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EURON

European Robotics Network

Network of Excellence
Information Society Technologies

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EURON Annual Report - Yr. 1

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Executive Summary

The European Robotics Network was setup to to address the need for a higher degree of cohesion across the involved research efforts within Europe and to integrate the efforts within the “Beyond Robotics” programme sponsored by the Future and Emerging Technologies unit. The effort involves five types of activities:

- Joint Research Projects
- Research Planning and Benchmarking
- Education and Training
- Industrial Links
- Dissemination

The joint research projects are organised through competitive calls for proposals. The projects are related to prospective research projects (seed funds for novel new ideas), research ateliers (focused studies), and topical research studies. During the first year 1 prospective project and 2 research ateliers have been selected for funding.

The research planning and benchmarking efforts are directed at formulation of a research roadmap for European robotics, as part of a long-term planning process. In addition the benchmarking is related to definition of benchmarks for comparative research and evaluation across different R&D efforts. During the first year a structure for the roadmap has been defined and a web facility for community involvement has been setup. In terms of benchmarking a survey of existing standards has been generated.

Education and training is key to ensuring human resources for the industry and a key factor in any research effort. The effort involves an effort to generate an inventory of robotics efforts in Europe as a basis for discussions on standard curricula in robotics. In addition a web book has been initiated to generate a comprehensive reference text of robotics. A first structure is available and it is anticipated that the community will be actively involved in populating the book with material. An excellent mechanism for graduate education on selected topics is summer schools. This year four schools have been organized and another five will take place during 2005. In addition standard mechanisms for generation of feedback from the events have been established. Finally a PhD Award is given each year for the best PhD thesis on robotics. A major factor in selection of the winner is evaluation of the actual impact the work has had on society at large.

In terms of industrial links there is an active effort to involve European industry at large. This is achieved through joint efforts with the industry interest organisations such as IFR and EUnited Robotics. In addition there is active participation in the UN/IFR effort on statistical analysis of the evolution of robotics. To ensure that the industrial needs feeds into policy making and the roadmap white papers are prepared on selected topics such as manufacturing. An effort is also underway to set up a yellow page (who’s who) facility for research and development in Europe. Finally a joint EURON/EUnited Robotics Technology Transfer Award is given out. This year the winners were an SME on new applications and a joint effort between ABB and Lund University. There has also been an active involvement in the effort to set up a European Technology Platform on Robotics (EUROP). Dissemination is a major drive in academic research and at the same time it is important that society in general becomes aware of the economic opportunities offered by use of robotics and automation. Dissemination involves both contact to the general press, and scientific publication through a special
series established with Springer Verlag. In addition the EURON effort has an active web facility for general communication about its activities.

At present the EURON network involves about 160 institutions and companies across most of the member countries. The first year has been an effort to define the long-term objectives, and to get new mechanisms in place. Overall the network has made significant progress to make Europe the leader in terms of robotics R&D. It is highly satisfactory to see that robotics is a major focus in the proposed programme for FP7. In addition the initiation of an effort on a technology platform is also a direct demonstration of the interest from industry. In summary the gradient is most satisfactory.
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1 Introduction

Traditionally European Research on Robotics has been highly fragmented. On other continents there has been a higher degree of cohesion due to specific programmes put in place by funding agencies. In the US the NSF Multi-University Research Initiatives (MURI) programme has provided support for cross-university community setup, and the DARPA Mobile Autonomous Robot Systems (MARS) has served a similar purpose across most aspects of mobile robotics. The MARS programme has involved principal investigator meetings every 3 months, which has been an important mechanism to integration of the research community. In Japan the Humanoids programme has also been important for integration of the community across universities, and recently the networked robotics initiative has continued this work.

As part of various programmes sponsored by the European Commission a number of efforts on robotics have been sponsored, but the initiatives have been scattered over a number of different units and there has been limited, if any, coordination of these efforts. Consequently, the EU research on robotics has not been visible on the international scene.

EURON – The European Robotics Network – was setup to address the need for further integration of the research community. The effort involves both coordination across national programmes, and integration across projects sponsored through the “Beyond Robotics” programme. The aim of EURON is to provide support to ensure that the EU has the best community in robotics in terms of methods, human resources and mechanisms for transfer of results to industry.

1.1 A bit of history

Originally the EURON network was started under the CEC FP5 as a network of excellence during 2000. The network was conceived at the French embassy in Japan, and started as a voluntary network. Once it had some momentum an application was submitted to the commission for support. The FP5 project finished by April 2004, and has been continued (from May 2004) as a network of excellence under the 6th framework programme, sponsored by the Future and Emerging Technologies unit.

EURON is part of the FET pro-active initiative on “Beyond Robotics”, where the qualifier beyond specifically refers to research to promote robotics that extends beyond the traditional manufacturing domain. As part of the “Beyond Robotics” programme three integrated projects were also initiated

- Neurobotics – The fusion of neuroscience and robotics
- Cogniron – The Cognitive Robot Companion

An important aspect of EURON is also to provide support for the integrated projects in terms of community integration and dissemination.

1.2 Organisation

The EURON network has a rather unusual organisation for a Network of Excellence (NOE). The work is divided into two major components

- Organised community efforts
- Ad-Hoc Research Projects
The organised community effort is a top-down controlled structure that addresses community needs in terms of

- Research Planning
- Education and Training
- Industry Links
- Dissemination

These efforts each involve a number of efforts that have been planned in advance, as outlined in section 2.

The ad-hoc research projects is a mechanism to pick-up emerging ideas from the community and support them to allow them to mature. The ad-hoc projects are organised around three instruments

- Prospective Research Projects: The instrument is put in place to allow a consortium to apply for support for a novel idea, that is not yet mature enough for normal community support through mechanisms such as FET-Open or similar. Projects are supported for up to one year to enable the consortium to test the idea and provide a first set of results

- Research Ateliers: This instrument is used to support highly focussed studies in a single venue on a topic of general interest to the “Beyond Robotics” programme. Typical output from an atelier could be a chapter for the research roadmap, a whitepaper, or similar.

- Topical Research Studies: The topical studies is an instrument that is used to support a group of institutions that pursue studies on a particular topic in robotics. The output of a study could be an interest group, a topical web facility, a focussed study on a interdisciplinary problem such as user interfaces.

Through integration of both top-down and bottom-up mechanisms it is possible to pursue an overall community integration and at the same time provide enough support for new ideas that normally are beyond the reach of funding agencies.

