UK Civil Aviation Authority

Guidance for launch and return operator licence applicants and licensees

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Introduction

1.1 This guidance document explains how to apply for a launch operator licence or return operator licence under the Space Industry Act 2018 (SIA). It tells you about how we will assess your application and how long an application can take. It also summarises the duties you will have as a launch operator or return operator licensee, if your application is successful.

1.2 A launch operator is the organisation responsible for managing the **launch of a rocket or other craft that is intended to operate above the stratosphere**. That could be a rocket ("launch vehicle") that would be launched vertically, a balloon carrying crew or passengers, or a rocket that is carried on a spaceplane or carrier aircraft, to be released at a high altitude.

1.3 Any organisation wishing to carry out such launches from the UK or its territorial waters must obtain a **launch operator licence**. You can apply for a licence for a single launch or for a series of launches.

If you want to launch a rocket in the UK that is **not** intended to operate above the stratosphere, you do not need to get a launch operator licence. Instead, you may need to get a large rocket[1] permission under the Air Navigation Order. For more details on this process, read our Guidance to applicants on large rocket launch permissions under the Air Navigation Order (CAP2194).

1.4 A launch operator licence can also cover the return to earth in the UK, or in UK territorial waters of the same launch vehicle or any parts of it that are not intended to remain in space.

1.5 If you want to return a rocket or other craft that was launched into orbit from outside the UK to land in the UK or its territorial waters, you need a **return operator licence.**

1.6 The requirements for applying for a launch operator and return operator licence are similar. However, prospective launch operators are expected to provide considerably more information in support of their licence application. They also have more duties as licensees.

[1] Schedule 1 of the Air Navigation Order 2016 (as amended) defines a "large rocket" as meaning a rocket of which the total impulse of the motor or combination of motors is more than 10,240 Newton-seconds

Human spaceflight

1.7 There are also additional requirements for any organisation that intends to conduct human spaceflight, whether involving trained crew or carrying passengers (referred to in the Space Industry Regulations as spaceflight participants). These are discussed in separate sections of this guidance.

If you have questions about any of the matters covered in this guidance document, please contact the CAA spaceflight team, by emailing commercialspaceflight@caa.co.uk.

Requirement to obtain a licence

1.8 Under the SIA, if you want to carry out space activities, suborbital activities, and associated activities in the UK, you must get a licence.

1.9 There are different types of licence covering different activities. In addition to the launch operator licence and return operator licence:

- If you want to operate a space object (such as a satellite) in orbit, or conduct other activity in outer space, then you need an **orbital operator licence**. The most common example of activities that would be licensed under an orbital operator licence are the procurement of a satellite launch and the operation of a satellite.
- If you want to operate a spaceport, then you need a **spaceport licence**
- If you want to provide range control services in relation to spaceflight activities, then you need a **range control licence.**

1.10 If you want to carry out different licensed activities – for example, to launch a launch vehicle carrying a satellite or other space object and operate that object in space – you will need to apply for both a launch operator and orbital operator licence.

How to get a licence

1.11 To get any of these licences, you need to apply to the Civil Aviation Authority (CAA). We are the UK's spaceflight regulator. There is no charge for applying for a launch operator or return operator licence.

1.12 The application process is slightly different for each licence type, but there are some core requirements. This is summarised in our guidance document Space Licensing in the UK.

1.13 This guidance document explains how to apply for a launch operator or return operator licence and what information you have to provide. It also tells you about how we will assess your application and how long an application can take.

1.14 This document is written for people and organisations applying for a launch operator or return operator licence. Because the launch operation is at the core of spaceflight activities, some of this guidance may also be of interest to applicants for other types of licence under the SIA.

Our approach

1.15 As the regulator we enable space activities which are safe for the public, in line with UK national security and interests and meet the UK's international obligations.

1.16 To do this, we review a range of information about your organisation and the spaceflight activities you want to undertake. The information we require is set out in the Regulator's Licensing Rules. We need to understand how you propose to undertake those activities, and what steps you will take to ensure that the risks associated with the activities are as low as reasonably practicable. We know that there are lots of different potential approaches to space launches, so we examine each application individually, focusing on the outcomes you are trying to achieve and how well you demonstrate you can achieve those.

1.17 We are keen to help applicants provide the right information. So, we strongly encourage you to contact us before you apply and talk to us about your plans. In this pre-application phase, we can provide a range of support and guidance, including workshops on key aspects of the application.

