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MARTEC

ERA-Net Maritime Technologies

Co-ordination Action

ERA-Net

Best practice manual

D3.3 on transnational project/programme dissemination

D3.4 for enhanced exploitation of R&D results

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Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Content

Executive summary

The ERA-NET MARTEC (2006 – 2010) is an EU funded project in the 6th Framework Programme. The MARTEC partnership consists of 12 partners and 4 observers from 12 European countries. The topics on dissemination and exploitation belong close together, so it is consistant to put together two reports. The aim of the report is to present some best practice examples for dissemination and exploitation of R&D results. Best Practice is considered by some as a business buzzword used to describe the process of developing and following a standard way of doing things that multiple organizations can use for management, policy, and especially software systems.

'Dissemination' was defined as a planned process of providing information on the results of projects to key actors and end users. It occurs as and when the results of projects become available.

'Exploitation' consists of 'mainstreaming' and 'multiplication'. Mainstreaming is the planned process of transferring the successful results of projects to appropriate decision-makers in regulated local, regional, national or European level. Multiplication is the planned process of convincing individual end-users to adopt and/or apply the results of projects.

Dissemination and exploitation are therefore distinct but closely related to one another. Consideration of the intervention logic for these activities revealed that the keys to successful dissemination and exploitation are:

- Producing relevant results from projects and programmes/initiatives to satisfy the demands of providers and policy-makers – and ultimately society and industry more generally; and
- Ensuring, through the use of effective dissemination and exploitation mechanisms, that such results reach the right target audiences in a format and at a time which enables them to benefit.

D3.3 Best practice manual on transnational project/programme dissemination

1 Recommendations for the dissemination and exploitation of RTD results

Dissemination and commercial exploitation of RTD results should be dealt with as follows:

- Commercial exploitation by the project consortium
- Dissemination to the ERA

1.1 Commercial exploitation by the project consortium

This can be split into three phases:

- Proposal phase
- Project phase
- Post-project phase

Proposal Phase

In order to increase the opportunity for the dissemination and commercial exploitation of RTD results, it is crucial that the projects are set up correctly from the beginning, i.e. before the project commences, or the contract has been signed, an appropriate exploitation plan has been prepared and agreed by all partners, including their rights and responsibilities.

Such an implementation plan was utilised during FP5, i.e. the Technological Implementation Plan (TIP). This provided information that most EU R&D contractors had to submit as contractual obligation at the end of their project. It described the results of the project and the plans that the partners had to use those results and to encourage others to use them. At the end of the process the information was formally submitted to the Commission Project Officer who checked it was adequate, and if so accepted it.

It is also important that the motivation of the consortium is appropriate to the objective of exploitation and dissemination. Experience in public sector funded projects has shown that some partners view the grant as income contributing to "cash flow", rather than to investment in the company. This can be very true of very small companies who may expend a significant amount of personnel resource on a research project, with little remaining to continue their normal business activities. It may also be the case that this future business activity is dependent on the satisfactory completion of the project, including payment, and that any delays in either may create significant problems for the continuance of the company.

One issue that constantly creates problems when one considers collaborative projects is protection of IPR, particularly for SMEs. It is important that SMEs are reassured that they do not lose rights to their "Background Knowledge" if they collaborate and, furthermore, are able to protect any novel ideas or solutions they bring to a proposal.

It is also important that university partners are committed to the project's industrially driven objectives, rather than inward-looking academic objectives. Their commitment to, and understanding of, the need to commercially exploit the results is crucial and their contribution to exploitation should be expressly stated in the proposal.

Project Phase

As a project progresses, many things can change. This can be within the project, e.g. technical advances are not as significant as expected, or conversely, greater than expected. There may also be external factors that impinge on the opportunities for exploitation. Such factors could include competitive technologies or alternatives, or even legislation that reduces or increases opportunities.

It is important; therefore, that the Exploitation & Dissemination Plan is updated as the project is underway.

Post-project Phase

It is crucial that the project partners are fully aware of their obligations to commercially exploit the results of the research, i.e. the research should be a "means to an end", not the end itself. For example, the FP7 Grant Agreement (Annexe II) requires:

Use

The beneficiaries shall use the foreground, which they own or ensure that it is used.

The beneficiaries shall report on the expected use to be made of foreground in the plan for the use and dissemination of foreground. The information must be sufficiently detailed to permit the Commission to carry out any related audit.

Dissemination

Each beneficiary shall ensure that the foreground of which it has ownership is disseminated as swiftly as possible. If it fails to do so, the Commission may disseminate that foreground.

Capability to exploit is also important. Although SMEs are perceived as major innovators and the source of many new ideas, many do not have the financial or technical resources to commercially exploit the results of the project, so it is important to ensure that either:

- Other partners have the rights to exploit the results of the research, subject to appropriate compensation to the SME who owns the IPR
- There is a plan to license commercial exploitation rights to third parties
- Financing is available to develop the production facilities of the SME

Regarding university and research institute partners, it is important that they have rights to disseminate non-commercially sensitive information and/or the rights to continue to develop or undertake research applying the results of the research, subject to there being no dilution or transfer of the industrial partners' IPR to third-parties.

1.3 Elements of an Effective Dissemination Plan

The dissemination planning should start at the beginning of the research activities, not at the end. While some details of the dissemination effort will be suggested in your original proposal and refined as you progress through the research, the dissemination plan goals and objectives should be clarified at the beginning of the research project in consultation with the project coordinator.

1. **Goals:** Determination and documentation of the goals of the dissemination effort for the proposed project.
2. **Objectives**: Association of each goal with one or more objectives that clarifies what is to accomplish through the dissemination activities.
3. **Users:** Description of the scope and characteristics of the "potential users" that the planned dissemination activities are designed to reach for each of the specific objectives.
4. **Content:** Identification of the basic elements of the projected content to disseminate to each of the potential user groups identified.
5. **Source(s):** Identify the primary source or sources that each potential user group is already tied into or most respects as an information source. Consider ways to partner with these sources in your dissemination efforts.
6. **Medium:** Description of the medium or media which the content of the message can be best delivered to the potential clientele and describes the capabilities and resources that will be required of potential clientele to access the content for each medium to be used.
7. **Success:** Description of the measurement of the success of the dissemination activities.
8. **Access:** Description of the promotion of the access to the research informations.
9. **Barriers:** Identification of potential barriers that may interfere with the targeted clients access of your information and develop actions to reduce these barriers.

Example tabular for planned Dissemination/ Timetable

Planned-/ actual dates	Type of dissemination activity	Type of audience	Countries addressed	Partner responsible/ involved	URL

Results and targets of project partners can be quite different. Each partner of a project has to write its own, specific dissemination plan. Scientific partners will publish the results in conferences and scientific journals. Industrial partners have to look to more professional publications and trade fairs.

Overview of dissemination mechanisms

Dissemination mechanisms are well established and wide-spread in use across the different programmes and initiatives. Paper publications, mailing lists, websites, on-line databases and CD-ROMs are particularly popular on all levels to disseminate products, methods and to a lesser extent policy lessons.

Paper publications

- Newsletter / Magazine: a printed report giving news or information of interest to a special group;
- Press Releases: an announcement of an event, performance, or other newsworthy item that is issued to the press;
- Articles in specialised press, local and national press;
- Brochure: a small booklet or pamphlet, often containing promotional material or product information;
- Compendium / Directory: a list or collection of various products or projects; and
- Summary Note: a summary of an extensive study or piece of research.

