

PROJECT FINAL REPORT

(PUBLIC VERSION)

Grant Agreement number: 214889

Project acronym: INTERESTED

Project title: INTERoperable EEmbedded SSystems Toolchain for EEnhanced DDesign, prototyping and code generation

Funding Scheme: ICT-2007-3.3 B Embedded Systems Suite of interoperable design tools for rapid design and prototyping

Period covered: from 01/01/2008 to 31/03/2011

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2 Executive summary

The INTERESTED project has been built to exactly match the goals defined within the Objective ICT-2007-3.3b (“Suites of interoperable design tools for rapid design and prototyping”), namely creating a **reference and open** interoperable embedded systems tool-chain, fulfilling the needs of the industry for designing and prototyping embedded systems.

The main project results can be summarized as follows:

- The INTERESTED project has created an integrated and open reference tool chain for complex safety and mission-critical embedded systems and software development that is not only highly dependable, safe and efficient but also reduces design and deployment costs by up to 50%.
- The INTERESTED reference tool chain successfully assimilates tools from leading European embedded tool vendors into three distinct design domains - system and software design, networking and execution platform, and timing and code analysis - covering the full spectrum of embedded systems and software development.

“We are extremely pleased to have brought the INTERESTED project to a highly successful conclusion. It represents a major opportunity to improve the cost, quality and time-to-market of embedded systems in Europe,” said Eric Bantegnie, CEO of Esterel Technologies and co-ordinator of the INTERESTED consortium. “It has been a massive effort. The past 12 months alone has seen the completion of 17 integrations between the 11 different tools in the INTERESTED reference tool chain, so far resulting in 14 new product prototypes. This extends from requirements capture down to the actual integration of the code on target, including verification and validation.”

“The INTERESTED project successfully met its objective of delivering substantial savings in overall project costs as evidenced by the industrial evaluations,” said Hedley Apperly Atego’s Vice-President of Product and Marketing and the marketing spokesperson for the INTERESTED consortium. “The INTERESTED tool chain more than meets the requirements of major European companies across a broad spectrum of industries whose worldwide leadership position increasingly depends on reducing the cost of developing complex embedded systems and software. We are fully productizing the integrations we have developed as part of the project, as will all the other tool vendors involved in the consortium.”

2.1 Summary description of project context and objectives

The competitive advantage of European industries in embedded system design is constantly challenged by emerging as well as other industrialized economies, thus generating a need for:

- An increased productivity of system development
- An improved competitiveness of European companies that rely on the design and integration of embedded systems in their products by reducing costs and time to market
- A reinforced European scientific and technological leadership in the engineering of complex systems
- The emergence of a European Research Area in embedded systems
- The emergence and growth of high tech European companies that supply design tools and associated software.

The INTERESTED project has been built to exactly match the goals defined within the Objective ICT-2007-3.3b (“Suites of interoperable design tools for rapid design and prototyping”), namely creating a **reference and open** interoperable embedded systems tool-chain, fulfilling the needs of the industry for designing and prototyping embedded systems.

This project regroups a consortium of leading edge European embedded systems Tools Vendors, all being high tech innovative SMEs, as well as European Major Tool Users representing several industries that are both integrating massively embedded systems and contributing to the overall competitiveness of Europe: Aerospace, Automotive, Railway and Transportation and Energy.

As stated in the ICT Work-program Challenge 3: “Intelligent functions embedded in components and systems will be a key factor revolutionizing many different applications in health, safety and security, transport and provision of environmentally friendly sustainable applications”.

As such, the INTERESTED project planned impact is to consolidate European Tool Developer’s Joint RTD work through a long-term partnership that enjoys the commitment of Major Tool Users.