1.18 Once you have applied, we are likely to ask you additional questions about your proposals. We may want to examine documentation, visit sites, see prototype launch vehicles or get demonstrations of technology and systems you propose to use. Our rights to do this are set out in the SIA and Space Industry Regulations 2021. We will treat all information you give us as commercially sensitive.

1.19 Once you get a licence, you are responsible for ensuring your spaceflight activities continue in line with your application. We will conduct regular monitoring and inspections to check everything is going as planned for your spaceflight activities. We do have enforcement powers, which we can use if we identify that anything is going ahead that was not in line with the approved plans, or where we have reasons to be concerned about safety. You can read more about what this means in chapter 6 of this guidance.

What you need to know

1.20 This document is intended for guidance only. You should read it alongside the SIA, the Space Industry Regulations and the Regulator's Licensing Rules.

1.21 For full definitions of some of the terms used in this guidance, see the SIA and the Space Industry Regulations, in particular regulation 2. However, there are some definitions elsewhere in the SIA and the Space Industry Regulations.

1.22 This guidance focuses on what applicants and licensees are required to do under the SIA and Space Industry Regulations. Depending on what activities you are planning, you will also have to meet requirements under other laws and regulatory regimes. It is your responsibility to identify which other regulatory requirements apply to your operations. During the pre-application phase, we can highlight some other issues that may be relevant to your activities, but we can't advise you on how to meet other regulators' requirements.

1.23 Because the majority of space launches and landings may affect other airspace users, it is highly likely that you will need to apply for an airspace change, temporary restriction or Temporary Danger Area (TDA). Some proposals will need to be consulted on, and there may be fixed dates that determine when a change can be formally notified. Other national authorities may also need to be involved. It could take longer to successfully apply for an airspace change or restriction than for the space licence itself. The process to apply for an airspace change is managed by the CAA's Airspace Regulation Team and is set out in more detail in CAP1616 Airspace Change.

Chapter 2

Applying for a launch or return operator licence: overview

2.1 When you are applying for either a launch operator or return operator licence, the core requirements are broadly similar, particularly around organisational information and safety.

2.2 However, our regulatory approach is designed to be proportionate to the risks of the proposed activities. Therefore, while all applicants must provide sufficient information so that we are satisfied that all relevant criteria are met, it is likely that most applicants for a return operator licence will not have to provide as much information in support of their application as most applicants for a launch operator licence.

2.3 The Space Industry Regulations refer to both launch and return operators as "spaceflight operators". In this guidance, the term "spaceflight operators" is only used where a requirement is applicable to both licence types.

What you will need to do

2.4 When applying for a launch or return operator licence, you will need to:

- read and comply with the Regulator's Licensing Rules (CAP 2221) which tells you what information is required for each licence type.
- complete the standard online application form, including providing details of your company's legal status, financial and technical resources. The form is available through https://portal.caa.co.uk/. You have to register with the CAA to get access to the portal. For more details of what is required in completing this standard form, read the separate guidance on Applying for a licence under the Space Industry Act 2018 (CAP2209).
- conduct a **flight safety analysis** and a **ground safety analysis** for your proposed activities.
- produce and submit a **safety case**, incorporating the flight safety analysis and ground safety analysis, that meets the requirements detailed in regulation 29, including to:
  - describe in full the type of launches and/or landings you propose to conduct
  - identify the major accident hazards that could arise during licensed activities, including in the testing and integration of the launch vehicle, the handling and storage of hazardous materials, and any testing and preparation for launches, as well as during spaceflight

- assess the likelihood of major accidents arising from these hazards
- describe the control and mitigation measures you would take, including how you will work with other licensees, to ensure that the risks identified are as low as reasonably practicable (ALARP).

- compile a safety operations manual, that includes all the information listed in Schedule 5 of the Space Industry Regulations.
- submit a draft cyber security strategy, and the risk assessment on which it is based. These should not be submitted via the CAA's online portal. Please contact commercialspaceflight@caa.co.uk to arrange how your information will be delivered to the security assessment teams.
- confirm any radio frequencies and powers.
- provide evidence of engagement with insurers to secure sufficient cover for your licensed activities. The requirements for this are set out in a separate guidance document, Guidance on liabilities and insurance (CAP2218).
- provide specific information about your company Board of Directors (if there is one), executive officers and the people who will fulfil certain key roles in your operations, referred to in the SIA as "prescribed roles".

