

UK PATHFINDER LAUNCH

FROM SPACEPORT CORNWALL



LESSONS LEARNED REPORT

DECEMBER 2023

Context

On 9 January 2023, the UK made history by conducting its first ever orbital launch from Spaceport Cornwall in Newquay. Supported by a grant (managed within the UK Spaceflight Programme) from the UK Space Agency, Virgin Orbit's rocket (LauncherOne) was launched from a modified Boeing 747 aircraft named Cosmic Girl. Although the satellites onboard were not placed into orbit due to a technical anomaly with the rocket's second stage engine, this historic event demonstrated the UK's ability to launch, safely, legally and with the appropriate coordination across government. It also marked significant progress towards the delivery of ambitions set out in the National Space Strategy, published in 2021.

This first pathfinder launch event was the culmination of significant work across government. His Majesty's Government (HMG) through the UK Space Agency, DSIT (previously BEIS) Department for Transport (DfT), the Civil Aviation Authority (CAA) and other governmental departments, set in place the enabling conditions to allow the UK to be the first country in Europe to achieve a commercial pathfinder launch - laying the foundations for a commercially sustainable UK spaceflight market and ongoing market growth. The enabling conditions included:

- a. Enabling Legislation - Produce and enact primary legislation that provides the high-level enabling framework for UK commercial spaceflight activities.
- b. Space Industry Regulations - Establish the detailed provisions and regulations, required to implement UK Spaceflight primary legislation, and establish an independent UK space regulator.
- c. International Arrangements - Develop the necessary government-to-government arrangements for UK launch.
- d. Grant Management - Execute grants to develop the necessary infrastructure and operational locations (operational spaceports and launch service providers) through three pathfinder launch grants.
- e. Outreach and Education - Engaging the public in space and inspiring the next generation of space professionals to sustain the future talent pipeline.



LauncherOne in flight. Credit: Virgin Orbit.

Conducting the first ever launch from the UK was always set to be challenging, requiring project teams and stakeholders to adapt as processes and rules were tested for the first time. Achieving the UK's first launch was only possible due to the commitment and passion of all involved, often going above and beyond to deliver despite very limited resources.

All major complex programmes have their challenges, and it is only through identifying and implementing lessons learnt that processes will improve, and Government will achieve our National Space Strategy goal of becoming the leading provider of small satellite launch in Europe by 2030. This report, authored by the UK Space Agency's Launch Programme ('the programme'), following extensive engagement across government and its agencies, sets out the lessons identified from delivering the pathfinder launch, and the associated recommendations being taken forward to improve organisational responsibilities, processes, governance and international engagement.

All recommendations and actions in this report have been agreed by the UK Space Agency, DSIT, DfT and CAA. Progress will be monitored via the programme's governance and planned assurance activities.

Background

The UK Launch Programme

The programme was initiated in 2018 and is being delivered by the UK Space Agency, with support from DfT and CAA, enabling the development of small satellite launch capabilities from sites in Scotland, Wales and England. To enable first launch, and to cement the UK's position as Europe's most attractive destination for commercial launch activities, the programme has successfully implemented relevant regulatory frameworks, processes and international agreements.

HMG's investment is designed to develop the UK's space sector environment to capitalise on the UK's existing space capabilities by bringing further growth to this high-value sector and inspire the next generation of space professionals to take-up STEAM subjects, (Science, Technology, Engineering, the Arts and Mathematics) in order to sustain the future space talent pipeline.

Legislation and Regulation

The UK is the first country in Europe to implement spaceflight legislation, which specifically allows for the regulation of a wide range of commercial spaceflight activities and technologies, including traditional vertically launched vehicles, air-launched vehicles, sub-orbital spaceplanes, and balloons.

The Space Industry Act 2018 (SIA) created the high-level enabling framework for commercial spaceflight operations, and in July 2021, the programme implemented new Space Industry Regulations (SIR) which formally appointed the CAA as the UK's new independent space regulator. In addition to the marine licences issued by the relevant marine licensing regulators, with support from the Maritime & Coastguard Agency (MCA) for shipping and safe navigation, the CAA issued other relevant licences (spaceport, launch operator, range control services and payload), which enabled the first launch to take place.

International Arrangements

Launches undertaken from the UK are likely to include trajectories that cross airspace controlled by other nations. First stage and fairing deposition may also impact other countries maritime zones. To obtain a UK launch licence, launch operators must obtain relevant permissions and licences from countries affected by the launch.

The programme collaborated extensively with international allies and regulatory agencies within Europe and the United States to negotiate arrangements that enable spaceflight activities to take place from the UK. Memoranda of Understanding (MoUs) were agreed with Iceland, the Faroes and Ireland covering airspace interactions and maritime deposition. The UK-US Technology Safeguards Agreement (TSA), a legally binding agreement between the nations, enables US companies to operate from UK spaceports and export space launch technology to the UK. The TSA is counter-proliferation agreement that ensures US-originating spaceflight technology is properly protected when in the UK, whilst enabling UK companies' access to revenues and customers previously unavailable.