1.3 Membership

The EURON Network is organised around a four layer setup.

- The Coordinator
- National Coordinators (contractors)
- Key-Area Coordinators
- Regular Members

The Coordinator, Kungl Tekniska Hgskolan, is responsible for all communication with the commission and the overall organisation of the work.

Normally all members in an NOE are directly contractors, however, due to the size of the consortium this is not a realistic option, and in addition the network is open to new members at anytime during the lifespan of the project. Consequently a Board has been established with national coordinators. At
the start of the project this involved 23 members. These coordinators form a board of the initiative which handled all contractual matters and makes decisions on ad-hoc research projects etc.

For the implementation of the planned work-programme two key-area coordinators have been appointed for the areas of research, education, industry and dissemination. The key-area coordinators are:

<table>
<thead>
<tr>
<th>Area</th>
<th>Coordinators</th>
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<tbody>
<tr>
<td>Research</td>
<td>R. Dillmann</td>
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<td></td>
<td>A. Pobil</td>
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<td>Education</td>
<td>A. Casals</td>
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<td>R. Siegwart</td>
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<td>M. Hägele</td>
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<td>E. Prassler</td>
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<td>Dissemination</td>
<td>B. Siciliano</td>
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<td>F. Groen</td>
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In total the EURON network includes about 150 members, covering almost all EU countries and affiliated states. The distribution across nations is shown in figure 1.

![EURON Membership Spring 2005](image)

**Figure 1:** Distribution of EURON members across nations (Spring 2005)

The network is open to new members anytime. Interested parties are required to provide a brief research profile, a condensed CV for the contact person and administrative forms. Each month the board reviews received applications and makes a final decision on membership.

### 1.4 Organisation of Report

The progress report is organised with a presentation of an overall summary of the work performed in Section 2 and detailed reports for each of the workpackages in the work-programme in Section 3. Various aspects of management are discussed in Section 4. During the implementation of a programme that involves 150 institutions and the European Commission a number of challenges arise, as discussed in Section 5. The revised workplan for EURON is provided in a separate document, but a brief overview is presented in Section 6. Finally a summary is provided in Section 7.
2 Summary of work

As mentioned earlier the overall work programme for EURON is organised according to 4 key-areas involving research planning, education and training, industry links and dissemination. Consequently the presentation of the work during the first year is organised accordingly. In addition to these four areas a final section outlines efforts that have been undertaken in terms of community integration beyond the key-areas.

2.1 Research Planning

Research planning within EURON involves three efforts, of which two are directly under the leadership of the key-area coordinators, while the third is managed by the coordinator. The efforts are:

- Research Roadmap
- Benchmarking
- Research Projects

Roadmapping and benchmarking is organised by the key-area coordinators, while research projects are handled by the coordinator and the EURON board.

Roadmapping is a crucial activity for any research community. The objective of research roadmapping is to:

- Specify the overall objectives of the community
- Identify the main economic drivers for the area
- Outline the present state of the art
- Identify the main obstacles to progress
- Formulate a strategy to address these obstacles
- Discuss different mechanism to implement the strategy

As part of the FP5 effort an early roadmap for robotics was delivered as a final deliverable. In preparation for the 7th framework programme this roadmap has been a key component to push for robotics as a major research area in Europe. In parallel it is necessary to update and synthesize the roadmap based on developments worldwide and the other areas of research that may be pursued as part of FP7. The FP5 roadmap was in many respects an academic roadmap, as it primarily was authored by university researchers. Consequently a brainstorming meeting was organised by November 2004 with a 50% participation from industry. The objectives were both to discuss industrial drivers and derived research challenges.

In addition an overall roadmap revision is taking place. To facilitate this a WiKi site with the roadmap text has been setup at University of Karlsruhe. The purpose of a web based facility is to ensure that the entire community can participate in the formulation of the roadmap. To support the editorial process of the roadmap, an affiliated group of 6 researchers are responsible for the area integration. A first version of the roadmap is expected to be available by October 2005.

As part of the research planning there has also been a significant involvement, by the EURON co-
ordinator, in the definition of a European Technology Platform on Robotics – EUROP. A report on
the overall objectives has been prepared, and a number of topical groups have detailed documents on manufacturing, service robotics, and security/space. The effort has subsequently been taken over by industry as is expected for a technology platform effort.

Too much research is performed in the context of novel test environments, where the data is designed for each new test. This challenges comparison of research results across institutions and exemplars. This poses a challenge to more widespread utilisation of results. In addition it points to a lack of proper scientific rigor that characterizes a mature field. Consequently there is a strong need to develop benchmarks that allow comparison of research across individual efforts. Through adoption of a number of standard benchmarks it is expected that it will be easier to compare results and directly see the insight provided by individual projects. To promote the use of benchmarks and design a number of standard benchmarks to be used in the “Beyond Robotics” effort part of the research planning is devoted to research benchmarks. During the first year a number of benchmarks that are in use as part of robotics have been surveyed. The results are summarised in the deliverable DR.2.1 “Documentation of research benchmarks”.

For the coordination of research across the Integrated Projects and the integration with the wider EURON community a Strategic Advisory Committee has been defined. The Advisory committee is composed of the IP Coordinators, the EURON coordinator, Prof. Hirochika Inoue, Prof. Lynne Parker and Dr. Pekka Karp from the CEC. The external advisors are briefed on a regular basis and in addition a meeting was organised as part of the EURON Annual Meeting (Warsaw, February 2005). The committee has in particular discussed integrated with the IP projects, mechanisms for dissemination and relation to efforts elsewhere in the world. The committee provides a good mechanism for inter-project coordination.

Finally as part of research planning EURON advertises a call for research projects twice per year. The objective is to support ad-hoc activities as outlined in section 1.2. The first call for proposals was advertised 8 July 2004, with a closing date of 15 October. In total 7 proposals for prospective research projects (PRP), 4 proposals for research ateliers (RA) and 6 proposals for topical research studies (TRS) were received. The proposals were reviewed according to the procedure outlined in DR.3.1 (rev 1). All proposals were reviewed by at least 2 external experts. Based on these reviews the board made a final selection of projects to support. The first call provided sponsorship for 1 PRP and 2 RAs, as described in deliverable DR.3.2. A project contract with the coordinator has been defined (DR.3.1 rev 2) together with guidelines for economic reporting. This has unfortunately been a lengthy and rather difficult process to complete due to legal issues involving the partners, the CEC and the coordinator. However, future call will be simplified now that a model has been defined.

