

STAMAR - Showcasing Technology Applicable to Maritime SMEs in the Atlantic Area



Report for Activity 2

Transnational portfolio of best available technologies for the maritime sector

[University of Strathclyde(UoS), United Kingdom, Scotland]

[AUTHORS: Dracos Vassalos, Panagiotis Kaklis,
{d.vassalos, panagiotis.kaklis}@strath.ac.uk]

Responsible partner: Marine Institute, Ireland

Contributing partners: Axencia para a Modernización Tecnolóxica de Galicia (AMTEGA), Universidade do Porto, South-East Regional Authority, Universidade do Algarve, Marine Institute, University of Strathclyde, Instituto de Engenharia de Sistemas e Computadores do Porto (INESCPORTO), Galician Agency for Innovation (GAIN), Technopôle Brest Iroise.

1. Introduction

1.1 About Scotland

In March 2013 SMEs in Scotland were accounting for 99.3% of all private sector enterprises, 54.7% of private sector employment and 36.7% of private sector turnover. Energy & Low-Carbon Technologies incorporate oil and gas, thermal generation, renewables and environmental activities. This sector encompasses over 2,520 businesses in 2012, ranging from multinationals, large Scottish global companies and a highly regarded SME base.

According to the *Technology Strategy Board of UK (TSB-UK)*, the Scottish Government sets out the broad economic and innovation policy framework and direction for Scotland. The basic pair of organisations with primary responsibility for delivering this framework are Scotland's two development agencies: *Highlands and Islands Enterprise (HIE)* and *Scottish Enterprise (SE)*.

SE is the enterprise, innovation and investment agency for the southern and central belt of Scotland. In partnership with industry, academia and the public sector, SE aims to increase productivity in Scotland by helping businesses to start and grow, encouraging innovation and creating the right conditions for companies to access property, markets and finance. SE and TSB-UK have co-developed and co-funded joint projects in areas including Health and Life Sciences, Energy, Digital and Creative Industries and Enabling Technologies. SE offers a wide range of advice and support for businesses including:

- Securing funding and grants to develop new business ideas and products,
- Finding investors, business partners and collaborators,
- Getting advice from business professionals on how to achieve business growth,
- Refining existing products and services to make them more efficient and cost-effective,
- Information and advice on new working methods or production techniques, and
- Support to enable and equip businesses to break into new markets.

Highlands and Islands Enterprise (HIE) is the economic and community development agency for a diverse region which covers a territory of over 1500 square miles - containing some 443,000 people and over 21,000 businesses. To improve the region's performance and its contribution to the economic growth of Scotland, HIE delivers an integrated strategic approach to development, under three headings:

- Supporting high growth businesses and sectors, so raising growth rates across the area,
- Creating the infrastructure and conditions to improve regional competitiveness, and
- Strengthening communities, especially in the economically fragile parts of the area.

HIE and TSB-UK collaborate to cover key activities including:

European Marine Energy Centre: a world-class marine energy research facility, supporting the marine renewable sector and generating significant economic benefits for Scotland.

Digital Economy, ICT and Rural Broadband: ensuring the Highlands and Islands have appropriate connectivity for now and the future and the capacity to adopt new and emerging technologies to boost economic growth and positively impact on remote and rural society.

KTN-P (Knowledge-Transfer Network & Partnership) activities: establishing better mechanisms to reach and engage regional businesses with funding, knowledge, graduate recruitment and other opportunities.

SBRI (Small Business Research Initiative): promoting SBRI opportunities to businesses across the region.

