The ARTEMIS JU Annual Work Programme 2010

.

Table of Contents

1 Introduction 4
2 Context 5
2.1 Societal and Economic Context 5
2.2 Strategic context 6
2.3 Research & Development Context 7
3 Content and Objectives of 2010 Call 8
3.1 Industrial Priorities 8
3.1.1 Reference designs and architectures 8
3.1.2 Seamless connectivity and middleware 8
3.1.3 Design methods and tools 8
3.2 ARTEMIS Sub-programmes 9
3.2.1 ASP1: Methods and processes for safety-relevant embedded systems 9
3.2.2 ASP2: Healthcare systems 11
3.2.3 ASP3: Smart environments 13
3.2.4 ASP4: Efficient manufacturing and logistics 15
3.2.5 ASP5: Computing environments for embedded systems 17
3.2.6 ASP6: Inter-networked ES for Security and Critical Infrastructures Protection 19
3.2.7 ASP7: Embedded technology for sustainable urban life 21
3.2.8 ASP8: Human-centred design of embedded systems 23
4 Requirements 25
4.1 General 25
4.2 Contribution to the ARTEMIS targets 25
4.3 Expected impact 25
4.4 Technology vis-à-vis Application 25
4.5 Co-operation 25
4.6 Evolution of markets and market environment 25
4.7 Standards & Regulations 26
4.8 Innovation environment 26
4.9 Project duration 26
5 Implementation of Call in 2010 27
5.1 Call 3: JU-ARTEMIS-2010 27
5.2 Call implementation in 2010 27
6 Eligibility and Evaluation Criteria for Proposals 28
6.1 Eligibility Criteria for Proposals 28
6.2 Eligibility criteria for funding 28
6.3 Evaluation criteria 29
6.3.1 Project Outline 29
6.3.2 Full Project Proposal 29
7 How to submit a proposal 31

Change history from AWP 2009 to AWP2010

N.B. Only substantive changes are recorded here: not typographical, grammatical or formatting corrections, re-ordering of text, or stylistic clarification.

Place in text	Nature of change
Section 2. Context	1) New sub-section on 'Societal and Economic Context' 2) Other sub-sections restructured into 'Strategic Context' and 'R&D Context' (but without substantive change to the overall content).
Section 3. Introduction	1) Clarification of need to address Industrial Priorities in context of Sub-programmes 2) Expansion of potential (and need) to address whole 'chain', from academic research to industrial pre-commercial activities. 3) for all sub-programmes, structure of 'goals', relevance' and 'impact' revised to match better the evaluation criteria
Section 3.2.1. ASP1: Methods and processes for safety-relevant embedded systems	Refinements and clarifications of the intentions and expectations for this sub-programme.
Section 3.2.2. ASP2: Healthcare systems	Refinements and clarifications, especially of the broader view of healthcare systems expected to 'keep people healthy' (extending beyond the traditional 'health' domain), with more examples.
Section 3.2.3. ASP3: Smart Environments	Refinements and clarifications, with increased emphasis on the need for smart environments to support multiple application domains and user contexts.
Section 3.2.4. ASP4: Efficient manufacturing and logistics	Refinements and clarifications, with increased emphasis on the need for sustainability and energy efficiency, and linkage to the 'Factory of the Future' initiative.
Section 3.2.5. ASP5: Computing environments for embedded systems	1) Increased emphasis on aim for cross-domain applicability 2) Minor refinements and clarifications
Section 3.2.6. ASP6: Internetworked ES for Security and Critical Infrastructures Protection	1) New emphasis on two specific target areas: the Internet of Things and Critical Infrastructures. 2) Refinements and clarifications, particularly of the aims for proposed projects to contribute to trusted service platforms and communication protocols. Also increased emphasis on the need to address 'unmanaged' environments.
Section 3.2.7. ASP7: Embedded technology for sustainable urban life	1) Clarification of 3 main goals: Eco efficiency; Eco sufficiency; and Improved comfort and security, 2) Other detailed refinements and clarifications, including specific addition of 'visualization' as a desired topic.
Section 3.2.8. ASP8: Human-centred design of embedded systems	1) Clarification that the intention is to support all domains - not just safety critical domains, 2) Clarification of the need to address multi-modal HMIs, with increased emphasis on need to support the user in the pursuit of their (often unpredictable) goals, rather than constrain them, 3) Reinforced need for techniques to model, visualize and analyze user performance in combined human-machine systems, 4) Other detailed refinements and clarifications.
Section 4. Requirements	1) Expansion of Section 4.2 (contribution to Artemis Targets) with material moved (and slightly revised) from Section 3 of AWP 2009. (Aim is to consolidate requirements that apply to all sub-programmes.) 2) New Section 4.3 on Expected Impact to strengthen link between evaluation criteria and the expectations of the sub-programmes 3) Section on Innovation Environment Integration now includes former section on SMEs and new material on Education and Training. Also reduced prescription of the expectations of projects. 4) Other refinements, particularly to remove inessential detail.
Section 6. Eligibility and Evaluation Criteria	Addition of more explicit linkages between criteria for Relevance and Impact and the pertinent sections of the work-programme.

1 Introduction

Embedded Systems are everywhere, built into cars, roads, bridges and tunnels, into medical instruments and surgical robots, into homes, offices and factories, into aeroplanes and airports, into mobile phones and communication and virtual reality glasses, and even into our clothes. They are interconnected in networks of many devices - the car to the fixed road infrastructure, the smart card to the banking system. Embedded Systems technologies are deployed in all relevant market sectors for Europe. Consequently Embedded Systems have a major impact on the way these sectors work and collaborate, how they will develop, how they are perceived by both professionals and the public, and how successful their products will be on the world market.

This present document - the ARTEMIS[1] Annual Work Programme for 2010 - sets out the research priorities for projects to be supported through the 3rd Call for Proposals of the ARTEMIS Joint Undertaking (JU).

[1] ARTEMIS -*"**A**dvanced **R**esearch and **T**echnology for **Em**bedded **I**ntelligence and **S**ystems"*- is the European Technology Platform for Embedded Computing Systems.

2 Context

2.1 Societal and Economic Context

Embedded Systems will enable us to respond to the two wake-up calls that society has had in recent times - climate change and the economic crisis. Both these developments indicate a need for better use of natural, industrial and human resources.

This is recognised in the recovery package of the European Commission[2] which includes, for instance, a proposal to establish 3 major partnerships between the public and private sectors:

- In the automobile sector, a 'European green cars initiative'
- In the construction sector, a 'European energy-efficient buildings' initiative
- To increase the use of technology in manufacturing, "a factories of the future initiative".

As the 2009 ISTAG Report[3] indicates, Embedded Systems enable better use of resources, with reduced waste and pollution, by providing more and better information and more sensitive and finely tuned monitoring and control in all domains - aviation, automobiles, manufacturing, traffic management, logistics, energy management ... even personal healthcare.

And, given sector-independent inter-communication, Embedded Systems enable us to move from localised, sector-specific improvements - in homes, offices, vehicles, factories, traffic management, healthcare, and so on .. to 'joined-up' optimisation - to smart cities and even smart societies. We expect a blurring of the boundaries between previously distinct sectors: the role of transport, for instance, is now to be considered alongside ePresence within the wider context of the appropriate means to achieve work and personal objectives, and also a work-life balance.

The 2009 ISTAG Report specifically states that:

> *"ISTAG believes that the Artemis JTI, amongst other ETPs, within the federating concept of the Future Internet, can make essential contributions to the development and support of research objectives and the improvement of innovation capabilities in the area of the Internet of Things. This approach will benefit the many industrial sectors that depend on ICT innovation for their progress (automotive, aerospace, health, smart buildings, telecommunications, energy efficiency, security …) and which participate in the Artemis JTI. The technologies will also make significant contributions to a plethora of semi-autonomous "cyber-physical" systems with different local intelligence. ISTAG believes that keeping a competitive edge in design methodology for such networked systems is vital to the success of European industry."*[4]

Apart from their contribution to energy management and especially reduced consumption in other domains, new techniques are emerging to reduce the energy consumption of Embedded Systems themselves. This is important given the explosion in their use in all sectors, not least the consumer sector, from mobile telephones to plasma TV screens.

