European Clearing House
for Open Robotics Development
www.echord.info

Annex 1

GUIDE FOR APPLICANTS

Second call for ECHORD Experiment proposals

This Guide, together with all information related to ECHORD Calls for Experiment Proposals, can be downloaded from the following web-site:

http://www.echord.info

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1 ECHORD Experiments

This guide is related to the FP7 project ECHORD (European Clearing House for Open Robotics Development, Grant Agreement Number 231143).

In the context of ECHORD, small-scale projects, the so-called “experiments”, will be conducted, which will use state-of-the art robotic equipment. Depending on the experiments the equipment providers can either just sell the robotic equipment to an experiment or be part of the experiment’s consortium.

A list of suitable equipment offered by manufacturers to the research community, along with terms and conditions of providing this equipment, are available on the ECHORD web site (http://www.echord.info). 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.

1.1 Background information

Approximately 50 experiments will be funded in 3 distinct *Calls for Experiments*. The first call has been issued in October 2009. The second call will be published on March 16, 2010, with the last call being issued after information of the proposers about the results of the second call. All calls will be posted on the ECHORD web site. Each call will be open for approx. 2 months. Evaluation and selection of proposals will last approx. 2 months from the time of call closing.

Experiments can be of three different types:

- **Joint enabling technology development**. Experiment partners work together to develop new robots, components, and networks, etc. based on the bi-directional exchange of knowledge and on the industry quality equipment provided by robot manufacturers. *Expected results*: a workable technological solution to a given problem that can be directly applied to the areas of operations of the robot manufacturer. *Learning effects*: knowledge about the theory and practice of a certain problem solution, knowledge about the internals of the robot manufacturer’s components (on the part of the academic partner). *Competences needed*: robot specialists on both sides who share a common vocabulary and have complementary skills.
- **Application development**. Robot equipment from the robot manufacturer (which may need to be modified), together with components from third parties, are combined to perform tasks in new applications. This can include standard tasks in new areas or new tasks in known areas. *Expected results*: robust prototypical implementation of the new task/scenario with associated publications. *Learning effects*: a basic understanding of the potential of robotics technologies, limitations and constraints of the equipment, as well as the identification of further technological challenges. *Competences needed*: good working knowledge of the conditions of the

target area (new or classical), and roboticists who are able to work together with specialists from other domains (e.g., cognitive sciences, systems science, materials science, …).

- **Feasibility demonstration**. Unlike application development, this is for demonstrating in principle that robots can be used in complex industrial settings where they have not been used before. As an example, this could be (small) SMEs that do not have enough capital (and lot sizes) to justify the use of a fixed robot for just one specific task. If, however, the robot could be easily adapted to a number of similar tasks and could easily change its location, completely new uses for such a robot may become possible. Another example would be hospital laboratory automation with mobile manipulators, where only some of the crucial tasks would be demonstrated to be performable. *Expected results*: if crucial parts of the automation of a new domain can be shown to be realizable, this will encourage other industries to see a new market niche. *Learning effects*: potential for improvement of the chosen approaches for the crucial tasks, needs for further developments to handle the entire complex process. *Competences*: this should only be done by people who have experience in robotics technologies (on both sides). Here, it will be optimal to have industry, academic researchers, and system integrators work together.

Three scenarios for likely future robot use have been defined to outline the scope of research work to be performed in the experiments. These scenarios make it possible for all stakeholders to get a clear picture if and how their proposed work and envisaged results can be embedded into a coherent vision of robotic applications. Thus, they describe the application context from an exterior view.

The identified **scenarios**, which are both scientifically challenging and commercially relevant, represent comprehensive sets of challenges in an illustrative way, so that robotics experts can easily relate their own research to them:

- The first scenario of ECHORD is the **human-robot co-worker scenario**. 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**. 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 scenario**. This 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.

Within the frame of the above three scenarios, four research foci have been identified, which are the reference points for the expected scientific progress of experiments proposals. The following research foci have been selected for research to be carried out in ECHORD experiments:

- The first focus of ECHORD is **human-robot interfacing and safety**. Experiments will have to show how they add to practical, usable and certifiable solutions for safe human-robot cooperation within the human-robot co-working scenario. The work may also lead to a contribution to ISO 10218 “Robots for industrial environments – safety requirements”, which is currently in preparation. Most important, however, are practical demonstrations to be developed in close cooperation between academia and industry which show that such safe interaction is indeed possible (with all kinds of sensor failures and adverse conditions). From a scientific point of view, experiments can lead to further insight into the perceptual, representational, reasoning, learning capabilities of robot systems. They may result in networked components that enable safe cells for cooperative work, but they may also carry out case studies and/or user evaluations, find concrete ways of adjusting autonomy, and explore new topics such as mixed-mode learning and mixed initiative interaction.
- The second focus of ECHORD is **robot hands and complex manipulation**. Experiments will have to show how they improve on the current state of laboratory setups in the direction of practical usability as well as promising breakthroughs in the area of sensors and sensor-guided manipulation. This will pertain to – and can be demonstrated in – both to the human-robot interaction and the hyper-flexible cell scenarios. For the latter, it would be particularly useful to integrate an automatic ad-

aptation to a variety of given tasks from the industrial repertoire.

- The third focus of ECHORD is **mobile manipulators and cooperation**. Experiments will have to show how mobile manipulators will solve concrete problems, and that tasks can be performed in a robust way, even in the presence of dynamically changing environments, in real-time, with moving obstacles, in the interaction with humans – both for instruction and for adaptation to new environments. Moreover, the two challenging aspects of communication with devices in the environment (i.e., being in physical contact and communicating about the ongoing action) and of cooperation with other mobile manipulators should be addressed.
- The fourth focus of ECHORD is **networked robots**. For the area of networking industrial robots, demonstrators are to be developed in collaboration between industry and academia, provided that industry disclose their controller architecture to academia – and academia contribute their knowledge in advanced real-time networking technologies as well as service-oriented architectures. For the area of more loosely coupled systems, experiments with mobile robots that establish new showcases, new applications and robot systems for monitoring tasks are expected. For both areas, the question of joint knowledge building would also be of high interest. Clearly, adaptive networked robots, both fixed and mobile, are of high interest to the cognitive factory scenario – with immediate applications to the hyper-flexible cell scenario as well.

The research foci are listed in the table below, along with **examples** for possible experiments.

Research foci	Experiments topics (examples)
Human-robot interfacing and safety	• Practical multi-modal (HMI) interfaces • Human detection devices • Speed/position supervision • High-speed force control • Algorithms for adaptive vision • Off-line high-level programming environments with physical simulators
Robot hands and complex manipulation	• Improving hand performance through (new) lightweight materials and actuators • Miniaturized mechatronics for hand designs • Object recognition for grasping scenarios • Theory and practice of bimanual and trimanual manipulation • Simulation package integrating sensor models with soft/hard contact/slippage control • Real-time motion planning and collision avoidance for kinematics with many DOFs
Mobile manipulators and cooperation	• Hardware/software integration of arm controllers and platform control • Precise synchronised control of locomotion and manipulation • Safe navigation and mapping with walking humans in the way • Real-time trajectory-planning and re-planning • Cooperation with humans and with fixed robots • Intuitive programmability of complex interwoven tasks integrating arm and platform • Robot team cooperation

Networked Robots	• New concepts for open controllers giving safe low-level access to actuators • High-speed inter-robot communication • Shared knowledge building • Wireless sensors, universal-plug-and-play networks • Flexible workflow simulation package allowing the integration of user-specific devices and components • Tightly synchronised control of great numbers of cooperating robots and motion axes • Coordination of a multi-robot system with a cell storage system and other devices • Specific showcases

The intended relation between scenarios and research foci is given in the following non-exhaustive table:

Scenario / Research focus	Scenario 1: Human-robot co-worker	Scenario 2: Hyper-flexible cells	Scenario 3: Cognitive factory
Focus 1: Human-robot interfacing and safety	X		
Focus 2: Robot hands and complex manipulation	X	X	
Focus 3: Mobile manipulators and cooperation	X	X	X
Focus 4: Networked robots		X	X

1.2 Coaching and pre-proposals

The ECHORD Service Centre will coach the earlier stages of proposal development, e.g. through the evaluation of pre-proposals. It will also help with finding suitable academic and/or industrial partners for an experiment.

Pre-Proposals can be submitted (via ECHORD web site) until two weeks before the call closes. They should not be longer than two pages and only describe the experiment idea and its context. A member of the staff of the ECHORD Service Centre will respond to pre-proposers within one week. The response will be limited to clarifying whether the proposal fits into the call's scope (innovation, compatibility with call).

1.3 Size, resources and indicative average duration

The size, scope and internal organisation of experiments should be compatible with the overall objectives and manageability of the whole endeavour and can vary depending on the scenario and the research focus.