Identifying Lessons Learned

To identify lessons learned, the UK Space Agency consulted with multiple programme stakeholders from across government and industry who shared their reflections through a series of independently facilitated workshops. Through these workshops, prominent themes emerged from the events leading up to and including pathfinder launch. These themes collectively identify key areas for lessons learned and form the basis of the recommendation actions developed to mitigate recurrence of the issues raised.

These themes include ensuring clarity of roles, responsibilities and ownership of communication, decision-making and escalation protocols, and the instigation of reviews into the regulatory landscape, the approach to insurance and liabilities, the approach to international agreements (in conjunction with European partners) and consideration of how to improve knowledge sharing and guidance.

Work is already underway, or complete, on several recommendations to provide tangible improvements across the programme and for the benefit of the UK space industry.

Recommendations

The key recommendations that HMG is taking forward to improve HMG activities and deliver a more efficient experience for launch operators are set out below.

Theme One: Review the regulatory landscape

The Government should review the regulatory landscape and where possible, improve co-ordination of licensing and guidance with operators to reduce administrative efforts and costs.

Observed challenge(s): The Space Industry Act (SIA) states that the CAA cannot grant a licence unless the applicant has the financial and technical resources to do the things authorised by the licence and is otherwise a fit and proper person - as defined by the Space Industry Regulations. Whilst aspects of the Regulations work well, Operators reported finding this process disproportionate and time-consuming, and would therefore benefit from a review of proportionality, as well as conducting these checks earlier in the application process to avoid delays.

Recommendations include:

It is vital that the Regulator is assured that launch operators have the financial and technical resources they need, and government will look at the proportionality of the information requested.

DSIT is already coordinating a regulatory review, alongside changes made by the CAA to the Regulator's licensing rules published on July 18, 2023. These changes are expected to reduce the amount of information required for fit and proper persons test. Furthermore, on 1 September 2023, DfT commenced a Space Industry Act post-implementation review, that is due to complete in April 2024. This will include input from across Government such as the UK Space Agency's Office of Regulation, DSIT's Space Sustainability & Resilience team and the CAA.

The DfT held a series of workshops with the UK Space Agency's Office of Regulation, DSIT, and CAA to review what aspects of the SIA is working well, what could be improved, identify any gaps and what provisions may be removed as part of the Post Implementation Review (PIR) of the Act. DfT expect to report back the conclusions of the review by April 2024.

Theme Two: Knowledge sharing and guidance

Improving knowledge dissemination will be beneficial to all parties, expediting processes and reducing the risk of delays and repetition. This is of particular importance considering the geographical challenges of launching across multiple national airspaces.

Observed challenge(s): For a commercial launch to take place from the UK, there are requirements to obtain a launch licence, an orbital licence, a spaceport licence, a marine licence, as well as the need to obtain other licences/permits from UK and foreign bodies e.g. planning permission for spaceports, airspace permits outside the UK, with dependencies on airspace arrangements and international arrangements. Operators reported that the requirement to provide the same information to be compliant with the licensing procedures of numerous different government agencies and bodies proved complex and time consuming to navigate.

However, a positive aspect of delivery was the collaborative working and knowledge sharing across HMG which included the UK Space Agency, DfT, CAA, DSIT, MCA and the Foreign, Commonwealth & Development Office (FCDO).

Recommendations include:

Whilst there are good reasons for different licences, HMG agree that operators would benefit from clearer guidance on licensing processes and overall streamlining of the informational requirements. DfT should consider how best to ensure launch operators understand the European airspace operating environment. For example, a rolling education programme should be considered for launch operators so that they are cognisant of the geographical challenges of launching across multiple national airspaces. This recommendation is owned by DfT and CAA and actions to implement the recommendation are expected to be completed by January 2024.



Cosmic Girl at Spaceport Cornwall. Credit: Virgin Orbit/Bad Wolf Horizon

Further HMG activity includes the CAA working to streamline and publish information on the licencing process, DSIT reviewing regulation including variable limits, and the UK Space Agency are working with launch operators to ensure UK launches and associated licencing activity are being managed effectively including project / programme capability.

Theme Three: Review approach to international agreement, in conjunction with European partners.

Arrangements with international near-neighbours, and those potentially impacted by launch flightpaths, were complex, burdensome and added risk to schedules.

Observed challenge(s): An understandable lack of familiarity with space launch in some European countries, hampered the negotiation of government-to-government arrangements designed to authorise the agreement of common practice and tactical/operational mechanisms used amongst airspace regulators and in the marine domain. In some instances, this delayed the agreement of the overarching political arrangements designed to facilitate the tactical/operational discussions, until all the issues surrounding the tactical/operational level were resolved.

The UK Space Agency is already proactively engaging with other nations affected by future launches to ensure that concerns are identified and mitigated earlier. In addition, international engagement was complicated by over-optimistic delivery plans from Virgin Orbit, resulting in significant effort and good will being expended across HMG and with other nations to enable a launch window that lacked credibility. HMG must balance its role to effectively support operators through the licencing process, as well as being a critical friend when it identifies overly optimistic delivery assumption.

