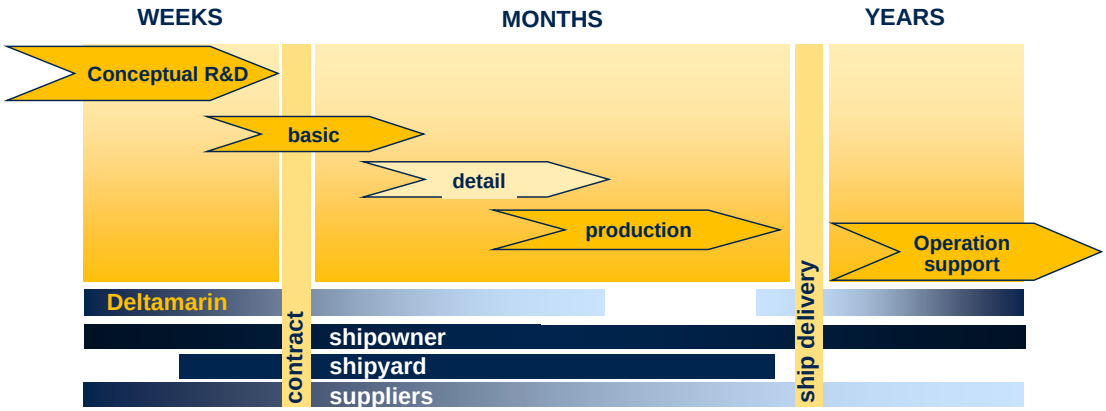
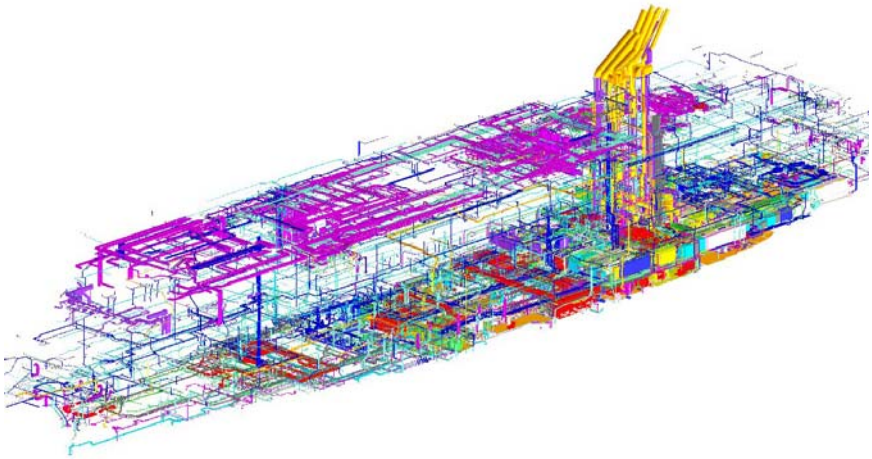
7. DETAIL ENGINEERING



Deltamarin's cornerstones in detail engineering are:

- high capacity
- multidiscipline engineering capability
- 3-D modelling techniques
- integrated project management



3-D co-ordination model of a ro-pax vessel

Detail engineering shall provide necessary work execution information in accordance with client's current practise enabling:

- work preparation
- material handling
- fabrication
- section and block outfitting
- onboard installation work

Detail engineering covers all disciplines:

- Hull
- Deck outfitting
- Interior
- HVAC
- Machinery
- Electrical

The work will be based on:

- Specification of the ship
- Basic engineering documentation
- Yard's building standards and work procedures
- Data from equipment suppliers
- Relevant rules and regulations

Manpower in Detail Engineering at Deltamarin

Hull	73
Deck Outfitting	20
Interior	40
Machinery and HVAC	105
Electric and Automation	22
Total	**260**

7.1 Co-ordination

The purpose of the co-ordination phase is to ensure uniform basis for detail engineering before the detail engineering commences. Space reservations will be checked and necessary definitions for location of various main items will be accomplished. The ship wide routing of piping, ducting and cabling will be made to prevent any discontinuity in design in way of areas of interface.

