Foreword

SPREEX Spill Response Experience was proposed as a coordination action in response to the EC DG Research call after the Prestige accident. The Prestige highlighted EU shortcomings with respect to technologies and in systems and resources for spill response effectiveness.

The project kicked-off in September 2005, and project partners identified twenty broad issues which were deemed more relevant for spill response preparedness and effectiveness based on past experiences prior to the recent Prestige spill. The issues were developed from four main different themes, later named "SPREEX pillars":

The first pillar, organisation and communications included operations, communications structure, training and legal aspects and places of refuge.
The second pillar addressed response means technology, vessels, equipment and systems including wreck interventions.
The third addressed information and communication technologies, emphasizing the need for real time detection and tracking and decision support systems.
Finally, the fourth addressed environmental and socio-economic aspects, with strong links to scientific approach for remediation, effects on the environment and economic aspects of impact assessment and NEBA (Net Environmental Benefit Analysis). Decision support systems were also assigned to this pillar.

Four major partner organizations (SASEMAR, CEDRE, SINTEF and DHI) were appointed as leaders of the four pillars, which were dealt with in separate work packages. Rapporteurs and "Contributor" partners were designated to each issue selected. State of the Art reports including past experience and on-going research were prepared and discussed first internally within the partnership, and later, during the mid-term workshop with end users, identifying from each State of the Art the main Gaps and end user needs.

The first results and conclusions from the mid-term workshop on November 16th have been confirmed by an extended consultation and disclosure on the SPREEX web site at: www.spreex.net.

The project culminated with a final workshop on June 1st, 2007 dedicated solely to the debate between the project partners (researchers) and the end

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users. The debates focused on the subjects selected as having attracted more interest for the end users. This was according to direct consultations and comments as well as the State of the Art reports download statistics from the SPREEX web page.

A total of 72 participants representing 10 countries, including end users from Denmark, Belgium, the Netherlands, Spain, Sweden, and UK, all confirmed that the project results deserve attention and backing from the end users, and it was agreed that there are Gaps needing further attention and research. Therefore, the dialogue and collaboration for undertaking new research is promising.

Acknowledgments

The project wishes to thank all partner organisations and individuals, "pillars" leaders, rapporteurs and contributors, the responders at the intermediate and the final workshop, from the Coast Guard and other governmental organisations of Belgium, Denmark, the Netherlands, Spain and Sweden, REMPEC, and major UK based organisations ITOPF, OSRL and CEFAS, invited experts and all intervening and attendants (Annex I).

Thanks also to the DG Research Project Officer, Mr. Joost de Bock for his unwavering support throughout the project, to EMSA officers for hosting two meetings with SPREEX before the mid-term workshop, and attending and closing the final workshop. We would also like to thank the DG Env. who participated in the mid-term workshop, the Spanish CDTI (Ministry of Industry) for hosting and opening the final workshop, and again the CDTI and the Spanish Ministry of Education for also attending SPREEX major events and encouraging research on spill response. Also, thanks to the Spanish Ministry of Fomento through tree organisations Puertos del Estado (Project Coordinator), SASEMAR and CEDEX (contributors), and INTA (from Ministry of Defence) as contributor and CEPRECO (from Ministry of Presidency) for participating in meetings of the project.

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SPREEX Project Coordinator

General conclusions

1 A **continuous dialogue between researchers and end users, as has been accomplished** by SPREEX, is deemed necessary for optimum response preparedness. Through research, boosting the application of the existing technologies and leveraging new technologies and synergies, solutions to Gaps identified by spill response end users can be achieved.

Rationale: SPREEX's strategy of building the state of the art reports drawing on past experience, on-going measures and research results, prior to making statement on the Gaps and opening debates with end users and authorities have proven practical and useful. SPREEX was initiated in reaction to the Prestige accident and SPREEX observations on spill response preparedness should not be on stand-by until another big accident occurs. The end of SPREEX should not imply the end of this type of study. The forum of OSR stakeholders should continue to provide research guidance and elevate end users' expectances of better systems with improved performance and wider application.

