Department for Transport

Innovation Challenge Fund
Grant Specifications

Moving Britain Ahead

December 2016

The Department for Transport has actively considered the needs of blind and partially sighted people in accessing this document. The text will be made available in full on the Department's website. The text may be freely downloaded and translated by individuals or organisations for conversion into other accessible formats. If you have other needs in this regard please contact the Department.

Department for Transport
Great Minster House
33 Horseferry Road
London SW1P 4DR
Telephone 0300 330 3000
Website www.gov.uk/dft
General enquiries: https://forms.dft.gov.uk

Contents

1. Introduction

1.1 The Innovation Challenge Fund (ICF) is a scheme that enables the Department for Transport (DfT) to fund post feasibility research projects to support development of technologies, methods or processes to help meet DfT policy goals.

1.2 This document provides details of the scope of the competitions within the ICF scheme.

1.3 This December 2016 ICF scheme includes three separate competitions to help address DfT policy goals on:

- Realising the benefits from unmanned and remotely piloted aircraft systems (Drones)
- Doubling cycling by 2025
- Improving driver training.

1.4 All three competitions use the same application form and assessment criteria.

2. Background

2.1 Projects must clearly state which challenge is being addressed within the scope of the competition that they are applying for. The solution to this challenge must be innovative and focussed on utilising or enabling the use of science, engineering or technology to meet the DfT policy goal.

2.2 The project application should succinctly describe what solution is being proposed and clearly highlight the innovative aspects.

2.3 The Department is interested in projects that might offer significant improvements to systems, processes or technology within each competition area.

2.4 The solution could well be a completely novel idea or approach. However, approaches or innovations from other areas, applied in a novel way to transport, will also be of interest.

2.5 Projects generally will be expected to be post proof of concept/feasibility stage.

2.6 A fully competent team should be able to deliver the aims and objectives of the proposed research project. Risks to the project together with risk mitigation measures should be suitably identified.

2.7 Grant applicants may wish to apply for more than one competition, however no more than 2 proposals will be considered. Although the grants will be assessed independently, the grant applicants will have to demonstrate the ability to deliver on both projects should they be selected for funding.

2.8 Applicants are advised to consider this specification along with the guidance document to ensure the questions in the application form are addressed as fully as possible.

2.9 Where projects address areas which impact on transport users, competition applicants should consider accessibility issues within their project proposal.

3. Realising the full benefit from unmanned and remotely piloted aircraft systems (Drones)

Background

3.1 The full benefit from unmanned and remotely piloted aircraft systems (UAS/RPAS) cannot be realised until it is possible for the full range of operational capabilities to be achievable. This means not only accommodating/integrating UAS/RPAS into the current national and international airspace systems, but also enabling operations in areas of the airspace that are not currently accessible to aircraft operations, such as within urban areas. Consideration should also be given to facilitating types of operation not previously possible, for example at very low and/or very high altitudes. Similarly, the types of operation possible by UAS/RPAS may extend the overall flight duration from hours to days, months and possibly years.

3.2 It is understood that Europe and the US are developing the next-generation air traffic control systems (SESAR & NEXTGEN). It is equally understood that aerospace manufacturers like Airbus and Boeing are already developing the next-generation aircraft to operate in this new environment. However, what happens beyond that (approx. 2050) has not been given much thought, but it is likely to be very different from today or that which is currently planned. It will almost certainly be digital and therefore cloud-based and will not be limited to just aircraft, but undoubtedly a multi-modal transport network operating multiple connected vehicles (trains, planes and driverless cars) with multiple sensors providing live updates in real-time, developing an integrated, unmanned traffic management system.

3.3 The burgeoning drones market offers the UK an opportunity to further its economic and regulatory competitive advantage over EU and international competitors. Whilst the manufacturing of smaller, hobby drones is already well-established in France and China, the UK is well positioned in the valuable higher technology market for more sophisticated technology and servicing industry – how drones are applied to solve problems. The value of the latter global market has recently been estimated at $127bn by 2025.[1] Given that the UK already accounts for half of all commercial drone operators in the EU and around one quarter of those globally, there is an opportunity for the UK to become a world-leader in the drone services market.

