Cruise + Ferry 2003

NEXT GENERATION OF CRUISE FERRIES

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Figure 1: Post Panama cruise ship “Navigator of the Seas”, 138 300 GT

Figure 2: Panamax cruise ship “Carnival Spirit”, 85 900 GT

Figure 3: Cruise Ferry “Color Line”, 74 600 GT

1. FERRY DEVELOPMENT TRENDS

1.1 Increasing size and capacity

The new cruise ferry for Color Line

Ferries are vessels carrying passengers, cars and cargo on short sea routes. The ferry business has become an important segment for ship designers, builders and operators. This ship type started to develop during the 60's in the Baltic and rapidly spread to the North Sea and to the Mediterranean routes. A strong local market can also be found in Japan. The passenger car ferries have been growing in size and capacity. This rapid growth has led to the development of several dedicated ferry types, each tailored for a different mix of passengers, cars and cargo. This range reaches from the cargo only RoRo ferries to the cruise ferries, with almost cruise ship like facilities onboard for a large number of passengers (fig 1). The latest new building ordered by Color Line from Kvaerner Masa-Yards will be an impressive vessel of close to 75 000 GT. The passenger capacity and the number of cabins will be comparable with a typical Panamax cruise ship.

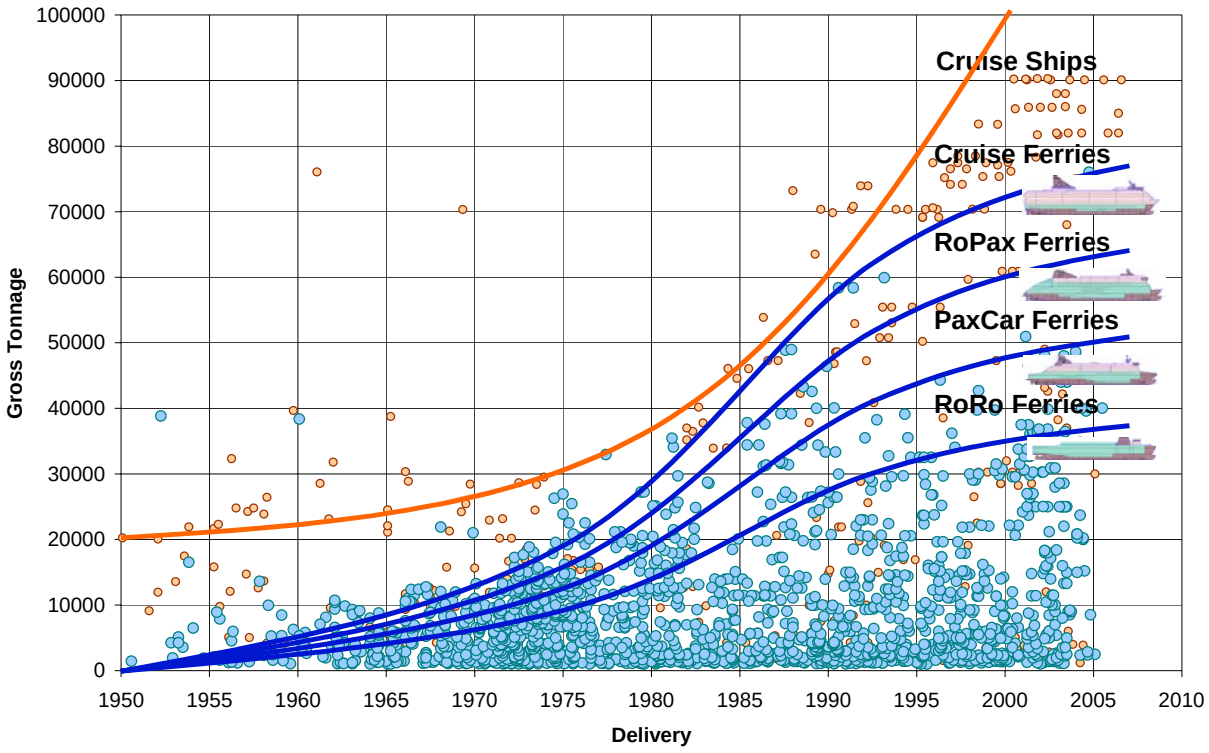

Figure 1: Ferry development trends

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1.2 Different ferry types

RoRo cargo is carried on many short sea routes. If less than 12 passengers or lorry drivers are carried onboard the vessel is a RoRo ferry and can be built according to cargo vessel rules (fig 2). Cargo is loaded through the stern, mostly only at one level to the main deck, with internal ramps to the lower hold and upper deck. The upper deck can be uncovered for the full length.

Figure 2: RoRo Ferry

If the ferry carries more than 12 passengers or drivers it is considered to be a passenger vessel. If the RoRo decks are large and the passenger facilities onboard are limited the vessel is called a RoPax ferry. This type often has a lower hold, main deck and upper deck for RoRo cargo (fig 3). The deckhouse is lengthened to accommodate space for the passengers. The upper RoRo deck is then partly covered. Most RoPax ferries have both stern and bow ramps to speed up the loading and unloading of the RoRo decks.

Figure 3: RoPax Ferry

Ferries with passenger facilities suitable for longer routes are called passenger-car ferries or PaxCar ferries (fig 4). On top of the RoRo decks these vessels have a full-length superstructure for the passenger cabins and public spaces. Hoistable car platforms are often installed on the RoRo decks to increase the deck area for private cars. The free height needed on the RoRo decks for lorries and trailers is 4,4…4,8 m and the hoistable platforms divide the space into two private car decks with a free height of 2,0…2,4 m.

Figure 4: PaxCar Ferry

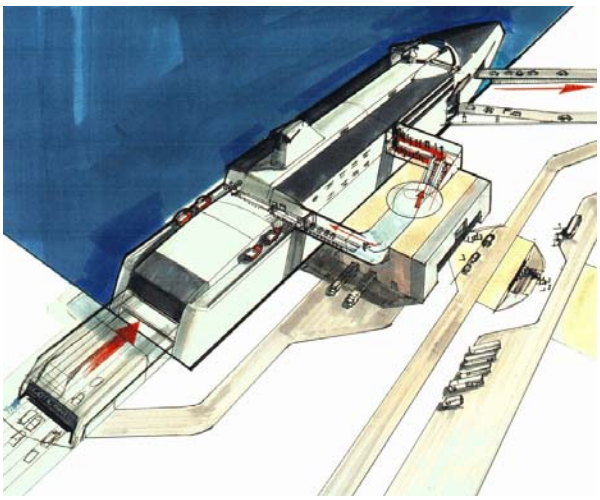
Ferries with cabin space for all passengers and large public spaces with restaurants, lounges, bars, etc. are often called Cruise Ferries. These ferries operate on over night routes and some of the passengers travel back with the ferry on the return trip (fig 5). The RoRo decks are small and the passenger cars occupy a large portion of the RoRo space.

Figure 5: Cruise Ferry

2. FERRY PAYLOAD

2.1 Passenger capacity

Passengers with or without cars are the important targets for the ferries. The large seasonal variations in the number of travellers demand flexibility from the ferry operators. On many routes the capacity needed during the summer vacation period is much bigger than during the low winter season. By adding onboard facilities and services, like meeting rooms and conference spaces, health centres, speciality restaurants and live entertainment the ferry operators try to attract passengers year-round. The passenger capacity and number of cabins for ferries of different type and size are shown in figures 6 and 7.