HIE also offers a wide range of services and programmes to businesses to support knowledge transfer, technology and research and development. These include:

- Business and innovation information and advice,
- Funding options and opportunities,
- Interface – linking businesses with academic research,
- Research and Development funding scheme,
- Business Innovation Grants – supporting links between businesses and academic institutions, and
- Framework Programme (FP7) – grants to encourage and support pan-Europe business collaborations

1.2 About University of Strathclyde (UoS)

With an illustrious history stretching back to 1882, **Dept. NAOME, i.e., the Department of Naval Architecture, Ocean and Marine Engineering, UoS**, is a key provider of Marine Technology expertise in the UK and beyond. As civilisation seeks to explore for natural resources in more extreme environments, increase international trade in a sustainable way and harness the raw power of nature; skills and expertise in the field of Marine Technology will only increase. Building on the city of Glasgow's rich heritage of Naval Architecture and Shipbuilding, NAOME provides first-rate graduates and research for the **Maritime, Oil & Gas and Marine Renewables industries** worldwide.

NAOME is a highly active research department, with world-leading expertise in a number of research areas. Our main research interests cover a wide spectrum of areas, including:

- **Ship Stability and Safety,**
- **Marine Hydrodynamics,**
- **Marine Structures,**
- **Ocean Engineering,**
- **Marine Engineering,**
- **Emerging Technologies,** and
- **Offshore Renewable Energy and Alternative fuels.**

Students studying for a PhD (3 years) or MPhil (1 year) may choose to carry out their research in any one of the above areas. The entry requirement is a first or upper second class BEng Honours degree (or equivalent) or an MSc in a related subject. NAOME is also a partner of **IDCORE (Industrial Doctorate Centre for Offshore Renewable Energy)** comprising:

- the Universities of Edinburgh, Strathclyde and Exeter,
- the Scottish Association for Marine Science, and
- HR-Wallingford.

The Centre is funded by the *Energy Technologies Institute* and the *RCUK (Research Councils UK) Energy Programme*. IDCORE offers a 4-year Engineering Doctorate (EngD) programme. The EngD is a doctoral level research and training programme equivalent in academic standing to a conventional PhD but is achieved through research which is much more industrially focused and which is designed to produce graduates who have a sound understanding of the business implications of industrial research activity.

NAOME staff participate in a wide range of research projects and networks funded by the EPSRC, EU, and the UK government. NAOME makes a significant contribution to National, European and International policy-making in Marine Technology research and its application through the participation of members of staff in research bodies. These research bodies include:

- **Foresight Transport Panel,**
- **Engineering and Physical Sciences Research Council (EPSRC) College,**
- **EU Research & Development Co-ordination Group, and**
- **WEGEMT** (an association of 43 EU Universities involved in Marine Technology and Related Sciences),

as well as some major international bodies, such as:

- **International Standards Organisation (ISO),**
- **International Maritime Organisation (IMO),**
- **Offshore Structures Code,**
- **International Towing Tank Conference (ITTC), and**
- **International Ship Structures Committee (ISSC).**

In fine, NAOME attracts researchers and visiting academics from a wide range of prestigious institutions worldwide. Strong collaborative research links with UK and overseas Universities provide the basis for continuous interchange between research staff and students. Recent visitors include more than 20 academics from renowned Universities all around the world of academia.

2. Methodology Used for the Pre-selection of Best Available Technologies (BAT)

The methodology we have employed for identifying BAT, that could be of use to maritime SMEs, combined three approaches, namely:

- a) Exploiting NAOME's link with the EU-funded project *EuroVIP* (June 2011 – May 2014) coordinated by Professor Alex Duffy (Department of Design, Manufacturing and Engineering Management (DMEM), UoS),
- b) Initiating a link with *Maritime-Graphics Group, Fraunhofer-Institut für Graphische Datenverarbeitung IGD,*
- c) Selecting mature ICT tools, which are associated to the research activities of the first of the authors of the present report.

The EuroVIP link: The project EuroVIP aimed to co-ordinate European maritime SMEs, associations, larger companies and research institutions to promote the application of research results and innovative

technologies in SMEs, by Service, Technology and Information (STI) transfer in terms of operational and technical collaboration. In this context, EuroVIP focused on developing a viable means for the exploitation of outputs from past, present and future projects.