[2] COM(2008) 800, action 8: 'Increase investment in R&D, Innovation and Education'
[3] *"Revising Europe's ICT Strategy"*. February 2009. (http://cordis.europa.eu/ist/istag-reports.htm)
[4] ibid.

2.2 Strategic context

The ARTEMIS strategy is to overcome fragmentation in the Embedded Systems markets so as to increase the efficiency of technological development and, at the same time, facilitate the establishment of a competitive market in the supply of Embedded Systems technologies.

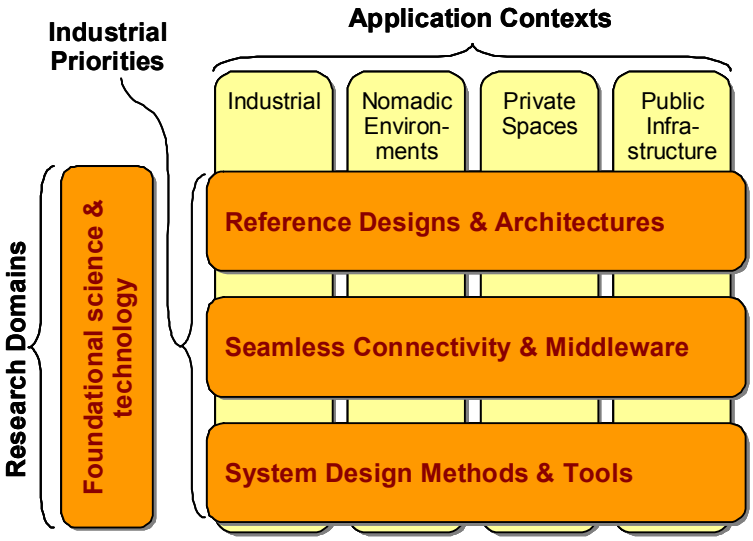
Specific barriers to progress have been identified that have common characteristics across the different application contexts. These fall into three main Research Domains that comprise the 'Industrial Priorities' (see section 3.1):

"Reference Designs and Architectures"
"Seamless Connectivity and Middleware"
"Design Methods and Tools"

While the ARTEMIS JU seeks maximum commonality across application sectors, it is recognised that different application domains impose differing demands on the technology to be developed. The ARTEMIS SRA therefore identifies a number of representative 'Application Contexts' in which sets of applications can share common domain expertise, design characteristics and requirements so that they can, in turn, share methods, tools, technologies and skills. These are:

"Industrial systems"
"Nomadic Environments"
"Private Spaces"
"Public Infrastructure"

There are therefore two dimensions to the ARTEMIS strategy: the four clusters of Application Contexts and the three Research Domains (which are themselves supported by research into foundational science and technology):



The industrial partners within ARTEMIS stress that the downstream research supported by the JU should be application-oriented, providing proofs of concepts for novel embedded systems in specific domains, so as to empirically validate design requirements and allow for real-time performance evaluation of novel designs and architectures. Therefore, in order to focus the research towards concrete instantiations of these Application Contexts, the ARTEMIS-JU Research Agenda (RA) defines eight 'sub-programmes' of research into both technologies and applications:

ASP1. Methods and processes for safety-relevant embedded systems
ASP2. Healthcare systems
ASP3. Smart environments
ASP4. Efficient manufacturing and logistics
ASP5. Computing environments for embedded systems
ASP6. Inter-networked ES for Security and Critical Infrastructures Protection
ASP7. Embedded technology for sustainable urban life
ASP8. Human-centred design of embedded systems

One of the major characteristics of the new research approach promoted by the ARTEMIS JU is **the promotion of cross-fertilization and reuse of technology results in different application domains**. The implementation will therefore be managed by **tightly coordinating and synchronizing the research** performed in the sub-programmes, **with the longer-term goal** of stimulating long-lasting and self-sustaining "eco-systems" of actors, as described in the ARTEMIS-JU MASP. This tight coordination will be assured by encouraging projects to be highly visible (within the constraints of the IPR contractual agreements). In addition, the contribution of projects to the attainment of the ARTEMIS high-level objectives will be monitored, initially by requesting projects to propose self-assessment criteria and baselines, and later via specific actions which will identify Success Criteria and Metrics at the JU level, whose lead- and lag-indicators will offer a powerful tool for steering the content of future calls. *(See section 4.2 'Contribution to the ARTEMIS targets')*

In addition to making a contribution to the cross-domain aims of the strategy, the outcome of the research within the Work Programme is expected to fulfil concrete targets for the ARTEMIS JU that are set out in the MASP (*see References, section 7*).

2.3 Research & Development Context

The structure of the ARTEMIS Joint Undertaking (JU) is laid down in the Council Regulation no 74/2008 which states that the Joint Undertaking will develop its own ARTEMIS Research Agenda (RA). The Research Agenda closely follows the recommendations of the ARTEMIS Strategic Research Agenda (SRA) of the ARTEMIS Technology Platform and addresses the design, development and deployment of ubiquitous, interoperable and cost-effective, powerful, safe and secure electronic and software systems.

However, the scope of the ARTEMIS RA is only part of the scope of the ARTEMIS SRA. It is intended to avoid overlap with European programmes - particularly the Framework Programme - that also contribute to the goals of the ARTEMIS SRA. Artemis is also intended to help reduce the fragmentation of R&D resources available for national and regional programmes.

In particular***, the ARTEMIS RA focuses on downstream-oriented research and technological development*** *with a strong market drive.* This is intended to deliver ***prototype*** or ***demonstrator*** solutions with ***high cross-domain applicability*** to address ***specific societal needs***. It may also be enriched on topics that are not described in detail in the ARTEMIS SRA.

ARTEMIS also maintains a Multi-Annual Strategic Plan (MASP), which defines the strategy that the JU, will follow to execute the RA, how it will be financed, and how it will be managed.

The ARTEMIS MASP and RA, and the consequent Annual Work Plan, are designed to be complementary to other initiatives.

The downstream nature of the research distinguishes it from the Framework Programme, and the level of focus provided by the ARTEMIS sub-programmes distinguishes it from EUREKA (ITEA2, CATRENE, etc.) as well as from National and Regional programmes. While also market oriented, Eureka programmes are typically much broader in scope, allowing for a different degree of market orientation, while National and regional programmes focus on local priorities.

Each year, the specific objectives for R&D to be achieved through Calls for Proposals are detailed in an Annual Work Programme. There is one Call for Proposals to address those requirements during each year.

This present document is the Annual Work Programme for 2010. It defines the content and scope of the Call for Proposals to be launched in 2010.

The text of the subsequent Call for Proposals will further detail the available budget and the eligibility criteria, taking into account the requirements of both the European Commission and Member States.

3 Content and Objectives of 2010 Call

Each proposal should have a technological focus on at least one of the Industrial Priorities of ARTEMIS (see Section 3.1) in the context of at least one Sub-Programme (see Section 3.2). The application-driven development of new technologies and solutions can direct the project results more towards real user needs and businesses. Proposals will benefit from having a central role for applications and early feedback during the projects in order to achieve market-relevant results. Proposals should identify which of the Industrial Priorities and Sub-Programmes they address.

As indicated in section 2.3 above, ARTEMIS research is intended to focus on *"downstream-oriented research and technological development with a strong market drive"*. However, the focus on downstream RTD does not preclude and indeed it specifically *includes* exploration of the potential for practical application of upstream research from academic institutions and RTOs, such as the validation of embryonic techniques and technologies in an industrial setting, for example through prototypes, demonstrators or test-beds. And, as also indicated in section 2.3, it extends in the downstream direction to the prototyping of innovative embedded systems.