An experiment proposal can be submitted by a single partner. Proposers are to keep the number of partners small (1 to 3). Partners are not required to belong to the same country; industries can participate to experiments as partners. The funding of an experiment is expected to be about €300,000, and experiments are expected to last typically between 12 to 18 months.

1.4 Activities

The activities to be carried out in the context of an experiment must include only Research and Technological Development activities (RTD), aimed at a significant advance beyond the established state of the art. Other types of activities (e.g., Demonstration, Management) are not eligible for funding. The costs of the certificates on the financial statements, if needed, are eligible.

For details on the different types of activities in the FP7, contact the ECHORD Sevice Centre (www.echord.info).

1.5 Reimbursement

Reimbursement will be based on eligible costs as defined in Article II.14 of the FP7 model grant agreement.[1] Direct and indirect costs are to be indentified in accordance with Article II.15 of the FP7 model grant agreement. Maximum reimbursement rates of eligible costs for Research and Technological Development (RTD) are, in accordance with Article II.16(1) of the FP7 model grant agreement, 50% or 75%, where the 75% rate applies to participants that are nonprofit public bodies, secondary and higher education establishments, research organisations and small and medium-sized enterprises (SMEs).[2] More information about reimbursement will be provided by ECHORD[3].

For equipment purchase and maintenance in the experiments, the maximum reimbursement is capped at 100% of the acquisition and maintenance cost. Depreciation of equipment may depend on local or national depreciation policies and rules; proposers are asked to check this issue with their organisation.

Although consortia are strongly encouraged to use equipment specified in the list made available by ECHORD on its web site, other equipment might be used if the need for it is justified in the experiment proposal.

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[1] ftp://ftp.cordis.europa.eu/pub/fp7/docs/fp7-ga-annex2-v3_en.pdf

[2] For a definition of SMEs see http://ec.europa.eu/enterprise/enterprise_policy/sme_definition/index_en.htm

[3] See also, at ftp://ftp.cordis.europa.eu/pub/fp7/docs, the following documents: fp7-ga-annex2-v3_en.pdf and financialguide_en.pdf

Examples

Consider, e.g., a nonprofit public body adopting a 60% flat rate for indirect costs calculation. Assume that the institution is able to depreciate only a fraction (say 50%) of the net (i.e., without taxes) equipment cost (say 60.000,00 EUR) along the experiment duration. Then, a possible budget figure for the participant can be as follows.

Direct costs	
Personnel costs:	EUR 30.000,00
Travel expenses:	EUR 10.000,00
Equipment (50% of the net cost):	EUR 30.000,00
Total direct costs:	**EUR 70.000,00**
Indirect costs (60% of direct costs)	
Personnel costs:	EUR 18.000,00
Travel expenses:	EUR 6.000,00
Equipment:	EUR 18.000,00
Total indirect costs:	**EUR 42.000,00**
Funding	
Personnel costs (75% of direct+indirect costs for personnel):	EUR 36.000,00
Travel expenses (75% of direct+indirect costs for travel):	EUR 12.000,00
Equipment (75% of direct+indirect costs for equipment, eventually capped at 100% of direct cost):	EUR 36.000,00
Total funding:	**EUR 84.000,00**

In other words, an institution can use as direct cost only the fraction of the equipment full cost for the experiment's duration in relation to its real or expected useful life; such a fraction may depend on local or national rules on depreciation.
However, the maximum reimbursement of equipment costs cannot exceed 100% of the net real cost. For example, if the same institution, adopting the transitional 60% flat rate for indirect costs, is able to depreciate the full net (i.e., without taxes) equipment cost (say 60.000,00 EUR) along the experiment duration, the budget figure changes as follows.

Direct costs	
Personnel costs:	EUR 30.000,00
Travel expenses:	EUR 10.000,00
Equipment (100% of the net cost):	EUR 60.000,00
Total direct costs:	**EUR 100.000,00**
Indirect costs (60% of direct costs)	
Personnel costs:	EUR 18.000,00
Travel expenses:	EUR 6.000,00
Equipment:	EUR 36.000,00
Total indirect costs:	**EUR 60.000,00**
Funding	
Personnel costs (75% of direct+indirect costs for personnel):	EUR 36.000,00
Travel expenses (75% of direct+indirect costs for travel):	EUR 12.000,00
Equipment (75% of direct+indirect costs for equipment, eventually capped at 100% of the direct cost):	EUR 60.000,00

Total funding: **EUR 108.000,00**

Where the funding for equipment is not equal to the standard 75% of the whole cost (i.e., EUR 72.000,00), but it has been capped at the direct cost (i.e., 100% of the full cost without taxes).

