MARITIME RESEARCH & DEVELOPMENT ACTIVITIES IN EUROPE RELEVANT TO SNAME T&R COMMITTEE

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INTRODUCTION

When one examines maritime research and development activities in Europe it is found that the work is occurring at three levels: international, national, and regional/local. Work underway at the regional/local level, relates almost exclusively to ports and harbor initiatives and to the education and training of the local work forces. Major programs in all areas of interest are active at both the international level and at the national level. The most outstanding example of international sponsorship is the European Union program; additionally, almost every nation with access to water has its own specific version of research and development relating to the maritime sector. I would like to describe some of these activities to give SNAME members an idea of the intensity of effort, and the direction of interest.

The next section describes work underway via European Union sponsorship. This is followed by a section that describes the initiatives being proposed in the United Kingdom, and efforts underway in Norway. Activities within these two nations are considered to be representative of the overall span of program.

A final section describes the Office of Naval Research Europe assignment in providing liaison and information to the U.S. maritime industry.

EUROPEAN UNION PROGRAMS

There was a master plan developed by the European Union in 1996 that presents a review of research and development needs of the various maritime industries, and the priority expectations with respect to research initiatives. There were two sector plans developed. The first sector deals with the ship in the transport chain, and the second sector focuses on exploitation of the marine resources. The document describes, in detail, the specifics of focus areas of concern, and is viewed as the genesis statement around which all of the research initiatives are tied.

A. The Ship in the Transport Chain

Designing, Building, and Maintaining the Ship

The first area of focus is on problems associated with the design process relative to product performance, cost of building, and cost of operating. Specific project opportunities included:

1. Innovative tools for the early design procedure, especially using expert systems;
2. Improvement of tools for hydromechanic basic design procedures, with emphasis on the improvement of prediction codes incorporating calculations for ship viscous resistance, and=
3. Counteractive effects with multihull design, maneuvering behaviour, and the effect of restricted water depth;
4. Improvement of propulsors design tools; and
5. Improvement of predictive tools for structural behaviour.

Improvement of production efficiency was an area of focus the designated the following project opportunities:

1. enhancement of automatization and robotization;
2. improved methods for welding processes;
3. improved methods for parts and components fabrication; and,
4. construction accuracy and quality assurance methods.

Modules and standardization was considered essential to improve position, and included the following specific R&D efforts:

1. standardization of components;
2. standardization of important operational areas; and
3. modularization.

Use of New Materials

Research in this area is aimed at contributing to the reduction of acquisition and operating costs, and to the improvement of the quality of the ship components through higher reliability.

Types of materials mainly concerned are:
1. composite materials;
2. high-strength and special alloy steels;
3. joining and non-destructive testing technology; and
4. corrosion protection materials.

Improvement of Information Exchange Technology
The aim is the implementation of a computer integrated manufacturing architecture as the integrator of information to serve an optimal level of automation and flexibility in parts manufacture as well as assembly. The areas of focus includes the following:

1. development of neutral formats for the information exchange;
2. implement of CIM architectures in the design and production processes;
3. implementation in the areas of production monitoring and
4. feedback, including quality management;
5. management support of life cycle information; and
6. development of further standards for ship control systems.

Application of Information/Communication Technologies
New generic technologies on information management and exchange are now commercially available. The application of relevant parts of these technologies in the maritime area is essential to achieve and maintain competitiveness in the industry. Research and development will address:

1. high level multi-level communication technologies;
2. virtual reality tools;
3. development of technologies to support virtual consortia/companies;
4. improvement of production simulation and production planning techniques;
5. implementation of expert systems to support decision making and standardization of EDI design tools.

Improvement of Supportive Environment
To improve the quality of the supportive environment with regard to the design-building phase, three main areas are being investigated:
1. the education and training process;
2. the design management; and,
3. the organization and philosophy of work in building complex marine structures.

Improvement for Safety
A clear tendency of moving from prescriptive to performance-based safety regulation is emerging internationally. According to this approach, compliance to safety standards will be based on a comprehensive assessment of the risks involved, and the selected risk mitigation measures will also take into account. It is essential to develop and adopt a risk assessment process covering all steps in the design. R&D efforts are grouped into three categories:
1. design for safety, which includes structural damage robustness, damage stability, life saving equipment, and fire prevention and protection;
2. implementation of risk assessment processes, which includes: development of risk assessment methods, development of risk assessment tools, development of ship systems failure classification, and demonstration of prototype applications; and
3. safety in the production processes.