3.1 Industrial Priorities

The ARTEMIS JTI on Embedded Computing Systems addresses the design, development and deployment of ubiquitous, interoperable and cost-effective, powerful, safe and secure electronics and software systems. To do this it must deliver on 3 industrial priorities:

3.1.1 Reference designs and architectures

Reference designs and architectures that offer common architectural approaches for given ranges of applications. It includes topics such as:

- composability: the ability to derive instantiations of architecture from a generic platform that support the constructive composition of large systems out of components and sub-systems without uncontrolled emergent behaviour or side effects.
- architectural dependability, to ensure secure, reliable and timely system services despite accidental failure of system components and/or the activity of malicious intruders.
- design for safety by means of architectures instantiated from a generic platform that enable the implementation of safety critical systems and the concurrent construction of dependability models. In addition to the required dependability and functionality of the provided services, emphasis is put on architectural support for certification, and the establishment of a safety case.

3.1.2 Seamless connectivity and middleware

Middleware that allows seamless connectivity and interoperability. It includes topics such as:

- cross domain connectivity and communication capabilities, necessary to realise the seamless interoperability between the 'Ambient Intelligent Environments' envisaged for the European citizen (at home, travelling, at work, in public spaces,…)
- resource management to insure seamless connectivity between ES in a physical and logical environment more and more subject to changes, and to dynamically adapt to such changes. Resource management should ensure high utilization of the system resources such as CPU, memory, network, and energy, and guarantee operation within resource reserves or budgets.

3.1.3 Design methods and tools

Integrated system design methods and tools for rapid development and prototyping. It includes topics such as:

- establishment of integrated chains of European-sourced tools platforms, based on ARTEMIS JU results, to support a complete process flow of development of Embedded Systems from user requirements, through system design, to system-on-chip production.

- system-level model-based tools and design processes that contribute, in an integrated fashion, to elevating the abstraction level for architecture exploration and product design.
- test, validation and verification tools to support compositional design that can be integrated into the complete process flow to support concurrent verification and validation at the product level as an integral part of the design process.

3.2 ARTEMIS Sub-programmes

The specific sub-programme priorities for 2010 are indicated below. These are set in the context of the sub-programme definitions contained in the ARTEMIS Multi-Annual Strategic Plan and the ARTEMIS-JU Research Agenda.

A research project should specifically address the Main Goals and Approach, the Applications Relevance, and the Cross-domains aspects of the sub-programmes, as described below.

In addition, all projects are required to satisfy general requirements, not specific to any of the sub-programmes. These general requirements are set out in Section 4.

3.2.1 ASP1: Methods and processes for safety-relevant embedded systems

Objectives and Approach

The overall aim of this sub-programme is to enhance the quality of services and products in strategic European industrial sectors and to decrease fatalities and injuries by building cost-efficient processes and methods supporting the development and operation of safety enabling embedded systems.

The aim is to achieve technological breakthroughs in four research areas:

- Requirement Management
- Architecture Modelling and Exploration
- Analysis Methods
- Component Based Design, particularly building reliable systems out of unreliable components

Such breakthroughs are required not just for conventional discrete stand-alone devices, but also to multi-processor systems-on-a-chip.

Projects should contribute to one or more of the following specific objectives:

- A European Standard Reference Technology Platform, embodying meta-models, methods, and tools for safety-critical hard-real-time system development supported by European tool vendors.
- A model-driven process for the compositional development of safety and security critical systems. This should enable model-based compositional development and qualification, supporting reasoning about non-functional properties (including but not limited to safety) and it should provide a basis for rapid qualification or certification of compositionally designed systems and especially rapid re-qualification or re-certification after change.
- An analysis methodology to establish an industrially applicable methodology for exploration of design spaces and multi-criteria constraint satisfaction and design and development decision-making, with particular regard to safety properties.
- The design and prototype implementation of a cross-domain embedded systems architecture that addresses the requirements and constraints of the ARTEMIS SRA for composability, Networking and Security, Robustness, Diagnosis and Maintenance, Integrated Resource Management, Evolvability and Self-Organization.

Expected Impact

Embedded systems with high safety requirements contribute more and more in the total costs and value creation in a large variety of equipment in application areas such as:

- Transportation (automotive, aerospace, rail): for instance, maximally utilizing the capacity of roads to accommodate increase in traffic demand while *improving* safety[5];
- Industry (process control, manufacturing, ..)
- Public infrastructures and utilities (electricity, gas, water, ..)
- Medicine (surgical equipment, diagnostic equipment, imaging equipment, health monitoring devices, systems and equipment, ..)
- Energy generation.

Projects are therefore expected to:

- reduce time to market despite the increasing contribution of embedded systems and software and their increasing size and complexity;
- increase the quality and reliability of products and services while providing novel functionalities to the user;
- improve cross-domain fertilisation.

Projects in this sub-programme are also expected make breakthroughs as described above in order to contribute to progress in one or more of several transverse processes such as Design for Safety, Design for Maintainability, Design for Reuse, and Design for Certification.

The ARTEMIS-JU 2010 MASP declares an aim to form an agreed set of specifications dedicated to well-defined applications and aspects of the complete design tool chain, referred to as a Tool Platform. It is expected that each Tool Platform will attract specialised developers and users, thereby forming an eco-system of technical expertise. Projects intending to address this ASP are expected to propose specific, adequately resourced contributions to the establishment of such a Tool Platform.

Cross-domain aspects

The development of safety-relevant systems will mainly rely on development of cross-domain S/W tools and design processes with multiple objectives (cost, time, energy, memory, safety, design distribution, standards compliance).

Systems of systems specific requirements, if needed, (e.g. self-assembly in manufacture, and intermodality, formation flying or driving in transport) should be addressed in conjunction with the relevant application-oriented sub-programmes.

ASP1 depends on suitable platform technologies for the construction of dependable embedded computer systems. Examples for points of interaction include certifiable computing environments, fault-tolerance and robustness technologies or diagnosis and maintenance mechanisms for safety-relevant embedded systems. As a result, ASP1 will have a strong interaction with ASP5.

Synergy will also be sought with ASP6 in view of the similar objectives.

Synergy will be sought with ASP8 since usability is a main concern for early and smooth adoption in projects, and since there are safety aspects to the design of Human Machine Interfaces.

[5] The EU has a goal of zero traffic fatalities by 2020.

3.2.2 ASP2: Healthcare systems

Objectives and Approach

Europe has an ageing population, growth in chronic diseases, more demanding citizens, and increasing expenditure on healthcare - presently rising from a recent figure of about 8% of GDP - or about 600 billion Euro p.a.

The main goal of this sub-programme is to facilitate the transformation from 'health care' to 'health management'. That is to say from "how to treat patients" to "how to keep people healthy".

This sub-programme aims to establish an overall system approach for healthcare based on an integrated system concept of seamless integration of interoperable components (both devices and services). This will support personalized prevention and treatment strategies by taking advantage of the opportunities offered by new technology, such as:

- gathering data by a large variety of sensors and controlling treatment by various actuators in relevant situations: at home, on the move, at work, in health centres, clinics and hospitals, and enabling easy, efficient and effective wide-scale screening;
- analysis of the gathered data, from historical as well as parallel care cycles, and present the relevant information in adequate way to persons related to their task and situation;
- ubiquitous access to a citizens health data, by all partners in an inter-disciplinary care team under the conditions of proper privacy enforcements;
- supporting professionals and enabling adequate communication between partners in inter-disciplinary care teams using collaboration technology, including secure messaging, instant messaging, audio and video communication and even remote sharing of applications at any place and time on the device of choice.

The approach is to develop and deploy advances in embedded systems technology: communicating sensors and actuators; improvements in genetic, molecular and imaging equipment for diagnostics, including algorithms, equipment and infra-structure for massive image processing and simulation to support combination of images from different modalities (CT, ultra sound, MRI, X-Ray) and comparison or fusion of images with physiological models (e.g. from heart, brain …); telemedicine including tele-monitoring and tele-surgery; facilities for diagnostic and epidemiological analysis, remote management of implanted drug delivery; multi-modal interaction technologies (speech, vision and gestures) supporting navigation and decision making for diagnostic and (minimal invasive) surgery, not hampering the normal workflow.

Projects should contribute to one or more of the following specific objectives:

- a reference architecture to support integrated care cycles;
- interoperability guidelines and selected standards ;
- provision of sensors and actuators, both portable and stationary, that are compliant to interoperability standards;
- standards to build applications that cover the full path from sensor and actuators up to the backend infrastructure to make the information available to other health services;
- a licensing model for medical data;
- a stable, robust and extendable standard format for medical data (the data should and have to be readable more or less indefinitely, or at least over a human life time).

