Exploitation plan

The exploitation plan focuses on the promotion of the pSHIELD framework, highlight the advantages of using it in different SPD emerging applications as well as in enhanced SPD needs coming from the applications already addressed in the project.

pSHIELD will give opportunity to industries and SMEs to acquire know-how and the possibility to exploit results in order to reach the following (but not limited to) main objectives:

- Consolidate the competences

- Identify new possible application scenarios of SPD technology

- Introduce new commercial products

- Contribute to regulatory bodies with an effective services and technology architecture proposal

Here follows the most important exploitation perspective of pSHIELD partners.

Ansaldo STS

The results provided by the application of the pSHIELD platform to the railway security system are expected to have a considerable impact on the quality of the system developed as well as on the design and development costs. In fact pSHIELD will likely improve the advantage of the security system in terms of resiliency, availability and scalability with respect to competing products and this is going to have a positive marketing impact. Concerning the reduction in development costs, pSHIELD will significantly reduce the time to market since it enables design modularity with possible reusability of components and it also allows for a quicker verification and assessment of the overall system. Furthermore, due to the generality of system architecture, the results can be applied to other dependability critical systems (e.g. those used for railway supervision and management, railway bridges, freight cars, all infrastructure surveillance) developed by Ansaldo STS.

From the business point of view, Ansaldo STS aims at exploiting pSHIELD results in its wide worldwide market. The developed prototype extends Ansaldo STS security product portfolio and integrates with the security management system, already developed by Ansaldo itself. This monitoring infrastructure prototype is expected to be an attractive product for potential customers due to its originality, resiliency, cost-effectiveness, easy installation and maintenance.

Critical Software

Critical Software is going to exploit pSHIELD results in two main ways:
1. General use of pSHIELD results and knowledge horizontally e.g. in current projects, with the expected value of improved methodologies and tools (indirect use);

2. Through new products, tools and services that can be marketed directly to other organizations (direct use).

Indirect use of pSHIELD results is planned from the following results and knowledge:

- New competences in SPD Methods that allow direct application of security in networked embedded systems development projects.

- Combined use of Security, Privacy and Dependability in the context of heterogeneous Embedded Systems together with CSW knowledge in formal methods and, more precisely (SysML) in the first phases of the software development.

- Capability of using the pSHIELD composable framework during modelling of SPD aspects in given desired software in the initial development stages, improving efficiency and reliability.

- Reuse of SPD components.

- Incorporate new methodologies arising from pSHIELD in quality management process. CMMI-based process improvement includes identifying the organisation's process strengths and weaknesses and making process changes to turn weaknesses into strengths.

- Use of pSHIELD composable Framework, particularly the SPD multi-layered approach, in every new starting project.

- Modularity and expandability - The possibility of abstracting parts of the whole pSHIELD network as well as the integration of different components, and as such can be integrated in future projects.

Direct use of pSHIELD results is planned and foresees their integration in several CSW products such as:

- eXception Product, which is related to the safety critical domain,

- a dedicated command-and-control platform for civil protection, space and security application, known as C&C framework,

- projects related to electric vehicles charging networks and vehicle-to- vehicle and vehicle-to-network communication and specific applications.

Eurotech

pSHIELD project represents an opportunity to increase Eurotech Group presence in high performance embedded computing markets, with a particular attention to all the application contexts requiring a high level of SPD. pSHIELD results will foster the identification of guidelines that will suggest and drive the evolution of Eurotech Group products in markets with SPD requirements: as such the project represents an investment for the future in terms of research and know-now.
Eurotech R&D center ETH Lab and FinMeccanica Group are directly interested in the exploitation of technologies, approaches and solutions identified and developed in the project with respect to four main areas: High Performance Embedded Nodes, Reconfigurable SPD Hardware, Mobile and Rugged High Performance Embedded Systems. The exploitation activities in the mentioned fields will put in clear evidence the SPD capabilities of the new products and will have an important social impact, accelerating the public acceptance of pervasive system in everyday life. Finally, SHIELD's results will be used by Eurotech HPC Business Unit and ETH Lab in further research activities referring to the mentioned areas of scientific interest.

Hellenic Aerospace Industry

A basic notion and desirable feature of pSHIELD regards the possibilities to abstract components from the platform and create pSHIELD subsystems, depending on the needs of specific applications.

This composability is what partners, especially the industrial ones, wish to, firstly, consolidate and later exploit in the form of a SHIELD prototype.

A wide range of industrial control activities can be served by ESs and WSNs, including supervision of assembly line, energy management, automation, process control and inventory tracking. The concept of integrating heterogeneous platforms exploiting their composability capabilities, aims at offering optimized resources management, through the "ad-hoc" formation and collaboration of sub-networks, according to each time needs and availabilities.

