European Clearing House
for Open Robotics Development
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Annex 4 to Quote for Robotic Equipment:

ECHORD: Background, objectives and implementation

Background. Europe has a very strong robot industry and there is significant world-class research potential and technological knowledge spread throughout Europe. There has always been excellent R&D performed at both Robot Manufacturers and Research Institutions and Organisations (universities, research centres, institutes, and organisations). However, finding *common ground* between manufacturers and the research community, especially when it comes to defining future direction of robotics research, has been difficult in the past. This is one of the recurring themes on both sides, and a new quality of the cooperation has often been called for.

In a number of important areas there has been a significant discrepancy between the state of the art in robotics research and its practical application in products. Promoting direct contact between researchers (who usually write papers) and industrial engineers (who normally do not read papers), requires that results have to be put in a truly industrial perspective. For this reason, it is advantageous to strengthen the European technology profile by creating new opportunities for know-how transfer between researchers and manufacturers. This should be done both for the developments in classical industrial robotics and also for the technologies that will be required, e.g., for future intelligent machines in “cognitive factory” scenarios.

How can effective and efficient cooperation be achieved? The project provides a conclusive and comprehensive answer to this question as follows:

ECHORD is a “clearing house” to streamline successful know-how transfers. It is truly open to those entrepreneurial research institutions or organisations willing to carry out challenging robotics development in cooperation with manufacturers willing to invest into research and technology development, and it will ultimately increase European competitiveness in robotics.

Objectives. It is the objective of **ECHORD** to take an industrial perspective and provide incentives for both sides in order to systematically extend successful cooperation patterns that have been in place between a few privileged combinations of research and industry. This will include those manufacturers and research institutions or organisations, who have not had preferred mutual access and will enable partners with well-established cooperations to invest more.

Extensive discussions have revealed that it is very appealing to both sides to carry out joint projects solving concrete problems, particularly if processes are simple and quick. To avoid confusion, these joint projects are called *experiments*. The experiments will not only be simple and quick to propose and negotiate; to achieve a max-

imum level of application-orientation they will also be based on standard industry equipment (or dedicated equipment) provided by the manufacturers. More specifically, it is **ECHORD**'s mission to:

- enable research institutions and organisations to use industrial-level equipment for know-how transfer experiments, by means of the manufacturers providing state-of-the-art equipment in research labs;
- encourage manufacturers and researchers to identify and work together on emerging technology scenarios – by means of establishing a "structured dialogue" between all players;
- take advantage of and put into practice results achieved in previous European research projects by means of suggesting tailor-made know-how transfer experiments;
- extract, consolidate and broadcast the actual progress achieved in the experiments to the communities of manufacturers and researchers by means of continuous monitoring, reporting and public relation activities.

Implementation. There are two key concepts for achieving the goals outlined above – the *experiment* and the *structured dialogue*:

- An **experiment** is a small to medium sized technical project carried out by a consortium of one or more research institute and optionally a manufacturer, which will last no longer than 12 to 18 months.

For the experiment, a manufacturer will provide state-of-the-art equipment (robots, components, software, …) and will have the option to participate – but it is not compulsory. Experiments can be of different **types**: they can be for **joint enabling technology development**, **application development** or *feasibility demonstration*. Experiments hence serve multiple purposes: they will bring people together, they will build up excellence and they will showcase potential applications. The procedure for soliciting and granting proposals for experiments is as follows: first, there will be a short work programme published, which coarsely delineates the scope of the work to be addressed in the experiments. Based on this workprogramme, manufacturers are invited to prepare lists of suitable equipment they want to offer to the research institutions and organisations, along with terms and conditions of providing this equipment. Once the offers from the manufacturers are accepted by the European Commission (EC), a call for proposals will be published. Consortia are encouraged to use equipment specified in the list. The proposals will then be evaluated by independent experts from science and industry, ranked by an expert panel and then approved by the European Commission.

