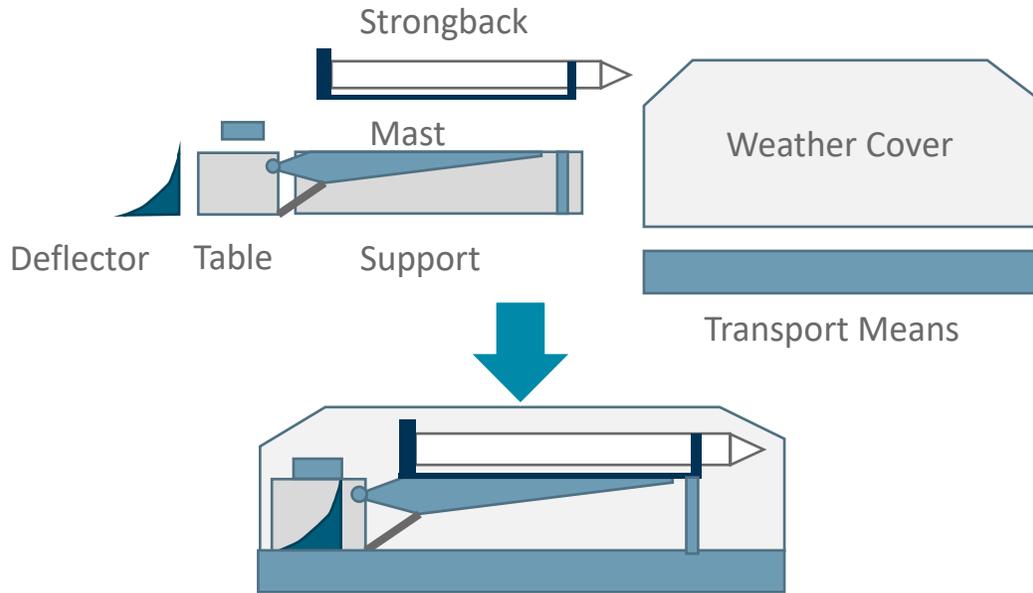


Post-Launch Activities



Launch

MOBILE LAUNCH PAD



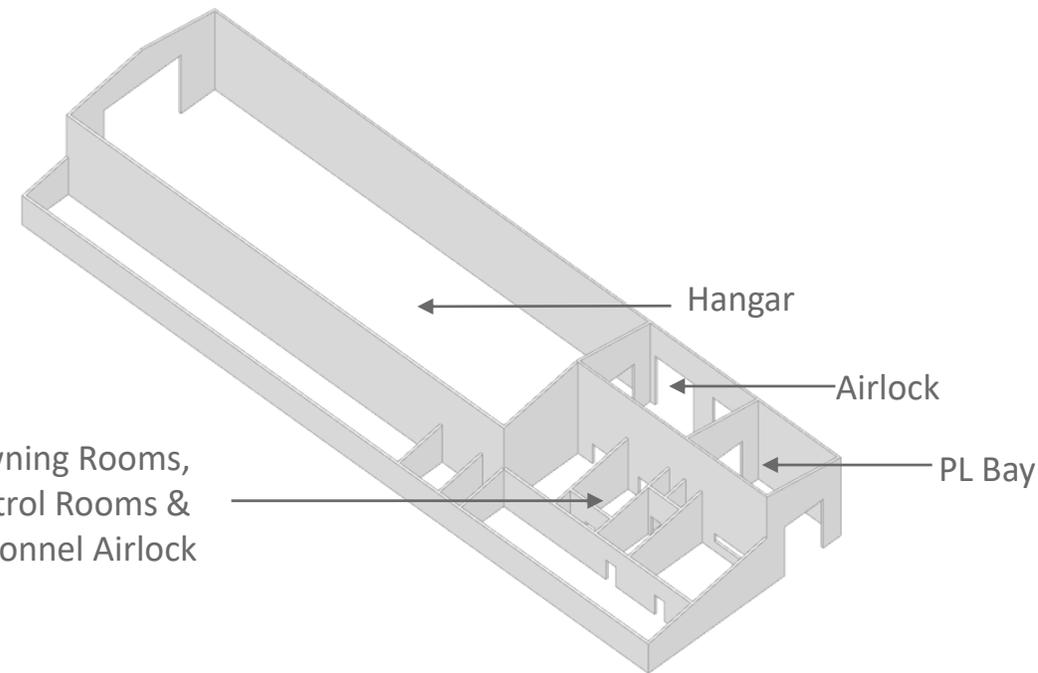
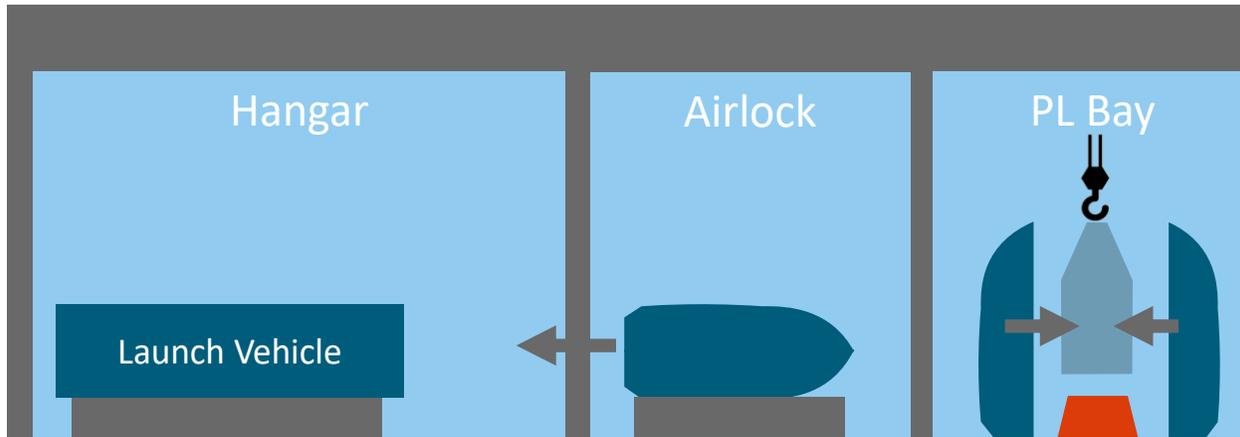
- Fluid-Systems (Fuel Storage, Piping, Delivery Panel, Water Deluge)
- Electrical Systems (Power Supply, Power Network,..)
- Monitoring & Control
- Safety Systems (Sensors, Alarms, Firefighting System,...)