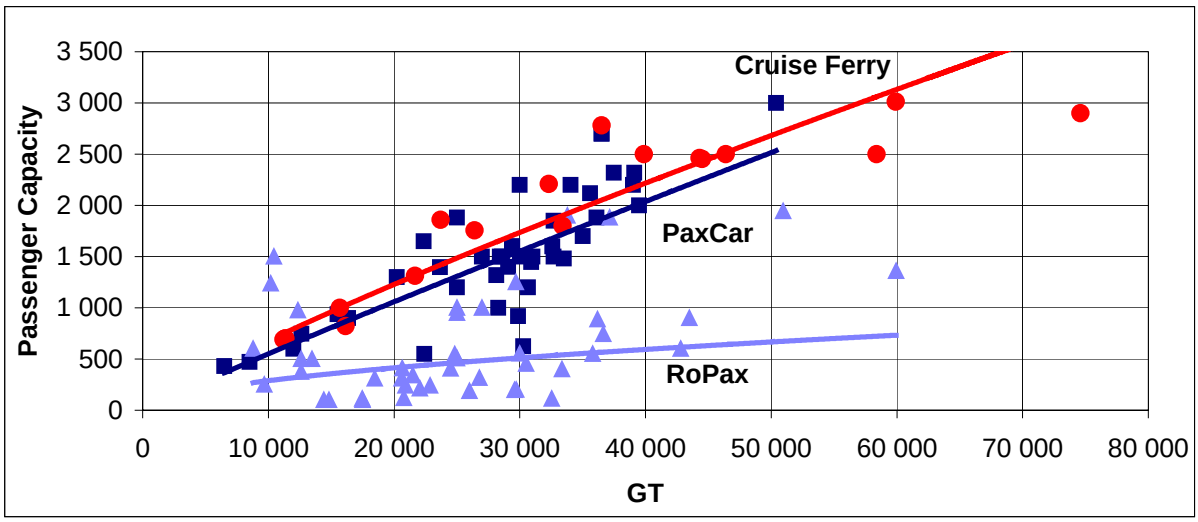


Figure 6: Passenger Capacity

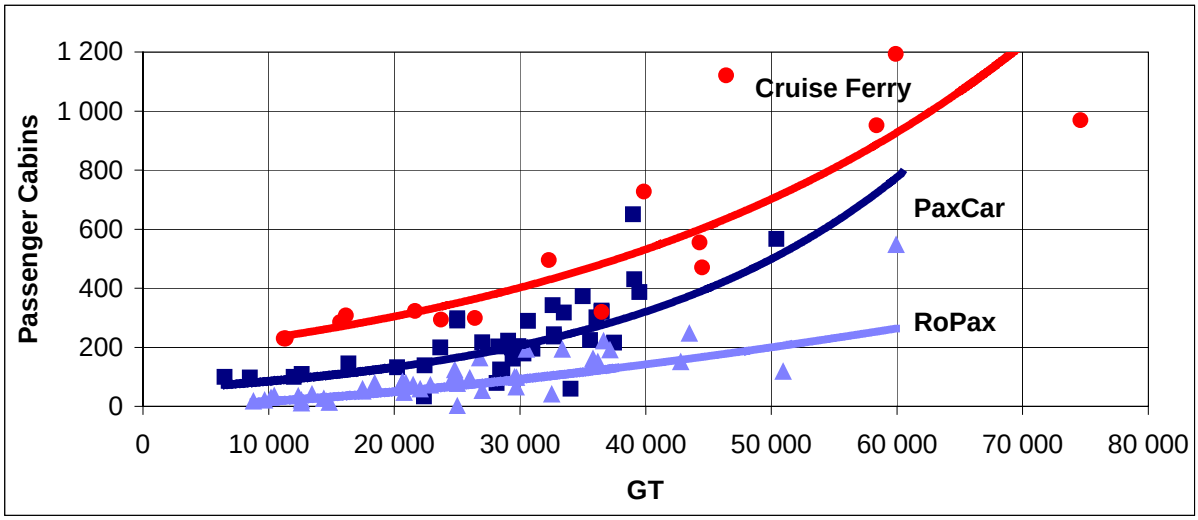
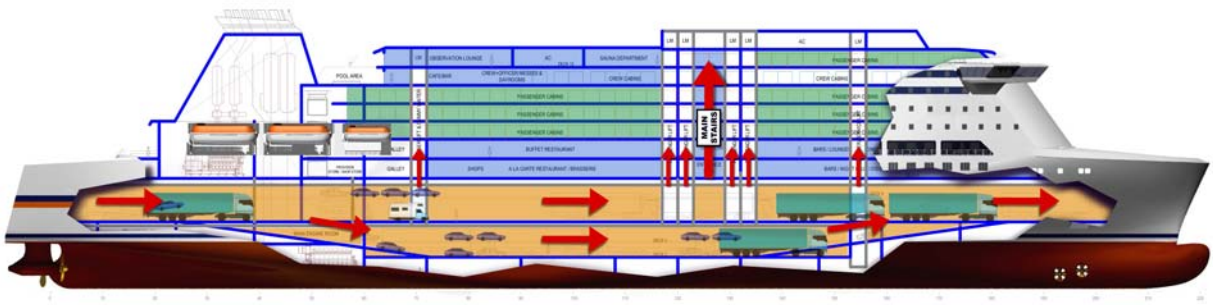


Figure 7: Passenger Cabins

2.2 Cars and cargo capacity in different ferry types



Ferries are an important link in the intermodal “city - to - city” transport network, due to their regular schedules and frequent departures. The RoRo decks in modern ferries can accommodate many different types of vehicles. Private cars, trucks and trailers are typical cargo carried by the passenger car ferries. The RoRo capacities for different types of ferries are shown in figures 8 and 9.

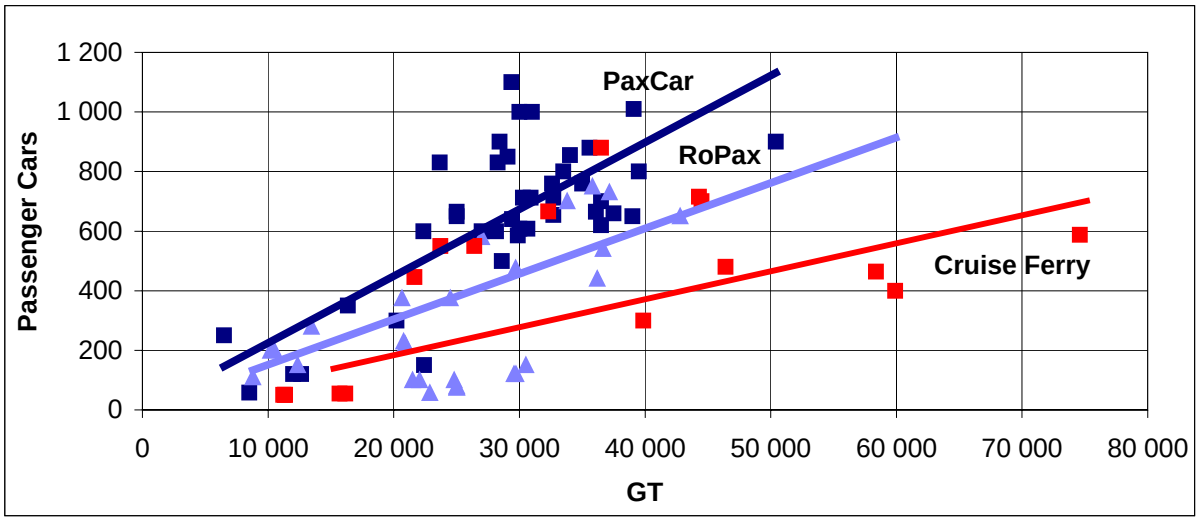


Figure 8: Car Capacity

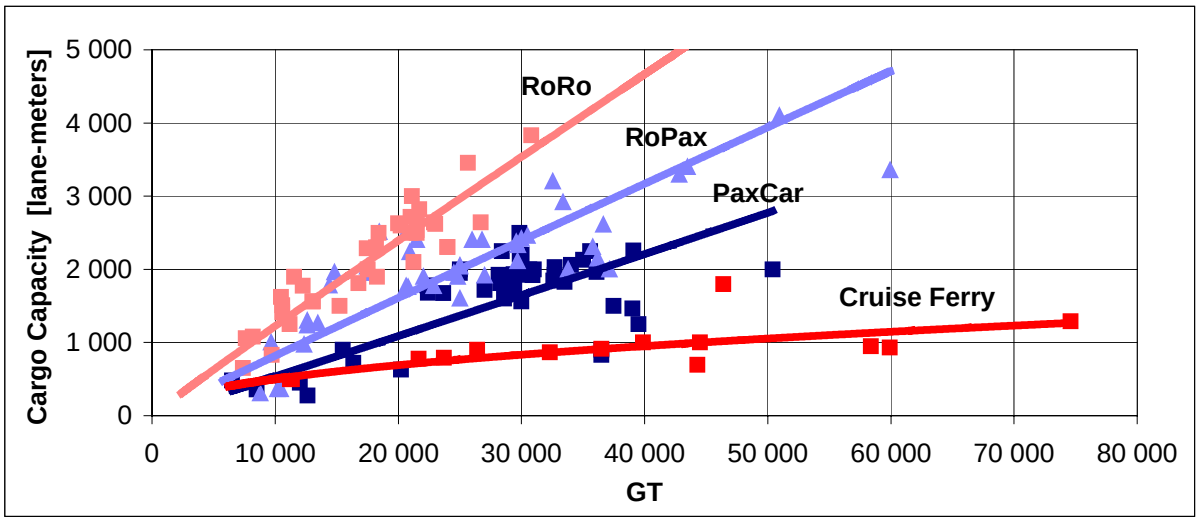


Figure 9: Cargo Capacity

2.3 RoRo deck arrangement

The car and cargo capacity of the ferries has grown significantly during the 90's. The number of RoRo decks has increased from initially only one to two or even three full height trailer decks. In addition many ferries have a lower hold to further increase the cargo capacity (fig 10). The RoRo deck capacity and arrangement indicates which type the ferry belongs to.