- The **structured dialogue** is a sequence of systematic exchanges between the robotics community and ECHORD about expected future trends in robotics.

The structured dialogue is an iterative process of successive information gathering and consensus finding between all parties. This approach is well suited to the structurally diverse and interdisciplinary field of robotics, with many potentially interesting directions. Based on a collection of ideas gathered in polls, web-consultations, expert-meetings, an initial set of ideas will be profiled, re-distributed with specific ques-

tions for discussion (filtered under an economic, scientific, technology perspective) and then summarised in a white paper of working hypotheses. This will be presented at site visits and/or sent to the participants with a final possibility to add a limited number of comments. The final version will then be presented to the public.

Technology areas for experiments. The set of research topics and subjects that may eventually lead to the creation of new products in the field of robotics is virtually unlimited. To be in line with industry's needs and building on previous roadmapping work in various European projects, **ECHORD** has adopted the strategic research agenda (SRA), as compiled by EUROP. For the first call, research challenges are derived from the SRA's "industrial segment". Nevertheless, manufacturers have repeatedly emphasized their intentions to diversify into new areas, which means that **ECHORD** will be very open to additional suggestions for research areas – to be worked out in the structured dialogue. Three scenarios have been identified which offer a number of research foci for the experiments to be developed under **ECHORD**:

The **first** scenario of **ECHORD** is the **human-robot co-worker scenario**[1]. In this scenario, the traditional idea of a robot performing "pre-programmed action" will change drastically, in that the robot co-worker interacts with the human worker towards achieving a common goal. Here, the environment is much less structured than in the classical setting, and the human worker is supposed to "program" the – partly autonomous – robot interactively and intuitively as the work unfolds. This implies the use of speech and natural language interfaces, vision systems for object or user detection/recognition, gesture and gaze identification, and the utilization of several physical interaction devices (force, touch).

The **second** scenario of **ECHORD** is the **hyper-flexible cells scenario**[2]. The adoption of robotics technology in small or medium enterprises (SMEs) is complicated by the current conception of the work cells. Up to now, robot technology has been complex to install and was mainly employed in cases where very high production volumes justified the high cost of investments (time, money, other resources). This scenario envisages not only the replacement of the specialized workers or craftsmen with one or more highly dexterous and cooperative robots, but also the hardware and software integration of the robots with an automatic warehouse system and the other devices present in the cell. This implies the availability of consistent middleware for automation modules to seamlessly connect robots and peripheral devices in a "plug and play" fashion, and in general, of supervisory control solutions for the whole cell.

The **third** scenario of **ECHORD** is the **cognitive factory**. This future scenario will embrace both the first and the second scenario and take the classical concept of the flexible manufacturing systems to a new level. A cognitive factory will be composed of a multitude of machines with built-in sets of cognitive skills for adaptation – to the environment, to the manufacturing processes and objects, as well as to the human co-worker. Cognitive factories will, to a large extent, configure themselves and be fault-tolerant. They will contain autonomous robots jointly participating in the production process with their human counterparts. The cognitive skills needed include perception of assembly objects, perception of context conditions and the assessment of production results.

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[1] See EUROP-SRA (http://www.robotics-platform.eu/sra) and the annex describing application scenarios (http://www.robotics-platform.eu/sra/scenarios)

[2] See "White Paper on Trends and Challenges in Industrial Robot Automation" available at http://www.euron. org/miscdocs/docs/year3/DR.13.4.pdf.

Summary. Through **ECHORD**'s new concept of know-how transfer experiments, substantial progress can be expected along two dimensions:

a) *Fostering technological progress in robotics*: achieve excellence in selected technology areas that are needed for European manufacturers to survive and grow in increasingly competitive world markets.

b) *Structural progress*: improvement of communication, structural coherence and cohesion in the cooperation between research and industry to bring forward and deploy robotic technology.

These will be achieved through a wholly new combination of actions and measures, which will help Europe's robot industry to shape its future profile by bringing technology forward and by building up excellence.