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NIA Project Registration and PEA Document

Date of Submission

Apr 2014

Project Reference Number

NIA_SGN0035

Project Registration

Project Title

Beyond Visual Line of Sight Aerial Inspection Vehicle

Project Reference Number

NIA_SGN0035

Project Licensee(s)

SGN

Project Start

March 2014

Project Duration

1 year and 7 months

Nominated Project Contact(s)

Oliver Machan, Innovation Project Manager

Project Budget

£567,111.00

Summary

The scope of this 1½ year programme of work by VTOL Technologies is to develop an RPAS BVLOS specification that is endorsed by the CAA which can then be used to develop a RPAS BVLOS system (not part of this project).

The project will contain four stages –

Stage 1: BVLOS Requirements Gathering (6 months)

Stage 2: Developing the Simulation Environment (4 months)

Stage 3: Assessing Requirements (4 months)

Stage 4: An Industry Standard BVLOS Specification (4 months)

Nominated Contact Email Address(es)

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Problem Being Solved

Currently all the GB Gas Distribution Networks (GDNs) and Electricity Distribution Networks Operators (DNOs) use manned flights for regular planned inspection tasks of their networks. These flights are expensive to charter have to be scheduled and are environmentally disruptive. Currently two GB DNOs already use unmanned aerial systems for surveying overhead power lines. These aerial systems are used 'Within Line of Sight' (WLOS), limiting their range and thus reducing network coverage. Extending the WLOS aerial systems range and effectiveness would require them to have the capability to go 'Beyond Visual Line Of Sight' (BVLOS). It is recognized that these WLOS systems would not be suited to be adapted to BVLOS operations. Additionally to develop a complete BVLOS Remotely Piloted Aerial Systems (RPAS) would very expensive and would not be guaranteed to gain approval from the Civil Aviation Authority (CAA). Therefore to achieve RPAS BVLOS capability for the GDNs and DNOs a stepwise approach to the

development has been adopted to reduce the risk to the GDNs and DNOs. This project, the first step, addresses the following three critical issues for the electricity overhead-line and gas pipeline network industries:-

- Clearly defining BVLOS operations for which CAA approval can be sought and secured.
- A financial analysis that can provide a clear indication as to where categorized BVLOS operations will provide the best Return On Investment (ROI) for the DNOs and GDNs and be viable for current and/or as yet undefined future operations.
- Specifying a Remotely Piloted Aerial System (RPAS) that can provide a long endurance capability and fly BVLOS as well as meeting CAA regulatory requirements.

Method(s)

In order to achieve a BVLOS capability with RPAS for GDN and DNO network surveillance tasks this project aims to develop an RPAS BVLOS specification that is endorsed by the CAA.

The method proposed by this project to deliver this specification can be split into four stages: -

Stage 1: The project will engage with the GDNs, DNOs and some remote aerial system operators to identify and gather operational requirements. Critical areas of analysis and information gathering will include assessing the extent of each organisation's network for which BVLOS RPAS operations are being considered, identifying all the key network information that will be required to perform BVLOS RPAS operations. These inspection requirements will be categorised according to technical, financial and regulatory implementation criteria.

Stage 2: Once a clear picture has been established of the categorized and prioritised RPAS BVLOS operations, a simulation model will then be assembled to simulate two selected electricity distribution network geographies and two gas pipeline network geographies with their associated concept of operations over a 5km distance. These chosen geographies will be modelled to a high accuracy level in order to fully simulate a representative environment for BVLOS operations.

Stage 3: Each prioritised and selected concept of operation will be modelled and analysed to determine the optimum flight path and associated flight manoeuvres required to perform a successful aerial inspection. Communications and avoid and detect technologies will be identified. Working in close co-operation with the CAA, agreement will be reached on how to operate RPAS BVLOS using tightly defined flight envelopes / corridors around electricity distribution networks and above underground gas pipeline networks. Basic simulation analyses will then be carried out as well as working on establishing appropriate flight safety procedures in close co-operation with the CAA. The final tasks will be assessing system power requirements and platform sizing in order to achieve the concept of operations goals.

Stage 4: The final stage will be translating the requirements identified in Stage 3 into an industry standard BVLOS RPAS specification that can meet the GDNs and DNOs needs. Operation of the final RPAS BVLOS inspection solution(s) will be simulated, enabling confirmation that the resultant RPAS specification will meet the industry's requirements. Advanced flight manoeuvres such as flight safety procedures, more complex flight path inspection and interactive inspection operations will also be demonstrated. The simulation model will be open for evaluation and test by the DNOs, GDNs as well as the CAA. An assessment of the overall feasibility of the industry implementing the desired RPAS BVLOS operations will be made as well as the provision of an implementation roadmap. Based upon the information provided, the GDNs and DNOs will be in a strong position to decide if and how they would like to invest and introduce BVLOS RPAS systems stepwise, securing CAA operational approvals in a highly efficient manner, along the way.