Environment Sustainability
The design of an environmentally friendly ship is a challenge. A solution has to be found for the effective combination of economic operation and environmental protection. Methods have to be developed to allow non-subjective evaluation of the impact of new design, procedures, and components on the environment. Areas of focus include:
1. limitation of operational pollution;
2. use of environmental friendly materials; and

3. development of environmental friendly ships.

New Vessels for New Shipping

Persistent growth in world trade and competitive pressures in shipping are the basis of a continuous development of new types of tonnage. Topics of especial interest include:

1. speed of ships;
2. new concepts for short sea shipping;
3. innovative concepts applied to sea/river vessels and to inland waterway vessels; and
4. new routes, with Northern navigation being a unique opportunity.

Maritime Logistics

Maritime transport services are not stand-alone activities. They are part of the logistic requirements and systems of international manufacturing and trade. The efficiency of maritime logistics is dictated by the quality in/of:

1. logistics management, which needs improvements in logistic modeling and hard- and software for communication and information technologies;
2. shipboard equipment and systems that include development and/or improvement of
   [1] integrated ship control systems,
   [2] robust sensors to support the extension of overhaul periods,
   [3] radar antennas,
   [4] development of new materials to enhance the life of machinery components,
   [5] improved mooring equipment, and
   [6] improved diesel-electric propulsion systems; and
3. ports and terminals R&D which focus on enhancing the intermodal linkup.

Exploitation of Marine Resources

The priorities in the second sector had one area of interest to SNAME: offshore production systems:

A. Extension of the Operative Life of Platforms and Subsea Systems

The significant modification in the design procedure of offshore structures and in the production activities together with the need of extending the operating life of some of the existing platforms call for the development of suitable procedures for the assessment of the residual operative life and for the inspection of such activities. Specific R&D focus areas include:

1. platforms and pipeline assessment and rehabilitation, and
2. rules and recommendations.

B. Platform Abandonment and Recycling

Oil companies are requested to remove all the offshore facilities at the end of their operative life. The emerging awareness on the need of protecting the marine environment from any form of pollution calls for the development and demonstration of suitable technologies and procedures. Projects aiming at developing decommissioning and removal technology should be pursued. Focus should be on:

1. design of platforms to ease their recycling,
2. decommissioning and removal of platform and pipeline, including cutting and cleaning technology,
3. recycling and environmental impact.

B. Arctic and Subarctic Technologies

1. production systems,
2. ice management procedures, and
3. loading of information technologies

C. Application of Information Technologies

Simulations are currently used in the offshore industry.

Increased focus is warranted in the areas of:

1. three-dimensional explosion simulation for damage minimization,
2. hull wave load stresses, and
3. design of robots and simulation of deep-water operations.

D. Other Areas

Other areas included in the master plan, but omitted from this presentation included:
marine renewable energies,

1. fisheries and aquaculture,
2. fresh water and marine mineral resources,
3. coastal zone management and sea space utilization.

EXAMPLES OF NATIONAL AND INDUSTRIAL ORGANIZATIONS PROGRAMS

A. Kvaerner AS of Norway

One of the most interesting national programs is the R3D program started by the Kvaerner organization of Norway in 1995, and which has supporting funds from the national governments of Norway, United Kingdom, Finland, and the European Union. The total investment is $77 million over a five-year period, starting in 1995. There are approximately 20 projects underway; they are spread throughout the Kvaerner organization, with additional technical support from owners, classification societies, vendors, and universities in the region. The listed projects are:

1. cruise vessels and ferries projects
2. high speed craft project
3. LNG project
4. LPG project
5. liquid cargo project
6. shuttle tanker project
7. chemical tanker project
8. reefer 2002 project
9. refrigeration systems project
10. unit cargo ships project
11. unit cargo logistics project
12. hull forms project
13. machinery arrangements project
14. materials and structures projects
15. water jets project
16. exhaust gas cleaning project
17. arctic operations project

B. United Kingdom

In 1997 United Kingdom's Office of Science and Technology completed a study of the marine sector's significance to the nation. The study, prepared by a panel of nationally recognized experts, highlighted the importance of science and technology for the continuing health of the sector, and made recommendations for R&D actions that should be taken. A number of generic research and technology areas were stated; the ones of interest to SNAME included the following:

1. design and system integration with life cycle cost optimization for ships and offshore construction;
2. digital information technology;
3. environmental impact assessment;
4. integrated electrical systems for high efficiency of marine vehicles and lower pollution products and techniques for marine vehicles;
5. intermodal marine transport systems;
6. material properties and adhesives [high strength, corrosion and fire resistant, lightweight, low cost, smart materials, coatings, and construction technology;
7. miniaturization and nanotechnology;
8. numerical modeling and simulation;
9. safety management and risk assessment methodologies;
10. subsea automation and robotics; and,
11. subsea communications.

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