64º Congreso Internacional de Ingeniería Naval e Industria Marítima
Gijón 26-28 de marzo de 2025

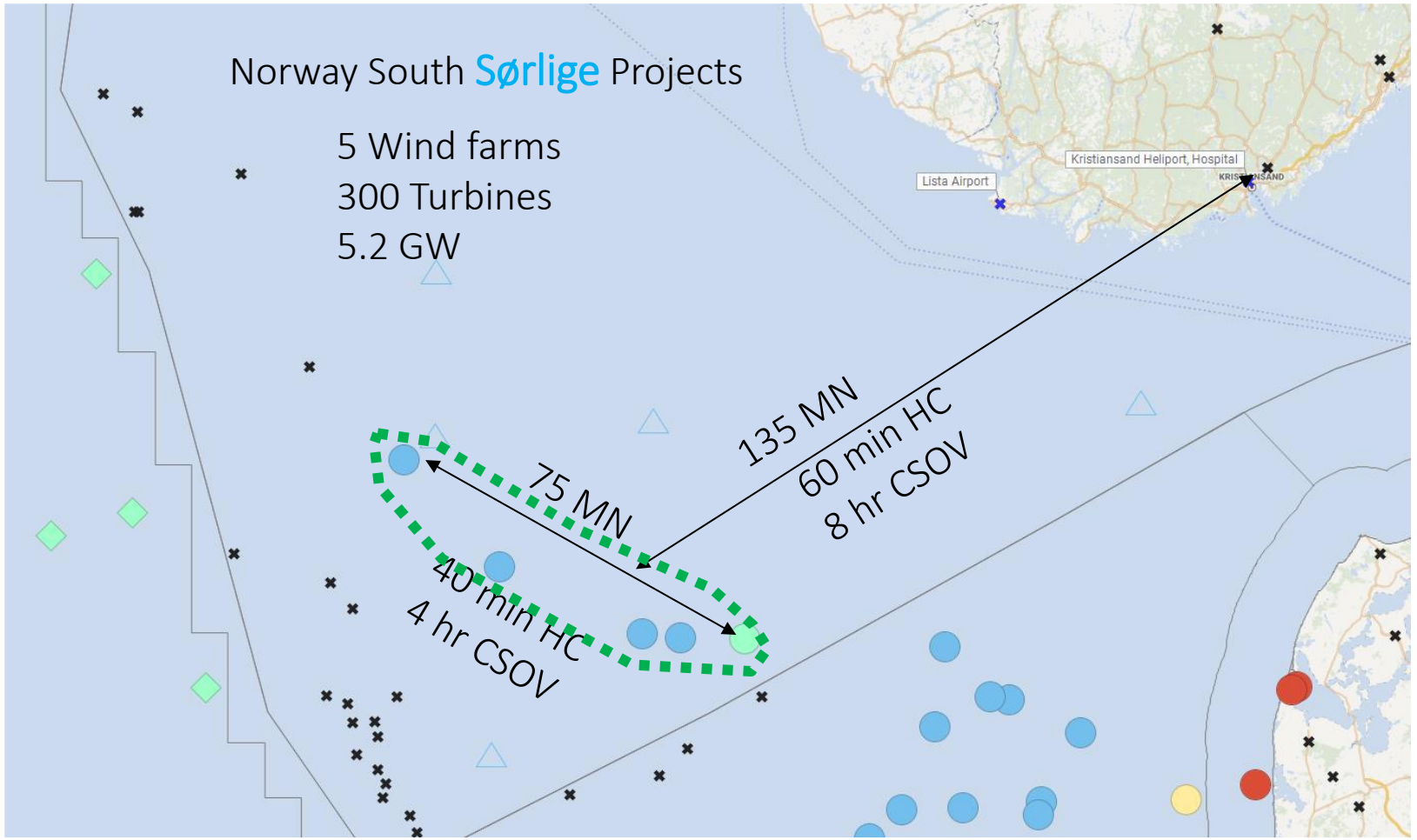
64th International Congress of Naval Architecture
Gijon, 27th March 2025

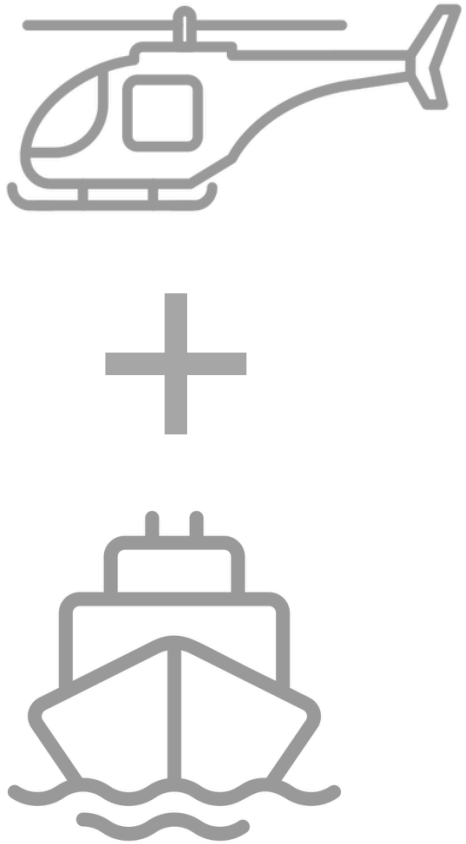
Santiago de Guzmán
sguzman@seaplace.es

On the Helicopter Integration on CSOV

Motivation

- New offshore wind farms are located in harsher conditions and farther from shore
- The industry faces **new challenges** that require more efficient ships for the O&M





Summary

- **Objective:** Seaplace and Airbus Helicopter are collaborating on the assessment of the **potential benefits of integrating the helicopter into the CSOV**

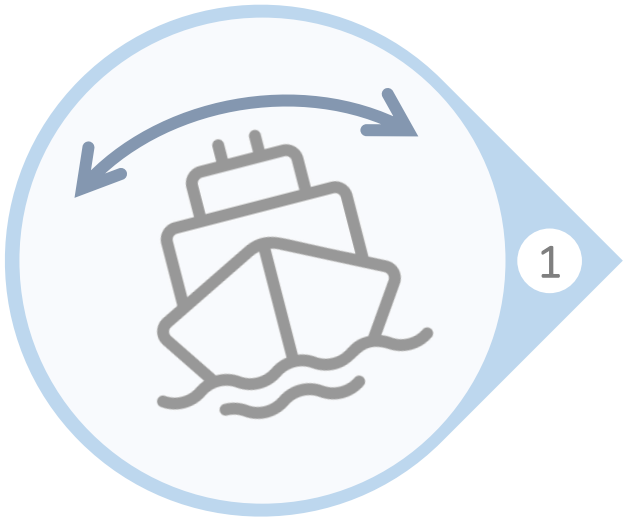
- **Reference case:**
  - **Ship:** SEA-1629 Design for Bibby by Seaplace
  - **Helicopter:** H145 and H175 by Airbus
  - **Wind farm**: Norwegian Northern North Sea
- **Accessibility criteria:**
  - **Gangway**: mechanical limits from the equipment (stroke, stroke speed and luffing)
  - **Helicopter**:
    - Aircraft category B, helideck Category 1
    - Aircraft category B, helideck Category 2-3
- **Scenarios for accessibility assessment**
  - **Transfer operations with the gangway**: Ship in DP mode, gangway connected, 3-hour duration
  - **Offshore landing operations with the helicopter**: Ship in DP mode, gangway connected, 20-min duration
  - **Ship-helicopter combined**: combined transfer