Recommendations include:

Government will work with European and other international partners to simplify or manage airspace requirements better in a European context, exploring a system of cross-European governance for launches from Europe through Eurocontrol, a non-EU intergovernmental organisation for the safety of air navigation in Europe. This recommendation is owned by DfT and actions to implement the recommendation are expected to be completed by March 2025.

Government should utilise established relationships with other transport authorities and should also explore how the UK can best manage engagement of stakeholders with respect to marine safety and to agree process at a strategic and operational level. This recommendation is owned by DfT/MCA/CAA, and is ongoing.

Theme Four: Review approach to insurance and liabilities.

Ensuring a proportionate approach to liabilities and insurance is key to reducing the burden on operators and satellite providers. This should give the UK a competitive advantage in the marketplace, reducing the applicants' overheads and potentially shortening time to launch.

Observed challenge(s): Operators and satellite providers repeatedly raised concerns over liabilities and insurance being disproportionate, burdensome and an impediment to progress towards launch. To counter this, Government should consider a variable Third-Party Liability (TPL) insurance approach for satellite operations and should explore options to set an upper flat rate cap for launch operator insurance & liability.

Recommendations include:

Government response to consultation on a variable limit is planned for Spring 2024, subject to outcome of consultation - consultation launched 14 September 2023.

Government will explore options to set an upper cap for launch operator insurance and liability, which may, for example, offer applicants a choice of accepting the upper cap or having their insurance set through the current methodology which provides a bespoke insurance amount, tailored to the risks posed by the launch

activity. This recommendation is owned by DfT, and actions to implement the recommendation are expected to be completed by December 2024.

Theme Five: Provide clear definition of communication, decision-making and escalation protocols.

Programme governance processes should be reviewed to ensure there are clear communication, decision and escalation processes.

Observed challenge(s): The complexities delivering a launch at pace across multiple government departments and industry stakeholders were, at times, compounded by a lack of clarity around reporting remits and escalation routes.

For example, there was a late request from the launch operator to seek assistance from the MCA, the Marine Management Organisation (MMO), the Irish Coastguard and the Navy to monitor and request vessels to move from the high-risk shipping area. This is the responsibility of the operator and highlighted the process for managing escalations and planning for communications with vessels in the high-risk shipping area could be further improved.

Recommendations include:

DfT and CAA should ensure that there is a consistent understanding across government and launch operators of escalation protocols and ownership within operators, specifically with respect to how the risks to vessels in these areas are managed. This recommendation is owned by DfT and CAA and actions to implement the recommendation are expected to be completed by October 2024.

Programme governance processes should be reviewed to ensure there are clear communication, decision, and escalation processes. This recommendation will be part of the UK Space Agency annual review. Next review January 2024.

Theme Six: Review and clarify roles, responsibilities & ownership.

Early identification of roles and responsibilities enables better information flow between all participating stakeholders and clarifies lines of accountability.

Observed challenge(s): Operators reported that the programme would benefit from better definition of roles and responsibilities. Similarly, there was an absence of key roles within the operator that hampered more effective programmatic and technical engagement with the UK Space Agency. For example, there was no single programme or engineering lead identified within the operator. Operator engagement for most of the project was largely undertaken through a third party who did not have direct access to timely information.

Recommendations include:

The programme is committed to clarifying roles, responsibilities, and ownership through use of responsibility assignment matrices (often referred to as a RACI), ensuring that regular discussions between teams are in place to ensure timely sharing of information and actions, especially when these relate to international airspace and maritime issues. Reviews by the UK Space Agency/DfT/DSIT/CAA will take place annually, with the next review due February 2024.

The programme will also ensure that delivery criteria for future grants will strengthen standards of monitoring processes with clear lines of accountability, ensuring that operators have clear accountability for reporting and resolution of non-compliance through grant terms and conditions.

Next Steps

The lessons learned in this report are drawn from the collective experiences of all contributing stakeholders preceding, and including, the first commercial pathfinder launch from the United Kingdom in January 2023. The excellent collaborative nature in which these stakeholders worked to resolve issues during this period, and subsequently in producing these lessons learned, is a clear indicator as to the health and ambitions of the UK space sector.

Part of the continual improvement process, these lessons learned draw on several cross-cutting themes, from regulation to international agreements, and from communication and escalation protocols to knowledge sharing. The recommendations identified under these themes have been agreed by the contributing stakeholders and ownership assigned.

Whilst acknowledging that work is already underway or complete for several key recommendations, progress against each remaining action will be monitored via the programme's formal governance structure and through planned assurance activities.

By listening to our fellow stakeholders and the wider space sector, and implementing the framework to act on these valuable inputs, the UK is in a stronger position than ever to achieve the ambitions of the National Space Strategy including progressing towards the pathfinder launches from SaxaVord and Sutherland in 2024.



Artist's impression of launch from SaxaVord Spaceport. Credit: Shetland Flyer Aerial Media