New Naval

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Test Trials
Oil Recovery of VLSFO
IMAROS$_2$
February 2025

IMAROS2 Final Conference

Venue - Hilton Hotel, St. Julian's Malta
19 November 2025

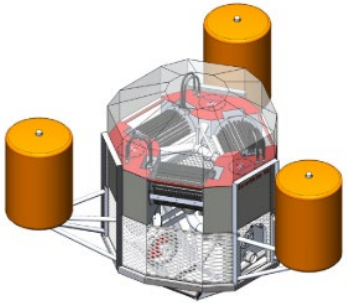
Approach

Starting point

- 3in discharge outlet
- 3 recovery banks (360º)
- No thrusters
- Remote or on-board pump
- No external floats
- No water/steam injection

Proposed Approach

- 4in discharge outlet
- 3 recovery bank (360º)
- 2 x thrusters –water movement
- High-efficient on-board pump
- 3 external floats – open sea
- Water/Steam injection (heavy fuel oils & arctic conditions)
- Ice breaking grid or different type of brushes



Final Approach

- 3in discharge outlet
- One recovery bank
- High-efficient on-board pump
- 2 external floats
- Water/Steam injection (heavy fuel oils & arctic conditions)
- Ice breaking grid
- different type of brushes (standard, curly, cut bristles in different lengths)

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Describe the potential for the unit	The current state	Proposed modifications	Final modifications
The ability to switch to larger diameter hose	Discharge connection is 3in.	Discharge connection can be modified from 3in to 4in.	Discharge connection is 3in.
The ability to move towards the oil (e.g. with thrusters)	Without any device for motion.	Addition of two twin propellers thrusters. Max. Thrust 220 kgf per piece. Independent water movement.	Not feasible due to the dimensional constraints of the test tank (Depth: 0.80-0.90m)
The ability to switch to different types of pumps	Remote or on-board pump.	On board hydraulic Submersible Centrifugal Screw Pump, so as to increase efficiency and solids handling and face any suction height issues.	On-board submersible, positive displacement Archimedes' screw pump.
The ability to change the floating properties	Without external floats.	Addition of 3 external floats. Open sea operations	Addition of 2 external floats for optimum buoyancy and balance the additional weight of on-board pump.
The ability to install hot water injection on the equipment	No provision.	Addition of Steam injection system with skimmer cover and water injection system in pump's inlet	Addition of steam injection circuits (one at the front and one at the pump's suction inlet)
Other relevant features		Ice-breaking grid or different type of brushes	Front-facing ice-breaking grid. Different type of brushes (standard, curly, cut bristles in different lengths)

Test Facility

Purpose of tests

Purpose of tests: Investigate the capability of oil skimmers in recovering very low sulphur fuel oil (VLSFO).

- 80-90% ice coverage
- Water
- 350-500 liters of VLFSO

The test conditions are mimicking solid ice field that has a fairway broken at the sea.

Air Temperature: -2°C

VLSFO Data

Table 1 *Description of the oils.*

SINTEF ID	IMAROS ID	Labeling	Comment
2024-5377	IM-27	VLSFO Danmark	Bottle leaked during transport to SINTEF
2024-5378	IM-28	VLSFO Malta	
2024-5379	IM-29	ULSFO Sverige	

Table 3

SINTEF I

2024-53
2024-53
2024-53

Visual ob
at lower
(approx.

Table 2 *The oils physical properties. Viscosity measurements are from the temperature sweep.*

SINTEF ID	IM no.	Viscosity, temp sweep (cP)		Density (g/mL)		Water content	Pour
		10 °C	50 °C	50 °C (measured)	15 °C (calculated)	(%)	(°
2024-5377	IM-27	23104	282	0.931	0.954	0.1	2
2024-5378	IM-28	36277	110	0.909	0.932	0.1	3
2024-5379	IM-29	932	9.6	0.866	0.890	0.2	2

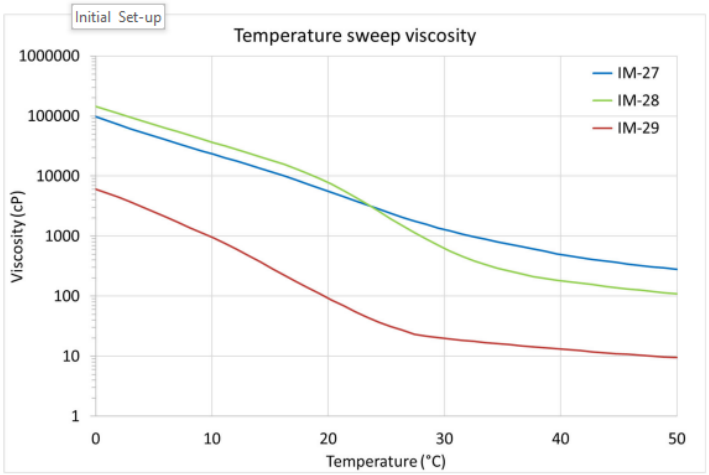
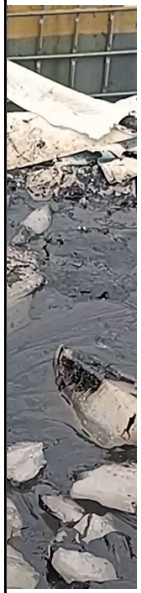


Figure 5 Temperature sweep for viscosity (cP) from 50 to 0 °C (1 °C/min) at shear rate $10s^{-1}$.