Mailing list (postal and electronic)

A strong point of using a mailing list (postal and electronic) is the fact that once a contact database is set up and running, mailing lists are very easy to maintain and update and only demand little time. Electronic mailing lists are obviously much more advantageous in use as they are much cheaper and faster than mailing by post.
Mailing lists (weaknesses) can prove counter-productive if they do not:

- include opt-in lists that people voluntarily subscribe to;
- enable people to easily subscribe and unsubscribe as members;
- limit the size of e-mail messages;
- prevent lists from becoming dormant by sending e-mails in set periods with updated information; and
- publicise their existence on any other material: publications and websites.

Website

The advantages of using a website to disseminate results are manifold:

- Access to the internet and its use is becoming increasingly wide-spread in the European Union and thus offers a great scope of reaching a large and diversified audience.
- Once a website has been set up, it is relatively cost-efficient in maintenance.
- All existing and newly developed paper format publications can be made available on the website through the download option. Thus, the managing authority does not need to spend time and money on the development of separate dissemination material to be put on the website.

Although there are many positive aspects to the wide set of websites in that the information they provide is accessible, useful and, in general, well received, on especially the Commission websites and many websites of the National Agencies or other intermediaries and project promoters, project results are often not clearly identified and described. When they are described, the explanation is often difficult to read by someone who is less familiar or unfamiliar with the specific programme because the language is unknown or because the project results are part of a large downloadable document.

Databases

The advantage of using a database to disseminate results is the fact that it is much less static than a paper format publication or a website. The option of a search engine allows the viewer to scan the database and search for results of their particular interest. Search options are in most cases organised by organisation type, geographical location, type of result and type of users. Strength of using a database to disseminate results is the fact that it has the potential to offer an overview of a very wide range of results, with the option of spanning multiple programmes and initiatives. This can be achieved by building one large database or by linking up several smaller ones.

An important weakness of using a database to disseminate results is the fact that it needs continually updating as it can become rapidly out of date. A scan of the available databases shows the existence of this weakness. Many current databases only cover several years or are delayed in being updated.

Audio-visual material

Audio-visual material includes all material that is both audible and visible, such as video, DVD and digitalized video on the internet. The use of such material is not yet common among Commission Units, National Agencies or other intermediaries and project promoters.

Prizes and awards

A common mechanism to bring a programme and its results to the attention of a large audience is through prizes or award for the most successful projects (or other activities). The prize or award is also intended to encourage project promoters to excel in their activities. Usually the prize or award is given out at a large European or national event.

1.3 Dissemination to the ERA

The existence of the WATERBORNE Technology Platform provides an ideal structure to disseminate results throughout the maritime community. WATERBORNE incorporates and represents all stakeholders involved in the waterborne value chain, including shipbuilders and repairers; systems and equipment manufacturers; ship operators; port operators; classification societies; and the research and academic communities. This representation takes place through the European associations of national associations, however, as referred to earlier, information does not always flow that far, and many individual companies, especially SMEs, are not as aware of WATERBORNE as is supposed. This is a matter for those individual associations, however, and there should be measures taken to improve communications within those existing networks, rather than create new dissemination channels.

Another dissemination route is through both the Member States directly; either through the MARTEC partners or through the WATERBORNE Mirror Group, where either that differs or where there is no MARTEC participation.

To assist dissemination throughout maritime networks, the following initiatives should be considered:

- One novel possibility could be that projects are allowed to include an actual "dissemination" task, allowing expenditure on such activities. Such eligible activities could include participation in trade exhibitions, presentations at conferences and publication of articles in appropriate journals.
- The MARTEC website should incorporate a section to provide information on ongoing and completed projects.
- Newsletters, providing Case Studies of ongoing projects
- The MARTEC project itself could arrange a number of centralised dissemination activities, e.g. participation in WATERBONE or other European maritime conferences, promoting MARTEC projects and outcomes

D3.4 Best practice manual for enhanced Exploitation of R&D results

2 Presentation of examples for the inter-relationships within the entire maritime industry supply chain

There are a number of “factors for success” for maritime technology projects. These include:

- The involvement of the whole maritime industry supply chain is crucial within a research programme, although it is not necessary to involve all actors in individual projects. These actors will range from equipment manufacturers all the way through to the logistic chain, interconnecting with other transport modes, incorporating naval architects and designers, shipyards, ship repair yards, ship operators, and port operators.
- Individual projects should involve elements of the supply chain, so that end users can apply the technology being developed, whether that is a shipyard, ship operator, or major subsystem manufacturer.
- The role of researchers, whether they are university or private institute based, should be to support industrial research, rather than drive it. However, it is also important that research projects should consider “technology push” as well as “market pull”. One of the disadvantages of only responding to the demands of end-users is that it can create short-term thinking and not encourage development of, what are now called, “destructive technologies”, particularly those from the IT sector, that can completely change thinking and potential solutions to traditional problems. An obvious example is the impact the Internet has had.

However, there can still be “Market barriers” to participation in these projects, for example:

- Due to the traditional supply chain, particularly in relation to the shipbuilding sector, there is a perception that customers are risk averse and new technologies will not be accepted.
- Because of the “political” and sometime “nationalistic” nature of the industry and a preference for working with the local or national supply chain, some “foreign” companies will not be able to gain access to some projects.
- There is a concern that if the Call for Proposals is over-subscribed and the success rate is low, then significant costs will incurred to for no benefit. This is particularly important for SMEs. It is important that applicants are not encouraged to incur excessive expenditure without a reasonable chance for success.
- Perceived bureaucracy is seen as an additional overhead in both cost and time for collaborative projects, and these are even more onerous for European projects. Consequently, many experienced participants are reluctant to submit their best ideas, due to the need to get products to market quickly. Actual submitted proposals are those that are either not time dependent or due to risk require external funding to make them viable. However, for some partners, particularly SMEs, the benefits of undertaking the project on the European scale outweigh the benefits to individual partners.

There are two further issues that have a greater effect on SME participation. The first relates to “cash flow” and the other to ownership and protection of “IPR”.

- Participation in European-scale projects can cause problems due to the period of time that can elapse between the initial proposal phase and the first payment of grant. This could be overcome to a certain extent if, like the European Commission, the rules of the national funding agency allows an advance payment.
- SMEs are reluctant to share information with larger companies, as they believe their ideas will be stolen. Ownership and protection of IPR is therefore important and can act a barrier to their participation in collaborative projects. As mentioned elsewhere, some education is required to reassure SMEs of the exact position regarding background information.

Examples of Projects Incorporating the Supply Chain

The following projects, supported under FP5 and FP6 provide examples of collaborative projects that incorporate aspects of the supply chain:

- BONDSHIP (Bonding of lightweight materials for cost effective production of high speed craft and passenger ships)

- PACSCAT (Partial Air Cushion Supported Catamaran)

- SAFETOW (Strategic Aid for Escort Tugs at Work)

- SEA-AHED (Simulation environment and advisory system for on-board help, and estimation of manoeuvring performance during design)

- SHIPMATES (SHIPrepair to MAintain Transport which is Environmentally Sustainable)

BONDSHIP (*Bonding of lightweight materials for cost effective production of high speed craft and passenger ships*)

BONDSHIP was a three-year, €4.6 m project funded under the FP5 Growth Programme. The project started on the 1st of April 2000 and was completed on 30th June 2003.

Objectives

The aim of BONDSHIP was to introduce adhesive bonding into shipbuilding as an industrial process for joining lightweight materials and make European shipyards more competitive by achieving considerable cost savings in the production and operation of more fuel-efficient passenger ships, ferries and high-speed craft. The wider use of adhesive bonding will also make positive contributions to the preservation and improvement of the quality of the environment as a significant reduction of welding slag is expected. It has been estimated that a medium size shipyard produces about 60 tons per year of welding slag, which is considered special waste for which a controlled disposal is required. The focus of the project was on aluminium-aluminium, aluminium-steel and aluminium-composite joints.

