

## 1. R&D STUDIES

Your ideas! We can make them happen. We have made revolutionary ideas come true. And the track record is an unbeaten number of proven innovations and products at sea.

Deltamarin R&D carries out annually 35-40 different studies. By June 2004 the files consist of more than 390 reports covering all kinds of ships, machinery options and systems. The studies are carried out for shipowners and suppliers for their product and project development and to support their decision making process.

The principal mission of an R&D study is to define two main outputs: definition of possible options and judgement of technical and economical feasibility of possible found options.

R&D studies are carried out in various stages of a project: from feasibility assessment of sea transport to operational fine-tuning of selected option. The studies are needed as well for defining correct configurations and solutions for newbuilding as for estimating possibilities on conversion projects.

The survey can be prepared separately for a clearly identified subject or in parallel with project or basic design phases to give guidelines for the choices.

The results are always reported in a standard format. Summary is made to present essential results for executive presentation. The report describes all assumptions of the study, basic data, technical and economical background as well as the results in detail and in compressed form. The executive summary of the report and detailed description of the findings gives a good basis for continuation with the project.

Deltamarin R&D products can be divided into six principal categories according to the contents and use of the results:

- Market studies
- Feasibility studies
- Machinery and system studies
- Operational studies
- Evaluation programs and databases

## 1.1 Market Studies

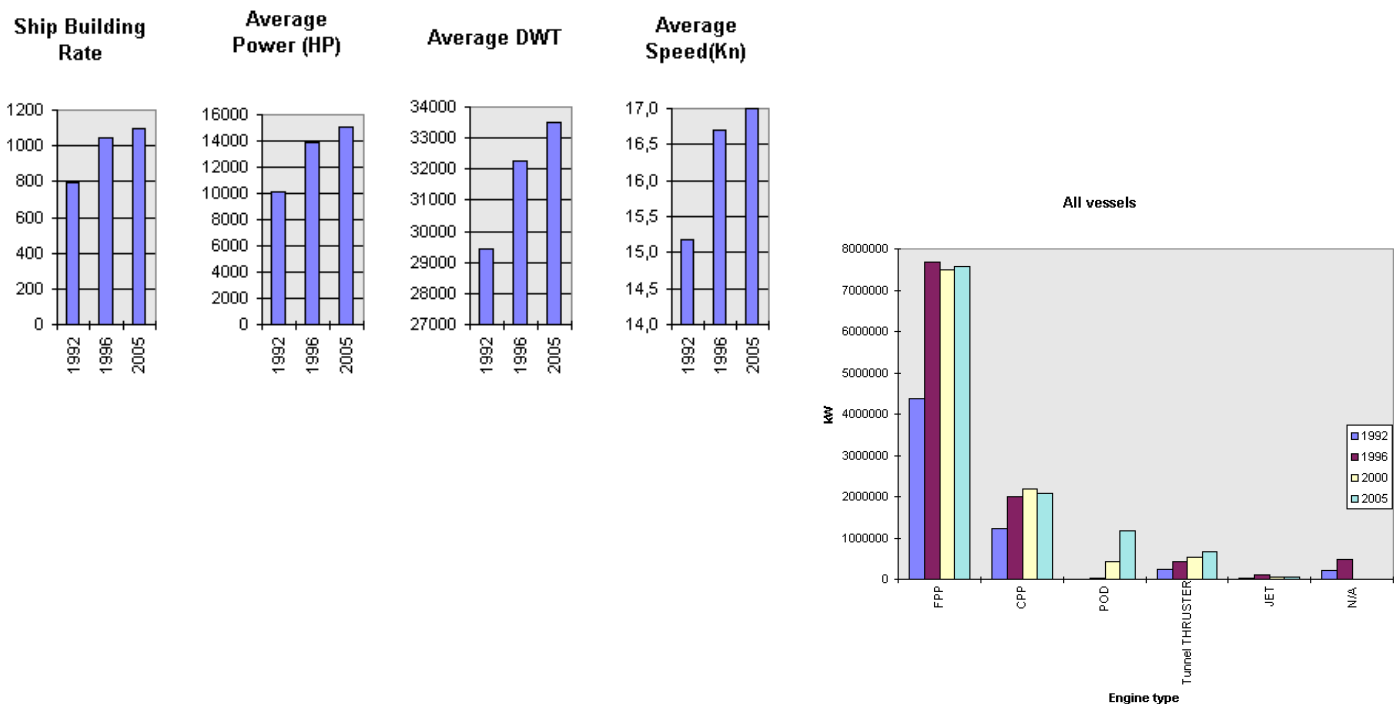
How does our product fit on the market? Which are the main competitors? What are the needs for this type of product when applied on a ship? What is crucial in decision making? In which direction should we develop our product in order to get wider market coverage? Will the market accept our product? Future market development?

