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Accompanying document to the

Proposal for a

COUNCIL REGULATION

on the establishment of the "ARTEMIS Joint Undertaking" to implement a Joint Technology Initiative in Embedded Computing Systems

Summary of the Impact Assessment

[COM(2007) 243 final]
[SEC(2007) 582]

EXECUTIVE SUMMARY

BACKGROUND

The Seventh Framework Programme[1] introduces Joint Technology Initiatives (JTIs) as a response to the research needs of industry and other stakeholders. JTIs should pursue activities that are of common European interest[2] and should contribute to the achievement of the Lisbon competitiveness objective and the Barcelona targets for research spending[3].

Information and communication technologies (ICT) are of crucial economic and social importance and play a key role in realising the renewed Lisbon strategy for European growth and employment. The Commission's "i2010" initiative[4] has identified the strengthening of innovation and investment in ICT research as a priority to address the productivity gap between Europe and competing zones. Embedded computing systems — the invisible electronics and software that impart intelligence to products and processes — are an especially important part of the ICT landscape as they underpin competitiveness, innovation and growth in key sectors of European industry (e.g. automotive, aerospace, consumer electronics, telecommunications, automation). Embedded Systems have been identified as one of the EU's main industrial and technological strengths in global markets[5]. Forecasts predict more than 16 billion embedded devices by 2010 (nearly three devices per person on earth) and over 40 billion by 2020[6]. Within the next five years, the share of embedded systems in the value of final products is expected to reach significant levels[7] in automobiles (36%), industrial automation (22%), telecommunications (37%), consumer electronics and intelligent homes (41%), and health and medical equipment (33%).

Worldwide, whereas total R&D should increase by around 170% over the next ten years, expenditure on embedded software R&D is predicted to increase by 225%, from €58bn in 2002 to €132bn by 2015[8].

JTIs arise from the work of European Technology Platforms (ETPs). The ARTEMIS Technology Platform[9] brings together relevant sectors from industry, research and European public authorities in the field of embedded systems. Its aim is to create critical mass and coordinate the research efforts and initiatives across Europe in order to implement a coherent strategy for EU leadership in the domain. One of its core tasks is the definition of a "Strategic

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1 1982/2006/EC 18.12.2006.
2 SEC (88)1882
3 {COM(2005) 488 final} "More Research and Innovation - Investing for Growth and Employment:A Common Approach" Impact Assessment
4 "i2010" provides an integrated approach to information society and audio-visual policies in the EU.
5 Commission Communication COM(2006) 697, SEC(2006) 1467- "Economic reforms and competitiveness: key messages from the European Competitiveness Report 2006".
6 Embedded Computing, Fisher, Farabosch & Young. Fisher (2005) and Automotive Open System Architecture. http://www.autosar.org.
7 Worldwide Trends and R&D Programmes in Embedded Systems by FAST GmbH and Software Intensive Systems in the Future by IDATE/TNO (2005)
8 *Software Intensive Systems in the Future,* IDATE/TNO, 2005.
9 ARTEMIS Technology Platform, http://www.artemis-office.org/

Research Agenda" (SRA) that becomes a reference in the field and attracts investment from all stakeholders. The first version of the SRA was published in March 2006.

The creation of the ARTEMIS Technology Platform in January 2004 was followed by extensive consultations with stakeholders, including national public authorities from 24 Member States and countries associated with the Framework Programme. The SRA and the governance and operational aspects of the Joint Undertaking were presented and discussed at major public events. Additionally, wide-ranging discussions and two recent studies[10] provided further input on the funding landscape, the technological and market trends in embedded systems, the governance structure and the expected impact of this initiative.

THE NATURE OF THE PROBLEM

Insufficient R&D investment

In the EU, ICT R&D accounts for around 18% of total R&D expenditure compared to 34% in the United States and 35% in Japan[11]. On a per capita basis the EU spends around €80 per head compared to €350 in the US and €400 in Japan. For embedded systems research, total public funding in Europe[12] is only 11% of the total for ICT, despite the fact that embedded systems-related R&D accounts for more than 50% of business expenditure on ICT R&D.

The fragmentation of research funding

There are several funding programmes relevant to embedded systems in Europe. The Framework Programmes made major investments in ICT research over a number of years but represent a small percentage of the EU's total public budget[13]. The inter-governmental Eureka scheme provides public funding to industrial R&D projects; however, various shortcomings (like duplication of evaluation and project monitoring procedures at inter-governmental and national level, poor predictability of public funding, delays before starting projects) have weakened its effectiveness. At national level, 17 out of 122 ICT programmes in 23 EU Member States and Associated Countries are related to embedded systems. In some countries, embedded systems activities are spread over several (sometimes disconnected) programmes. Overall, **current instruments do not provide an appropriate framework for mobilising European resources on a large scale and around common objectives, while remaining effective and efficient**.