2 **Spill response research cannot be justified by market pull** and can only be effective in filling existing Gaps through the **joint development of national and EU programmes such as 7FP.**

Rationale: Spill response and systems and services supply are not part of a competitive business scenario, since administrations are the main and almost sole customers. Spill consequences may be catastrophic, but the cost of the response systems and their maintenance cannot be weighed against economy, nor can security preparedness. The responsibility of minimizing the consequences of spill accidents is the responsibility of local, regional and national administrations. Preparedness is structured on the contingency response plans using local resources proportionate to national resources and plans or perhaps even at a European level, depending on the accident's magnitude and potential impact. The research on spill response technologies and effectiveness is multidisciplinary and costs cannot be expected to be justified by patchy market demand.

3 **Spill response research** needs to be based on past experience from previous accidents but must not be limited solely to the most recent scenarios and to the reaction to previous accidents: it **must be proactive by anticipating the**

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risks of new possible postulated accidents with short-, medium- and long-term perspectives.

Rationale: The transport of products by sea is constantly increasing in traffic volume, carrier tonnage and product diversity. This brings not only increasing environmental risks but also risks for human life and, more directly, for the responders and crews. As each accident is different from those previous, research should anticipate new potential accidents so as to address the existing systems and organisational Gaps covering both pollution from port and shore terminals, as well as safety aspects.
Spill response research financing should not decay on time elapsed from past spill accidents as if it only reacted to media after accidentsand must anticipate on the preparedness for potential accidents. If we are just reacting to the media after accidents, research will be discontinuous, and the results of projects cannot be in time and won't help facing new challenges.

4 **Research** must address **not only new technologies, but also the integration of existing technologies not fully incorporated into spill response** on efficient systems addressing different applications and needs.

Rationale: Technologies may exist but not be applied or integrated for responder use. Some security technologies and surveillance systems can be adapted for spill detection and response.
No new vessels dedicated to spill response are likely to be built. Multipurpose vessels, occasional vessels and their equipment and systems as well as all the supporting services need further research to improve effectiveness while working in different scenarios and tasks.
Research may not be the entire solution for all Gaps, as there is always a synergic component. EMSA within its mandate is already fostering European synergies on some of the Gaps in debate. However, technology research is complementary and demonstrations and validation need research contribution that can only be fulfilled by EU research programmes.

5 Sea transport of oil and other products involves various administrations with different missions and competences. Spill response is multidisciplinary. Industries and services may not be grouped in existing sectors. A spill response research framework must be outlined at a European level to avoid major Gaps and to enable access to international databases, while at the same

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time avoiding duplication of efforts and facilitating the coordination of human resources and response means when needed.

Rationale

For example, spill detection includes sensor technologies, processing, integration and platforms on land, from the air or via satellite. UAV and balloons have also been in use. Models include meteorological and hydrological data, and must include changing properties at the spill (weathering) or the dispersed product as it constantly changes over the time as a result of external conditions. A response system includes different equipment for different products and conditions integrated in dedicated, multipurpose or even occasional response ships. Aerial vehicles detect and track spills, support operations and are used to dispense dispersants. The gathering of data as well as its transmission, integration and processing are needed in order to make decisions in response to a complex, and fast changing scenario.

There is a broad variety of Gaps and specialties, needing both EU and overseas cooperation to share past experiences and developments and reduce the cost of redundant actions. A policy dealing with research and EU synergic action coordination of national research programmes and common undertakings is necessary.

Spill response is an issue raised by sea transport, since energy and products for industrial use are being carried. Responders use satellite and airborne data, meteorological data and data from sea surface and underwater. Responders use their own aerial means for operation support and even to dispense the dispersants.

The spills may occur off-shore but the consequences and ultimate response take place along the coast. Therefore, the logistics for disposal, cleaning and remedies are coastal competences. So many local and upper level administrations are involved that research must be coordinated and a spill response research framework at a European level is necessary.

