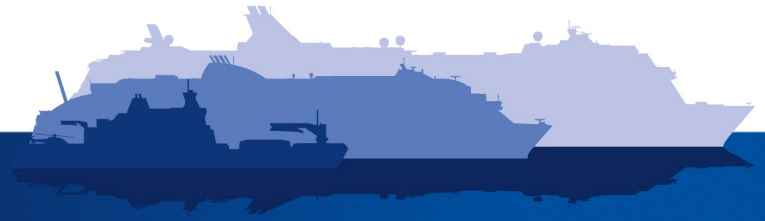
Efficient Design on Ferries

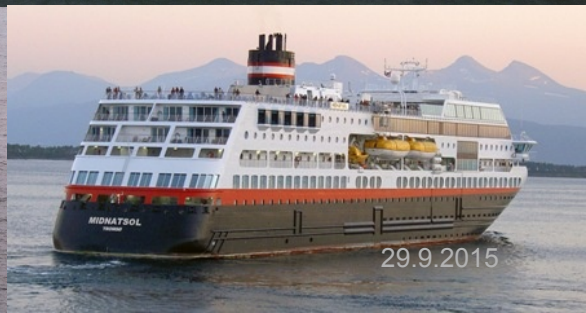
Ship Efficiency by STG, 29.9.2015.

Sami Kouvonen



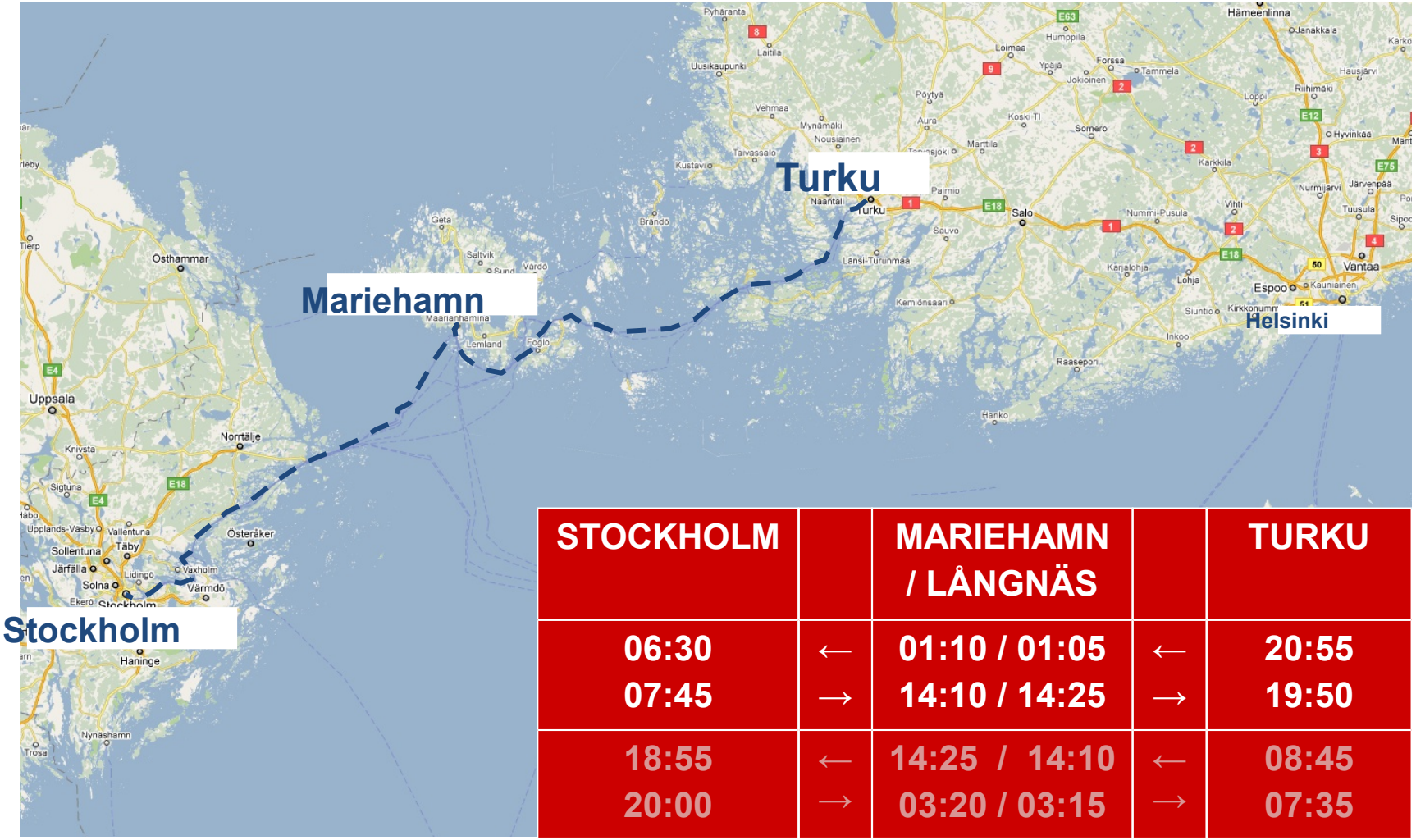
MEYER TURKU
SHIPYARD 1737

Passenger car ferries



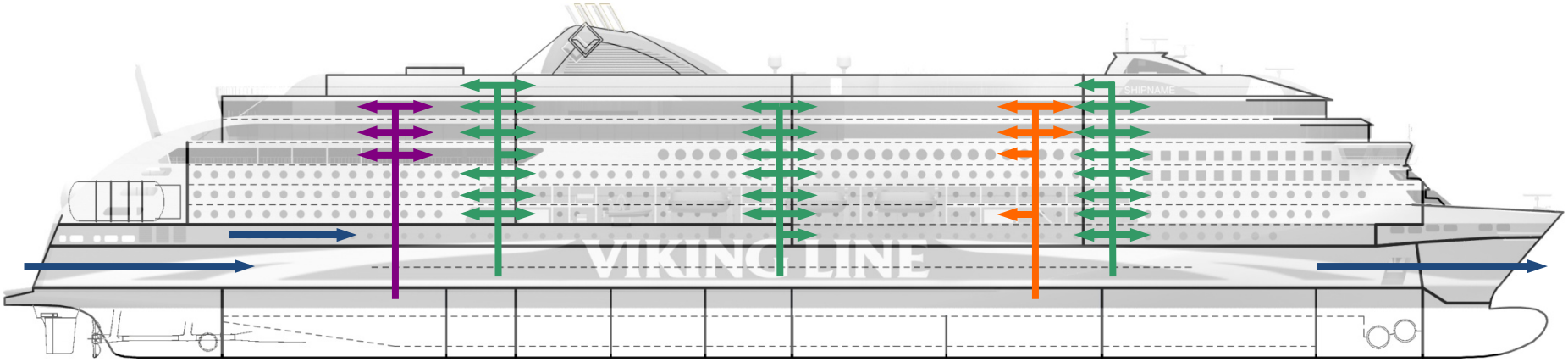
Efficient Design - Concept

Viking Grace – Route & Timetable

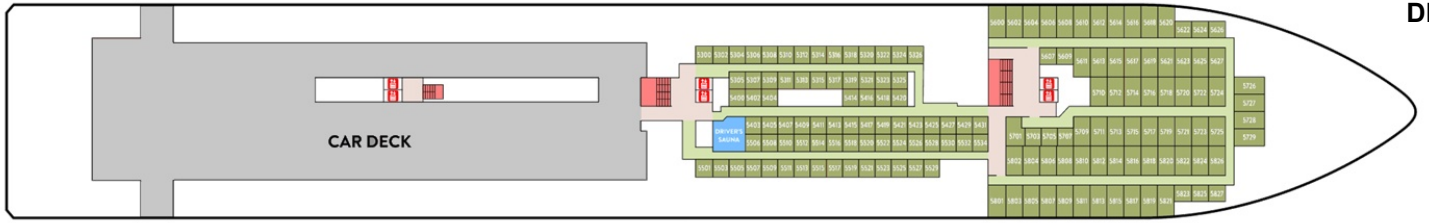


STOCKHOLM		MARIEHAMN / LÅNGNÄS		TURKU
06:30	←	01:10 / 01:05	←	20:55
07:45	→	14:10 / 14:25	→	19:50
18:55	←	14:25 / 14:10	←	08:45
20:00	→	03:20 / 03:15	→	07:35

