

2012 VISIONS-OLYMPICS COMPETITION

The next generation products and procedures for Vessels and Floating Structures

Idea Number: **L3-17**

Project Related to:	RA1 – Offshore installations	☐
	RA2 – Alternative products for the Marine Industry	☒

Project Title:

MULTI VENTURE: ENERGY EFFICIENT AND ENVIRONMENTALLY FRIENDLY TANKERS

Following an extensive multi-objective optimization of an AFRAMAX tanker for the minimization of the Accidental Oil Outflow (according to the MARPOL probabilistic model), the minimization of the IMO Energy Efficiency Design Index (EEDI) and the minimization of the Required Freight Rate, Multi Venture is an additional study that takes place in order to maximize the efficiency of the design and implement alternative fuels. This effort is done following a holistic approach but by emphasizing two design aspects:

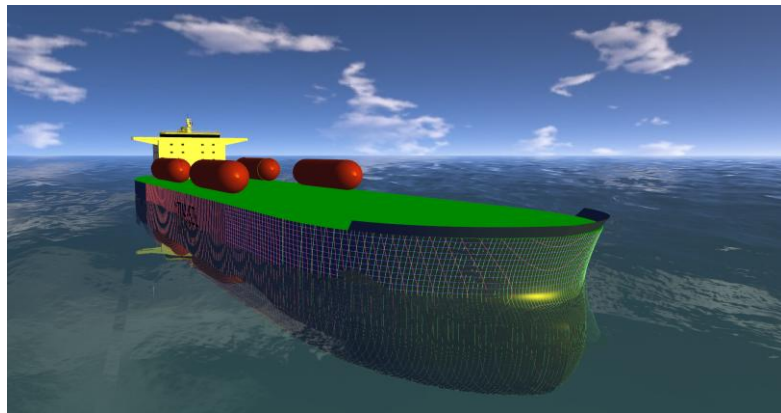
1. The local hullform optimization as a means to maximize the efficiency of the design and energy conservation by means of resistance reduction. This is done using principles of simulation driven design and coupling with state of the art design and CFD software. The efficiency of the propulsor is also addressed by designing a new propeller adapted to the wake field of the vessel.
2. The machinery arrangements are re-examined, considering LNG as main fuel. The use of hybrid power plants and applications within an all electric ship is taken into account as well as the optimization of the piping and machinery arrangements. The lifecycle performance is considered and the energy conservation is of primary importance.

The overall concept of Multi Venture can be summarized as:

- **Safe and Pollution free:** Reduction of the Accidental Oil Outflow Index is at the level of 40%.
- **Transport Efficient:** More cargo is transported with the same principal dimensions
- **Energy Efficient:** Innovative Propulsion System that utilizes waste heat and fuel cell technologies, within a smarter hybrid propulsion plant.
- **Alternative Fuel:** Use of LNG as primary ship fuel
- **Emission Free:** Increased Efficiency and LNG drastically reduce the environmental footprint
- **"Semi-Ballast Free" design:** 50% reduction of the required ballast water
- **Reliable:** Structural maintenance is reduced and machinery failures are sustained by the increased redundancy
- **Competitive:** Increased cargo spaces combined with reduced overall fuel costs and reduced ballast voyage costs
- **Maintainability:** Reduced ballast spaces (side tanks) reduce significantly the structural maintenance costs while the modularized engine room concept
- **Economic:** Over the ship's lifecycle the Required Freight Rate is up to 12% lower in comparison with conventional designs.

The business scenario assumed for Multi Venture is that of an AFRAMAX tanker trading in the Caribbean and Gulf areas with a typical voyage of 2015 nautical miles. The Gulf ECA is soon to be implemented and force the ship to run on low sulphur fuels, while the ports of the area impose important draft restrictions.

Multi Venture can provide a new niche market for the European Shipbuilding Industry both in retrofitting of systems or in new built ships.



**MULTI VENTURE
HIGH ENERGY EFFICIENCY AND ALTERNATIVE FUELS FOR TANKERS**

LIFECYCLE ASSESSMENT
Environmental and Economic Assessment

OVERALL ENERGY EFFICIENCY

**PROPULSION
EFFICIENCY**

- **ALL ELECTRIC SHIP**
Hybrid propulsion plant with Dual Fuel Gensets and hybrid components in a modularized engine room.
- **WASTE HEAT RECOVERY**
Steam Turbine generator from exhaust gas boiler with output up to 15% of the normal operating load (laden condition)
- **FUEL CELLS**
Containerized modules of fuel cells that ensure low cost and zero emission operation with natural gas
- **POWER MANAGEMENT**
Clever power management and automation for reduction of power surplus

HULL EFFICIENCY

- **GLOBAL OPTIMIZATION STUDIES**
Baseline model is a result of an exhaustive multi-objective design optimization that produced a ship with :
 - 42% reduced Accidental Oil Outflow
 - 10% reduced Required Freight Rate
 - 58% Reduced Ballast Water Amount
 - 5% Reduced EEDI
- **LOCAL BULB OPTIMIZATION**
Fine Tuning of the bulb geometry with CFD simulation produced decreased wave making resistance and wetted surface (frictional resistance)

ALTERNATIVE FUELS

- **LNG as a primary ship fuel**
Range with LNG up to 5000 n.m, or 46% of the design range (15000nm). In Caribbean business scenario (Gulf ECA) operation is done entirely in LNG.
- **IMO C-Type Tanks for Storage**
4 large units mounted on deck and 3 arranged vertically in the engine room.
- **LNG feeding of Fuel Cells**