Collaboration through the exchange of industrial and research innovations is a key factor in achieving the competitive benefits that globalisation can bring to maritime organisations. However, achieving successful awareness and effective collaboration remains a significant obstacle. There is a clear need for European SMEs to fully engage with each other and to adopt a more advanced approach with regard to the exploitation of innovations through the development of collaborations on a grander geographical scale.

Outcomes of EuroVIP comprised, among others, the **European Maritime Collaboration Portal (EMCP)**, a web-based facility that includes a repository of collaboration partners, innovative service and technology exploitables, providing a unified search and retrieval mechanism of the available resources, and configuration of partnership. On the basis of its functionality and its successful use in the context of EuroVIP, EMCP is proposed to be included in the set of BAT as a *meta-technology tool*, that could be further exploited for identifying BAT via searching among the existing EMCP network, currently comprising 80 organisations from 12 countries. In this connection, EuroVIP coordinators have agreed to forward to all EuroVIP partners a pertinent invitation message on behalf of EuroVIP and STAMAR for making proposals for technologies that fit to the frame of Activity 2 of STAMAR. The message has been sent out on Thursday, September 11th, 2014.

The Fraunhofer-Institut link: A similar invitation on behalf of the STAMAR partner UoS has been forwarded on August 28th 2014, to Professor Uwe Freiherr von Lukas, who is leading the Competence Center Maritime-Graphics Group, Fraunhofer-Institut für Graphische Datenverarbeitung IGD. This group is supporting clients from shipbuilding, shipping, maritime technology and maritime research in a digital, virtual and visual way. Maritime Graphics stands for graphic software solutions for the benefit and advantage of the maritime industry, including:

- 3D model preparation,
- visualization tools for simulations and data acquisition,
- virtual and augmented reality technologies, and
- image-processing procedures.

Contacting the Maritime-Graphics Group of the Fraunhofer-Institut aimed to exploit the intensive ICT character of the processes and software tools in the development of which the Maritime-Graphics Group has been involved in collaboration with the maritime industry. Professor von Lukas replied in positive to the invitation of the STAMAR partner UoS and their reply is expected by mid of September.

ICT tools Evi and ISYS: Professor Vassalos (NAOME-UoS) and his collaborators at NAOME-UoS, SSRC-UoS (Ship Stability Research Center) and Brooke-Bell-Safety-at-Sea Ltd UK have developed a wide spectrum of methodologies and software tools associated with the aim of designing and operating safe maritime assets. The proposed tools, namely:

- **EVI** – a software tool supporting advanced evacuation analysis,
- **ISYS** – a software tool supporting Systems Operability & Failure Mode Effect Analysis,

are mature ICT tools that have been being used and successfully tested by the maritime industry.

3. Results on the Selection of Best Available Technologies

As described in the previous section, the methodology adopted for preselecting BAT resulted so far¹ in identifying and proposing 3 technologies, that could be of use to maritime SMEs, namely:

1. The **European Maritime Collaborative Portal (EMCP)**, developed by the EU-funded project EuroVIP (coordinated by the Department of Design, Manufacturing and Engineering Management (DMEM-UoS)),
2. **Evi**, an evacuation simulation tool currently owned and maintained by Bell Brookes – Safety at Sea, and
3. **ISYS**, a Systems-Operability and Failure-Mode-Effect Analysis tool, currently owned and maintained by Bell Brookes – Safety at Sea Ltd, UK .

A description of the chosen technologies follows below.

1. The functionality of EMCP, which was presented by the second of the authors of this report during the STAMAR Working Group meeting at Waterford on July 2014, can be outlined as below:

- Support of maritime technologies and services dissemination,
- Bringing the best expertise together,
- Evolutionary collaboration support for people who need:
 - Innovative technologies,
 - Environmental-friendly technologies,
 - Improving traditional technologies,
 - Research results, and
 - Services, and, finally,
- Access to the right information at the right time.

In this connection, the user interface of EMCP enables the interested user to:

- REGISTER (register an account),
- SUBMIT NEW CONTENT (register technology/project/service, publish a call for collaboration, submit tender),
- FIND A TECHNOLOGY, SERVICE or PRODUCT,
- EXPLORE COLLABORATION OPTIONS (search calls, find collaboration partners, contact a potential partner), and
- START or RESUME COLLABORATION (start/resume collaboration orchestration, start/resume technology and service collaboration, form a networking group).

