



GERMAN
OFFSHORE SPACEPORT
ALLIANCE

GERMAN OFFSHORE SPACEPORT ALLIANCE (GOSA) A EUROPEAN OFFSHORE SPACEPORT FOR MICROLAUNCHERS

WORKSHOP ON NEW ENTRANTS INTEGRATION IN THE NAT REGION
14.05.2024, ICAO EUR/NAT – PARIS

Contacts:

Arne Gläß

GOSA Air Traffic Coordination Manager

arne.glaess@ohb.de

Alain Pajonk

GOSA Project Manager

alain.pajonk@ohb.de

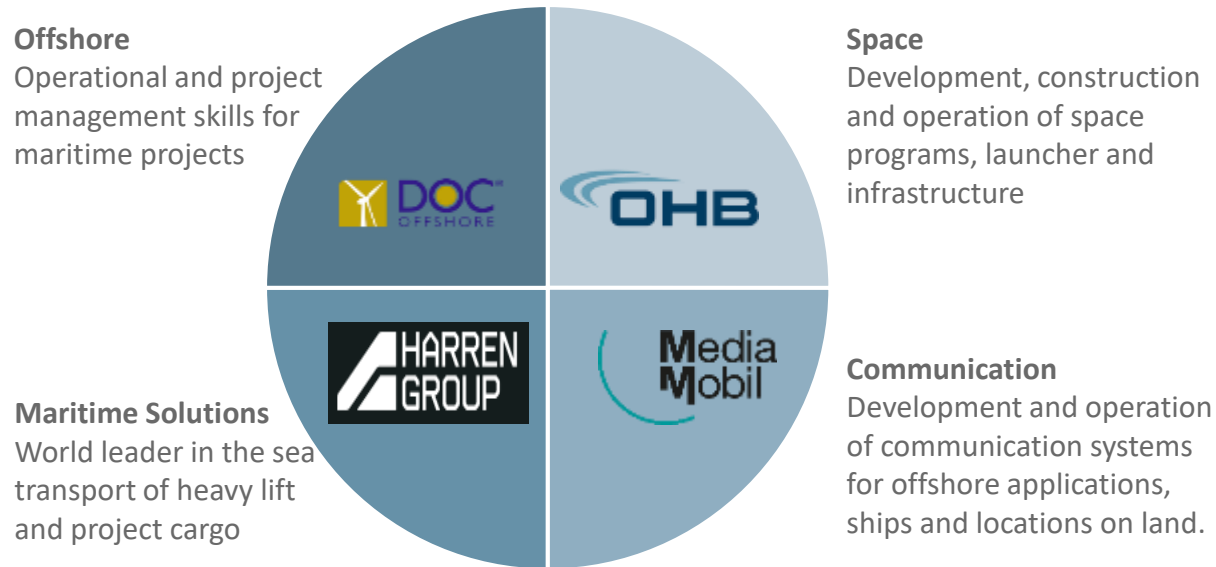


GERMAN
OFFSHORE SPACEPORT
ALLIANCE

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
- Flexibility to adjust launch location depending on mission requirements
- Limited fixed costs due to vessel agnostic mobile launch pad concept
- Reduced land occupation
- Easier implementation of safety requirements





GERMAN
OFFSHORE SPACEPORT
ALLIANCE

THE EUROPEAN OFFSHORE SPACEPORT (EOS)

MID-TERM OUTLOOK

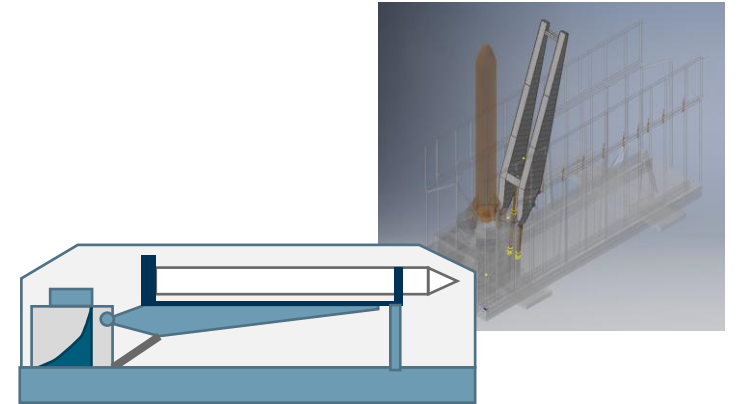
ONSHORE OPERATIONS



Launcher & Payload arrive in Bremerhaven



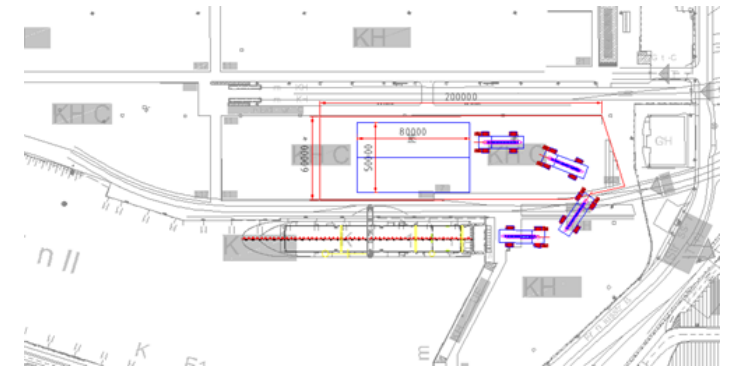
Joint Payload & Launcher Preparation at Integration Facility