Next Generation of CSOV & SOV

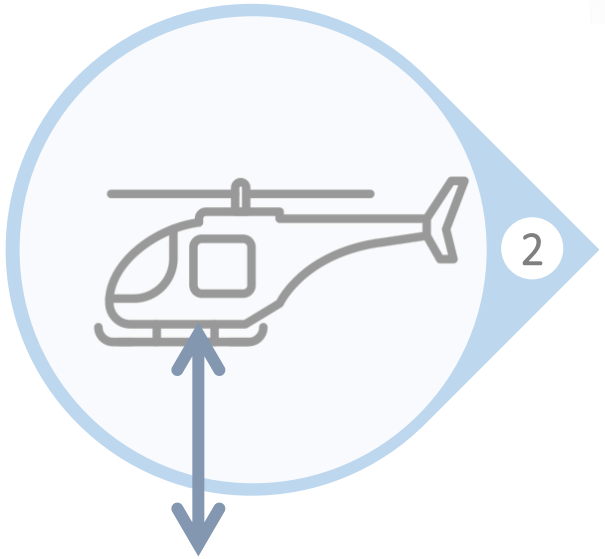
Floating-wind ready concept

- Flexible ship designs (bottom fixed and floating wind)
- High performance, efficiency & safety
- Workable in harsher environments, increasing weather windows
- Float-to-Float operations

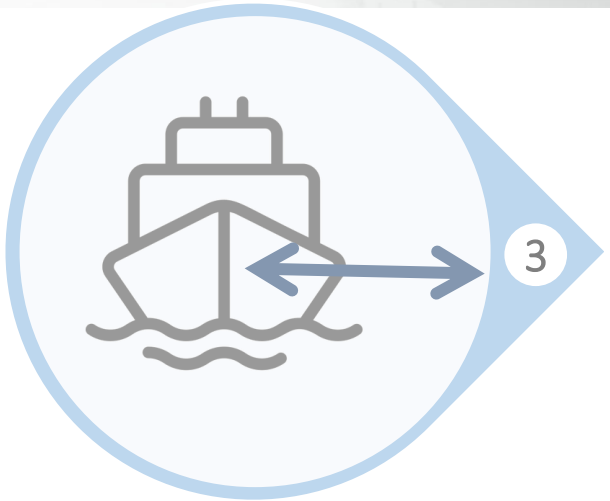
CSOV – SEA 1629



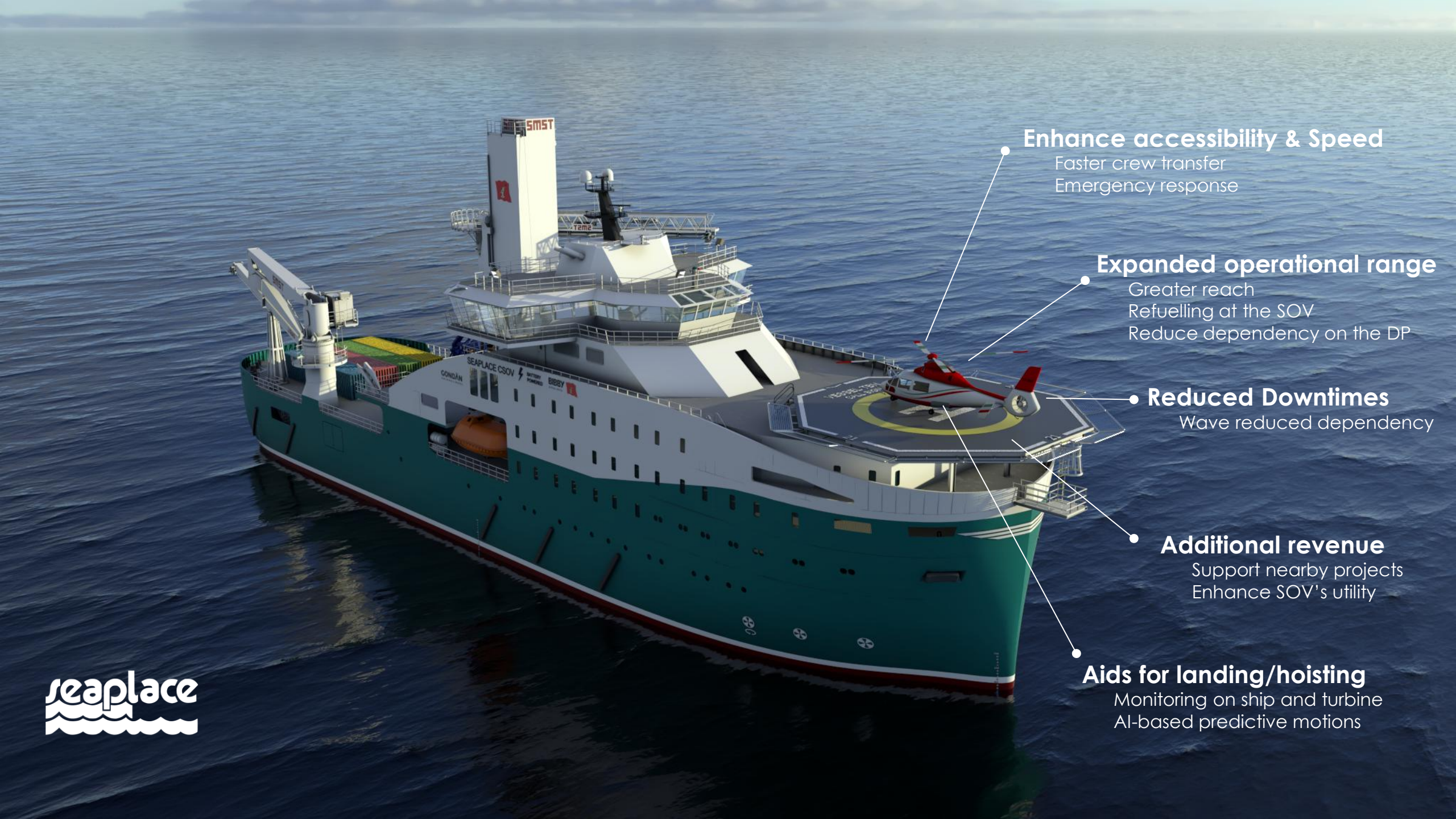
Roll Stabilization



Helicopter integration



Dynamic positioning



Enhance accessibility & Speed
Faster crew transfer
Emergency response

Expanded operational range
Greater reach
Refuelling at the SOV
Reduce dependency on the DP