Expected impact

By optimising the use of resources, fostering the 'digital hospital' where all devices, patients, and professionals are connected, projects are expected to lead to:

- reduction in visits to doctors,
- reduction in visits to hospitals (including out-patient clinics),
- shorter periods of hospitalisation (when hospitalisation is necessary),

- greater longevity with improved quality of life throughout,
- increased support to interdisciplinary care teams to achieve the outcomes above.

Cross-domain aspects

As we move from treatment to prevention, so healthcare must move out of its own separate compartments of hospitals and doctors' surgeries to pervade all the citizens' environments - workplaces, home, transport, leisure, .. . There must also be interfaces to public infrastructures since in many countries regional or national Health Information Exchange infrastructures are or will be implemented and even European ideas in the context of eHealth are on the agenda (eHealth card and Patient Summary Records). Healthcare must make use of the information and communication resources in these many environments. Healthcare systems must therefore be compatible and, as far as the citizen is concerned, appear to be integrated.

Projects in this sub-programme must therefore share research and results with projects in other sub-programmes operating in private spaces, nomadic environments and transportation to enable this connectivity. The base technologies developed by the other sub-programmes will be used to implement the specific needs of this sub-programme.

With respect to the development of devices and systems collaboration with ASP1 "Methods and Processes for Safety-relevant Embedded Systems" will be expected.

An important issue is the interaction with people, the citizen/patient as well as professionals, using the system in the context and situation of their task. This relates to ASP8 "Human Centred design of embedded systems" particularly concerning cognitive modelling.

The dynamics of several services involved from device level up to data management, processing and interacting with persons could benefit from the work of ASP3 "Smart Environments". In the context of the Person Centric Health Management sub-programme account must be taken of specific healthcare requirements like the development of medical profiles for connectivity on top of Bluetooth, USB and Zigbee, …

ASP6 "Inter-networked ES for Security and Critical Infrastructures Protection", is also relevant to, for instance, enable fine-grain situation-based access control based on an ambient identification system for care professionals as well as patients; and bi-directional authentication between sensor and actuator devices with other parts of an end-to-end system as well as identification of these devices e.g. to check their certification as medical device.

In addition, since senior citizens are an important target group and likely also need more support in managing their health, and to ensure transparency, and facilitate co-ordination and the achievement of synergy, proposals in this sub-programme should state how their proposed work would relate to work in the Ambient Assisted Living initiative.

3.2.3 ASP3: Smart environments

Objectives and Approach

The overall goal of ASP3 is to provide methods, tools, technology and models with which developers will be able to build “smart environments” of smart and heterogeneous devices interacting with each other and with the environment, and cooperating together to provide a foundation for rapid local applications and service innovations. Such smart environments are characterised by dynamicity, requiring a balance between design time choices and adaptability to runtime changes and frequent, possibly autonomous, runtime reconfiguration. And the systems of smart environments must be deployable on a wide range of devices, some of which may have restricted resources.

This will be achieved by building an interoperable infrastructure for service innovation and identifying vertical service cases with relevant business models. The requirements of all stakeholders must be accommodated - SMEs, corporations, research institutes and public authorities willing to enter the innovative market of smart environment applications.

Application scenarios for smart environments that have been identified already include:

- Smart locations (smart city, smart home, smart public space, ...)
- Smart physical objects (objects equipped with identification mechanisms such as RFID tags, smart multi-media content storage, smart communications objects such as wireless grids and co-operative networks)
- Smart virtual spaces (Mixed mode Physical and 3D-Virtual spaces, community spaces)
- Private mobile social networks ('PMSNs')
- Profile-dependent intelligent guide ('PDIG')

The vertical and horizontal approaches are strictly related. Systems for vertical scenarios must be designed taking into account interoperability and extensibility: common service platforms must be able to cope with the needs of the most relevant applications. In order to narrow down the possible choices, a dual approach will be taken:

1. identify a common architecture and build a horizontal interoperable infrastructure for service innovation
2. identify a set of domain specific services, “vertical cases”, with relevant business models

Projects should contribute to one or more of the following specific objectives:

- a common, multi-domain architecture
- standards for interoperability in smart environments
- Interaction model between horizontal and vertical activities, to assure proper tackling of the interoperability and cross-domain issues
- infrastructure requirements to support new interaction and interface concepts (e.g. goal-based user-environment interaction, and automatic triggering of services with non-explicit requests)
- Environment representation language to support interoperability and reasoning
- Validation of SP3 vision on one vertical case that can be generalized
- Semantic platform specification

Expected impact

Citizens are no longer seeing themselves as simply performing a single role - worker, patient, student, artist... - defined by their present physical environment. The multiple roles that we all perform are no longer compartmentalised. Projects in this ASP should enhance the ability of the citizen to participate in multiple communities and societies, whatever their actual, present, physical environment.

Projects should also provide the citizen with more local, personal control, less reliance on manufacturers and corporate service providers, less stress, less overhead and increased comfort and safety in everyday life.

Projects are expected to lead to:

- easier use of digital systems for citizens and professional users

- an infrastructural basis for new multi-domain services, integrating data and services from several application domains;
- some basic multi-domain services, defined and offered to the market;
- implementation and deployment of preliminary applications for smart homes, private and public area monitoring.

The ARTEMIS-JU 2010 MASP declares an aim to form an agreed set of specifications dedicated to well-defined applications and aspects of the complete design tool chain, referred to as a Tool Platform. It is expected that each Tool Platform will attract specialised developers and users, thereby forming an eco-system of technical expertise. Projects intending to address this ASP are expected to propose specific, adequately resourced contributions to the establishment of such a Tool Platform.

Cross-domain aspects

One of the central notions of the smart environment applications is their ability to benefit from information in different domains. The potential for reaching across application domains is expected to provide growth opportunities beyond what is possible with domain specific solutions, since the same smart environment can be used for multiple purposes by multiple classes of users. This should enable novel possibilities for service aggregation and service composition.

Projects must demonstrate that smart environments' connectivity and interaction technologies can provide strategic input to enhance the potential of all ARTEMIS application-oriented Sub-programmes, particularly ASP1 "Methods and Processes for Safety-relevant Embedded Systems" (focused on transportation systems), ASP2 "Healthcare systems", ASP7 "Embedded Technology for Sustainable Urban Life" and ASP8 "Human Centred Design of Embedded Systems".

In return, the common architecture (embracing seamless connectivity and middleware) supporting the expected horizontal and interoperable infrastructure will certainly have the potential to highly benefit from the incorporation and exploitation of input from all of the transversal sub-programmes, particularly ASP5 "Computing Environments for Embedded Systems", and ASP6 "Inter-networked ES for Security and Critical Infrastructures Protection", especially since smart environments will be based, to a large extent, on a secure, dependable, Internet of Things.

3.2.4 ASP4: Efficient manufacturing and logistics

Objectives and Approach

This ASP is an essential enabler of the 'Factory of the Future'. As factories are big consumers of energy (they consume nearly one third of global primary energy and emit nearly one third of the CO2), they need to react and adapt quickly to business challenges imposed by evolving environmental demands and fluctuating energy prices. The main ambitions are to improve time-to-market, productivity and Overall Equipment Effectiveness (OEE) for manufacturing and logistics, and to reduce significantly the energy required. It should be recognised that the boundaries between manufacturing and logistics will become blurred as manufacturing operations are carried out closer to the customer, and in-transit manufacture blurs the boundaries between production and distribution.

The goal of reducing energy consumption can only be achieved if energy use is made transparent. One major objective is to make the energy consumption of manufacturing equipment and processes transparent at fine granularity.

The approach is to establish an embedded systems' architecture together with supporting methodologies and tools that enables holistic lifecycle management for manufacturing, distribution, recycling and disposal of goods.

