

The logo for EPSRC, consisting of the letters 'EPSRC' in a bold, purple, sans-serif font, with a horizontal line above and below the text.

Engineering and Physical Sciences  
Research Council



## **TASCC: Towards Autonomy – Smart and Connected Control**

**Call type: Invitation for outlines**

**Closing date: 29 January 2015**

**Related themes: Engineering, ICT**

### **Summary**

The EPSRC Engineering and Information and Communication Technologies (ICT) Themes in partnership with Jaguar Land Rover (JLR) are inviting outline proposals that explore research in the area of 'Smart and Connected Control' around the central challenge of moving towards a fully autonomous car.

This call is being issued as part of the EPSRC-JLR strategic partnership.

Funds of up to £10 million are available. We expect to support between four and six research projects, up to five years in duration, subject to the quality of the proposals received.

The first stage of this call is an invitation for Outlines, and will be followed by Full Proposals. Applicants will be interviewed at the full proposal stage by an expert panel.

As part of this activity there will be a series of workshops to develop ideas and interactions with JLR and other research groups. To register to attend the first TASCC workshop on 9 December 2014 please go to <http://www.eventbrite.co.uk/e/tascc-towards-autonomy-smart-and-connected-control-epsrc-jlr-joint-workshop-tickets-14287455163>

As a joint funder JLR will work closely with successful applicants.

### **Background**

As part of the existing EPSRC-JLR strategic partnership, we are launching a jointly funded and executed activity in the area of 'Towards Autonomy – Smart and Connected Control'. The overall aim of this co-operative activity is to expand research capability in the area of 'Smart and Connected Control' around the central challenge of moving towards a fully autonomous car. As well as underpinning UK economic growth, TASCC's wider societal benefits include helping to improve mobility and reduce congestion, increase fuel efficiency, and reduce accidents and stress.

# Scope of the Call

The programme scope has been developed around a vision of a commercially-viable vehicle with features including:

- Night and day autonomous driving on motorways, dual-carriageways and A-roads
- Co-operative driving on motorways
- In-traffic 'stop-start' autonomous driving
- Auto 'valet' parking
- Navigation-based autonomous traffic avoidance
- Off-road driver assistance
- Intelligent, adaptive vehicle with personalised interior

An autonomous vehicle must be built as an integrated system. It requires communication between many components and system flexibility and an underpinning software architecture are critical. A step-change is needed: incremental steps based on current technologies and work practices are not enough. Brand new ground-up architecture is required.

Research will be defined in three key areas:

- Autonomous driving control
- User experience in vehicles with autonomous intelligent features
- Enabling technologies, processes and legal framework for autonomous vehicles

The research scope covers the following themes:

1. Human interaction	Understanding the role of the driver in an autonomous car and their interaction with the vehicle through appropriate interface technologies. A key challenge is to understand the psychology of the relationship of control between driver and vehicle and to manage the transfer of control between them.
2. Autonomous vehicle control	New dynamic control techniques for an intelligent, adaptive vehicle with predictive capability, integrating user patterns and real-time data. Systems engineering approaches and whole system-level understanding, optimisation and control.
3. Autonomous intelligent features	Autonomous control of vehicle features that are supplementary to driving, such as climate control, in-car entertainment, lighting and communications. Creating a personalised experience for the driver and passengers includes profile identification for integration of multiple sources such as key-fobs and consumer electronic devices. Research areas include