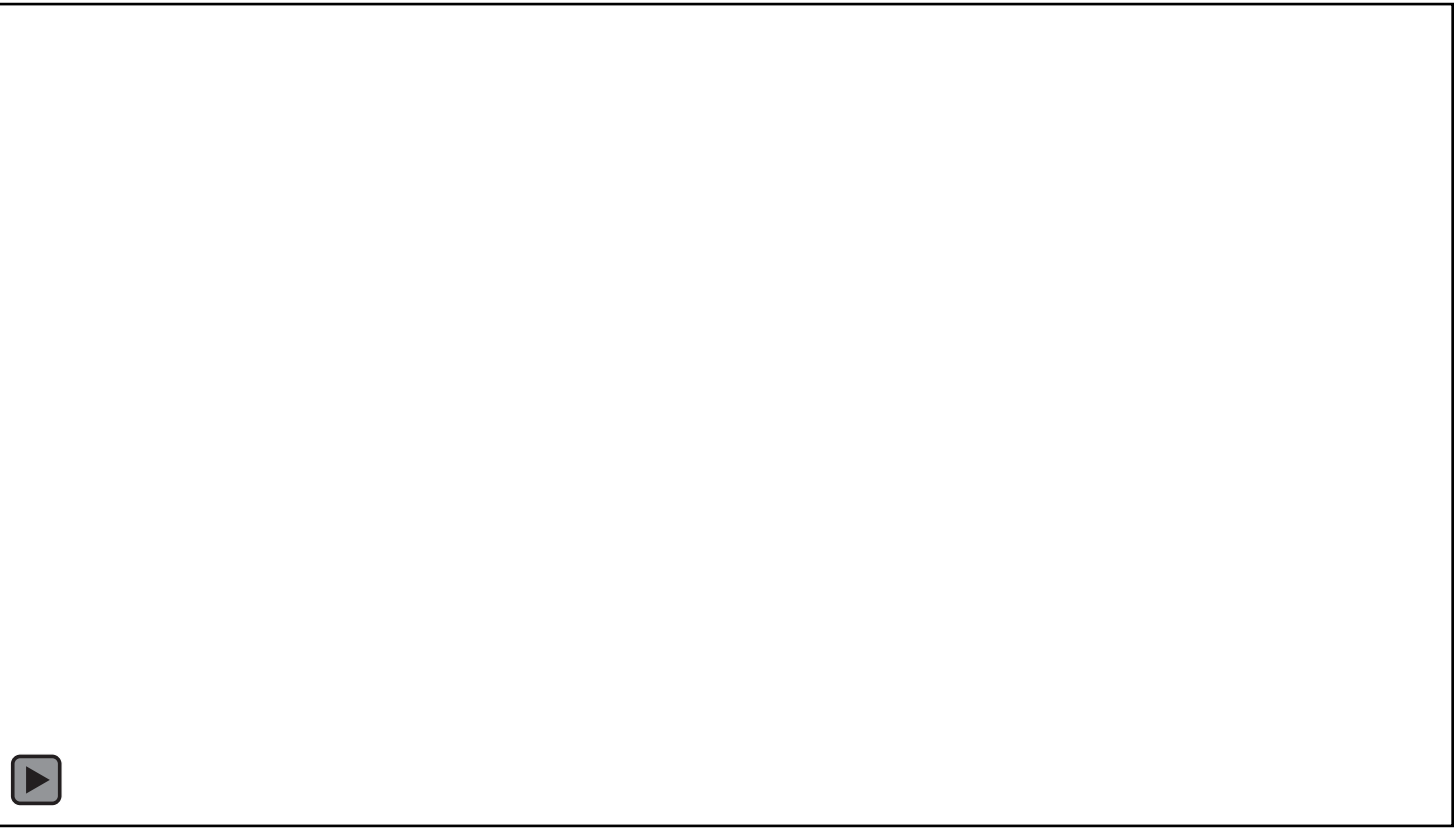
Initial Set-up

Test Trials Day 1

Removal of Front Grid



Test Trials
Day 1



Test Trials
Day 1

Day 2

Day 2
Run 1

Day 2
Run 2 & 3

Feedback

- VLSFO behaves like heavy fuel oil.
- Obstacles hinder induced flow.
- In cold conditions, oil stiffens and is trapped in ice.
- Unobstructed skimmer front improves flow to recovery banks.
- Skimmer showed satisfactory performance.
- Further adjustments needed for efficient VLSFO recovery.
- Thrusters improve skimmer manoeuvrability towards slicks.
- Multiple banks enable 360° oil recovery.
- Pump-inlet heating preferred over steam/water injection.

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Next Actions

- Improvement of the skimmer’s design to enhance VLSFO recovery performance.
- Implementation of new adjustments to optimize oil-recovery efficiency under ice conditions.
- Consideration of VLSFO characteristics specific to the Mediterranean Sea.
- Further testing of our equipment with VLSFO.

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Thank you for your attention!!!!

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