Most passengers carrying ferries have drive through possibilities with bow and stern doors. This makes it possible to load and unload also trucks and trailers during the short port time. RoRo cargo vessels can carry only 12 drivers and semi-trailers must be used. When terminal tractors are used for handling semi-trailers or cargo on cassettes drive through facilities are not needed and most RoRo cargo vessels have only stern loading ramps.

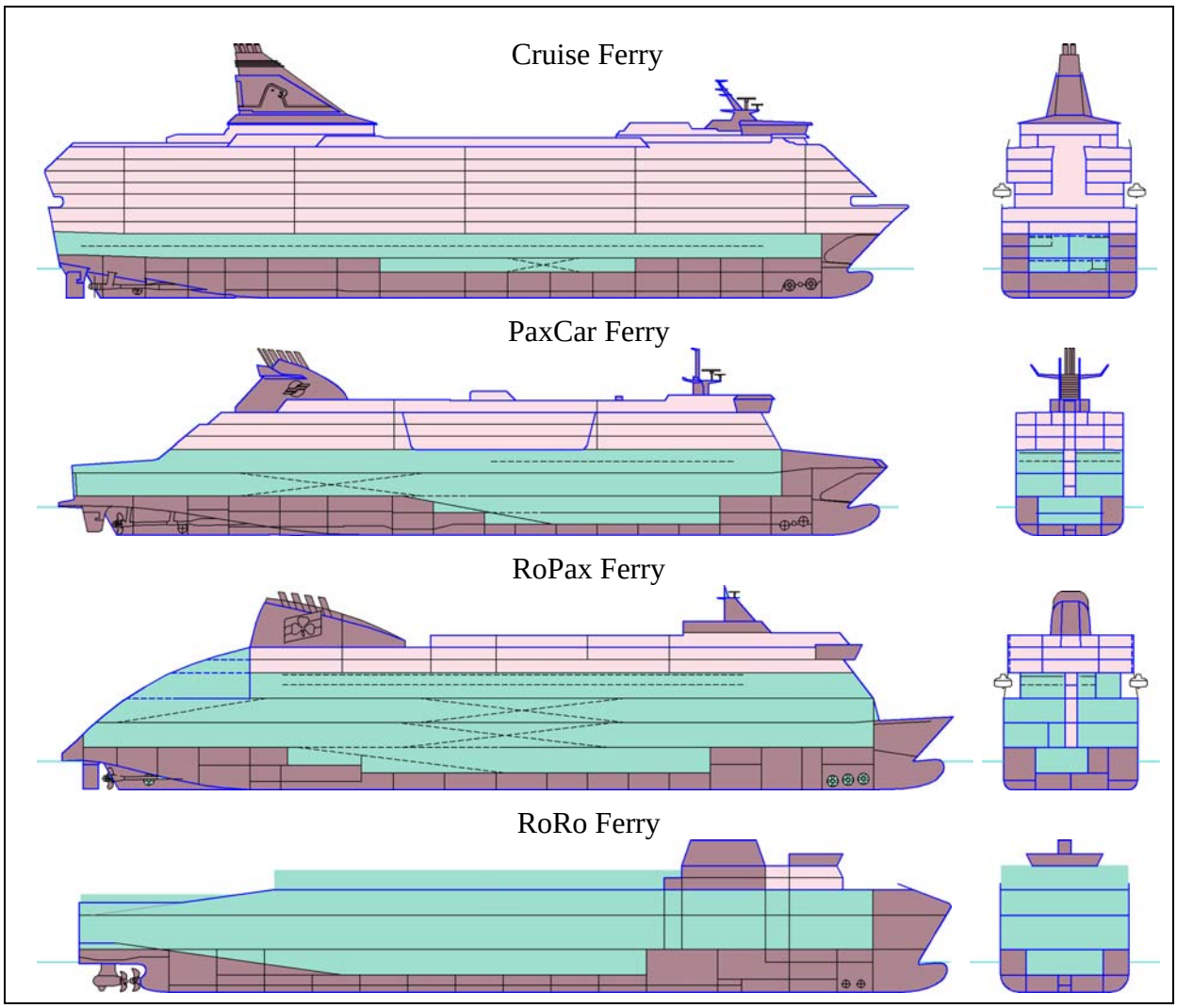


Figure 10: RoRo deck arrangement

The access for the passengers from the car decks to the public spaces must also be considered. If a centre casing is used the arranging of stairs and lift is often easier than when side casings are used. A centre casing also divides the length of the deck beams and reduces the vibration amplitudes on the passenger decks above.

3. CRUISE FERRY DESIGN

3.1 Lay out of the next generation

Both passenger expectation and safety rules demand today that the passenger cabins are located mainly in the superstructure. Also the public spaces should be in the superstructure or on the top decks of the hull. An indoor promenade connects the public spaces and some inside cabins can have windows looking down on the activities onboard. This solution was first introduced in "Silja Serenade" and has become a major feature also in the Voyager class cruise ships.
The main RoRo space is on the bulkhead deck. A separate garage deck for private cars located above the main RoRo space and close to the passenger spaces. During the peak season cars, trucks and trailers must share the space available on the main RoRo deck. To further increase the capacity for private cars, hoistable platform decks are used. In ferries with powerful machinery and large HVAC plants, the lower holds become rather small. For cruise ferries the RoRo capacity demand is low and the wide side casings can be used for crew cabins, mess- and dayrooms (fig 11).

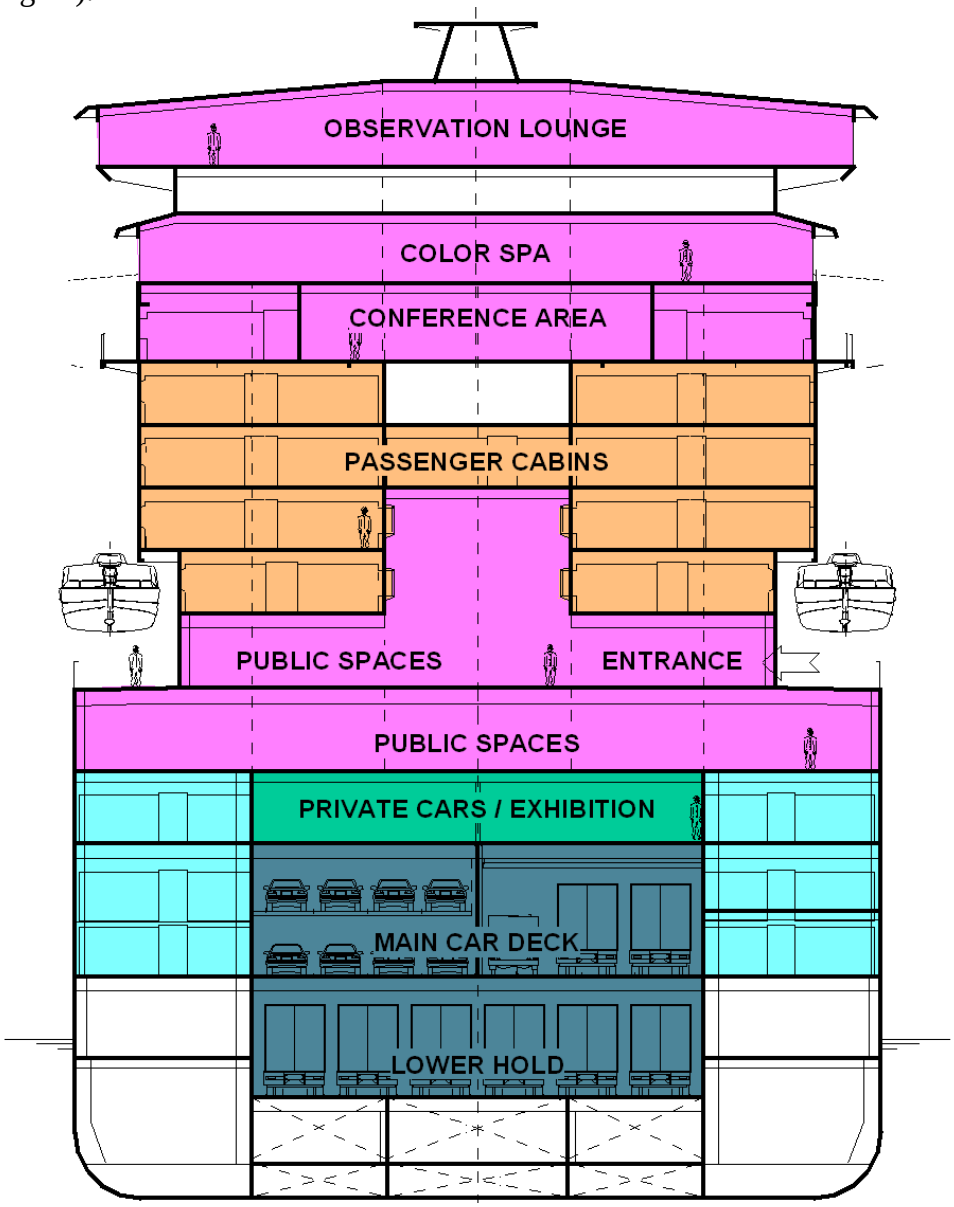


Figure 11: Lay out of the new Color Line cruise ferry

3.2 Passenger, crew and service spaces

The large public spaces in cruise ferries with several food service options, entertainment alternatives, conference spaces and other activities is reflected in the large passenger areas compared with the more transport orientated PaxCar and RoPax ferries (fig 12 and 13).