Project Description

The main project results are guidelines for design and modelling of joints, acceptance tests and criteria, test and inspection methods for joints, documented application cases and joint designs, material data, repair guidelines, documented production and assembly procedures and practical experience and skills from using adhesives in a shipyard.

Participants

Participant	Activity
Det Norske Veritas, Norway	Classification Society
VT Composite Technology Centre, UK	Shipyard
NDT solutions Ltd, UK (SME)	NDT Consultancy and Ultrasonic Instrumentation
University of Southampton, School of Engineering Sciences, UK	University
Alcan Mass Transportation Systems, Switzerland	Aluminium producer
Cetena, Italy	Ship research institute
DGA - CTA, France	Research institute
FiReCo, Norway	Engineering consultant for composite materials
Fincantieri S.p.A., Italy	Shipyard
Fraunhofer-Institut für Fertigungstechnik und Angewandte Materialforschung, Germany	Research centre for adhesive technology
Meyer Werft, Germany	Shipyard
Sika AG, Switzerland	Adhesive producer
Stena Rederi AB, Sweden	Ship operator

PACSCAT (Partial Air Cushion Supported Catamaran)

PACSCAT was a 30 month project funded under the FP5 GROWTH Programme, launched in December 2002, with a total cost of approximately €2 M.

Objective

The objective was to develop and evaluate a novel vessel concept for high-speed waterborne freight transportation, based on a Partial Air Cushion Support Catamaran. This would allow operation on inland waterways, particularly the Rhine and Danube, without the draught restrictions of conventional vessels.

Description

PACSCAT is based on a slender hull Partial Air Cushion Support Catamaran concept developed by maritime transportation consultants IMAA Ltd. The air cushion is contained between the sidehulls and end seals, and is generated by installed lift fans. The vessel was designed to operate on the Rhine and Danube rivers, utilising existing berthing/loading facilities. The draught and height can be optimised to cope with shallow conditions on both rivers and the bridge height limitations. At a design speed of around 20kt (37km/ hr), the vessel will be optimised to attract freight from road transport to rivers. The payload capacity will be in the order of 2000t, which is equivalent to around 60 truckloads.
The project was carried out in 8 main work packages (WPs) as follows:

- WP1 - Market assessment, exploring specific waterway logistics markets and wider replication markets
- WP2 - Specification of two initial river freighter vessels
- WP3 - Performance assessment of the vessels as specified, utilising advanced hydrodynamic analysis, model tank testing and large-scale open water testing
- WP4 - Operations assessment including risk assessment and human factors for PACSCAT craft operation, and definition of operating envelopes compliant with regulatory limits
- WP5 - Detailed design of initial PACSCAT river freighters in accordance with above outputs
- WP6 - Cost-effectiveness appraisal based on actual yard cost modelling for construction using WP5 outputs, and operating cost estimates resulting from WP3 and WP4 outputs
- WP7 - Commercialisation planning, to address initial introduction of PACSCAT and subsequent replication
- WP8 - Dissemination of PACSCAT achievements to a wide range of operators and other actors

Participants

The PACSCAT project was undertaken by a European consortium spanning the complete value chain from vessel designer to operator, and including interfaces with key regulatory authorities.

Participant	Activity
Marinetech South Ltd	Project Management
Independent Maritime Assessment Associates (IMAA) Ltd	Naval Architects / Designers
Avon Fabrications (Checkmate), UK	Composites manufacturer
CETEC Consultancy, UK	Engineering consultants
Shipbuilders & Shiprepairers Association, UK	Industry Association
The Institute of Shipping Economics & Logistics (ISL), Germany	Economists
Witt & Sohn, Germany	Equipment manufacturer
Wartsila Propulsion, Netherlands	Marine engine manufacturer
Germanischer Lloyd	Classification society
European Development Centre for Inland & Coastal Navigation (VBD), Germany	Research Centre
MDS Transmodal, UK/France	Transport consultants
Sovtransavto Deutschland, Germany	Shippers / freight forwarders
Maritime Simulation Rotterdam (MSR), Netherlands	Training centre

SAFETOW (Strategic Aid for Escort Tugs at Work)

SAFETOW was a 36 month FP6 project with a total cost of €2.24 m.

Objectives

The overall objective was to provide:

- Masters of vessels with tools to help them control their vessels if they become disabled and
- Masters of salvage and escort tugs with tools, which will enable them to take decisions in real-time with the best available information regarding the consequence of their actions.

The project encompassed an experimental programme, which would collect the manoeuvring data, including collaborative manoeuvring with more than one tug. This data was then analysed and used as a basis of validation for the simulation software. The software was then integrated with the vessels' bridge systems to provide real-time help and decision support, training capability and monitoring.

Project Description

SAFETOW built on innovative technologies to develop parameterisable modular solutions for:

- A Manoeuvring Aid
- A Towing Aid
- A Lines Monitor
- An on-board Manoeuvring Simulator
- An on-board Towing Simulator

The Manoeuvring Aid is aimed at tankers. It will advise the disabled ship on the likely results of any manoeuvre (or lack of). Even when a ship is disabled there are a few actions available to it, which will have an effect on the way it is drifting. Such actions may include operating the engine (forward or astern), the deployment of the anchor or of a sea anchor or using a small tug or the help of a nearby ship. In some cases, even a few degrees of change in the tracking head, provided they are taken in good time, are all that is necessary to avoid a headland or a dangerous obstruction (e.g. an oil rig). It is however essential to forecast accurately the consequences of any such action to be sure of taking the appropriate decision. The manoeuvring model will have information about the drift characteristics of the ship, its load condition, tides, currents, wind conditions etc and it will be able to predict the drift mode (tracking head and speed) accurately. It will also make suggestions about the most advisable course of action. Finally it will be possible to run this manoeuvring model as an on-board Manoeuvring Simulator for training and for the purpose of gathering data about the drift characteristics of the ship.

The Towing Aid is aimed at escort and salvage tugs. It will have a full model of the tug plus configurable and easily parametrisable models of the towed vessel and other involved tugs. This will allow the manoeuvring model of the whole tugs plus disabled tanker system to be put together in real time out of pre-existing models and a few basic parameters: size of vessels, load, etc. (Of course, should the tanker and the other tugs be deploying a SAFETOW system, the accurate manoeuvring models for the tanker and other tugs will simply be downloaded. However, we shall not depend on the general availability of such models.)

The software will also be parametrisable to allow the assembly of manoeuvring models for specific tugs and configurations of control equipment (thruster, propellers, rudders etc). It will be modular to allow for the inclusion or exclusion of any data that is available. For example, up to date detailed information may or may not be available for the towed vessel in question, so the system will be able to use the information if it is available and not if it is not.
The towing model can also be used as on-board Towing Simulator for on-board training and for exploring what-if scenarios in advance of engaging a tow. The Lines Monitor will assist the tug crews in determining whether the towing equipment is being stressed, which is usually a sign of problems in the towing configuration. The accuracy of these models will depend to a great extent on the quality of the data. To collect high quality data we will run an Experimental Program. To do that will require a clear idea of the Accident Scenarios to cover.