Full Integration of Launcher in Mobile Launch Box



Launch Box Roll-on in Port



Transfer to Launch vessel

OFFSHORE OPERATIONS



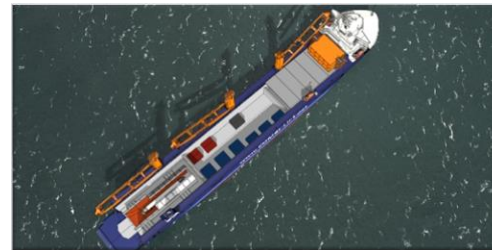
Transit to Launch Site – 1 day



Launch Vehicle final Preparation, Erection, Evacuation, Fueling



Transit to Port - 1 day

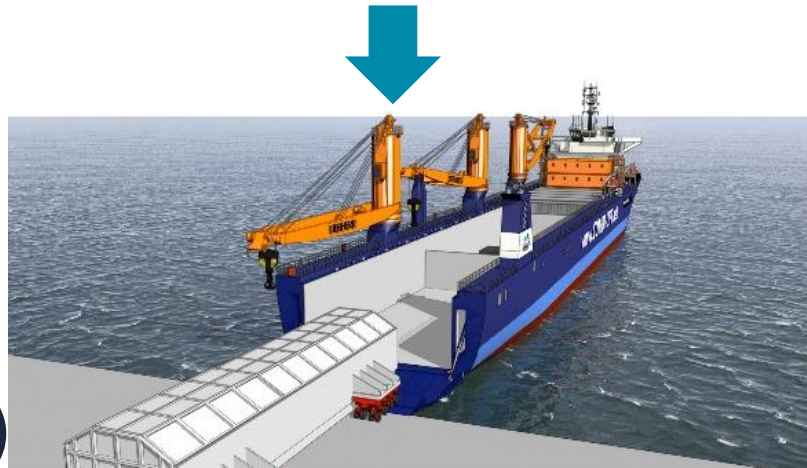
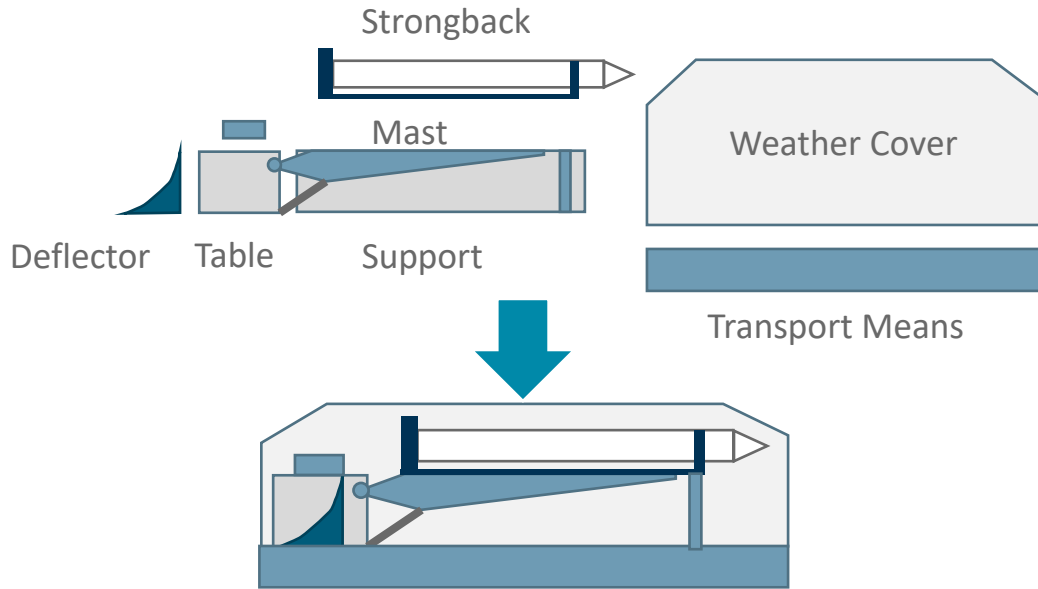


Post-Launch Activities



Launch

MOBILE LAUNCH PAD



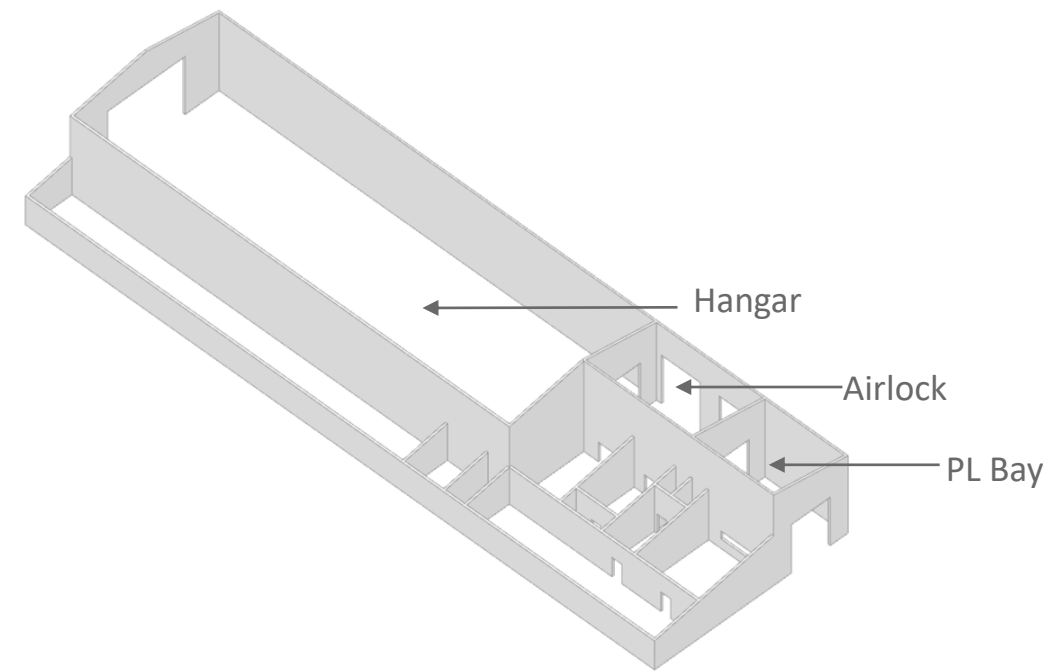
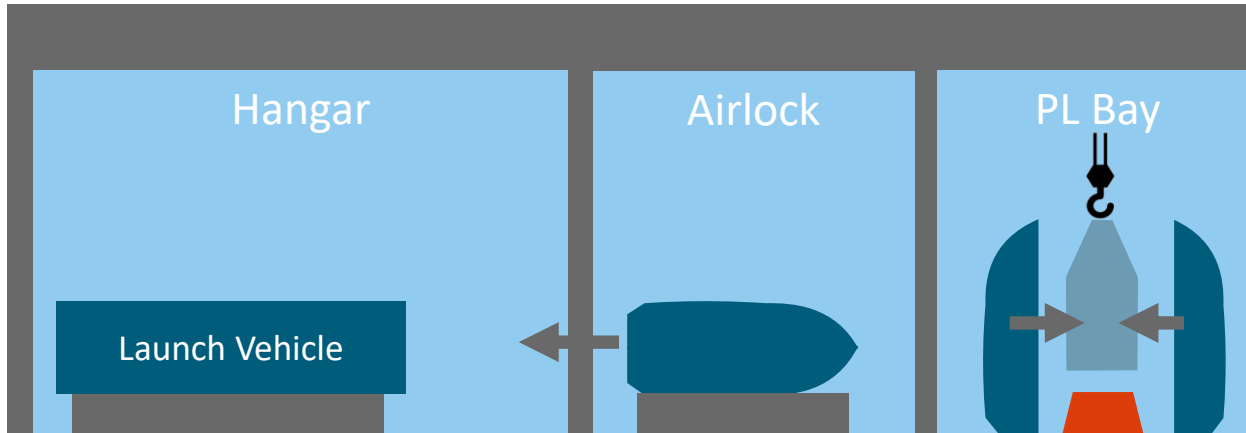
- Fluid-Systems (Fuel Storage, Piping, Delivery Panel, Water Deluge)
- Electrical Systems (Power Supply, Power Network,..)
- Monitoring & Control
- Safety Systems (Sensors, Alarms, Firefighting System,...)