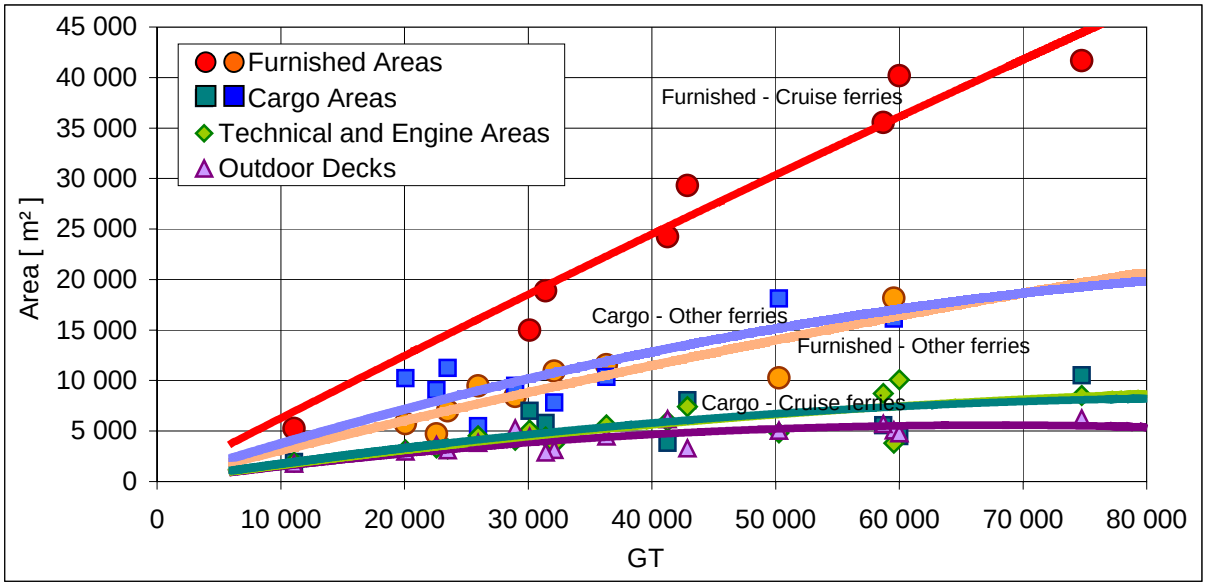


Figure 12: Area distribution

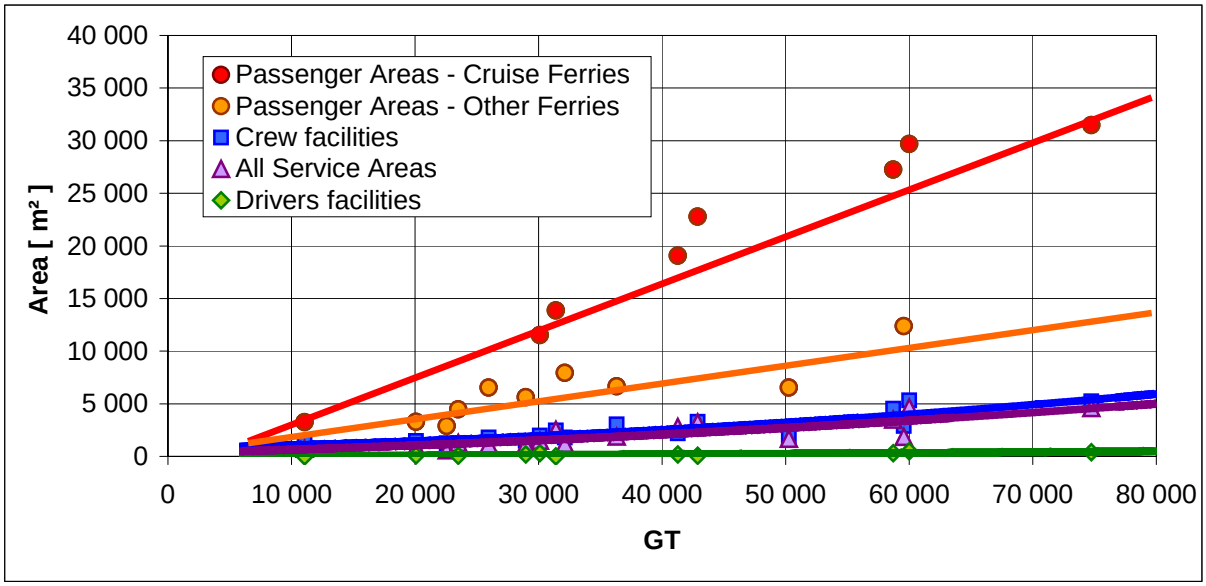


Figure 13: Furnished areas

The passenger mix is very diversified in ferries and several different cabin types should be available to meet the customers' expectation and suite their willingness to spend. The cabin types in a cruise ferry ranges from large suites, well equipped cabins for couples, family cabins with 4 or 5 beds and cabins for conference delegates, mainly intended for single occupancy. Passengers spend only 1 or 2 nights onboard and the ferry cabins can be smaller than in cruise ships. But many ferry passengers now prefer double beds and more cabins should be laid out in that style

With all passenger cabins in the superstructure an increased number of outside cabins with window can be provided. New structural solutions for the accommodation decks make it possible to have very large windows in the outside cabins. In a ferry with an indoor promenade some of the inside cabins can have windows facing this space (fig. 14).

3.3 Passenger Flow

All spaces onboard must be arranged so that it is easy for the passenger to find their way around the ship. Two main stairway halls with ample lift capacity reaches from the main RoRo deck to the sun deck and observation lounge. The main passenger spaces with food service, shops and entertainment are located on two decks above the car garage and RoRo cargo deck. These spaces are grouped along the indoor promenade, which becomes the focal point onboard (fig 14). All passenger cabins are located in the superstructure on the decks above. The upper decks are for different activities, with conference facilities, swimming hall, spa and health centre, teenager and children rooms. The observation lounge on the top will give the passengers a fantastic view of sights along the route. This location of all spaces is very straightforward and the passenger flow unrestricted both vertically and horizontally throughout the vessel (fig 15).

Figure 14: Indoor promenade “Silja Serenade”