Additional requirements

For applicants for a launch operator licence

2.5 In addition to the requirements above, applicants for a launch operator licence must also:

- undertake an **assessment of environmental effects**. The requirements for this are covered in a separate guidance document, Guidance for the assessment of environmental effects (CAP2215)
- submit an operator security programme, plus the risk assessment on which this is based. These should not be submitted via the CAA's online portal. Please contact commercialspaceflight@caa.co.uk to arrange how your information will be delivered to the security assessment teams.

2.6 Launch operator licensees must also, before they start their licensed activities, provide us with details of the person who they propose to appoint as training manager for us to approve. If you have already identified the person, you can do this alongside your application.

For applicants for a return operator licence

2.7 If you are applying for a **return operator licence**, and your proposed activities may give rise to an issue of national security, you must also:

- provide details of the person who you would appoint as security manager

- submit a draft site security programme, plus the risk assessment on which this is based.

2.8 Broadly, return operations are likely to give rise to issues of national security where:

- sensitive or classified information is involved, or
- where the operator, the asset being licensed, or the mission management facility are designated as critical national infrastructure.

For applications to launch, or land, on a ship

2.9 If you are proposing to launch, or land, a vehicle on a ship or platform in UK waters, or to control sub-orbital activities from a ship, you must also provide:

- the precise proposed location of the ship or platform when the activities would take place
- the flag of the ship
- the nationality of the operator.

If you are considering using a ship or platform in this way, you are strongly advised to contact the CAA spaceflight team about your proposals as early as possible, by emailing commercialspaceflight@caa.co.uk

For launch operator licence applicants who wish to conduct missions involving human spaceflight

2.10 If you are applying to conduct missions involving either flight crew or spaceflight participants, there are additional requirements you must address in your application. These vary depending on the nature of your proposed operations.

2.11 All applicants for a launch operator licence who are proposing to conduct missions involving human spaceflight must complete a **risk assessment**, in line with regulation 32, and submit a written record of it.

2.12 You must also demonstrate how you would meet the safety requirements for launch vehicles with human occupants set out in regulations 106 to 123 that apply to your proposed operations.

Pilot licences

2.13 If you are applying to conduct launches using a carrier aircraft, then:

- each member of the aircraft flight crew must hold a CAA or International Civil Aviation Organization (ICAO)-compliant commercial pilot's licence with instrument rating, and
- the aircraft engineer must hold a relevant aircraft engineer's licence issued by the CAA, or an ICAO-compliant equivalent.

2.14 If you are applying to conduct launches using a piloted balloon, then the balloon pilot must hold a CAA or ICAO-compliant commercial pilot's licence for balloons.

If you are seeking a licence for launches involving human spaceflight, we strongly recommend you contact us as early as possible to discuss your proposed operations. Email commercialspaceflight@caa.co.uk.

Working with other licensees

2.15 When applying for a spaceflight operator licence, you will need to work with other licensees or licence applicants and include relevant details about them and their operations in your application. In particular, these details will be relevant to your safety case.

2.16 In your application for a launch operator licence, you must:

- state which spaceport you propose to use for launches and returns (including if these are different) and include relevant details of the spaceport licensee or licence applicant
- describe any range control services that would be needed to support your operations. If you have selected the range control service provider that you propose to use, the safety case must include their details
- provide details of the types of payloads you would carry, if you are intending to conduct such operations. Each payload carried on a launch vehicle must be covered by an orbital operator licence (UK-based satellite operators) or Procurement of Launch licence (non-UK operators). If you know any of the relevant orbital operator licensees, you should include these within your application.

2.17 In addition to these specific details that should be included in launch operator licence applications, applicants for either a launch operator licence or return operator licence may also wish to obtain information from the other licensees/applicants that could be relevant to your safety case.

2.18 Though there is likely to be some overlap between a spaceflight operator's safety case and a spaceport's, they should not be the same. This is because each organisation has to identify and respond to different risks in demonstrating how they will make the overall risk of their operations ALARP.

Use of agents

2.19 If you are considering using an agent – i.e. a third party to carry out specific activities on your behalf – you must provide details of them in your application, including:

- a detailed description of the spaceflight activities that the agent will carry out and evidence that the agent is capable to carry out the activities, and

- any applicable agency contracts.