Onshore

Offshore

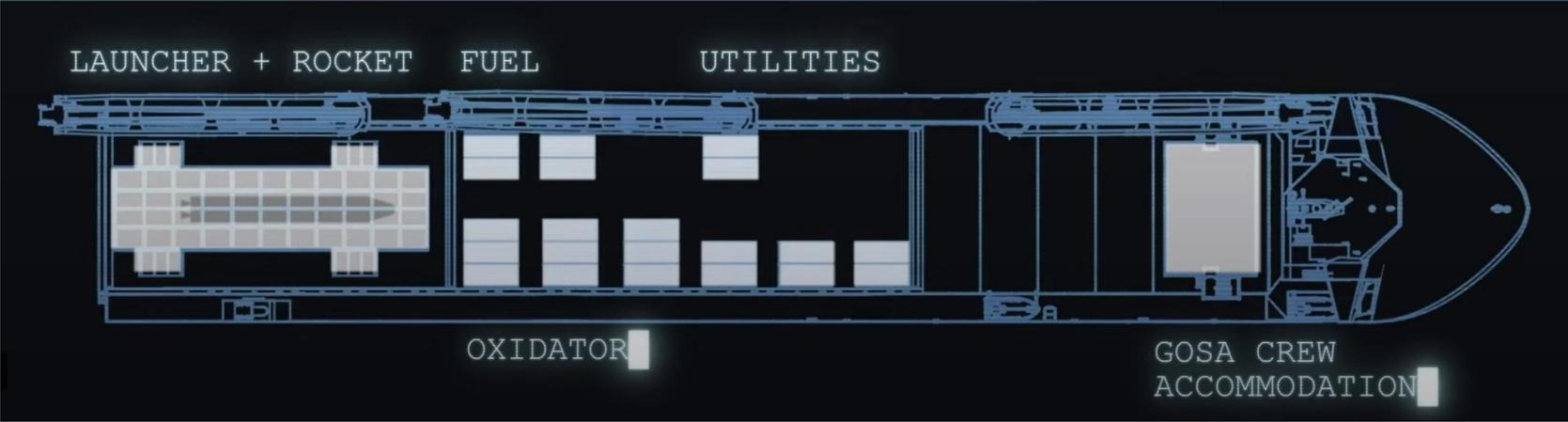


JOINT INTEGRATION FACILITY



- Short distances and linear assembly path
- Central equipment airlock
- Separate personnel airlocks
- Freight containers connected to the building via air-tight lock
- Optional facility expansion (e.g. for hazard processing)
- High payload bay for larger payloads up to 6m
- Additional payload bays for smaller payloads
- Space for small launchers of 30m length

EOS LAUNCH VESSEL



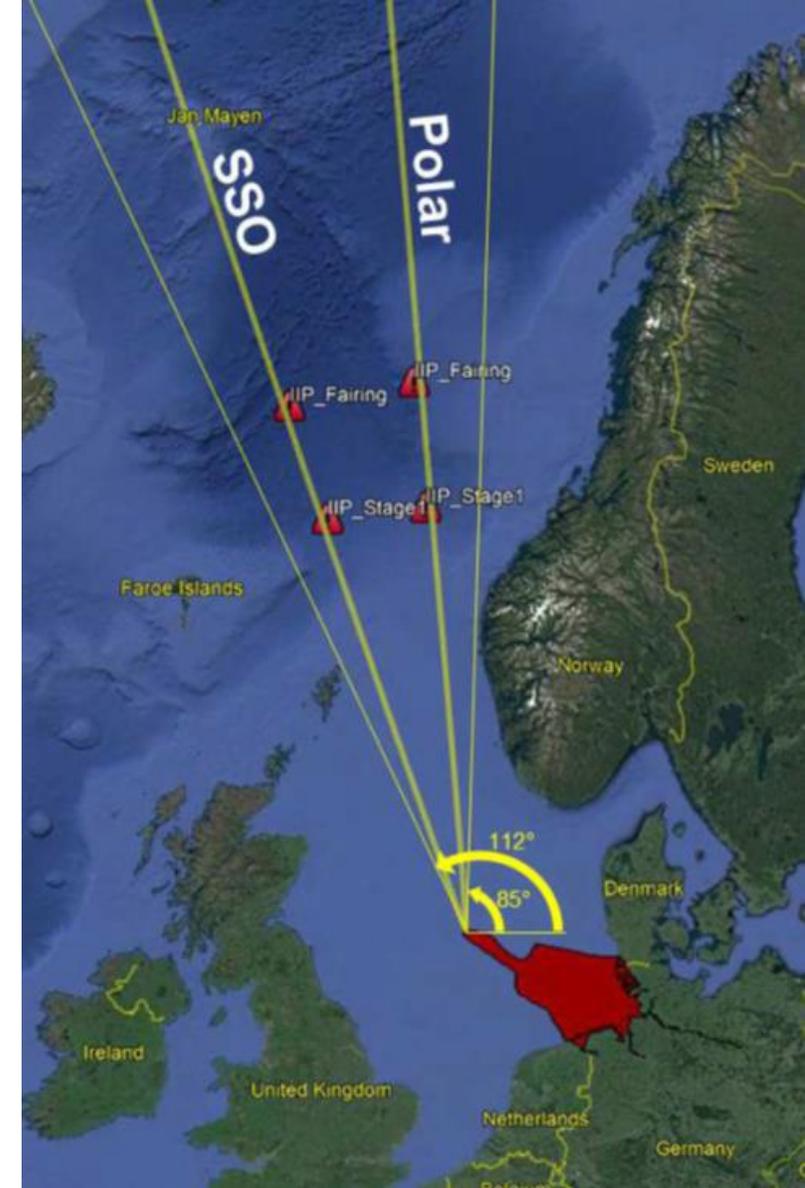
EOS PRIMARY LAUNCH LOCATION

- Baseline launch location in the German Exclusive Economic Zone (EEZ) in the North Sea – so-called “Entenschnabel” (duckbill)
- Ca. 400km (230nm) from Bremerhaven
- One-way transit times 14h (@ 16kn) to 29h (@ 8kn)