The second call for proposals was advertised on January 18, 2005 with a deadline of 18 April 2005. In this call 14 PRPs, 1 RA and 3 TRS proposals were received. The selection of projects for funding is on-going.

The resources required to process/evaluate research proposals are unfortunately much more higher than initially anticipated, which challenges the publication of such research calls in the future.

2.2 Education and Training

Long-term economic growth in robotics is not only dependent on access to excellent research environments and results, but equally dependent on access to human resources that have training and experience in robotics. It is thus natural that EURON involves a significant effort on training and education. The main activities include:

- Definition of a Web Book on Robotics
• Coordination of Robotics Curricula
• Organisation of EURON summer schools
• PhD Award

In general there is a lack of comprehensive reference material on robotics. Most textbooks only provide topical coverage. The community is in need of a more comprehensive reference. At the same time many teachers prepare detailed lecture notes for specialised courses. To capitalize on these efforts an activity within EURON is directed at the setup of a WEB book on robotics that can provide comprehensive coverage of robotics. A major effort during the first years has been definition of a framework for contribution to the webbook. As robotics methods typically a described using a mathematical basis it is important to have a methodology that allow use of HTML in combination with equations. A mixed strategy involving \LaTeX, PDF and HTML has been adopted. An overall outline of the structure of the book has been defined and made available at \url{http://www.roble.info/}. A variety of robotics curricula is available across universities in Europe. It would be of interest to be able to understand how robotics is taught at different universities. In addition there is an interest to see how specific topics are presented. This is for example of interest when trying to setup a new course or revising an existing one. To accommodate this a database for presentation of courses available at different universities has been defined. The database is available through the web server, \url{http://euron.upc.es/rcdb/}. As part of teaching there is also interest in having access to standard material such as pictures, movies and slides. Many teachers put significant effort into preparation of excellent material and it is of interest to be able to capitalize on such effort. Through the EURON web site such material is also collected and made available, at the address \url{http://felsted.mip.sdu.dk:8081/HyperLearn/viewPage.action?site=EURON}.

Most universities do not have access to the best experts in the world on all topics of robotics. In addition there is a need to generate a mechanism for community integration for junior researchers involved in robotics. To address this issue EURON sponsors 5-6 summer schools each year. Twice per year a call for proposals is advertised and the educational committee evaluates the proposals both in terms of scientific quality, coverage and economy. During 2004 EURON (co-)sponsored 4 summer-schools on:

• Human-Robot Interaction
• Mobile Manipulation
• Images and Robotics
• Simultaneous Localisation and Mapping

In total about 200 junior researchers and PhD students were trained at these summer schools. A new generation of summer schools have been planned for the summer of 2005. The distribution of students across schools and nations is shown in Figure 2. As part of the summer schools it is also important to fully understand the quality of the various aspects. To provide a mechanism for improving the schools, each student was required to fill in a questionnaire that details aspects related to organisation, lectures, exercises, and other aspects. The overall grades from the questionnaires is shown in figure 3. Overall the results are highly satisfactory. However, the use and design of exercises is obviously an aspect that could benefit from further consideration.
Figure 2: Distribution of students across nations and topics for the 2004 summer schools

Figure 3: Feedback received from the students that participated in the 2004 summer schools
From the start of the EURON initiative it was decided to have a mechanism for promotion of research excellence among junior researchers. Consequently the Georges Giralt PhD Award was set. The prize is named in honor of Prof. Giralt, LAAS in recognition of his work for European robotics. Candidates are encouraged to submit their thesis and support material to the jury up to two years after graduation. The jury considers both the overall thesis but more importantly the impact of the work in terms of dissemination and pickup by the community and/or industry. This year 13 submissions were received. The jury selected 3 candidates for public presentations at the annual meeting. Finally the winner Juan Andrade-Cetto, UPC-CSIC was selected as the winner of the 2005 PhD award. Both the winner and shortlisted candidates are encouraged to submit a revised version of their thesis for publication as part of the Springer STAR Series (see Section 2.3). The next call for the Giralt PhD Award has just been published for submission during September 2005. The final selection will be presented at the annual meeting 2006.

![Image](image_url)

Figure 4: The winner and shortlisted candidates/representatives for the Georges Giralt PhD Award with the chair of the educational committee Prof Casals

### 2.3 Dissemination

As part of the Beyond Robotics initiative it is essential to provide mechanisms for dissemination of information about the overall initiative and the involved projects. To facilitate this the following mechanism are in place:

- General dissemination about EURON
- The Springer STAR Series
- A WWW facility for EURON

The general dissemination about the initiative has taken two forms. First of all it has been organised that EURON published a column about its activities in the IEEE Robotics and Automation Magazine.
The column is edited by Prof. Kyriakopoulos and Prof. Siciliano. In total 4 columns have been published covering the tech transfer award, the new integrated projects, initiatives on robotics in FP6 and the annual meeting. The column is circulated to more than 10,000 subscribers and provides an excellent channel for dissemination to the academic robotics community. In addition an agreement has been reached with a professional journalist in the UK on an information leaflet, and popular science articles about the initiative. Such material is, however, not yet available. It is anticipated that the material will be available by September 2005.

As part of EURON-1 a series on robotics was established with the engineering department of Springer Verlag. The new series is named Springer Tracts in Advanced Robotics (STAR) and is edited by Prof. Siciliano, Prof. Groen and Prof. Khatib. During the reporting period 5 new volumes have been published. In addition 7 volumes have been accepted for publication, 7 submissions have been rejected, 4 have been recommended a revision and another 4 are under review. The STAR series is one of the best new book series with the Springer Engineering department and is selling well. Nominees for the Giralt PhD Award are also encouraged to published their revised thesis as part of the series. In many cases this also happens, however for theses that were not originally authored in English there is a significant lack of publication, as the translation often is considered to much of an effort.

At the start of the project it was decided to make a call for tender on the design of a WWW facility. Two applications were received. Unfortunately none of them were of the quality anticipated. A later proposal from University of Southern Denmark to edit and host the facility was accepted. Within a short time period a new web facility was designed and brought on line. The design is based on an open-source platform to ensure easy transfer across platforms. The site at present comprises ≈ 150 pages. The site receives about 2400 page hits per day of which 13% are from search engines. The entry page for EURON is shown in Figure 5.
Overall the revised web design has been extremely well received and has become an important facility for dissemination of information about EURON. Finally two email lists are also maintained by EURON. There is a list for official EURON material and another for community dissemination, which is named euron-dist. Both email lists are hosted by FhG AIS, and maintained by the EURON coordinator.