Deltamarin takes regularly advantage of 3-D modelling tools in selected areas.

Typically the following drawings will be produced:

Interior

- measure drawing of interior spaces (interior plan)

HVAC

- co-ordination drawings of pipes, ducts and cable trays on top of interior plans of each fire zone deck by deck
- co-ordination drawings of casings
- measure drawings of technical spaces (location of equipment)

Machinery

- machinery space arrangements (location of equipment)
- co-ordination drawings of machinery piping on top of machinery space arrangements

Electric

- dimensional drawings of electric equipment spaces
- co-ordination drawings of electric main cable trays and trunks

7.2 Detail engineering

The engineering work will be planned and co-ordinated with other disciplines in accordance with the client's current work execution practise and Deltamarin's Quality Assurance system.

Typically complete information and data for identification, fabrication and assembly or installation will be produced.

The scope of work will always be agreed case by case with each client based on building strategy, work procedures and production facilities.

The following design products are typically included in detail engineering package:

Hull

- block drawings
- nesting of profiles and plates
- jigs
- material take-off
- part lists
- NC information

Outfitting

- installation drawings
- foundation drawings
- material and equipment lists
- grilles and gratings arrangement
- stairs, ladders, hatches, rigging, etc.

Interior

- hot outfitting drawing
- deck covering drawing
- ceiling drawings
- wall elevations of divisional and liner bulkheads
- furniture plans
- fire load calculations

HVAC (Heating, Ventilation, Air-conditioning)

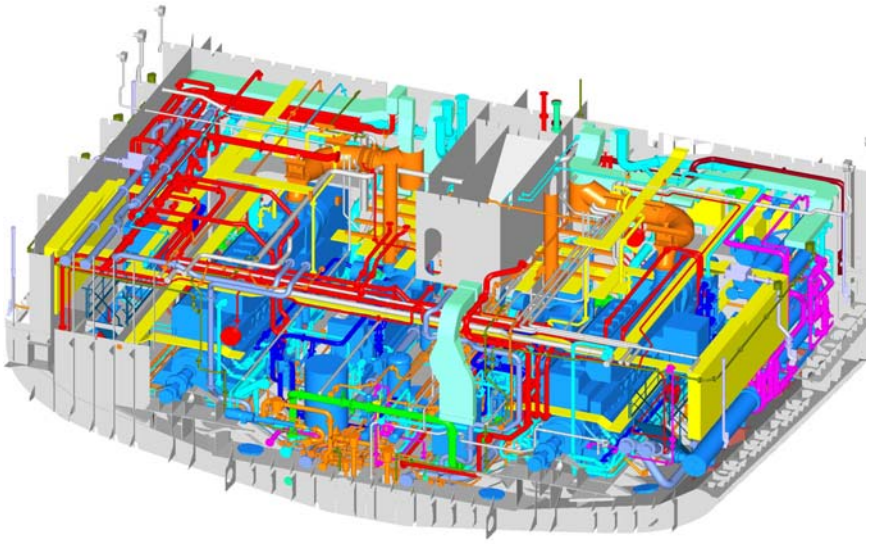
- arrangement drawings of ducts and piping including cable trays
- prefabrication drawings
- foundations
- mounting of aggregates and equipment
- material and equipment lists
- penetration drawings

Machinery

- Arrangement drawings
- Pipe package and equipment unit drawings
- Pipe installation drawings
- Isometric drawings
- Foundation drawings

Electric and Automation

- Electrical systems, cabling drawings
- Electrical systems, connection drawings
- Electrical equipment, co-ordination/location drawings
- Electrical spaces, arrangement drawings
- Cable trays and penetrations, main cable route diagram
- 3-D cable tray model and routing of cables
- internal circuit diagrams, e.g. for switchboards, motor starters and consoles



3-D model of a machinery space