	intelligent methods and techniques for machine learning for vehicle systems configuration and adaptation, deep learning and pervasive listening, the self-learning car and digital integration with smart devices, wearables, home automation and the internet of things.
4. Data fusion & analytics	Efficient data capture, validation, processing, management and storage. Integration of data from multiple sources, both on-board and off-board, and real-time processing of massive data sets for knowledge extraction, decision making and intelligent vehicle capability. Includes integration of real-time data with learned user patterns and division of data processing logic and capacity between in-vehicle and off-board capabilities.
5. Sensing	New sensing technologies and the integration, optimisation and management of multiple sensors on a partially/fully autonomous vehicle. This includes sensor fusion, intelligent and pre-emptive sensing, and augmentation of sensed data with off-board data.
6. Off-board data & infrastructure	The fully autonomous car will need to communicate with its environment – with other cars and road users, with roadside infrastructure, and with external data services etc. This theme involves research into distributed systems architecture connecting the vehicle to the rest of the world. It includes both vehicle-to-vehicle and vehicle-to-infrastructure data sharing, and on- and off-board strategy for cloud integration.
7. Distributed systems & control architecture	The distributed system architecture of the vehicle. Architectures need to be integrated, flexible and scalable, providing the underpinning foundation enabling communication between many components and technologies. In the context of smart and connected vehicles, research includes software engineering, control architectures and physical electronic network architectures.
8. Verification, robustness & safety	The specific challenges that verification and validation of the design and robustness of autonomous vehicle systems to meet functional, legal and safety requirements brings.
9. Legislative framework	The legislative framework enabling autonomous vehicles to be legal (current legislation requires the driver to be in control at all

Your proposed research must fit within the call's research scope and the majority of activity must be within EPSRC's remit.

All applications to this call must demonstrate broad support of EPSRC's Delivery Plan objectives and articulate the contribution the award will make to strategies, priorities and national importance as detailed on the EPSRC website.

Published EPSRC strategic statements should be considered. Relevant strategies include:

- Towards an Intelligent Information Infrastructure  
<http://www.epsrc.ac.uk/research/ourportfolio/themes/ict/introduction/ti3/>
- Many-core Architectures and Concurrency in Distributed and Embedded Systems  
<http://www.epsrc.ac.uk/research/ourportfolio/themes/ict/introduction/manycore/>
- Working Together  
<http://www.epsrc.ac.uk/research/ourportfolio/themes/ict/introduction/workingtogether/>

For more information about EPSRC's portfolio and specific Research Areas strategies, see our website: <http://www.epsrc.ac.uk/research/ourportfolio/>

Applicants must reflect on EPSRC's recently published Responsible Innovation framework and integrate appropriate working approaches into their application <http://www.epsrc.ac.uk/research/framework/>

## **Funding available**

EPSRC and JLR have allocated a budget of up to £10 million to support research arising from this call. It is anticipated that up to four to six projects will be sponsored and that grants will be up to five years in duration.

To avoid delay to the start of the programme, all grants will be required to start by end of December 2015.

## **Studentships**

The majority of the £10 million for this call will be on research grant funding which will be split between EPSRC and JLR. There will be specific funding from JLR for PhD/EngD students. Applicants will be able to apply for one studentship for approximately each £600k of research grant funding. The number of students that applicants can apply for to be associated with their research grant will be confirmed when the full proposals are invited.

## **Collaboration**

As a condition of funding, successful applicants will be required to sign a collaboration agreement with JLR based on JLR's standard template for research collaboration. JLR's standard template will be shared with applicants when they are invited to submit a full proposal, or earlier on request.

Applicants are invited to include other academic partner universities. The inclusion of non-competitive industrial partners will be considered on a case-by-case basis at the outline proposal stage.

Applicants will be required to sign an institutional non-disclosure agreement with JLR, specific to the subject area of 'towards autonomy – smart and connected

control', if they accept the invitation to submit a full proposal to the call. Non-disclosure agreements are not required for the first TASCSC workshop or the outline proposal stage.

## Equipment

Where possible, researchers are asked to make use of existing facilities and equipment, including those hosted at other universities. If equipment is needed as part of the research proposal, applicants must follow EPSRC's rules for requesting equipment over £10,000 in value. Individual items of equipment up to the current OJEC (Official Journal of the European Communities) procurement threshold can be included on research proposals submitted through this call, but research organisations will be expected to make a contribution to the cost. All requests for single items of equipment above the current OJEC threshold will need to go through a separate process which will assess the strategic need for the equipment and how to ensure maximum usage. These proposals will be assessed through the separate Strategic Equipment peer review process.

