CADET - IT Support for Joint Naval Shipbuilding Projects

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Abstract

The basic idea is to develop methods and tools dedicated to European cooperative naval (military) projects. The project proposal CADET, and its software tools in particular, shall support all decision steps recognized as contributing to the success of any naval cooperative project. They provide a common methodology, a common language, as well as the same structure of information for all partners (navies and shipbuilders).

1. Purpose

The basic idea behind the "CADET" project proposal is to develop methods and tools dedicated to European cooperative naval (military) projects. Partners would be provided with a complete road map of the project, from initial navies requirements to final building in the shipyards.

CADET tools are intended to support all decision steps which have been recognized as contributing to the success of an EC naval cooperative project. They provide a common methodology, a common language, as well as the same structure of information for all partners of a cooperative naval project (navies and shipbuilders).

2. History of EC naval cooperative projects

A short history of EC cooperative naval projects shows that there is some room for improvement, in particular it can be noted that:

- after the initial enthusiasm, bitter discussions follows;
- the duration of the definition phase of the common vessel is usually quite long (several years);
- large differences between navies requirements may limit the common design work to not much more than a common platform;
- having searched without success to build a common ship type, each navy may finally build a quite different ship;
- partners sometimes go away before the end of the project.

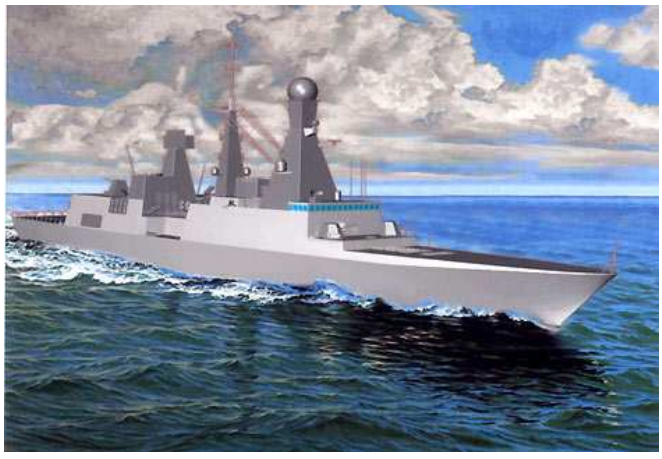

Fig.1: Horizon frigate

Fig.2: CVF aircraft carrier

Although insiders may judge the summary of Table I as caricatured or partly inaccurate, it provides useful cues on the difficulties encountered in those joint programs.

Table I: Recent history of joint naval projects involving European shipbuilders (from public sources)

Starting year	Ship type	Partners	Outcome
1979	NATO frigate	All NATO countries	Collapses for no agreement on common vessel.
1994	HORIZON frigate	UK, Italy, France	UK withdraws for no agreement on common vessel. Definition of the vessel lasts 9 years. One frigate costs approx. 1.3 Billion Euros. 20 frigates planned, but 4 frigates finally built (2 for France and 2 for Italy).
1994	TRILATERAL frigate (TFC)	Germany, Netherlands, Spain	Common platform, but no common systems.
First delivery Sept 2005	Scorpène (AIP conventional submarine)	French DCN /Spanish NAVANTIA	Rather successful, but the situation is close to NAVANTIA building under licence from DCN.
First delivery 2004	U212A (AIP conventional submarine)	German HDW / Italian FINCANTIERI	Rather successful, but the situation is close to FINCANTIERI building under licence from HDW.
1994	Viking project (conventional submarine)	Sweden, Denmark, Norway	Rather successful, but Norway left on budgetary grounds.
2002	Multi-missions European frigate (FREMM) 27 frigates expected	Italy, France	Agreement on hull and propulsion. Some discussion still on-going on systems.
2006	CVF aircraft carrier (approx. 60 000 tons)	UK, France	UK sold their design to France. No “common” design.

3. EC research policy

The huge EC shipping industry initiative, “Waterborne”, mentions that EC naval ships of the future should be “off the shelf” ships. The idea is clearly to build long series of naval ships, thus cheaper to build and to maintain.

4. EC industrial policy

USA and EC have a very different industrial organisation regarding naval shipbuilding:

- USA has two industrial groups only: Northrop Grumman and General Dynamics, each one operating three yards;
- EC has multiple countries, industrial groups and shipyards. There is, by now, little consolidation of the industry.

This disadvantage could be compensated by an enhanced EC cooperative organisation and systems.

