

CAA Operational Assessment (Limited)

Background

Virgin Orbit (**VO**) (the sponsor) is a launch operator, which is seeking to achieve the first rocket launch to space from the UK this year, departing from Spaceport Cornwall. The system comprises a carrier aircraft (a modified B747 known as Cosmic Girl) and a rocket (known as Launcher 1 (**L1**)) carried on the fifth pylon of Cosmic Girl.

This temporary Airspace Change Proposal (**ACP**) seeks to establish five temporary Danger Areas (**DAs**) around the launch site (off the southern coast of Ireland) and the recovery site (off the West coast of Portugal), to enable L1 to deliver satellites into orbit. Establishment of the temporary DAs would allow L1 to be launched from Cosmic Girl from a known safe environment of pre-defined dimensions with airspace management procedures in place.

The temporary DAs have been designed to meet the specific requirements of the different phases of the launch activity. Elements 1, 2 and 4 were originally proposed by the sponsor and Elements 3 and 5 were further proposed by the sponsor after receiving the UK CAA's initial safety analysis.

Operational Assessment of the Proposed Temporary DAs

1. **Temporary DA 1** – The Race-Track DA (Surface (**SFC**) to Flight Level (**FL**) 400): This temporary DA is established to provide protection for Cosmic Girl (with L1 attached) to fly a race-track profile with the launch being conducted on the second pass. The structure is big enough to contain the race-track manoeuvre and has an 11 nautical mile (**nm**) buffer added.
2. **Temporary DA 2** – Rocket Ignition (SFC to Unlimited): This temporary DA is established to provide protection from the launch and is aimed at containing both nominal and non-nominal events. The dimensions of this temporary DA have been assessed by the CAA Commercial Space Team and been deemed appropriate to contain the hazard.
3. **Temporary DA 3** – Transit DA (SFC to Unlimited): This temporary DA is established to join Temporary DAs 2 and 4 to provide additional protection from the launch and aimed at containing debris in the event of a non-nominal event. The dimensions of this temporary DA have been assessed by the CAA Commercial Space Team. In the absence of being able to implement mitigating air traffic procedures within this area, this temporary DA has been deemed necessary by the CAA Airspace Regulation Team and its dimensions have been deemed appropriate to contain the hazard by the CAA Commercial Space Team.
4. **Temporary DA 4** – Stage 1 and Fairing Splashdown (SFC to Unlimited): This temporary DA is established to provide protection from the debris fall from the Stage 1 and Fairing Splashdown. Its purpose is to contain the debris fall (to encompass a 6 σ statistical analysis for debris fall) with an additional 10 nm buffer applied. The dimensions of this temporary DA have been assessed by the CAA Commercial Space Team and been deemed appropriate to contain the hazard.
5. **Temporary DA 5** – Stage 1 and Fairing Splashdown Continuation (SFC to Unlimited): This temporary DA is established to provide additional protection from the launch and its purpose is to contain debris in the event of a non-nominal event. In the absence of being able to implement mitigating air traffic procedures within this area, this temporary DA has

been deemed necessary by the CAA Airspace Regulation Team and its dimensions have been deemed appropriate to contain the hazard by the CAA Commercial Space Team.

The five temporary DAs would be notified through Aeronautical Information Circulars (**AICs**) for a period of 90-days and are planned to be activated on one occasion within that period, for a duration of approximately 1-2 hours. We note that the launch will occur post 2200 UTC to minimise its impact on other airspace users within the North Atlantic (**NAT**), which will be taken into account when the CAA considers whether to approve/recommend activation of the temporary DAs.

The target launch date is not before 6 October 2022 with backup dates of 7 and 8 October 2022. However, the sponsor acknowledges that these dates may need to be pushed back for operational reasons and so will be seeking a 3-day launch window between 6 October 2022 and 6 January 2023. Before the launch window can be finalised the CAA will need to make the further decisions referred to below.

In summary, the launch of L1 is proposed to be conducted within a series of temporary DAs in the SHANNON, SHANWICK, MADRID, LISBOA, and SANTA MARIA and CANARIAS Flight Information Regions (**FIRs**) / Upper Information Regions (**UIRs**) and the Shannon Oceanic Transition Area (**SOTA**). The temporary DAs are needed to provide a suitable airspace construct that covers the site of the VO launch and recovery.

Timing and Scope of the CAA's Operational Assessment and Decision

The Aeronautical Information Regulation and Control (**AIRAC**) is a 28-day cycle that manages the updating of aeronautical information globally. The days that information changes become operational (known as effective days) are internationally pre-determined.

The proposed operation requires aeronautical information to be published by Irish, Spanish and Portuguese National Aviation Authorities (**NAAs**) in their respective Aeronautical Information Publications (**AIPs**). The UK CAA has assessed the proposed airspace design in accordance with its functions, duties and published process for considering a temporary airspace change of this nature in airspace managed by the UK. The other NAAs will consider the CAA's assessment before deciding to promulgate the airspace design proposed by the sponsor and considered in this assessment. (The same process will be followed in respect of any decision to activate the temporary DAs.)

In accordance with the AIRAC publication cycle, a launch date in October would require an application for the coordinates associated with the airspace change to be submitted by 12 August 2022. This would result in the publication of the coordinates in the relevant AIPs on 22 September 2022, enabling activation by Notice to Aviators (**NOTAM**) for a launch in October 2022.

In order to meet these internationally recognised timeframes for a target launch date in October 2022, the CAA has conducted a Limited Operational Assessment of the temporary ACP. The CAA's airspace regulation assessment at this stage is confined to the safety of the structure and dimensions of the proposed temporary ACP (i.e. whether the proposed airspace construct is sufficient from a safety perspective to contain any hazards, for both nominal and non-nominal events, and thereby maintains a high standard of safety). At this stage and for the purpose of this limited assessment, the CAA has not considered any other aspects it would normally consider before agreeing or not to a proposed temporary ACP such as the operational procedures of the launch (notification, activation and management).