2. The software environment Evi (the acronym stemming from: Evacuability index), exploits a virtual environment for enhanced effectiveness of evacuation performance evaluation. It represents the state-of-the-art computer simulation-based capability for the prediction of passenger mustering and

¹ Further input is expected to be submitted from EuroVIP partners and the Maritime-Graphics Group of the Fraunhofer-Institut

evacuation involving a number of escape and rescue scenarios (abandon ship, transfer to refuge centres or a combination of these) in a range of incidents (fire, collision, progressive flooding, cargo shift, foundering) whilst accounting for ship motions in a sea environment. Unlike earlier models, Evi has been developed from the outset for application to passenger ships in a sea environment, including the largest cruise liners and Ropax. Valuable input and feedback from the owners/operators helped refine and render the model into a practical tool which, coupled to modelling of uncertainty in all the parameters that may affect evacuation times and the ability to play back a given scenario as video, provide for wide-ranging capability in modelling realistically the most complex of evacuation scenarios thus allowing for routine application of passenger evacuation analysis. The latter entails a wide range of evacuation capabilities including evaluation of evacuation time, potential bottlenecks, assessment of accommodation module layout and sensitivity analyses to assist design for ease of evacuation, passenger familiarisation with a ship's environment, "what if" scenarios for training, devising effective evacuation planning procedures/strategies and decision support to manage a crisis. Evi is available in the form of a computer program that can be readily customised to any vessel environment with an efficiently tailored user interface and Run Time Simulator (RTS). Typically, simulation of 5,000 passengers mustering on a 17-deck vessel can be achieved at real time.

3. ISYS is a Systems operability analysis tool developed to verify compliance with *“Safe Return to Port”* requirements, SOLAS II-2. Entering into force on July 2010, this new regulation, applied to large Passenger Vessels and highly occupied Special Purpose Ships, recognises adage that *“A ship is its own best lifeboat”*.

The Safe-Return-to-Port regulations provide performance requirements for ‘essential systems’ that must be demonstrated to remain operational following fire and flooding damages that do not exceed a certain pre-defined “casualty threshold”. ISYS can support the customer to apply the Safe Return to Port criterion correctly and efficiently by performing the overall and detailed systems analysis. ISYS enables the components and connections involved in complex and interrelated ship systems to be easily modelled. This is done within the geometric subdivision of the vessel by the use of logical expressions defining dependency. ISYS allows all of the IMO required essential systems to be modelled in a unique analysis frame, including the connections between systems. The damage scenarios required by the regulations are then input into the ISYS model and the availability of each of the essential systems is determined for each damage case. The system automatically generates reports for submission for approval and can also be used to create ship documentation for crew operating procedures.

Content of questionnaire related to the *meta-technology tool* EMCB (European Maritime Collaborative Portal) developed by the Department of Design, Manufacturing and Engineering Management

Survey question	Response
CONTACT DETAILS	
Institution/ Company name	DMEM, University of Strathclyde
Category	<input checked="" type="checkbox"/> R&D Institution/University <input type="checkbox"/> Company <input type="checkbox"/> Other <input type="checkbox"/> Public <input type="checkbox"/> Private
Address	75 Montrose Street
Website	http://www.strath.ac.uk/dmem/
Contact person at institution/company	
Email	enquiries@dmem.strath.ac.uk
Phone No	+44 (0)141 548 2091
CURRENT ACTIVITIES	
Description of main activity (products and Services)	Research and education
Is Marine technology central to the company's activities?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No, but we believe that might be in the near future <input checked="" type="checkbox"/> No
What percentage of the business was conducted within the marine sector? (please use 2012 as reference year)	I do not know, but a small percentage is marine related, like EuroVIP.
Standards and Certificates of relevance	
Keywords of relevance	
What sector(s) does the company currently offer products/services?	
Description of ICT intensive technologies that company/Institution offers	<input type="checkbox"/> Advanced engineering (including robotics/control systems) <input type="checkbox"/> Communications (including data acquisition and transmission) <input type="checkbox"/> Data management (including storage and processing) and visualisation data analysis and modelling (including geoinformatics) <input type="checkbox"/> Materials/fabrication/assembly <input type="checkbox"/> Satellite Navigation <input type="checkbox"/> Sensors/instrumentation/electronics <input checked="" type="checkbox"/> Software engineering/development <input type="checkbox"/> Other technology (please specify)