Well managed naval cooperation is therefore of high value for the EC naval industry, and it is the only way, in the foreseeable future, to economically produce and maintain naval ships in the EC.
There is an on-going trend towards the shaping of a few naval shipbuilders consortiums in Europe. The creation of long term cooperation between naval shipyards should logically encourage the implementation of CADET-like methodology and tools for building ships in cooperation.

In the aeronautics industry, the Airbus consortium has provided one full scale example of organization for EC joint projects: following the common design phase, the plane is assembled at a single construction site. Components are build in different countries then shipped and assembled in this single construction site. Anyway, there is one single plane model eventually proposed to the market.

Naval shipbuilding is a different story, as it must take into account the different requirements from the national navies. Therefore, it is reasonable to expect the final result of any cooperation to consist of one ship version per nation. The improvement in productivity can therefore only come from upstream, concentrating, during the cooperative work, on common high level design and common procurement list.

5. Tools functions

The partners are guided step by step in the common design, going through appropriate CADET software modules.

These modules focus on the information really common to all partners, therefore staying at the suitable level of abstraction. They do not address any information which might be specific to any partner (e.g. relating to the level of pre-assembly of blocks, the size of drydocks or assembly halls).

The "Common design database" is filled-out with high level information, in the first place. The partners will progressively move to lower levels of information, translating this high level information into lower level information. The lowest level of information will eventually be made of components which can be physically manipulated by the yard.
Example :

- if the high level information is: ship speed = 20 kts,
- we can derive, at a lower level of information: engine power = 8000 KW,
- eventually we end, at the lowest level of information, with the engine main body description.

Each time a consensus is reached between the partners, the corresponding information is entered into the relevant software tools and transferred into the "Common design database", in which the complete cooperative information is finally stored.

Typical software modules are as follows:

- general requirements of the ship: operational objectives as defined by the navies, main characteristics (speed requirements, dimensions, etc).

- initial design: it provides a simplified structural model of the ship, visualisation of the ship included.
  The block cutting options will be studied at this stage, leading to the rational choice of the most appropriate building shipyards.
  All usual initial design studies are carried out at this stage, such as weight, hydrostatics, damage stability, longitudinal strength, speed and power prediction.

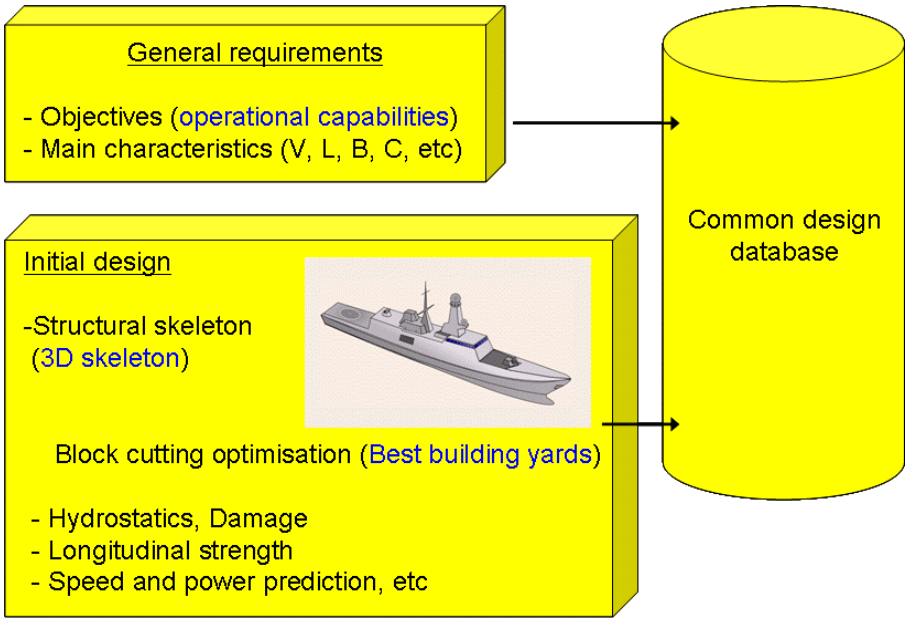

Fig.3: Common design - Requirements and initial design

- systems definition: it generates the "wiring diagrams" of the major systems on-board, typically propulsion, navigation and weaponry.

  It concentrates on the functional relationship between equipments and not on any geographical positioning on board or specific maker/model of equipment.

  Standard values for the characteristics of equipment are proposed in menus (dimensions, pressure, power, etc), in view to fostering the choice of standard equipment.