The Government Drones programme

3.4 DfT leads a cross-Whitehall programme on drones designed to enable positive commercial and public sector use, whilst ensuring regulation keeps pace with

[1] Clarity from above PwC global report on the commercial applications of drone technology, May 2016 http://preview.thenewsmarket.com/Previews/PWC/DocumentAssets/433056.pdf

challenges on safety, security and privacy. We are pursuing a rolling programme of reform and action to do this to enable full and safe use of the technology and realisation of benefits as soon as possible.

3.5 In the first wave of our rolling programme, we are focusing on addressing public concerns that drones pose risks to safety, security and privacy. This is necessary to ensure standards in these areas are maintained and that there is no public backlash against drones. Currently, the Government is pursuing this through media safety campaigns, commissioning collision research and collaboration between the Police, DfT and others, such as the CAA's Drone Code.[2]

3.6 In addition, plans for the second wave of reform and action in our rolling programme include:

- The drone 'Pathfinder' programme, which was announced last year. Led by a cross Government team, the programme comprises a series of trials, partnering with various public and private sector organisations to test the challenges faced and explore potential solutions for beyond visual line of sight drone service provision.
- Exploring options for a national drones traffic management system that would ensure our high safety standards for aviation and airspace traffic are maintained and replicated for drones. This is essential to enable the full benefits of drones to be realised.

Goal

3.7 The overarching principle is one of maximising the opportunities for unmanned systems while maintaining safety and security at all times. In scope for this work:

- Integration with existing airspace/unmanned aircraft traffic management concepts
- Tools providing accurate and up to date geographic and mapping information to allow flight planning including requesting access to fly over restricted sites
- Systems to provide secure and reliable data communications to allow situational information to be passed from the system to the operator and control input to be relayed from the operator to the system.

3.8 Not in scope for this work:

- RPAS operator training requirements and licencing.

Scope

3.9 The full benefits of unmanned and remotely piloted aircraft systems (UAS/RPAS) require new enabling technologies to permit safe integration with existing airspace users. In the case of RPAS, secure and reliable communication must be achieved to provide situational awareness to operators comparable to that of a manned aircraft

[2] http://dronesafe.uk/

pilot. For all unmanned aircraft, safe failure modes and the authority of the platform to take autonomous actions must be considered.

Integration into existing airspace

3.10 The ambition to maximise the use of unmanned systems will result in aircraft with very different capabilities sharing the same airspace. An unmanned aircraft traffic management (UTM) system is required to allow this finite airspace to be shared. It is a requirement that any UTM must not impose significant extra burden on manned aviation and air traffic control. Concepts for the operation of such a system are invited. Consideration of the following should be included:

- A means of ensuring unmanned platforms are conspicuous to other aircraft and traffic management systems. This is envisaged as being a form of radio transponder or similar, but other techniques are within scope.
- A means of receiving and approving flight plans. This would preferably be performed automatically, but methods for human intervention and approval should also be considered.
- Flight clearance immediately before a flight commences.
- Position reporting of all aircraft to the UTM and relay of any proximity warnings to the aircraft. Position of manned aircraft should be accomplished using existing technologies.

3.11 A hierarchy of airspace users could be considered which will define which aircraft types must give way to others. It is foreseen that manned aircraft will be at the top of this hierarchy and will continue to give way to each other under the direction of air traffic control. The UTM must be able to communicate the potential for conflict to unmanned systems to prevent them from coming into conflict with each other and with manned aircraft.

Navigation/planning

3.12 One essential aspect of UTM is the provision of accurate and up to date geographic and mapping information. This information is required to allow the planning and execution of missions using unmanned aircraft.