Market characterisation, technology assessment and competition analysis are the main tasks in a market study. This is needed when a company launches a new product or an existing product to a new market or starts development of a new product.

The study covers typically mapping of markets and technical evaluation of the product. The results cover estimation of the product's suitability to the market, describe needs for further development as well as outline major strengths and weaknesses when compared with competitors' products and market size. Total configuration development/assessment is an essential part of the work and in many cases also the critical part, e.g. higher investment cost is well covered with additional revenue from a new configuration enabled by the new product.

### Selected References:

- ✓ Gas Turbine potential for marine applications (EGT)
- ✓ Azipod feasibility study (ABB)
- ✓ Market characterisation, technology assessment and competitive assessment in ships' machinery and monitoring (LITTON MARINE SYSTEMS)
- ✓ Mooring study (RAUMA WINCHES)
- ✓ Market and machinery trend study (ABB)
- ✓ Ship market study (KAMEWA)



## 1.2 Feasibility Studies

Should we operate a conventional ferry or a fast ferry or a high-speed full displacement ferry or to have a combined fleet? Should we invest in a fast catamaran or would a mono-hull design fit better on the route? What operation speed do we need for the vessel? How many passengers do we have to transport in order to get proper economical result? Which are our competitors on that route and would an additional ferry route be feasible? What are the risks for delayed or cancelled sailings due to extreme weather conditions?

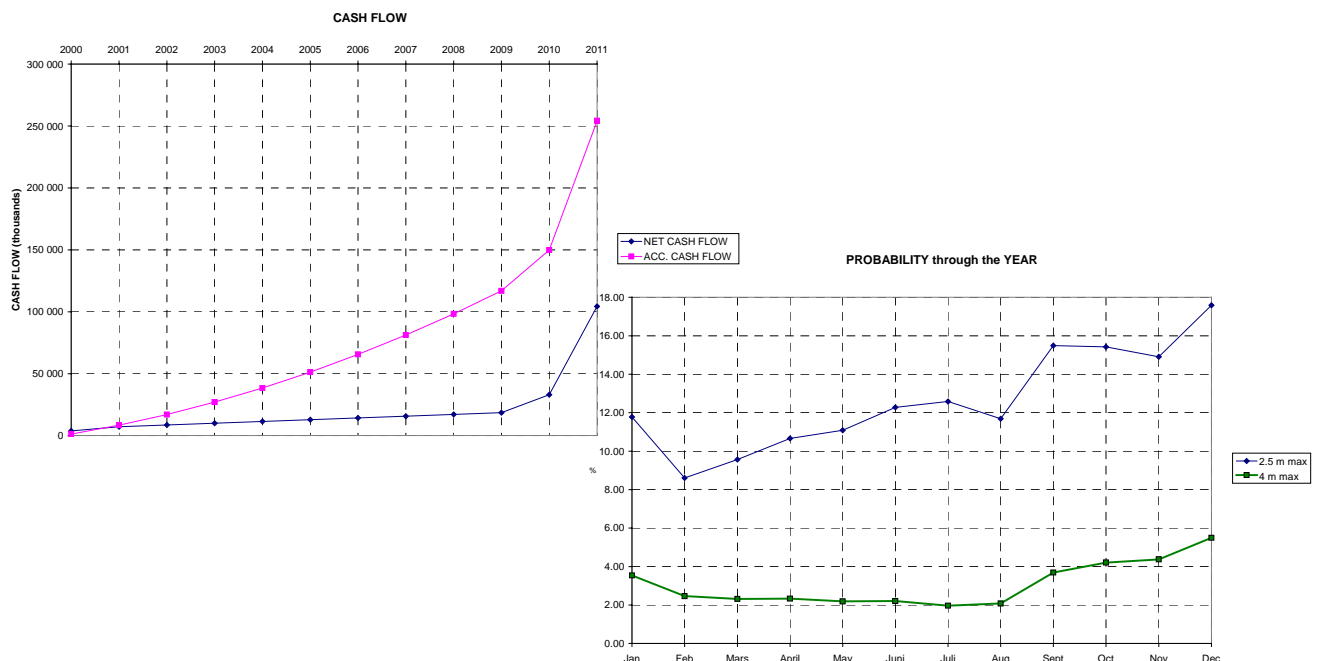
These are some of the questions a feasibility study can answer.

Feasibility studies are mainly carried out in order to define the feasibility of a dedicated sea transport task.