Onshore

Offshore

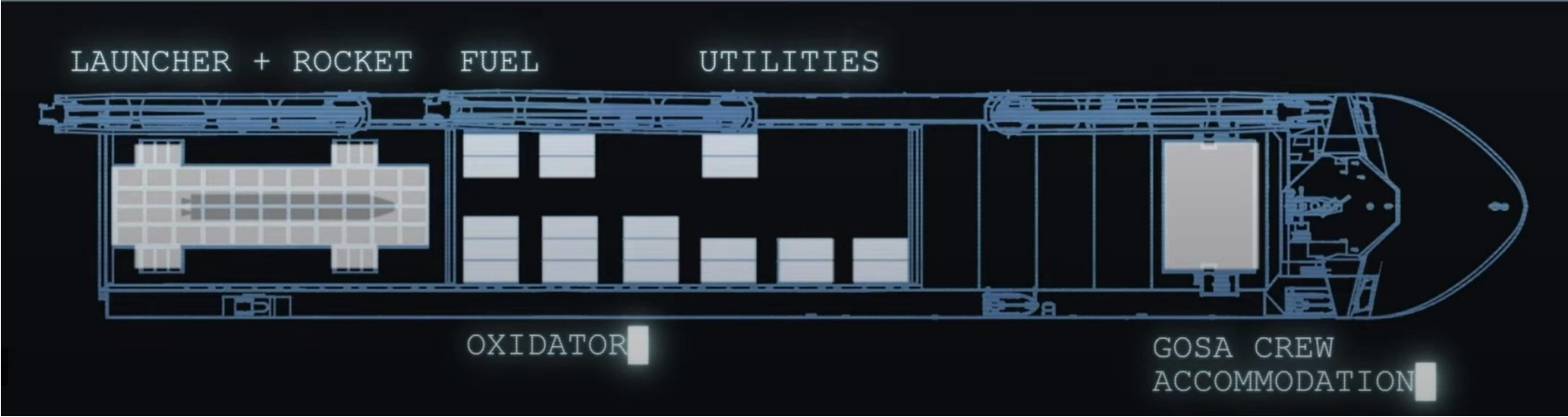


JOINT INTEGRATION FACILITY



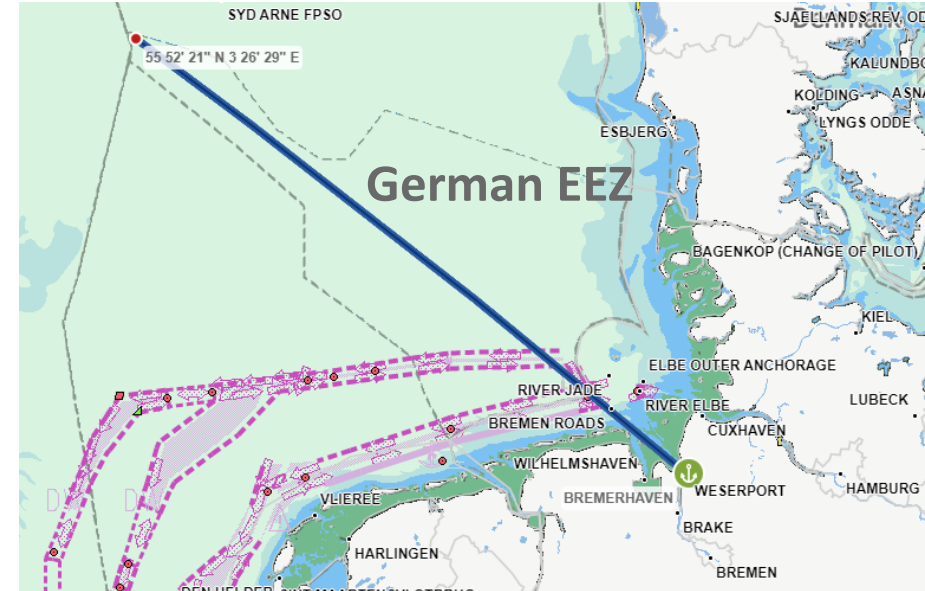
- Onshore facilities supporting lean Payload and LV horizontal integration concept of operation
- Mobile hazardous facility extension (upon need)