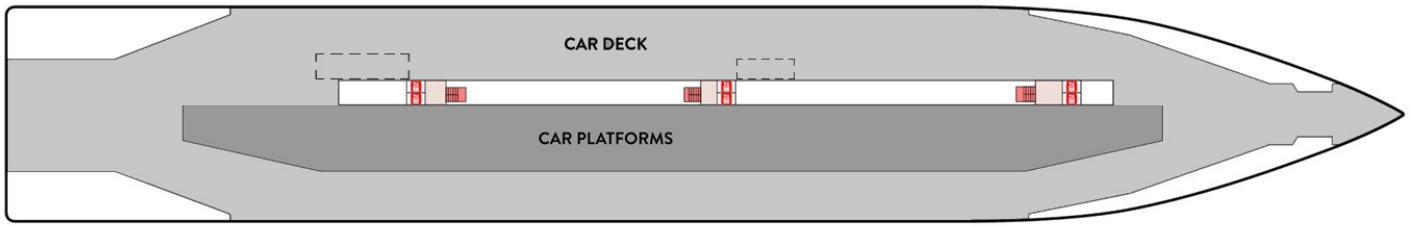
Viking Grace - Onboard Flows



SERVICE & SHOP
SERVICE & PROVISION
PASSENGERS
RORO



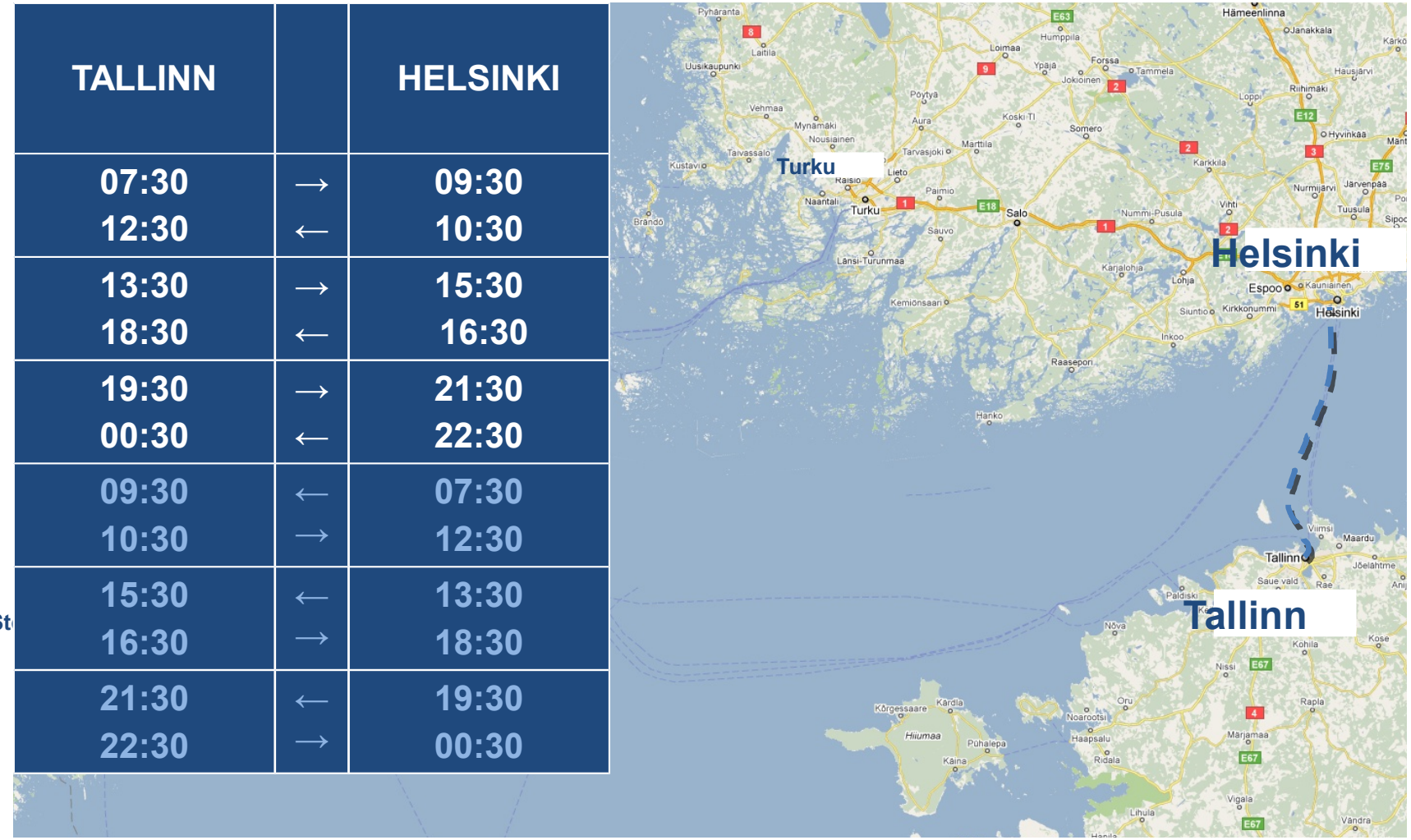
DECK 5



DECK 3

Tallink NB – Route & Timetable

TALLINN		HELSINKI
07:30	→	09:30
12:30	←	10:30
13:30	→	15:30
18:30	←	16:30
19:30	→	21:30
00:30	←	22:30
09:30	←	07:30
10:30	→	12:30
15:30	←	13:30
16:30	→	18:30
21:30	←	19:30
22:30	→	00:30



Service speed vs. Harbour time

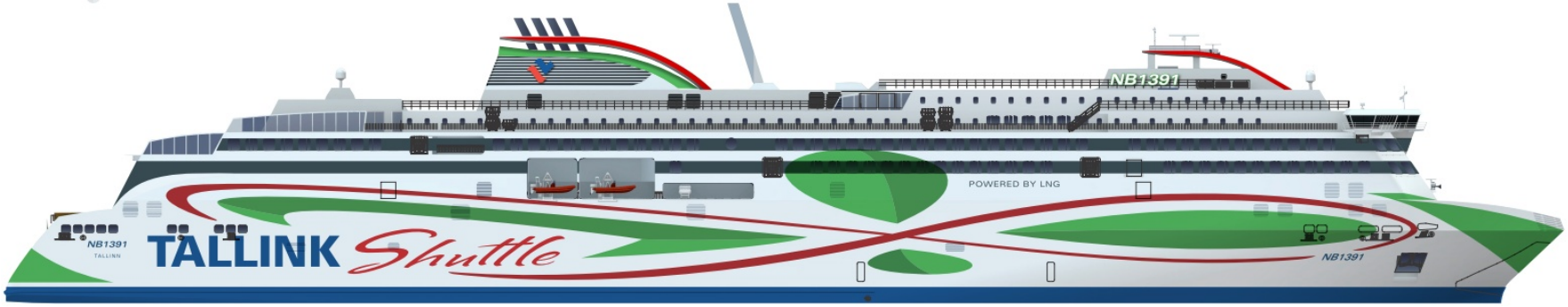
Harbour time should be minimized, especially on high speed routes

Helsinki – Tallinn route

- **2 hours transit, ~1½ hours normal transit speed ~27kn**
- **1 hour in harbour for loading and unloading**
  - If harbour or manoeuvring time can be reduced by 2 minutes, and the transit speed reduced accordingly, the annual saving of fuel is about 500 kEUR *
  - If harbour or manoeuvring time can be reduced by 4 minutes, and the transit speed reduced accordingly, the annual saving of fuel is about 930 kEUR *

*) Assuming LSMGO 450 EUR/t

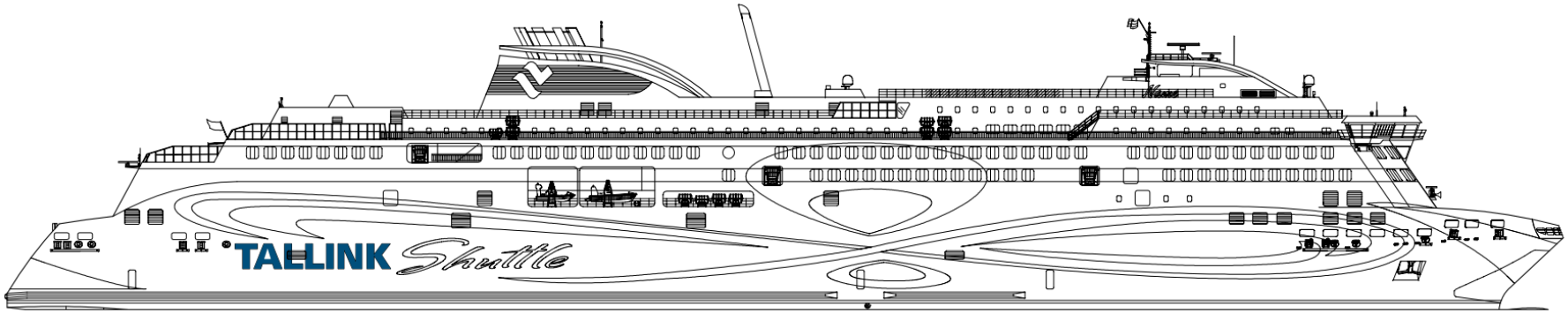
Tallink NB - Data Sheet

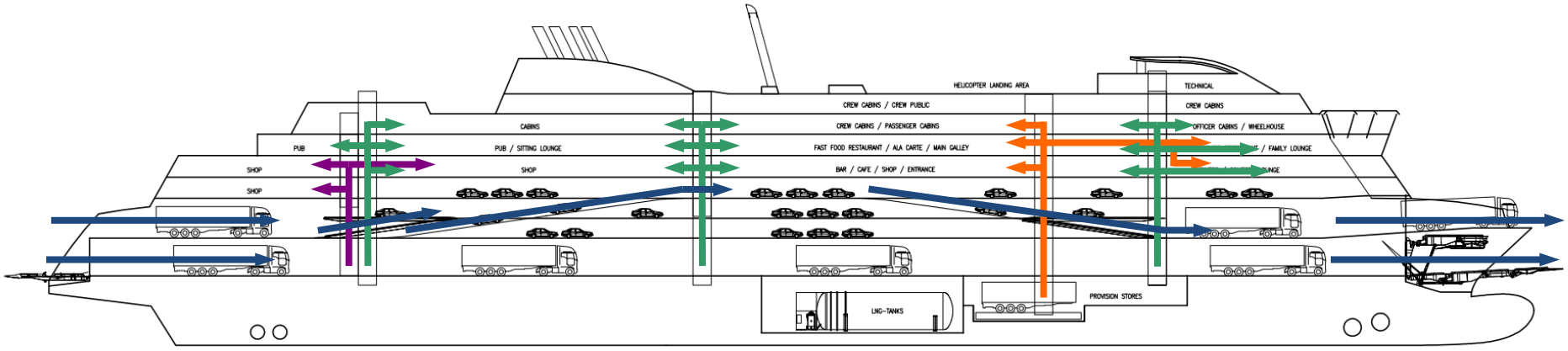


Loa	212 m	Passengers	2800 persons
Lpp	192.6 m	Crew	180 persons
B mld	30.6 m	Trailer intake max abt.	110 pcs
H main deck	9.9 m	Car intake D5+D6 abt.	160 pcs
T dwl	7.00 m		
T max	7.1 m	Car intake in Garage abt.	155 pcs
DWT	5800 t		
GT abt.	49000	Flag Estonia	