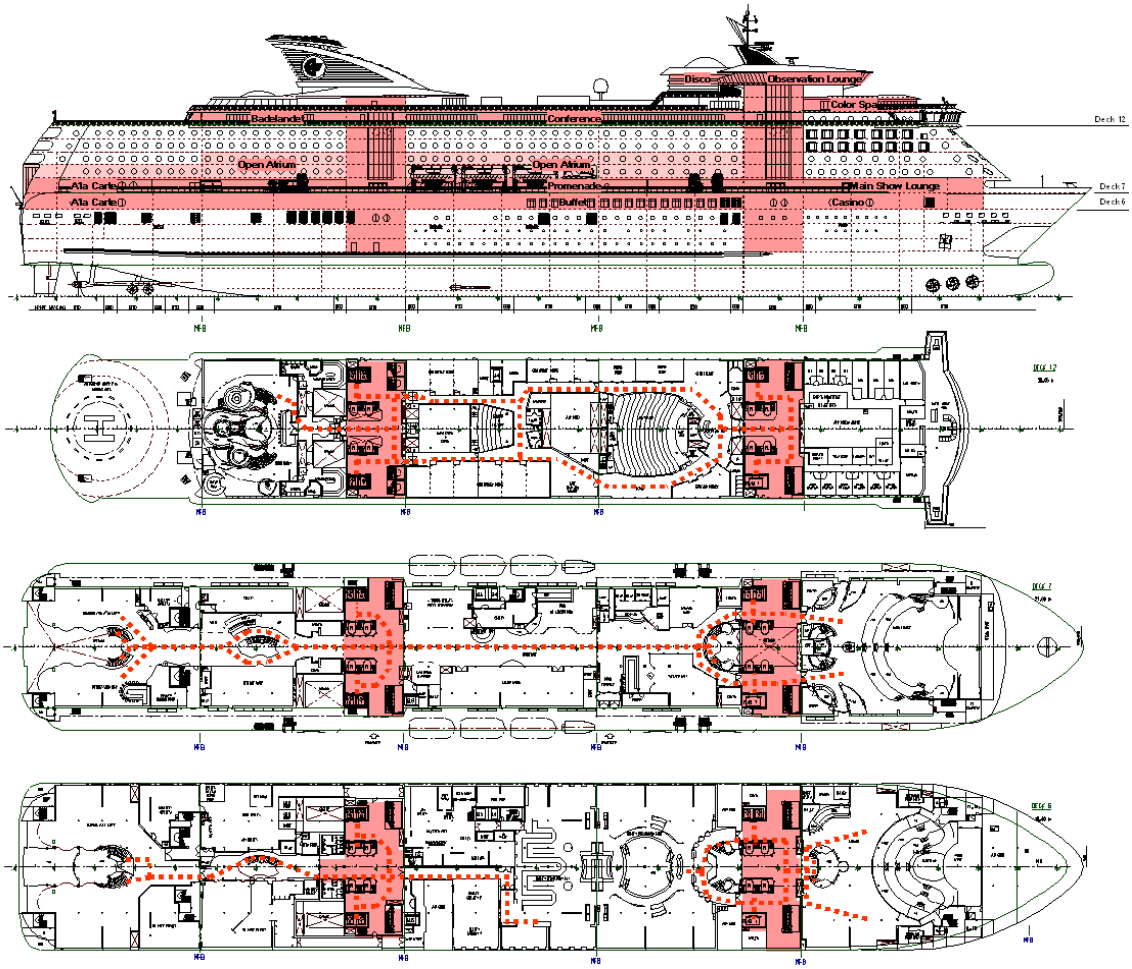


Figure 15: Passenger flow of the new Color Line cruise ferry

3.4 Onboard service

The extensive onboard service provided in cruise ferries demands well-organised internal transport between storerooms, galleys, pantries, bars and shops. Also the change of bed linens and towels must be well organised during the short time in port. Containers or trailers are used to speed up the processes. Loading of supplies and unloading of garbage must not prevent the cargo handling on the RoRo decks. Most cruise ferries can use the main RoRo deck for the supply handling, but in RoPax ferries the supply containers are lifted onboard "through the roof".

Figure 16: Indoor promenade "Voyager of the Seas"

The new escape rules for ferries prevent the location of passenger and crew spaces below the main RoRo deck and this space is now best utilized for stores (fig 17)