EOS LAUNCH VESSEL



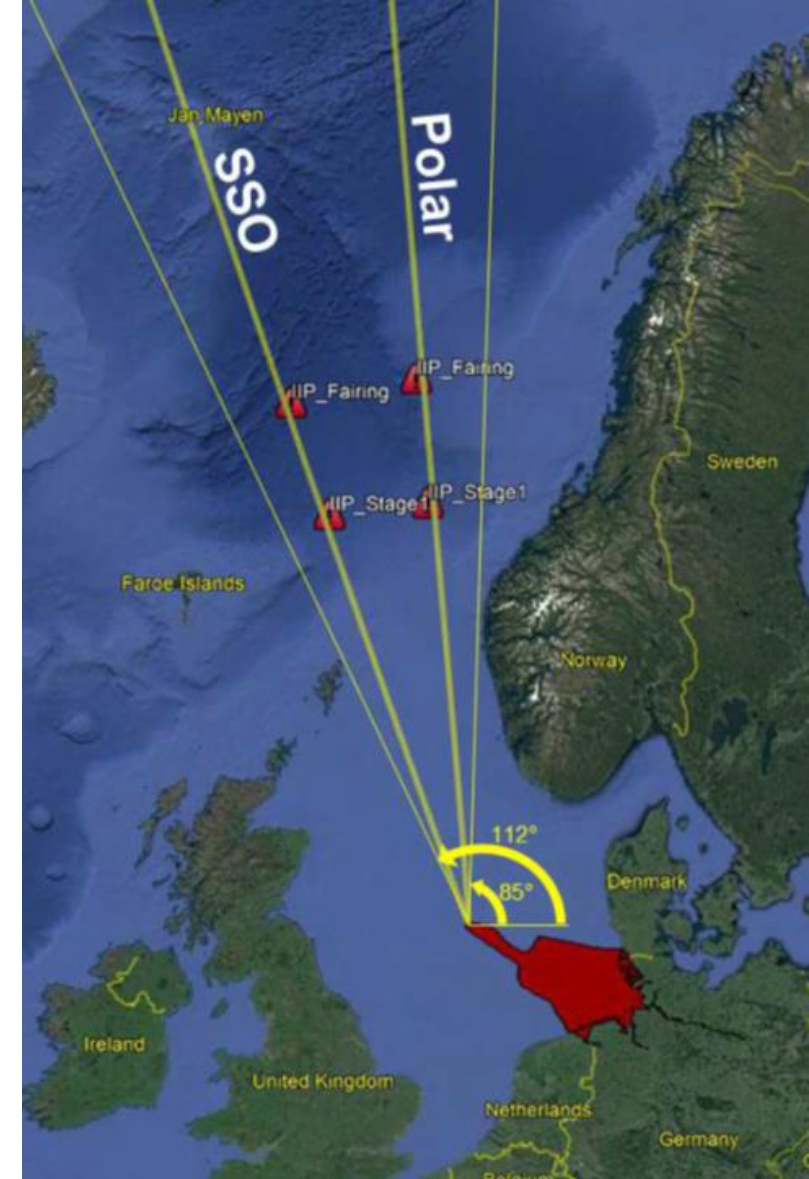
EOS PRIMARY LAUNCH LOCATION

- 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

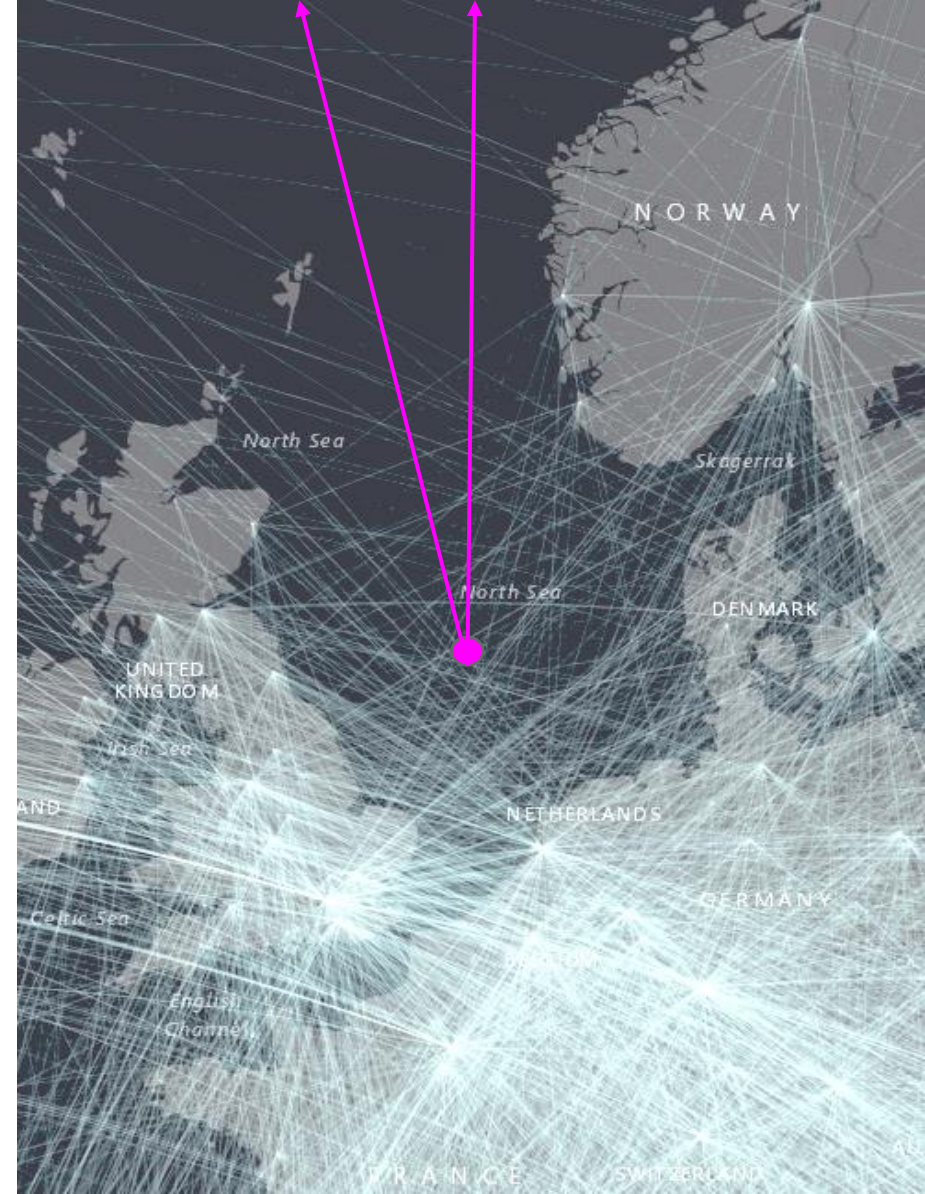
- Launch corridor ranging from 85° to 112° enabling launch toward both Polar and Sun-Synchronous Orbits (SSO)
- Preliminary assessment of drop zones for stages and fairing concluded for both Polar & SSO – no showstoppers identified
- Other launch locations considered for other inclinations



AIR TRAFFIC

- Launch corridor in an area with relatively limited airspace traffic

... but this you know best! ;-)