Bureau Veritas I + Hull, + Mach, Ro-Ro Passenger Ship - SRTP - DUALFUEL, UNRESTRICTED NAVIGATION, INWATERSURVEY, MON-SHAFT, CLEANSHIP, GREEN PASSPORT, AUT UMS, SYS-IBS, SYS-NEQ-1, Finnish Ice class 1A

Tallink NB – Exterior and Logistics





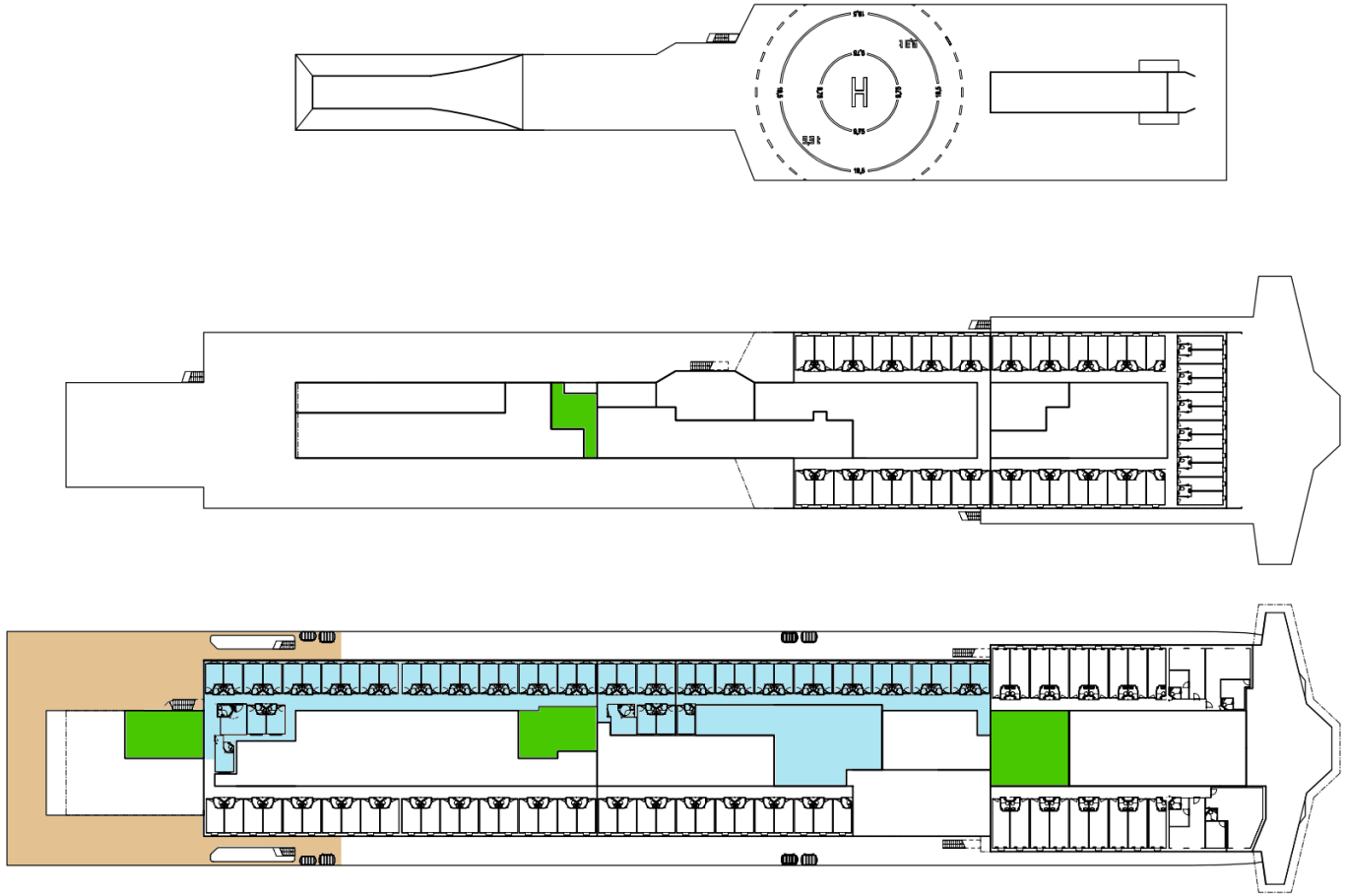
SERVICE & SHOP

SERVICE & PROVISION

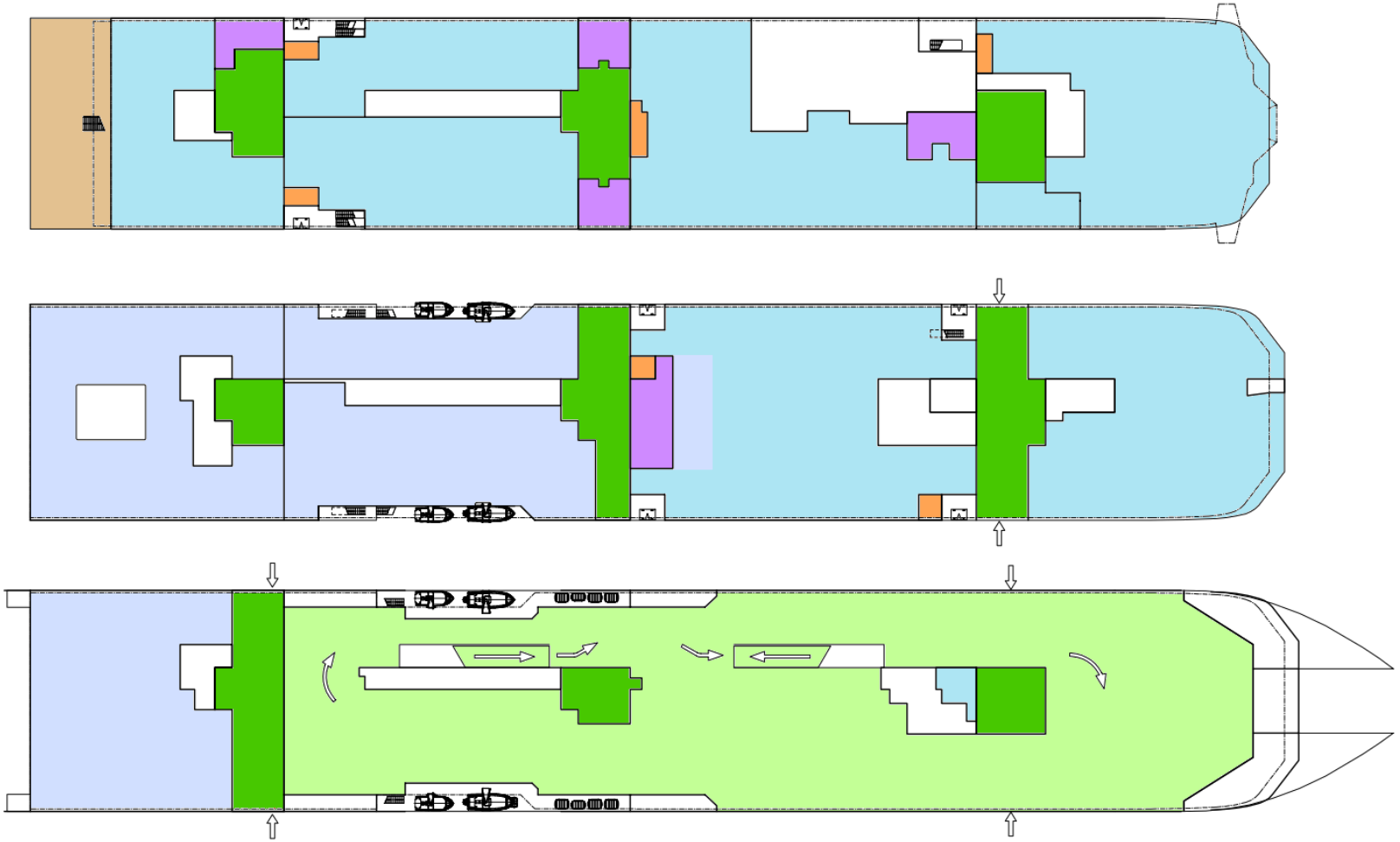
PASSENGERS

RORO

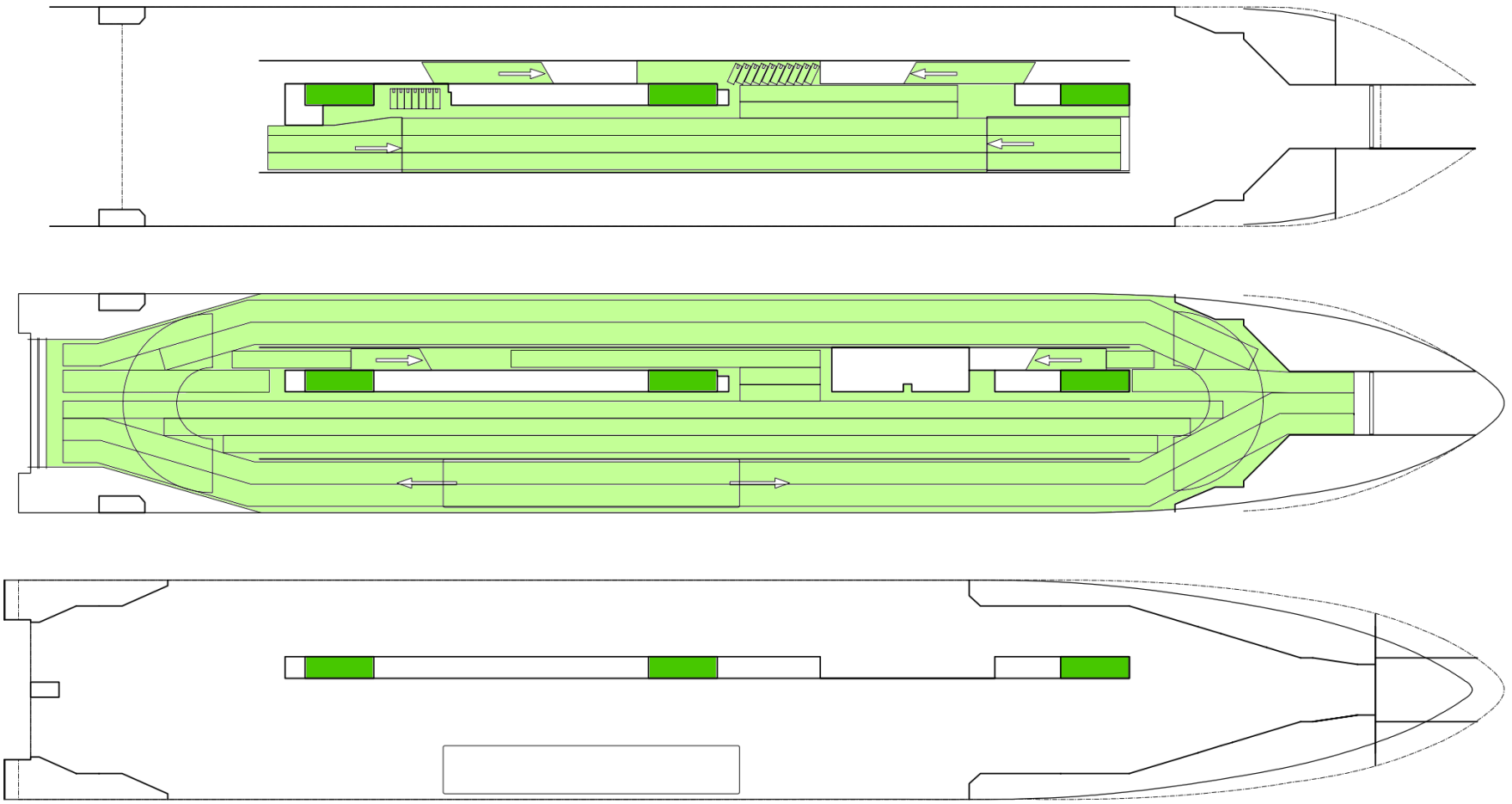
