

ReconCell Open Call – Guide for Applicants

Project acronym:	ReconCell
Project grant agreement:	No. 680431
Project Full name:	A Re configurable robot work Cell for fast set-up of automated assembly processes in SMEs
Project web address:	http://reconcell.eu
Call title:	ReconCell Open Call
Full call information	https://reconcell.inhancer.dk/opencall/
Call publication date:	November 30 th , 2017
Proposal submission deadline:	17:00 Brussels local time, March 22 nd , 2018
Proposal submission web address:	https://reconcell.inhancer.dk/opencall/
Expected duration of participation:	3-6 months
Total budget:	€170,000. Maximum funding per proposal: €85,000
Funding constraints	ReconCell beneficiaries are excluded from this call
Language in which proposals should be submitted:	English
More information:	info@reconcell.eu

The ReconCell project

The ReconCell project proposes to develop a flexible robotic workcell that will allow very short, self-adaptable and affordable changeovers under the conditions demanded and based on end-user needs. This will be achieved with the minimum use of additional resources over the system's lifetime.



ReconCell Results

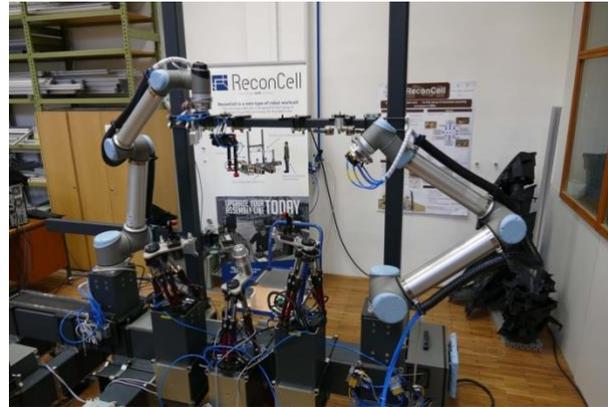
A new kind of robotic workcell has been developed in the ReconCell project. It enables the application of robots for small batch size production (also called "few-of-a-kind production"). The developed workcell is based on novel ICT technologies for programming, monitoring, and executing assembly operations in an autonomous way. It can be partly automatically reconfigured to execute new assembly tasks efficiently, precisely, and economically with a minimum amount of human intervention. This is possible due to recent developments in the area of robot programming, fast reconfigurable machinery, vision technologies, modelling, and simulation. The proposed approach is backed up by a business intelligence module that guides production planning and the introduction of new technologies. The aim of business intelligence is to show that the ReconCell system is economically viable especially for SMEs.

Call Details

ReconCell project invites applications to the Open Call for robot assembly experiments (use cases) in a reconfigurable workcell. All organisations that meet EU criteria for participation in H2020 projects are eligible to submit. Priority will be given to the experiments driven by the requirements of manufacturing SMEs. Active participation of manufacturing SMEs is encouraged. The timeframe for each experiment will be 3-6 months, with a budget of up to 85.000 Euro allocated for supporting the experiments.

To get an idea for what kind of assembly problems the ReconCell workcell currently realizes, applicants can look at the following three experiments on the [ReconCell website](#):¹

- Assembly of a gripper (manufacturing of robots and machines)
- Final assembly & customization of drive systems and control boxes (electronics industry / furniture industry)
- Assembly of automotive lights (automotive industry)



An ideal experiment should match the following criteria:

- Several variants of a product needs to be assembled in a reconfigurable workcell
- All components of the product need to be rigid
- Assembly should make use of components and current set-up (see next section) of the ReconCell system
- Assembly sequence for each variant of the product should not involve more than 5 parts
- Should not replicate existing experiments

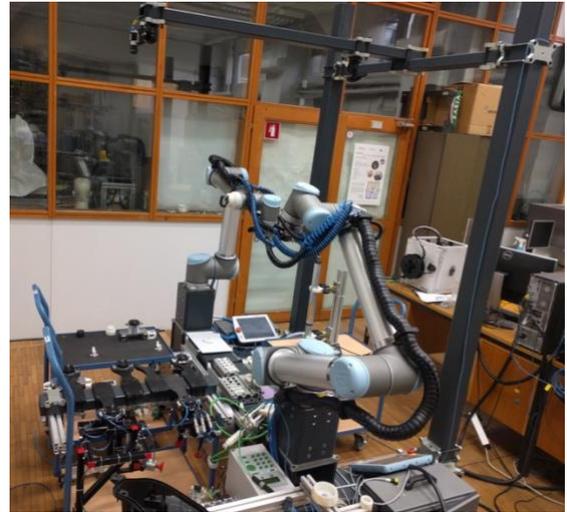
The main evaluation criteria will be the quality of use case specification, its fit to the ReconCell technologies described below, and the potential industrial impact for manufacturing SMEs.