GERMAN
OFFSHORE SPACEPORT
ALLIANCE

DEMO #1 MISSION OPERATIONS

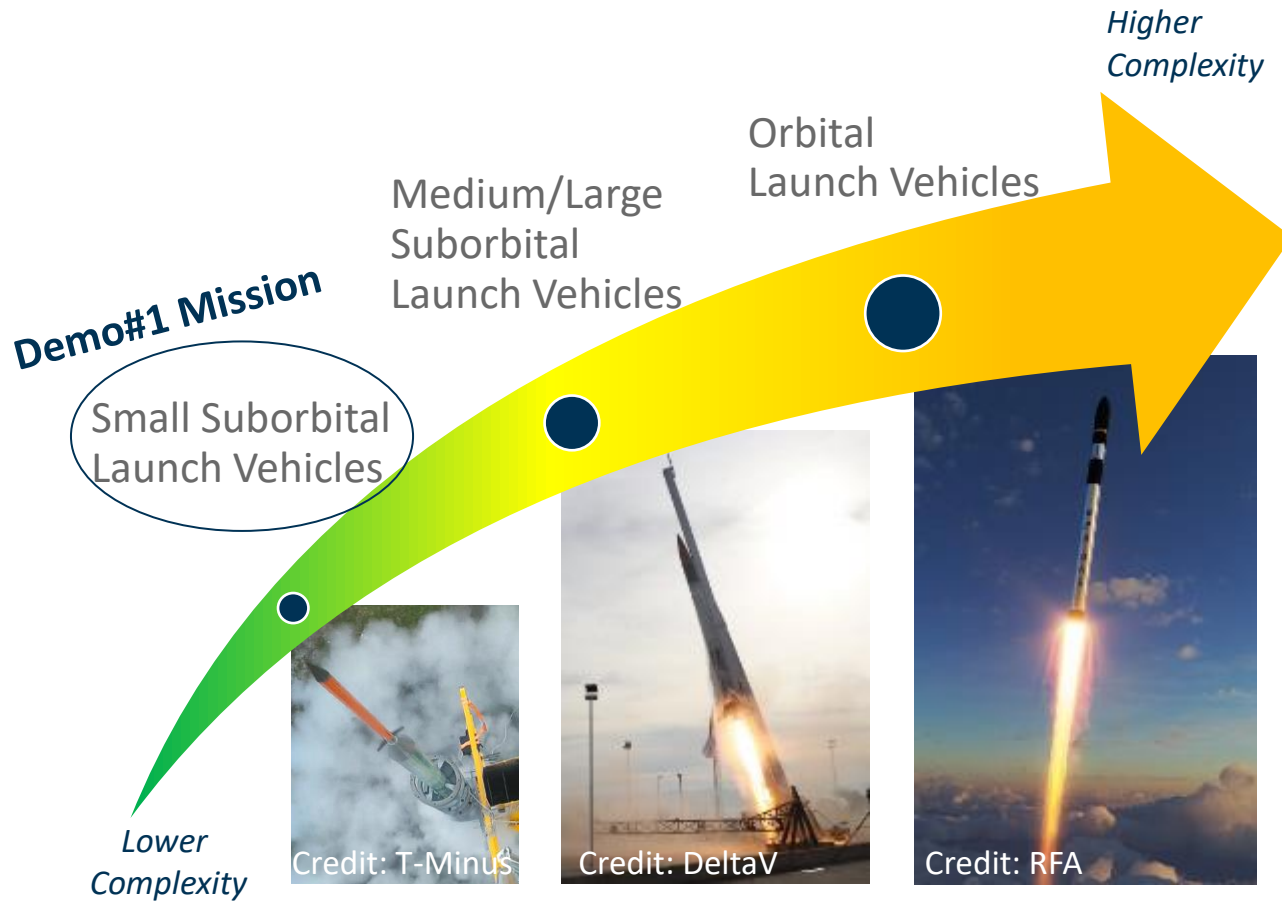
SUMMER 2024

EOS DEMO#1 MISSION

➤ Preparation and Execution of an unguided suborbital rockets launch mission

- ❑ Launch campaign planned in Summer 2024
- ❑ Involving German and EU Launch Vehicle Operators (LVOs)
- ❑ 1st step towards Demo#2 Mission which will involve larger (incl. guided) suborbital rockets, upgraded TM, FTS, consideration of applicable space licencing framework
- ❑ Legal framework:
 - no applicable launch licencing procedure
 - maritime licence application ongoing with UK MMO (deposit in UK EEZ)
 - GOSA baseline for safety aspects is compliance to US FAA requirements
 - insurance contract scheme set with GOSA partner
- ❑ Airspace coordination
 - Ongoing with EUROCONTROL and relevant stakeholders (recurrent progress meetings ongoing)
 - Hazard Area assessment reviewed by UK CAA
 - LoA in work

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

- **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

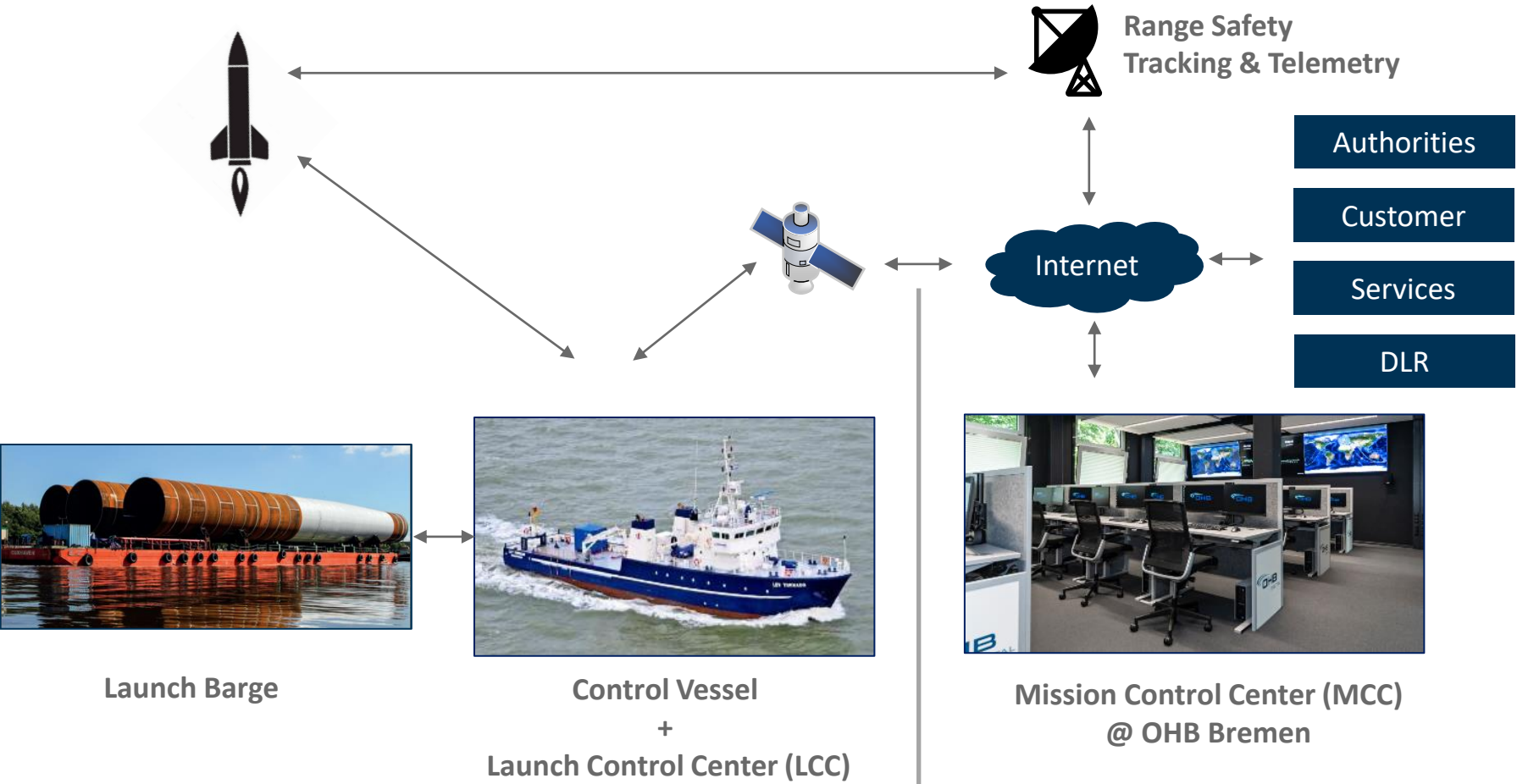
TIME SCHEDULE (TBC)

- 1w onshore
- 1w offshore

Week	23							24							25							26							27						
Date	3.6	4.6	5.6	6.6	7.6	8.6	9.6	10.6	11.6	12.6	13.6	14.6	15.6	16.6	17.6	18.6	19.6	20.6	21.6	22.6	23.6	24.6	25.6	26.6	27.6	28.6	29.6	30.6	1.7	2.7	3.7	4.7	5.7	6.7	7.7
Weekday	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su
Onshore Mob & Prep (2w)	[Green bars from 3.6 to 23.6]																																		
earliest	[Green bars from 3.6 to 23.6]																																		
latest	[Green bars from 10.6 to 23.6]																																		
Offshore Launch Campaign (1w)	[Green bars from 17.6 to 30.6]																																		
earliest	[Green bars from 17.6 to 30.6]																																		
latest	[Green bars from 24.6 to 30.6]																																		
Possible Launch Days	[Red bars from 17.6 to 28.6, labeled L01-L12]																																		
Demobilisation (3d)	[Green bars from 17.6 to 20.6]																																		
earliest	[Green bars from 17.6 to 20.6]																																		
latest	[Green bars from 17.6 to 20.6]																																		