Reduced Downtimes
Wave reduced dependency

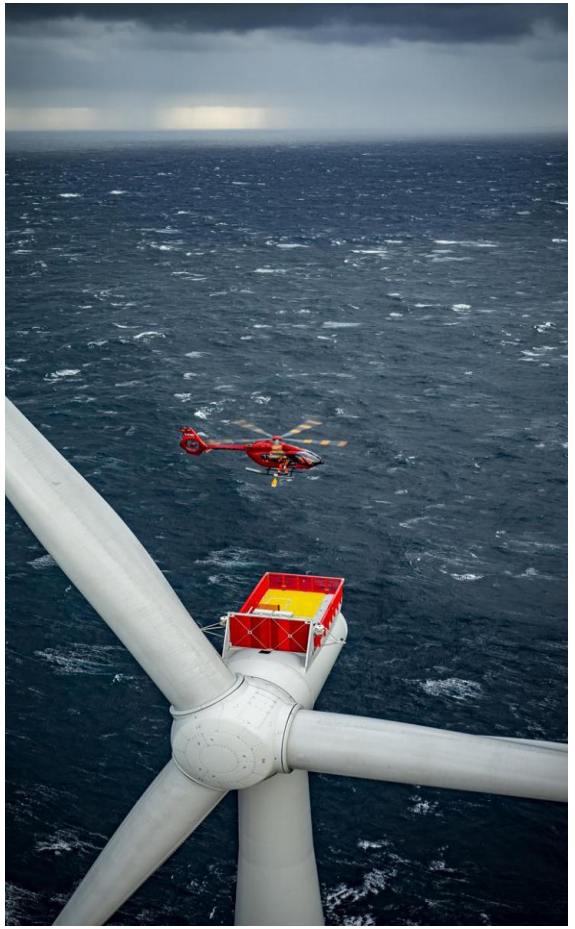
Additional revenue
Support nearby projects
Enhance SOV's utility

Aids for landing/hoisting
Monitoring on ship and turbine
AI-based predictive motions

seaplace

The helicopter mission

Primary: Transporting technical teams of 3 to 6 personnel to the turbines.



The helicopter mission

Secondary:

- Performing vessel crew changes when necessary (bi-weekly).
- Delivering materials to the turbines.

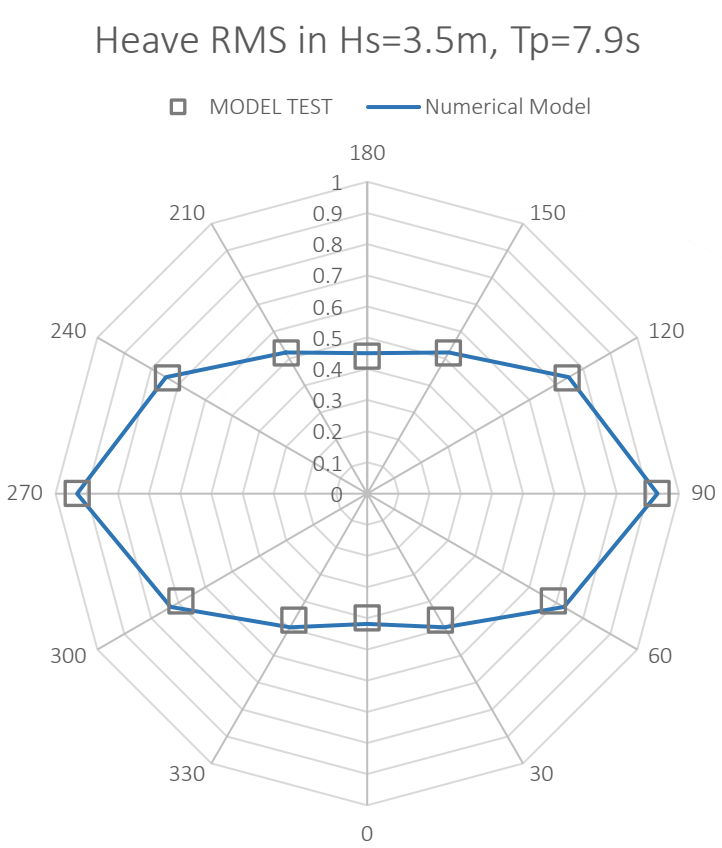
The helicopter mission

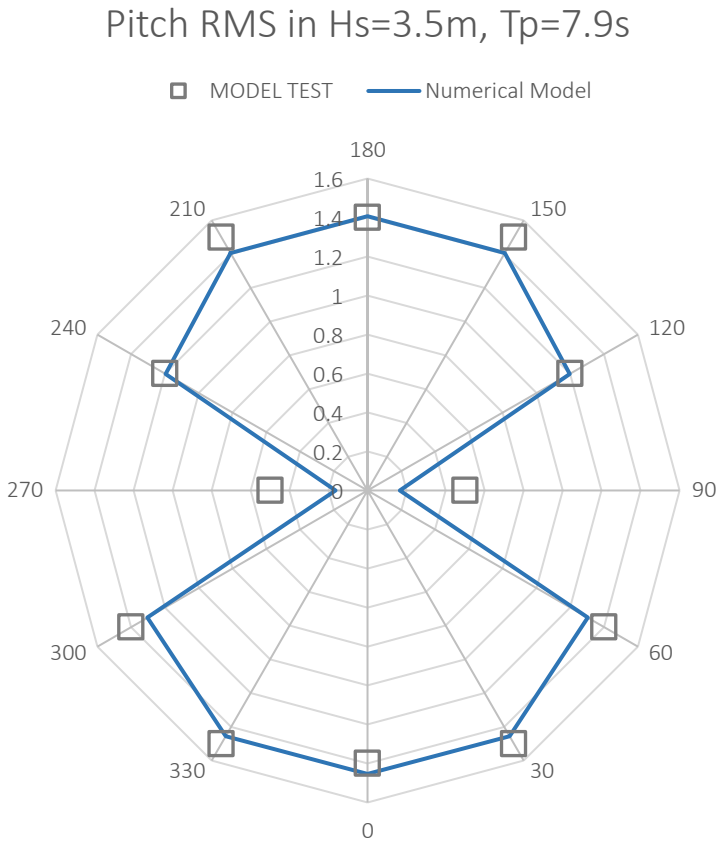
Emergency Mission:
Evacuating personnel from the turbines or the ship, flying if required directly to a hospital with adequate medical facilities

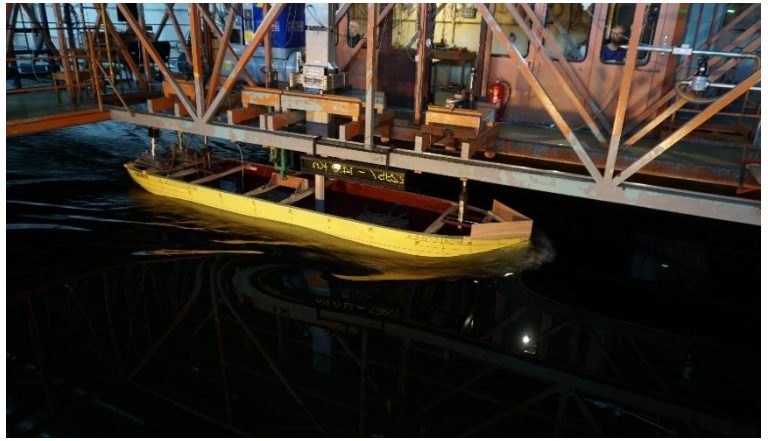
The helicopter mission

	H145	H175
Crew change people	10	18
Speed (knots)	140	155
Endurance (h)	3h 35min	6h
Range (NM)	351	627
D value (m)	13.54	18.06