POTENTIAL FUTURE DEVELOPMENT IN MARITIME SECTOR	
In which marine sector is institution/ company already involved, or could the organisation potentially target in the near future?	<input type="checkbox"/> Aquaculture <input type="checkbox"/> Coastal tourism <input type="checkbox"/> Environmental monitoring <input checked="" type="checkbox"/> Fisheries <input checked="" type="checkbox"/> Marine renewable energy <input checked="" type="checkbox"/> Maritime services <input type="checkbox"/> Oil and gas <input type="checkbox"/> Security <input type="checkbox"/> Shipbuilding <input type="checkbox"/> Transport and shipping <input type="checkbox"/> Water management <input type="checkbox"/> Other market areas
Does the company conduct R&D activities	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
What level of innovation is there in the company?	<input checked="" type="checkbox"/> Engaged in research <input checked="" type="checkbox"/> Company has an R&D capability <input checked="" type="checkbox"/> Develops IP <input type="checkbox"/> Patents IP
If the company/institution undertakes ICT R&D activities, what is the R&D focus?	<input type="checkbox"/> analysis and design algorithms <input type="checkbox"/> cloud computing <input checked="" type="checkbox"/> Communications <input type="checkbox"/> data analysis <input type="checkbox"/> hardware <input checked="" type="checkbox"/> Integrated circuit <input checked="" type="checkbox"/> model, simulate, forecast <input type="checkbox"/> Sensors <input checked="" type="checkbox"/> Software <input type="checkbox"/> Spatial data analysis <input type="checkbox"/> visualisation <input type="checkbox"/> other
Is the firm currently developing products that could be of use to the Marine sector?	Yes. The Virtual Integration Platform is used in maritime sector. The European Maritime Collaboration Portal (EMCP) is also a new portal for the maritime industry.
What product/service could be translated to the Maritime sector?	
Please describe 1 or 2 R&D projects, as a case study	EuroVIP, VIRTUE

Content of questionnaire related to the ICT-tools EVI and ISYS developed by Brookes Bell, Safety at Sea

Survey question	Response
CONTACT DETAILS	
Institution/ Company name	Brookes Bell, Safety at Sea
Category	<input checked="" type="checkbox"/> R&D Institution/University <input type="checkbox"/> Company <input checked="" type="checkbox"/> Other <input type="checkbox"/> Public <input type="checkbox"/> Private
Address	2 nd Floor, 280 St Vincent street, Glasgow, G2 5RL <u>Liverpool office:</u> Martins Building Water Street Liverpool, L2 3SX
Website	http://www.brookesbell.com/
Contact person at institution/company	Luis Guarin
Email	l.guarin@safety-at-sea.co.uk
Phone No	+44 (0)7852 934422
CURRENT ACTIVITIES	
Description of main activity (products and Services)	Marine, Scientific & Technical Consultants and Surveyors
Is Marine technology central to the company's activities?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No, but we believe that might be in the near future <input checked="" type="checkbox"/> No
What percentage of the business was conducted within the marine sector? (please use 2012 as reference year)	100 %
Standards and Certificates of relevance	ISO9001
Keywords of relevance	Ship design, innovative software, ship building advice and problem solving, marine scientific and technical consultancy, marine surveying, casualty investigation, product development.
What sector(s) does the company currently offer products/services?	Marine sector
Description of ICT intensive technologies that company/Institution offers	<input checked="" type="checkbox"/> Advanced engineering (including robotics/control systems) <input checked="" type="checkbox"/> Communications (including data acquisition and transmission) <input type="checkbox"/> Data management (including storage and processing) and visualisation data analysis and modelling (including geoinformatics) <input checked="" type="checkbox"/> Materials/fabrication/assembly