The method followed in the project is to:

- Integrate the requirements of Major Tool Users of embedded systems tools to realize a **reference and open** interoperable embedded systems tool-chain, having in mind a broad socio-economic benefit for the European citizens, the performance of Embedded Systems generating long term societal benefits such as increased aircraft and transportation safety, reduced fuel and energy consumption and competitiveness of key European industries.
- Cover the full scope of Embedded Systems and Software engineering disciplines, spanning:
- System and Application Software Design Modelling, Verification and Code Generation
- Networking and RTOS execution platforms, Hardware-Dependent Software verification and Code Generation
- Timing analysis and code execution verification
- Validate the use of the INTERESTED tool-chain on real-life demonstrators (the “Industrial Validators”) representing key application domains for European leading industries: Aerospace, Automotive, Railway and Transportation and Energy.
- Demonstrate openness and interoperability within the INTERESTED Tool-Chain of Commercial Off-The-Shelf (COTS) and Open Source tools to the benefit of the users and tool suppliers’ communities.

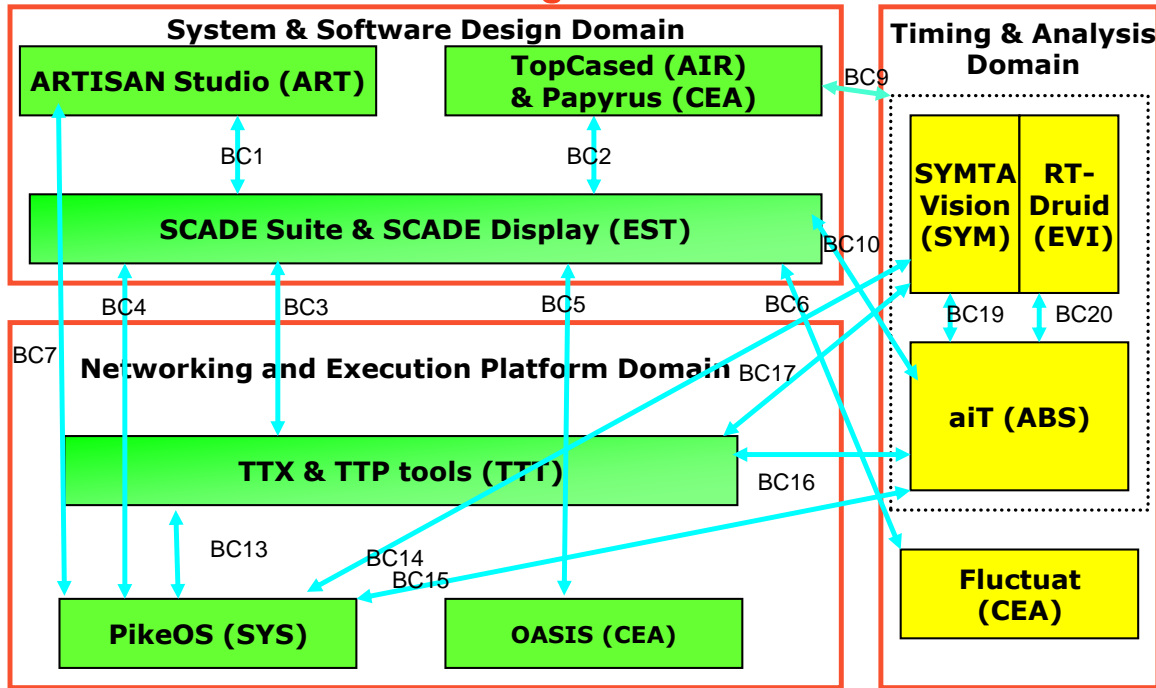
2.2 A description of the main S&T results/foregrounds

From a technical standpoint, the INTERESTED reference Tool-Chain integrates, using standards-based integration and interoperability solutions the following tools:

- Architecture definition tools (UML/SysML tools from ATEGO as well as demonstrated interoperability with Open Source UML and SysML Modellers such as SCADE System/TOPCASED/ Papyrus provided as interoperability demonstration case by Airbus and CEA (a convergence process is being initiated between these 2 tools and is funded outside of INTERESTED).
- Embedded GUI design tools (SCADE Display from Esterel Technologies),
- Application Software Design, Verification and Code Generation tools (SCADE Suite and SCADE Display from Esterel Technologies),
- Networking Infrastructure support tools (FlexRay and TTP tools from TTTech)
- RTOS execution platforms (PikeOS from SYSGO as well as demonstrated interoperability with domain specific execution platform such as the OASIS environment from CEA)
- WCET and Stack Analysis Tools (aiT from ABSINT)
- Schedulability analysis tools (SymTA/S from Symtavisio and RT-Druid from Evidence), as well as numerical precision analysis tools (Fluctuat from CEA)