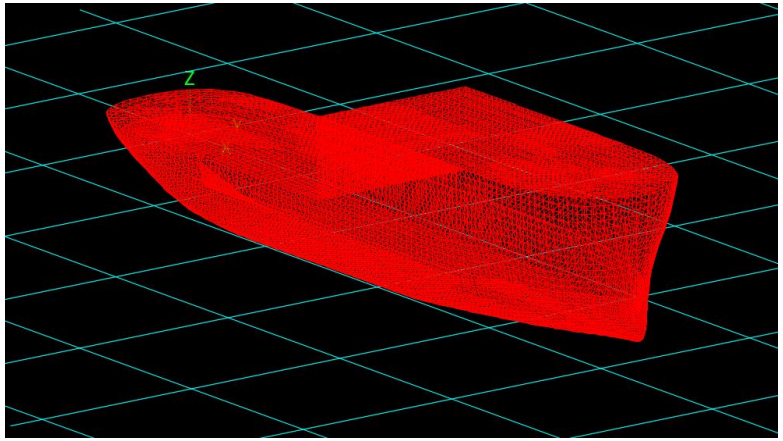
Numerical model calibration: model tests







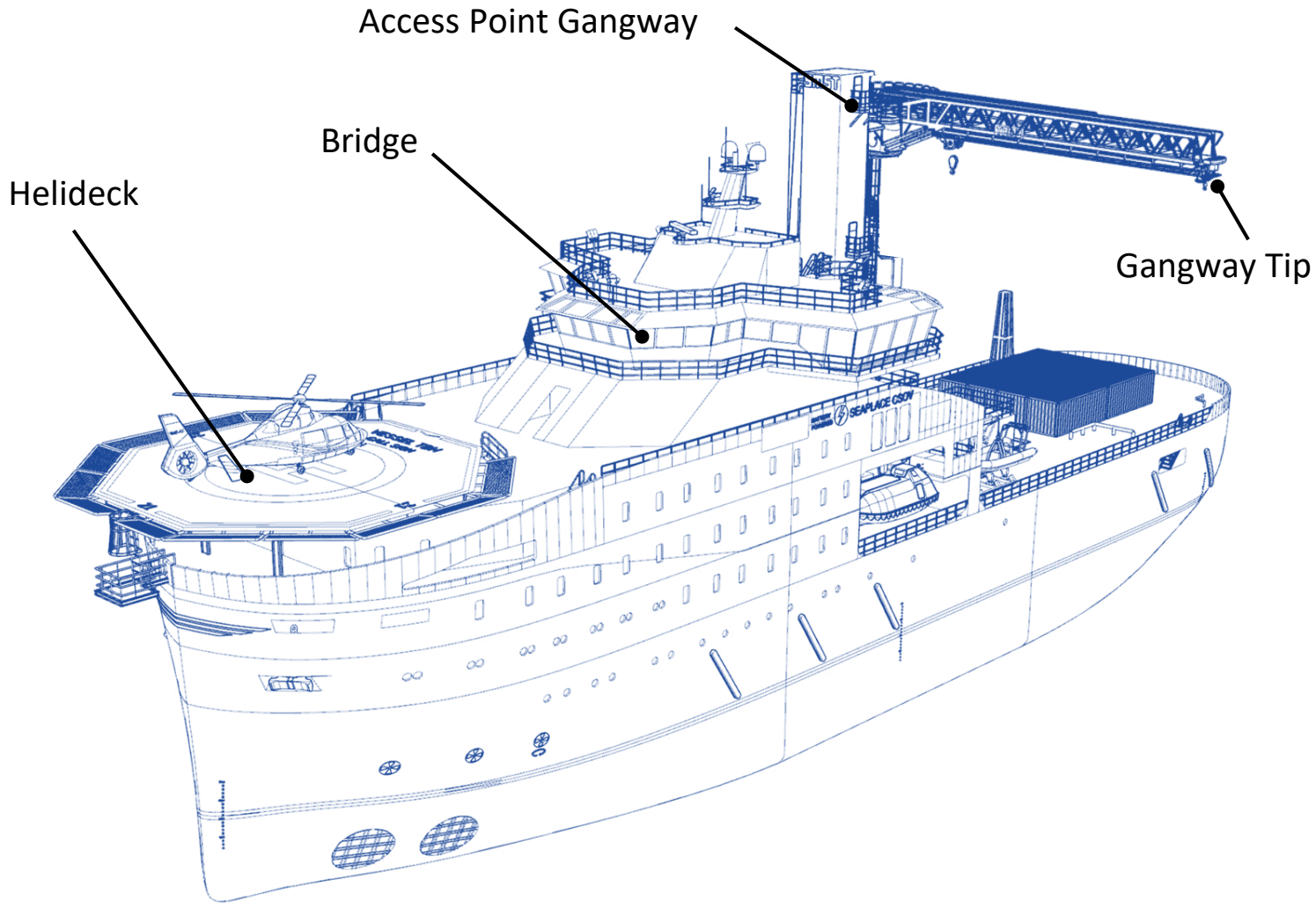
SEA-1629 Model tests at CTO



SEA-1629 Numerical Model

We calibrate our numerical models through model testing campaigns

Global Motion Assessment



Helicopter Landing limits for validation

Standard Helideck Monitoring Systems Rev 9b 2020 11 01

Airbus H175 & H145
Aircraft category B

CSOV – SEA 1629