The study includes calculation of total economy when considering competing transport methods, existing infrastructure, suitability of the ship for the route, estimation of feasible transport speed as well as estimated transport and income rates. Preliminary check of the technical feasibility can be combined.

### Selected References

- ✓ Fast Ferry Feasibility Study; Helsinki – Tallinn (NORDIC JET LINE)
- ✓ Feasibility of a fast car carrying vessel (KVAERNER FJELLSTRAND)
- ✓ Feasibility study on fast ferry combined with conventional and high speed full displacement ferries (COLOR LINE)
- ✓ Feasibility study of different fast ferry concepts for a Mediterranean route (TRASMEDITERRANEA)
- ✓ Feasibility study for inter-island traffic (ANES)



### 1.3 Machinery and System Studies

Which machinery or system is the most suitable for the ship? Would diesel-electric machinery fit better than diesel-mechanic propulsion? Should we consider gas turbines or diesels for the newbuilding? Does the engine choice affect the cargo carrying efficiency? Which is the best way to produce fresh water, or how should we specify AC compressors? What kind of fire fighting system is the most efficient for special technical spaces? How is the total configuration of the ship affected or can we turn it the other way round? Is there a possibility for a new more efficient ship configuration?

These are typical questions at different stages of a ship project. A comprehensive machinery and system study gives clear answers and guidelines for problem solving and development of the project.

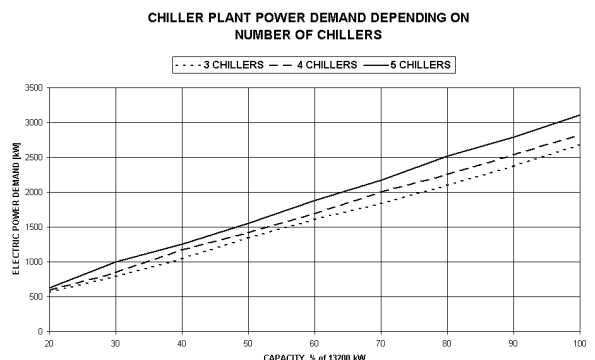
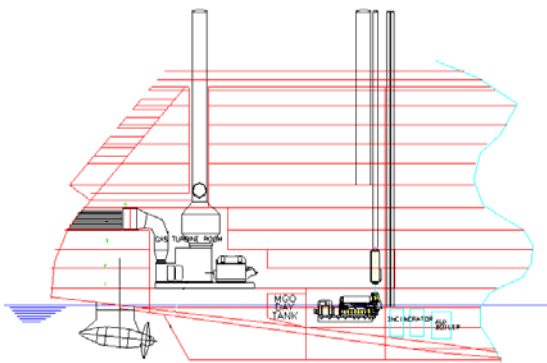
Machinery studies are carried out in order to define the most valuable and relevant solution among several options. The outcome of the study is a calculation of total economy related to other options and differences in technical properties.

The task is typically an evaluation between different propulsion plants, but in many cases the subject can be related to ship auxiliary service, such as air conditioning, water production or sewage treatment system.

The total configuration of the ship is always considered and possibilities for a more advanced configuration are studied.

#### Selected References:

- ✓ Machinery and ship concept comparison on a luxury cruise ship (DISNEY CRUISE LINES)
- ✓ Evaluation of marine AC-chillers for use on a passenger cruise ship (YORK)
- ✓ LNG study for APM (A. P. MOLLER)
- ✓ WR-21 for use of a passenger cruise ship (ROLLS-ROYCE)
- ✓ Conversion study for Prinsesse Ragnhild (COLOR LINE)
- ✓ Study of gas turbine machinery in the new 'Vantage'/'Millennium' type cruise ships (RCI)
- ✓ Study of diesel-electric and pod machinery in a ro-ro passenger ferry (TT-LINE)
- ✓ Study of diesel-electric machinery in a chemical carrier (STOLT PARCEL TANKERS)



## 1.4 Operational Studies

How much lower maintenance cost is expected by burning MDO instead of HFO? Are we loading the engines too high on the route? Does our operation meet the expected operation profile or should we change profile to get better economy and life for the engines?

Operational studies are carried out in order to evaluate ship operation on a given route. The evaluation of running hours and engine loading can be utilised in maintenance contract negotiations or when defining maintenance cost budgets for the ship. Condition monitoring maintenance and preventive maintenance can be based on operational profile study.