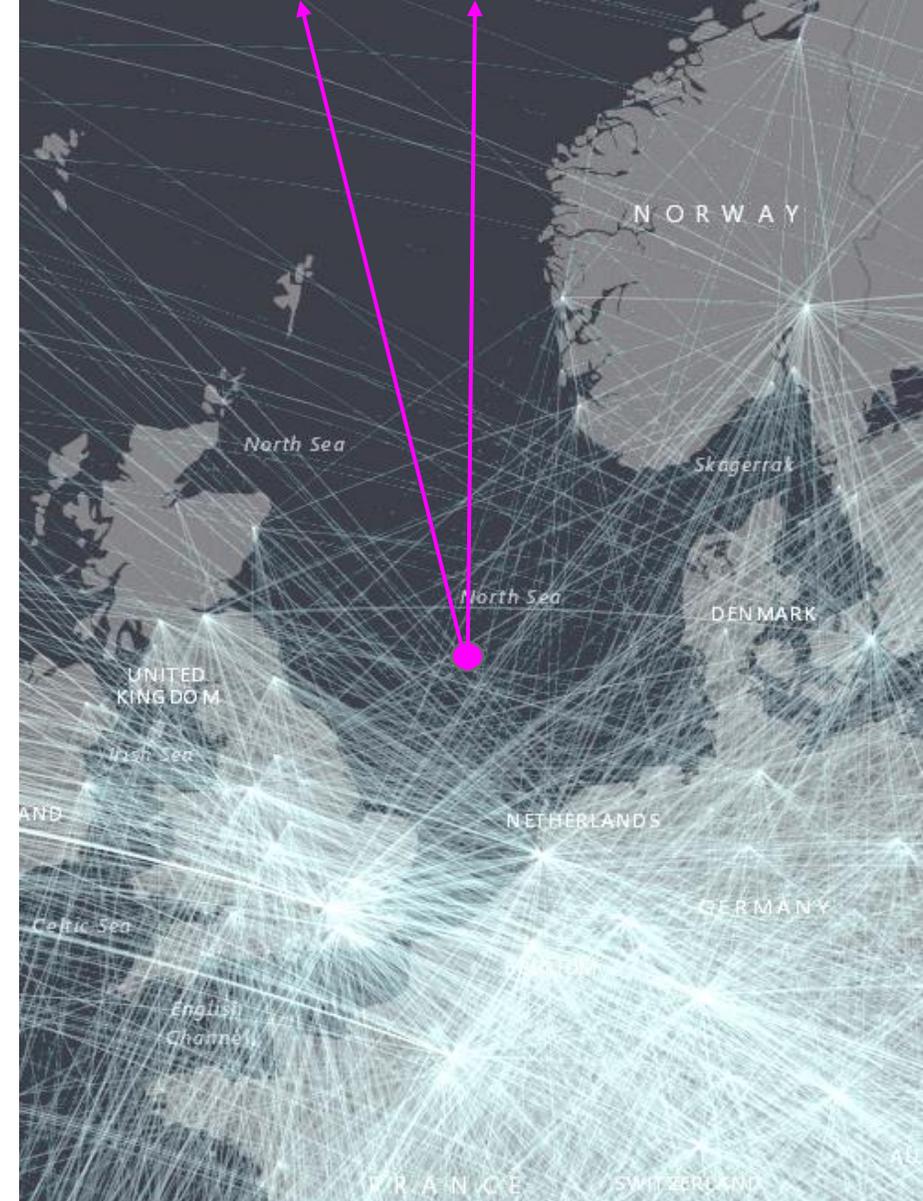
EOS PRIMARY LAUNCH CORRIDOR

- Launch corridor ranging from 85° to 112° – both Polar and Sun-Synchronous Orbits (SSO) can be achieved
- To offer launch inclinations lower than 85° , launch location can be altered
- Preliminary assessment of drop zones for stages and fairing concluded for both Polar & SSO – no showstoppers identified



AIR TRAFFIC

- Launch corridor in an area with limited air traffic due to high latitude
- Mainly interfering with air traffic from/to Norway and northern part of United Kingdom
- Main air traffic routes south of launch location