The Tool Technical Integration overview is summarized below:

INTERESTED tools integration overview



July, 8th, 2011

Slide 5

The project has been organized in 3 specific subprojects to handle all technical integrations between the tools addressing the system and software design tools (Artisan Studio, Topcased/Papyrus/SCADE System, and SCADA Suite & SCADA Display) on one hand, the tools addressing the networking and execution platform domain (TTX tools, PikeOS and OASIS) and the tools addressing the timing and numerical analysis domains (SymtA/S, RT Druid, aiT and Fluctuat), and then the technical integrations between the previous 3 domains.

A high level process and tools positioning summary of this integration is defined in the following chart, according to the Embedded Systems Common Technical Baseline (CTB) "Tools & Process View":

Interested Products in CTB (Common Technical Baseline)

Tool structure according to CTB

<http://embedded-systems-portal.com/CTB>

SCADE Suite & Display
& Artisan Studio

TopCased-Papyrus-
SCADE System &
Artisan Studio

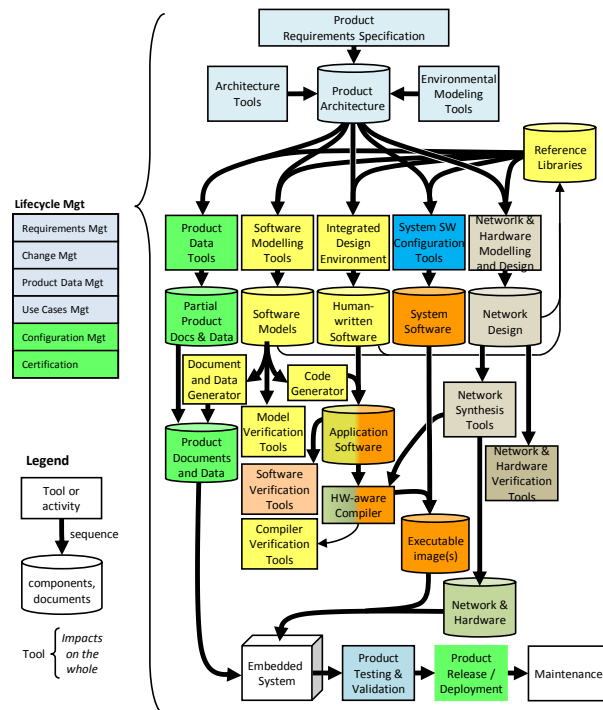
SCADE LifeCycle &
Artisan Studio

TT-Tools

Fluctuat & aiT

PikeOS & OASIS

SymTA/S & RT-Druid



Tool Vendors within the INTERESTED project have realized a number of Integration Technical Business Cases for the integration of their tools, validated against the Major Tool Users requirements and have ensured that all selected Integration Technical Business Cases specifications and developments are architected in an interoperable way with 3rd party tools, such interoperability being verified within the Industrial Validators.

One Major Tool User (CEA), due to its mission, enjoying strong links with academics partners, has steered an Academic Advisory Board to make sure that innovative and proper advice from the academic community has been clearly taken into account.

2.3 The potential impact

Major Tool Users (AIRBUS, THALES, MAGNETI MARELLI, SIEMENS MOBILITY and CEA) brought their requirements for the Tool-Chain content, structuring, features, interoperability architecture and characteristics, as well as real-life demonstration cases for their use of relevant parts of the tool-chain and interoperability demonstration cases with in-house or open source tools.

They have ensured, thru appropriate metrics the progress and evaluation of the cost reduction target that the INTERESTED reference tool-chain enables:

- Airbus Industries has estimated that its use of the INTERESTED tool chain resulted in a 48% reduction in overall project effort due mainly to the benefits derived from implementing model-driven processes and automatic code generation, coupled with the ability to guarantee consistency of data exchanged between systems and software teams reduce integration effort and the time needed for rework.
- Thales reported that the rigour imposed by the use of model-driven tools compared to freeform alternatives resulted in a 25% reduction total effort including design and reviews, a 10% reduction in

the time spent on modelling (diagram design effort) and a 25% reduction in the number of remarks raised by design reviewers.