	<input checked="" type="checkbox"/> Satellite Navigation <input checked="" type="checkbox"/> Sensors/instrumentation/electronics <input type="checkbox"/> Software engineering/development <input checked="" type="checkbox"/> Other technology (please specify)
POTENTIAL FUTURE DEVELOPMENT IN MARITIME SECTOR	
In which marine sector is institution/ company already involved, or could the organisation potentially target in the near future?	<input checked="" type="checkbox"/> Aquaculture <input checked="" type="checkbox"/> Coastal tourism <input checked="" type="checkbox"/> Environmental monitoring <input checked="" type="checkbox"/> Fisheries <input type="checkbox"/> Marine renewable energy <input type="checkbox"/> Maritime services <input type="checkbox"/> Oil and gas <input checked="" type="checkbox"/> Security <input type="checkbox"/> Shipbuilding <input checked="" type="checkbox"/> Transport and shipping <input checked="" type="checkbox"/> Water management <input type="checkbox"/> Other market areas
Does the company conduct R&D activities	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
What level of innovation is there in the company?	<input type="checkbox"/> Engaged in research <input type="checkbox"/> Company has an R&D capability <input type="checkbox"/> Develops IP <input checked="" type="checkbox"/> Patents IP
If the company/institution undertakes ICT R&D activities, what is the R&D focus?	<input type="checkbox"/> analysis and design algorithms <input checked="" type="checkbox"/> cloud computing <input checked="" type="checkbox"/> Communications <input type="checkbox"/> data analysis <input checked="" type="checkbox"/> hardware <input checked="" type="checkbox"/> Integrated circuit <input type="checkbox"/> model, simulate, forecast <input checked="" type="checkbox"/> Sensors <input type="checkbox"/> Software <input type="checkbox"/> Spatial data analysis <input type="checkbox"/> visualisation <input type="checkbox"/> other
Is the firm currently developing products that could be of use to the Marine sector?	Yes. Software for consultancy: EVI - Advanced evacuation analysis ISYS - Systems operability analysis tool and Failure Mode Effect Analysis.
What product/service could be translated to the Maritime sector?	Products are specifically developed for the maritime sector.

<p>Please describe 1 or 2 R&D projects, as a case study</p>	<p>SAFEGUARD: An EU funded project (http://www.safeguardproject.info) looked at improving the International Maritime Organisation (IMO) guidelines for evacuation of passenger ships. Ship trials were conducted and passengers' reaction and assembly times were collected. Evi, the advanced evacuation software, was used in this project to model Ropax and cruise liner in order to assess a number of different damage scenarios.</p>
---	--

Content of questionnaire completed the Maritime Graphics, Fraunhofer IGD

Survey question	Response
CONTACT DETAILS	
Institution/ Company name	Fraunhofer IGD, Maritime Graphics
Category	<input type="checkbox"/> R&D Institution/University <input type="checkbox"/> Company <input type="checkbox"/> Other <input type="checkbox"/> Public <input type="checkbox"/> Private
Address	Joachim-Jungius-Str. 11 18059 Rostock Germany
Website	http://www.igd.fraunhofer.de/mag
Contact person at institution/company	Uwe Freiherr von Lukas
Email	Uwe.von.lukas@igd-r.fraunhofer.de
Phone No	+49 381 4024 150
CURRENT ACTIVITIES	
Description of main activity (products and Services)	Applied research in visual computing for maritime industries
Is Marine technology central to the company's activities?	<input type="checkbox"/> Yes <input type="checkbox"/> No, but we believe that might be in the near future <input type="checkbox"/> No
What percentage of the business was conducted within the marine sector? (please use 2012 as reference year)	90%
Standards and Certificates of relevance	
Keywords of relevance	Virtual Reality, Augmented Reality, Visual Analytics, mobile computing, web-based visualization
What sector(s) does the company currently offer products/services?	Shipbuilding, maritime training, maritime services, offshore, advanced navigation, maritime security
Description of ICT intensive technologies that company/Institution offers	<input type="checkbox"/> Advanced engineering (including robotics/control systems) <input type="checkbox"/> Communications (including data acquisition and transmission) <input type="checkbox"/> Data management (including storage and processing) and visualisation data analysis and modelling (including geoinformatics) <input type="checkbox"/> Materials/fabrication/assembly <input type="checkbox"/> Satellite Navigation <input type="checkbox"/> Sensors/instrumentation/electronics <input type="checkbox"/> Software engineering/development <input type="checkbox"/> Other technology (please specify)