Participants

Participant	**Activity**
BMT Ltd	Salvage association and supplier of manoeuvring simulators
The Salvage Association	Naval Architects / Designers
Gijon Port Authority	Port authority
Smit Salvage	Salvage company
ATLAS Marine Electronics	Equipment manufacturer
Bureau Veritas	Classification Society
University of Glasgow and Strathclyde	University

SEA-AHED (Simulation environment and advisory system for on-board help, and estimation of manoeuvering performance during design)

SEA-AHED was a 39 month FP5 project, launched in January 2001 with a total cost of €3.4m.

Objectives

- Creation of systems that will enable shipyards and shipowners to assess the manoeuvring characteristics of vessels at an early stage of design,
- Development of a navigational aid displaying in real-time the vessels current position together with future predicted or simulated positions and capable of advising the pilot of potential hazards.
- Development of a manoeuvring training aid that will allow crews to replay previous manoeuvres and demonstrate the effects of alternate actions on the basis of real environmental information.

Project Description

This project proposed to produce a system that could more accurately predict the course of cruise ships than any current commercial product, by considering the non-linear and time-varying manoeuvring characteristics of the vessel, taking account of wind speed, wind direction, water depth, currents, actual rudder angles, demanded rudder angles, thruster performances, etc. Current state-of-the-art systems generally relied on constant rate models that do not provide the accuracy necessary for safe operation. The system would exploit very recent advances in aerospace and robotics applications using a technique called the Julier-Ulhmann filter.
It is claimed by the consortium that, for the non-linear models under consideration, this far outperforms the industry standard extended Kalman Filter, as the manoeuvring characteristics of vessels are automatically updated.

Participants

Participant	Business activity
BMT, UK	Software Developer
Atlas Marine Elektronik, Germany	Maritime Equipment Manufacturer and Supplier
Cetena, Italy	Software Development
Fincanteiri, Italy	Ship Builder
P&O Cruises, UK	Cruise Ship Operator
Warsaw University of Technology	Education/Research/Consulting

SHIPMATES (SHIPrepair to MAintain Transport which is environmentally Sustainable)

SHIPMATES was a three year FP6 project, commencing early in 2004, with an estimated cost of €4,302,000.

Objectives

The objective was to provide a blueprint for a technologically advanced and environmentally friendly shiprepair/conversion yard, with a target of a 20% productivity improvement over today's European yards.

Project Description

The project methodology was designed to provide a clear understanding of best practice in the ship repair sector and to map and to simulate the range of repair and conversion yard activities, with the exception of the painting and coating range of activities.

The project comprised four Work Packages that ran simultaneously:

- Improve the steel cutting and joining processes relevant to repair yards;
- Advancing the processes of repair and replacement of cabling and pipework; and
- Establishing a controlled process for converting/retrofitting ships in order to make operation more environmentally friendly;
- Exploring ship breaking and recycling as an alternative market.

The totality of the work was devoted to devising ways in which ship repair and conversion can be carried out in Europe in a safe, environmentally friendly and economically efficient way.

Participants

Participant	Activity
A&P Group, UK	Ship repair, ship conversion
CETENA, Italy	Research & Development Centre
Fincantieri, Italy	Ship repair, ship conversion
Estaleiros Navais de Viana do Castelo, Portugal	Ship repair, ship conversion
Lisnave Estaleiros Navais, Portugal	Ship repair, ship conversion
Choren Design & Consulting, Poland	Design, Conversion Consultants
BERTECH, Poland	Consultants
Instituto Superieur Tecnico (IST), Portugal	University
Patras University (Laboratory for Manufacturing Systems), Greece	University
Hertfordshire University, UK	University
Newcastle University, UK	University

3 Recommendations for quality criteria and generic measures to support improved and enhanced exploitation of R&D

In order to undertake this task we looked at a number of similar and relevant Programmes to assess what quality criteria and generic measures were applied to support improved and enhanced exploitation of R&D. The main programmes considered were:

- FP6 Sustainable Surface Transport
- FP7 Transport
- UK Technology Programme

3.1 FP6 Sustainable Surface Transport

The Evaluation Criteria (Ref: Guidance Note for Evaluators) developed a number of criteria, however, in relation to exploitation, the measures were as follows:

Criterion Potential Impact

- The extent to which the proposed project is suitably ambitious in terms of its strategic impact on reinforcing competitiveness (including that of SMEs) or on solving societal problems.

- The extent to which the innovation-related activities and exploitation and/or dissemination plans are adequate to ensure optimal use of the project results.

- The extent to which the proposal demonstrates a clear added value in carrying out the work at European level and takes account of research activities at national level and under European initiatives (e.g. Eureka).

3.3 FP7 Sustainable Surface Transport

In FP7, the third of the three Evaluation Criteria (Ref: Guide for Applicants), is:
Impact - “Potential impact through the development, dissemination and use of project results”
Contribution, at the European and/or international level, to the expected impacts listed in the work programme under the relevant topic/activity
Appropriateness of measures for the dissemination and/or exploitation of project results, and management of intellectual property.

The information required of proposers in proposal Form B, includes

Impact
Expected impacts listed in the work programme
- Describe how your project will contribute towards the expected impacts listed in the work programme in relation to the topic or topics in question.

- Mention the steps that will be needed to bring about these impacts. Explain why this contribution requires a European (rather than a national or local) approach. Indicate how account is taken of other national or international research activities.
- Mention any assumptions and external factors that may determine whether the impacts will be achieved.

Dissemination and/or exploitation of project results, and management of intellectual property

Describe the measures you propose for the dissemination and/or exploitation of project results, and the management of knowledge, of intellectual property.

The criterion in FP7 went much further than FP6, because the Work Programme explicitly states what "impacts" the topics, and therefore projects, need to achieve. This means that FP7 is top-down, unlike MARTEC, which covers a much wider set of objectives and marine sectors and consequently is more flexible and is bottom-up. Therefore, it is important to provide more guidance to both applicants and evaluators with regards to the criteria for exploitation and dissemination. An example of this is the UK Technology Programme:

3.3 UK Technology Programme

The UK Technology Programme is nationally funded and supports collaborative projects of the type that would be funded within MARTEC, and would be the criteria applied if UK organisations sought funding under MARTEC or EUREKA.

The Guidance for Applicants for the Spring 2007 Competition for Funding for Collaborative Research & Development Projects required applicants to consider the following:

Criterion: The size of the market opportunity

1. Applicants should describe the size of the market opportunities that this project might open up including details of:

- the current nature of the specific market(s) at which the project is targeted (e.g. is it characterised by price competition amongst commoditised suppliers, dominance by a single leading firm etc.);
- the dynamics of this market;
- the projected scale of the market (including details on the robustness of this projection);
- the potential to create value added for the UK and/or the European Economic Area (EEA).

2. What are the possible applications of this project and how do you intend to disseminate and exploit the results? What Intellectual Property (IP) will be generated and how will this be identified and managed?

- Applicants should demonstrate the potential for commercial exploitation of the project, e.g. possible applications, markets, processes or products, and their arrangements for disseminating and exploiting the results of the project including identifying and exploiting any IP.
- Applicants should include any methods of exploitation / protection, e.g. patents, trade secrets, being first to market etc. Applicants should also identify whether exploitation potential exists if the project is not completed, i.e. part use of the results.
- In evaluating this the assessors will also consider the following questions:
    - **Basic Research.** Have the applicants identified **many** potential applications to a **range** of markets, processes or products? Does the consortium have good arrangements for identifying and exploiting potential applications?
    - **Applied Research.** Have the applicants identified a **limited** range of applications focusing on specific markets and market opportunities, together with remaining technological integration issues?
    - **Experimental Development.** Have the applicants identified the clear use and commercial exploitation of the project's results, together with **clear routes** to market based on product, process or service developments?