2.4 Industry Links

EURON is not only an academic network, it is also supposed to have strong ties to the industry. The industrial links effort is directed at this. The activity is composed of:

- Liaison with related organisations
- Industry workshops
- Industrial white papers
- Technology Transfer Award
- Yellow Pages for European Robotics

There are a number of industrial organisations that directly handle industrial robotics such as International Federation on Robotics (IFR) and the EUnited Robotics. Exchange of information with these entities is performed in a regular basis and memorandum of understanding are to be signed shortly. As part of this there is also participation in the IFR / UN effort on statistical processing of data related to stock and sales of industrial and service robots. At the release of the 2004 version of the World Robotics book a workshop was co-organised at the UN headquarters in Geneva on October 20, 2004. The event included presentations by the CEC, Kuka, Korea Robotics and iRobot.

An industry workshop has been organised with the manufacturing robotics companies in Europe. This workshop was part of the initiative to define a European Technology Platform (EUROP) on Robotics. As part of this effort a sectorial report on Manufacturing Robotics has also been prepared. This document will form the core of the upcoming white paper on industrial robotics in Europe. Jointly with the Research Planning key area two workshop have also been organised at the CEC for brainstorming on robotics as part of FP7.

To encourage transfer of results to industry a EURON Technology Transfer Award has been defined. The award is jointly sponsored by EURON and EUnited Robotics. The award process is managed by FhG-IPA. Submitted proposals are evaluated by a joint jury. This year 10 nominations were received for the award. Of these, 5 proposals were shortlisted for presentation at the annual meeting. A tie was the final decision by the jury. The first prize was shared between the two projects StarKick and AUTOFETT. StarKick is a soccer playing robot for the entertainment business, while AUTOFETT is a project for automated Fettling and finishing of castings. The prize carries a cash award of 5KEuro and a designer trophy. The winners and short-listed candidates are shown in figure 6.

In a joint effort with European Robotics Forum a Yellow Page facility for European Robotics had also been planned – www.robotics-in-europe.org. However, ERF was dissolved shortly after the start of EURON. A re-launch has been discussed with the EUnited, and a preliminary agreement has been reached. The design of the new site has also been initiated. At the request of the EURON board a proposal for presence at a major industrial fair has also been prepared, in particular aimed at the Automatica 2006 fair that is to take place in Munich. A final decision on the proposal has not been reached.
2.5 Management / Community Efforts

The overall responsibility of the EURON network is with the board, that is composed of the national representatives. In addition the key-area chairs are non-voting members of the board. The board has two meetings during the reporting period. One at the start of the project and another by end of November 2004. In addition the board has monthly discussions of on-going business. In particular the board each month reviews received applications for membership. Overall a highly cooperative forum has been setup for the initiative.

The board is also responsible for the final approval of the research proposals received as part of the ad-hoc organisation of research.

The day-to-day management of the network is performed by the coordinator, where a half-time administrator is responsible for the administrative aspects, and the coordinator provides the overall coordination. In general the model of interaction has been successful.

An important aspect of the network activities is the annual meeting. The first annual meeting took place in Warsaw 16-17 February 2005 organised by Prof. Zielinski. The meeting was attended by 175 people from almost all member countries. The meeting included activities on:

- Annual report on EURON activities
- Invited presentations
  - H. Inoue - “The Birth of Robotics”
  - L. Parker - “Experiments with a Large-Scale Heterogeneous Mobile Robot Team”
- Brief presentations by shortlisted candidates for
  - Giralt PhD Award
  - Technology Transfer Award
- Topical workshops on Beyond Robotics
It is important to realize that the EURON annual meeting first and foremost is for planning and community integration and as such it does not serve as a conference.

3 Work per workpackage

In this section the work performed in each of the Workpackages mentioned in the EURON Programme of Work. The structure of the presentation is harmonized to the extent possible with a presentation of objectives, work performed and the resulting deliverables.

3.1 WP 1: Research Roadmap

3.1.1 Objectives

The objectives of this workpackage is to generate a roadmap that outlines state of the art, emerging issues, and plan to address these issues. Particular attention is devoted to the key issues within “Beyond Robotics”.

3.1.2 Work Performed

During the first project phase work focused on the structure the final roadmap should obey to. This work was driven by the requirements of robotics research. In order to stress the need for integrated solutions and systems, embedded in their environments, the structure was oriented towards the applications and challenges including the enabling technologies, which are leading the development. In order to fill the proposed structure with contents, a web-based platform for distributed co-authoring was set up and facilities for contribution were introduced to the research planning committee. A workshop on road mapping was held during the EURON annual meeting in Warsaw, Feb 2005. It’s results, as well as the results of the EURON brainstorm meeting in Bruxelles, November 8-9 2004 guided the development and structure of the road map. The resulting structure of the roadmap document is divided into chapters dealing with advanced production systems, adaptive robot servants and intelligent homes, network robotics, outdoor robotics, health care and life quality.

3.1.3 Deliverables

No deliverables had been planned for this period. A draft roadmap is expected to be delivered by month 15 (August 2005).

3.2 WP 2: Research Benchmarks

3.2.1 Objectives

To define standard benchmarks for comparison of results across experiments, laboratories and disciplines. Benchmarks are critical to facilitate comparative research. Particular attention should be devoted to analysis of existing benchmarks, and those provided by international organisations such as FIPA, RoboCup, and IFR.
3.2.2 Work Performed

Identify the relevant benchmark issues and generate an inventory of existing benchmarks from other efforts such as FIPA, RoboCup, IFR, etc. Collect possible scenarios in particular domains proposed by experts in these domains. Several discussions were held and a number of working groups set up to initiate a process of convergence towards consensus in order to ensure community wide acceptance of the benchmarks in the long term. An inter-IP meeting on benchmarks had also been anticipated, but unfortunately it has not been possible to arrange such a meeting.

3.2.3 Deliverables

Deliverables DR.2.1 is a first compilation of a number of benchmarks that are used in robotics for research evaluation, algorithmic comparison etc. In addition a web site is brought online to support community wide involvement benchmarks.

3.3 WP 3: Inter-project coordination

3.3.1 Objectives

To provide the mechanisms and resources to ensure cross-IP cooperation, and integration with nationally funded efforts. The workpackage will provide coordination across the efforts in the “Beyond Robotics” initiative and potential efforts to ensure synergy through coordination with national efforts. The aim is to provide the required mechanisms for guidance of the overall initiative.