2 How to apply

The proposal must meet the following requirements:

- It has to be submitted electronically before the given deadline. The complete proposal consists of
    - a filled-in proposal template
    - filled-in web form

  The details of electronic submission are available on the ECHORD web site www.echord.info.

- The content of the proposal relates to one or more of the ECHORD Scenarios described in the current text.

- The proposal must be submitted by legal entities established in one of the member states of the EU or in an associated country. For a list of associated countries, see ftp://ftp.cordis.europa.eu/pub/fp7/docs/third_country_agreements_en.pdf.

2.1 Experiment coordinator

For a given proposal, the coordinator acts as the single point of contact between the experiment partners and ECHORD. The coordinator is generally responsible for the overall planning of the proposal and for building up the consortium that will do the work.

2.2 Proposal focus

The work set out in the proposal must correspond to one of the ECHORD scenarios and associated research foci. Proposals that fail to do so will be regarded ineligible. A “pre-proposal check” service is available by the ECHORD Service Centre (see ECHORD web site and section 1.2).

2.3 Ethical issues

Research activities in FP7 should respect fundamental ethical principles, including those reflected in the Charter of Fundamental Rights of the European Union. Therefore, questions about ethical issues are to be answered on the web form.

2.4 Form of proposals

Proposals must comply with a standardised template available on the ECHORD website upon opening of the call to allow their easy conversion into a Description of Work in the event of proposal selection.

Basic information about the proposers, the scenario, research focus and ethical issues, etc. have to be provided on a web form. The proposal text needs to be uploaded as a single pdf-document, which complies with the Template for ECHORD Experiment Proposals (Annex 2 to the call text).

2.5 Submission

Proposals have to be submitted using the electronic proposal submission service provided by ECHORD. Full instructions are available on the ECHORD web site.

Proposals must be submitted by the deadline specified in the call text. It is the proposers' responsibility to ensure the timely submission of proposals. Call deadlines are absolutely firm and are strictly enforced.

Shortly after the effective submission of the proposal, the ECHORD staff will send an acknowledgement of receipt to the e-mail address of the proposal coordinator given in the submitted proposal. The sending of an acknowledgement of receipt does not imply that a proposal has been accepted as eligible for evaluation.

3 Evaluation

3.1 General

On receipt by ECHORD, proposals are registered and acknowledged and their contents entered into a database to support the evaluation process. Eligibility criteria for each proposal are also checked by ECHORD before the evaluation begins. Proposals which do not fulfil these criteria will not be included in the evaluation.

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

- It is received before the deadline given in the call text.
- It is complete (i.e., the proposal description has been provided in all its parts):
  - Filled-in template
  - Filled-in web form

- The proposal must be submitted by legal entities established in one of the member states of the EU or in an associated country. For a list of associated countries, see ftp://ftp.cordis.europa.eu/pub/fp7/docs/third_country_agreements_en.pdf.

- The content of the proposal relates to the ECHORD Scenarios, Research Foci and Experiment Types described before.

The evaluation of proposals is carried out by independent experts whose appointment will be approved by the European Commission. Each proposal will be evaluated by two experts (evaluators) who are independent of ECHORD and the proposers and have no conflicts of interest. They will maintain strict confidentiality with respect to the whole evaluation process. Experts perform evaluations in their private capacity, not as representatives of their employer, their country or any other entity.

In constituting the lists of experts, ECHORD also takes account of their abilities to appreciate the industrial and European dimension of the proposed work. ECHORD allocates proposals to individual experts taking account of the fields of expertise of the experts and avoiding conflicts of interest.

3.1.1 Handling of conflicts of interest during the evaluation process

Experts must declare any known conflicts of interest beforehand and must immediately inform ECHORD if one becomes apparent during the course of the evaluation. The ECHORD consortium will take whatever action is necessary to remove any conflict. A disqualifying conflict of interest exists if an evaluator:

- was involved in the preparation of the proposal,
- if he or she or his or her organisation could stand to benefit, or be disadvantaged, as a direct result of the evaluation carried out,
- has a close family relationship with any person representing a participating organisation in the proposal,
- is a director, trustee or partner of any beneficiary, participating in the proposal, or is a subcontractor/third party carrying out work for any beneficiary in the proposal concerned,
- is employed by one of the beneficiaries, participating in the proposal or by a subcontractor/third party carrying out work for any beneficiary in the proposal concerned,
- is in any other situation that comprises his or her ability to review the proposal impartially.