3.13 For this work we would like to understand the methods available to provide information on the physical environment that drones will operate in. This will include:

- Buildings/structures
- Restricted airspace

3.14 This could be in the form of a cloud based application running on a mobile device and would allow an operator to plan and execute an operation. The system would also provide warnings to the operator during the planning stages which would alert them to any factors which would prevent the proposed flight plan.

3.15 Consideration should also be given to how the platform will navigate during the operation and what actions can be taken to mitigate any dangers. This will require a sense and avoid solution to provide real-time situational awareness to the platform or remote pilot. Consideration should also be given to the authority of the platform to perform actions in response to unforeseen events. If remotely piloted what

capabilities will be required to allow the platform to safely abort or autonomously continue the mission.

3.16 A method for an operator to request access to fly over airfields and other restricted sites should be available as part of the planning system.

Remote Piloting

3.17 If an unmanned system is remotely piloted, the operator must have a situational awareness of the condition of the system on a level comparable to a pilot of a manned aircraft. This will require secure and reliable data communications to allow situational information to be passed from the system to the operator and control input to be relayed from the operator to the system. This communication must be secure to prevent the platform from being maliciously taken over by another party and also must prevent the input signals from interfering with other systems.

3.18 Modes of failure between the pilot and the system shall result in a safe action being autonomously taken by the aircraft. This could be a continuation of the mission under automation or a safe automatic landing. Consideration should be given to the logic behind the decisions required by the system and the necessary control authority required.

3.19 Similarly, the system should have its own situational awareness and detect and avoid capabilities which will either be able to alert the operator to an impending collision and possibly to take control to prevent a collision without further command from the operator.

4. Improving driver training

Background

4.1 This competition complements existing road safety initiatives. The aim is to identify innovative developments and/or applications - such as Augmented Reality (AR), Virtual Reality (VR), gamification or similar technological solutions - that could be used to improve drivers' hazard perception skills with the objective of reducing road casualties, particularly fatalities and serious injuries.

4.2 The solution or product should complement on-road driving practice and be capable of demonstrating a variety of realistic driving conditions. The solution or product may be used and evaluated in a new major young driver research programme, involving randomised control trials, that is due to be commissioned by the Department for Transport shortly[3] and/or may be used by the Driver and Vehicle Standards Agency to promote driver training.

4.3 This challenge would help to deliver one of the priorities in "Working Together to Build a Safer Road System: British Road Safety Statement", the Government's vision for reducing road casualties during this Parliament. Britain has a strong road safety record, but making further reductions to casualty numbers – a Manifesto and Single Departmental Plan commitment - is becoming increasingly challenging. We need to focus our efforts on those road user groups that are disproportionately involved in collisions. One such group is young drivers (17 – 24). In 2014, collisions involving young car drivers made up nearly a fifth of all road collisions, resulting in 342 deaths.

4.4 DfT are interested in taking action to reduce young driver casualties but in a way that doesn't unduly restrict young people's independence and freedom or impose excessive costs. Recent research commissioned by the Department has identified four interventions that show particular promise.

4.5 One of these is to encourage more on-road practice in a wider range of conditions, e.g. on motorways, rural roads, in the dark and in poor weather. This proposal has been welcomed by young drivers and their parents in recent focus groups. But we know that time implications for accompanying parents and the cost of lessons restrict the amount of additional practice that young people are willing and able to undertake. A second intervention – more training to develop skills to better recognise hazards on the road – was also well-received, with focus group participants' envisaging a simulation-style experience, and suggesting that a virtual reality device or software could be used to prepare and familiarise them with the range of hazards experienced in the simulation.

[3] The development of interventions for the young driver research programme is expected to take place in the first half of 2017.

Goal

4.6 The Department is therefore interested in the potential of innovative technological solutions to engage learner and young drivers and encourage and enable them to develop their skills of recognising hazards on the road in a variety of environments and conditions. The aim is to complement existing on-road practice and the current DVSA driver training and testing regime. We see this very much as an addition to driving lessons and on-road practice, not an alternative.