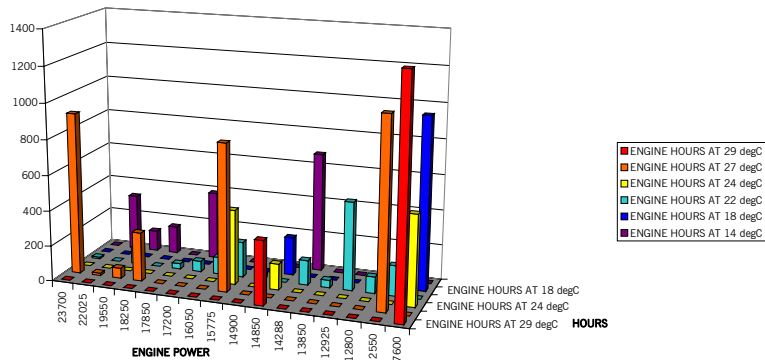
Feasibility of different fuel types for use on a certain ship and route as well as estimation of exhaust emission reduction possibilities are frequently checked today for newbuildings and existing fleet.

Efficient tools exist for customer use as well.

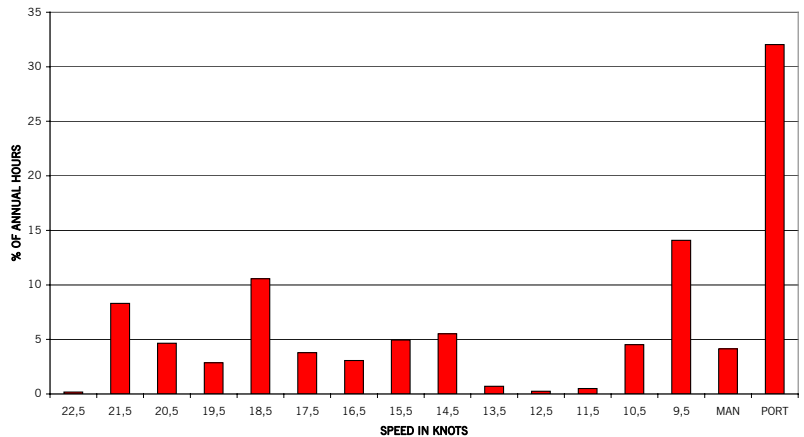
### Selected References:

- ✓ Fuel study (WALLENIOUS)
- ✓ MS Robin Hood / Nils Dacke manoeuvring study (TT-LINE)
- ✓ Slow speed manoeuvring study (RCI)
- ✓ COGES operation profile study for Millennium class (CELEBRITY)

ANNUAL ENGINE HOURS vs POWER vs AMBIENT TEMPERATURE



SPEED PROFILE



## 1.5 **Evaluation Programs and Databases**

Various tool programs and databases are created to enable also our customers to prepare their own first stage evaluations in an easy way.

**DELTA-AVEC** database includes detail information of 100 recently built passenger ships and ferries. This data can be effectively utilised when comparing different vessels to each other as well as giving efficient feedback and guideline for a new project.

How much AC fan room area do we need on our ship? Do we have enough restaurant area or is the crew/passenger ratio in line with competing vessels? Answers can be found from Deltamarin AVEC database.

The extensive database also supports the combined project development program with which it is easy to prepare the first reliable project design approach within 2-3 hours and to check the feasibility with the linked economical calculation, both operational and investment parts are included.

**DELTA-CONCEPT** is a tool for making quick evaluations between different machinery options. The program calculates the total economy including the first and operation cost. A comprehensive manual including general input values is supporting the program user. Delta-Concept allows easy running of sensitivity analysis in order to find out the decisive factors of total economy.

Delta-Concept gives answers to questions like which options should be considered for further evaluation? What is the difference between diesel-electric and diesel-mechanical machinery? How much better should the pod propulsion be in terms of hydrodynamic efficiency in order to give better total economy than traditional diesel-electric machinery? How much should the income for the increased cargo volume be in order to cover the higher cost of the new machinery configuration? What is the impact in fuel cost if we change engine type / configuration?

**DELTA-FUEL** is a program prepared for calculating impacts of fuel choice. It can be used for calculating newbuilding and existing vessels.

What does it mean if we shift to heavier distillate or what if we turn to marine diesel oil? How much should we pay for specific quality of fuel compared with others? What impacts does MDO have on the annual economy? What fuel should we select for our newbuilding?

The above questions can be answered easily by running the Delta-Fuel program. The calculation can be done at a general level or at a very detailed level including all impacts the fuel choice may have on the total economy. The program is adjusted exclusively for each client and ship in question.

### **Selected References:**

- ✓ DELTA-AVEC (Viking Line, Color Line, Stena, P&O, Brittany Ferries, Celebrity Cruises)
- ✓ DELTA-CONCEPT (Kamewa, ABB, Wärtsilä NSD)
- ✓ DELTA-FUEL (Wallenius)