Scope

The scope of this 1½ year programme of work by VTOL Technologies is to develop an RPAS BVLOS specification that is endorsed by the CAA which can then be used to develop a RPAS BVLOS system (not part of this project).

The project will contain four stages –

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Stage 4: An Industry Standard BVLOS Specification (4 months)

Following the transition from the IFI to the NIA funding mechanism for the DNO's, an NIA allowance for the remainder of the project has

now been included.

Objective(s)

The objective of this project is to –

- Identify what operational requirements the GDNs and DNOs might have for RPAS BVLOS.
- Create a simulation environment based on real sections of the GDNs and DNOs networks.
- Use the simulation environment to develop the specification(s) that will achieve the GDNs and DNOs operational requirements whilst also meeting the CAA's criteria.
- Use the simulation environment to demonstrate the specification to the GDNs, DNOs and CAA.
- Deliver a specification(s), confirmed by the CAA that is one step towards developing a RPAS BVLOS for which CAA approval can be secured.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria for the project are:

- The RPAS BVLOS requirements for the GDNs and DNOs are identified.
- The costs of developing RPAS BVLOS capability are quantified and justified.
- An RPAS BVLOS specification(s) is developed and agreed by the CAA.

The GDNs and DNOs are in a position to decide on whether to develop this specification(s) knowing that the potential system has the best chance of being compliant when presented to the CAA for approval.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This project has been designed to be the initial stages of the larger project of developing an RPAS with BVLOS capability. Adopting a stepwise approach allows the costs and risks to be managed whilst at the same time gauging CAA support for each stage

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

5km sections of the gas and electricity distribution networks will be simulated in this project.

Revenue Allowed for the RIIO Settlement

As this Project is starting at a low TRL, it is not yet possible to determine whether revenue savings are likely during RIIO-GD1. However it is assumed that if progressed successfully through to development and field trial in future stages this type of solution will have potential to provide Network Licensees with an excellent outperformance opportunity with regards to pipeline surveys and Networks safety performance. Expected savings against specific areas will be quantified in the early stages of this project.

Indicative Total NIA Project Expenditure

SGN

£92,650 total Project expenditure, 90% of which is Allowable NIA Expenditure (£83,385)

NGN

£91,770 total Project expenditure, 90% of which is Allowable NIA Expenditure (£82,593)

SSE

£10,000 total Project expenditure, 90% of which is Allowable NIA Expenditure (£9,000)

SP

£16,666 total Project expenditure, 90% of which is Allowable NIA Expenditure (£15,000)

UKPN

£28,363 total Project expenditure, 90% of which is Allowable NIA Expenditure (£25,527)

NPG

£8,750 total Project expenditure, 90% of which is Allowable NIA Expenditure (£7,875)

Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

n/a

How the Project has potential to benefit consumer in vulnerable situations:

n/a

Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

With long flight times and much reduced fuel consumption the potential for savings using a RPAS BVLOS for surveys verses a combination of helicopter and ground surveys is great. Stage one of this project will identify the potential financial gains that BVLOS RPAS could deliver.

Please provide a calculation of the expected benefits the Solution

Research based.

Please provide an estimate of how replicable the Method is across GB

This method could be applied across the whole of GB and applies to all network operators.

Please provide an outline of the costs of rolling out the Method across GB.

Not currently known.

Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

- A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify repeating it as part of a project) equipment (including control and communications system software).
- A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)
- A specific novel operational practice directly related to the operation of the Network Licensees system
- A specific novel commercial arrangement

RIIO-2 Projects

- A specific piece of new equipment (including monitoring, control and communications systems and software)
- A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven
- A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)
- A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology
- A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution
- A specific novel commercial arrangement

Specific Requirements 4 / 2a

Please explain how the learning that will be generated could be used by the relevant Network Licensees

This project is expected to provide all Network Licensees with a fundamental understanding of whether it is feasible to introduce RPAS BVLOS capability for GB gas or electricity distribution networks. If it is feasible, specific tasks will be identified that could gain CAA approval.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

Not applicable.

- Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

Is the default IPR position being applied?

- Yes

Project Eligibility Assessment Part 2

Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

n/a

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

n/a

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

n/a

Relevant Foreground IPR

n/a

Data Access Details

n/a

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

n/a

Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project

n/a

This project has been approved by a senior member of staff

Yes