Monitored Helideck

Helideck category 2-3

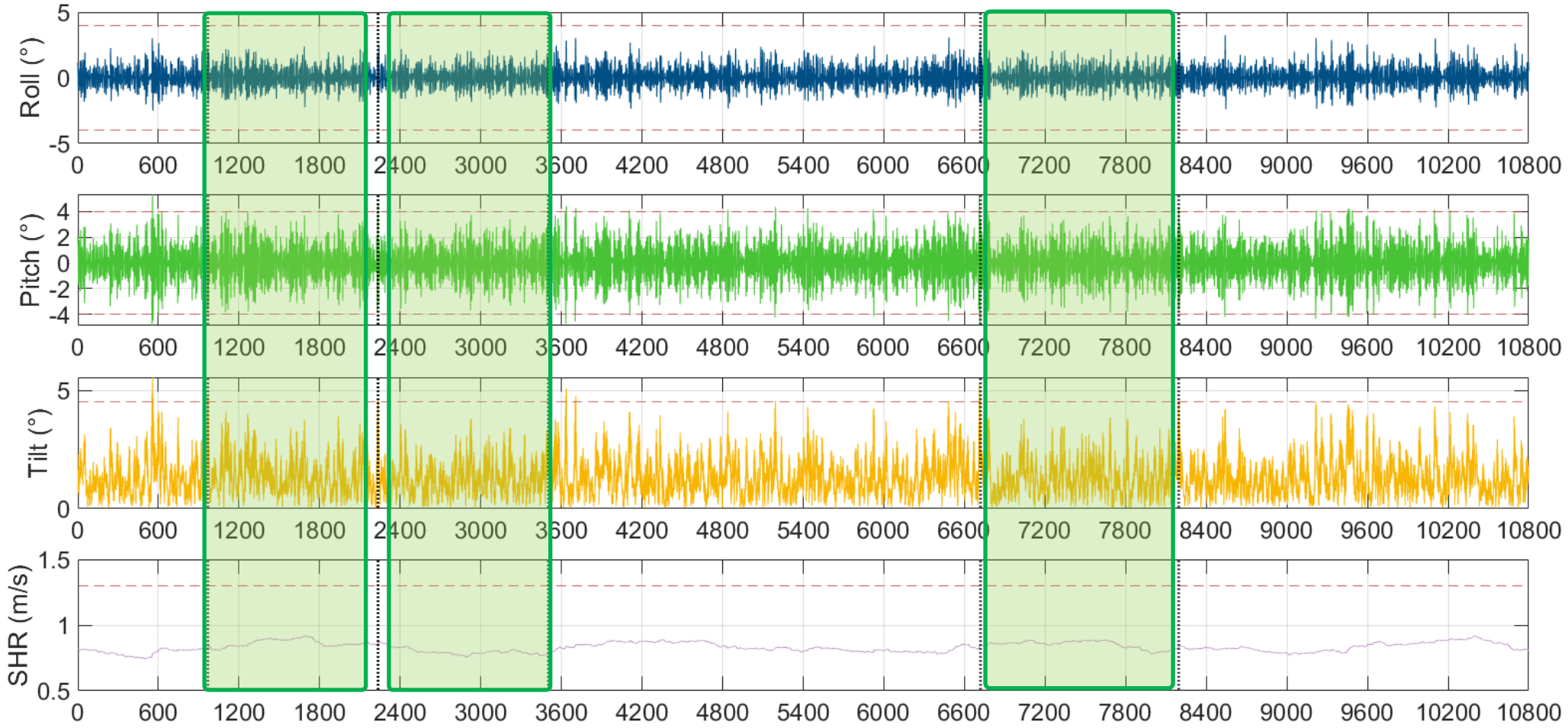
Ship allowable motions

Operational window: 20 min
Maximum roll: ± 3 degrees
Maximum pitch: ± 3 degrees
Maximum tilt: 3.5 degrees
Significant heave rate: 1.0 m/s

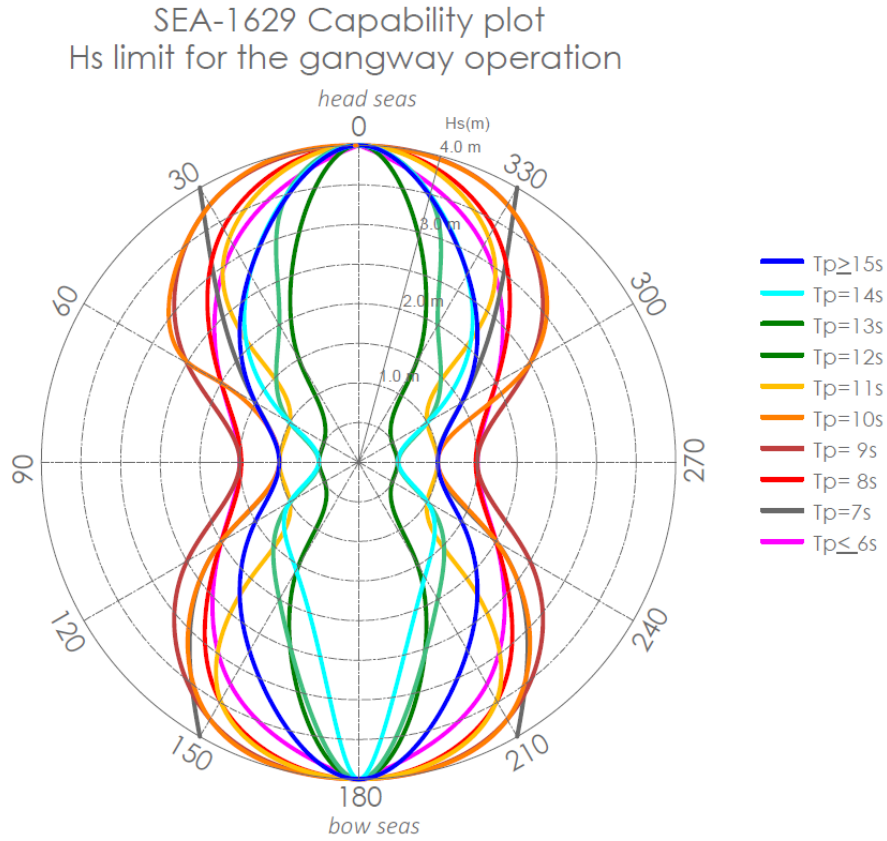
AIRBUS seaplace

Feasibility Analysis

We select 20-min windows where the landing limits are met, for each 3-hour sea state (Hs, Tp, Direction)