- Siemens Mobility reduced overall projects costs by 20% but remarked that the INTERESTED tool chain would have reduced them by up to 52% had the tools and techniques all been new to its process.
- Focusing on overall development effort, the Commissariat à l'Energie Atomique estimated that, with advanced familiarity of the development tools, initial development costs were reduced by approximately 40% and 69% for ongoing maintenance costs.
- Magneti Marelli stated that, with 70% of rework relating to changes or issues in the architecture design, a 50% time saving, and possibly more, could be made by applying the INTERESTED tool chain. The adoption of a model-based design architecture, together with systematic timing analysis, saved one person-year effort in verifying functionality and responding to change requests.

Airbus has basically focussed its efforts on the integration of system and software development tools, with an application on a real-life Flight Warning System, a highly complex and safety-sensitive application

Thales has performed several technical validations covering a large part of the whole tool chain, including on a large scale real world subway train control system

Siemens Mobility has also focussed, like Airbus on the integration of system and software development tools, with an application on a real life track warrant control system, but has also performed a technical validation of the different timing tools on a track vacancy detection system.

Magneti Marelli has mapped most of the development tool chain on a demanding AUTOSAR-compliant engine control system, with a dedicated focus on timing analysis, multi-core support and SPICE process compliance

CEA has itself performed a specific validation of then integration of its numerical analysis tool with SCAD Suite, as well as its integration with the OASIS execution environment on a Qualified Nuclear Display system

The Industrial Validators of the INTERESTED tool chain have each detailed their findings within Industrial White Papers, which are appended in Annex A, B, C, D and E.

The main dissemination activities are summarized in section 3

2.4 The address of the project public website, as well as relevant contact details.

Project Web Site: www.interested-ip.eu

Project Coordinator Contact details: eric.bantegnie@esterel-technologies.com

3 Use and dissemination of foreground

3.1 Dissemination

The detailed dissemination activities can be found at the project Web Site

3.1.1 Technology Partners Dissemination

All the Technology Partners has participated at more than 50 conferences and events during the course of the project, where key facts of the INTERESTED project have been presented.

It is particularly worthwhile to note that, for the announcement of the SCADE System product line, which is the marketing names used by Esterel Technologies for the Papyrus/SCADE Suite integration done within ITBC 2, Esterel Technologies has received at Embedded World Nuremberg 2011 in March 2011, the “Best of Show” award in front of 800 exhibitors, by the principal US-based market analyst, the company VDC Research.



3.1.2 Industrial Partners Dissemination

The industrial partners have undergone several internal and external dissemination events, such as the Topcased dissemination event for Airbus (all the integration components developed in Topcased for the INTERESTED project are included in the OPEES project (ITEA Label) to insure their durability) and the distribution of internal articles, dissemination materials on the companies' Intranets and internal seminars on the INTERESTED results, with the participation of the toll vendors.

Magneti Marelli has presented the INTERESTED approach to the timing analysis of AUTOSAR discussing design options and trade-offs.

Esterel Technologies and the CEA LIST Institute formed a joint R&D lab, the LISTEREL Critical Software Lab to Advance Critical Systems and Software Development Tools and Processes.

CEA LIST as co-organizer of ECMFA'2010 conference (www.ecmfa-2010.org) contributed to disseminate INTERESTED results and proposed together with Evidence a workshop on platform for model driven development of embedded systems: HOPES

CEA LIST has organized a Tech Show in Japan at the beginning of June 2010 to present its expertise and technologies around at least three INTERESTED components: System modelling with Papyrus and SCADE Suite integration; Scheduling analysis from Papyrus and MARTE models; PharOS platform from automotive systems derived from OASIS technologies (<http://sites.google.com/site/listtechshow2010/home>).

Thales Research & Technology organizes every year several technical meetings in which some operational units are invited. This type of meeting is a means to have exchanges and to mix together operational needs and R&T topics. Mission critical information systems are one such topic. It will be the opportunity to present some INTERESTED results to operational units.