3. What are the expected quantified commercial benefits and what is the timescale over which these will be realized?

- Applicants should identify, and where possible quantify, the expected commercial benefits to each of the consortium partners, making it clear where the risk factors need to be applied. The timeframe over which these benefits are achievable will vary according to the stage of the research, and the assessors will expect the timescales identified to be credible.
- The level of detail to be provided by the applicants is expected to vary according to the stage of the research as follows:
    - **Basic Research.** Identify how the project will produce a broad base of knowledge that will generate commercial benefits.
    - **Applied Research.** Identify the balance of commercial costs and benefits.
    - **Experimental Development.** Quantify the market potential of the project, including economic returns and profitability including a realistic Net Present Value (NPV).

4. Applicants should also explicitly identify any sustainability benefits expected to accrue to any of the consortium partners. Sustainable development balances economic growth with the protection of the environmental and social impacts. In detailing the potential sustainability benefits to the consortium partners, applicants should consider the following questions:

- Is it anticipated that the project will improve the energy efficiency of any of the consortium partners, whether in terms of the production process, distribution etc.?
- Will the project lead to a reduction in the waste generated by any of the consortium partners?
- Will the project lead to lower use of inputs to production, lower scrap rates etc. by any of the consortium partners?

Criterion: Potential impact and timescale

5. What economic and sustainability benefits is the project expected to deliver to those outside the consortium and over what timescale?

- Applicants should identify any economic and sustainability benefits that are expected to accrue to those outside the consortium.
- In terms of economic benefits, applicants should highlight any expected "spill-over" benefits external to the project, e.g. benefits to users (intermediaries and end users), suppliers, industrial markets and the UK. The application should identify and quantify where possible the benefit to each of the beneficiaries, making it clear where the risk factors need to be applied.
- Sustainable development balances economic growth with the protection of the environmental and social impacts. Applicants should identify any expected social impacts, either positive or negative, on, for example, the quality of life, social inclusion / exclusion, health and safety, diversity, and any expected impact on Government priorities such as transport congestion and healthcare.
- In detailing potential environmental benefits, projects should consider the following:
  - What are the potential environmental impacts of undertaking the project on those outside the consortium, and how significant are they relative to the economic benefits? Detail the full range of potential environmental benefits such as increased energy efficiency, reduced waste generation, increased product life, increased suitability for re-use or recycling, reduced potential for environmental harm at the end of the product's life etc.;
  - If the project is likely to have any negative environmental impacts, assessors will expect to see these identified, together with credible plans to mitigate negative impacts.

We also considered the WATERBORNE Strategic Research Agenda Implementation Plan.

3.4 WATERBORNE Strategic Research Agenda Implementation Plan

The Implementation Plan presents a list of research priorities and sub-priorities that needed a Route Map to deliver an Implementation Plan. A Technology Impact Evaluation was initially carried out to help prepare a structure for a Route Map and Implementation Plan by:

- Ranking research topics
- Identifying potential exploitation outcomes
- Identifying programmes that contribute to a common vision goal

A Technology Impact Evaluation was undertaken to identify the greatest added value research activities.

Stage 1 – Each research agenda topic was mapped on to each vision objective in terms of a high, medium or low impact

Stage 2 – The size of the research challenge in terms of Rough Order of Magnitude (ROM) cost and timescale is estimated.

Stage 3 – Research Topics were then proposed to deliver the greatest added value

The research topics were then developed by the Waterborne stakeholders to address the WSRA priorities and industry research needs are presented in the following format:

- Waterborne Pillar
- Strategic Research Agenda Priority
- Research Topic
- Research Objectives
- Research Programme
- Pre-requisites
- Research timescales
- Budget estimates
- Technology, Tools and Processes
- Expected research Outcomes & Milestones

The Exploitation Outcomes that deliver the Vision Targets were developed from a series of workshops that addressed each Waterborne pillar individually. The Research Topics define the objectives and work scope content against the SRA research priorities and deliver robust research outcomes for Route Map milestones. The milestones identify the major achievements that the research programmes will deliver in 5 to 15 year timescales, and combine to create substantial new world leading products and capability.
If MARTEC does apply the WSRA IP as one input to the Calls for Proposals, then in those top-down situations, a target or objective that can guide both applicants and evaluators already exists.
In order to increase innovation impacts of programs and exploitation of RTD results, the following support measures for trans-national cooperative (as well as pure national) programs and other joint activities should be considered:

Pre-proposal Stage

1. Where possible, set out the quantitative outcomes, objectives or targets that the Call for Proposal is setting out to achieve. This can be project based, i.e. increase in productivity/reduction of emissions, or in terms of wider benefits, e.g. competitiveness, environmental impact, etc.
2. Ensure that SMEs, in particular, are aware of the IPR ownership issues in order that their participation is not limited by misconceptions, e.g. that they will need to give away their background knowledge, or that the funding agencies will own the IPR in exchange for support.

Proposal Preparation

1. In the Guidance Notes for applicants, be very explicit about the information required in relation to impact, commercial exploitation and dissemination. The UK Technology Programme Guidance Notes are an example.
2. The information should be provided as an Exploitation & Dissemination Plan (see below) that is to be updated during the project and at the Final Report stage.

Evaluation

Evaluators should include persons experienced in sales & marketing and business development, as well as those with technical expertise.

Negotiation

Agreement to the Exploitation & Dissemination Plan by the national funding agencies should be as important as the assessment of eligible costs.

Project Phase

The Exploitation & Dissemination Plan should form one of the Work Packages and be updated as information becomes available, either from within the project or externally.
This Work Package should continue for 12 months after the technical work packages are complete, allowing a contribution to the costs of participation in trade exhibitions, presentations at conferences and publication of articles in appropriate journals

Post-project Phase

It is important that the project partners are fully aware of their obligations to commercially exploit the results of the research within a reasonable period. A suitable clause should be inserted in the grant agreement.

Exploitation & Dissemination Plan

The content of the Exploitation & Dissemination Plan should include the following:

- Description of the supply chain and how the results will be of benefit
- Applications of research results
- Projected scale of market opportunity and timescale of market entry
- Competitive technologies and companies
- What IPR will be produced?
- Who will own the IPR?
- How will the IPR be protected?
- What will happen if the project is only partially successful?
- What are the expected commercial benefits to each of the consortium partners?
- Do the partners have a business/marketing plan to exploit the results?
- What are the commercial risks?
- How will the results be disseminated?
- What economic or other benefits will the project be expected to deliver to those outside the consortium and over what timescale?

4 Creation and extrapolation of exploitation plans

The German handbook (BMBF) of project management includes basic structures for the creation and extrapolation of exploitation plans.
Every partner of a cooperative project has to establish an exploitation plan already during the application phase. The partners have to have in mind also the project cross linking. Partners are responsible for content and time table of exploitation plans. These plans should be updated during the runtime of the project every six month or at least once a year. Exploitation plans should include general time horizons. First prognoses and estimations can be made in the beginning of the project. Estimations should be done on a flexible basis during the runtime of the project. Concreter results (milestones) can be forecasted in the end of the project. Exploitation of research results should be realized in Germany.