2.20 If you use an agent, you are ultimately responsible for ensuring the agent can provide the specified services to the correct specification and service level agreed.

How we assess your application

2.21 We can grant a licence as we see fit, but **only** if we are satisfied that the proposed activities:

- will not jeopardise public health or the safety of persons or property
- will not undermine national security
- will not compromise the UK's ability to carry out its obligations under the various international treaties and agreements that govern space activities, including treaties regarding the responsible use of space, or otherwise impact on UK national interests.

2.22 To assess these matters, we examine the information you provide in your application. We can also request further information or clarification in the course of the assessment.

2.23 For example, we use the information you provide in your application to confirm your organisation has the technical and financial resources to conduct the proposed spaceflight operations. We then examine the safety case and safety operations manual to determine whether your proposal has managed the risk of conducting those operations to as low as reasonably practicable (ALARP) and that the residual risk is acceptable.

2.24 Where necessary, we can ask you to revise aspects of your safety case, on an iterative basis, to address additional major accident hazards or to adopt additional mitigation measures, before we grant a licence.

2.25 We can also place conditions on a licence. These could, for example, require you to put in place specific measures or undertake specific actions before any launches can go ahead. We will inform you of the conditions we propose to place on your licence before the licence is issued, so that you can comment on them.

2.26 As part of assessing your application, we will need to consider how your proposed activities may impact other countries. This may require state-to-state agreements to allow the activity to take place. You can simplify the process by planning flight trajectories to avoid crossing another country's sovereign airspace where possible, and by avoiding planned depositions in another country's exclusive economic zone (EEZ).

2.27 The **minimum** time we require to determine a launch operator or return operator licence application is nine months from the submission date. However, if any of

the required information is missing, or we ask you to revise the safety case because we cannot be satisfied that all risks have been reduced to ALARP, we will stop the clock while we wait for your response.

Granting a licence

2.28 We will write to you to inform you of our decision.

2.29 If your licence has been granted, you will be sent the licence (electronic or paper format). The licence will set out any conditions we have placed on the licence. We will also provide written reasons for including those conditions.

2.30 We will also send you a reporting plan to support our ongoing monitoring of your licensed activities. The reporting plan will detail what information you are required to send us and when. This is in addition to general reporting requirements under the SIA and Space Industry Regulations. Further details of these general reporting requirements and the other duties you will have as a licensee are set out in our separate guidance document Working with the regulator as a licensee under The Space Industry Act 2018 (CAP2214).

2.31 If your application has been refused, we will write to you to confirm this and explain why. Under section 60 of the SIA and Schedule 10, you can appeal against:

- a decision to refuse an application for a licence
- a decision to grant a licence subject to conditions.

2.32 The Space Industry (Appeals) Regulations apply in such cases. For further details, see the separate document Guidance on appealing decisions made under the Space Industry Act 2018 (CAP2216).

Duties after you get a licence

Launch operators

2.33 If you are granted a **launch operator** licence, there are additional things you must do to remain compliant with that licence. These include:

- securing insurance cover for your operations, that meets the level / requirements we stipulate
- carrying out your spaceflight activities safely, in accordance with the safety case
- reviewing the safety case on an ongoing basis and informing us of certain proposed changes **before** they are implemented

- providing us with specific information relating to the launch operations, such as details of all payloads. This refers to information that was not available, or not confirmed, at the time you applied for a licence – some of which may necessitate a review of the safety case
- operating in line with the safety operations manual, keeping it updated and ensuring all staff are aware of any procedures and requirements in the safety operations manual that are relevant to their role
- putting in place a safety management system that meets the requirements in Schedule 4 of the Space Industry Regulations
- appointing people to the prescribed roles and informing us if any of these individuals change
- testing the launch vehicle and any necessary support equipment
- ensuring the selected spaceport and range are suitable for your operations
- making adequate preparations for each launch, including checking meteorological and environmental conditions
- developing an emergency response plan, reflecting the safety case, and testing it
- maintaining appropriate and proportionate levels of security
- establishing a training programme and ensuring that all individuals involved in your operations have participated in it, to a level appropriate to their role, and have been assessed as being competent
- keeping records about your operations
- adhering to the reporting plan we will send you with your licence.

2.34 These duties are covered in chapter 6 of this guidance document. Some duties must be fulfilled on an ongoing basis. Others must take place shortly before a launch, during the spaceflight, or immediately after.