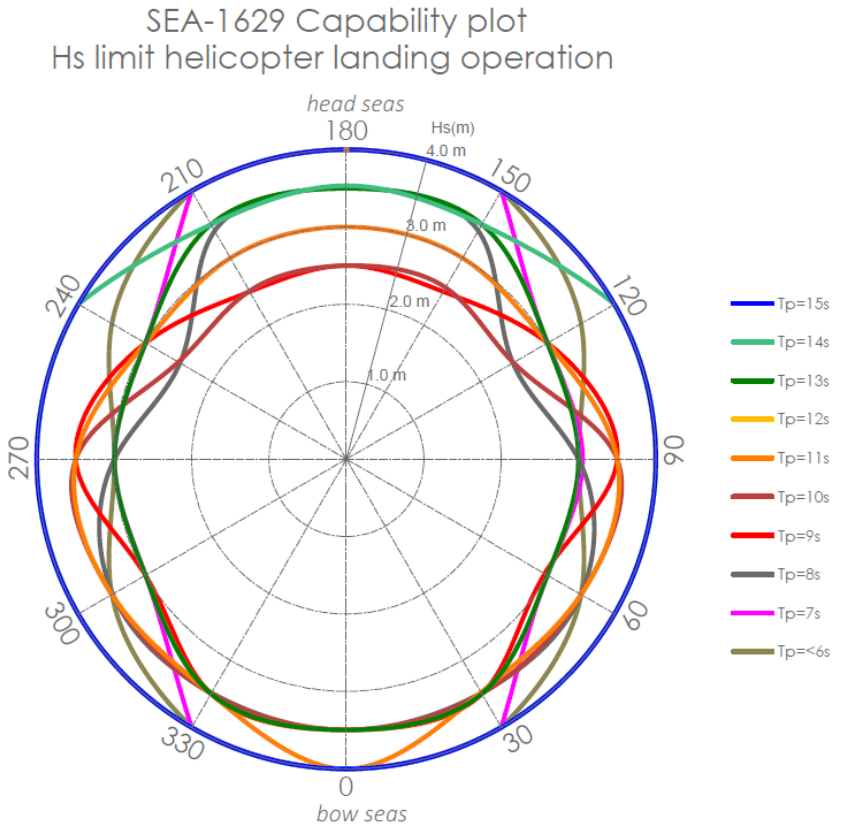


Standalone capability plots



Gangway capability plot

Ship in DP mode



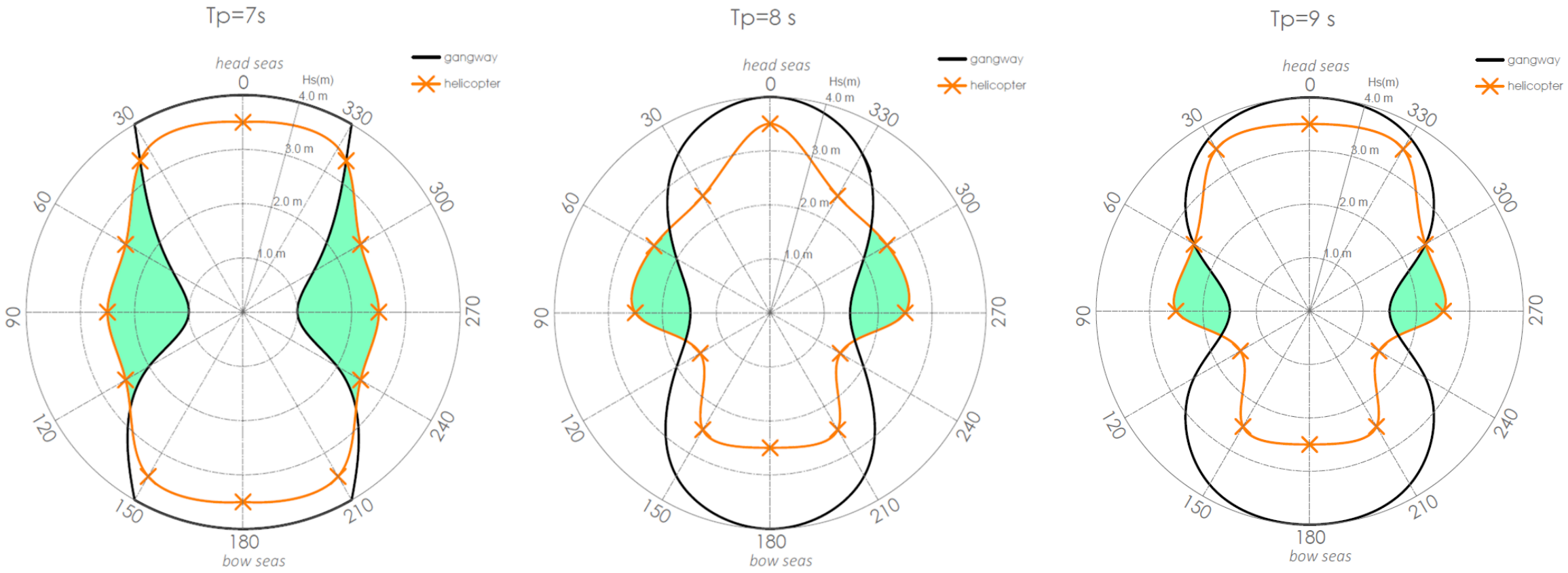
Helicopter capability plot

Ship in DP mode – Not navigating

Helideck Category 3

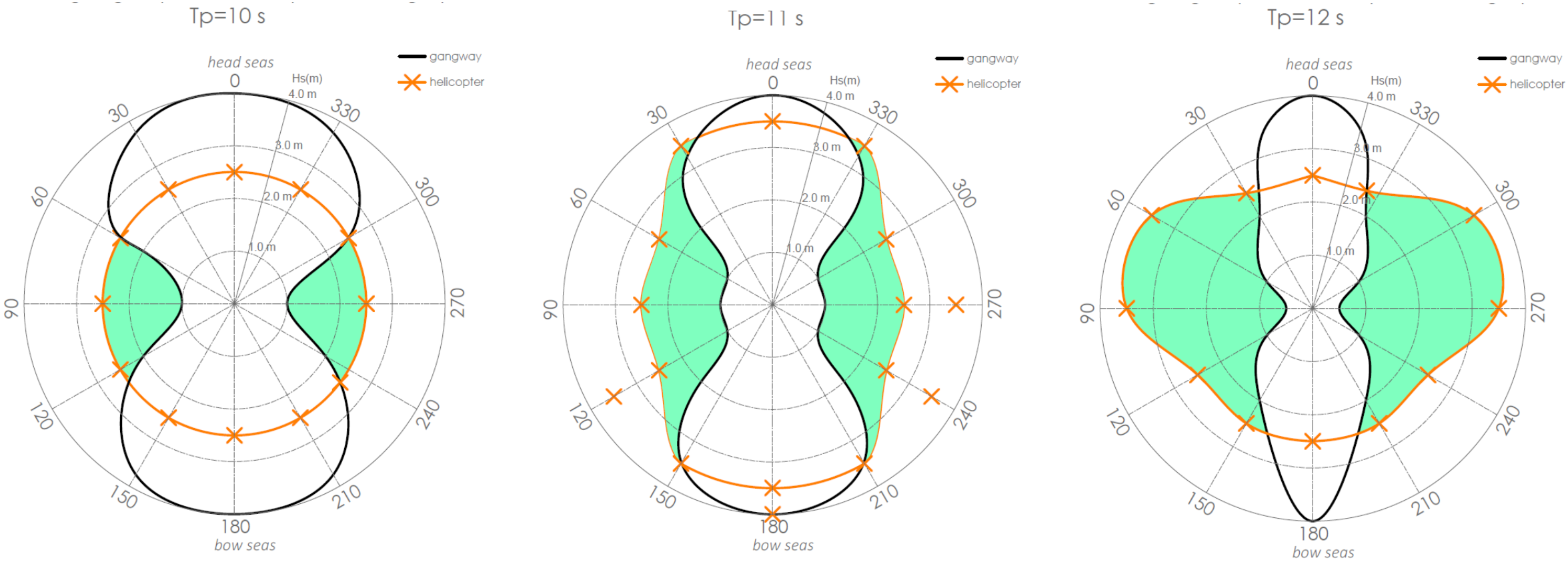
Accessibility: Gangway Vs Helicopter

Maximum Significant Wave Height for accessibility



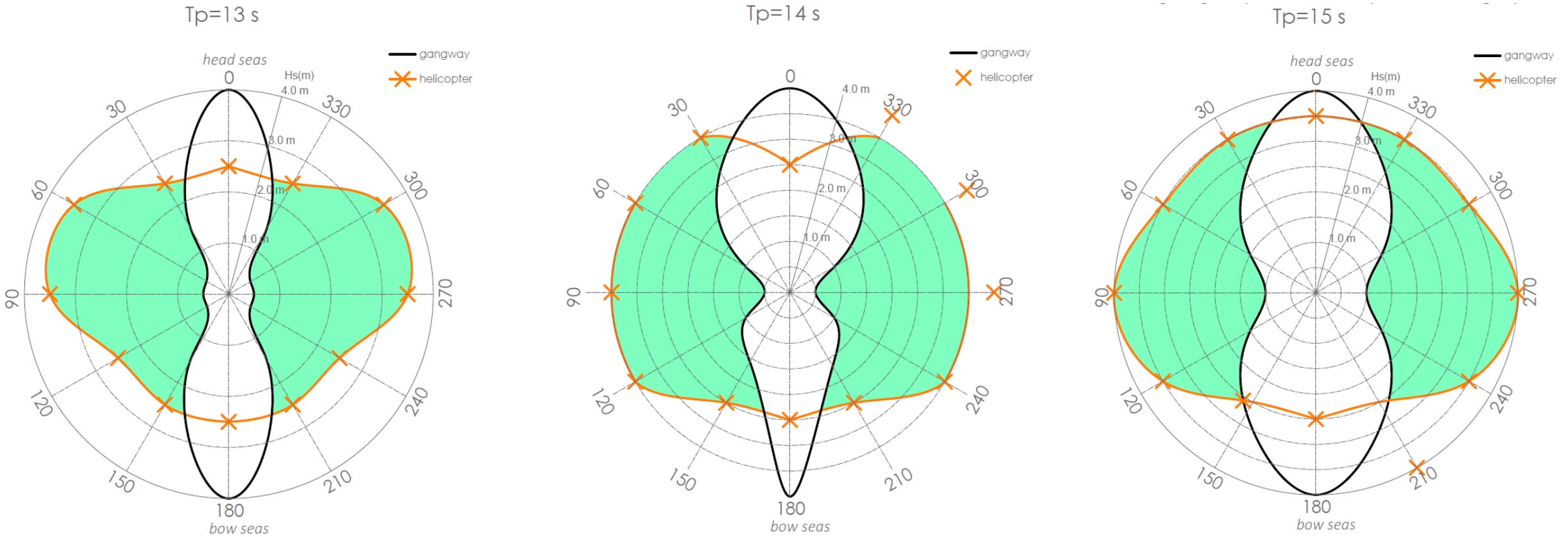
Accessibility: Gangway Vs Helicopter

Maximum Significant Wave Height for accessibility



Accessibility: Gangway Vs Helicopter

Maximum Significant Wave Height for accessibility



Operability Assessment – Norway

Wave Scatter in the Reference Project (Hs-Tp)

Hs(m)	Tp (s)										
	<6.5	6.5-7.5	7.5-8.5	8.5-9.5	9.5-10.5	10.5-11.5	11.5-12.5	13.5-14.5	14.5-15.5	15.5-16.5	>16.5
0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0-0.5	0.9%	0.1%	0.3%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
0.5-1	6.3%	1.5%	2.8%	1.5%	1.3%	1.0%	0.7%	0.3%	0.2%	0.1%	0.0%
1-1.5	6.3%	2.2%	4.1%	1.9%	1.6%	1.5%	1.2%	0.7%	0.3%	0.1%	0.0%
1.5-2	4.1%	2.2%	3.8%	1.5%	1.5%	1.2%	1.0%	0.7%	0.4%	0.1%	0.0%
2-2.5	1.7%	1.9%	4.2%	1.2%	1.1%	1.1%	0.8%	0.6%	0.4%	0.1%	0.0%
2.5-3	0.4%	1.1%	3.8%	1.4%	0.8%	0.7%	0.6%	0.4%	0.3%	0.1%	0.0%
3-3.5	0.0%	0.4%	2.8%	1.7%	0.8%	0.5%	0.4%	0.3%	0.2%	0.1%	0.0%
3.5-4	0.0%	0.1%	1.5%	1.5%	1.0%	0.4%	0.3%	0.2%	0.1%	0.1%	0.0%
4-4.5	0.0%	0.0%	0.6%	1.1%	1.0%	0.4%	0.2%	0.1%	0.1%	0.0%	0.0%
4.5-5	0.0%	0.0%	0.2%	0.5%	0.9%	0.5%	0.2%	0.1%	0.1%	0.0%	0.0%