Here follow some exploitation possibilities envisaged by HAI:

➢ Located in a heavily polluted industrial zone, HAI will rely on the use of wireless sensor networks in the effort to mitigate the conditions for the company itself, the neighbouring industries and the area inhabitants. *Environmental improvement* can be achieved by reducing the release of toxic substances responsible for air and water pollution. Sensor networks can be used to monitor these unwanted releases. A collaborative grid can be formed with the installation of sensors in the nearby plants also, granting the possibility of dynamically configured sensor networks, according to occasional environmental needs.

➢ HAI, being a sizeable organization, is especially interested in an effective *energy management* mechanism. Sensors and actuators can be used, firstly to monitor the indoor conditions and possible losses in the energy balance and subsequently to control the energy distribution or take corrective actions. Composability offers the possibility of different user panels and administrative schemes. For example, an energy management center could supervise the distribution of resources in the plant. Alternatively, in a more generalized format, many involved parties could play a hierarchical role, from the power provider company to a regional or a building block administrator.

➢ *Logistics* is an aspect of industrial life, which HAI believes can be substantially benefited from the use of sensor networks with synthetic capabilities. Tagging on materials allows the sharing of useful information (ID, location) between all involved parties in the procedures of manufacturing, transporting, storing and ordering products. Collaborative sensor networks render these products traceable all along the path between assembly line and customer delivery.

Movation

Movation is the network node of the Nordics, connecting entrepreneurs having novel ideas with industrial and scientific partners such as Telenor, Statoil, Opera Software, Microsoft through the Innovation Stock Exchange (http://innobors.eu). As security for embedded systems is seen as one of the major challenges, the outcome of the pSHIELD project will be used to transfer this knowledge to our Inner Circle members and innovative companies in the domain.

We expect that the Future Internet will be driven by the Internet of Things, and that concepts not including security of embedded systems are bound to fail. Our main exploitation strategy is therefor to form an industrial network including providers such as ABB, industrial actors such as Statoil, end-user distributors such as Telenor and Research Institutes such as the Norwegian Defense Research Establishment (FFI) and Standard Norway. We have successfully launched together with Sintef the *Internet of Things Value Network*, which is driving application development in the domain. Our aim

is that Integrated Operations, as implemented in the oil and gas industry of Norway, will be used in other industrial domains. And that all these industrial domains follow the security metrics established in SHIELD. We have founded several for a to successfully exploit the results, including InnoBors for entrepreneurs, our Inner Circle partner network consisting of major industrial players, the IoT value network and last but not least the Innovation Forum Norway.

Selex Elsag SpA

SELEX Elsag will exploit the pSHIELD project results in several activities related with Intelligent ES Nodes, Smart Transmissions, secure and dependable service middleware and information aggregation solutions for Embedded Systems distributed over IP network infrastructures.
SELEX Elsag has a key-role within the European Secure SOftware defined Radio (ESSOR) project that sets its targets on providing architecture of Software Defined Radio (SDR) for military purposes and a military High Data Waveform (HDR WF) compliant with such architecture, thus offering the normative referential required for development and production of software radios in Europe. The results from pSHIELD project will be used in order to deliver guidelines which are related to the validation and verification of waveform portability and platform re-configurability, setting up a common security basis to increase interoperability between European Forces.

SESM - Finmeccanica

SESM - Finmeccanica will exploit the pSHIELD project results applying the new approach of FPGA Run Time Reconfiguration of ESs investigated during the project. This will allow improving the products and services offered by SESM in the market of communications at airports.

Designed during the project SPD Power Node framework, together with its implementation in build at SESM FPGA Power Node Prototype, constitute a solid base for future SPD ESs developments. Also whole pSHIELD layers architecture may speed up time to market of new products. But important element in real world applications of pSHIELD solutions is prior standardization and certification of proposed architecture.

Tecnologie nelle Reti e nei Sistemi T.R.S. S.p.A

T.R.S. S.p.a. will take advantages from the research results on data distribution systems. New services and products will be delivered deploying DDS software in COTS and embedded systems.

A major exploitation is expected to develop a Decision Support software module, which uses these technologies, which TRS is developing in Vessel Traffic Monitoring domain.

Advancements in semantic technologies expected in pSHIELD project have already been introduced in some TRS products. Further developments of such technologies are used in a number of research projects in TRS.