Technological complexity is a major challenge

Over the last 20 years, embedded systems have evolved from stand-alone single-processor computers to advanced multiprocessor systems with increasing communication capabilities coupled to the "real world" through sensing and actuating functions. The resulting complexity is a huge technological challenge that currently cannot be met due to the **lack of a systematic approach and associated engineering methods and tools.** Innovation is also hindered by

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10 Worldwide Trends and R&D Programmes in Embedded Systems by FAST and Software Intensive Systems in the Future by IDATE and TNO (2005)

11 Commission Communication "*i2010: A European Information Society for Growth and Employment", European Commission, 2005.*

12 Around €380m annually

13 FP6 accounted for 5-6% of all public support for civilian research expenditure in the EU.

the lack of common standards. Acceptance of design tools in development organisations will be poor if there is a danger of being "locked in" to a specific vendor and no open standards exist. Similarly, new standards are needed to allow diverse embedded devices to talk to and "understand" each other.

What is at stake

Europe's capability to provide domain-specific integration know-how has given the EU a large share of markets in the automotive, industrial and energy, or defence and space sectors. Embedded systems are not only crucial to the competitiveness of such existing industry sectors; they are also at the heart of the next generation of ICT systems that is transforming our economy and society. Like the first two IT "waves" (desktop computing and the internet), the third wave made possible by the "embedding of intelligence" in our everyday environment will create large markets for applications we cannot yet fully grasp.

At risk is not just the opportunity to innovate but the very ability to innovate. Embedded systems are so central to value creation that an economy that fails to meet these technological challenges will lose its innovation capability. There is also a 'cultural' risk: these intelligent systems will touch intimately upon the lives of European citizens. European industry needs to be able to respond to home-grown demand in a way that recognises Europe's unique preferences and values.

THE CASE FOR EU ACTION

The EU must increase and make better use of its investment in this strategic area, instead of relying entirely on a research structure that lacks focus and leads to duplication of effort. **The current structure of the EU industry does not provide the necessary framework in which to develop the necessary enabling technologies and standards.** Many of the technologies involved transcend the traditional industrial sectors, whereas most industrial developments are still sectoral; the European design tools and software industry is fragmented with hardly any major players that can lead developments; many of the technology components and tools are for markets that do not yet exist, and their development therefore entails high risks. Progress is held back by the **lack of coordination of industrial R&D objectives, duplication of effort, and suboptimal use of limited research funding**.

Only Community legislation can establish an operational R&D framework combining the benefits of European integration with rapid adaptability of industrial goals and policies and with flexibility in participation on the part of Member States.

OBJECTIVES

On the economic and technological side, the aim is to launch an initiative to **realise Europe's potential in the future markets for intelligent products, processes and services** and achieve world leadership in embedded technologies.

On the policy side, the aims are:

(1) **To create a single, Europe-wide R&D programme** that is **industrially** driven

(2) **To put in place a new mechanism able to combine, for the first time, national, EU and private funding**

(3) **To ramp up R&D investment in Europe.**

POLICY OPTIONS AND ANALYSIS

The following two policy options have been considered:

(1) **'Business-as-usual'** option. This is a continuation of the current working arrangements.

(2) **"ARTEMIS JTI" -** ***Joint Undertaking*** on the basis of Article 171 of the Treaty **to implement a "Joint Technology Initiative"** with the participation of industry, the European Commission and Member States and countries associated to FP7, building on the existing ARTEMIS Technology Platform.

ECONOMIC IMPACT

Economic benefits from the achievement of the technological objectives

The analysis shows that the **ARTEMIS JTI will achieve gains of at least €14.7bn per year** in reduced system design and development costs by 2015, equivalent to at least 55k person-years of effort compared to the "business-as-usual" scenario. The net present value of these gains in 2006 is estimated at €109bn.

The economic impact of achieving several other goals set forth in the Strategic Research Agenda is harder to quantify, although it may be significant as it would lead to the creation of entirely new markets.

Financial leverage effect

The proposed ARTEMIS JTI option will enable every euro contributed by the Commission to leverage about 2 euros at national level plus additional private research efforts, to yield an expected overall **leverage effect of 1 to 7 euros of R&D effort**. In the "business-as-usual" option, the Commission's contribution will not have any leverage effect at national level and would be matched by roughly 0.5 euros in private funding

A more efficient R&D and innovation framework for industry

The ARTEMIS JTI provides R&D actors with a reliable and efficient framework that **removes the budget uncertainty** that exists in Eureka. Due to the streamlining of procedures through the JTI, each R&D project will gain six months over "business-as-usual". A 50% reduction will be achieved for proposal preparation and submission. The ARTEMIS JTI will thus yield net savings of €73m. Further savings will accrue from removing duplication in reporting and monitoring, estimated at about €52m. Overall, **the ARTEMIS JTI would save €125m in "procedural costs" compared with the business-as-usual scenario.**

Streamlined procedures allow research results to reach the market rapidly. This reduced time-to-market is one of the most significant benefits of the ARTEMIS JTI. Moreover, the JTI will broaden participation and increase the number of new partners in the R&D activities.