Tallink NB – GA deck 10 to 12



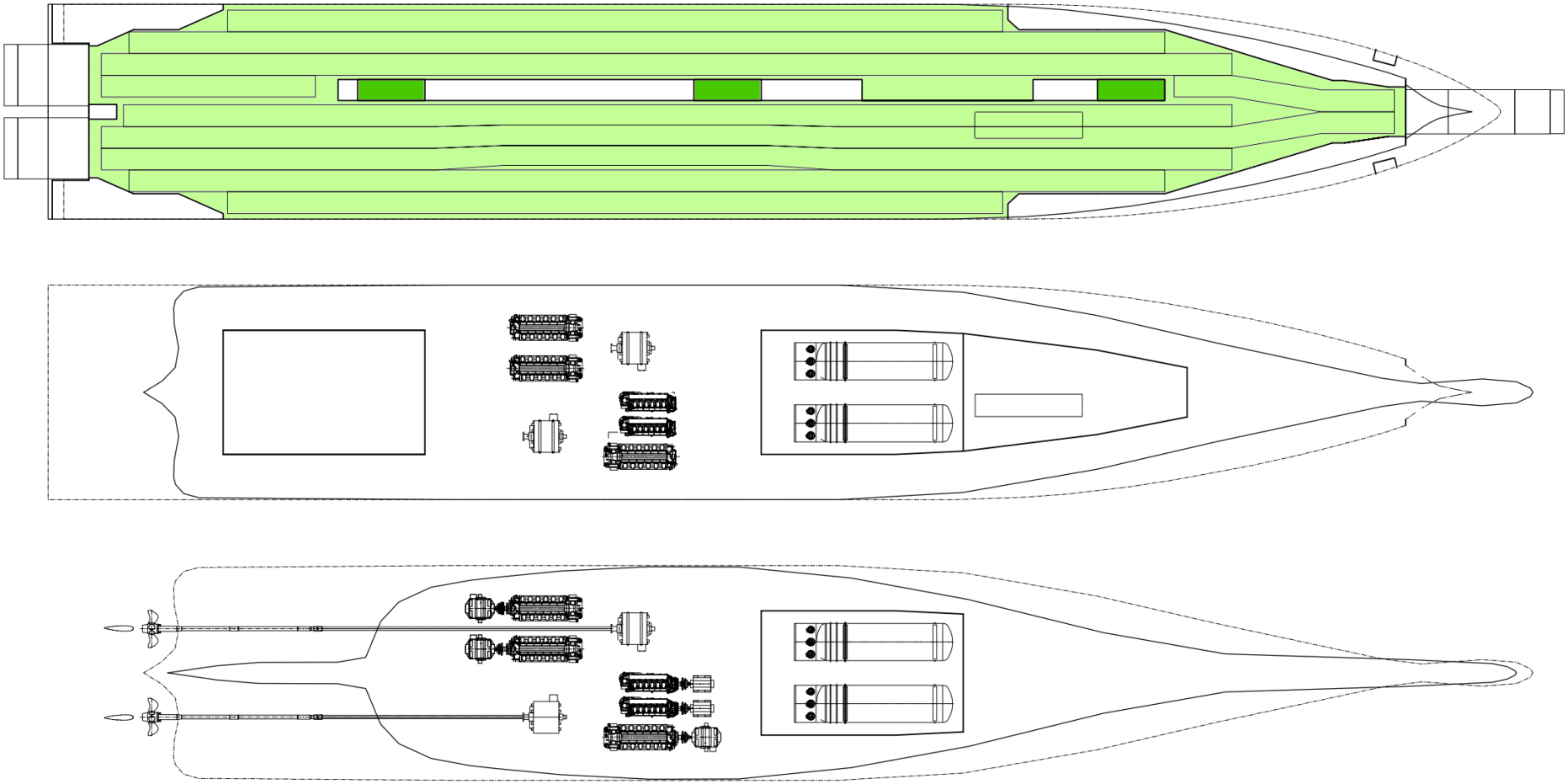
Tallink NB – GA deck 7 to 9



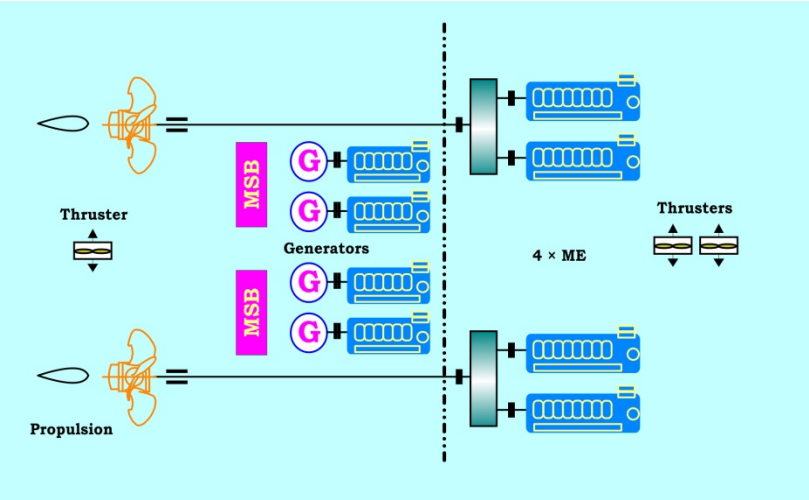
Tallink NB – GA deck 4 to 6



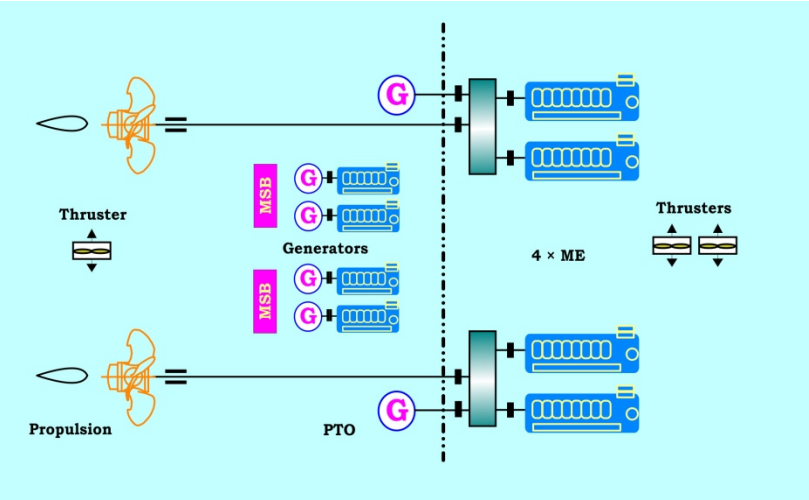
Tallink NB – GA deck 1 to 3



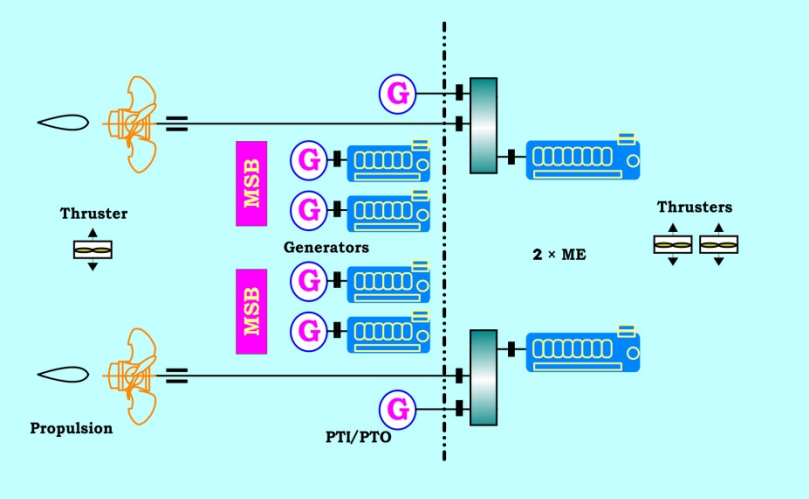
Ropax Machinery Configurations



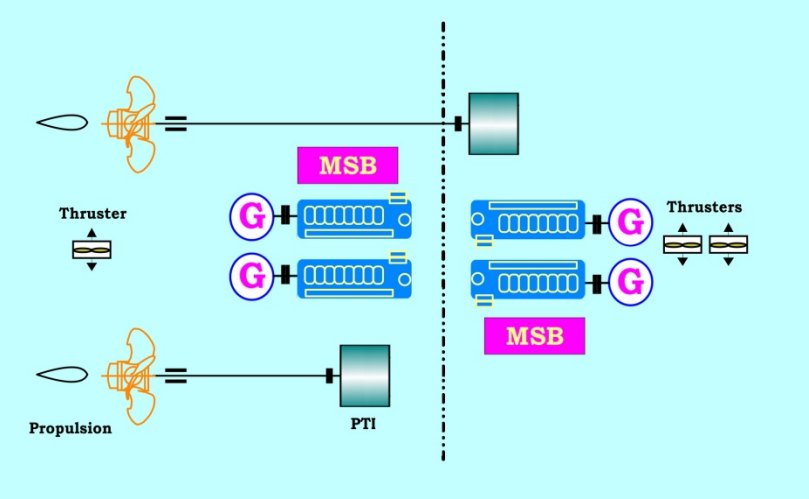
Diesel mechanical



Diesel mechanical with PTOs