The architecture should enable the interoperation and reconfiguration of embedded devices and systems in both products and processing equipment so as to build complete plant solutions that enable owners and operators to save energy and achieve greater transparency of operation, greater predictability, reduced safety risks, enhanced security, and cost efficiency.

The architecture should be supported by all the necessary systems and tools to support development and implementation of systems conforming with the architecture. These may include look-ahead-simulation of real-time operations and virtual commissioning based on asset data, and tools for virtualization and complexity management.

Projects should contribute to one or more of the following specific objectives:

- a new factory oriented framework for goods manufacturing, using smart automation to achieve sustainable production, with innovative networking, communication and controlling technologies to enable open, modular and reconfigurable control and automation platforms;
- a real-time asset monitoring protocol for large-scale distributed production processes, linked to automatic scheduling of maintenance activities and automatic reaction to malfunctions.
- a methodology for continuous tracking of material flow from raw material to final deployed products based on RFIDs and sensors network technologies.
- new multi-disciplinary coordination and control principles for large-scale, wireless sensor and actuator networks, including combined Control, Computing and Communication (C3) strategies.
- new tools for managing uncertainty and risk in distributed and networked systems;
- new tools for visualization of plant operations and energy usage

Expected impact

The manufacturing industry employs around 35 million people in Europe making it by far the largest sector. Productivity improvements in this sector will have major impact for European economy and competitiveness. Projects are expected to increase manufacturing efficiency so as to improve quality, shorten time-to-market, and enable tailored and customised products - ultimately aiming at *'the segment of one'* - while cutting social, economic and environmental costs.

Increased usage of technology and particularly automation - verging on autonomy - will enable *'High resolution management'*. Projects are expected to improve efficiency, safety and working conditions, reducing waste, reducing energy consumption, and reducing the need for tedious or heavy manual work.

New architectures and communications also open the prospect for remote maintenance, monitoring, control and industrial services in which SMEs may participate more easily, and projects are expected to facilitate the 'opening up' of the market for such services.

Cross-domain aspects

Low-power solutions and future wireless sensor networks, as required by instruments, for example, have much in common with nomadic applications (ASP3).

The reduction of risk of industrial accidents to achieve improved safety of manufacturing facilities and personnel, and improved protection of the environment and other citizens, will entail co-operation with ASP1 'Methods and processes for safety-relevant embedded systems'.

Projects in this ASP must share research and results with projects in ASP6 'Inter-networked ES for Security and Critical Infrastructures Protection. Manufacturing has less advanced solutions for cyber security than available for other IT dependent industries, such as web commerce and financial applications, and it would be highly advantageous to utilize the cyber security technology from such sectors, though with adjustment of focus to availability of the production system (e.g. uninterrupted energy supply)

3.2.5 ASP5: Computing environments for embedded systems

Objectives and Approach

The main goal of this sub-programme is to enable transition from separate, sectoral, vertically structured application markets to a horizontally structured embedded system market that supports cross-domain re-use and interoperation.

A secondary goal is to enable massive real-time data-processing in multiple domains (image processing, signal processing, computational fluid flow, ...).

A further goal is to enable composition of platform independent software over highly concurrent, fault-tolerant systems with a variety of communication schemes, types of core, etc. Run-time adaptability is required so as to optimise performance and resource usage - particularly extremely low power consumption, since modern electronics is an increasingly significant contributor to global power consumption and carbon emissions.

The approach is for cooperative projects to identify clusters of applications in different domains willing to agree on common “business pull” of innovations, and clusters of technical areas where the “techno push” makes sense with respect to the challenges of these application domains. Each cooperative project is expected to identify the key standards to be considered in its scope of application/technology focus and the sets of innovations needed, such as core technologies and associated APIs and Intellectual Properties for multi-core computing architectures, interfaces to the physical world, run-time software, and communication mechanisms.

Projects should contribute to one or more of the following specific objectives:

- establishment of a common multi-domain architecture, APIs, and design tool platform for advanced multi-core hardware and middleware solutions
- establishment of heterogeneous multi-domain architectures and integrable and interoperable tool suites to support massive real-time data-processing
- definition of a new programming model & new types of API to support platform-independent composition
- definition of performance & resource management models, meta-data and system layers in order to achieve global performance and resource optimization and management.
- development of design tools and associated runtime support to enable composability, predictability, parallelisation, aggregation and management of systems according to a service-driven or data-centric approach, performance and energy modelling and analysis, verification, scalability … while preserving system-level predictability and appropriate levels of safety.

Project results must be demonstrated with application use cases derived from one or several application domains, such as advanced road vehicle management; data intensive multi-sensor applications (vision, radar, lidar, …); adaptive nomadic context-sensitive multimedia service provision; adaptable/evolvable autonomous systems; robotic control systems. Some specific application domain clusters in which fundamental requirements for computing environments are similar are particularly important. The Transportation and Manufacturing cluster, and the Nomadic and Consumer Electronics cluster are considered as priority targets for this sub-programme.

Expected impact

Projects are expected to facilitate the transition from a vertically structured to a horizontally structured market by enabling easier IP reuse across applications and domains, and thereby creating new market opportunities and stimulating the emergence of new innovation ecosystems, in particular supporting SMEs.

Projects in this sub-programme are also expected to enable the development of low cost solutions for high volume market development through enhanced modularity, reuse, scalability, and portability.

The ARTEMIS-JU 2010 MASP declares an aim to form an agreed set of specifications dedicated to well-defined applications and aspects of the complete design tool chain, referred to as a Tool Platform. It is expected that each Tool Platform will attract specialised developers and users, thereby forming an eco-system of technical expertise. Projects intending to address this ASP are expected to propose specific, adequately resourced contributions to the establishment of such a Tool Platform.

Cross-domain aspects

This sub-programme sits at the heart of the Artemis ambition to *"remove barriers between application sectors .. yielding multi-domain reusable results"* (Reference - Artemis SRA). The need for multi-domain and cross-domain application is therefore central to this sub-programme.

Nevertheless, there is most probably no "one-fits-all" global solution for all types of systems and applications. The computing environment for embedded systems has to address a wide design space in a variety of application domains. However, as a result of cross-domain synergies, computing infrastructures suitable for multiple application domains should emerge. Such computing infrastructures should therefore provide a variety of configuration, parameterisation, and tuning capabilities, at different levels: hardware, firmware, operating system components, reusable application software components. They should also provide appropriate optimisation techniques to achieve this new type of co-design.

Even then, effective solutions to the often conflicting demands on applications - and on the computing platform - will continue to require domain-specific trade-off analysis for issues such as reliability, safety, hard real-time responsiveness, support for security, predictability and resource management, and energy usage v. performance.

At the same time, cross-domain studies and exchanges should be undertaken so as to achieve conceptual and technological sharing between domain specific solutions.

3.2.6 ASP6: Inter-networked ES for Security and Critical Infrastructures Protection

Objectives and Approach

The main goal of this sub-programme is to ensure that security, privacy and dependability (SPD) can be ensured for systems and services that are built from integrated and interoperating heterogeneous services, applications, systems and devices. Such systems and services must be robust in the sense that an acceptable level of service is available despite the occurrence of transient and permanent perturbations such as hardware faults, design faults, imprecise specifications, accidental operational faults, and deliberate, malicious, attacks.

The main goal and vision will be to address the upcoming impact of the Internet of Things to security, privacy, and dependability, from the early stages of design up to final deployment. The Internet of Things imposes a new scale of security challenges as more and more items around us communicate in a ubiquitous way, posing new challenges in terms of overall system complexity and real-time response.

One target of the programme will be to enhance security of ESs as stand-alone or networked systems, i.e. at both the node and the network level. Special focus will be given to developing technologies for:

- efficient, reliable, adaptable, resilient and dependable ESs.
- ESs that defend against malicious attacks from intruders, maintain the confidentiality of sensitive data and protect intellectual property.
- efficient and reliable communications and dependable networks for and utilizing ESs.

Another target of the programme will be to develop appropriate ES technologies enabling protection of critical public infrastructure, such as transportation/communication/utilities networks, public building/areas, and our commercial and economic infrastructure. In this respect, special focus will be given on developing ES technologies to:

- improve mobility of people and goods while preserving privacy;
- provide support for critical applications, such as protection of infrastructures.