For more information on equipment funding, please see:

<http://www.epsrc.ac.uk/research/ourportfolio/themes/researchinfrastructure/subthemes/equipment/>

The current OJEC threshold can be found at:

<http://www.epsrc.ac.uk/research/facilities/equipment/>

## Eligibility

For information on the eligibility of organisations and individuals to receive EPSRC funding, see the EPSRC Funding Guide:

<http://www.epsrc.ac.uk/funding/howtoapply/fundingguide/>

As this call is a targeted funding opportunity provided by EPSRC, higher education institutions, and some research council institutes and independent research organisations are eligible to apply. A list of eligible organisations to apply to EPSRC is provided at: <http://www.rcuk.ac.uk/funding/eligibilityforrcs/>

## How to apply

### Submitting application

You should prepare and submit your proposal using the Research Councils' Joint electronic Submission (Je-S) System (<https://je-s.rcuk.ac.uk/>).

When adding a new proposal, you should select:

- Council 'EPSRC'
- Document type 'Outline Proposal'
- Scheme 'Outline'
- On the Project Details page you should select the 'Towards Autonomy - Smart and Connected Control' call.

Note that clicking 'submit document' on your proposal form in Je-S initially submits the proposal to your host organisation's administration, not to EPSRC. Please allow sufficient time for your organisation's submission process between

submitting your proposal to them and the call closing date. EPSRC must receive your application by **16:00 on 29 January 2015**.

Guidance on the types of support that may be sought and advice on the completion of the research proposal forms are given on the EPSRC website (<http://www.epsrc.ac.uk/funding/howtoapply/routes/>) which should be consulted when preparing all proposals.

## **Guidance on writing application**

### **Guidance on writing the outline application**

Your outline proposal should consist of the Outline application form and Case for Support document.

- All proposals including multi-institutional bids must be submitted on one common Je-S proposal form by the lead organisation.

Outline application form - the summary section should contain an overview of the research proposed.

- All applicants must articulate how the proposed research addresses the scope of the call
- The outline will need to give an indication of the total research grant funds sought should a full proposal be invited. Costs for studentships should not be included on the outline application form.

Outline Case for Support – no more than four pages of A4, addressing the key assessment criteria and giving an indication of the resources being requested and any project partners. The minimum acceptable font is size 11, and the minimum margin in all directions is 2cm.

- Applicants should give an overview of the project, clearly articulating the novel research being tackled, including a description of the approach and methodology being used and the expertise and experience of the team involved.

### **Full Proposals**

Full Proposals should enhance and expand the information presented in the outlines. We will send full details of what is required with the invitation letters. Applicants invited to the second stage will be expected to engage constructively with JLR in developing full proposals. Applicants will be required to sign an institutional non-disclosure agreement with JLR, specific to the subject area of 'towards autonomy – smart and connected control' if they accept the invitation to submit a full proposal to the call.

If the attachments are uploaded as Word documents, please be aware that once the application has been submitted to the Council/Funder, all the attachments will be converted and held as an Adobe Acrobat file (PDF). Also please note, that whilst we support a wide range, **we do not support all MS Word font types**. Therefore if an unsupported font type is used a different font type may be substituted which may result in changes to the layout of the document. For this reason we recommend that the documents are converted to PDF files before uploading.

Also, please note that on submission to council **all** non-PDF documents are converted to PDF, the use of non-standard fonts may result in errors or font conversion, which could affect the overall length of the document.

In addition, where non-standard fonts are present, and even though the converted PDF document may look unaffected in the Je-S System, when it is imported into the Research Councils Grants System some information may be removed. We therefore recommend that where a document contains any non-standard fonts (scientific notation, diagrams etc), the document is converted to PDF prior to attaching it to the proposal

For advice on writing proposals see:

<http://www.epsrc.ac.uk/funding/howtoapply/preparing/>

## **Assessment**

### **Assessment process**

EPSRC will manage the peer review process on behalf of EPSRC and JLR. There are two stages in the assessment process:

#### **1. Outline Proposals**

Postal peer review will not be used in this call. A panel meeting will be held in March 2015 and this external peer review panel will short-list the outline proposals based on the information provided in the Je-S form and case for support. Selected applicants will be invited to submit full proposals.

#### **2. Full Proposals**

Full proposals will be assessed by an expert panel who will interview applicants invited to submit a full proposal. The expert panel will review all full proposals against the standard research criteria. The interview panel meeting will be held in late July 2015 where proposals will be prioritised for funding.