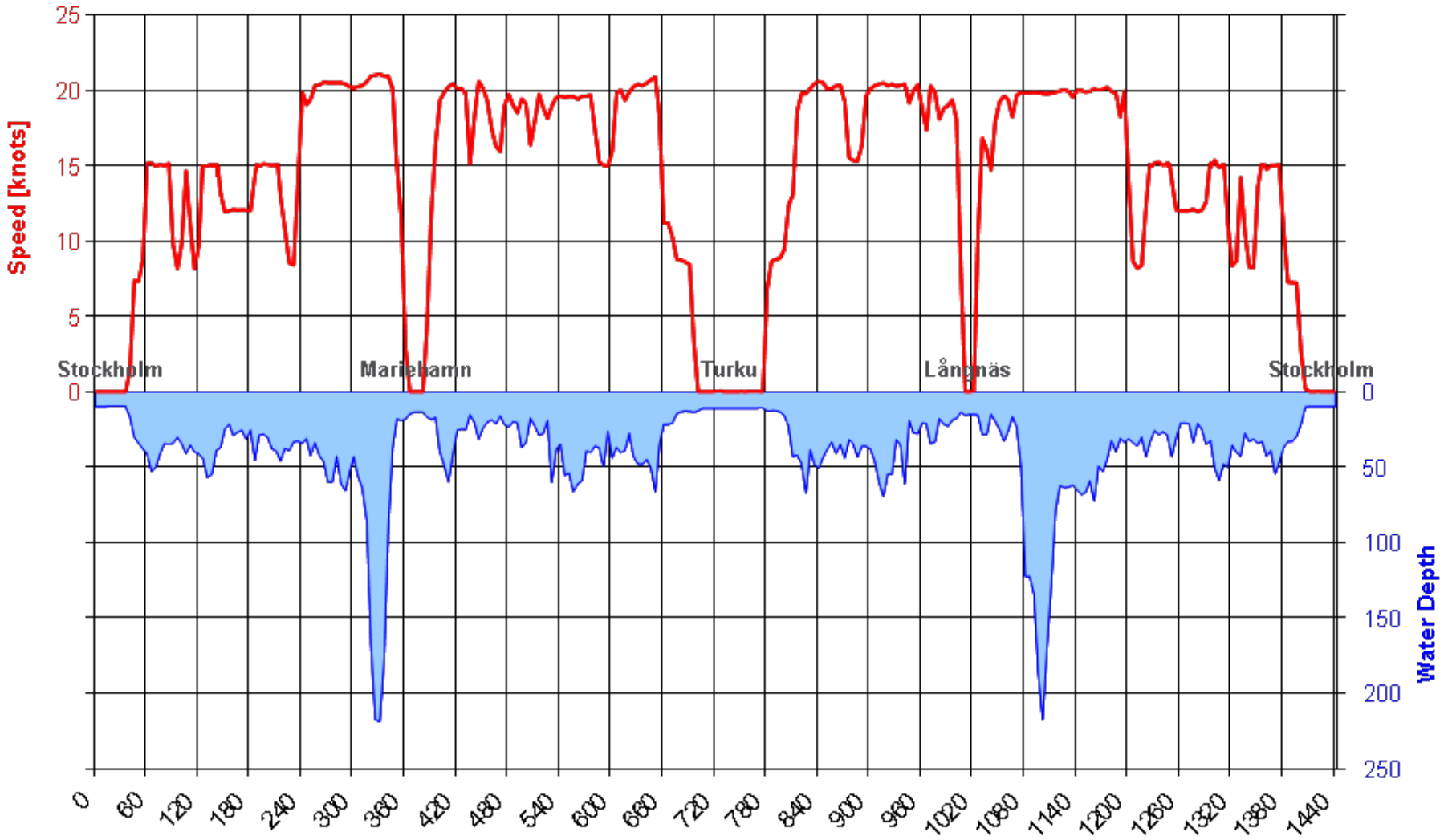


Hybrid



Diesel electric

Viking Grace - Speed vs Depth

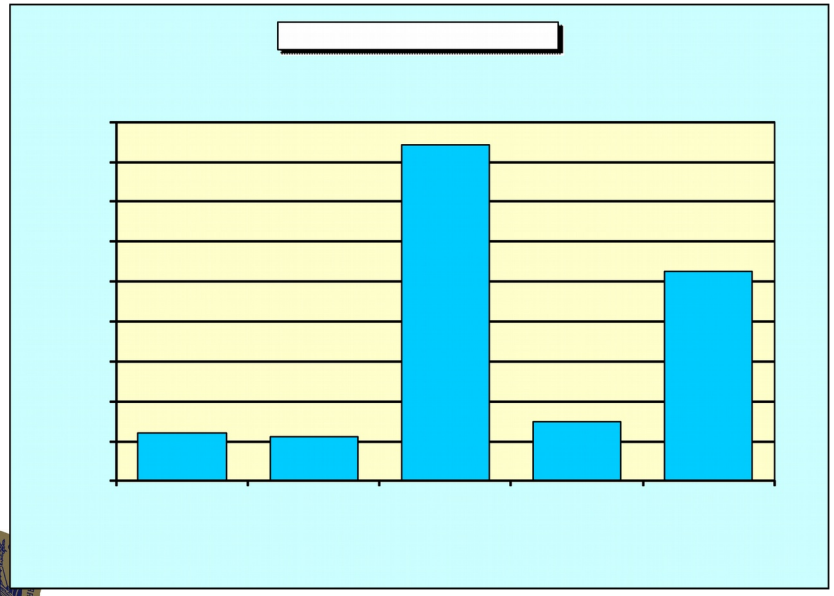


Stockholm Harbour time 1 h 15 min **Turku Harbour time 1 h 10 min**

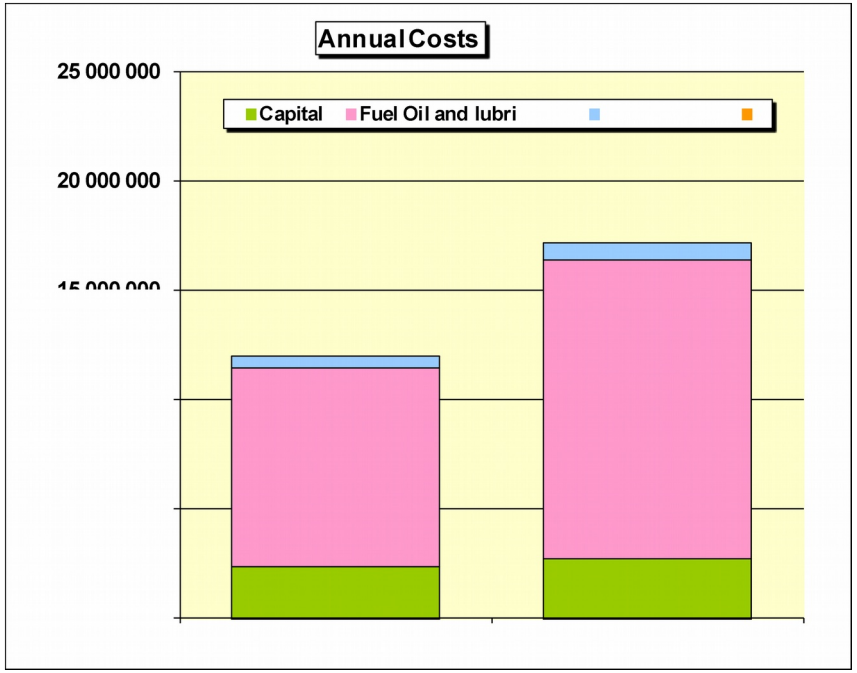
Ropax ship complex operation profile

ROUTE		
Route	Turku - Stockholm - Turku	
Schedule		
Roundtrip:	1.00 days	
Length of Roundtrip:	342 nm	