  A modular design of systems is proposed, in the sense that each major operational requirement corresponds to a certain module of systems. Therefore the whole ship systems are made of the assembly of the "common platform" module and the optional modules, which could be, for instance, "anti-aircraft", "anti-ship" or "anti-submarine" modules.

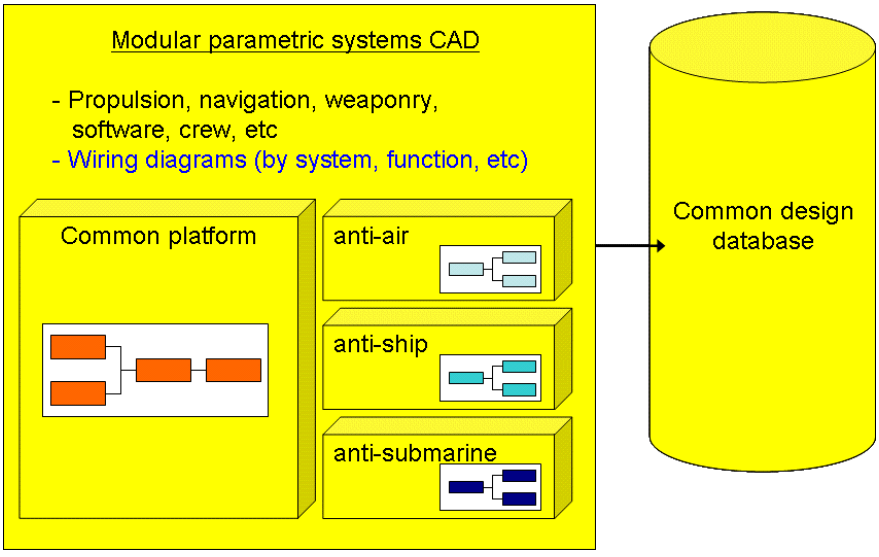

Fig.4: Common design - Modular systems

- fight simulation: the set of whole ship systems modules defines a "virtual ship", which can be systematically tested by an adequate simulation software, for its reaction against various threats, both for fighting capability and survival skills.

- procurement: for each piece of equipment referenced in the "wiring diagrams" of the systems, the partners take decisions regarding the choice of maker and model. Each partner is informed of the choices made by the other partners, so that, in case of discrepancy, he has to make sure that there are strong grounds no to choose the same equipment. The tool calculates the achieved global level of procurement commonality between the partners. For instance, if partners have, let us say, 50% of the equipment list in common, this could be considered as a success.

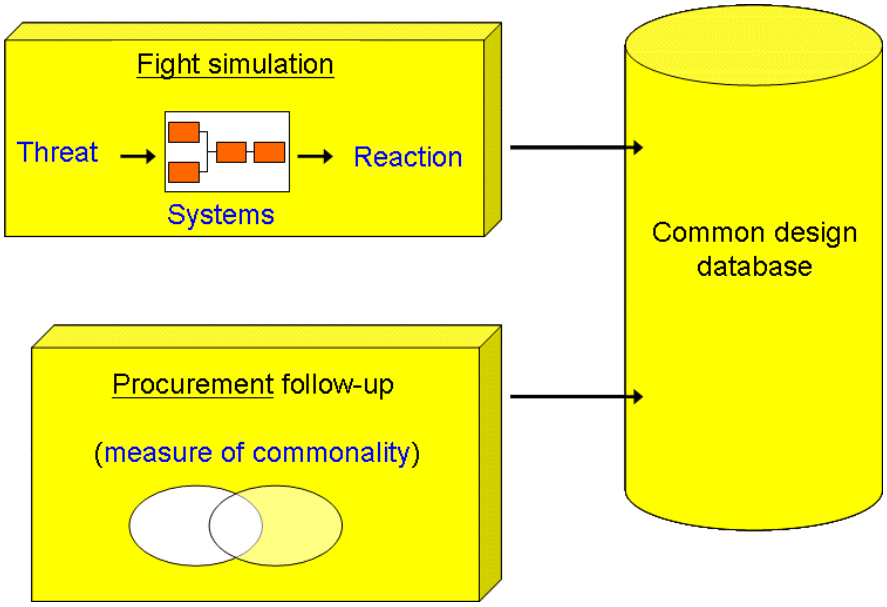

Fig.5: Common design - Simulation and Equipments orders

Each partner will inject the contents of the "Common design database", resulting from the common design decisions taken by all partners, into his own CAD system. Starting from there, he will finalize his own version of the ship. He will then be free to adjust to any local constraints regarding the specific navy requirements, optimisation of the design, specific choice of supplier, building habits or building facilities