THYIA

THYIA's plan of the exploitation is addressed toward SPD-WSNs and nano, micro/personal sensor nodes for a range of security applications in different market domains. Through Social Mobility Networking (SMN) scenario, the implementation of pSHIELD project has the potential to bring new service to market. The scenario can bring in significant economic benefit by reducing cost in the transport sector.

THYIA is aiming to explore embedded technology and SPD approach that are key technologies for SMN scenario. An indoor and outdoor demonstrator will be developed in which a heterogeneous network infrastructure will be used for proof of the concept for these scenarios. The short range communication will be achieved by 60 GHz radio, optical fiber technology, and power electrical grid that allow continuity of services over different access technologies. Exploring new SPD technologies for such complex system infrastructure is a primary aim of THYIA in pSHIELD project

The main interest of THYIA in the exploitation plan lies in testing SMN scenarios targeted in nSHIELD, and the use of specific sensor platforms, and other devices that will be delivered in the market after the termination of the nSHIELD project.

Mondragon Goi Eskola Politeknikoa

Results will be used in the context of teaching activities at the University (at computer science and telecommunication engineering degrees and postgraduate lectures). This teaching material will also be offered as industry courses.

Mondragon University plans to develop advanced courses and seminars to train personnel from local companies during the first two years after the project and also the dissemination of the results by means of publications.

Università di Genova

University of Genova is responsible for large scale simulation scenarios in the European Secure SOftware defined Radio (ESSOR) project. pSHIELD results will be exploited within this project that sets its targets on providing architecture of Software Defined Radio (SDR) for military purposes and a military High Data Waveform (HDR WF) compliant with such architecture, to deliver guidelines which are related to the validation and verification of waveform portability and platform re-configurability.

One of the research areas agreed with other partners in the consortium is focused on Networked Embedded System. In this area, pSHIELD results will be exploited dealing with various technological issues concerning embedded systems and networks of the future, which represent a very important basis for the development of many intelligent and pervasive applications. From a scientific-technical point of view, the course provides insights on topics such as simulations of networks, design of processors and embedded systems, communication networks and smart sensors. Seasonal schools and workshops will be organized (the first summer school was organized in September 2011 in Klagenfurt (AT), while the second will be organized in Italy in September 2012) with specific tracks focused on SPD related concepts in Networked Embedded Systems.

Università di Roma

University of Rome "La Sapienza" will exploit the results of the pilot project mainly for didactic and teaching purposes. In particular many master degree theses have and are expected to profit from the documentation and the background coming from the pSHIELD project.

Moreover, project results will be exploited to upgrade and update the programs of several courses and to hold thematic seminars on these matters both at universities and in the companies.

In particular during the course of "Technologies for Automation", in the context of Computer Science degree, the concept of "composability" has been introduced to the students from an academic perspective, by rising interesting discussions about the mathematical tools at the basis of the formulation of the problem, as well as the potential industrial application of this concept. Starting from that, participation to this project (at least by disseminating its results) will allow new generation engineers to acquire know-how on control theory and informatics and more specifically on secure

resource management over heterogeneous embedded systems networks. If the SHIELD concepts will become a reality, and a standard, then the new generation of engineers will be prepared to face this challenge.

Center for Wireless Innovation Norway

The Center for Wireless Innovation Norway is a University Collaboration of seven Universities in Norway. The collaboration aims at applied research together with industrial partners. In pSHIELD the two institutions UNIK and University of Agder contributed, and developed trust metrices and sensor integration into M2M platforms.

The ongoing exploitation has opened for application areas in eHealth, in offshore wind energy, and in sensor networks for avalanche protection of the Norwegian Railway. Results of these collaborations will be presented during the ongoing SHIELD project.

4.3   Report on societal implications

A   General Information

JU Grant Agreement Number:	100204
Title of Project:	*pilot embedded Systems arcHItecturE for multi-Layer Dependable solutions*
Name and Title of Coordinator:	Dr. Josef Noll

B   Ethics

	○ **Yes** ● **No**
1. Did you have ethicists or others with specific experience of ethical issues involved in the project?	

2.   Please indicate whether your project involved any of the following issues (tick box) :

INFORMED CONSENT	
• Did the project involve children?	NO
• Did the project involve patients or persons not able to give consent?	NO
• Did the project involve adult healthy volunteers?	NO
• Did the project involve Human Genetic Material?	NO
• Did the project involve Human biological samples?	NO
• Did the project involve Human data collection?	NO
RESEARCH ON HUMAN EMBRYO/FOETUS	
• Did the project involve Human Embryos?	NO
• Did the project involve Human Foetal Tissue / Cells?	NO
• Did the project involve Human Embryonic Stem Cells?	NO
PRIVACY	
• Did the project involve processing of genetic information or personal data (e.g. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)	NO
• Did the project involve tracking the location or observation of people?	NO
RESEARCH ON ANIMALS	
• Did the project involve research on animals?	NO
• Were those animals transgenic small laboratory animals?	NO
• Were those animals transgenic farm animals?	NO
• Were those animals cloning farm animals?	NO
• Were those animals non-human primates?	NO
RESEARCH INVOLVING DEVELOPING COUNTRIES	
• Use of local resources (genetic, animal, plant etc)	NO
• Benefit to local community (capacity building i.e. access to healthcare, education etc)	NO
DUAL USE	
• Research having potential military / terrorist application	NO

C   Workforce Statistics

3   Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).

