**Date of Submission**

**March 2016**

# Network Innovation Allowance Closedown Report

*Notes on Completion:* Please refer to the appropriate NIA Governance Document to assist in the completion of this form.

Network Licensees must publish the required Project Progress information on the Smarter Networks Portal by 31st July 2014 and each year thereafter. The Network Licensee(s) must publish Project Progress information for each NIA Project that has developed new learning in the preceding relevant year.

## Project Closedown

| Project Title | Project Reference |
|---|---|
| Beyond Visual Line of Sight Aerial Inspection Vehicle | NIA_SGN0035 |

| Project Licensee(s) | Project Start Date | Project Duration |
|---|---|---|
| Northern Gas Networks, Northern Powergrid, Scottish and Southern Energy Power Distribution, Scottish Power Transmission, SGN, UK Power Networks | Mar 2014 | 18 Months |

**Nominated Project Contact(s)**

SGN - Oliver Machan (Innovation Project Manager) – (lead GDN) SGN - Barry Mackay (Engineering Project Manager) NGN - Craig Alderston (Project Manager) SSE - Tawanda Chitifa (Project Manager) SP - Graeme Duncan (Project Manager) SP - Geoff Murphy (Technology Development Manager) NPG - Gavin Howarth (Project Manager) UKPN - David Folkerd (Project Manager) VTOL - Ashley Bryant

**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 –

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)

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.

**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.

**Performance Compared to the Original Project Aims, Objectives and Success Criteria**

Against the stated success criteria the Project has performed accordingly –

- The RPAS BVLOS requirements for the GDNs and DNOs are identified.
  - Through consultation with the networks the project identified, categorized and prioritised BVLOS operations which would be required by the GDNs and DNOs. The project investigated the feasibility of operating RPAS BVLOS from the following perspectives; Commercial, Technical and Regulatory (UK Civil Aviation Authority). The results of these investigations clearly indicates that RPAS operations BVLOS are truly feasible from all three of the above perspectives and the details within the stage 1 completion report provide the basis behind this conclusion.

- The costs of developing RPAS BVLOS capability are quantified and justified.
  - Within the limitations of this project the potential maximum combined UK DNO and GDN industry savings, deploying optimised RPAS technology was shown to reach a figure of £4,750,000 when fully implemented. The potential financial returns clearly outline the potential for either saving costs compared with current aerial inspection operations or for re-investing these savings into improving the inspection processes as demands for energy increase and more demanding inspection capabilities are required.
  - Compared with existing 'Within Visual Line of Sight' operations, the project proved that BVLOS capability could improve the overall inspection process. The consistency, repeatability, deployability and scalability of the solution could significantly benefit from the development and approval of an automated BVLOS RPAS,
  - The project identified precision navigation, collision avoidance, BVLOS communications, miniaturising payloads, high density energy storage and precision and long endurance RPAS as the key technology areas that are critical to the development of RPAS BVLOS capability. The maturity and availability of these technologies was assessed and although no definite development cost of RPAS BVLOS was established a clearer understanding of the requirements was gained.

- An RPAS BVLOS specification(s) is developed and agreed by the Civil Aviation Authority (CAA).
  - The project developed a simulation environment to develop and test the RPAS BVLOS requirements for the three ConOps chosen. The simulation environment allowed all the parameters to be tested and provided a platform to demonstrate the RPAS BVLOS capabilities to the participating network operators and the CAA.
  - Three Concepts of Operations (ConOps) were considered in this Project; Simulation Study 1 – Gas Sector (Pipeline), Simulation Study 2 – Electricity Sector (Pylon) & Simulation Study 3 – Electricity Sector (Pole). Each simulation investigated the length of the routes, nature and number of the assets inspected as well as the type of inspections needed.
  - After defining the ConOps and utilising the simulation environment the project delivered an electricity networks RPAS BVLOS requirements specification and a gas networks RPAS BVLOS requirements specification.

**Required Modifications to the Planned Approach During the Course of the Project**

The Project completed on time and on budget and without any modifications to the original scope. A minor financial adjustment was made to the original PEA to transfer the DNOs from IFI to an NIA funding as per 2015/16 arrangements.

**Lessons Learnt for Future Projects**

It is recognized that to develop RPAS BVLOS capability the challenges are beyond just the technological and that innovative changes to the air space regulations would be required as well. Within this complex environment a stepwise approach to develop a physical RPAS BVLOS was required to limit the networks risk and by utilizing a simulation approach the reduction of risk has been achieved.

The simulation of three types of operations was based on real network assets and although there are limitations of only being simulations such an exercise provided a powerful demonstration to the CAA. The networks operational requirements and an understanding of the working environment being demonstrated so graphically has allowed a high degree of engagement with the CAA and the sense that the CAA will be highly supportive of follow up work.

**Note:** The following sections are only required for those projects which have been completed since 1st April 2013, or since the previous Project Progress information was reported.

**The Outcomes of the Project**

The Project delivered an electricity networks RPAS BVLOS requirements specification and a gas networks RPAS BVLOS requirements specification.

The increase in TRL from 3 to 5 has been in line with the registration document as the subsystems have been demonstrated in a relevant environment; the simulation environment.

A significant outcome of the project has been the interaction and engagement of the CAA, a vital necessity for any further development work in the RPAS BVLOS arena

**Planned Implementation**

RPAS BVLOS for network operations is still at a low TRL and therefore there is still considerable development and integration of subsystems before any BVLOS system can be implemented. Further work to be considered –

- Identification of suppliers and developers to deliver components of specifications.
- Development of first RPAS BVLOS system to undertake specific task(s) for DNOs and GDNs. Specific operations and flight plan certified and approved by the CAA.
- Roll out of BVLOs operations on a case by case basis. CAA approval of further submitted flight plans.

**Other Comments**

The Department of Transport has started a new initiative to accelerate the progress of RPAS BVLOS operations within the UK. The initiative is to help and enable this capability within many sectors including energy networks. The program will provide a focus for developers to consider the requirements for the industry sectors but primarily will be an instrument for enabling the adaptation of the air space regulations.

The outcomes of this project have provided a good platform for the DNOs and GDNs to be involved in such an initiative.