3.3.2 Work Performed

A strategic advisory committee has been setup for the general coordination across the entire “Beyond Robotics” programme. The committee is composed of

- Paolo Dario (Neurobotics)
- Raja Chatila (Cogniron)
- Heinz Wrn (iSwarm)
- Pekka Karp (CEC)
- Hirochika Inoue (JSPS/AIST, JP)
- Lynne Parker (UTK, US)
- Henrik I Christensen (EURON)

One meeting has been held with the advisory committee. Originally two meetings had been planned, however, the initiative had to be launched and the members had to be appointed. As to coordination with national initiatives there has been a joint meeting with the French ROBEA programme.

3.3.3 Deliverables

Deliverable DR.3.1 contains the minutes from the first advisory meeting. The second meeting has been planned for fall 2005, and consequently the deliverables DR.3.2 has been postponed.
3.4 WP 4: Joint Research

3.4.1 Objectives

i) To provide the required resources for Prospective Research Projects, Ateliers, and Topical Research Studies. ii) To provide the necessary mechanisms for evaluation of proposals. To provide the mechanisms for ad-hoc consideration of new research ideas, and in-depth topical studies.

3.4.2 Work Performed

During the reporting period 2 calls for proposals have been advertised, and the guidelines for evaluation have been prepared (twice!). All proposals received are sent to three international reviewers and upon receipt of review reports a consensus / summary is generated for each proposal. Based on this a ranking of the proposals is generated. Finally the board of EURON selects proposals for sponsorship. The selected consortia are required to sign a contract with the coordinator (a third party contract). Significant effort has been devoted to design of a contractual framework for these contracts. The effort involved in setup and running evaluations has unfortunately been much more significant than expected.

3.4.3 Deliverables

The workpackage has resulted in two guidelines for evaluations (DR.4.1 – rev 1 and rev 2), a summary of the first round of proposals (DR.4.2) and the model contract and financial guidelines for sponsored projects (DR.4.1 – rev 3). The second call for proposals was advertised on January 18 and had a deadline of April 18. Consequently the evaluations has not been completed by May 1 (the end of yr 1).

3.5 WP 5: Teaching Material

3.5.1 Objectives

To collect a comprehensive set of notes related to robotics, organised in a web-book. The web book is expected to evolve into an encyclopedia of robotics organised in a hierarchical fashion according to a general taxonomy for robotics. Material published in the web book will be organised appropriately for use as teaching material. Presentations and proceedings from summer schools are to be included in the web book.

3.5.2 Work Performed

During the first year a platform for presentation and editing of a comprehensive web book on robotics has been selected. It uses a mixture of LaTeX, PDF and HTML. The general structure of the book has been outlined and sample contributions have been prepared.

3.5.3 Deliverables

A web facility [http://www.roble.info/](http://www.roble.info/) has been brought on-line and the deliverables DR.5.1 summaries the design and the present status. In addition an repository of theses in robotics has been planned. Finally a database of teaching material has been set up at [http://felsted.mip.sdu.dk:8081/HyperLearn/viewPage.action?site=EURON](http://felsted.mip.sdu.dk:8081/HyperLearn/viewPage.action?site=EURON).
3.6 WP 6: Robotics Curricula

3.6.1 Objectives

There is a need to coordinate curricula across Europe to ensure some cohesion in terms of scope and contents. The workpackage will initially generate a survey of existing educational programmes in robotics and mechatronics across Europe. Based on this, a set of recommendations for robotics programmes will be generated. The long-term aim is to provide guidelines for robotics curricula and associated educational platforms.

3.6.2 Work Performed

The coordination committee for education and training met in October 2004 to design a strategy for generating an inventory of robotics education in Europe. It was decided to initially have a database of courses given in robotics across involved universities. To this end a website has been setup to collect information about courses. The initial inventory is now available. In addition it is considered how packages of courses could form the core for various curricula across involved disciplines such as mechanical engineering, computer science, production engineering, etc.

The development of the Euron Robotic Courses Data Base in which the courses on Robotics can be entered has taken much more time than expected and some improvements have been done after receiving feedback from the first contributors, on request. Therefore, the Call for collection of contributions from the whole Euron members has also been delayed.

3.6.3 Deliverables

The deliverables DR.6.1 provides an overview of the web facility that contains a survey of courses in robotics. The recommended robotics curricula deliverables (DR. 6.2) has been postponed until a better overview of available courses and models is available. An initial version is expected by September 2005.

3.7 WP 7: Summer Schools

3.7.1 Objectives

Summer schools have turned out to be an excellent mechanism for focussed educational efforts on well-defined topics. Furthermore, they provide an excellent forum for young researchers to network with other researchers working on the same topic. The summer schools thus provide an interesting mechanism for scientific and social integration across the community. The aim of this work-package is to provide the needed resources for set up and implementation of 4-5 summer schools per year.

3.7.2 Work Performed

There has been two calls for summer schools during the reporting period. The call are advertised with a generous deadline. The received proposals are evaluated on research coverage, support for students, composition of school programme and quality of lecturers. Four schools have been supported as reported in [2.2]. Each school is normally sponsored at a level of 10K Euro.

In addition a template evaluation forms has been prepared that all students are required to fill in and return to the summer schools coordinator, Prof. Siegwart. The evaluations has clearly indicated the quality of the events and a need to further consider the way exercises are performed.
3.7.3 Deliverables
The deliverables DR.7.1 reports on the first years summer schools, and the report DR.7.2 has a summary of the evaluations from the first year. A new series of summer schools have been selected for the summer of 2005.

3.8 WP 8: PhD Award

3.8.1 Objectives
Each year recent graduates (within the last two years) are invited to submit their thesis for consideration for the “Georges Giralt PhD Award”, a prize for the best European thesis on robotics. The aim is to promote good theoretical and experimental research on robotics and to make the wider community aware of such work.

3.8.2 Work Performed
A call for best PhD Award was advertised early June 2005 and the deadline for submission was October 2005. The 12 received proposals were evaluated by an international panel of senior researchers. The review panel is composed of:

- Alicia Casals (chair)
- Raja Chatila
- Hendrik van Brussel
- Rudiger Dillmann
- Paolo Dario
- Bruno Siciliano
- Henrik I Christensen

Each thesis is reviewed by three members and each provides a vote on impact, quality and overall score. The three top candidates are considered by all members of the panel and invited to give a presentation at the annual meeting. This year the winner was Juan Andrede-Cetto, UPC-CSIC. Shortlisted candidates were Kai Arras, EPFL and Tine Lefebre, KU Leuven.