Type of Position	Number of Women	Number of Men
Scientific Coordinator	1	

Work package leader	2	5
Experienced researcher (i.e. PhD holders)	3	57
PhD Students	NA	NA
Other	NA	NA

4 How many additional researchers (in companies and universities) were recruited specifically for this project?	**NA**
Of which, indicate the number of men:	NA
Of which, indicate the number of women:	NA

D	**Gender Aspects**		

5	**Did you carry out specific Gender Equality Actions under the project**?	○ ●	Yes No

6 Which of the following actions did you carry out and how effective were they?

		Not at all effective	Very effective
❑	Design and implement an equal opportunity policy	○ ○ ○ ○ ○	
❑	Set targets to achieve a gender balance in the workforce	○ ○ ○ ○ ○	
❑	Organise conferences and workshops on gender	○ ○ ○ ○ ○	
❑	Actions to improve work-life balance	○ ○ ○ ○ ○	
○	Other:		

7 Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?

- ○ Yes- please specify
- ● No

E	**Synergies with Science Education**

8 Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?

- ● Yes- please specify: The pSHIELD sensor network was the first installation on the Telenor M2M platform Shepherd, and the electrical motorbike is used during open days at Telenor.

- ○ No

9 Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?

- ● Yes- please specify: Telenor has created a video based on the M2M communication for future transportation.

- ○ No

F	**Interdisciplinarity**

10 Which disciplines (see list below) are involved in your project?

- ○ Main discipline[5]: 2.2
- ○ Associated discipline5: 1.1

G	**Engaging with Civil society and policy makers**

11a	**Did your project engage with societal actors beyond the research community?** *(if 'No', go to Question 14)*	○ ●	Yes No

11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?

- ○ No
- ○ Yes- in determining what research should be performed

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[5] Insert number from list below (Frascati Manual)

○ Yes - in implementing the research	
○ Yes, in communicating /disseminating / using the results of the project	

11c **In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?**	○ ○	Yes No

12   **Did you engage with government / public bodies or policy makers (including international organisations)**

- ○ No
- ● Yes- in framing the research agenda
- ○ Yes - in implementing the research agenda
- ○ Yes, in communicating /disseminating / using the results of the project

13a   **Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?**

- ○ Yes – as a **primary** objective (please indicate areas below- multiple answers possible)
- ○ Yes – as a **secondary** objective (please indicate areas below - multiple answer possible)
- ● No

13b If Yes, in which fields?

Agriculture Audiovisual and Media Budget Competition Consumers Culture Customs Development Economic and Monetary Affairs Education, Training, Youth Employment and Social Affairs	Energy Enlargement Enterprise Environment External Relations External Trade Fisheries and Maritime Affairs Food Safety Foreign and Security Policy Fraud Humanitarian aid	Human rights Information Society Institutional affairs Internal Market Justice, freedom and security Public Health Regional Policy Research and Innovation Space Taxation Transport	

13c If Yes, at which level?

- ○ Local / regional levels
- ○ National level
- ○ European level
- ○ International level

H   Use and dissemination

14 How many Articles were published/accepted for publication in peer-reviewed journals?	**4**
To how many of these is open access[6] provided?	**1**
How many of these are published in open access journals?	**0**
How many of these are published in open repositories?	**0**
To how many of these is open access not provided?	**3**

Please check all applicable reasons for not providing open access:

❑ publisher's licensing agreement would not permit publishing in a repository
❑ no suitable repository available
❑ no suitable open access journal available
● no funds available to publish in an open access journal
❑ lack of time and resources
❑ lack of information on open access
● other: ……………

15 How many new patent applications ('priority filings') have been made? *("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).*	**0**

16 Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	
	Registered design	
	Other	

17 How many spin-off companies were created / are planned as a direct result of the project?	**0**
Indicate the approximate number of additional jobs in these companies:	

18 Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:

❑ Increase in employment, or	❑ In small & medium-sized enterprises
❑ Safeguard employment, or	❑ In large companies
❑ Decrease in employment,	❑ None of the above / not relevant to the project
● Difficult to estimate / not possible to quantify	❑

19 For each project partner, please estimate the employment effect resulting directly from your participation in Full Time Equivalent (*FTE = one person working fulltime for a year*) jobs:	*Indicate figure:* *48 FTE* ●
Difficult to estimate / but a good guess is 48 FTE	

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[6] Open Access is defined as free of charge access for anyone via the internet.