POTENTIAL FUTURE DEVELOPMENT IN MARITIME SECTOR	
In which marine sector is institution/ company already involved, or could the organisation potentially target in the near future?	<input type="checkbox"/> Aquaculture <input type="checkbox"/> Coastal tourism <input type="checkbox"/> Environmental monitoring <input type="checkbox"/> Fisheries <input type="checkbox"/> Marine renewable energy <input type="checkbox"/> <i>Maritime services</i> <input type="checkbox"/> Oil and gas <input type="checkbox"/> Security <input type="checkbox"/> Shipbuilding <input type="checkbox"/> Transport and shipping <input type="checkbox"/> Water management <input type="checkbox"/> Other market areas: Marine Mining
Does the company conduct R&D activities	<input type="checkbox"/> Yes <input type="checkbox"/> No
What level of innovation is there in the company?	<input type="checkbox"/> Engaged in research <input type="checkbox"/> Company has an R&D capability <input type="checkbox"/> Develops IP <input type="checkbox"/> Patents IP
If the company/institution undertakes ICT R&D activities, what is the R&D focus?	<input type="checkbox"/> analysis and design algorithms <input type="checkbox"/> cloud computing <input type="checkbox"/> Communications <input type="checkbox"/> data analysis <input type="checkbox"/> hardware <input type="checkbox"/> Integrated circuit <input type="checkbox"/> model, simulate, forecast <input type="checkbox"/> Sensors <input type="checkbox"/> Software <input type="checkbox"/> Spatial data analysis <input type="checkbox"/> visualisation <input type="checkbox"/> other: under water computer vision
Is the firm currently developing products that could be of use to the Marine sector?	We typically develop technologies that are licenced to end users or software companies.
What product/service could be translated to the Maritime sector?	
Please describe 1 or 2 R&D projects, as a case study	1. In the FlexMoT project the consortium is aiming for a flexible monitoring tool with a modular sensor platform for underwater usage. One project partner is developing a novel Methane sensor that can be used for early warnings in the surrounding of an oil & gas platform or pipeline. Fraunhofer IGD is responsible for collecting the data of the various sensors and offer user-specific visualization and

interpretation of data. For this reason we build an open integration framework that allows for easy plug & play connection of new sensors and that provides several monitoring and data exploration tools with a scalable web-based frontend.

Additionally we can provide advanced touch-based interaction and visualization concepts that support operators with an easy-to-use application. It offers an integrated presentation of various sensor values together with a 3D model of the real environment and the possibility of physical simulation for prediction purposes. With visual computing we can support the maritime industry in safely operating underwater installations and making the right decisions to protect the environment.



2. With VI:MAR:CON, the Virtual Maritime Configurator, we present a system that can be used to virtually evaluate design alternatives of a cabin in a yacht or cruise liner. Using a high-resolution scanner for physical materials we can easily attach a realistic texture to the surface of the furniture, walls etc. When changing the lighting condition, the virtual material will show the same reflections and shadows as the original material. With VI:MAR:CON the process of designing the interior of a vessel is not only faster and cheaper but can also save energy and materials that would be needed for a physical mock-up – clear ecologic advantage.