Evaluation regarding economic exploitation success:
- Creation of new markets as well as protection of existing markets
- Security of employment and creation of new jobs
- Preparation of market potentials
- Increase of return and turnover
- Creation of efficient company structures
- Improvement of competitive situation
- Increase in efficiency of value added chain
- Sustainable economisation
- Improvement of social structures and infrastructure
- Sustainability
- Improvement of living conditions of certain target groups
- Increase of employability
- Personal and organisational development
- Interlocking of research and functional technologies
- Advantages against competitive solutions
- Benefit for different user groups

Scientific and/or technical exploitation success:
- Creation of know-how to preserve competence
- Increase of scientific competitiveness
- Development of application potential
- Transfer to user groups
- Support of young scientists
- Simplified access to information resources
- Value for open tasks, databases, networks and transfer organisations
- Improved cooperation of companies, networks, research organisations

Scientific and economic connectivity regarding exploitation:
- Follow up projects
- Perpetuation of institutions
- Creation and dissemination of know how
- Establishment of contacts to potential user groups in different subjects

Instruments of exploitation:

- Patents, property rights, licences, copyrights
- Use of technology-transfer agencies
- Use of multipliers
- Business plans
- Spin-offs
- Publications
- Dissemination of results
- Perpetuation of results
- Consultation services
- Internet presence
- Information material
- Involvement of stakeholders
- Conferences
- Drafts for legislative procedures
- Legislative annotations
- Drafts for regulations
- Procedure models
- Sketches for project user guides or guidelines
- Networking creation
- Exhibition presentation
- User conferences
- ….

Check-up criteria:

- Type of patent (international, EU, national)
- State of the art within an innovation chain
- Reports
- Market analysis
- Use of exploitation agencies
- Special public interest in exploitation
- Proof of exploitation
- Quantity of members in a network
- Reports of network activities
- Dissemination and integration of results to user groups
- Were and how was publicised?
- Influence of results to regulations
- Impact to national or international standards
- Innovation grade
- Originality
- Application range
- ….

Co-operation with policy makers and other stakeholders

Co-operation of the National Agencies and other intermediaries and project promoters with a wide range of stakeholders – policy decision-makers, practitioners and others – is crucial in all stages of a project and to ensure proper programme management, but is even more critical in the stage of exploitation of project results. Only through co-operation is it possible for project results to be of any influence to

change mainstream practice and mainstream policy. It is important to note here that co-operation does not always lead to the exploitation of results. This is very much depending on the role, involvement and interest of the different interested parties.

Organisation of events

One of the most frequently mentioned mechanisms to exploit project results and used by all levels concerns the organization of events (European events, Theme-related events, National events). The use varies greatly in type, scope, audience and underlying objectives. Many different types of events exist. The most often used ones are the following:

- Conference - a meeting for consultation or discussion
- Seminar - a meeting for an exchange of ideas, most often smaller than a conference
- Workshop - an educational seminar or series of meetings emphasizing interaction and exchange of information among a usually small number of participants
- Debate – an event where participants are engaged in a formal discussion or argument
- Round table discussion – same as a debate but often in a smaller group
- Soirée – an evening party or reception
- Showcasing – an event to display project results

The most common problems with events only having a limited or even no impact are the following:

- Unclear aim and objectives of the event for both the organizing agency and the audience – make sure these are clear from the outset.
- Invitation of the wrong audience - often organizers are so focused on assuring a large audience, that they do not keep an eye on targeting.
- Wrong event type for the aim and objectives - ensure that the event type fits with your objectives.
- Not enough media attention - make sure the press and other agencies are aware of the event and its objectives.
- Wrong event location - it is for example important that enough “standing” space is created for networking events, while for an event focusing on policy impact smaller rooms where different debates can be held are more useful.
- Lack of preparation of presenters - often presenters are contacted to hold a presentation, but are not properly briefed about the objective of the event organizers. Consequently they focus too much on “their own objective” which might not be useful for the purpose of the event and does not help others to understand how the results might be applied in their own context.
- Lack of agenda setting - it is widely known that especially during debates and discussions, agenda items are dropped because of lack of time. It is important to have a good chairman that can keep a grip during debates and discussions.
- Lack of creativity & outlining - often events are organized following a traditional outline focusing too heavily on long presentations. It is important that the audience remains interested by organizing a good outline with space for creativity.
- Lack of “agenda gaps” like coffee and tea breaks and evenings - these should not be underestimated. Especially with respect to building new network linkages and the sharing of best practice, these “gaps” can create a great impact. When

an event organiser is interested in including local/national business stakeholders it is especially important to include the late afternoon and evenings in the event. Local/national employers often do not have time during the day to attend conferences, but are often motivated to come to for example network drinks in the early afternoon, dinners or other evening events.

A problem often recognized by event organizers and delegates is the fact hat very often the same audience is present at these different events. Dissemination and exploitation within the same circle restricts impact. Consequently, it is important that more attention is given to attracting a new audience. This can be established in many ways, but can be time consuming.

Special calls and actions for dissemination and exploitation
Special calls and actions for dissemination and exploitation do not lead directly to dissemination and exploitation, but build a framework that makes dissemination and exploitation of project results possible.

Discussion forums
A discussion forum can be established through regular meetings in person, but can also be set up and run on the web.

Making project results sustainable
Ensuring that project results are sustained, kept in existence, is important to facilitate a wider use of project results and eventually the tailoring, transferring and implementation of project results in mainstream policy and practise. Sustainability can be pursued through two steps:

- Raising awareness of the results to policy makers, providers, practitioners and other stakeholders.
- Undertaking of direct action to sustain results

Project promoters are in the position to sustain their results by keeping them available on their website, by motivating a wider set of users to use their results or for example by seeking accreditation of their project results where it concerns training or education material.

Transfer of results to new contexts
Transfer of results maximises good practice because it extends or exploits existing results into new contexts. Three steps can be identified that lead to the transfer of results:

- Raising awareness of the results to policy makers, providers, practitioners and other stakeholders.
- Actual extension or transfer of results to other contexts.
- Agreements with other organisations or authorities for delivery of results with refocusing to suit local conditions and the needs of potential end users.

Commercialisation of project results
Commercialisation can only truly be pursued by the project promoters. The Commission Units and the National Agencies can assist in the process but cannot undertake much further steps. At present, many project promoters under all programmes and initiatives undertake an effort to commercialise, where possible,

their project results. However, the scale of commercialisation by project promoters under the current programmes is limited.

Accreditation of periods of mobility

For the beneficiary of a period of mobility, the main result is an experience. This may encompass personal development, new or improved skills, greater confidence, enhanced language skills etc. Whilst these are valuable in their own right, they may not be immediately recognisable to an employer or to another learning provider to which the individual may apply for a further course of learning, particularly one in a different country.

Many factors need to be taken into account during choosing and setting up dissemination and exploitation mechanisms:

- Type of programme
- Type of results
- Type of end user (audience)
- The objective for dissemination and exploitation
- The expertise on a certain practice
- Budget available
- Time schedule
- Available staff

5 Guidelines for enhanced exploitation of R&D results[1]

- **Website use – for the majority of the websites insufficient consideration is given to who the end user is. A good way to deal with this issue is by adding a practical header on the website which indicates which pages are interesting for which end user (applicant, project promoter, policy maker, delivery Organisations, associations, practitioners, other).**

- **Audio-visual – intangible results like experiences, for example, are better caught on audio-visual materials like DVDs rather than on paper or online.**

- **Events – events are very often used to disseminate, but to a lesser extent used for the objective to exploit. The impact will be small when the audience is not kept interested and/or informed after the event through the organisation of a follow-up action. This could be in the shape of summary notes, action plans, the set up of discussion groups, the use of a new contact person, etc.**

- **Events – It is important to understand what makes a mechanism to disseminate or exploit a success. Events in a particular field can tend to attract the same limited audience. Commission guidance on events should stress the importance of varying the audience by attracting new people with a fresh perspective and interest in the results. This can, of course, be demanding in terms of time and resources.**

- **Product database – databases should ensure a linkage or a technical connection between one product database and other related databases.**

- **Product database – databases require regular updating. Where possible, project promoters should be encouraged and/or required to take responsibility for adding their project to the database and updating the information regularly.**

- **Committees – an efficient way to disseminate and exploit results is by using the networking opportunities offered by committees.**
  Committees can be used much more proactively by debating with them a work plan to disseminate and exploit and to see how their networks can be used.