I   Media and Communication to the general public

20   As part of the project, were any of the beneficiaries professionals in communication or media relations?

      ○   Yes   ●   No

21   As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?

      ○   Yes   ●   No

22   Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?

❏	Press Release	❏	Coverage in specialist press
❏	Media briefing	❏	Coverage in general (non-specialist) press
❏	TV coverage / report	❏	Coverage in national press
❏	Radio coverage / report	❏	Coverage in international press
●	Brochures /posters / flyers	●	Website for the general public / internet
❏	DVD /Film /Multimedia	●	Event targeting general public (festival, conference, exhibition, science café)

23   In which languages are the information products for the general public produced?

❏	Language of the coordinator	●	English
❏	Other language(s)		

Question F-10: Classification of Scientific Disciplines according to the Frascati Manual 2002 (Proposed Standard Practice for Surveys on Research and Experimental Development, OECD 2002):

FIELDS OF SCIENCE AND TECHNOLOGY

1.   NATURAL SCIENCES
1.1   Mathematics and computer sciences [mathematics and other allied fields: computer sciences and other allied subjects (software development only; hardware development should be classified in the engineering fields)]
1.2   Physical sciences (astronomy and space sciences, physics and other allied subjects)
1.3   Chemical sciences (chemistry, other allied subjects)
1.4   Earth and related environmental sciences (geology, geophysics, mineralogy, physical geography and other geosciences, meteorology and other atmospheric sciences including climatic research, oceanography, vulcanology, palaeoecology, other allied sciences)
1.5   Biological sciences (biology, botany, bacteriology, microbiology, zoology, entomology, genetics, biochemistry, biophysics, other allied sciences, excluding clinical and veterinary sciences)

2   ENGINEERING AND TECHNOLOGY
2.1   Civil engineering (architecture engineering, building science and engineering, construction engineering, municipal and structural engineering and other allied subjects)
2.2   Electrical engineering, electronics [electrical engineering, electronics, communication engineering and systems, computer engineering (hardware only) and other allied subjects]
2.3.   Other engineering sciences (such as chemical, aeronautical and space, mechanical, metallurgical and materials engineering, and their specialised subdivisions; forest products; applied sciences such as geodesy, industrial chemistry, etc.; the science and technology of food production; specialised technologies of interdisciplinary fields, e.g. systems analysis, metallurgy, mining, textile technology and other applied subjects)

3.   MEDICAL SCIENCES

3.1 Basic medicine (anatomy, cytology, physiology, genetics, pharmacy, pharmacology, toxicology, immunology and immunohaematology, clinical chemistry, clinical microbiology, pathology)

3.2 Clinical medicine (anaesthesiology, paediatrics, obstetrics and gynaecology, internal medicine, surgery, dentistry, neurology, psychiatry, radiology, therapeutics, otorhinolaryngology, ophthalmology)

3.3 Health sciences (public health services, social medicine, hygiene, nursing, epidemiology)

4. AGRICULTURAL SCIENCES

4.1 Agriculture, forestry, fisheries and allied sciences (agronomy, animal husbandry, fisheries, forestry, horticulture, other allied subjects)

4.2 Veterinary medicine

5. SOCIAL SCIENCES

5.1 Psychology

5.2 Economics

5.3 Educational sciences (education and training and other allied subjects)

5.4 Other social sciences [anthropology (social and cultural) and ethnology, demography, geography (human, economic and social), town and country planning, management, law, linguistics, political sciences, sociology, organisation and methods, miscellaneous social sciences and interdisciplinary , methodological and historical S1T activities relating to subjects in this group. Physical anthropology, physical geography and psychophysiology should normally be classified with the natural sciences].

6. HUMANITIES

6.1 History (history, prehistory and history, together with auxiliary historical disciplines such as archaeology, numismatics, palaeography, genealogy, etc.)

6.2 Languages and literature (ancient and modern)

6.3 Other humanities [philosophy (including the history of science and technology) arts, history of art, art criticism, painting, sculpture, musicology, dramatic art excluding artistic "research" of any kind, religion, theology, other fields and subjects pertaining to the humanities, methodological, historical and other S1T activities relating to the subjects in this group]