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DEMO #1 MISSION OPERATIONS

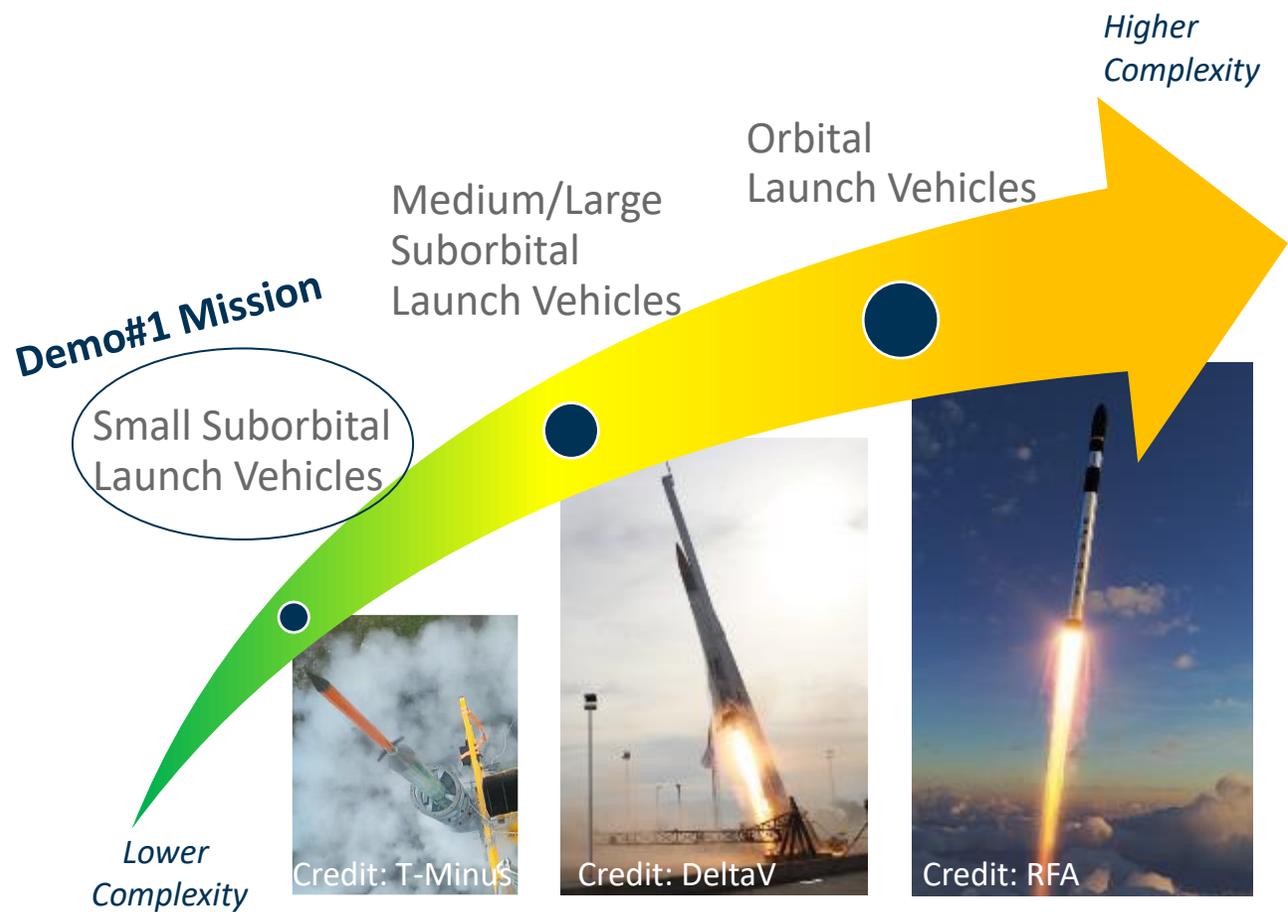
SUMMER 2024

EOS DEMO#1 MISSION

➤ Preparation and Execution of a unguided suborbital rockets launch mission

- ❑ Launch targeted for Summer 2024
- ❑ Involving German and EU Launch Vehicle Operators (LVOs)
- ❑ 1st step towards Demo#2 Mission with upgraded setup getting closer to the EOS Initial Operation Capability concept in development, involving larger incl. (guided) suborbital rockets, DP vessel instead of barge, upgraded TM, FTS, consideration of German space law (draft) regulation, etc.
- ❑ Legal framework:
 - no applicable launch licencing procedure
 - need for maritime licence (considering splashdown/deposit aspect)
 - GOSA baseline for safety aspects is compliance to US FAA requirements
 - liability/insurance contract scheme in work with GOSA partner
 - Proposed Hazard Area is reviewed regarding airspace by UK CAA

EOS DEMO#1 MISSION DETAILS



Demo#1 Mission

- Prove the **feasibility** of a launch from a maritime platform in the in the North Sea in the German EEZ
- ### Mission Design

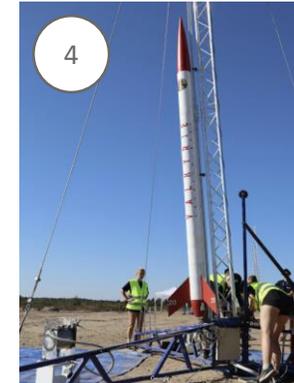
- Up to **four unguided suborbital rockets** from different national/European operators
- **Representative Operational Setup** towards orbital mission, but lower complexity and low hazards
- Designed to be **simple, reliable, and cost-effective**

Expected Outcomes

- **Generate know-how**, operational experience, lessons learned
- **Setup lines of communications** with stakeholders
- **Implement processes** to obtain permissions
- **Enable feedback** towards a future German Space Law

EOS DEMO#1 MISSION LAUNCH VEHICLES

ID	Manufacturer	Vehicle	Length/ Diameter	Mass Dry/ Wet	Total Impulse	Propulsion/ Propellants	Apogee	Maximum Velocity	Class
1	T-Minus	SDART	4m/ 100mm	15kg/ 35kg	48kNs	Solid/ APCP	42km	1715 m/s	Amateur Rocket Class 2
2	Space Team Aachen	Aquila	3.8m/ 114mm	22.5kg/ 31.8kg	20.15kNs	Solid / APCP	9.7km	615 m/s	Amateur Rocket Class 2
2	FAR	Nova I	4.2m/ 172mm	57kg/ 98kg	64kNs	Solid/ TM78	12.3km	800 m/s	Amateur Rocket Class 3
4	DanStar	Fornax	4.53m/ 203mm	52.18kg/ 83.33kg	44.6 kNs	Biliquid/ IPA & N2O	8.77km	372 m/s	Amateur Rocket Class 2