Evaluators with disqualifying conflicts of interest cannot take part in the evaluation of experiments.

A potential conflict of interest may exist, even in cases not covered by the clear disqualifying conflicts indicated above, if any expert:

- was employed by one of the participating organizations in a proposal in the last three years,
- is involved in a contract or research collaboration with a participating organisation, or had been so in the previous three years,
- is in any other situation that could cast doubt on his or her ability to review the proposal impartially, or that could reasonably appear to do so in the eyes of an external third party

Evaluators cannot evaluate proposals where they have a potential conflict of interest. Also, they are excluded from the evaluation panel meeting (see section 4 for more details). However, they can evaluate proposals where no potential conflict of interest exists.

3.1.2 Confidentiality of the evaluation process

Experts are to maintain strict confidentiality with respect to the whole evaluation process. Under no circumstance may an expert attempt to contact an applicant on his own account, either during the evaluation or afterwards.

3.2 Evaluation criteria

The evaluation of experiments will be based on marks given according to three basic criteria:

a) Scientific and/or technological **excellence** relevant to the scenario and research focus.

b) Quality and efficiency of the **implementation** and the management, intended to assess the efficient use of resources and the quality of the participants.

c) Potential **impact** through the development, dissemination and use of project results.. As for this criterion, the following qualities serve as indicators:
   - bi-directional know-how and technology exchange between robot manufacturers and research organisations, if applicable,
   - documented degree of synchronicity between the robot manufacturers' research plans and experiment goals, if applicable,
   - commitment of the robot manufacturers to use the work in their future product program, if applicable,
   - potential of the proposed work to contribute to new products/services/tools in a reasonable time frame,

- European dimension of the experiment, intended as potential impact of the experiment activities and results on European research, society and economy.

For each criterion, a 0-to-5 mark will be given; the experiment will be considered in the final selection if each mark is above a threshold of 3 and the sum of the three marks is not less than 10. Half points can be used.

4 Selection

A panel meeting will take place, where a ranking of the proposals is established and where the scores of the proposals are calibrated. The panel meeting is held with a subset of experts who have acted as evaluators and/or rapporteurs.
The appointment of the evaluation panel will be approved by the European Commission.

The initial ranking of proposals will be based on the scores of the evaluations. The panel will then check the consistency of the scoring of the proposals and might increase or decrease the scores. Also, the panel will resolve cases in which proposals have equal scores. The number of ranked proposals receiving funding depends on the requested and budget available for this call for experiments. An annotated ranking of the proposals will be compiled at the end of the evaluation panel, together with evaluation summary reports. The evaluation summary reports will be sent to the proposers. The reports and evaluation panel minutes will then be forwarded to the European Commission by ECHORD. Based on this information the European Commission approves the final list of selected experiments which will receive funding.

5 Joining the ECHORD Consortium

Selected proposals will be modified as necessary to produce the contractual Descriptions of Work and the budget for the experiments will be finalised during a negotiation phase. The organisations involved in selected proposals are proposed for accession to the ECHORD Grant Agreement. The accession has to be approved by the European Commission.

The Description of Work and the budget of the selected experiments will be appended to ECHORD's European Commission Grant Agreement and ECHORD's consortium agreement.

Strict deadlines will be set for compliance with the obligations related to the accession procedure:

- for the submission of the finalized Description of Work and the budget
- for compliance with the administrative requirements of the EC.

6 Experiments implementation

The experiments will receive a payment from the ECHORD Coordinator at the beginning of the experiment to cover their equipment costs. Labour and other costs will be paid after the end of ECHORD's reporting periods in accordance with the provisions of the Grant Agreement.

7 Experiments monitoring

Experiments will have a specific (small) set of deliverables including regular (short) reports (typically one page), which will be evaluated against the terms of the experiment's description of work. In return for being lightweight in terms of preparatory paperwork, it is expected that every experiment produces a final demonstrator presenting the promised features. During the duration of the experiment, the experimenters are encouraged to produce multimedia material (video and pictures) showing their progress. Pre-versions of the demonstrator need to be in place as soon as possible, so that a mid-term review or demonstration can be performed.

The mid-term and final review of experiments will be managed by ECHORD, which appoints at least two experts for reviews. These appointments are approved by the European Commission. The review reports will include a recommendation (continue, continue with modifications, discontinue), the European Commission will make a final decision about the continuation of the experiment after consulting ECHORD.