3.8.3 Deliverables
As mentioned above the three candidates for the award were presented at the annual meeting and each were given an award. The overall process and results are reported in the report DR.8.1.

3.9 WP 9: Book Series

3.9.1 Objectives
As part of EURON-1 a book series was commissioned with Springer Verlag. Its aim is to collect the best theses, monographs and proceedings into a single collection on robotics. In other areas, such as computer science, there are established series on the best material. As a community is set up and various efforts are organised there is a need to make this material of supreme research and educational
efforts available to the community. The aim of the STAR series is to provide an efficient mechanism for identification of high quality work in robotics and assist authors in the preparation of material in a form suitable for publication with the Springer STAR series.

### 3.9.2 Work Performed

The STAR series in one of the most successful new series in the Engineering Department at Springer Verlag. Five new volumes has been published this year. In addition 7 volumes have been accepted for printing. Another 7 proposals were rejected, have been recommended for revision and 4 more proposals are under review.

The series has been a big success in terms of organising a focus point for publishing in robotics in particular in terms of revised PhD theses and high quality meetings reports.

### 3.9.3 Deliverables

The deliverables DR.9.1 provides a summary of the STAR volumes published during the first year.

### 3.10 WP 10: WWW Site

#### 3.10.1 Objectives

In the (sub-)contracting procedure for the EURON-2 website there were two main competitors: a company (e2advance.com), and the Maersk Institute for Production Technology (MIP) in Denmark, under the supervision of John Hallam. The website has been assigned to MIP; its main features are a content management using open source technology, lower maintenance costs (under 80.000 EUR), and content provision and editing by qualified personnel (Bridget Hallam). We anticipate that the use of open-source software for the website will allow easy maintenance of the site after EURON-2 ends.

#### 3.10.2 Work Performed

The key goals for the web site ([www.euron.org](http://www.euron.org)) for this year were to provide an attractive, stable and usable site with the key information wanted by EURON members and the public. The site went fully on-line on January 11, 2005 and has run without interruption since then. It receives an average of around 2400 page hits per day, of which 13% are from search engine robots.

#### 3.10.3 Deliverables

The site comprises more than 150 pages of material, with sections for each EURON-2 key area, for news and events, for EURON-2 administration and for students. Sections for journalists and for member-to-member information are under development. A gallery of images of members’ robots is also hosted. The site is fully indexed by Google and other search engines and is compatible with all of the popular browsers. In parallel, a conference calendar is maintained for EURON by the University of Amsterdam ([www.science.uva.nl/~vlassis/CFP/](http://www.science.uva.nl/~vlassis/CFP/)). This site receives on the average 500 visits per month.
3.11 WP 11: Information about EURON and the Beyond Robotics Initiative

3.11.1 Objectives

EURON-2 should try to disseminate its activities and achievements outside the European domain in order to promote further networking. The Institute of the Electrical and Electronic Engineers (IEEE) is the largest worldwide professional organization. Thus, we established a contact with the management of the IEEE Robotics and Automation Magazine (RAM), an official publication of the IEEE Robotics Society read by a large international audience of researchers and practitioners (10,000 copies) and having a large impact ratio. This lead to the adoption of a scheme of publishing a 400-500 words column on EURON activities and the European robotics research area, coauthored by Profs. Kostas Kyriakopoulos (NTUA) and Bruno Siciliano (U.Naples), for each RAM issue. Further to this, general information about EURON-2 and the "Beyond Robotics" initiative of the Future and Emerging Technologies (FET) programme of the Information Society Technologies programme of the Information Society Directorate General of the European Commission has been disseminated.

3.11.2 Work Performed

During the first 12 months we published four (4) columns with subjects:

- The "EURON/ European Robotics Forum Technology Transfer Award 2004" an annual award created to improve the quality of robotics research and to raise the profile of technology transfer between science and industry.
- The three (3) Integrated Projects funded under the "Beyond Robotics" FET initiative.
- The new robotics related initiatives for the 6th Research and Technological Development Framework Program.
- A report on the Annual Meeting of the EURON-2 that took place between February 16-18, 2005 in the campus of Warsaw University of Technology, Warsaw, Poland.

In addition to this, an Information Flyer has been prepared outlining the main activities within EURON-2 and "Beyond Robotics" which is being distributed around at major conferences and meetings during the latest six months. Contacts with a science journalist are undergoing which shall lead to production of a general information/media package for wider audiences. Finally, a Press Release for the above Technology Transfer Award 2004 has been delivered as a means to enlighten successful collaboration between research and industry.

3.11.3 Deliverables

An information brief about EURON has been prepared as reported in DR.11.1 and DR.11.2 In addition the produced columns in IEEE RAM are contained in DR.11.3

3.12 WP 12: Liaison with Organisations

3.12.1 Objectives

Maintain and establish liaisons with international robot automation organisations, such as:
• The International Federation of Robotics (IFR)
• The European organisation of robotic manufacturers (EUnited Robotics)
• Robotics industries (both for industrial robot automation and service robotics)

3.12.2 Work Performed

Activities up to now:

• IPA is a member of all of these organisations so easy access to their members, governing bodies and infrastructure is secured. In all organizations regular reports were delivered on EURON-activities and possible collaborations and joint activities were discussed and initiated. The following meetings were attended where activities of EURON have been presented:
  – EUnited Press conference June 16th, 2004, Munich
  – IFR Secretariat on service robotics activities, Oct 1st, 2004 (Paris)
  – EUnited Robotics General Assembly Feb. 10th, 2005 (Brussels)
  – IFR Executive Meeting April, 19th, 2005 (Barcelona)

• The International Federation of Robotics (IFR): Short account of EURON highlights at Executive Meeting (April 19th, 2005), short report in coming newsletter. The interest of IFR in EURON is high. A Memorandum of Understanding (MoU) is about to be formulated. A joint activity towards an online internet-based robotics symposium is underway (scheduled July 2005); see http://www.e-symposium.com.

• Contribution to the robotics statistical framework (World Robotics 2004, 2005). This reference in the field receives highest attention by media, industry, research and government bodies. The contribution aimed especially at formulating the chapter on Service Robotics. World Robotics was presented on Oct, 20th, 2004 in Geneva with high visibility and public attendance. Results and highlights of the statistics were communicated into the EURON network. The edition of World Robotics is underway (to be delivered in July 2005). A revised statistical classification for service-robotics has been provided. An almost complete database of all service-robotics companies has been established and is accessible upon request.