2.35 For operations involving human spaceflight, you must also:

- ensure all flight crew and spaceflight participants have received training relevant to their role
- obtain informed consent from each person who will be on board the spacecraft, at a relevant time before the launch
- assess the medical fitness of each person who will be on board, at relevant times before the launch.

2.36 These duties are covered in chapter 7 of this guidance document.

Return operators

2.37 If you are granted a **return operator** licence, there are additional things you must do to remain compliant with that licence. These include:

- securing insurance cover for your operations, that meets the level / requirements we stipulate
- reviewing the safety case on an ongoing basis and informing us of certain proposed changes **before** they are implemented.
- providing us with specific information relating to the return operations, such as trajectory, return location and timing and safety information. This refers to information that was not available, or not confirmed, at the time you applied for a licence – some of which may necessitate a review of the safety case
- operating in line with the safety operations manual, keeping it updated and ensuring all staff are aware of any procedures and requirements in the safety operations manual that are relevant to their role
- putting in place a safety management system that meets the requirements in Schedule 4 of the Space Industry Regulations
- appointing people to the prescribed roles and informing us if any of these individuals change
- developing an emergency response plan, reflecting the safety case, and testing it
- maintaining appropriate and proportionate levels of security
- establishing a training programme and ensuring that all individuals involved in your operations have participated in it, to a level appropriate to their role, and have been assessed as being competent
- keeping records about your operations
- adhering to the reporting plan we will send you with your licence.

Legislative background

SIA

2.38 Under section 9 of the SIA, any applicant for a launch operator (or return operator) licence must:

- assess the risks to those taking part in the activities in a prescribed role or capacity, and

- take all reasonable steps to ensure that risks to the health, safety and property of persons who aren't acting in a prescribed role or capacity are acceptable and as low as reasonably practicable (ALARP).

When you apply for a launch operator licence, you must satisfy us that you have met these requirements. The Space Industry Regulations set out further details on what applicants must do (particularly in Part 4 of the Space Industry Regulations, as referenced below).

2.39 Section 11 of the SIA sets the requirement for any applicant for a launch operator licence to conduct an assessment of environmental effects, as part of their application. This is covered in more detail in separate guidance.

2.40 Sections 17 and 18 of the SIA focus on the individuals who are to take part in spaceflight activities.

- Section 17 sets out the principle that persons taking part in the activity in prescribed roles and capacities must sign their consent to accept the risks involved and meet prescribed criteria with respect to age and mental capacity. You must not allow anyone to take part in spaceflight activities unless they give such informed consent.
- Section 18 is related to ensuring that individuals involved are suitably trained and medically fit.

Space Industry Regulations 2021

2.41 Part 4 of the Space Industry Regulations is titled "Grant of a spaceflight operator licence – risk". It sets out the requirements for applicants for launch operator or return operator licences to:

- conduct a flight safety analysis and a ground safety analysis for their proposed activities
- produce a safety case, that reflects these analyses and includes all the information listed in Schedule 1
- develop a safety operations manual that includes all the information listed in Schedule 5
- take certain steps to assess risks identified by the flight safety analysis and ground safety analysis
- if the proposed activity includes human occupants flying on board a launch vehicle, conduct a risk assessment to evaluate the risks to the health and safety of human occupants and define measures to reduce or eliminate those risks.

2.42 Part 8 of the Space Industry Regulations addresses the duties of a licensee once a licence is granted. It includes the safety duty and requirements for licensees to:

- retain and review the safety case on an ongoing basis
- produce the safety operations manual and distribute it to all personnel
- put in place a safety management system that meets the requirements in Schedule 4
- make all necessary preparations for a launch
- have suitable arrangements for monitoring and, if necessary, terminating a flight.

2.43 It also sets out the responsibilities of any flight crew or remote pilot, flight termination personnel, the accountable manager, launch director and the safety manager.

2.44 Part 7 of the Space Industry Regulations and Schedule 3 cover the requirements for training and qualifications for a range of key roles in relation to launch operations, including the requirements for:

- the training manager
- the launch director
- the flight termination personnel, in circumstances where such personnel are necessary
- any flight crew and remote pilots (for launches involving human spaceflight)
- the engineer (for launches involving a suborbital aircraft).

2.45 This part also sets out the duty of the licensee to ensure that any spaceflight participants are medically fit to fly and describes medical fitness requirements for personnel in non-flying key roles.