### **Assessment criteria (for both outline and full proposals)**

The assessment criteria for the Outline stage are:

- **Quality** – the degree of excellence of the proposal making reference to: the novelty, relationship to the context, timeliness, ambition and adventure, and transformative aspects identified, appropriateness of the proposed methodology
- **Applicant** –the applicants' ability to deliver the proposed project making reference to: Appropriateness of the track record of the applicant(s), and Balance of skills of the project team, including academic partners.
- **Importance** – the national importance over a 10 to 50 year time frame in relation to other research in the area and how the proposal demonstrates how the research would underpin or contribute to other research areas, societal challenges (including EPSRC challenge themes), and the success of the UK economy and emerging industry
- **Fit to call** – relevance of research proposed to call remit

In addition to the criteria above, full proposals will also be assessed against the following two criteria:

- **Impact** – How complete and realistic are the impacts identified for this work. The effectiveness of the activities identified to help realise these impacts, including the resources requested for this purpose. The relevance and appropriateness of any beneficiaries or collaborators
- **Resources and management** – The effectiveness of the proposed planning and management and on whether the requested resources are appropriate and have been fully justified. Please comment explicitly on the viability of the arrangements described to access equipment needed for this project, and particularly on any university or third party contribution.

### **Moving forward – further workshops**

Applicants invited to submit a full proposal will be invited to attend a workshop with JLR and EPSRC detailing the next part of the process and further developing the collaborative relationship with JLR. The workshop will be held mid to late March 2015.

There will be a third workshop in August-September 2015 to help build links between the funded projects.

### **Additional grant conditions**

In addition to the standard terms and conditions for grants, successful applicants will be required to sign a collaboration agreement with JLR based on JLR's standard template for research collaboration. JLR's standard template will be shared with applicants when they are invited to submit a full proposal, or earlier on request. Collaboration agreements with any other partners are also required to be in place before the grant starts.

To avoid delay to the start of the programme, all grants will be required to start by end of December 2015.

Projects funded through this call will be allocated a technical lead at JLR to work with the grant principal investigator to deliver the research project. Projects will be managed through JLR's TCDS or milestone process. A Programme Steering Group will meet quarterly to monitor and evaluate the activities funded through TASC. Membership of the group includes EPSRC, Jaguar Land Rover and academic research leads. For successful applications, the principal investigator of the grant will be invited to join this group.

### **Key dates**

<b>Activity</b>	<b>Date</b>
Outline Proposal Deadline	16:00 29 January 2015
Outline Panel Meeting	Wk beginning 09 March 2015
Briefing Workshop	Mid to late March 2015

<b>Activity</b>	<b>Date</b>
Full Proposal Deadline	Wk beginning 11 May 2015
Interview Panel Meeting	Wk beginning 27 July 2015
Grant Holders Integration Workshop	October 2015

## **Contacts**

In the first instance queries should be directed to  
[Towards.Autonomy@epsrc.ac.uk](mailto:Towards.Autonomy@epsrc.ac.uk)

## **EPSRC**

- Susan Soulsby ([susan.soulsby@epsrc.ac.uk](mailto:susan.soulsby@epsrc.ac.uk) - 01793 44 4248)
- Alex Broomsgrove ([alex.broomsgrove@epsrc.ac.uk](mailto:alex.broomsgrove@epsrc.ac.uk) - 01793 44 4223)
- Diane Howard ([diane.howard@epsrc.ac.uk](mailto:diane.howard@epsrc.ac.uk) - 01793 44 4193)

## **Jaguar Land Rover**

For questions relating to collaboration agreements and working with JLR in general, please contact Mark Niziolowski, Research and Innovation Management ([mniziolo@jaguarlandrover.com](mailto:mniziolo@jaguarlandrover.com)).

## **Je-S**

Your research administration should be able to offer advice about costing your proposal and the Je-S system.

If there are any queries related to Je-S, please contact the Je-S helpdesk: [JeSHelp@rcuk.ac.uk](mailto:JeSHelp@rcuk.ac.uk) or 01793 444164.

Please allow enough time before the closing date for your organisation's submission process.

## **Change log**

<b>Name</b>	<b>Date</b>	<b>Version</b>	<b>Change</b>
Susan Soulsby	18/11/2011	1	N/A