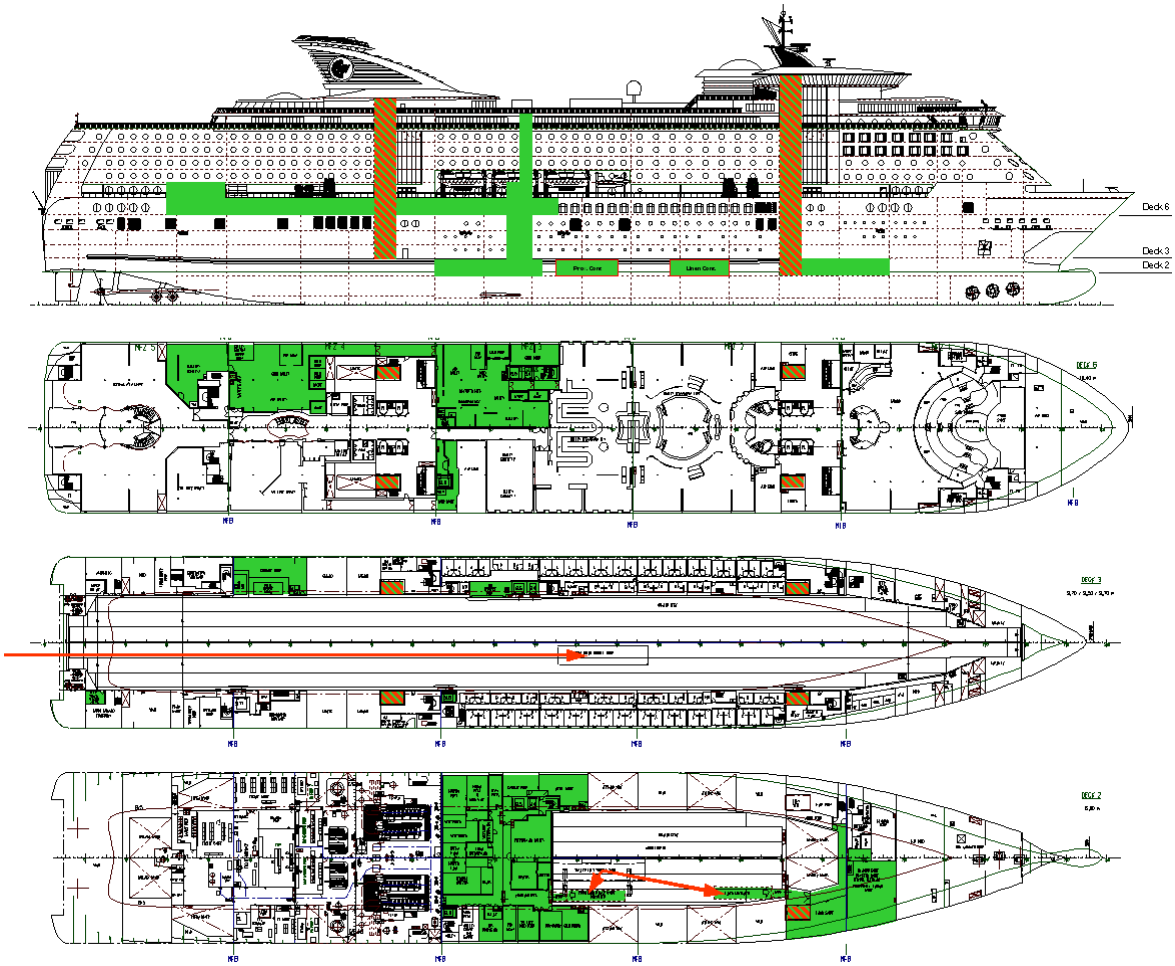


Figure 17: Service flow of the new Color Line cruise ferry

3.5 Car Deck Arrangement

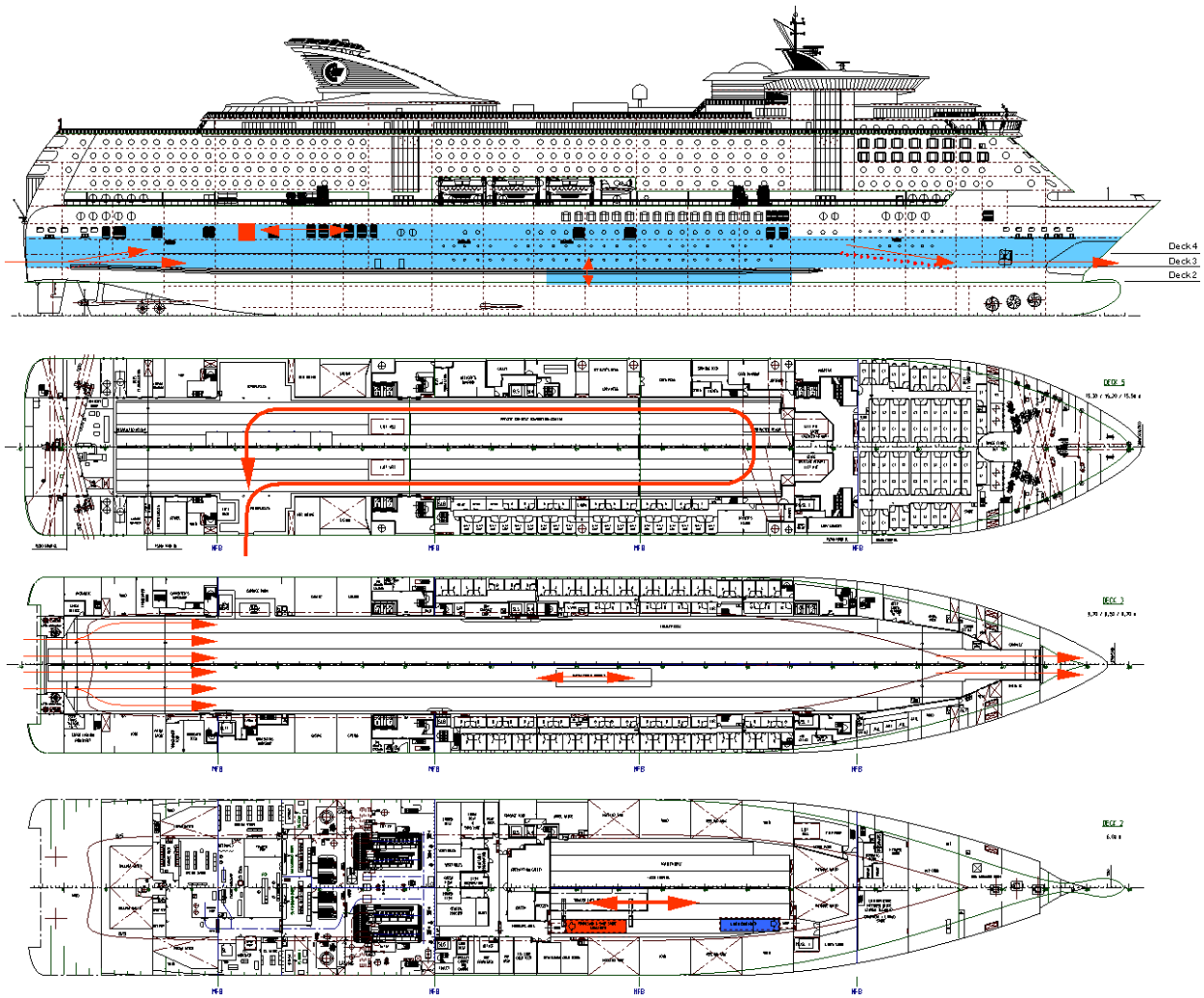


Figure 18: Car and cargo deck arrangement of the new Color Line cruise ferry

The cruise ferries on “city - to - city” routes need only limited RoRo facilities for private cars, trucks with trailers and unaccompanied semi-trailers. Drive-through facilities on the main car deck speeds up the cargo handling. The deck has 6 truck lanes and wide side casings on both sides. A row of pillars in the centreline supports the beams of the decks above. Hoistable car platforms with 4 lanes are installed on port and starboard sides. The platforms can be used in several configurations to suite the mix of trucks, busses, mobile homes and cars on each voyage.

The lower hold is intended for semi-trailers with a lift platform installed for cargo handling. In the lower hold there are storage space for the provision and laundry trailers, with access ramps to the storerooms

Above the main RoRo deck is a separate garage for private cars. The garage has a side door aft and a fixed ramp in the port is used for driving the cars on and off the ferry. Through the main stairs and lifts there is easy access to the passenger spaces above. The garage will be outfitted so that this space can also be used for exhibitions.

3.6 Machinery alternatives

Passenger and RoRo ferries are almost exclusively equipped with medium speed diesel engines. This engine type has the advantage of compact size and low weight, but still can operate on heavy fuel oil. Several different machinery solutions have been studied for the next generation of cruise ferry. The evaluation of the alternatives was based on cost, reliability and environmental friendliness.

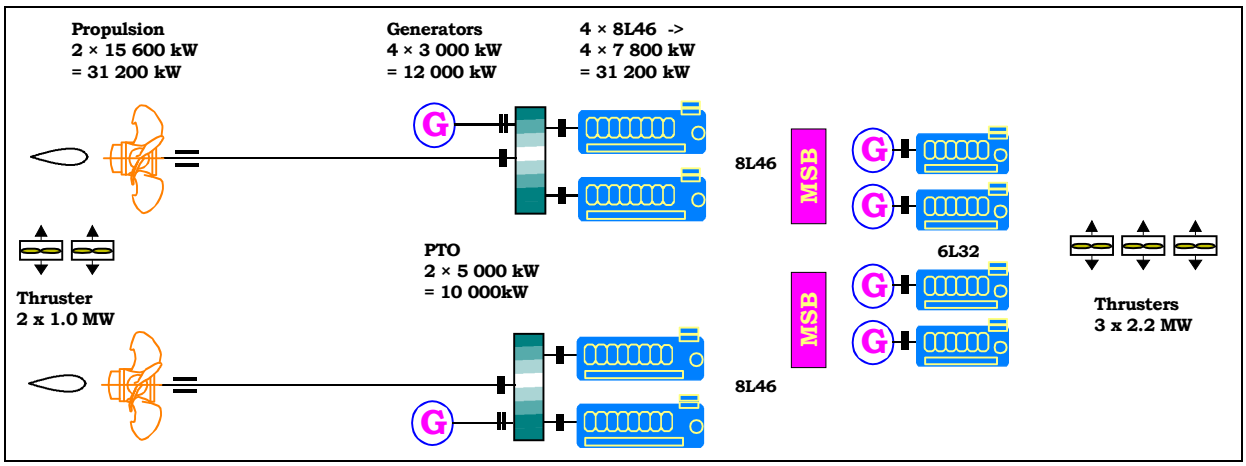


Figure 19: Diesel-mechanical drive with CP propellers

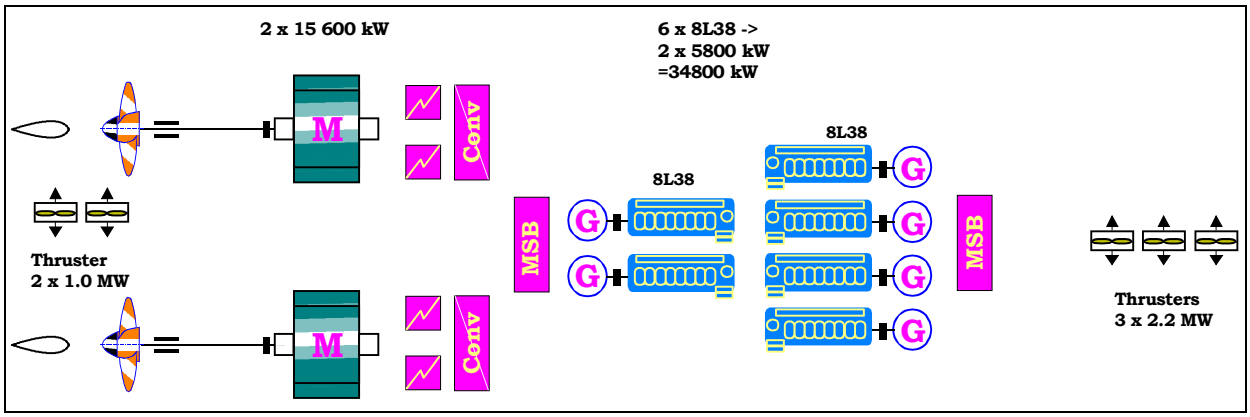


Figure 20: Diesel-electric drive with twin FP propellers

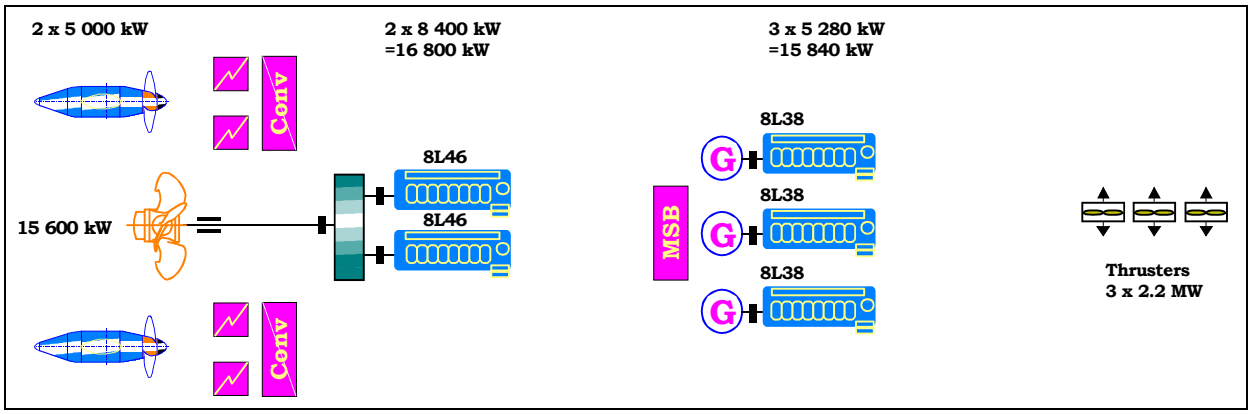


Figure 21: Diesel-mechanical centre propeller with twin diesel-electric pods

3.6 Machinery comparison

The ferry is operating on a 360 nm route with many hours of full speed in both deep and shallow waters. The initial cost of the major machinery components is lowest for the diesel-mechanical machinery. The twin pod diesel-electric alternative is about 25 % more expensive and the hybrid machinery with diesel-mechanical centre propeller and diesel-electric twin pods lays in between (fig 22). The pod propulsion has about 8% lower shaft power than the traditional twin-screw ship with long exposed shaft lines, brackets and rudders. But due to the electrical transmission losses of the variable speed pod drive the fuel consumption is almost the same. The hybrid arrangement, however, gives a considerable saving due to the improved propulsion efficiency and reduced power of the electric part of the machinery. Model tests with the hybrid arrangement show saving potential of up to than 15 % in propulsion power. The total annual cost is lowest for this alternative (fig 23), but the difference is small compared to the well-proven diesel-mechanical solution. Figure 24 shows the machinery layout selected for the new Color ferry.