2.46 The requirement to obtain informed consent from all human occupants of a launch vehicle is detailed in Part 12 of the Space Industry Regulations, which also sets out what information spaceflight operators must give prospective occupants so that those occupants can give informed consent.

2.47 Security requirements for all licensees are detailed in Part 11 of the Space Industry Regulations.

Other relevant legislation

2.48 For launches involving carrier aircraft, UK aviation legislation will apply to those aircraft as far as possible. This is examined further in the section on carrier aircraft in chapter 4 of this guidance.

2.49 In addition, other legislation / regulation may be relevant to launch operations and the safety case, such as:

- The Control of Major Accident Hazards Regulations 2015 (COMAH), which relate to the storage and safe handling of chemicals and explosive materials
- The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR)
- The Explosives Regulations 2014.

2.50 It is your responsibility to identify which regulations apply and to understand how any of these apply to your proposed operation.

2.51 During the pre-application phase, we may be able to highlight some other regulations that may be relevant to your activities, though we can't advise you on how to meet other regulators' requirements.

Chapter 3

Applying for a spaceflight operator licence: safety requirements

3.1 This chapter provides guidance on the following elements of an application for a spaceflight operator licence:

- flight safety analysis
- ground safety analysis
- safety case
- safety operations manual.

3.2 You are required to submit a safety case to us, as part of your application, that:

- explains the major accident hazards and risks to people and property from the proposed operations and how you have identified them, and
- demonstrates the steps you have taken, or will take, to manage those risks so that they are acceptable and as low as reasonably practicable (ALARP).

3.3 This is the core document that we use to assess the safety of your operations. It should be proportionate to the level of risk.

3.4 To enable you to develop a robust safety case, you must first develop sufficient understanding of the risks associated with the proposed spaceflight activity. This is the purpose of the flight safety analysis and ground safety analysis. The requirement to conduct these analyses is part of how a common risk management approach has been built into the UK's space regulatory framework.

3.5 Regulation 28 sets out what steps you must take for each identified hazard. These steps are very similar for both the flight safety analysis and ground safety analysis but are applied to different activities and different hazards. The outputs from these steps form the evidence base for the safety case.

Flight safety analysis

3.6 The flight safety analysis is the process of identifying the major accident hazards for the proposed spaceflight activities and then assessing their likelihood of occurring. It must be undertaken for both normally operating and malfunctioning operations, for all phases of the flight, from lift-off to re-entry of all spent stages, boosters, fairings or other discarded equipment.

3.7 In the case of a launch operation using a carrier aircraft, the flight safety analysis should include:

- the take-off and transit phases of the launch operation, and
- in the event of a failed release of the launch vehicle, a return to base and landing of the carrier aircraft with the launch vehicle still attached.

Identifying major accident hazards

3.8 Under regulation 26, you must consider the possible major accident hazards that could result from any of the following activities that you wish to be licensed to conduct:

- launching a launch vehicle
- launching a carrier aircraft
- operating the launch vehicle or a carrier aircraft to
  - carry a spaceflight participant
  - carry a payload until its release or separation from the launch vehicle
  - carry out sub-orbital activities, or
  - return to earth and complete its flight

including orbital activities only in so far as they are necessary to complete such an assignment.

3.9 As a minimum, you must consider the potential for the following hazards (listed in Schedule 1 paragraph 18(1) of the Space Industry Regulations) in these activities:

- blast overpressure
- fragmentation debris
- thermal radiation
- toxic release
- major accident hazards arising from:
  - any discarded part of the launch vehicle and any object, including any payload, released or separated from the launch vehicle
  - collision with a space object
  - meteorological or environmental conditions
  - the use of a carrier aircraft (if applicable)

- re-entry of the launch vehicle or any part of it from orbit (if applicable).

3.10 The accident scenarios you consider should reflect the spaceflight activity proposed. For example, an unguided, single-stage suborbital sounding rocket does not necessarily involve the same major accident scenarios as a multi-stage, guided orbital launch vehicle with multiple satellite payloads.

Identifying conditions

3.11 As set out in regulation 28, once you have identified the relevant major accident hazards for your operations, you must then identify any conditions required for the hazard to be realised.