Hours at Sea:	22.3 Hrs =>	
Hours at Harbour	1.7 Hrs =>	
Number of Trips:	365.00	
Average Speed:	15.3 knots	
Operating Days:	364 Days	

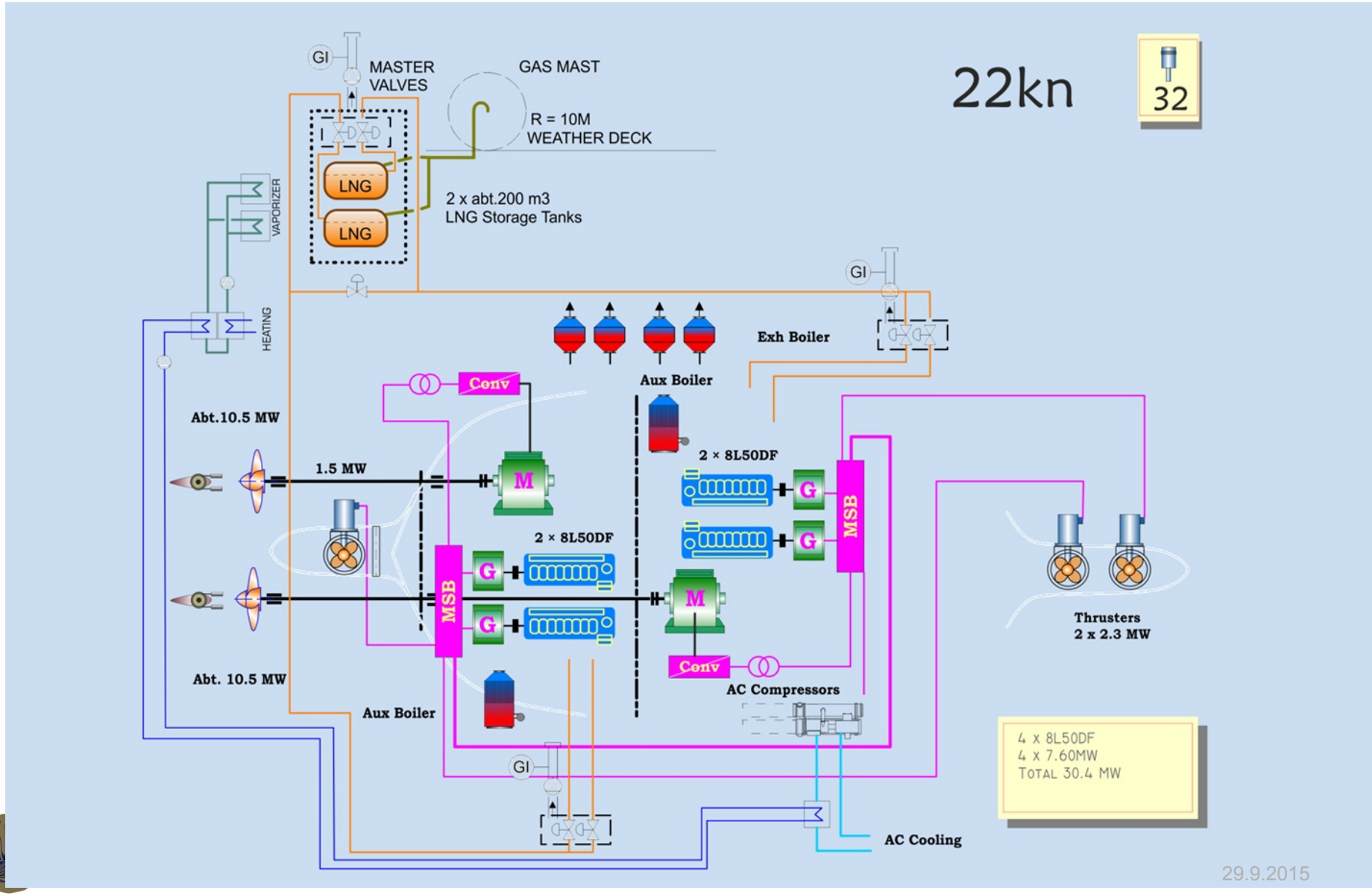
OPERATION PROFILE



- **The DE-powerplant (Diesel-Electrical) principle has been traditionally used in ships that have complex operation profiles**



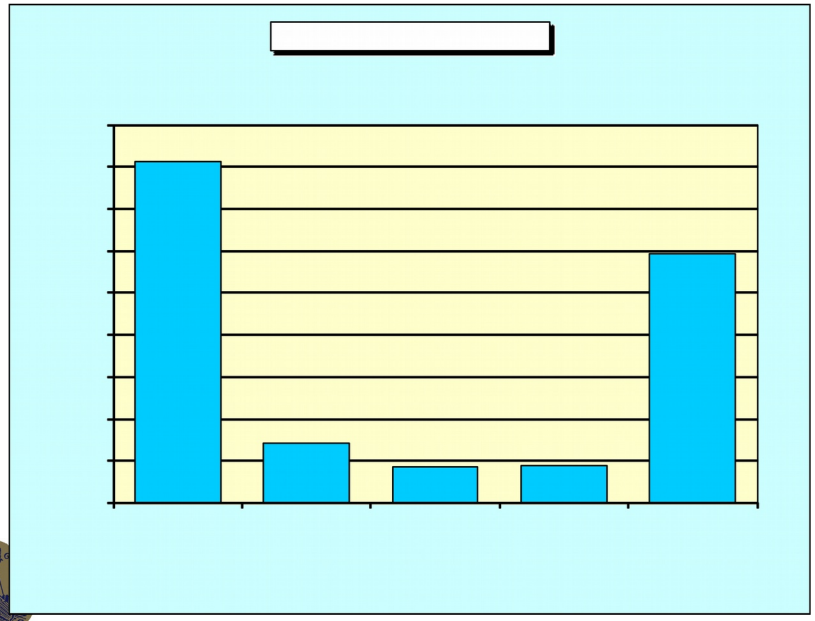
Machinery – LNG Diesel Electric Machinery