More efficient R&D spending by public authorities

The expected ~€750m of national money spent through the ARTEMIS JTI will be allocated through common European procedures and work plans as in the Framework Programme. It is expected that the impact of this spending on GDP will be similar to that of EU-level expenditure, and much higher[14] than in the "business-as-usual" scenario, where this funding would be disbursed according to the different priorities of national programmes.

Broader economic and social impacts

The **common technologies** developed by the ARTEMIS JTI will provide a level playing field for embedded systems-based industry, leading to increased competition for products and services based on common platforms.

The ARTEMIS JTI will contribute to more and better quality jobs and enable smarter working and more agile production, as many applications will enhance automation and and support to human operators, thus increasing the added value of many jobs. Some of the application scenarios envisaged in the ARTEMIS SRA have also a strong societal orientation (e.g. environmental monitoring and management).

MEETING THE CRITERIA FOR A JOINT TECHNOLOGY INITIATIVE

The proposal satisfies all of the criteria set out for a Joint Technology Initiative under the 7th Framework Programme:

- *Scale of the Impact on Industrial Competitiveness and Growth*: **Embedded systems are a strategic technology for Europe,** as they underpin the future development of key sectors for the EU's economic strength and are significant drivers of innovation and growth.

- *Degree and Clarity of the Definition of the Objective and Deliverables to be Pursued:* The ARTEMIS SRA sets out **tangible industrial objectives** to keep Europe at the forefront of the embedded systems field, aiming at realising the EU's potential in the future markets for intelligent products, processes and services.

- *Inability of Existing Instruments to Achieve the Objective:* While the EU will continue to invest in embedded systems research under the Framework Programme, the regular FP instruments alone cannot bring together resources on the scale needed to meet the investment challenge. **None of the existing instruments can combine, under one umbrella, industry, Member States and the Community**.

[14] In the long run, FP-level disbursements have 89% more impact on GDP per € invested than funding allocated at national level: Commission Staff Working Paper annexed to the proposal for the 7th Framework Programme {COM(2005) 119 final}, Annex 1, p. 59.

- *Added Value of European-Level Intervention:* The ARTEMIS JTI provides the necessary legal and organisational framework to stimulate long-term commitments from all stakeholders. This new framework can be established only **by action at Community level**, combining the benefits of European integration with **rapid adaptability of technology goals and industrial policies and with flexibility in participation on the part of Member States**.

- *Strength of the Financial and Resource Commitment from Industry:* Industry has already invested a lot of effort in preparatory activities and **will financially contribute to the operating costs of the JTI at 1% of the overall costs of the R&D** (estimated at around €2.7 billion). In terms of in-kind contributions to R&D projects, **industry is expected to contribute around 60% of costs**.

- *Importance of the Contribution to Broader Policy Objectives Including Benefit to Society:* Achieving the ARTEMIS JTI technological objectives will have direct benefits for European industry of at least **€14.7bn per year** by 2015 through savings in development costs. Further indirect benefits can be expected from this improved profitability in terms of increasing market share and revenues, moving to higher added-value product segments, and improving longer-term technological competitiveness.

- *Capacity to Attract Additional National Support and Leverage Current and Future Industry Funding:* The ARTEMIS JTI uses Community funding as a lever to increase and align national funding towards common goals and objectives and to provide incentives for greater investment by industry. Industry is prepared to double its resources in this field over the next years. For a total Community funding of €410m for R&D activities, the ARTEMIS JTI should **leverage about seven times that amount**, 60% of which would come from the contributions of industry and other R&D actors.

CONCLUSION

The proposed JTI on Embedded Computing Systems (ARTEMIS JTI) is **an appropriate means to implement an initiative to realise Europe's potential** in the future markets for intelligent products, processes and services. The ARTEMIS JTI addresses the **core of the Lisbon agenda:** it will pursue objectives of high strategic value for EU competitiveness; will foster greater investment in the area by industry; will allow Community funding to be used as a lever to align national funding in a flexible way towards common goals and objectives, creating a true European Research Area in the field; and will provide a mechanism for broadening participation in R&D and for industry to act together towards common goals and objectives, so as to achieve greater leverage in how results are exploited and applied. The JTI governance and operation model also provides an appropriate framework to combine the strengths of inter-governmental schemes (Eureka) and European programmes while overcoming their weaknesses.