¹ <http://www.reconcell.eu/content/space/experiments.html>

ReconCell Set-Up

Overall workcell specifications

- Two UR10 robots
- Steel frame
- Plug-and-Produce trolleys
- Passive reconfigurable flexible fixtures
- Passive linear unit for relocating a robot along a single degree of freedom
- 2-D and 3-D camera
- Footprint: 4 m by 3 m
- Weight: 1000 kg
- Power: 7kW
- Pressured air: 6 bar



Robot specification

- Payload 8 kg
- 16 digital outputs
- 16 digital inputs
- 2 analog outputs
- 2 analog inputs
- Repeatability +/- 0.1 mm
- Reach 1300 mm
- 6 rotating joints
- Equipped with *force/torque sensor*
- Equipped with a *tool exchange system*

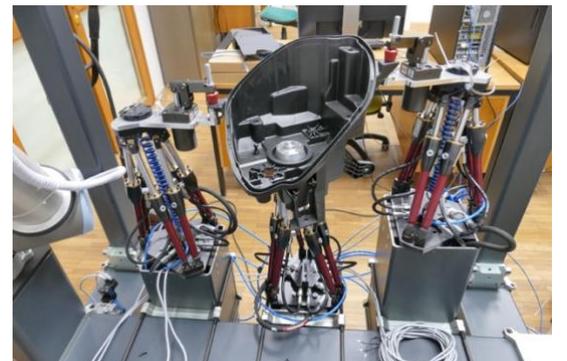


Computer system

- 1 master computer (required)
- 1 simulation computer (optional)
- 1 vision computer (optional)
- Local area network

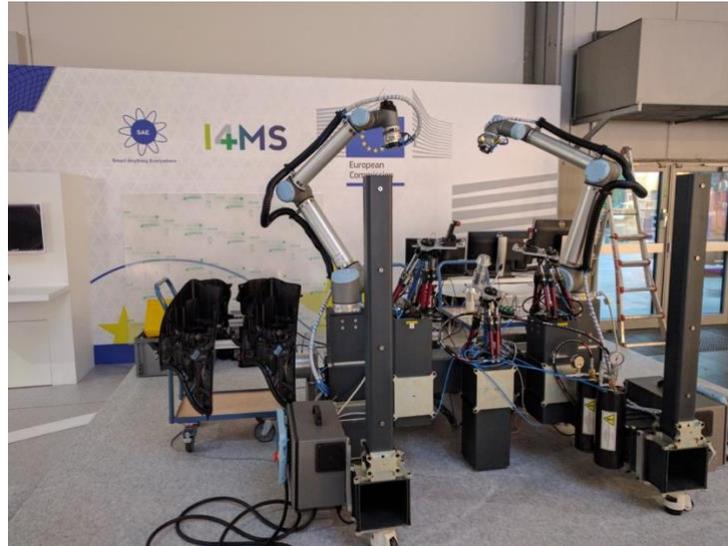
Tool exchange system

- 4 pneumatic outputs
- 2 digital outputs
- 2 digital inputs
- 1 analog input
- Ethernet
- 12/24 V output 600 mA



Software features

- ROS-based network interfaces to connect the robots, sensors and robot periphery
- Programming by demonstration system for teaching new assembly skills
- Workcell visualization software
- State machine for task control
- Graphical user interface for robot task programming
- Vision system for pose localization, quality control and cell status monitoring
- Workcell simulation software



Detailed explanations of various components

Tool exchange system

All robots in the ReconCell system are equipped with a Destaco tool exchange system consisting of QC-30 part (robot side) and TP-30 coupler (tool side). Each end-effector in the workcell therefore has the Destaco TP-30 coupler attached, which fits onto the QC-30 part attached to the robot tip (Figure 1). This enables the robots to exchange the mounted tool depending on the current task. The tool exchange system has electric and pneumatic connections to operate both mechanical and electrical tools. This allows the robots to interchangeably use various pneumatic or electric grippers and even Ethernet-based cameras for vision. Additionally, TP-30 couplers mounted on top of passive flexible fixtures enable the robot to move the flexible fixtures to new configurations. Thus, the robots can autonomously reconfigure the desired workcell layout by manipulating the reconfigurable fixtures.



Figure 1 Destaco QC-30 part (above) and TP-30 coupler (below)

ROS network

The ReconCell's software infrastructure was built on top of ROS middleware. ROS is an open source set of software libraries and tools that facilitate building robot applications (<http://www.ros.org>).