Scope

4.7 Driving test candidates are currently supported in their preparation for the Hazard Perception Test by CD-ROMs, DVDs and mobile phone apps created by DVSA's official publisher, TSO, or by DVSA's licensees using official learning material. They are also encouraged to prepare when out on the road with their driving instructor.

4.8 We would want to ensure that any new approach or platform was properly aligned with the learning to drive syllabus (devised by DVSA) and encouraged safe driving.

4.9 DVSA are developing and testing new Hazard Perception Training (HPT) materials to improve learner drivers' awareness of developing hazards in varying weather and lighting conditions, and are broadening the scope of scenarios providing experience of real life situations such as encountering vulnerable road users. DVSA are also working with Highways England to develop clips that respond to the most common hazards on motorways and dual carriageways.

4.10 Any solution or product proposed as part of the Innovation Challenge Fund should complement and build on these approaches and materials, not duplicate them.

4.11 The research mentioned in paragraph 4.4 highlights three 'off-the-shelf' PC-based HPT programmes, which high-quality evaluations have shown to be effective:

- Risk Awareness and Perception Training Programme (RAPT)
- Road Aware® (RA)
- Act and Anticipate Hazard Perception Training (AAHPT).

These programmes have various common features:

- Interactive element
- Demonstrate hazards from the perspective of the driver
- Exposure to a wide range of 'materialised' and 'un-materialised' hazards
- Training on complex hazards
- Exposure to a wide range of traffic situations
- Provision of feedback to participants.

4.12 While all the interventions described above are PC-based, the research notes that there are a range of hazard perception delivery mechanisms known to work (for example watching video commentaries from expert drivers, e-learning based training, or on-road hazard perception tuition).

4.13 For ICF project(s) we are primarily interested in the potential of different innovative technological solutions that will engage and support learner and young drivers. We

are also interested in a) the potential of such solutions to realistically demonstrate hazards from the perspective of different road users (i.e. not just drivers) and b) investigating whether experiencing the road environment from the perspective of a cyclist/motorcyclist/lorry driver may help learner and young drivers to understand how different vehicles use the road and the associated hazards.

4.14 One possible new technological approach, and that preferred by learner and novice driver focus group participants, is the use of a VR solution in driver training. It has been suggested that a VR solution would complement existing on-road practice and improve young drivers' safety by enabling them to develop their hazard perception experience and skills without the time and cost constraints of a car and driving instructor. Augmented Reality (AR) or other approaches may also have similar benefits and we are interested in research proposals utilising these.

4.15 Augmented Reality' in which a real-world environment's elements are augmented (or supplemented) by computer-generated sensory input such as sound, video, graphics or Global Positioning System (GPS) data is another example of this. The term 'Virtual Reality' can cover a range of significantly different technological developments, from VR headsets that fit to the head (the most basic using 'slotted-in' mobile phone screens), through to simulators with 2D, surround screens, 3D and sophisticated VR. Some non-immersed, some partially immersed, some fully immersed and some with movement of body or vehicle and sound. Likewise differing technology approaches can use other computer mediated reality to expose users to situations in a controlled manner.

4.16 These different solutions have varying degrees of accessibility, costs and inter-relationships with practical driving training. When considering which platform, application or delivery mechanism to take forward, the research should consider cost, acceptability and ability to engage learner and young drivers, ease of delivery and the evidence base. Applicants will be expected to set out in detail which type of solution(s) they propose to develop and provide justification as to why the proposed solution is likely to engage and be accessible to learner and young drivers as well as be effective in improving their skills. Applicants are also expected to demonstrate awareness of how their proposed solution could be implemented in order to support delivery of the policy goal.

4.17 The researchers developing potential solutions will be expected to engage with the Supplier that is engaged by DfT to develop and deliver the trials mentioned in paragraph 4.2. More information will be made available to ICF grant recipient researchers.

4.18 DVSA are also looking into a number of possibilities for HPT and the researchers are expected to collaborate closely with them when developing the HPT solution.