5-5.5	0.0%	0.0%	0.0%	0.2%	0.6%	0.5%	0.1%	0.1%	0.0%	0.0%	0.0%
5.5-6	0.0%	0.0%	0.0%	0.1%	0.3%	0.5%	0.2%	0.1%	0.0%	0.0%	0.0%
6-6.5	0.0%	0.0%	0.0%	0.0%	0.2%	0.3%	0.2%	0.1%	0.0%	0.0%	0.0%
6.5-7	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.2%	0.1%	0.0%	0.0%	0.0%
7-7.5	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
7.5-8	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%
>8	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%

Delta operability of the helicopter Vs gangway

The delta of operability of the helicopter (standalone) against gangway (standalone) is about 4 **(Category 2-3)**

Heli Vs. DP	180	150	120	90	60	30	0	330	300	270	240	210	Total
<6	0.0%	0.0%	0.2%	-1.1%	0.2%	0.0%	0.0%	0.0%	0.2%	-1.1%	0.2%	0.0%	**-1%**
7	0.0%	0.0%	0.3%	0.5%	0.2%	0.0%	0.0%	0.0%	0.2%	0.5%	0.3%	0.0%	**2%**
8	-0.7%	-0.3%	-0.9%	0.7%	0.3%	0.0%	-0.1%	0.2%	0.3%	0.7%	-0.9%	-0.6%	**-1%**
9	-0.4%	-0.4%	-0.5%	0.2%	0.0%	-0.1%	-0.1%	-0.1%	0.0%	0.2%	-0.5%	-0.4%	**-2%**
10	-0.2%	-0.1%	0.1%	0.4%	0.1%	-0.2%	-0.2%	-0.1%	0.1%	0.4%	0.1%	-0.2%	**0%**
11	-0.1%	-0.1%	0.3%	0.5%	0.3%	-0.1%	-0.1%	-0.1%	0.3%	0.5%	0.3%	-0.1%	**2%**
12	-0.1%	0.0%	0.3%	0.4%	0.4%	0.0%	-0.1%	0.0%	0.4%	0.4%	0.3%	0.0%	**2%**
13	-0.1%	0.2%	0.2%	0.3%	0.3%	0.2%	-0.1%	0.2%	0.3%	0.3%	0.2%	0.2%	**2%**
14	-0.1%	0.0%	0.1%	0.2%	0.1%	0.0%	-0.1%	0.1%	0.1%	0.2%	0.1%	0.0%	**1%**
15	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	**0%**
Total	**-2%**	**-1%**	**0%**	**2%**	**2%**	**0%**	**-1%**	**0%**	**2%**	**2%**	**0%**	**-1%**	**4%**