Demo-Mission#1 baseline timeline

MISSION INTEGRATION

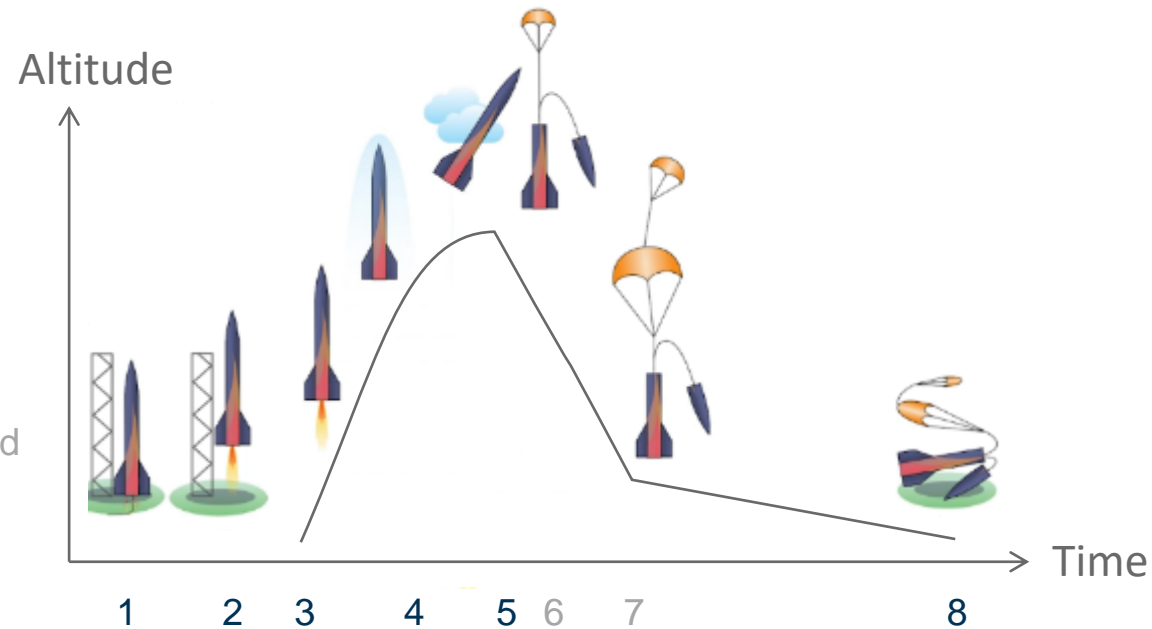


Control Center Features

- 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

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



Credits: Skyward Experimental Rocketry, 2021

*Only if Recovery – optional.

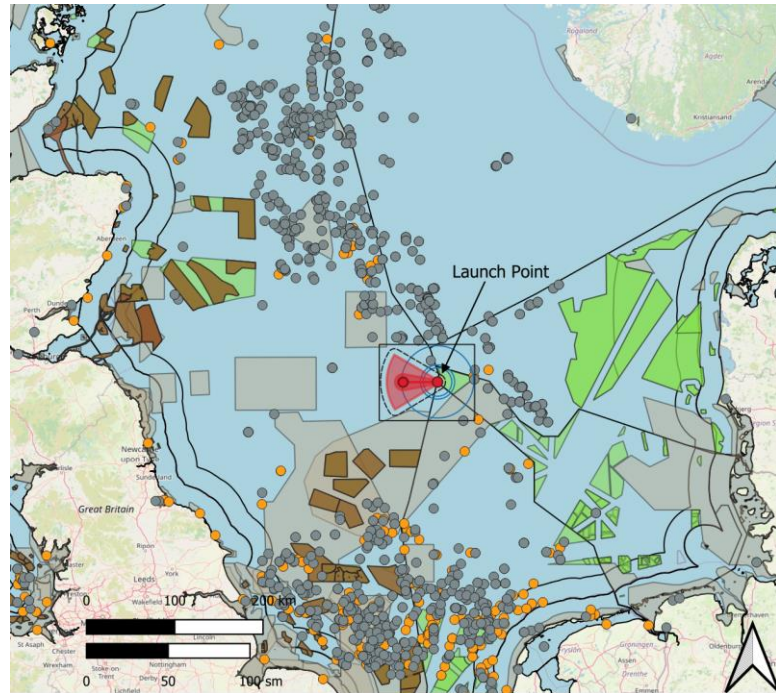
EOS DEMO#1 MISSION – PARACHUTE DRIFT CASES

Case	Wind	Drift Range	Details
Normal flight	Mean wind	5 km	Drogue parachute at apogee deployment, main parachute deployment at low altitude (ca. 450-500m)
Normal Flight	Max wind	15 km	
Failure case	Mean wind	18 km	Drogue failure, Main parachute premature deployment at apogee
Failure case	Max wind	38 km	

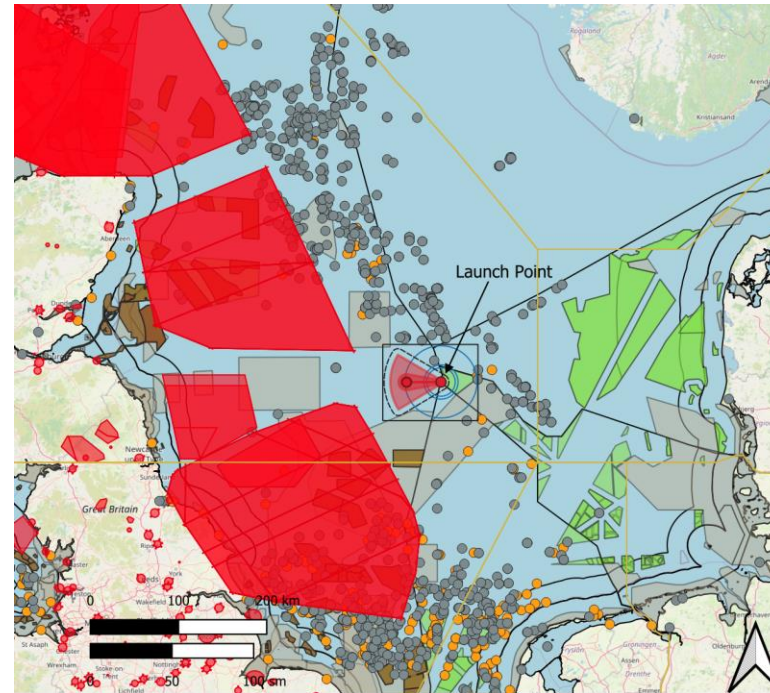
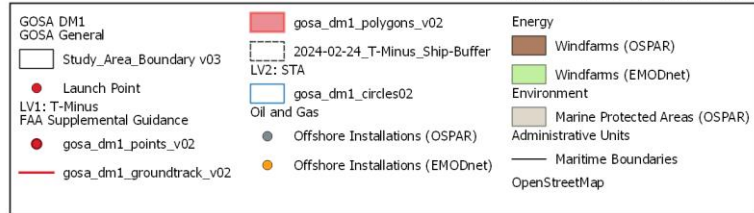
EOS DEMO#1 MISSION – BUFFER ZONES (TBC)

Vehicle	Speed	Mission Time	Buffer Zone
Aircraft	700 mph	50 s	15.6 km / 8.4 nm
Aircraft	700 mph	250 s	78.2 km / 42.2 nm
Aircraft	700 mph	500 s	156 km / 84.5 nm
Ship	25 kn	50 s	0.6 km / 0.3 nm
Ship	25 kn	250 s	3.2 km / 1.7 nm
Ship	25 kn	500 s	6.4 km / 3.5 nm