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Summary of Gaps proposed by the project and commented on by the responders and workshop interventions in the final Workshop Round Tables

Round Table 1 (Pillar WP 3) : Real time detection and tracking. Integration and real time updating of spill and ship information.
Round Table T 2 (Pillar WP 4a): Response management and decision support systems.
Round Table T3 (Pillar WP 2): Recovery vessels and equipment, and use of dispersants.
Round Table T4 (WP4b): Environmental and socio-economic effects.

The main Gaps proposed are the following: (the complete list on the workshop RT Power Point presentations):

1 **Spill detection sensors** with resolution and capabilities on harsh sea conditions, on submerged oil spill detection and also on thickness and spill weathering information.
Systems integrating data from different sensors and platforms which include new aerial carriers such as AUV.

2 **Models** combining meteorological and hydrodynamic data, MetOcean forecast for oil drift and coastal approach.
Compare oil spill models used by national authorities in Europe, to develop a common oil spill model which can be used for all EU waters. This model should satisfy a basic set of criteria and only utilize standard input (MetOcean, maps, oil data etc.). Validation in exercises and in real spills.

3 **Real time information systems**, should be available through user-oriented presentation to oil spill responders and concerned authorities, supported by full availability of the basic information on the main characteristics of the transported products, traceable to a common open database on widely accepted formats, and should use artificial intelligence algorithms on data processing and distribution.

4 **Decision Support Systems** (DSS) based on information from real time, providing the framework for contingency planning, local response, and coordinated response on major accidents. The DSS should provide the

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framework for contingency planning, local response, and coordinated response on major accidents. Models and DSS tools shall be used for training, on preparedness exercises and refined and validated on real spills, including modelling of weathering processes of the oil and potential impacts on ecosystem and socio-economic resources in coastal/marine areas.

The DSS not intended to make a decision by itself, but should provide integrated and filtered data, tools, models and scenarios which may assist in the decision making process. The DSS may assist both the experienced responder and the concerned authorities, including cost assessment service, response dimensioning and a resource allocation service.

5 **Limitations of ships equipment, booms and containment techniques** in rough seas, or in strong currents impair response efficiency. Need for equipment testing procedures and performance assessment of the recovery systems in operation conditions, extended to rough sea conditions and to different products and viscosity. Design accounting for spill changes by weathering and oil mixing with water requires improved skimmers and effective water separation by decanting and on-board heating capacity for handling.

Dedicated response vessels are no longer being built and response vessels should have a multipurpose design. Occasional response ships have also been prepared and are ready to install suitable response adapted equipment. These vessels could broaden their use to a wider range of pollutants, all receiving improved guidance (remote sensing, forecasting,etc)

6 **Dispersants** decision and application guidelines. Drift, fate, medium- and long-term effects of the dispersed product need to be assessed by previous tests on the different coastal resources and modelled on tests experience. New dispersants applicable on more open windows and spill products. National and local product approval for use needs an EU framework for testing, databases, knowledge and stock and dispensing platforms which requires cooperation /communication between regulators, national authorities and laboratories. Widely accepted test procedures throughout Europe must be developed and validated through experimental approach in lab and at sea.

7 **Effects of dispersed oil** and assessment and quantification of socio-economic impacts on fisheries, tourism and other human activities needs commonly accepted methodologies and tools for preparedness, decision making, for assessment, shore logistics and criteria for clean-up completion. Shore logistics and preparedness for disposal of mixed wastes after spill

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accidents (from sea recovery and coast cleaning) must be included in contingency planning.