Further analysis and engagement activity is being carried out by the sponsor in relation to those elements. This assessment only relates to the dimensions of the temporary DAs. At a later date,

when that further work has been provided to the CAA, the CAA will assess whether the dimensions of the temporary DAs remain fit-for-purpose and whether activation of the temporary DAs can be approved/recommended. Before making any decision to activate/recommend activation, the CAA will consider all the aspects of the proposal including its impacts.

If material provided to the CAA after this assessment results in any changes needed to the structure and dimensions of the temporary DAs, the CAA will withdraw any decision made as a result of this assessment and will consider the proposed structure and dimensions afresh in a new decision.

Safety Assessment

The sponsor is required to present statistical data demonstrating that the proposed dimensions of the structure are suitable to contain the launch activity, under both nominal and non-nominal conditions. The required expertise to evaluate that evidence is held by the CAA's Commercial Space Team and, as such, it was agreed that this evidence would be provided directly to them for analysis. The CAA's Airspace Regulation Team has considered the assessment of the CAA's Commercial Space Team to reach a view on whether the proposed ACP will maintain a high standard of safety.

The data provided to the CAA Commercial Space Team has been assessed and has led to a number of discussions with the sponsor, the CAA and the Federal Aviation Administration (**FAA**) to fully understand the safety risks associated with the launch activity. The airspace structure has undergone several redesigns in response to those discussions to ensure suitable risk mitigation including the following:

The sponsor demonstrated that the dimensions of temporary DAs 2 and 4 are sufficient to satisfy FAA licencing requirements to contain any risk presented by a launch, for both nominal and non-nominal events, to 1×10^{-6} or greater. The Flight Safety Analysis (**FSA**) methodology applied by the sponsor corresponds with the temporary DAs requested, is consistent with good practice and therefore is considered by the CAA to represent an appropriate approach to generating hazard areas.

However, the CAA Airspace Regulation Team identified a residual risk between the temporary DAs 2 and 4 and beyond temporary DA 4 that was not addressed with these hazard areas. It is noted that further operational measures can in some circumstances be implemented in areas with residual risks to mitigate such risks including limiting flight trajectories through the area, reducing the overall volume of traffic transiting those areas, not permitting aircraft to loiter within those areas and not permitting airports to be actively handling departures and arrivals. These measures are typically applied where possible in the US within the 1×10^{-7} risk contours. However, such measures have not been proposed for the airspace design for the space flight activity which is the subject of this decision. Further long-term and international work could result in these measures being developed and so available for use in European airspace in future space flight activity. In the absence of these mitigating measures and to further reduce these residual risks so as to maintain a high standard of safety for the sponsor's upcoming launch, temporary DAs 3 and 5 have been introduced to contain the 1×10^{-7} risk contours.

Temporary DA 1 was proposed by the sponsor to provide protection for Cosmic Girl (with L1 attached) to fly a race-track profile, based on the proposed flight path and race-track manoeuvre with an 11 nm buffer added. The CAA is content that the dimensions of temporary DA 1 are suitable from a safety perspective.

From an operational assessment perspective, it is recommended that the structure and dimensions of the temporary ACP be approved by the CAA/recommended to the relevant NAAs for notification but subject to the following:

1. This decision is limited to the safety of the structure and dimensions of the temporary ACP.
2. This decision has been made on the basis of the information provided to date. If material outstanding at the time of this assessment results in any changes to the structure and dimensions of the temporary ACP or if subsequent information changes the nature of the operation such that the dimensions of the temporary DAs considered in this assessment are no longer suitable:
 - a. the CAA will not approve/recommend activation of the temporary DAs;
 - b. a decision will be made to withdraw this decision; and
 - c. a new or amended ACP proposal on the acceptable dimensions of any temporary DA will be considered.
3. In any event, a separate CAA decision is needed before activation of the temporary DAs can be approved/recommended.

Operational Assessment Sign-Off	Name	Signature	Date
Operational Assessment and recommendation completed by Airspace Regulator (Technical)	[REDACTED]	[REDACTED]	12 Aug 2022
Operational Assessment approved and recommendation reviewed by Manager Airspace Regulation	[REDACTED]	[REDACTED]	12 Aug 2022

Manager Airspace Regulation Comments:

Cognisant this approval is only considering the dimensions of the proposed structures and rationale for their use, I am content to recommend their submission into the Aeronautical Information Management System is approved. This approval is required to enable the structures to be submitted with sufficient time for notification. Resultant activation and use of these structures will be subject to a separate CAA regulatory decision. Noting that some of the structures described within this temporary ACP are outside of UK responsibility, these structures have been separately approved for notification by Ireland, Portugal and Spain as required. It is important to note each State retains responsibility for approving any subsequent activation of a structure within their delegated airspace.

The dimensions of the proposed structures within this ACP bound the areas with the calculated risk contours of 1×10^{-6} and 1×10^{-7} . It is noted that the FAA routinely utilise different assured processes to mitigate risks within the 1×10^{-7} risk areas. However, at the current time, those assured processes are not developed within the UK and may be impractical to implement within the timeframe for this launch when considering the complexity of cross-border operations. This proposal therefore represents a safe alternative and is reflective of a necessary and logical approach to the introduction of a 'new type of airspace user' within UK airspace. Extraordinary collaboration with neighbouring States has been at the heart of this ACP, where further development of this ACP will be dependent upon this collaborative approach.