The approach is to establish a common conceptual framework - and thereafter conformant methods and tools for design and implementation - to assure security, privacy and dependability in three classes of systems. These three classes are differentiated on the basis of whether they are ‘managed systems’ where the security attributes are centrally defined by the provider managing the system; ‘unmanaged systems’ built on the top of a set of independent and dynamic managed systems, where the security attributes cannot be defined by a single provider; and systems that are combinations of the managed and unmanaged systems.

Projects should contribute to one or more of the following specific objectives:

- definition of a common conceptual framework to address the requirements for security, privacy and dependability in one or more of the three classes of systems identified above, with a particular focus on compositional design and development.
- instantiation of this framework with architectures, components, methods, interfaces and communications, tools and tool chains, to enable the design, development, analysis, validation, and deployment, as well as certification (or qualification).
- a cost and time effective, widely adoptable certification scheme for ESs in the domain of security;
- trusted service platforms supporting the governance of the Internet of Things and enabling seamless and secure interactions and cooperation of ESs over heterogeneous communication infrastructures;
- flexible communication protocols that enable trade-off between performance (latency, jitter, throughput, etc.) and security parameters (determinism, reliability, security, etc.);
- principles and methodology for specifying and implementing a dynamic security policy for federations of large networked embedded systems, dynamically composed by unmanaged devices, and incorporating spontaneously co-operating objects and ad hoc networks.

Expected Impact

Projects are expected to create new market opportunities by enhancing security, privacy and dependability so as to increase people's confidence in applications, systems, devices and infrastructures that were considered vulnerable or untrustworthy in the past, or by coping with the increasing risk of cybercrime resulting from the sharp increase of sensors and devices accessing the Internet, by:

- reducing the users' fear or reluctance in using inter-networked devices by providing fully guaranteed secured services and access, thus increasing the willingness of people to socialize, and decreasing the risks;
- enabling industrial actors and service providers to offer new security features with minimal additional cost and more freedom to the customer.
- enforcement of privacy and sensitive data protection against external threats , with high availability of operations and systems thus creating a business differentiator through the development of new security solutions.

Cross-domain aspects

The results of research on ES security and privacy in this sub-program will be applicable beyond the traditional fields of pervasive computing applications and services and public infrastructure protections. Contributions to other sub-programs will be realized through the following results:

- trusted architectures (mono and multi–core)
- modules and subsystems for security & privacy support
- trusted platform design at SW level (protocols and embedded OS) as well as seamless integration of event-based and SOA middleware platforms
- trusted platform design at HW level (tamper proof, tamper resistance, HW accelerators for cryptography, etc.) as well as smart-sensors and sensor-networks development tools and methods
- ad-hoc networking and robust communication (secure protocols, routing, etc.) technologies
- autonomic, auto-recovery, fault tolerance graceful degradation, self management, self configuration, self healing methodologies and tools, consistent management of a dynamic contest formed by large networks of autonomous systems

At the same time this sub-program will monitor security, privacy and dependability conditions and requirements and use technological results obtained by other sub-programs (for instance those concerned with "nomadic environment", "safety" and "energy management") that will present security and privacy features for ES boards and appliances, ES networks, ES firmware/middleware or will influence the implementation technologies for security provision.

In particular, this sub-programme will specifically focus on the interplay of security and safety in fault-tolerant (redundant and/or diverse) configurations. This has up to now not been resolved only in special domains or applications, and is not well-addressed in standards for either safety or security. Synergy will therefore be sought between this ASP and ASP1 'Methods and processes for safety-relevant embedded systems', and projects in this ASP will be expected to share research and results with projects in ASP1.

3.2.7 ASP7: Embedded technology for sustainable urban life

Objectives and Approach

Since 2008 over 50% of the population lives in cities, and the aim of this sub-programme is to enable sustainable urban life, improving comfort and security while optimising resource usage. Additionally, it is expected that the results will also bring urban benefits to non-urban areas, thereby countering the tendency towards over-urbanisation.

There are three main goals:

- Eco efficiency - optimising usage and management of all resources, such as water and energy;
- Eco sufficiency - through helping people to make better use of resources and enabling more effective renovation, maintenance and waste management;
- Improved comfort and security - via intelligent urban infrastructures to manage environmental quality, to support work, leisure and domestic life including surveillance and intelligent response.

The approach is to develop embedded intelligence and integration technology to achieve greater efficiency in use of resources, more flexibility in the provision of resources and better situation awareness for the citizen and for service and infrastructure owners. This should be achieved through the deployment and inter-operation of embedded systems throughout the environment.

Appliances are no longer independent entities, but part of a larger system connected through a residential gateway, with intelligent smart capabilities. Energy efficiency is a driver for purchase and renovation of domestic brown and white goods.

Projects should contribute to one or more of the following specific objectives:

- definition and initial instantiation of architectures and communication platforms to enable the flexible and evolvable interoperation of systems, including sensors, actuators, information systems, and control systems across multiple domains - e.g. transport and energy management - and multiple vendors and service providers.
- reference designs for energy efficient HW/SW architectures (e.g. reference mobile handset, reference tiny communicating device)
- definition of a standard HW and SW modelling framework and of development tools based on common industry driven meta-models, for high-level analysis and validation of resource usage, emphasizing composability and reuse
- design and realization of design-time energy exploration and optimization tools and methods
- models to enable energy efficient topology management in distributed systems, with emphasis on dynamic reconfiguration capabilities of resource management devices as key non-functional capability to cope with the legacy challenge
- Visualization of Sustainable Urban Life, and integration of such visualization with the underlying models and applications.

Three market sectors are especially relevant: public infrastructures and utilities; residential and non-residential buildings; and domestic electronics and appliances.

Expected impact

Public infrastructures and utilities span all kinds of urban buildings and infrastructures from power generation and distribution, to water supply and waste management, public health, education and leisure, security services, transport systems in urban areas, etc. Projects are expected to lead to offers of high-level internet-based services based on open reference implementations that enable the connection of diverse devices with each other, with home networks, and with smart grids. Public authorities should be involved where necessary to harmonize innovation and regulation.

Projects are expected to stimulate the creation of new business models - from conceptualisation to maintenance and operation of urban systems.

Projects are also expected to improve:

- eco-efficiency, such as improving energy efficiency and energy management (e.g. for energy efficient buildings), or improving sustainable use of resources in urban systems;
- eco-sufficiency, through improving human behaviour in the use of resources or improving the management and maintenance of resource distribution and management systems;
- comfort and security, through improvements in environmental quality, increased automation, and advances in Ambient Intelligence.

Cross-domain aspects

Safety aspects of transport systems, addressed in ASP1, will complement work in this sub-programme on the use of embedded systems for transport system optimisation in urban areas.

Comfort and security services aimed at eco-efficiency and eco-sufficiency addressed in this sub-programme constitute one specific aspect of ASP3 “Smart Environments”.

In addition, there are cross-domain problems that are addressed in technology-oriented domains and applicable in developments and systems for sustainable urban life. This is the case particularly for computing environments and energy management in embedded systems (ASP5), security, privacy and dependability (ASP6), and user interfaces (ASP8).

This sub-programme will also draw on developments from these other areas, focusing on development and/or adaptation of specific aspects of the technology, such as surveillance systems, access control, and accessibility.

3.2.8 ASP8: Human-centred design of embedded systems

Objectives and Approach

The HMI determines how systems are perceived by the users. It is the mediator between new functionalities or services and the user, mediating human intervention (like configuration, adjusting or overriding) and machine intervention (like preventing hazardous manoeuvres).

The main goal of this sub-programme is to develop and validate technical and methodological means to provide embedded HMI solutions which integrate naturally into operational environments, are easy to use and understand, and support an adequate level of situation awareness.