Siemens AG has distributed key facts of the INTERESTED project in regular newsletters (e. g. R&D-Newsletter, Software-Initiative Newsletter, Rail Automation News)

3.2 Section B Exploitation

The following table summarises the product versions and target dates for productization of each ITBC.

It is remarkable to point out that most research prototypes developed and successfully validated my major tool users are now directly integrated within the respective tool vendors offering

3.2.1 Productization roadmap – Tool vendor exploitation -

ITBC	Target Product Versions		Target Date
ITBC 1 Atego Artisan Studio – Esterel Scade	SCADE Suite 6.4	Artisan 7.X (tbd)	Q4/12
ITBC 2 CEA List Papyrus Sys/ML – Esterel Scade	SCADE System 1.0	Papyrus 0.8	Q4/11
ITBC 3 TTTech FlexRay – Esterel Scade	SCADE Suite 6.2	TTX Tool Suite	Available
ITBC 4 Sysgo PikeOS – Esterel Scade	SCADE Suite 6.2 (for C)	PikeOS 3.0	Available
	SCADE Suite 6.4 (for Ada)	PikeOS 4.0	Q4/12
ITBC 5 CEA List OASIS Psy C – Esterel Scade	Dependent upon customer feedback, prototype ready for customer evaluation		TBD
ITBC 6 CEA List Fluctuat – Esterel Scade	Dependent upon customer feedback, prototype ready for customer evaluation		TBD
ITBC 7 Atego Artisan Studio – Sysgo PikeOS	Dependent upon customer feedback, prototype ready for customer evaluation	Artisan Studio 7.3	TBD
ITBC 9 CEA List Papyrus Sys/ML – Evidence RT-Druid	RT Druid 1.6	Papyrus 0.8	Q4/11
ITBC 10 AbsInt a ³ – Esterel Scade	SCADE Suite 6.2 (for C)	aiT 12.10	Available
	SCADE Suite 6.4 (for Ada)	aiT 12.10	Q4/12
ITBC 13 TTTech TTP/TTEthernet – Sysgo PikeOS	PikeOS 3.1	TTE & TTP interface prototype available	Q1/12

ITBC 14 Symtavigation SymtA/S – Sysgo PikeOS	PikeOS 3.1	SymTA/S 2.5	Q1/12
ITBC 15 AbsInt a ³ – Sysgo PikeOS	PikeOS 3.1	aiT 12.10	Q1/12
ITBC 16 AbsInt a ³ – TTTech FlexRay/TTP	Prototype interface TTP to aiT available	aiT 12.10	Available
ITBC 17 Symtavigation SymtA/S–TTTech TTP/TTEthernet	Dependent upon customer feedback, prototype ready for customer evaluation		TBD
ITBC 19 Symtavigation Symta/S – AbsInt a ³	SymTA/S2.4	aiT 12.10	Available
ITBC 20 Evidence RT-Druid – AbsInt a ³	RT Druid 1.5	aiT 12.10	Available

3.2.2 Major Tool Users exploitation

All major tool users have defined detailed internal exploitation plan, based on the deployment of the relevant parts of the INTERESTED tool chain, toward their current and future projects.

As an example, Airbus has referenced the INTERESTED tool chain as a candidate for its next generation airplane program, while several of the existing INTERESTED tools are already in operational use within multiple aircraft programs (A340, A380, A400M, A350...) at Airbus and its suppliers like THALES.

3.2.3 Training

A particular key effort about exploitation is the delivery of a comprehensive set of trainings for each tool couplings.

The public version of all these trainings can now be found at: <http://www.interested-ip.eu/trainings.html>

3.3 Report on societal implications

Replies to the following questions will assist the Commission to obtain statistics and indicators on societal and socio-economic issues addressed by projects. The questions are arranged in a number of key themes. As well as producing certain statistics, the replies will also help identify those projects that have shown a real engagement with wider societal issues, and thereby identify interesting approaches to these issues and best practices. The replies for individual projects will not be made public.