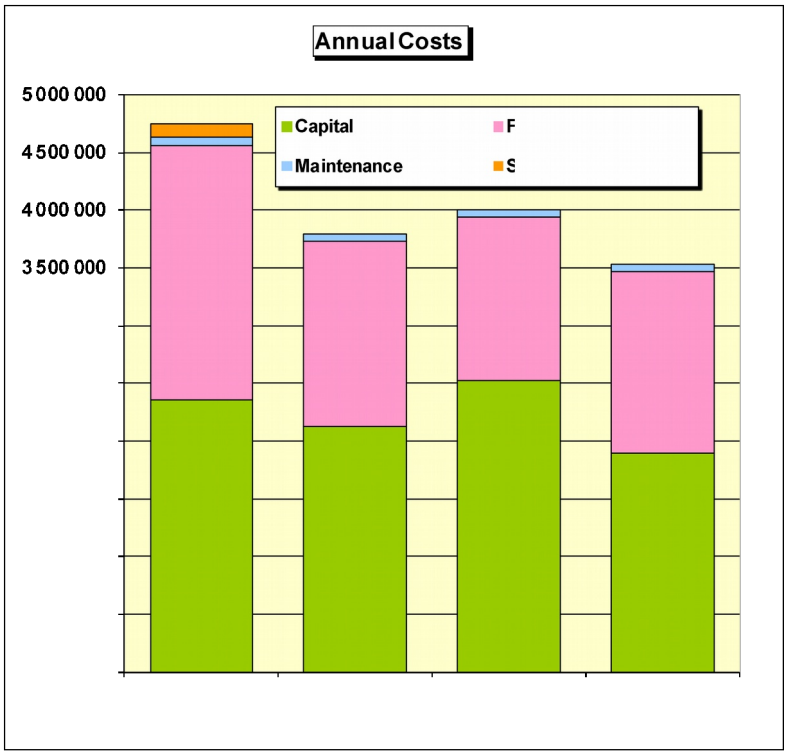
Ropax ship simple operation profile

ROUTE		
Route	Two roundtrips daily	
Schedule		
Roundtrip:	1.00 days	
Length of Roundtrip:	150 nm	
Hours at Sea:	12.7 Hrs =>	
Hours at Harbour	11.3 Hrs =>	
Number of Trips:	360.00	
Average Speed:	14.0 knots	
Operating Days:	360 Days	

OPERATION PROFILE					

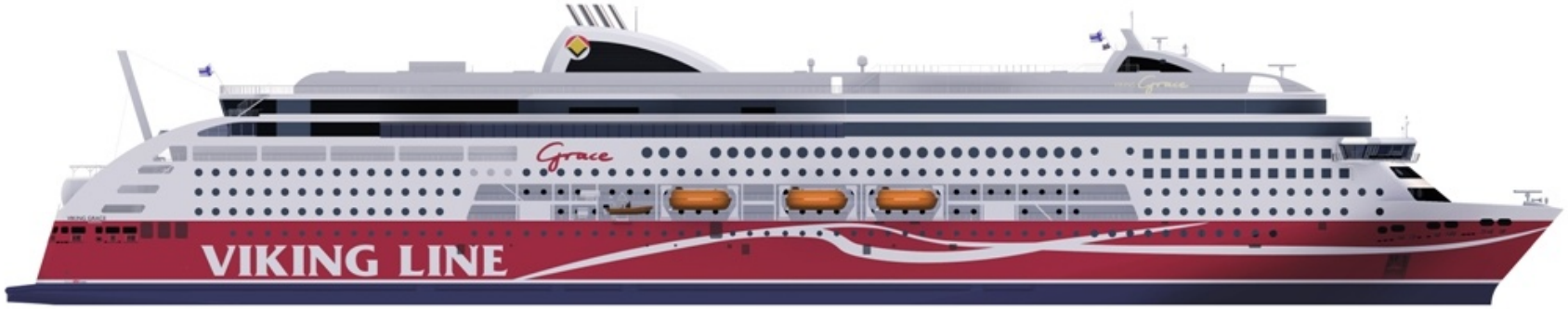


- **In recent Ropax projects/studies the DE-powerplant (Diesel-Electrical) principle has turned out to be the most feasible - even with quite simple operation profile**