Programming by demonstration

The UR10 robots can be put into the so-called gravity compensation mode. In this mode, the robot becomes compliant and can be moved around kinesthetically, i.e. it can be guided by hand to different poses in its workspace. This feature can be exploited to teach robot tasks by marking (saving) various points in joint or task space or whole trajectories, again, in joint or task space. This provides an intuitive interface to program the assembly sequences and calibrate the workcell.

Graphical user interface

A custom interface is available to facilitate the programming of an assembly sequence. This software enables the user to program the task with a block graphical user interface. Programs can be put together by connecting and moving a set of action blocks. Each block represents an event: movement, change in digital output, digital input reading, query database, gripper action, change gripper, etc.

Vision system

The cell is equipped with vision sensors, both 2D and 3D. The vision sensors can be used in various applications depending on the task. The vision sensors can be mounted on the cell frame or on the robot (in-hand). This allows for vision based quality control, part localization, or overall cell monitoring. The required image processing algorithms usually depend on the task and need to be adapted for each new task.

Simulation software

VEROSIM is a powerful simulation program that allows users to simulate robot tasks before executing them in the real workcell. The program also simulates collisions and interaction forces so it is possible to plan collision free paths in simulation provided the complete workcell model is available. The simulation software provides an interface to the ROS network to enable communication between the simulation system and hardware infrastructure.

Submission Details

Submission deadline: All submissions must be made by 17:00 Brussels local time, March 22nd, 2018.

Electronic submission: Proposal submission is exclusively in electronic form using the proposal submission tool accessible via the ReconCell Open Call submission platform: <https://reconcell.inhancer.dk/opencall/>

A submission template is provided. Eligibility criteria will be checked and receipt of submission confirmed by e-mail after the deadline.

The central component of proposal submission is the uploading of a PDF-document (whose size must not exceed 5.0 MB) compliant with the instructions on the proposal structure given below. A video (whose size must not exceed 20.0 MB) can be uploaded when uploading the PDF.

Proposal format and structure: Proposals must be submitted in English. The main section of the proposal must not exceed 7 pages in length (Times New Roman 11 pt font, line spacing 1.15 lines, 6pt after, standard A4 page size and margins).

In addition, applicants should include two cover pages and an administrative page (discussed below), the maximum page count is 10 pages. The two cover pages are specified in the template and include the title page and the table of contents. They should not be changed except for entering the proposal-specific information. Proposals will be truncated to this page count and the expert evaluators will only be provided with the truncated version.

The structure of the proposal (and indicative length per section) should be as follows:

1. Summary (limit: 0.5 pages)
2. Assembly task description (limit: 3.5 pages)
3. Industrial relevance & business case (limit: 1 page)
4. Budget and justification of costs and resources (limit: 1 page)
5. Information about the participant(s) (limit: 1 page)

As indicated above, the overall length of the above 5 sections must not exceed 7 pages.

A management structure will be imposed on the successful proposals. That is, the proposal does not need to contain a description of how the project will be managed. In addition to the 7 pages proposal description specified above, an appendix can include max. 1 page of administrative data including a list of all participants, SME status of the participant (yes/no) and, if available, the Participant Identification Code (PIC) (<http://ec.europa.eu/research/participants/portal/desktop/en/organisations/register.html>).

Indicative Budget

ReconCell will make use of H2020 Third Parties Funding method to enable the inclusion of new use case partners. The maximum indicative funding budget for an individual experiment (use case) is 85,000 €. The funding of Third Parties must follow the same principles as used for existing project beneficiaries of

ReconCell, which receives European Commission funding as an “Innovation Action”. Thus, Third Parties will receive 70% funding of eligible costs arising (except for non-profit organizations which receive 100% funding). The requested funding for an individual experiment may not exceed 85,000 € (covering all participant 3rd parties). Proposers should consider their actual needs and not target this upper limit mandatorily. The evaluation will take into account the appropriateness of the requested resources. Erroneous budget data included in the accepted proposals will not result in the final budget that possibly exceeds the upper requested limit for funding of the experiment as a whole or of individual participants: ReconCell reserves the right to make the appropriate and necessary effort and budget cuts.

Call Eligibility & Budget

The process of eligibility assessment is based on the table below. The questions have to be answered with ‘yes’ or ‘no’. Only the proposals which can answer all the questions with ‘yes’ will go further for the evaluation phase.

Eligibility criteria	
Organizations that may participate	Is the application from entities that are eligible to participate within the H2020 framework program?
Respect of deadline	Was the application submitted online in time?
Completeness & correctness of the application	Was the application fully completed and correctly filled in according to the given guidelines?