- **Separate call – Programmes and initiatives have different characteristics and some programme results are more challenging to disseminate and exploit than others. For intangible results a solution is to focus on the organisation of a separate call or action to disseminate and exploit.**

[1] A Final Report to the Directorate-General for Education and Culture (DGEAC) of the European Commission

Table 15. Rearranged Evaluation Indicators for National R&D Programs in Korea

	Category	Indicator
Quality	Performance	Q1. Performance and its effect Q2. Quality of R&D enough to achieve program goal
	Goal Achievement	Q3. *Extent of goal achievement in terms of duration, cost, performance* Q4. Degree of achievement against the projected tangible outcome Q5. Degree of achievement against the projected technological goal Q6. Other tangible and intangible outcomes
Relevance	Marketability	R1. Commercialization of developed technologies and/or establishment of new firm R2. Market size, export effect, and/or Market forecast of commercialized technologies R3. Feasibility of developed technologies for other fields or for venture Market
	Adaptability to Environmental Change	R4. Adaptability of current program to expected changes in government role or function R5. Adaptability of current program to environmental changes R6. Program structure that can adapt to future environmental changes R7. Existence of clearly defined customer groups
	Future Technological Demand	R8. Technological validity of current program against technology forecast R9. Economic validity of current program against Market forecast R10. Necessity of program adjustment
	Socio-Economic Impact	R11. *Cost/Benefit Analysis of developed technologies* R12. *Techno-Economic effects when terminated or reduced* R13. *Provision of proper solutions to its technological, economic, and social problems* R14. *Technological or Economic effects of program reduction or suspension*
Leadership		L1. *Appropriateness of technological goals compared to those of competitors*
Infrastructure	Large User Facility	
	Infrastructural Facility	
M&O	Program Management	M1. Management which is rational enough to achieve the projected goals M2. Appropriateness of resource size and allocation M3. Appropriateness of program size, structure, and organization M4. Appropriateness of program management to its R&D environment M5. Account of plausible risks in the process of management
	Program Operations	M6. Feasibility of projected technological goal M7. Appropriateness of budget size M8. Appropriateness of program duration M9. Effectiveness of physical and human resources M10. Interim evaluation or frequency of evaluation M11. Program adjustment M12. Program structure and strategy
	Strategy	M13. Appropriateness of technology import rather than development M14. Appropriateness of program changes in terms of direction, subject, duration, or size

* This table is the rearrangement of Table 1 (Lee, 2000).

Table 16. Summary of Evaluation Indicators in Office of Science, DOE, US

	Research Support	Laboratory M&O	Scientific User Facilities	Construction	Infrastructure
Quality	Q1. technical/scientific merit Q2. technical soundness and feasibility Q3. appropriateness of method or approach Q4. performance competency of researcher Q5. cost reasonableness and realism	Q1. research quality Q2. research performance Q3. Environment, Safety and Health (ES&H)			
Relevance	R1. relevance to SC's missions R2. consistency with program funding priorities R3. educational benefits	R1. relevance to mission	R1. furthered the Department missions R2. manage facilities to meet their goals R3. effectiveness of user facility research programs R4. benefits of facilities R5. scientific and technological demand R6. user demand R7. scientific impact R8. impacts of the shutdown R9. trained students	R1. Lehman Reviews R2. Project conformance to mission needs	R1. stakeholder relations R2. availability of funding sources R3. allocations in support of landlord activities R4. overall effectiveness of the implementation of landlord responsibilities R5. whether unfunded risks are acceptable
Leadership	L1. national and international standing of the portfolio elements L2. program policy and priorities L3. breadth and depth of portfolio elements	L1. corporate involvement & oversight			

	Research Support	Laboratory M&O	Scientific User Facilities	Construction	Infrastructure
	L4. appropriate balance among the program areas L5. future directions and opportunities				
Infrastructure		I1. research facilities I2. human resources I3. training I4. diversity I5. personal property I6. communications and trust	I1. service to users I2. user satisfaction on facility operations I3. user satisfaction on schedule or service I4. user satisfaction on facility performance I5. user satisfaction on facility staff I6. user satisfaction of access to unique capabilities I7. user satisfaction of facilitated collaborative interactions I8. user satisfaction on training and safety procedures I9. user recommendation on facility operations I10. long-range planning for all the facilities I11. need for new facilities I12. vision of the future I13. expected future capability I14. visions accommodate potential changes I15. capabilities complement one another		I1. 'Landlord Lehman Review' I2. infrastructure management and planning I3. human Resources I4. high quality federal staffs I5. federal workforce in the field I6. educational human resource development I7. appropriateness of position descriptions I8. annual performance appraisals on all workforce I9. diverse workforce I10. Facility Condition Index (FCI) I11. evaluation of improvements

	Research Support	Laboratory M&O	Scientific User Facilities	Construction	Infrastructure
			I16. funding priorities I17. appropriate level of R&D funding for continuous improvement of current facility operations I18. level of investment on facilities		
M&O	M1. completeness M2. duplication/overlap M3. availability of sufficient funds	M1. effectiveness and efficiency of research program management M2. Environment, Safety and Health (ES&H) M3. environmental performance & awareness	M1. average operational downtime below 10% of schedule M2. construction and upgrades within 10% of schedule and budget M3. user demographics	M1. technical work scope documentation M2. cost estimates: level of detail, basis, risks, contingency planning, funding/ obligations/cost plans, integration with schedules, overhead rates, material and labor quantities and rates/quotes, life cycle costs M3. schedules: level of detail, activity and logic assumptions, risks, contingency planning, integration with cost estimates, activity logic alignment with technical-scope planning, resource planning	M1. Environment, Safety & Health (ES&H) M2. energy efficiency M3. waste management

	Research Support	Laboratory M&O	Scientific User Facilities	Construction	Infrastructure
	M4. reasonableness and appropriateness of budget	M4. waste minimization/ pollution Prevention	M4. facility budget and operations data	M4. business management: management organization, staffing, work assignment process, project management control systems, risk management, baseline and technical work management, quality management, and ES&H/NEPA compliance.	M4. integrated safeguards and security
	M5. efficacy and quality of the processes	M5. safeguards & security	M5. laboratory management	M5. Recommendations and action items from previous reviews	M5. safeguards and security
	M6. how the process for these reviews might be improved	M6. integrated safety management	M6. ES&H	M6. Procurement Strategy	M6. incidents of safeguards and security concerns
	M7. how the award process has affected	M7. Injury Cost Index (ICI)	M7. cyber and other security activities	M7. ES&H	M7. site security plan
	M8. effects on science programs	M8. total recordable case/ lost workday case rates	M8. quality of operations		M8. nuclear materials accounting system
	M9. methods for performance measurement	M9. financial management	M9. technical		M9. nuclear material control program
	M10. appropriateness and comprehensiveness of evaluation methods	M10. procurement	M10. cost		M10. protection of DOE property and security interests
	M11. integration of performance measures with the budget process	M11. scientific & technical Information	M11. schedule		M11. accurate vulnerability assessments
		M12. information management			M12. cyber security
		M13. technology transfer			M13. comprehensive cyber security program