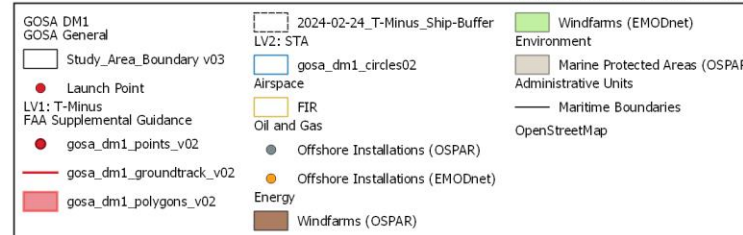
EOS DEMO#1 MISSION – LAUNCH LOCATION OVERVIEW



Coordinate System / Projection:
WGS 84 / Pseudo-Mercator (EPSG:3857)



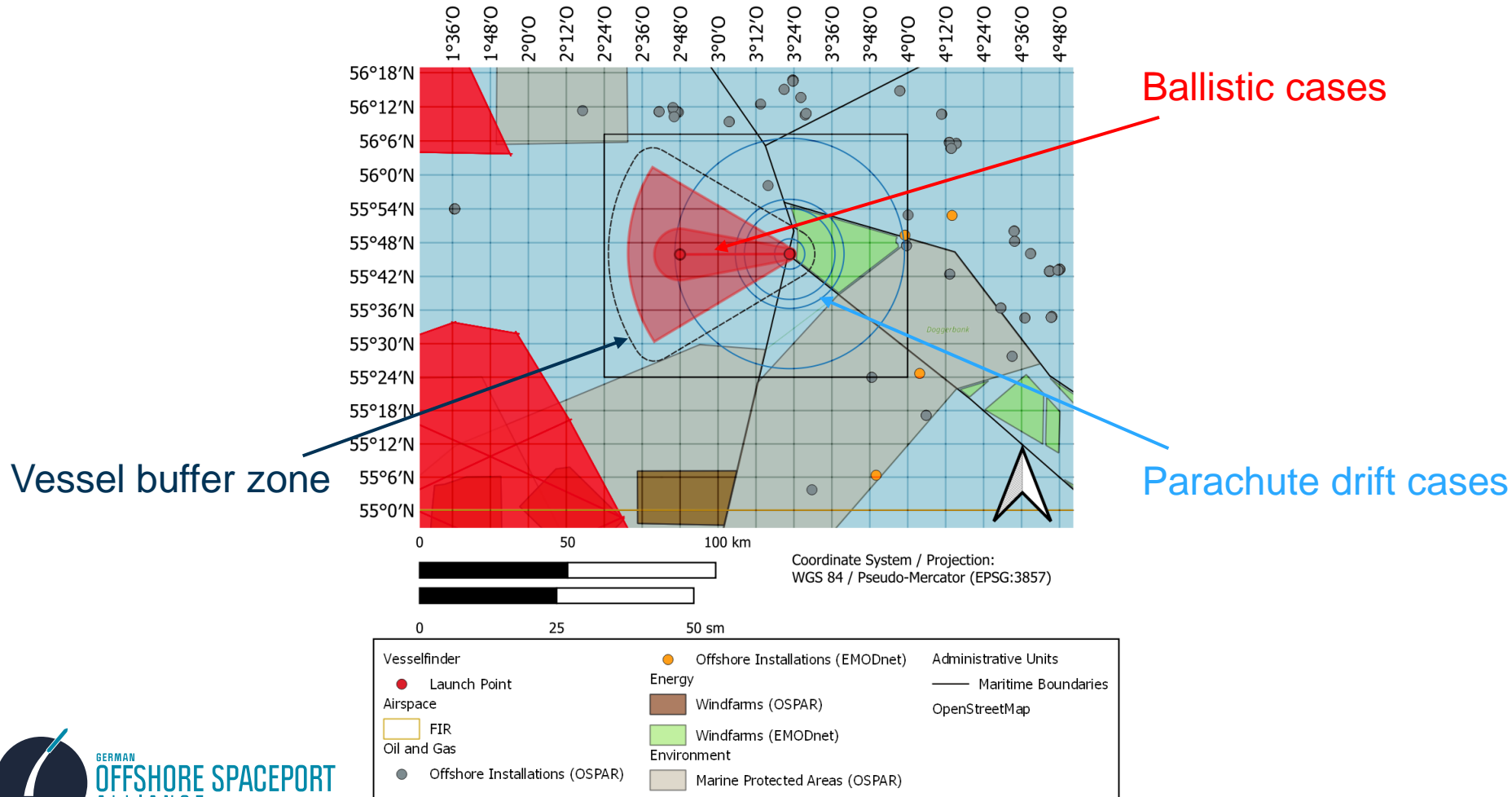
Coordinate System / Projection:
WGS 84 / Pseudo-Mercator (EPSG:3857)



Including Flight Information Regions (yellow lines) and restricted air spaces (red polygons, military training areas)

EOS DEMO#1 MISSION – LAUNCH LOCATION

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

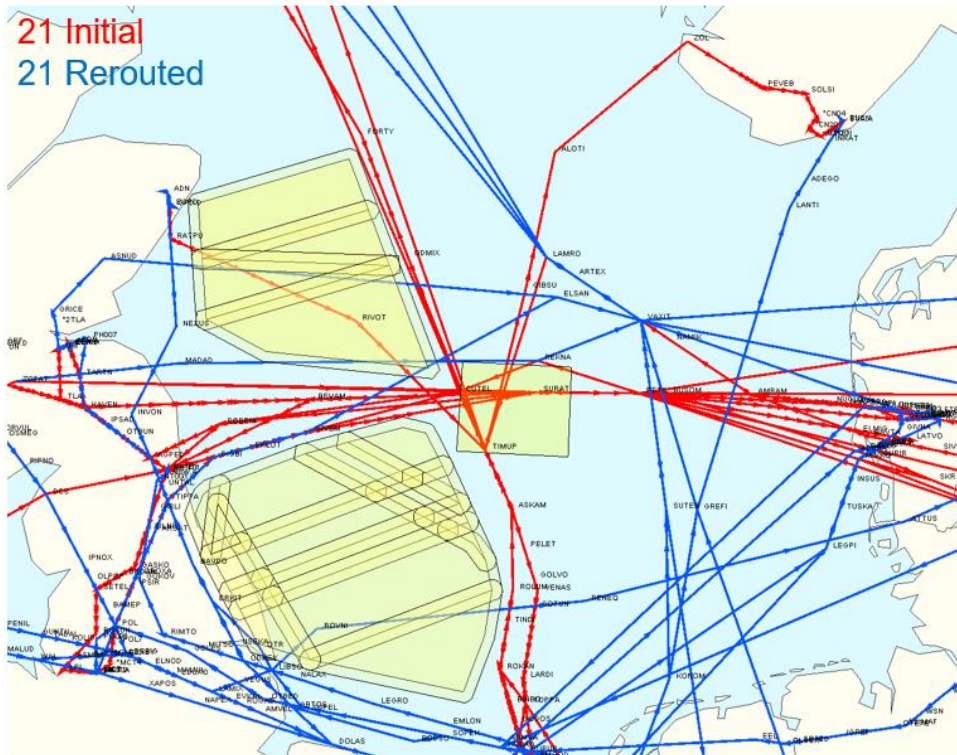


EOS DEMO#1 MISSION – AIR TRAFFIC IMPACT ASSESSMENT



Traffic rerouting on 20/06/2024 (ref 22/06/2023)