• EUnited Robotics. Founded in June 2004 as a succeeding organisation to the European Robotics Forum (erf), the organization as its relations to EURON set into their scope of activities, see http://www.eu-nited-robotics.net/home/about-us/scope-of-activities.html. All major European Robotics industries are represented by this organization. A MoU is about to be established. Very good exchange of information and support for EURON.

3.12.3 Deliverables

• Two MoUs (IFR, EUnited Robotics) with EURON before signature

• Yearbook World-Robotics 2004 (service-robotics chapter); http://www.unece.org/press/pr2004/04robots_index.htm

• Press release and conference collocated with the its presentation on Oct 20th, 2004
• Online symposium on advanced robotics with IFR, the first of this kind in robotics

• Sponsorships, joint activities (EUnited Robotics) on Tech-Transfer Award, road-mapping (EU-ROP platform)

The activities are summarised in deliverables DR.12.1 and DR.12.2.

3.13 WP 13: Industry Workshops

3.13.1 Objectives

Workshop should be held (e.g. "Service Robot Industries Meet Robotics Research") to stimulate transfer of ideas and information and to create a common understanding towards market and technological trends, joint efforts towards visibility and research funding.

3.13.2 Work Performed

• Several workshops with strong participation from the service robotics industries (Jan 25, April 20, 2005) were held towards establishing a forum for establishing EUROP. Follow-up activities comprised the edition of a joint document on state of the current situation (market, applications, and key-players), visions, obstacles, challenges, a joint European perspective and action plan.

• A web-based forum to share developments, applications, business cases, pioneering products etc regarding service robots will be launched for the first time on July 7th with free participation for the full day event. The web-based symposium is managed by a professional web-portal provider (e-symposium, located in the UK).

3.13.3 Deliverables

A web based symposium will be held on July 7, 2005, as advertised on the e-symposium web facility.

3.14 WP 14: Industrial White Paper

3.14.1 Objectives

Edition of a "White Paper" for "Industrial Robot Automation and Service Robotics". The goal of each White Paper is to communicate a consolidated view of the status of and opportunities for European robotics industry seen by their main stake holders. The White Paper will be made available to the robotic communities, industry, professional bodies and research funding organisations.

3.14.2 Work Performed

During the establishment of the EUROP platform sectorial reports on the current situation (market, applications, key-players), visions, obstacles, challenges, a joint European perspective and action plan in manufacturing automation, service robotics and defence/space robotics have been formulated. The manufacturing automation report was coordinated, edited and presented by M. Haegele. Besides the EUROP-related workshops a special workshop was held with the participation of European industrial robot manufacturers/suppliers and EUnited Robotics on March 4th at Fraunhofer IPA.
3.14.3 Deliverables

A sectorial report for EUROP on manufacturing has been delivered as reported on [http://www.cas.kth.se/europ/EUROP/manuf-v5.pdf](http://www.cas.kth.se/europ/EUROP/manuf-v5.pdf) A revised report will be delivered by month 18.

3.15 WP 15: Technology Transfer Award

3.15.1 Objectives

Continuation of the "EURON Technology Transfer Award” (suggested title). The prize will be awarded annually on the basis of published rules. This activity will be jointly conducted with the EUnited Robotics. The Award should create visibility for excellent European robotics and should motivate closer technology transfer activities between industry and academia.

3.15.2 Work Performed

The call for the "Second EURON/Eunited Technology Transfer Award” was published in fall 2004. Sponsorship (6K Euro) were received from the robotics industries (ABB, COMAU, FANUC Europe, Gdel, KUKA, Reis, Schunk) to stage the Award. Eleven applications were received, reviewed by a board composed of research and industry. Five finalists were invited to present their application at the EURON annual meeting in Warsaw. The event was well received and exploited in reports, press-releases; see [http://www.euron.org/industrial/techaward.html](http://www.euron.org/industrial/techaward.html)

3.15.3 Deliverables

- Award ceremony (Feb. 26th) and press release (4 April 2005)
- Press release distributed via dpa (April), directly provided to journals
- Diplomas, trophies for award winners shipped

The press release from the event is provided as deliverable DR.15.1.

3.16 WP 16: Yellow Pages

3.16.1 Objectives

The objective of this workpackage is to revise and improve the European robotics competence portal ("Robotics in Europe"). The goal of the portal is to help to locate competences, resources and expertise among European research and industries. It is envisaged to harmonize the [www.robotics-in-europe.org](http://www.robotics-in-europe.org) web-portal with the planned ERF-portal to create maximum completeness and acceptance.

3.16.2 Work Performed

- Initial communication with ERF/EUnited representatives in June 2004 (Automatica) regarding common portal (dialogue on details was deferred until EUnited Robotics was operational (fall 2004))
- Meeting with CEO EUnited (Thilo Brodtmann) on Robotics in Europe and other issues in November 2004 (in Korea) - EUnited Robotics has contracted a web designer to develop the EUnited web presence; suggests to go ahead and develop a prototype of the intended systems
Analysis of problems and deficiencies of existing "Robotics in Europe" portal. Major deficiencies are:

- user interface is too cumbersome and not user-friendly
- current structure and content is too much geared toward academia not "industry friendly" enough
- review process is not efficient

Development of draft and implementation plan for a revised portal Robotics in Europe

3.16.3 Deviation from initial plan and contingency measures

The communication with ERF regarding a common portal or a co-operation on "Robotics in Europe" started as early as June 2004 (during Automatica 2004). At that time ERF was about to be dissolved and the new organisation/association EUUnited Robotics was being established. For understandable reasons the EUUnited Robotics Headquarters preferred to delay a further discussion on this issue until EUUnited Robotics and its web presence were operational.

The issue was brought up again in Warsaw in Feb. 2005 in a discussion with Mr. Sagert. It was suggested that EURON should go ahead with creating an operational prototype and informing EUUnited on the progress. This proposal seemed reasonable particularly since Kuka Roboter and other robot manufacturers are members of EURON and can thus influence the re-design of Robotics in Europe.

Contingency measures going beyond the above agreement did not seem to be appropriate. A draft of the GUI developed as a consequence of this agreement and an implementation plan are provided in Deliverable DR.16.2

3.16.4 Deliverables

An agreement with ERF has been reached (DR.16.1) and a draft plan for the joint portal has also been prepared (DR.16.2).