	Research Support	Laboratory M&O	Scientific User Facilities	Construction	Infrastructure
					M14. training cyber-security personnel M15. Facilities Information Management System (FIMS) database M16. office space utilization M17. requirements for unclassified visits and assignments by foreign nationals

Table 17. Summary of Evaluation Indicators in Framework Programme, EU

	Annual Monitoring	Five-Year Assessment
Quality	Q1. overall progress as regards the major objectives Q2. progress and output of projects against the original targets set	Q1. Framework achievements Q2. major achievements Q3. performance of FP3&4
Relevance	R1. extent to which selected projects or clusters of projects fulfill the wider policy objectives of the EU	R1. relevance (whether the initial objectives are still valid against new S&T developments and socio-economic conditions)
	R2. consistency of the selection of projects with the initial objectives and the work programme	R2. effectiveness (whether the initial objectives have been achieved)
	R3. progress in ERA and the Lisbon Strategy	R3. coherence between the Community and national S&T policies with a view to enhancing their mutual consistency
	R4. Lisbon Strategy and the International Context	R4. coordination with other international S&T policies or programmes
	R5. contribution to enlargement	R5. focus and appropriateness
	R6. participation of SMEs	R6. harmonious and widespread development
	R7. women and science	R7. international cooperation
	R8. supporting the development of EU policies and instruments	R8. additionality
	R9. use of specific measures and support activities and participation in the programme of firms and institutions from less favored regions	R9. complementary work at Community level
	R10. commercialization of research	R10. cohesion of the common market
	R11. Impact of Framework Programme Research	R11. ensuring coherence
	R12. whether the objectives, priorities and financial resources are still appropriate in the overall context	R12. strategy for enlargement
	R13. whether these objectives, priorities and financial resources are still appropriate to changing circumstances	R13. Community's economic and social cohesion
	R14. flexibility to respond to the needs of society in the light of changing circumstances	R14. unification of European science and technology
	R15. needed changes to the balance of the Programmes or to the strategy for implementation, in the light of experience and changes in the wider environment	R15. expanding and creating good growth prospects
	R16. appropriateness of Community research objectives and synergies between Specific Programmes	R16. competitiveness of Community businesses
		R17. recommendations for future activities
		R18. Framework Tomorrow
		R19. maintaining momentum, scale and emphasis
		R20. emphasizing excellence and risk
		R21. retaining variety
		R22. nurturing human potential
		R23. keeping an emphasis on relevance
		R24. benefits
		R25. motives and goals
		R26. industrial achievements & expectations
		R27. nature of work
		R28. goal attainment
		R29. consumer satisfaction

	Annual Monitoring	Five-Year Assessment
		R30. social exclusion R31. reduced crime R32. critical mass in human and financial terms R33. contribution to implementation of one or more Community policies R34. standardization at Community level R35. development of European Research Area R36. equality between European regions R37. improving the employment situation R38. promoting the quality of life and health R39. preserving the environment R40. dissemination and exploitation of results
Leadership		L1. Beyond Framework L2. responding to the challenge L3. strategy for europe L3. importance of STI L4. taking the lead in RTD L5. opening up prospects of significant scientific and technological progress L6. stimulating innovation
Infra	I1. Joint Research Centre	I1.people and education I2. exploiting the EU treaty
M&O	M1. cost effective implementation M2. external communication and information dissemination M3. project monitoring and evaluation methodology M4. project and programme impact methodology M5. efficiency and transparency of the programme management and the internal Commission coordination M6. recommendations for the future indicators to be used for monitoring as well as the monitoring process itself M7. follow-up of previous monitoring recommendations M8. strengths and weaknesses M9. cases that need further examinations because of their significant impact or poor performances M10. Specific Programme Monitoring Reports M11. linking research, education & training M12. conclusions & recommendations	M1. efficiency (whether the objectives have been pursued in a cost effective manner through programme implementation) M2. lessons learned from programme implementation M3. initial implementation of FP5 M4. transition from FP4 to FP5 M5. implementing new management structures M6. Programmes management and administration M7. separation of functions M8. advisory structures M9. monitoring and evaluation M10. access to services M11. safety M12. informed consumers M13. citizen participation M14. security and reliability of electronic interactions M15. preserving the best of the past M16. re-engineering for flexibility M17. greater flexibility

Table 18. Comparative Analysis of Evaluation Indicators

	Korea	Office of Science					Framework Programme	
		Research Support	Laboratory M&O	User Facility	Construction	Infrastructure	Annual Monitoring	Five-Year Assessment
Quality	Q1. Performance and its effect	Q1	Q2				R11	Q1, Q2, Q3
	Q2. Quality of R&D enough to achieve program goal	Q2	Q1					
	Q3. *Extent of goal achievement in terms of duration, cost, performance*	R1, R2	R1	R2		R2, R3	Q1	R2
	Q4. Degree of achievement against the projected tangible outcome							
	Q5. Degree of achievement against the projected technological goal							
	Q6. Other tangible and intangible outcomes			R3, R4	R2	R4	Q2	
		Q3, Q4, Q5	Q3					
Relevance	R1. Commercialization of developed technologies and/or establishment of new firm						R10	
	R2. Market size, export effect, and/or Market forecast of commercialized technologies							
	R3. Feasibility of developed technologies for other fields or for venture Market							
	R4. Adaptability of current program to expected changes in government role or function						R1	R17
	R5. Adaptability of current program to environmental changes						R12, R13	R18
	R6. Program structure that can adapt to future environmental changes						R14, R15	
	R7. Existence of clearly defined customer groups					R1		
	R8. Technological validity of current program against technology forecast			R5				
	R9. Economic validity of current program against Market forecast							
	R10. Necessity of program adjustment							

	Korea	Office of Science					Framework Programme	
		Research Support	Laboratory M&O	User Facility	Construction	Infrastructure	Annual Monitoring	Five-Year Assessment
	R11. *Cost/Benefit Analysis of developed technologies* R12. *Techno-Economic effects when terminated or reduced* R13. *Provision of proper solutions to its technological, economic, and social problems* R14. *Technological or Economic effects of program reduction or suspension*			R8 R8		R5		R24
		R3		R1, R6, R7, R9	R1		R2 - R9, R16	R1, R3, R4 - R15, R19 - R40
Leadership	L1. *Appropriateness of technological goals compared to those of competitors*							R16
		L1 - L5	L1					L1 - L6
Infra								
			I1 - I6	I1 - I18		I1, I2, I9, I10	I1	I1, I2
M&O	M1. Management which is rational enough to achieve the projected goals M2. Appropriateness of resource size and allocation M3. Appropriateness of program size, structure, and organization M4. Appropriateness of program management to its R&D environment M5. Account of plausible risks in the process of management	M4 M5	M1	M1, M2, M5 M4			M1	M1

	Korea	Office of Science					Framework Programme	
		Research Support	Laboratory M&O	User Facility	Construction	Infrastructure	Annual Monitoring	Five-Year Assessment
	M6. Feasibility of projected technological goal							
	M7. Appropriateness of budget size		M9	M10				
	M8. Appropriateness of program duration			M11				
	M9. Effectiveness of physical and human resources					I3 - I8		
	M10. Interim evaluation or frequency of evaluation						M3	
	M11. Program adjustment	M6					M5	
	M12. Program structure and strategy	M8		M8		I11		M5, M6
	M13. Appropriateness of technology import rather than development		M13					
	M14. Appropriateness of program changes in terms of direction, subject, duration, or size							
		M1 - M3, M7, M9, M10, M11	M2 - M8, M10 - M12	M3, M6, M7, M9	M1 - M7	M1 - M17	M2, M4, M6 - M12	M2 - M4, M7 - M17