4.19 Project applications must include a robust evaluation of the benefits that their research can bring in terms of improved driver HPT. Proposals should include detailed information about how solutions would be tested with young people; how many young people would be involved in the testing process; how a representative sample of young people would be achieved; and what 'success' might look like.

5. Doubling cycling by 2025

Background

Cycling and Walking Investment Strategy

5.1 The draft Cycling and Walking Investment Strategy (CWIS)[4] published in March 2016 sets out the Government's strategy for walking and cycling in England (including London). The Strategy aims to make cycling and walking the natural choice for shorter journeys, or as part of a longer journey.

5.2 To help meet this ambition, the DfT has an aim to double cycling by 2025. The strategy also includes a number of unquantified objectives for both walking and cycling and financial resources for the period to 2020/21. It outlines details of governance arrangements for overseeing delivery of the Strategy, and an action plan for delivering against the objectives. The final strategy is due to be published shortly.

5.3 In meeting these aims, DfT intend to focus on three broad strands. These are:

- **Better safety** – because we know safety and safety perceptions have been cited as the biggest barriers for people wanting to take up cycling
- **Better mobility** – because we know that to make cycling and walking normal, easy and enjoyable, there needs to be better links and networks to key destinations
- **Better streets** – because we know that well designed and accessible streets can encourage people to walk or cycle more as part of their daily routine.

Existing DfT cycling projects

5.4 Government has set the following funding programmes which support provision of cycling and walking projects:

DfT cycling and walking specific programmes	• Cycle Ambition Cities (£191m, 2013-14 to 2017-18) • Bikeability (£50m, 2016-17 to 2019-20) • Highways England designated fund (£100m, 2015-16 to 2020-21) • Sustainable Travel Transition Year fund (£20m, 2016-17) • Access fund (£60m, 2017-18 to 2020-21)
DfT local transport programmes	• Local Growth Fund (£12bn, 2016-17 to 2020-21) • Highways maintenance block (£3.8bn, 2016-17 to 2020-21) • Integrated Transport Block (£1.3nm 2016-17 to 2020-21)

[4] https://www.gov.uk/government/consultations/draft-cycling-and-walking-investment-strategy

5.5 These funds are being used by Local Enterprise Partnerships (LEPs) and local transport authorities to invest in both capital infrastructure and complementary revenue measures which can support behaviour change and promote cycling at local level. By providing this funding, the Government wishes to support economic growth by improving access to employment and education and relieving congestion. It also wishes to promote improved health outcomes by promoting physical activity by making it easier for people to incorporate cycling and walking into their everyday lives.

Goal

5.6 The Government aims to double cycling, where cycling activity is measured as the estimated total number of bicycle stages made each year, from 0.8 billion stages[5] in 2013 to 1.6 billion stages in 2025. Given the relatively low growth in recent years, we are keen to identify approaches for closing the gap between anticipated outcome and this aim.

5.7 The Department is therefore interested in innovative technological solutions to increase the levels of cycling.

Scope

5.8 We would welcome creative and innovative research proposals which support our strategic aim to boost cycling in England. As a guide, these may fall into the following areas (this is not an exhaustive list):

- **Digital solutions** – to help promote cycling and make it easier for people to incorporate cycling into their everyday lives. Tools to assist local transport planners and practitioners
- **Business and employee engagement** – innovative solutions to assist businesses in making cycling provision available to their workforces, or providing direct support to employees to enable them to cycle to work. Support for jobseekers who may benefit from cycling to work to expand their employment horizons
- **Cycle safety** – solutions which support improved cycling safety or address perceptions of safety
- **Infrastructure/better streets** – solutions which support the development or promotion of new cycling infrastructure schemes.

[5] Cycling activity for the purpose of this document is measured as cycle stages as in the National Travel Survey. The basic unit of travel in the National Travel Survey is a trip, which consists of one or more stages. A new stage is defined when there is a change in the form of transport. Counting cycle stages rather than trips allows us to include journeys that involve a cycle but where this is not the main form of transport (for example, cycling to a railway station to catch the train to work).