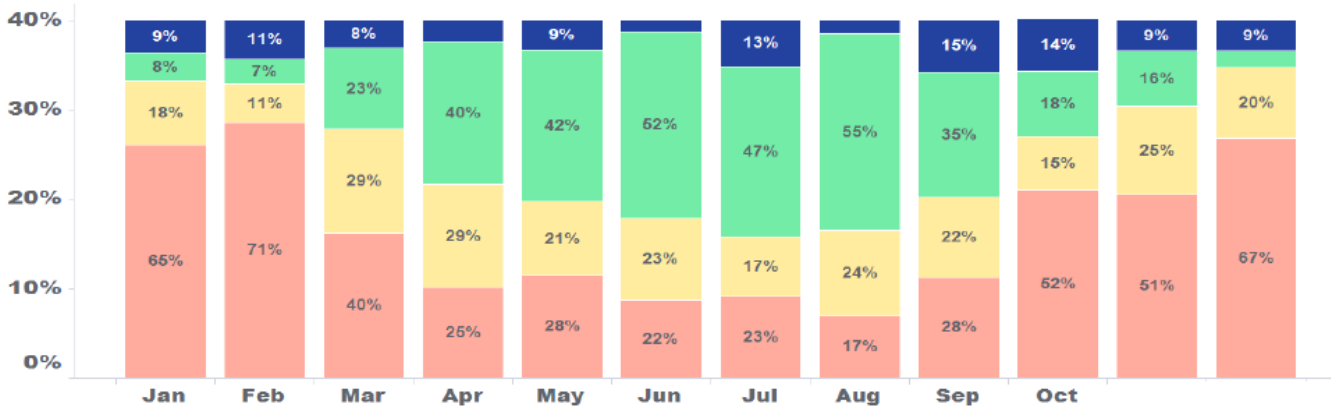
Delta operability of the integrated helicopter

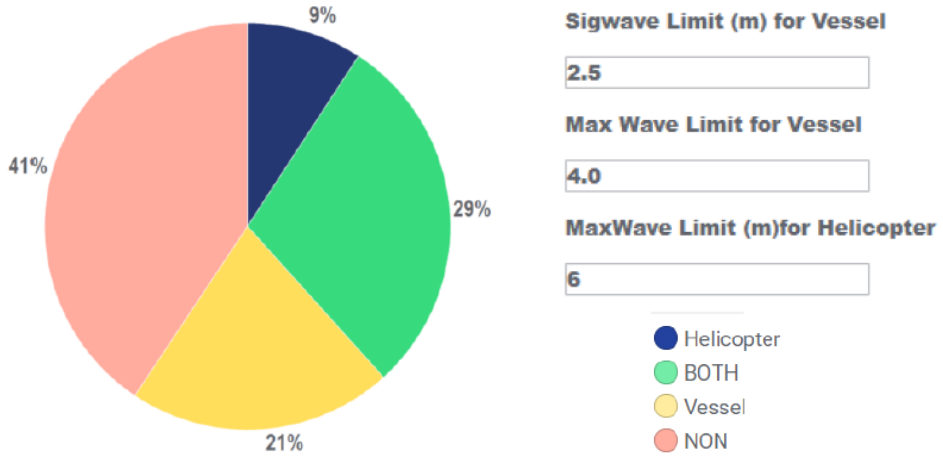
Crossing the results with the metocean data from Norway South, the delta of operability of a vessel that has integrated the helicopter and the gangway Vs a vessel with only the gangway is about 14% (**deck Category 2-3**)

Combined	180	150	120	90	60	30	0	330	300	270	240	210	Total
<6	0.0%	0.0%	0.2%	0.0%	0.2%	0.0%	0.0%	0.0%	0.2%	0.0%	0.2%	0.0%	**1%**
7	0.0%	0.0%	0.3%	0.5%	0.2%	0.0%	0.0%	0.0%	0.2%	0.5%	0.3%	0.0%	**2%**
8	0.0%	0.0%	0.0%	0.7%	0.3%	0.0%	0.0%	0.2%	0.3%	0.7%	0.0%	0.0%	**2%**
9	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	**0%**
10	0.0%	0.0%	0.1%	0.4%	0.1%	0.0%	0.0%	0.0%	0.1%	0.4%	0.1%	0.0%	**1%**
11	0.0%	0.0%	0.3%	0.5%	0.3%	0.0%	0.0%	0.0%	0.3%	0.5%	0.3%	0.0%	**2%**
12	0.0%	0.0%	0.3%	0.4%	0.4%	0.0%	0.0%	0.0%	0.4%	0.4%	0.3%	0.0%	**2%**
13	0.0%	0.2%	0.2%	0.3%	0.3%	0.2%	0.0%	0.2%	0.3%	0.3%	0.2%	0.2%	**2%**
14	0.0%	0.0%	0.1%	0.2%	0.1%	0.0%	0.0%	0.1%	0.1%	0.2%	0.1%	0.0%	**1%**
15	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	**0%**
Total	**0%**	**0%**	**2%**	**3%**	**2%**	**0%**	**0%**	**1%**	**2%**	**3%**	**2%**	**0%**	**14%**

Cost assessment

Accessibility due to weather in Norway South





*Accessibility based in 5 years backwards of historical weather data .Helicopter access just during daylight , when there aren't ice conditions on the Project and under Visual Flight Rules. Accessibility for the SOV is 24 hours , for both cases accessibility to work is limited to 20 m/s wind speed

	Operational Cost	Labor Cost	Total Cost	Energy Malus	Availability Lost	CO2
1 SOV Dedicated to 1 project (100 turbines)	13.32 M€/Yr	4.92 M€/Yr	18.22 M€/Yr	14.52 M€/Yr	3.14%	REF
1SOV+ 1H175 Multiproject (300 Turbines)	11.42 M€/Yr	2.45 M€/Yr	13.92 M€/Yr	10.42 M€/Yr	2.25%	-21%
Relative cost increase	14.0%	49.8%	23.7%	28.4%	28.4%	

* Simulation based on Failure rate=2 per turbine and year , 150 MMH preventive per turbine and year , 30 and 46 techs respectively onboard of SOV , SOV speed 20 knts , Hc speed 130 knts ,100 turbines 16.5 MW each, Load factor 40%, 0.08€/kw hour , market prices for helicopter and SOV acquisition and operational costs , etc .

Conclusions

Integrating the helicopter into offshore wind support vessels can significantly enhance performance and cost-effectiveness

Delta operability of the ship-helicopter tandem is **14% for the Norwegian Project**

- **Enhanced Operational Performance:** Detailed frequency and time-domain analyses show that the integration of the helicopter into the CSOV, irrespective of the level of integration, can markedly **improve crew and cargo transfer operations**, especially under challenging metocean conditions, keeping the emergency response time when needed.
- **Improved Safety Measures:** By benchmarking against industry standards such as the Helideck Monitoring Systems Rev 9b guidelines, the research confirms that the integration of helicopter operations not only **enhances landing safety** but also broadens the safe operational envelope of the vessel. Seaplace and Airbus are collaborating in the development of IA-based systems to assist landing operations.
- **Economic assessment:** Further investigations are needed to confirm that incorporating helicopter operations is economically advantageous. Seaplace and Airbus are currently performing specific studies to define the added value of helicopter integration in a **case-by-case approach**

INNOVATIVE SME
Valid until Apr 2nd 2022

GOBIERNO DE ESPAÑA · MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES

IMCA
Supplier (S) Member

ISO 9001
ISO 14001
BUREAU VERITAS
Certification

64º Congreso Internacional
de Ingeniería Naval e Industria Marítima
Gijón 26-28 de marzo de 2025

seaplace
AIRBUS

Thanks!

seaplace

Santiago de Guzmán
sguzman@seaplace.es

AIRBUS

Antonio Martinez
antonio.an.martinez@airbus.com

Seaplace, since 1980
seaplace@seaplace.es