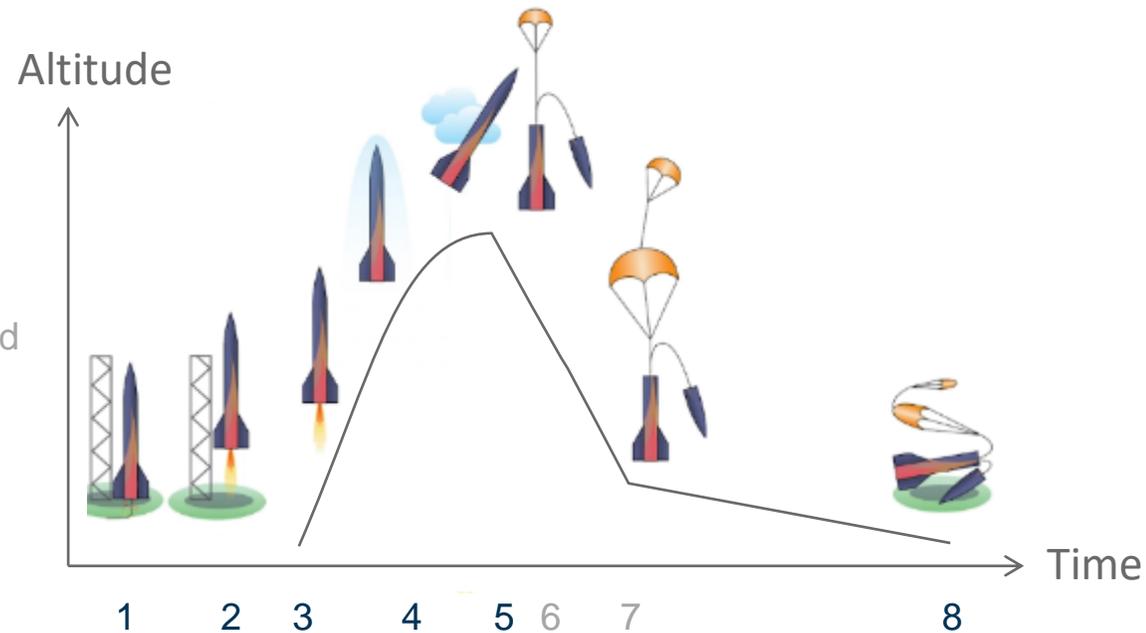
LAUNCH VEHICLE TRAJECTORIES

- All four launch vehicle will be launched towards the west (250-290°)
- One launch vehicle (LV1) will follow a ballistical trajectory and splash down within the UK EEZ
- Three launch vehicle (LV2-4) have a parachute system and are planned to descend first by a drogue chute and later by a main chute
- LV2-4, which are descending by parachute have a maximal nominal drift range of 15km and will land within the UK, Dutch, Danish or German EEZ (depending on wind direction and speed)
- In case of failure mode with opening of main chute at apogee LV2-4 might land in the Norwegian EEZ
- In case of failure mode without opening any chute all four launch vehicle will splash down within the UK EEZ

EOS DEMO#1 MISSION – SAMPLE OF AN LAUNCH OPERATION

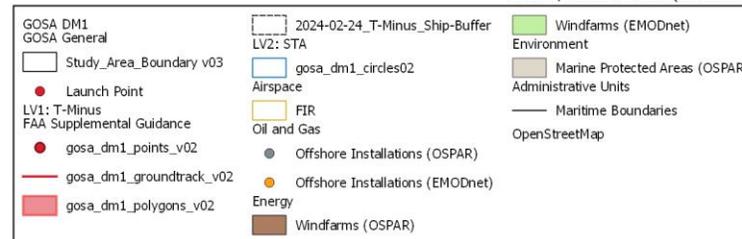
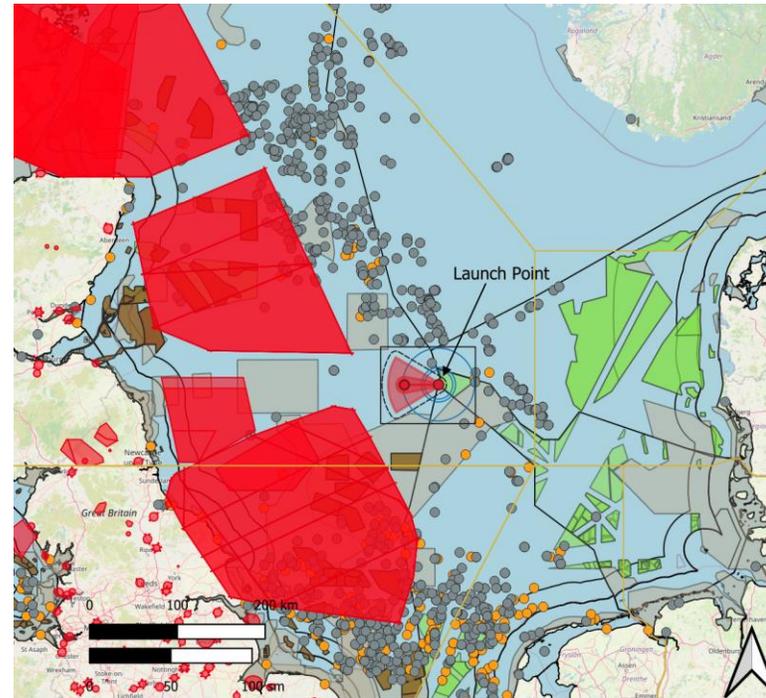
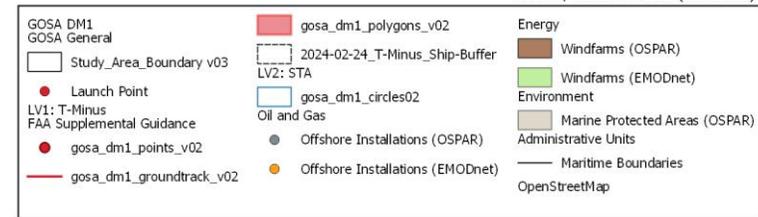
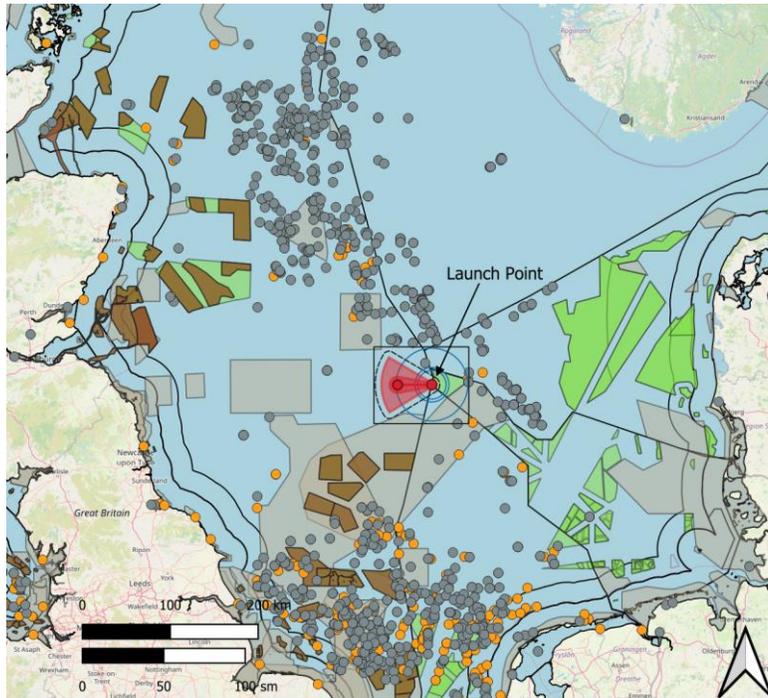
1. Ignition
2. Liftoff
3. Powered Flight until Burnout
4. Coasting
5. Apogee
6. Drogue Parachute Deployment and Drogue Descent*
7. Main Parachute Deployment and Main Descent*
8. Impact