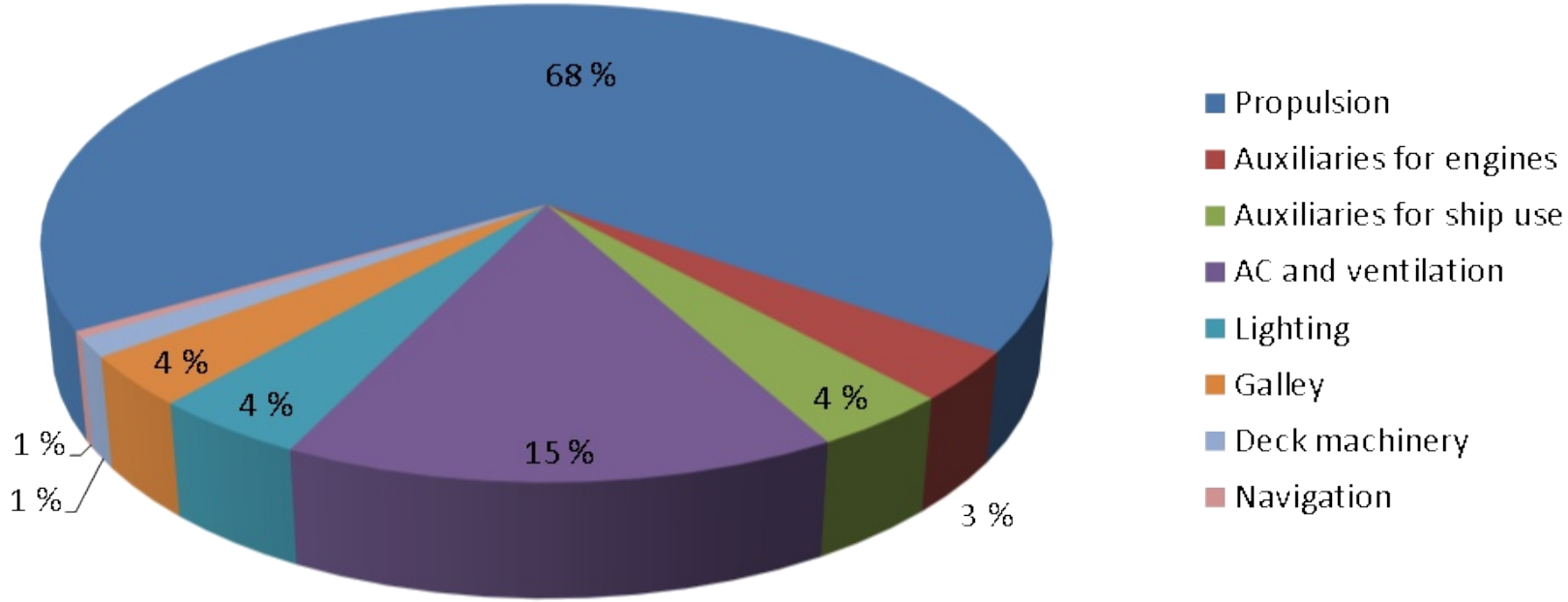


How to save fuel - Technical means

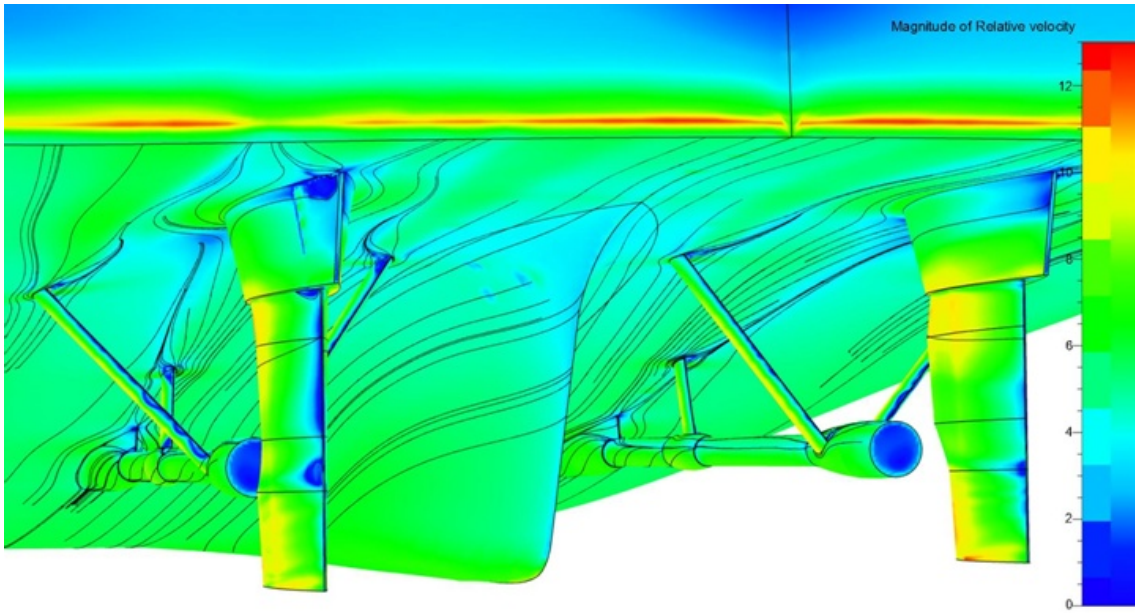
Viking Grace – Low Energy Demand



NB-1376 Energy Demand



Hydrodynamics



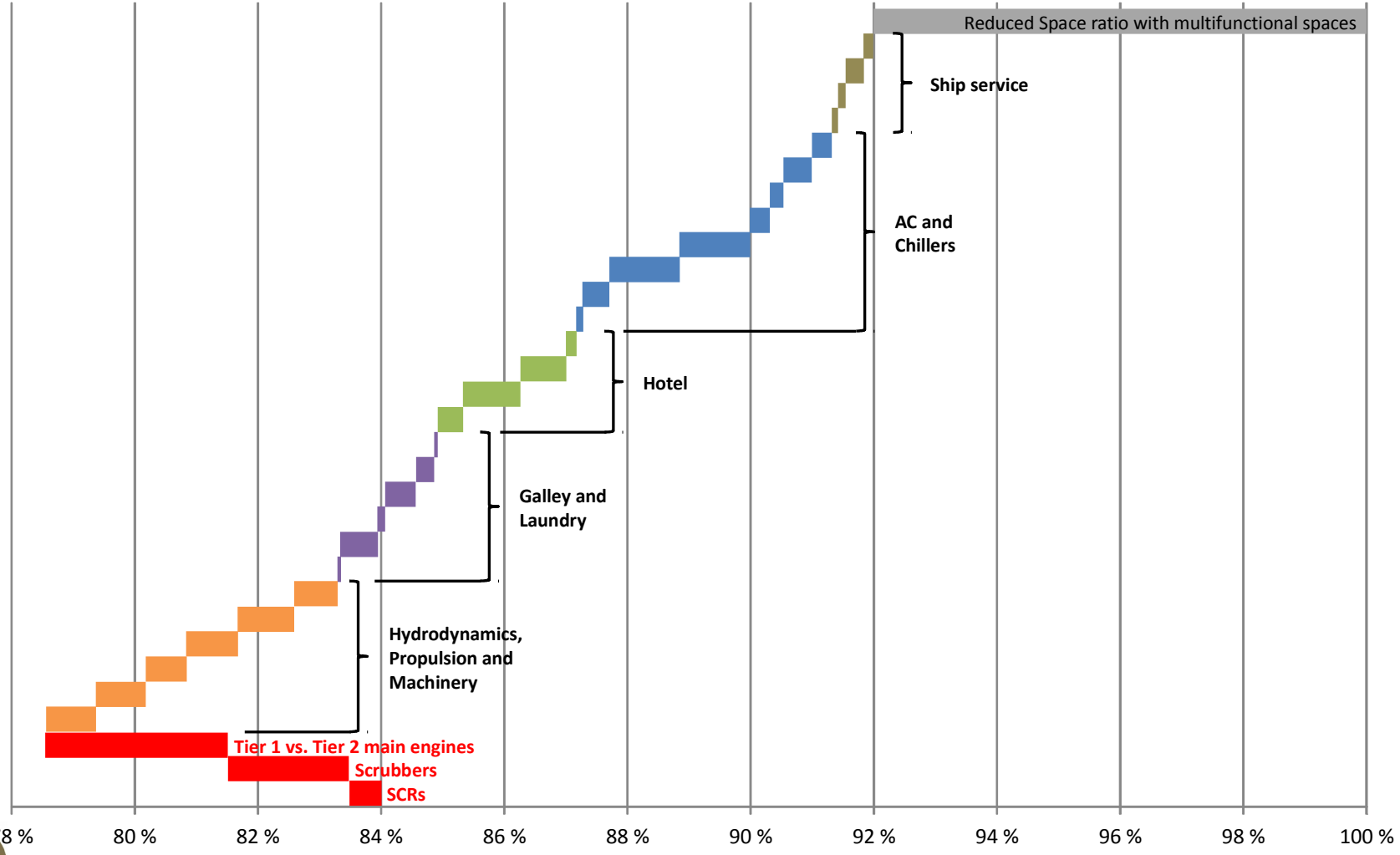
- **Extremely efficient hull form and appendages**
  - Advanced tools – current state of the art CFD
- **Bulbous bow optimization**
- **Typically a lot of manoeuvring - efficient rudders and thrusters**
- **Good aerodynamic design instead of bulky, production friendly exterior**
- **Comfort class**

Development of main dimensions

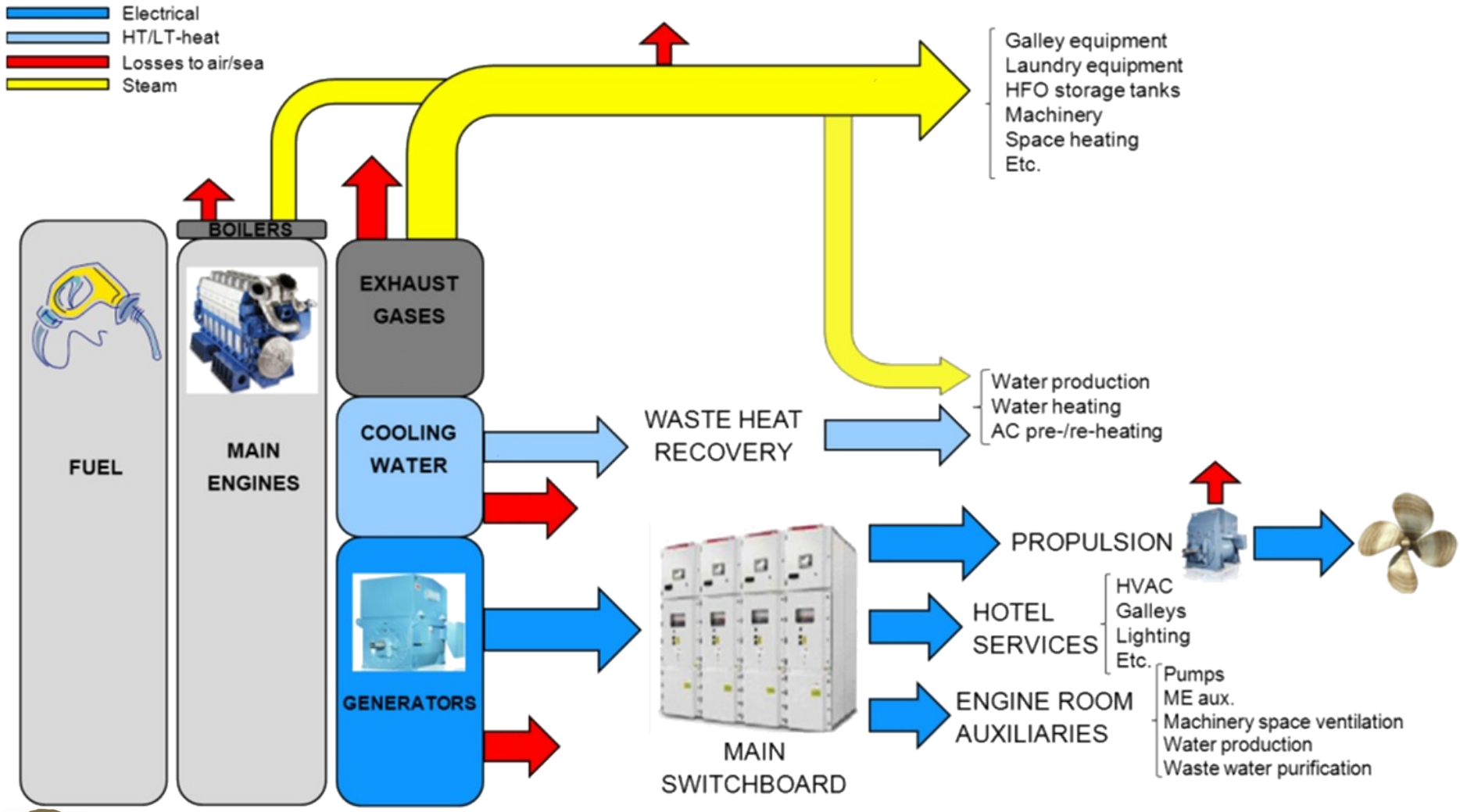
	Finnjet	Sup		
Delivery	1977			
Loa	213			
Lpp	200			
Bmld	25.4			

		27.5		

Continuous Energy Efficiency Improvement

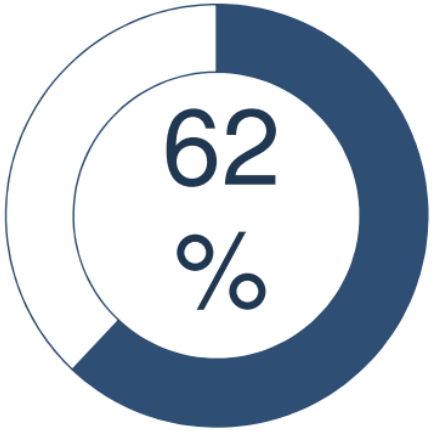


System Improvements and Waste Heat Utilisation

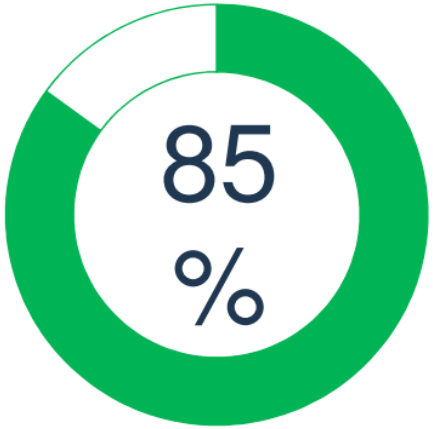


Fuel energy utilization rate

- **Current State-Of-Art overall fuel energy utilization rate is ~62 % including following WHR technologies:**
  - Main Engines Exhaust Gas Economizers for steam production
  - Main Engines HT cooling water heat recovery for:
    - Fresh water production
    - Accommodation heating
    - FW heating
    - Pool heating
    - Stand-by ME pre-heating



- **Future goal is to increase fuel energy utilization rate up to ~85 % by means of:**
  - Maximizing ME exhaust gas heat recovery
  - Incinerator flue gas heat recovery
  - Maximizing ME HT heat recovery
  - ME LT heat recovery
  - Utilizing new/novel WHR technologies



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