IV WINDOW 15:00–17:00



Traffic per sector group for the entire day

ACC	Initial	Rerouted	Diff
EGTTCTA	7152	7164	12
EDYYDUTA	2257	2267	10
EDYYUTA	5491	5501	10
EDDDCTA	10719	10725	6
EDYYHUTA	2459	2464	5
EDDZMCTA	10162	10164	2
ENOSECTA	1196	1197	1
EHAACCTA	1785	1786	1
EGTTICTA	3518	3519	1
EDWWCTA	1621	1622	1
ENOSCTA	1528	1528	0
ENKR1CTA	3	3	0
ENBDCTA	630	630	0
EKDK1CTA	258	258	0
EGTTTCTA	4464	4464	0
EGTT9CTA	430	430	0
EGPXICTA	115	115	0
EDYYBUTA	2798	2798	0
EDXXMCTA	4052	4052	0
EDMMCTA	3400	3400	0
EDGGSCCTA	2863	2863	0
EDGGNCTA	1628	1628	0
EKDK2CTA	2037	2036	-1
EKDKCTA	1734	1733	-1
ENOSWCTA	861	860	-1
EGPXCTA	3442	3440	-2
EGPXRCTA	1105	1097	-8
EGPXFCTA	1150	1138	-12

GOSA Operations in 2024

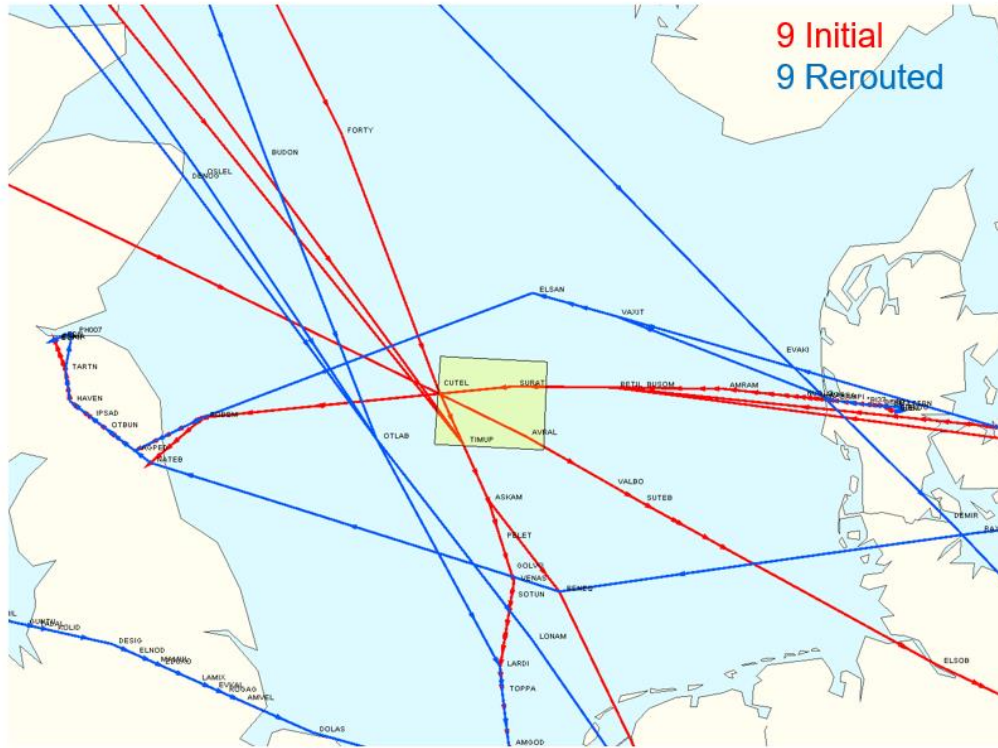
11

EOS DEMO#1 MISSION – AIR TRAFFIC IMPACT ASSESSMENT



Traffic rerouting on 20/06/2024 (ref 22/06/2023)

I WINDOW 04:30–06:30



Traffic per sector group for the entire day

	ACC	Initial	Rerouted	Diff
+	EDYYUTA	5491	5493	2
+	EDYYDUTA	2257	2259	2
+	EDDDCTA	10719	10721	2
+	EDDZMCTA	10162	10164	2
+	EGTT9CTA	430	431	1
+	EGTTCTA	7152	7153	1
+	ENOSCTA	1528	1529	1
+	ENOSWCTA	861	862	1
+	EDGGNCTA	1628	1628	0
+	EDGGSCCTA	2863	2863	0
+	EDMMCTA	3400	3400	0
+	EDWWCTA	1621	1621	0
+	EDXXMCTA	4052	4052	0
+	EDYYBUTA	2798	2798	0
+	EGPXCTA	3442	3442	0
+	EGPXICTA	115	115	0
+	EGPXRCTA	1105	1105	0
+	EGTTICTA	3518	3518	0
+	EGTTTCTA	4464	4464	0
+	EHAACCTA	1785	1785	0
+	EKDK1CTA	258	258	0
+	ENBDCTA	630	630	0
+	ENKR1CTA	3	3	0
+	ENOSECTA	1196	1196	0
+	EDYYHUTA	2459	2458	-1
+	EKDKCTA	1734	1733	-1
+	EKDK2CTA	2037	2036	-1
+	EGPXCTA	1150	1148	-2

GOSA Operations in 2024

8

EOS DEMO#1 MISSION – LAUNCH SLOTS (TBC)

Proposed launch slots

UTC		LW01	LW02	LW03	LW04	LW05
Launch Day	Launch Window	04:30-06:30	06:30-08:30	10:30-12:30	15:00-17:00	17:00-19:00
L01	18.6	x	x	x	x	x
L02	19.6	x	x	x	x	x
L03	20.6	x	x	x	x	x
L04	21.6	x	x	x	x	x
L05	22.6	x	x	x	x	x
L06	23.6	x	x	x	x	x
L07	24.6	x	x	x	x	x
L08	25.6	x	x	x	x	x
L09	26.6	x	x	x	x	x
L10	27.6	x	x	x	x	x
L11	28.6	x	x	x	x	x
L12	29.6	x	x	x	x	x



Selected launch slots

UTC		LW01	LW05
Launch Day	Launch Window	04:30-07:30	17:00-19:00
L01	18.6	x	
L02	19.6	x	
L03	20.6	x	
L04	21.6	x	
L05	22.6	x	x
L06	23.6	x	x
L07	24.6	x	
L08	25.6	x	
L09	26.6	x	
L10	27.6	x	
L11	28.6	x	
L12	29.6	x	x

- Selected launch slots mitigating impact on traffic, based Eurocontrol Network Impact Assessment
- A 5d period will be activated (NOTAM to be released 7d in advance) within the selected launch slots period



GERMAN
OFFSHORE SPACEPORT
ALLIANCE

**THANK YOU FOR
YOUR ATTENTION!**



Launch from a barge (Baltic Sea)



Rocket recovery operation

Credit: Copenhagen Suborbital, Heat 1-X (2011)