*Only if Recovery – optional.



Credits: Skyward Experimental Rocketry, 2021

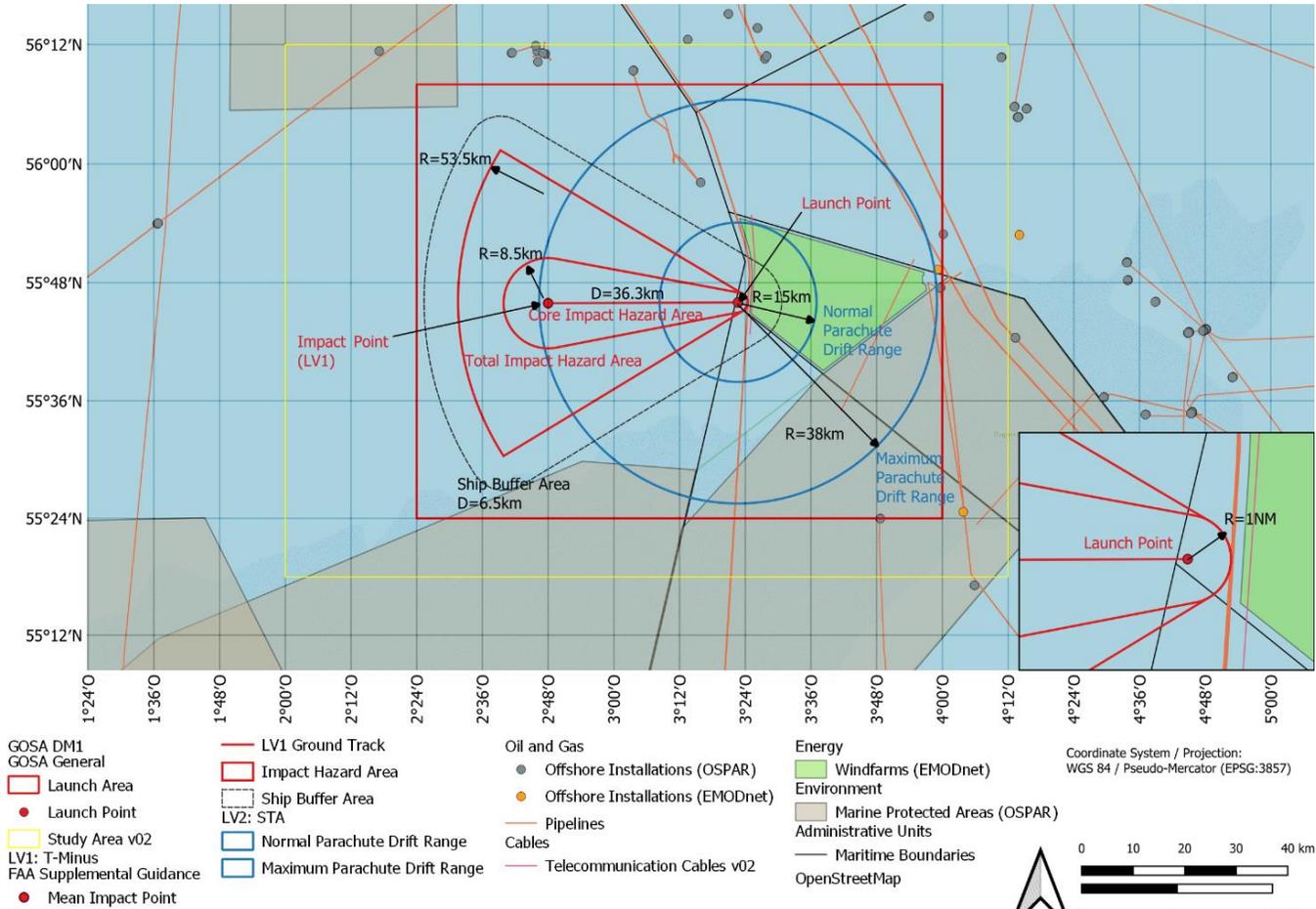
EOS DEMO#1 MISSION – LAUNCH LOCATION OVERVIEW