8 Need for **procedures, resources and candidate sites for Bioremediation**:
Need to activate the use of biological techniques to stimulate biodegradation of oil spills: Biostimulation, Biaugmentation and Phytoremediation to be accepted as secondary clean up techniques. Further evaluation of benefits, effectiveness and performance of commercial products on short-, medium- and long-term bases, and better knowledge of health effects associated with release of bioremediation agents is needed.
Lack of harmonisation of preparedness tools impedes consistency and continuity on shore logistics, and NEBA application must be conducted with harmonised and complete maps of coastal sensitivity.

Summary: Proposed path forward

Some of the SPREEX reported Gaps in synergies have already drawn the attention of the authorities and organisations such as the Clean Sea Net satellite data system recently introduced by EMSA and disclosed at the workshop conclusion. Technology integration and validation Gaps can only be solved by research.

Spreex has found itself aligned with the EurOCEAN 2007 "Marine challenges: Coastline to Deep Sea" that took place after the workshop on 18/21 June 2007 with Commissioner Borg's special address acknowledging the importance of the contribution expected from research relating to the Green Book

> *"Science is important in building the future Europe, as stated in the Green paper. Science can contribute to optimising the economic value of the marine/maritime cluster in a socially and economical sustainable way.*
>
> *A vision is urgently needed for marine related research in Europe leading to a strategy that derives even greater benefits from the RTD Framework Programmes and other sources of funding in Europe, avoids duplication, closes Gaps and creates synergies. The strategy should include mechanisms for optimising coordination, cooperation and dialogue between the Commission and policymakers, industry and scientific communities in member states and third countries. On the*

basis of input from the scientific and technical community, it should set out what is necessary to support strong and durable integration of activities among organisations carrying out research relating to the sea and maritime activities in Europe, and to provide for a stronger cross sectorial dialogue between scientific disciplines and technology developers, to provide input for a holistic approach to maritime policy".

The SPREEX outcome on technology Gaps can be filled by focussed research projects (short-term from 1 to 3 years). The integration and validation Gaps may need other research instruments and can be supported by the preparedness exercises, and by the information from accidents and may require initiatives at an international or at least a European level. Some of the validation exercises should use real accident response data.

Research has optimum conditions for achievement: a highly representative end users/researchers forum has been developed through the SPREEX project and the will to guide-and-work has been opened.

Details in Gaps and the supporting state of the art reports are available on the SPREEX web site at: www.spreex.net

Unfortunately, funding opportunities at the European level have been very limited for research which could fill the gaps in oil spill response. Spill response preparedness ceased to appear on the EC FPs after the Prestige ceased leaking, until the SPREEX Final Workshop, 1st June 2007. Hopefully, the next 7 FP calls will include coastal protection and spill response research before the next spill accident occurs in EU waters, which is likely to be before the end of the 7FP.

Spill response needs further research, and synergies cannot be separated but must be structured together. The research must provide the technology, integrated systems tools including models, testing, and validation, and synergies can be well built by the EU countries most concerned with spills as SPREEX has evidenced.

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Examples of possible initiatives.

1. SOA and gap follow-up SPREEX type observatory, preparing "SPREEX type" workshops and debates
2. EU framework for validation of dispersants dispensing and methods efficiency, decision support for its use, and effects of dispersed products on different shore environments
3. Program on EU MetOcean data model and validation framework
4. DSS data infrastructure adapted to end user decision makers, scalable to international cooperation and pluri-national cooperation

The project appeals to the attention of research, transport and energy policy makers who until now have only taken action after recent accidents, without considering the increasing risk of spill accidents due to the increase in traffic of different products, and ship sizes.
The project appeals also to local and national authorities who are setting up their contingency plans with the available equipment on the market without being able to test their performance under real conditions and share past experience within a wide end users forum.
Lastly, the project appeals to the research policy makers and research program managers, even if the multidiciplinary nature of spill response cannot fit on a single epigraph of the current work-programme. Research should not follow up but anticipate within the umbrella of a single concept: spill response preparedness.

Annexes:
I. List of RT responders and attendants.
II. SPREEX final workshop Strategy and presentations

They can be downloaded at SPREEX web site:
http://www.spreex.net/

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