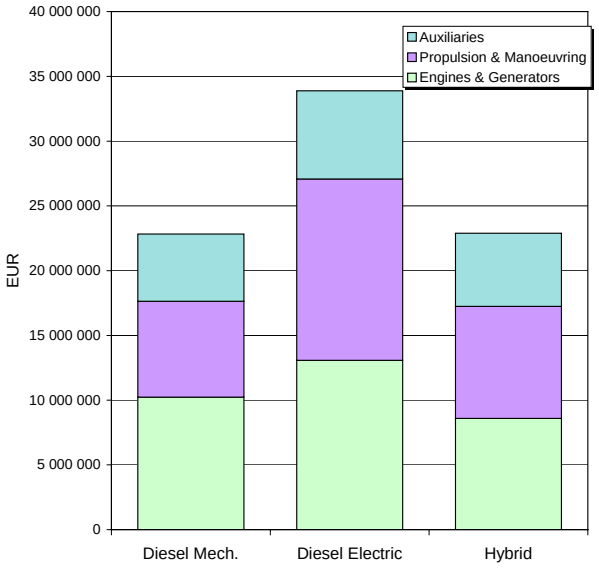


Figure 22: Initial cost

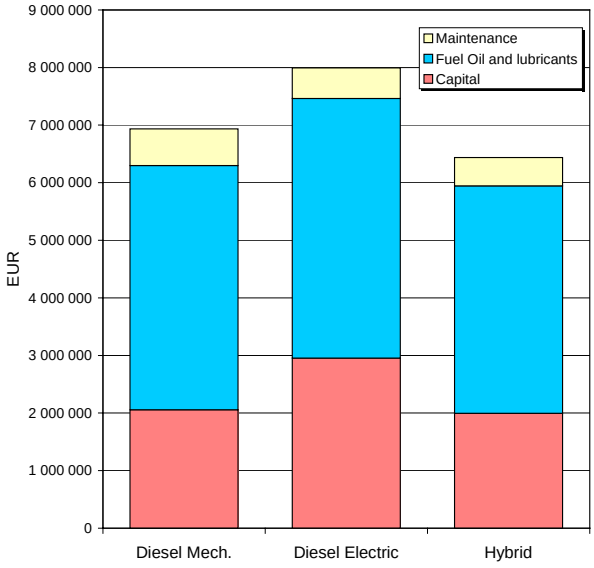


Figure 23: Annual cost

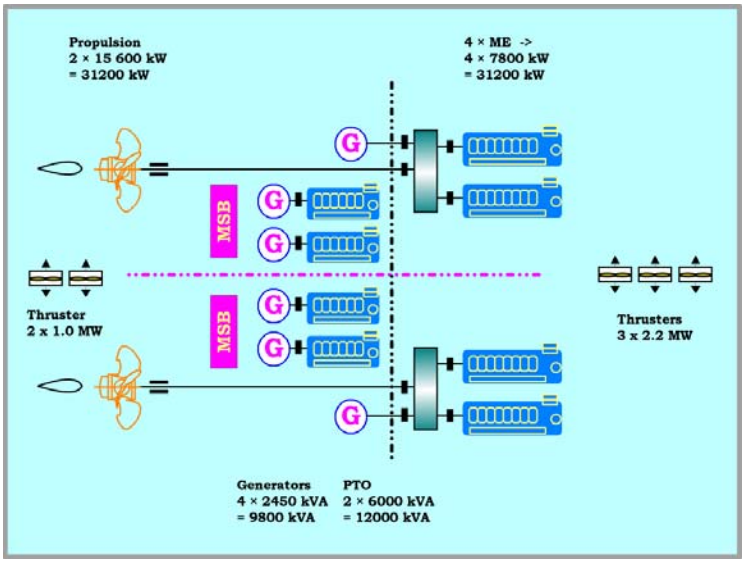


Figure 24: Diesel-mechanical machinery selected for the new Color Line cruise ferry

3.7 Safety and Environment Protection

For ferries there is a new rule for the escape route from all accommodation spaces. The escape stairs must not lead through more than two decks levels, up or down before reaching the muster station or an open deck. In a large cruise ferry there can be accommodation spaces on more than 10 decks above the bulkhead deck. This means that the escape routes must be arranged in a different way than in large cruise vessels. The number of lifeboats is in most ferries based on the rule for “Short International Voyages” and the liferafts accordingly. Escape slides or chutes with rafts for up to 100 persons are replacing the davit launch rafts in many newbuildings.

For environment protection the bunker is in inside deep tanks on top of the double bottom. Both black and grey water is processed and cleaned in the sewage plant before pumping overboard. Waste and garbage chutes from all decks leads to two garbage compression stations located on the main RoRo deck and all garbage is taken ashore.

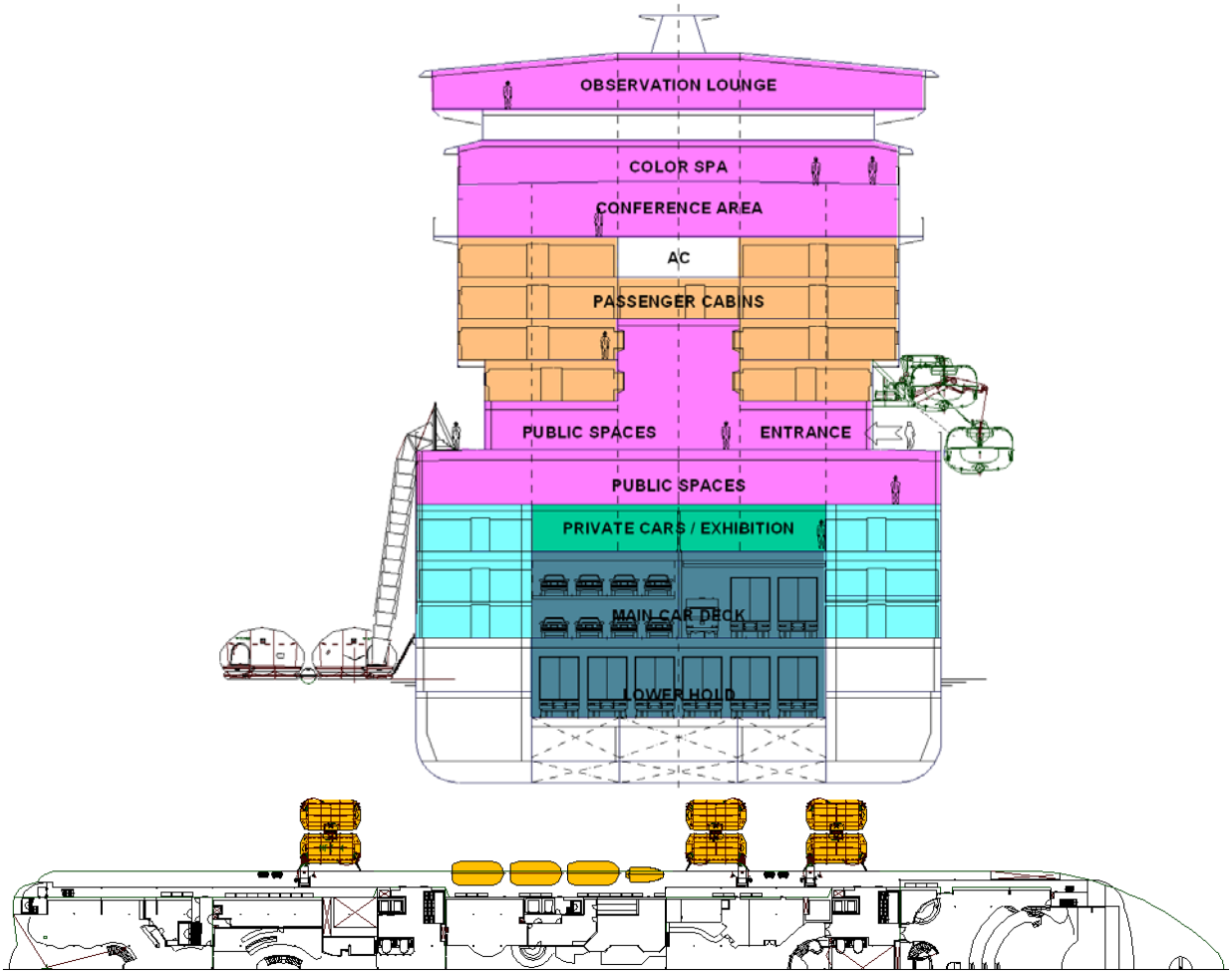


Figure 25: Lifeboats and liferafts of the new Color Line cruise ferry

4. 74 600 GT CRUISE FERRY FOR COLOR LINE

Figure 26: The new cruise ferry for Color Line

Main Dimensions:		
Length over all	223,90	m
Breadth, wl	35,00	m
Draught	6,8	m
Deadweight	5000	t
Gross tonnage	74 600	

Machinery and Propulsion		
Propulsion machinery	4 × 7800	kW
Electric power plant	4 × 2450	kVA
Shaft generators	2 × 6000	kVA
Bow thrusters	3 × 2200	kW
Aft thrusters	2 × 1000	kW

Passengers	
Passengers	2750
Passenger cabins	968
Outside	492
Atrium	120
Inside	356

Cargo:		
Trailer capacity	1270	lm
Car capacity	750	cars

Crew:	
Crew	250
Crew cabins	248

Olav Nils Sunde, Owner and CEO of Color Line:

"This is not a cruise ferry - this is a cruise ship with a car deck"

5. CITY TO CITY CRUISE

Color Line has had about 600 000 passenger yearly on the Oslo-Kiel route, which is expected to rise significantly by introducing the new cruise ferry, with more capacity and cruise-like attractions.