List of activities being supported by third party funding include:

- Personnel costs
- Other direct costs (travel, equipment, other goods and services)
- Indirect costs (25% of direct costs)

For the use case(s) winning this Open Call, the ReconCell consortium will provide the funding. The proposed budget must include the costs of all additional hardware and software components, which are not currently included in the ReconCell system but are necessary for the implementation of the use case. For example, additional hardware could include special grippers, fixtures, couplers to fit onto the tool exchange system, product to be assembled, etc. The beneficiaries will provide all the information and objects necessary to implement the use case: physical objects/products in sufficient quantity to support the use case implementation, technical documentation including CAD models, information on how the product is currently assembled, and business case parameters. The rights for this information to be used in publications will be granted to the ReconCell consortium, but the beneficiaries can request that sensitive information is kept confidential.

The implementation of the winning use case(s) will take place at Jožef Stefan Institute (JSI), Ljubljana, Slovenia, in collaboration between the ReconCell consortium and the beneficiaries. The staff of JSI and other ReconCell consortium partners will assist the implementation of the use case. The travelling costs of the winning applicants’ personnel to JSI can be included in the budget. The final result will be the implementation of use cases in simulation and in the real workcell.

Evaluation Criteria

The call will be carried out in the light of the same basic principles which govern Commission calls:

Evaluation Criteria – basic principles	
Excellence	The proposal(s) selected for funding must demonstrate a high quality in the context of the topics and criteria set out in the call
Transparency	Funding decisions must be based on clearly described rules and procedures, and all applicants should receive adequate feedback on the outcome of the evaluation of their proposals
Fairness & impartiality	All proposals submitted to the call are treated equally. They are evaluated impartially on their merits, irrespective of their origin or the identity of the applicants
Confidentiality	All proposals and related data, knowledge and documents are treated in confidence
Efficiency & speed	Evaluation of proposals and award of the financial support should be as rapid as possible, commensurate with maintaining the quality of the evaluation, and respecting the legal framework.

In addition, the evaluation criteria are enhanced to favor the appropriate use case selection of ReconCell. The ranking of selected experiments (use cases) will be created assessing:

1. Quality of use case specification:
 - a. Fit to the specifications of the ReconCell system and feasibility of implementation;
 - b. Amount of ReconCell techniques associated with the proposed use case (including reconfiguration);
 - c. Existence of several product variants belonging to the same product family in the proposed use case (for an example see assembly of automotive lights use case: <http://www.reconcell.eu/content/space/experiments.html#elvez>);
2. Innovation potential and impact, including relevance of the use case for manufacturing SMEs and business strategy;
3. Effective and justified deployment of resources.

Each of the three criteria will be given a score from 0 to 5. The sum of these scores is an overall score of the proposal. So, the scoring scale for each criterion remains the same as usual for H2020 (and also the fact that half marks can be given):

Score	Explanation
5 – Excellent	The proposal successfully addresses all relevant aspects of the criterion in question. Any shortcomings are minor.
4 – Very Good	The proposal addresses the criterion very well, although certain improvements are still possible.
3 – Good	The proposal addresses the criterion well, although improvements would be necessary.

2 – Fair	While the proposal broadly addresses the criterion, there are significant weaknesses.
1 – Poor	The criterion is addressed in an inadequate manner, or there are serious inherent weaknesses.
0 – Knock-Out	The proposal fails to address the criterion under examination or cannot be judged due to missing or incomplete information.

There will be a threshold score of 3 that will apply to criteria 2-3, while a threshold score of 3.5 will apply to criteria 1. Thus, the “Quality of use case specification” criterion will have a slightly higher relevance than other criteria.

Funding will be awarded to the most highly ranked proposal(s) as long as there is available budget. ReconCell financial support will be granted for use case implementation up to the limits indicated above, on the condition that the use case implementation reaches the excellence level requested and till the budget available is exhausted. If the call budget is not exhausted, the budget will be considered available for further activities to be agreed with the EC.

The priority order for proposals with the same overall score will be handled as follows: the proposals will be prioritized according to the scores they have been awarded for the criterion “Quality of use case specification”. If these scores are also equal, priority will be given to proposals with higher scores for the criterion “Innovation potential and impact”. If all scores are equal, a committee appointed by the ReconCell consortium will assess the equally evaluated projects and decide their ranking.

All proposers (successful and unsuccessful) will be contacted with the results of their evaluation.

The final support to each third party will be determined once the winning proposers provide the ReconCell consortium with the justification for the requested resources; i.e. personnel costs (nominal) and other direct costs.

All payments to the beneficiaries will be handled by the ReconCell partner University of Southern Denmark (SDU), Odense, Denmark. Typically, 20% of the payment will be released at contract signature, 40% at an intermediate report, and 40% at the conclusion of use case implementation and after the final report has been submitted and approved. The intermediate and final reviews will be based on midterm and final report produced by the beneficiaries and will be evaluated by a review team appointed by the ReconCell consortium.