3.17 WP 17: Management

3.17.1 Objectives

To provide the required mechanisms and resources for network-wide management of the initiative. The effort will include coordination across the key areas and close interactions with the board to ensure community-wide awareness of and involvement in the network activities. In addition, it includes the creation of self-evaluation mechanisms to ensure monitoring, assessment of progress and planning of corrective actions in the event of deviations.

3.17.2 Work Performed

The work has include the day-to-day management of the overall initiative, including:

- Admission of new members after board evaluation
- Organisation of two board meetings
- Organisation of review of received research proposals
• Setup of contracts with ad-hoc research projects
• Organisation of scientific advisory committee
• Handling of economic transactions to members and key-area chairs.
• Organisation of material to the European Commission

3.17.3 Deliverables
The work is collected in a number of deliverables, including this report. The minutes from board meetings is provided as deliverables DR.17.1 and DR.17.6. This report constitutes deliverable DR.17.4.

3.18 WP 18: Annual Meeting

3.18.1 Objectives
To organise the annual meeting of EURON. The meeting is the premier meeting venue for activities within EURON and provides the opportunity to discuss current progress, cross-project, and cross-programme coordination of research.

3.18.2 Work Performed
The annual meeting was organised 12-13 February 2005 in Warsaw. The local organizer was Cesary Zielinsky. The meeting was attended by 175 people from most of the member institutions. In association with the annual meeting three workshops were organised jointly with the integrated projects, and workshops on research planning and open-source robotics also took place. Two invited presentations from Japan (Prof. Inoue) and the US (Prof. Parker) gave perspectives on research in emerging disciplines (Humanoids and Multi-Robot Systems).

3.18.3 Deliverables
The proceedings from the annual meeting are provided as deliverables DR.18.1.

4 Management
The main aspects of management has already been outlined in Sections 2.5 and 3.17. The overall responsibility of the network is held by the board which is composed of national representatives and the key-areas chairs. These members also represent the contracting members of EURON. The board is in regular email contract for discussion of emerging issues. In addition member applications are handled on a monthly basis. Finally two board meetings have been organised for more general discussions on the progress of EURON.

The key-area chairs have been responsible for the day-to-day organisation of respective areas. They are supported by a coordination committees. Separate meetings have been organised by several of the key-areas to facilitate the organisation and coordination of the effort.

In addition two brainstorming meetings have been organised in a joint effort with the European Commission (October 2004 and February 2005).

The day-to-day management of the overall initiative has been handled by a part-time administrator and the coordinator. The effort required for the overall coordination has been significantly larger than
expected for the first year. The organisation of evaluations of research proposals has been a major effort and so has the organisation of the contracts for projects that were selected for sponsorship. This has also resulted in a delay in the initiation of these projects. It is hoped that the required resources will be significantly smaller for subsequent reporting periods. In general the management of the initiative is seen as adequate.

5 Challenges and Opportunities

As mentioned above the need for resources to run the entire effort has been a challenge. In addition it has taken longer than expected to get a number of the initiatives underway. A number of factors have influenced the work

- The setup of third party contracts was significantly more complex than anticipated.
- The rules for evaluation of proposals was changed by the commission, which required a revision of the evaluation system.
- The reporting guidelines for third party contracts were not clear from the start of the project.
- ERF was changed into EU-nited Robotics which changed the interaction with the manufacturing robotics companies.
- The selection of a WWW provider for EURON was changed from a sub-contract to a contracting partner, which changed the overall cost model. The end-result is clearly better, but inly recently has the implications in terms of administration become clear.
- The selection of research contracts and initiation of projects took longer than expected, which has resulted in late payment to the selected consortia. The funds will have to be transferred to the second reporting period.

Some of these factors have resulted in delays and in several cases in a need for extra resources. However, it is felt that EURON has achieved a significant momentum and is well underway to provide the integration of the European Research Community as a basis for increased economic growth for robotics in Europe in general.

The European Commission has decided to have Advanced Robotics as a pillar of research in FP7, which is highly encouraging and the present community integration is seen as a strong basis for such an initiative.

In addition plans for a European Technology Platform in Robotics are well advanced. The industry and key academic partners are strongly involved in the setup of the platform. The setup of a technology platform is likely to provide an even stronger catalyst for continued economic growth in robotics. The EUROP platform integrates manufacturing, service and security/space robotics. As such it provides a very broad and yet targeted basis for continued growth. The exact integration between a technology platform, which is industrially driven, and EURON which is primarily academic is still to be determined.

6 Summary of plans for the second year

The plans for the second year are largely a direct continuation of the effort during the first year. The items include.
1. Articulation of a research roadmap for EURON (first version), which might provide valuable input to the detailed definition of the FP7 work programme

2. Detailed definition of research benchmarks to assist in comparative research across projects and institutions

3. Two calls for ad-hoc research proposals with a volume of 460 K Euro


5. Comprehensive database on robotics courses in Europe.

6. Second call for Georges Giralt PhD Award

7. 5-6 new Summer Schools on Robotics


9. Two white papers on robotics related to Service and Manufacturing Robots.

10. A web-symposium on robotics

11. A first version of the Robotics Yellow Pages for Europe

12. Memorandum of Understanding with IFR and EU-nited Robotics

13. Formal involvement in the EUROP technology platform.

14. Publication of 5-7 new volumes in the STAR Series

15. Transfer of the EURON WWW site to a contents management system and ways for key-area chairs to edit selected areas

16. An information flyer for the major robotics events in Europe

17. Two popular science articles about “Beyond Robotics” in the general press


7 Summary

The EURON-II network has rapidly come into successful operation, partly based on the success of the initial network under FP5. A new component of the network has been initiation of ad-hoc research projects in addition to a number of community mechanisms. Most of these activities have been implemented according to the plan and in many cases results beyond those initially planned, such as participation in the setup of EURON. The network has created a European sense of community. Until recently the European research community had a relatively anonymous presence in the world. Today EURON is seen as a model for community integration both in the US and in Asia. This has also opened up opportunities for international cooperation. As a precursor to this a memorandum of understanding has been signed with the Korean Robotics Initiative and similar agreements may also be reached with Japan. Integration with the American community is relatively harder due to higher degree of diversity and less integration across institutions.
In a few cases changes in the community such as the change from ERF to EU-nited Robotics has lead to delays in implementation of the work programme, but in general the progress is considered highly satisfactory.