Figure 27: The route of the new Color Line cruise ferry

6. PASSENGER FERRY EVALUATION

The passenger ferries operating on many of the European short sea routes have gone through a fantastic development. It started from the need for transport of both passengers and goods. In the beginning the ferries only offered their passengers basic services needed on the crossing. But with growing wealth passenger interest increased and ferry travel became also part of their vacation or a weekend trip. The demand for comfort and service increased, the first step was that passengers wanted their own cabin. Ferry operators also quickly realized that passengers travelling for "fun" gave them a possibility to reduce the seasonal variations of the passenger loads. Short cruises, cruises to nowhere, conferences and business meetings could complement the basic transport function on the ferry route. The tax-free shopping possibility on the routes between the many countries in Europe supported this development. Also the technical development of the ferries has been impressive. The vessels have grown many times in size, machinery power and outfitting. With increasing volumes and speed safety and environment protection become of greatest importance. Safe and reliable operation is a must for the ferry business.

Today in a united Europe the scene is changing. Bridges and tunnels compete with sea transport on many routes. Tax-free shopping possibilities are limited to countries outside the European Union: The ferry operators must compete on equal terms with land based travel and transport operators. The potential passengers have many options to spend their free time and money. The next generation of ferries must offer a multitude of services and activities for the passengers to choose from at competitive cost. Passengers expect "value for money", but at the same time they are looking for unique experiences and are willing to pay if they find what they want. Passenger ferries have much to offer.

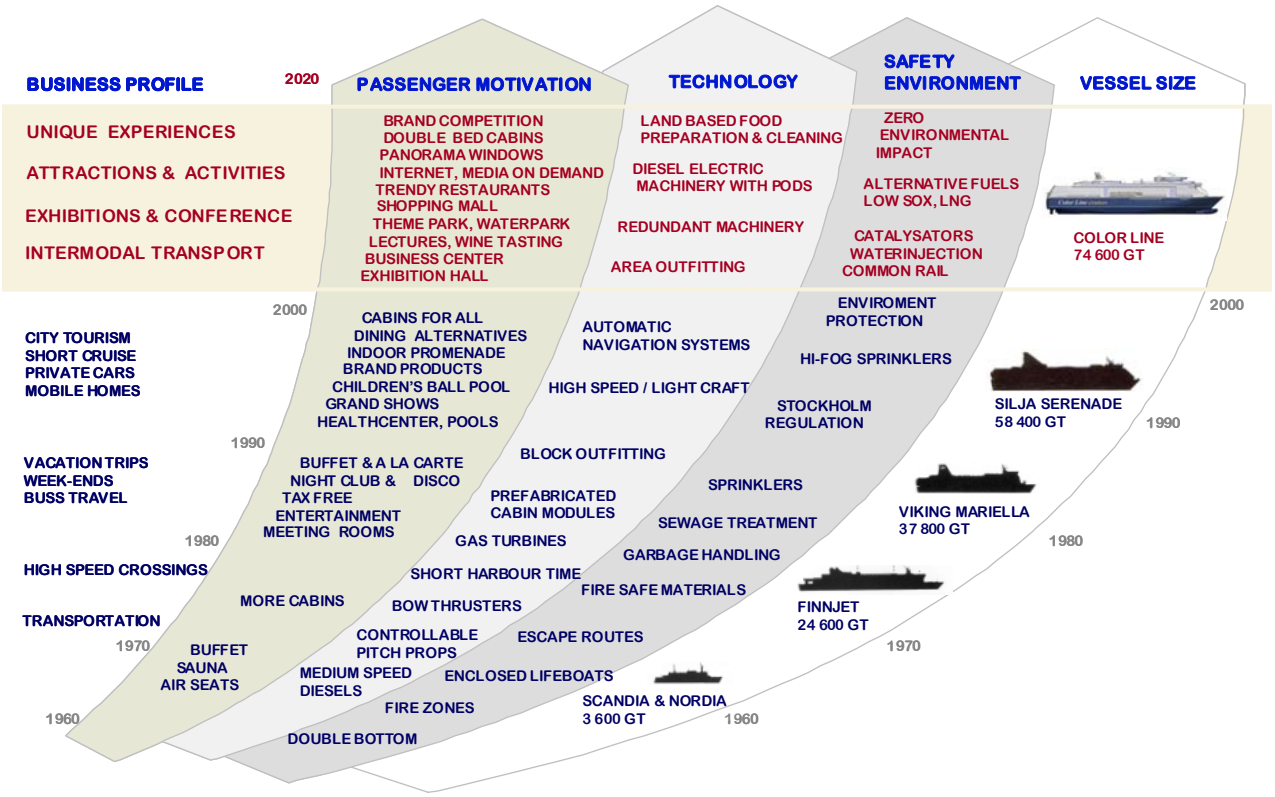


Figure 28: Ferry development trends

PASSENGER SHIPS FROM MASA-YARDS DURING THE LAST 15 YEARS

L-1294 Seaward
42 300 GT, 1988

L-1296 Royal Viking Sun
37 800 GT, 1988

L-1297 Athena
40 000 GT, 1989

L-1302 Cinderella
46 400 GT, 1989

L-479 Fantasy
70 400 GT, 1990

L-1298 Kalypso
40 100 GT, 1990

L-1301 Silja Serenade
58 400 GT, 1990

L-480 Ecstasy
70 400 GT, 1991

L-1309 Silja Symphony
58 400 GT, 1991

L-485 Barfleur
20 000 GT, 1993

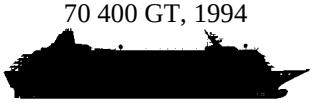
L-1312 Royal Majesty
32 000 GT, 1992

L-1315 Normandie
27 000 GT, 1992

L-484 Sensation
70 400 GT, 1993

L-1319 Juan J. Sister
22 000 GT, 1993

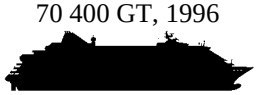
L-487 Fascination
70 400 GT, 1994



L-1323 Crystal Symphony
50 000 GT, 1995

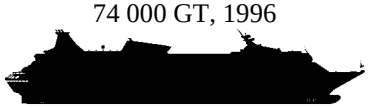
L-488 Imagination
70 400 GT, 1995

L-489 Inspiration
70 400 GT, 1996



L-1337 Aida
38 600 GT, 1996

L-492 Grandeur of the Seas
74 000 GT, 1996

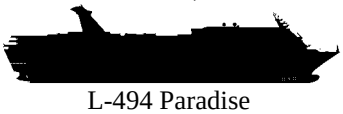


L-493 Enchantment of the Seas
74 000 GT, 1997

L-1340 Superfast III
30 000 GT, 1998

L-491 Elation
70 400 GT, 1998

L-1341 Superfast IV
30 000 GT, 1998

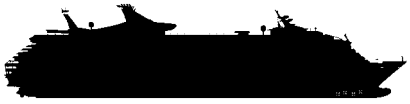


L-494 Paradise
70 400 GT, 1998

L-495 Europa
28 400 GT, 1999

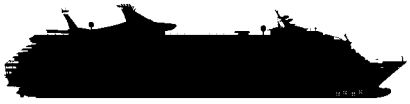
L-1344 Voyager of the Seas
137 300 GT, 1999

L-498 Costa Atlantica
85 700 GT, 2000

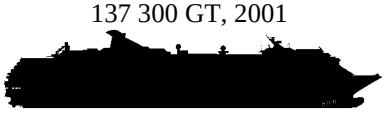


L-1345 Explorer of the Seas
137 300 GT, 2000

L-499 Carnival Spirit
85 700 GT, 2001



L-1345 Adventure of the Seas
137 300 GT, 2001



L-500 Carnival Pride
85 700 GT, 2001

L-501 Carnival Legend
85 700 GT, 2002

L-1347 Navigator of the Seas
137 300 GT, 2002

L-503 Carnival Miracle
85 700 GT, 2003

L-1348 Mariner of the Seas
137 300 GT, 2003

L-502 Costa Mediterranea
85 700 GT, 2003

L-1351 Color Line
74 600 GT, 2004