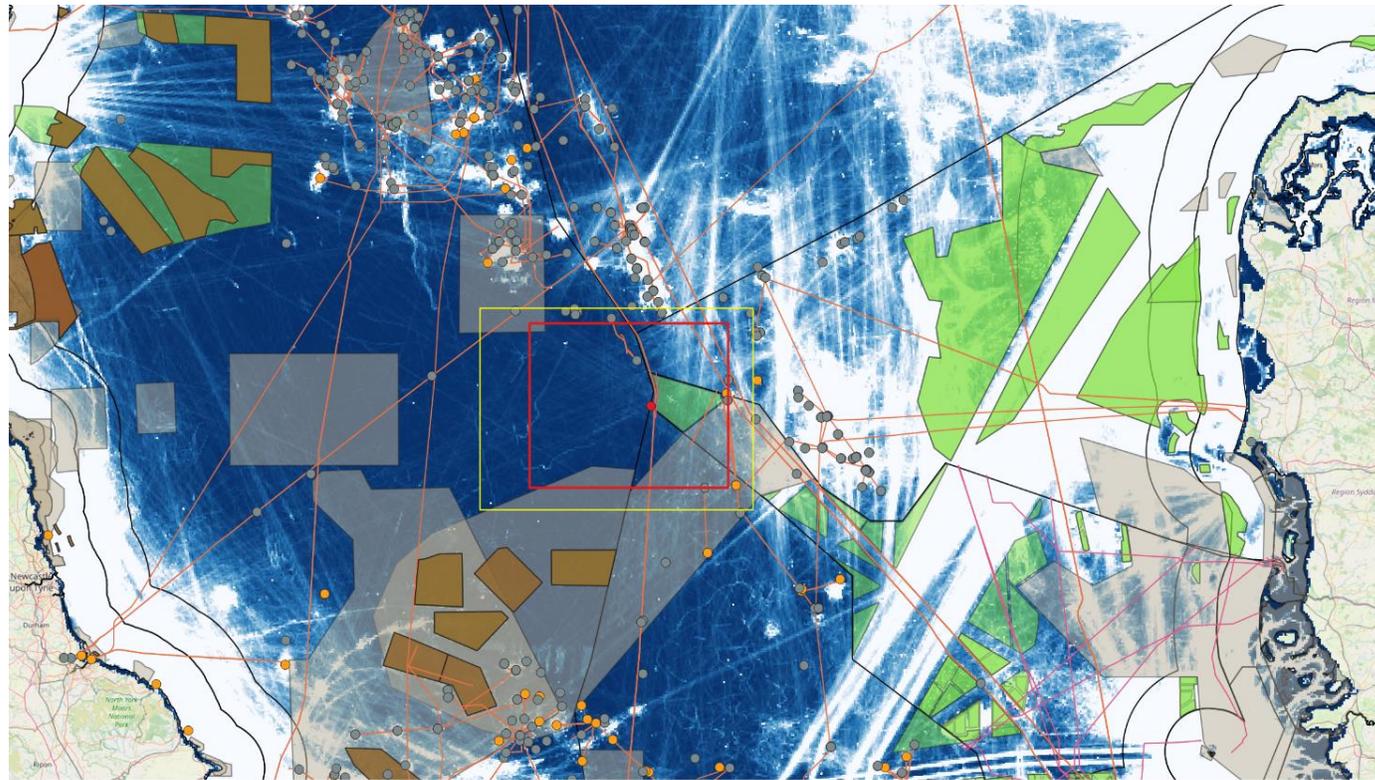
Including Flight Information Regions (yellow lines) and restricted air spaces (red polygons)

EOS DEMO#1 MISSION – LAUNCH LOCATION

Data below shows preliminary hazard area for ballistic cases and parachute drift cases



OVERVIEW MARINE TRAFFIC



GOSA DM1	● Offshore Installations (EMODnet)	Environment	EMODnet Vessel Density (yearly)
GOSA General	— Pipelines	■ Marine Protected Areas (OSPAR)	vesseldensity_all_2022
□ Launch Area	— Cables	— Administrative Units	Kanal 1 (Gray)
● Launch Point	— Telecommunication Cables v02	— Maritime Boundaries	0,5
□ Study Area v02	Energy		0
Oil and Gas	■ Windfarms (OSPAR)		
● Offshore Installations (OSPAR)	■ Windfarms (EMODnet)		

0 50 100 km

0 25 50 nm

OpenStreetMap

EOS DEMO#1 MISSION – SAMPLE FOR LAUNCH FROM BARGE

Launch of a rocket representative for the Demo Mission from a barge in the Baltic Sea 2011. Credit: Copenhagen Suborbital, Heat 1-X