A General Information *(completed automatically when Grant Agreement number is entered.*

Grant Agreement Number:	214889
Title of Project:	INTERESTED
Name and Title of Coordinator:	ERIC BANTEGNIE – ESTEREL TECHNOLOGIES

B Ethics	
1. Did your project undergo an Ethics Review (and/or Screening)? <ul style="list-style-type: none"> If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports? <p>Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 'Work Progress and Achievements'</p>	No
2. Please indicate whether your project involved any of the following issues (tick box) :	None
RESEARCH ON HUMANS	
• Did the project involve children?	
• Did the project involve patients?	
• Did the project involve persons not able to give consent?	
• Did the project involve adult healthy volunteers?	
• Did the project involve Human genetic material?	
• Did the project involve Human biological samples?	
• Did the project involve Human data collection?	
RESEARCH ON HUMAN EMBRYO/FOETUS	
• Did the project involve Human Embryos?	
• Did the project involve Human Foetal Tissue / Cells?	
• Did the project involve Human Embryonic Stem Cells (hESCs)?	
• Did the project on human Embryonic Stem Cells involve cells in culture?	
• Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?	
PRIVACY	
• Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	
• Did the project involve tracking the location or observation of people?	
RESEARCH ON ANIMALS	
• Did the project involve research on animals?	
• Were those animals transgenic small laboratory animals?	
• Were those animals transgenic farm animals?	
• Were those animals cloned farm animals?	

<ul style="list-style-type: none"> • Were those animals non-human primates? 	
RESEARCH INVOLVING DEVELOPING COUNTRIES	
<ul style="list-style-type: none"> • Did the project involve the use of local resources (genetic, animal, plant etc)? 	
<ul style="list-style-type: none"> • Was the project of benefit to local community (capacity building, access to healthcare, education etc)? 	
DUAL USE	
<ul style="list-style-type: none"> • Research having direct military use 	0 Yes 0 No
<ul style="list-style-type: none"> • Research having the potential for terrorist abuse 	

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		
Work package leaders		
Experienced researchers (i.e. PhD holders)		
PhD Students		
Other		

4. How many additional researchers (in companies and universities) were recruited specifically for this project?

Of which, indicate the number of men:

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 |
|---|---|---|
| <input type="checkbox"/> Design and implement an equal opportunity policy | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> |
| <input type="checkbox"/> Set targets to achieve a gender balance in the workforce | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> |
| <input type="checkbox"/> Organise conferences and workshops on gender | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> |
| <input type="checkbox"/> Actions to improve work-life balance | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> |

Other:

This was not specifically meaningful in the context of the project as all involved countries are subject to gender equality laws and as all companies involved their existing staff

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

No

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

Yes- please specify

No

F Interdisciplinarity

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

- Main discipline²: 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)]
- Associated discipline²: Associated discipline²:

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

² Insert number from list below (Frascati Manual).

<input type="radio"/> Yes - in implementing the research <input type="radio"/> 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)?			<input type="radio"/> <input type="radio"/>	Yes No
12. Did you engage with government / public bodies or policy makers (including international organisations)				
<input checked="" type="radio"/> No <input type="radio"/> Yes- in framing the research agenda <input type="radio"/> Yes - in implementing the research agenda <input type="radio"/> 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?				
<input type="radio"/> Yes – as a primary objective (please indicate areas below- multiple answers possible) <input type="radio"/> Yes – as a secondary objective (please indicate areas below - multiple answer possible) <input checked="" type="radio"/> 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?	2(academic dissemination was not the primary purpose, the target was industrial conferences)
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To how many of these is open access³ provided?	100%
--	-------------

How many of these are published in open access journals?	
---	--

How many of these are published in open repositories?	
--	--

To how many of these is open access not provided?	
--	--

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
- other⁴:

15. How many new patent applications ('priority filings') have been made? <i>("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).</i>	None (not applicable)
--	------------------------------

16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	None (not applicable)
	Registered design	
	Other	

17. How many spin-off companies were created / are planned as a direct result of the project?	None (not applicable)
--	-----------------------

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, (increased) | | In small & medium-sized enterprises

³ Open Access is defined as free of charge access for anyone via Internet.

⁴ For instance: classification for security project.

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 immuno-haematology, 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]

4 Annex A: Airbus White Paper

(provided as a separate .pdf file)

5 Annex B: Thales White Paper

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6 Annex C: CEA White Paper

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