The approach is to establish a methodology for design and development of human-in-the-loop adaptive control systems suitable for application in multiple domains and sectors - particularly safety critical domains - taking into account not just explicit interactions between human and machine, but also the cognitive state of the human. This will require:

- cross-domain reusable system design principles and methods that foster the transition from conventional unimodal, menu-based dialogue structures to multimodal, conversational dialogue structures. New HMIs must assist the user in defining his or her own goals rather than to require using predefined function calls.
- cross-domain technologies for analysing the effectiveness of assistance systems (e.g. in preventing errors, in reducing workload, enhancing situation awareness and user experience) and for analysing the intuitiveness or complexity of the interaction between user and machine along different usability dimensions with associated metrics (analysis of HMI)

These developments must be supported by research into human performance; agile HMI prototyping; cognitive user models; and intelligent multi-modal interactive systems.

Industry needs must be acquired from different domains, and their commonalities identified. Empirical studies must be performed to identify the needs of the end-users (e.g. pilots, drivers, train operators, plant operators, patients, carers) and to study the characteristics of human interactions with (partially) autonomous systems fulfilling these needs.

Projects should contribute to one or more of the following specific objectives:

- a generic HMI Design Methodology that fulfils industry needs and can be easily instantiated in different domains.
- extension of model-based design approaches to the design and analysis of human machine interaction, including human models to enable user centred functionalities and closed loop adaptivity
- cross-domain reusable technology to synthesize “intelligent” multi-modal HMI.
- cross-domain technologies to analyse the effectiveness and economy of interaction with “intelligent” multi modal HMI designs by predicting human behaviour.
- agile model-based HMI prototyping taking into account multi-modal interfaces and the need for allocation of capabilities between “presentation layer” and “data management layer”,
- methodologies for building cognitive user models taking into account perceptual, cognitive and psychomotor capabilities as well as emotional state and attitude,
- technologies for intelligent multi-modal interactive systems especially addressing the user’s inter-working with adaptive context-aware systems.

Expected impact

Human centred design (HCD) is a key enabler for embedded systems advancement and deployment in *all* ARTEMIS application contexts, and especially in safety critical domains:

- In *Industrial Systems* applications, projects should enhance the safety and confidence of users and the public by, for instance enable Advanced Driver Assistance Systems for road and rail vehicles and Advanced Multidimensional Cockpit Displays and Flight Management Systems in aircraft;
- In *Nomadic Environments* applications, projects should enhance the integration of information management in personal information spaces and reduce the digital divide;
- In *Private Spaces* applications, through the design of products with innovative user interfaces, projects should enhance the user experience and, for instance, ease access for aging or disabled persons;
- In *Public Infrastructure* applications, projects should enhance the safety and efficiency of, for instance, power plants, communication systems, emergency infrastructures, and health monitoring, care and treatment systems.

Projects are expected to lead to:
- the automation of tasks which are today fully under human control (e.g., driver assistance in the automotive domain), and/or
- the extension of automation in tasks which are today highly assisted (e.g., pilot assistance systems in the avionics domain).
- The fulfilment of the user centred and technical objectives by providing open innovation environment (e.g., open experimental test-bed).

Cross-domain aspects

In all domains addressed by ARTEMIS, interfaces of automated systems are used to interact with the environment, but also to interact with the user (e.g. to give the user advice or to intervene so as to prevent hazardous manoeuvres) and furthermore to allow the user to influence the automated system itself (e.g. to configure its rules and behaviour). In all ARTEMIS domains, systems are becoming more and more autonomous. In spite of differences in time-to-market, time-on-market, and certification requirements of automation and assistive technology in the different domains, cross-domain reuse of design methodologies, devices, processing hardware, and software components is achievable.

The sub-programme envisions cross-domain sharing of concepts, methods and tools in synthesis as well as analysis of HMI. Cross-domain clusters can be defined based on the interaction patterns between human and machine:

1. one human, one complex system (avionics, complex infrastructure monitoring, nomadic with "all in one" device, automotive, ..)
2. one human, many "not so complex systems" (home, automotive, ..)
3. several humans, one complex system (surgical team around a patient, satellite launch infrastructure, ...)
4. several humans, several complex systems (e.g. air traffic management, catastrophic situations management, systems of systems with human at different levels of responsibility, ...)

4 Requirements

The proposal should satisfy the following requirements.

4.1 General

Each proposal should address at least one ARTEMIS Sub-Programme (see Section 3.2) and identify which of the Industrial Priorities (see Section 3.1) are addressed

Each proposal should include demonstration of core technological developments in order to achieve the empirical validation expected (see Section 2.2).

Large, strategic initiatives are encouraged, complemented with smaller more focussed research proposals, to ensure maximum effective use of the available budgets.

4.2 Contribution to the ARTEMIS targets

ARTEMIS has an over-arching objective to close the design productivity gap between potential and capability. The results arising from Projects responding to this call will be expected to:

- reduce the cost of the system design from 2005 levels by 15% by 2013.
- achieve 15% reduction in development cycles - especially in sectors requiring qualification or certification - by 2013,
- manage a complexity increase of 25% with 10% effort reduction by 2013, compared with 2005,
- reduce the effort and time required for re-validation and recertification of systems after making changes by 15% by 2013, compared with 2005.
- achieve cross-sectoral reusability of Embedded Systems devices for example, interoperable components (hardware and software) for automotive, aerospace and manufacturing) that will be developed using the ARTEMIS JU results.

All projects to be supported will be expected to identify, at proposal stage, their intended contribution to achievement of these targets. Proposals should describe how projects would measure their contribution and how they would establish a baseline and thereafter monitor their progress from the baseline.

4.3 Expected impact

All projects to be supported will be expected to identify, at proposal stage, the impact that they aim to achieve with regard to the expected impact of the sub-programmes that they address. Proposals should describe how projects would measure their impact and how they would establish a baseline and thereafter monitor their progress from the baseline.

4.4 Technology vis-à-vis Application

All projects are expected to have a strong application focus in order to present a realistic context for industrially relevant, short to medium term research and technology development, and to enable its validation. Nevertheless, all projects in all sub-programmes must make explicit contributions to the technological ambitions of ARTEMIS for Embedded Systems development. Clear expression of the technical approach to the research objectives will be essential.

4.5 Co-operation

All projects to be supported will be expected to share requirements and emerging results, during project execution, so as to achieve the coherent, synergistic progress sought by the ARTEMIS JU.

4.6 Evolution of markets and market environment

All projects to be supported will be expected to maintain a ‘market watch’ to ensure the continuing relevance of their work to the evolving market, and to contribute to programme-level monitoring of the market for the purpose of evolving the Research Agenda and the Multi-Annual Strategic Plan.

4.7 Standards & Regulations

ARTEMIS has a Strategic Agenda for Standardisation (see *References* section 7.). Its principle mission is to support the ARTEMIS ambitions for cross-domain synergies, composability, reusability, reliability, interoperability, verification and certification. This entails overcoming the present domain-orientation of many standards and standardisation groups. Projects will be expected to contribute to this aim, engaging where appropriate with the relevant standardisation, regulation and certification bodies.

Specifically, proposals must make explicit their intended contribution to:

- standard development and harmonisation, as the basis of any integration and inter-operation;
- open source reference implementations of standards, in order to facilitate their take-up in the market.

4.8 Innovation environment

The ARTEMIS Strategic Research Agenda sets out the ambition to *"establish a new holistic approach to research, technology development, innovation and skill creation"* by improving the linkages between the three parts of the 'knowledge triangle' - education, research and innovation.

With regard to Education and Training, the ARTEMIS Strategic Research Agenda sets out the aim to *"overcome the gap between the theory of academic education and the practice in industrial application"*. Proposals should describe their specific intended contribution to this aim.

ARTEMIS has a specific target for having *50% more European SMEs within the aegis of ARTEMIS JU engaged in the Embedded Systems supply chain, from concept through design and manufacture, delivery and support, than there were in 2005.* Project proposals should clearly indicate concrete and quantifiable measures to assist participating SMEs in their dissemination of project results and subsequent valorisation of the results in near-future business plans. Moreover, project consortia must be balanced, considering explicitly the involvement of SMEs and favouring clustering of SMEs in innovation eco-systems.

ARTEMIS also supports the consistent grouping, on a permanent basis and at European scale, of industry and research in *Innovation Clusters* to foster the *Innovation Environment*. It is recommended that projects show awareness of existing eco-systems, with a view to more concrete collaboration in the future.