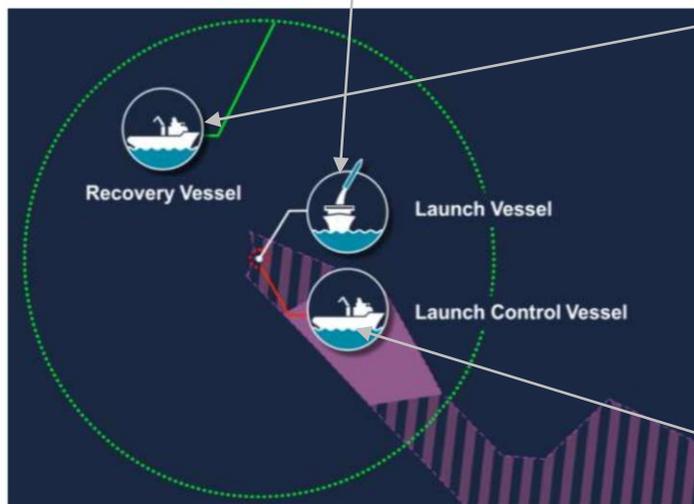


EOS DEMO#1 MISSION – SAMPLE FOR RECOVERY

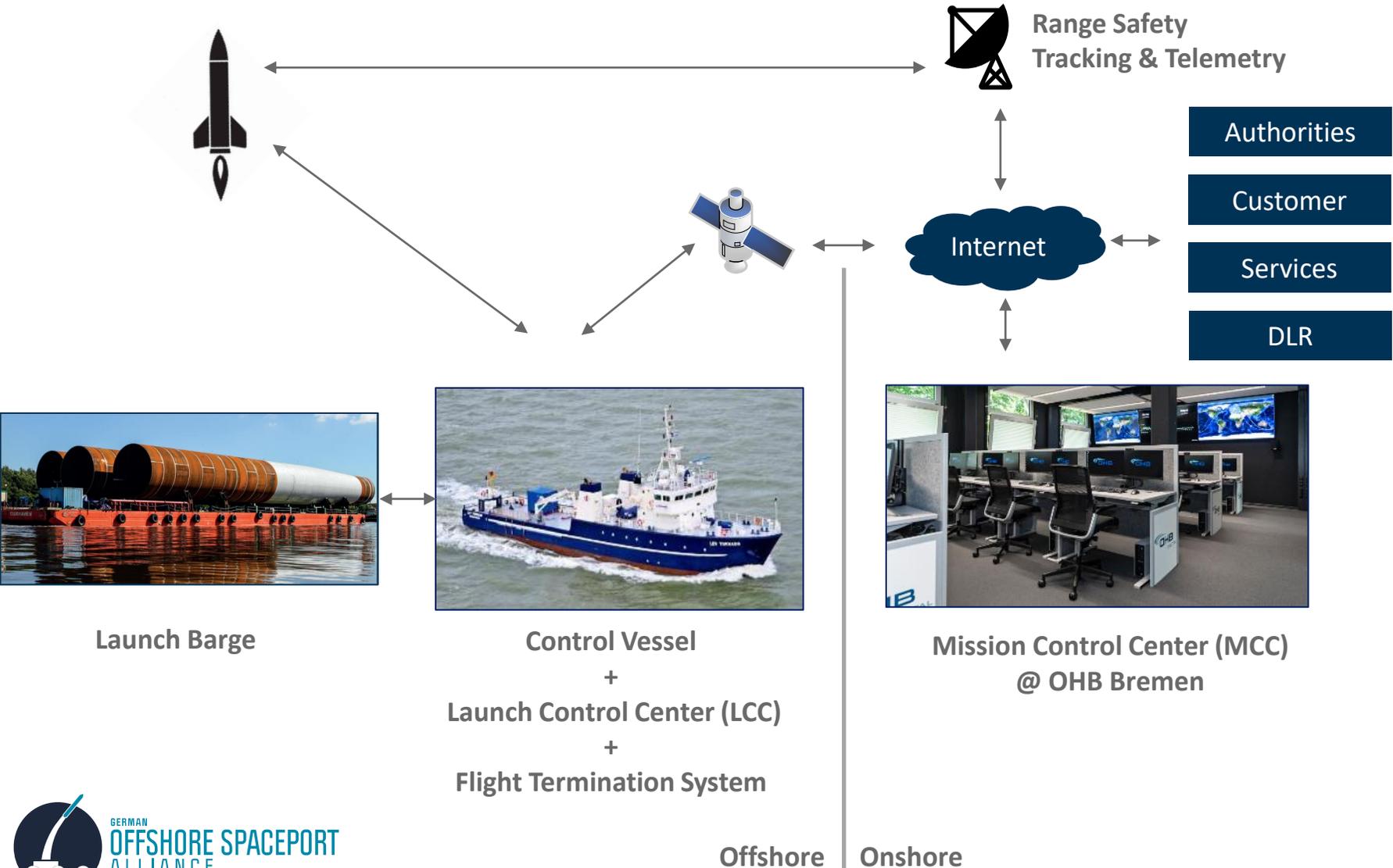
Recovery of a rocket representative for the Demo Mission from a barge in the Baltic Sea 2011. Credit: Copenhagen Suborbital, Heat 1-X



EOS DEMO#1 MISSION VESSELS (TBC)



MISSION INTEGRATION



Control Center Features

- Launch vehicle (LV) Tracking (Trajectory)
- Meteorological Data Processing
- Archive & Logging
- Air & sea traffic management
- Dashboard (synced)
- Video streams visualization
- Data/File exchange offshore-onshore
- Time Visualization & Synchronization
- Authority Management
- Service provisioning

TIME SCHEDULE

- **Start of marine phase: 13-June 2024 (planned)**
- **Mobilization: 4 days**
- **Transit to launch area: 1.5 days**
- **Launch campaign: max. 4 days (2 launch days, 2 buffer days)**
- **Transit to port: 1.5 days**
- **Demobilization: 3 days**

= total 14 days (7 onshore, 7 offshore)

NOTIFICATION METHODS TO MARINE TRAFFIC

- **Temporary Notice to Mariners**
- **Kingfisher Information Services**
- **Navigational Warnings**
- **Securite Broadcasts via VHF**
- **Other means via stakeholders (e.g. Fishery Association / Cruising Association newsletter)**

STAKEHOLDER CONTACTS (AUTHORITIES)

- **UK Maritime Management Organisation**
- **UK Maritime and Coastguard Agency**
- **UK Civil Aviation Authority**
- **Danish Maritime Authority**
- **Danish Defense (Coastguard)**
- **Norwegian Coastal Administration**
- **Netherlands Coastguard**
- **Federal Maritime and Hydrographic Agency (Bundesamt für Seeschifffahrt und Hydrographie, BSH)**
- **Federal Waterways and Shipping Agency (Generaldirektion Wasserstraßen und Schifffahrt)**
- **Wasserschifffahrtsamt Weser-Jade-Nordsee**
- **Harbour Master Bremen-Bremerhaven**
- **Havariekommando (German Central Command for Maritime Emergencies)**
- **Deutsche Gesellschaft zur Rettung Schiffbrüchiger (MRCC Bremen)**
- **Weltraumkommando (German Spaceforce)**
- **Marine (German Navy)**

STAKEHOLDERS CONTACTS (PRIVATE)

- **Sailing Associations in neighbouring countries (UK, DK, NL, NO, GER)**
- **Fishery Associations in neighbouring countries (UK, DK, NL, NO, GER)**
- **International Chamber of Shipping via UK Chamber of Shipping**
- **Pipeline and Comm-Cable operator (Franpipe, Zeepipe and NorthSeaCom1)**
- **Offshore Energy Association UK (Oil, Gas, Renewables)**



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THANK YOU FOR YOUR ATTENTION.