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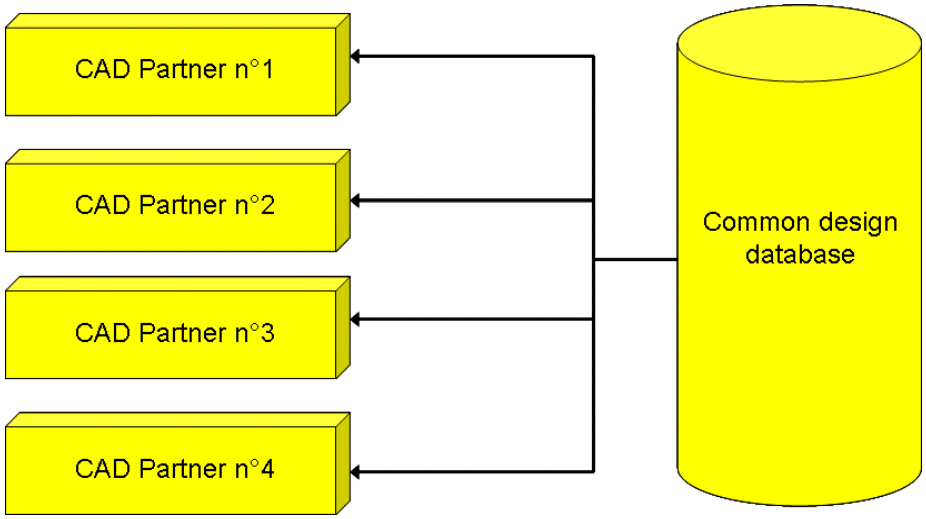

Fig.6: Individualized designs

6. Implementation

This research project is expected to be financed either by the concerned Ministries of defence, with taxpayers' money or as a Joint Industry Project, where partners invest their own money. It should be carried out by a consortium, associating several European naval shipbuilders, naval procurement agencies and societies specialised in naval CAD, with official support from the European Defence Agency. Once the tools developed and operationally used for real cooperative programs, we can imagine that they would be run by either:

- a common subsidiary of European naval shipbuilders,
- an independent service company,
- an EC administration technical service.

7. Benefits

The research project in itself will familiarize the naval shipbuilding actors with the idea of cooperative work, so that they will consider this option when starting their next real shipbuilding program. The software tools will ensure that:

- for each cooperative program, the general design will be discussed and shared between partners, gathering the best of partners' expertise and ideas;
- a shipbuilding efficient strategy will be decided at an early stage, by selecting the building yards on the basis of rational factors, such as blocks size and weight. For instance, an aircraft carrier being a wide vessel, the choice of a shipyard with wide drydocks looks like a natural initial choice;
- the extent of common design of systems will be maximized: only when there is a difference in the navy requirement will the system design be different;
- the extent of common procurement will be maximized: this feature will materialize in huge savings during the whole service life of the ships, as spare parts and repair contracts will be cheaper, due to a higher numbers of orders;
- once this common design phase is finished, each partner is free to deal with his national version of the ship, as he wishes, having in view the optimisation of his design: this could cover specific navy requirements, detailed arrangement, choice of minor equipment and adaptation to shipbuilding facilities constrains.

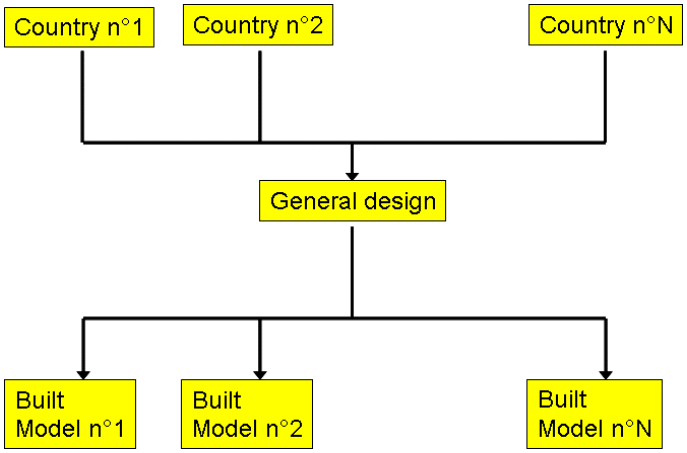

Fig.7: "CADET" cooperation schema

As a consequence, cross repair of naval ships between EC nations will be made theoretically possible, as repair shipyards, having become familiar with the common systems and equipment of ships of the same family, will be able to service all of them.