4.9 Project duration

In view of the downstream research focus of the ARTEMIS Joint Undertaking and the targets described in this document, projects with duration longer than 3 years must provide adequate justification for their length, relative to the application demonstrators and expected impact that they describe.

5 Implementation of Call in 2010

5.1 Call 3: JU-ARTEMIS-2010

- Date of publication: 26 February 2010
- Closure date: 1 September 2010, at 17.00 h Brussels local time.

  (NB. A two-step process is foreseen, where project proposer may submit a Project Outline by 26 March 2010, and receive feedback by 21 May 2010).
- Indicative budget: 93.341.000 €
- Evaluation procedure: two stages
- Indicative evaluation and contractual timetable: It is expected that the contract negotiations for the selected proposals will start as of late October 2010
- Project Cooperation agreements: Participants in all actions resulting from this call are required to conclude a project cooperation agreement.
- The grant which will be offered by the JU will be specified in the Grant Agreement applicable to ARTEMIS.

5.2 Call implementation in 2010

Budget per year as per (draft) AIP 2010	**Budget of Call 2010 (estimated)**
Total EC Contribution	33.121.000 €
Total contributions from ARTEMIS Member States	60.220.000 €
Total budget of Call 2010	**93.341.000 €**

6 Eligibility and Evaluation Criteria for Proposals

Eligibility checks

The following eligibility criteria will be checked by the ARTEMIS Joint Undertaking:

1. Eligibility Criteria for proposals (Project Outlines and Full Project Proposals)
2. Eligibility Criteria for funding of individual participants (ARTEMIS JU funding and national funding from ARTEMIS Member States)

6.1 Eligibility Criteria for Proposals

6.1.1 Project Outlines (PO)

A PO will only be considered eligible if it meets all of the following conditions:

- It is submitted using the EPSS (Electronic Proposal Submission System)
- It is received by the ARTEMIS JU before the deadline given in the call text for POs.
- It involves at least 3 non-affiliated legal entities established in at least 3 ARTEMIS Member
- States
- It is complete (i.e. both the requested administrative forms and the proposal description are
- present).
- It is submitted in English[6].
- The content of the PO relates to the topic(s) described in this work programme.

6.1.2 Full Project Proposals (FPP)

A FPP will only be considered eligible if it meets all of the following conditions:

- The corresponding PO has been considered eligible by the ARTEMIS JU
- It is submitted using the EPSS (Electronic Proposal Submission System)
- It is received by the ARTEMIS JU before the deadline given in the call text for FPPs.
- It involves at least 3 non-affiliated legal entities established in at least 3 ARTEMIS Member
- States.
- It is complete (i.e. both the requested administrative forms and the proposal description are
- present).
- It is submitted in English[7].
- The content of the FPP relates to the topic(s) described in this work programme.

6.2 Eligibility criteria for funding

The ARTEMIS JU will carry out the verification of participants from ARTEMIS member States and their contribution to the project proposals, on the basis of verifications carried out by the respective national authorities, against the pre-defined national eligibility criteria for funding as published in the Call. The verifications by national authorities will be done as much as possible before proposers submit a Full Project Proposal.

The full details on the eligibility criteria for funding will be published in the Call.

[6] Except for the additional information and forms that may be requested by ARTEMIS Member States for the verification of eligibility of national funding that can be in their respective national languages

[7] Except for the additional information and forms that may be requested by ARTEMIS Member States for the verification of eligibility of national funding that can be in their respective national languages

6.3 Evaluation criteria

6.3.1 Project Outline

The Project Outline will be assessed by the ARTEMIS JU, on the basis of the following criteria:

- Relevance will be considered in relation to the topic(s) of the work programme open in a given call and to the objectives of a call.
- Relevance and contribution to the overall ARTEMIS targets listed in section 4.
- Soundness of the concept
- Clarity and quality of the objectives and expected results
- Contribution, at the European and/or international level, to the expected impacts listed in the work-programme under the relevant sub-programme
- Degree of application innovation in the context of the sub-programmes addressed
- Expected market impact of the results for the industrial partners
- Quality of the consortium as a whole including complementarities, balance and involvement of SMEs

6.3.2 Full Project Proposal

The evaluation criteria against which proposals will be judged are set out in the document ARTEMISPAB-4-08: "ARTEMIS Joint Undertaking selection and evaluation procedures related to Calls for proposals". The 5 evaluation criteria are:

1. Relevance and contributions to the objectives of the Call.
2. R&D innovation and technical excellence.
3. Science and Technology (S&T) approach and work plan.
4. Market innovation and market impact.
5. Quality of consortium and management.

Evaluation scores will be awarded for each of the five criteria, and not for the sub-criteria. Each criterion will be scored from 1 to 10. Criteria 1, 2, 3, and 5 will have a weight of 1 and criterion 4 will have a weight of 2. The threshold for the individual criteria (1), (2), (3), (4) will be 6. There is no threshold for the individual criterion (5). The overall threshold, applying to the weighted sum of the five individual scores, will be 40.

Some further explanation on the evaluation criteria:

1. Relevance and contributions to the objectives of the Call.
   - Relevance will be considered in relation to the topic(s) of the work programme open in a given call and to the objectives of the sub-programmes for those topics as set out in Sections 3.2.1 to 3.2.8.
   - Relevance and contribution to the overall ARTEMIS targets listed in section 4.

2. R&D innovation and technical excellence.
   - Soundness of the concept
   - Clarity and quality of the objectives and expected results
   - Progress beyond the state-of-the-art.

3. S&T approach and work plan
   - Quality and effectiveness of the S&T methodology
   - Quality of the work plan.

4. Market innovation and market impact
   - Contribution, at the European and/or international level, to the expected impacts of the work programme, and specifically to the expected impacts of the sub-programme(s) that the proposed project intends to address as set out in Sections 3.2.1 to 3.2.8.
   - Degree of application innovation in the context of the sub-programmes addressed

- Market impact and quality of the exploitation plans of the industrial partners; quality of the market analysis section including competitor descriptions and market opportunities.
- Introduction and enablement of new, more competitive practices and methodologies
- Appropriateness of measures for the dissemination of project results.
- Contribution to standards.
- Management of intellectual property.

5. Quality of consortium and management[8].
   - Appropriateness of the management structure and procedures
   - Quality and relevant experience of the individual participants
   - Quality of the consortium as a whole including complementarities, balance and involvement of SMEs
   - Appropriateness of the level, allocation and justification of the resources to be committed (budget, staff, equipment).

[8] This evaluation criterion corresponds to the **selection criteria** in the meaning of the general financial regulation (article 115) [OJ L248, 16.09.2002, p. 1] and its implementing rules (article 176 and 177) [OJ L 357, 31.12.2002, p.1] and of the financial rules of the Joint Undertaking (article 101). It will also be the basis for assessing the 'operational capacity' of participants. The other four evaluation criteria (1-4) correspond to the **award criteria.**

7 How to submit a proposal

Proposals (Project Outlines and Full Project Proposals) should be submitted in accordance with the terms set out in the call for proposals. In order to submit a proposal, applicants should consult the following documents:

- The text of the call for proposals, as announced in the Official Journal of the European Union and published on the webpage of the ARTEMIS Joint Undertaking
- This work programme
- The guide for Applicants

There are also a number of other useful texts which applicants could refer to:

Document	Document / Web site
ARTEMIS SRA Introduction	http://www.artemis-sra.eu/downloads/SRA_MARS_2006.pdf
Reference Design & Architecture SRA	http://www.artemis-sra.eu/downloads/RAPPORT_RDA.pdf
Seamless Connectivity and Middleware SRA	http://www.artemis-sra.eu/downloads/RAPPORT_SCM.pdf
System Design Methods and Tools SRA	http://www.artemis-sra.eu/downloads/RAPPORT_DMT.pdf
ARTEMIS-JU MASP (including the ARTEMIS-JU Research Agenda)	https://www.artemisia-association.org/publications/MASP.pdf
STANDARDISATION SA	https://www.artemisia-association.org/publications/STANDARDS-SRA.pdf