3.12 For example, a possible major accident hazard is the impact of debris from the break-up of the launch vehicle during flight. The wind velocity (direction and speed) will affect the distance debris travels during freefall; therefore, you should consider the impact of different wind conditions for this major accident hazard, as well as any others that could be affected by the wind velocity.

Identifying causes

3.13 The next step is to identify what could cause or contribute to a hazard. Causes could be processes, physical effects or human factors.

3.14 Using the same example of debris from the break-up of the launch vehicle during flight, there may be multiple potential causes, such as a manufacturing defect; a process failure such as excessive rapid propellant loading; flight termination; or a defective flow rate sensor. You should construct different major accident scenarios for each possible cause.

Assessing the likelihood

3.15 You then need to estimate the likelihood of each major accident hazard arising.

3.16 It is up to you how you do this; however, you will need to explain to us the methods you have used. Potentially relevant information could be historical launch data of the vehicle or similar vehicles, and details of system, sub-system and component reliability.

Assessing the consequences

3.17 The next step is to assess the foreseeable consequences of the major accident hazards, in terms of the impact on people and property. This step is extremely useful when building the safety case, as a basis for establishing suitable risk controls.

3.18 Your assessment of the consequences should use modelling approaches with an appropriate level of fidelity for each major accident hazard scenario you are considering. We expect you to detail the approaches you have used when compiling your safety case. We will assess the suitability of the modelling

approaches to ensure they are proportionate to the hazard and the scope of the proposed spaceflight activity.

Estimating the risk

3.19 The final step in the flight safety analysis is to bring the above assessments together to evaluate the risk of **each** major accident hazard you have identified as relevant.

3.20 The Space Industry Regulations don't specify how you must evaluate each risk e.g. qualitative, semi-quantitative, quantitative. However, regulation 26(1)(c) requires you to provide an aggregate numerical estimate of the risks of death or serious injury from all the major accident hazards you have considered as part of the flight safety analysis. This provides a quantitative assessment of the level of risk from the proposed spaceflight activities.

3.21 Estimating the level of risk from each individual hazard helps you to understand the risk profile of the proposed spaceflight activities and to identify where controls and mitigations would be best directed. For example, it can provide insight into the geographical distribution of the risk, which can be useful in understanding where hazards may impact specific populations and subsequently provides valuable insight into establishing risk controls. An example of this is using individual risk contours or grids to determine the size of hazard or risk zones around the launch pad.

3.22 The estimated risk from each hazard is useful when considering if the risk has been reduced to ALARP.

3.23 The aggregated numerical estimate is important for understanding the geographic distribution of risk (to individuals) and potential societal impacts. It provides an indication of the overall level of risk relative to other spaceflight activities, and to other industries.

3.24 Any estimation of risk includes a significant amount of uncertainty. You should consider how you account for this uncertainty in your risk estimations. Sensitivity analysis should be used to understand how sensitive the risk estimate is to the input parameters, and therefore establish where additional risk controls may be needed.

Controls and mitigation

3.25 When carrying out the flight safety analysis, you must take into account:

- the locations of individuals who could be harmed by any of the identified hazards

- your organisation's capabilities, and your nominated range control service provider's capabilities, in:
  - tracking
  - telemetry
  - communications
- how any flight safety system will be activated, if its activation is necessary
- how you will coordinate and communicate with air navigation service providers, meteorological information providers and emergency services
- any legal requirements relevant to your proposed use of airspace
- information available about any known space object with which there is a risk of the launch vehicle colliding.

3.26 For each major accident hazard assessed in the flight safety analysis, you must define the appropriate risk controls you would use to:

- prevent a major accident related to that hazard occurring, and
- mitigate the consequences if a major accident does occur

3.27 Some of these controls will be based on the matters in 3.25.

3.28 For example, a standard risk control to prevent damage to property or injury to third parties from fragmentation debris would be to work with a range control service provider. The range control service provider would help to identify the designated range, determine the extent of any zone or zones that need to be subject to restrictions, exclusions or warnings during a spaceflight operation, and potentially issue notifications to that effect.

3.29 When assessing your application, we will assess the appropriateness of the proposed controls, in relation to the nature, severity and likelihood of the risk.

Ground safety analysis

3.30 The ground safety analysis focuses on all major accident hazards that could arise on the ground during preparations for a launch, or upon or after landing.

3.31 Paragraph 19 of Schedule 1 of the Space Industry Regulations provides a minimum set of hazards that you must consider in carrying out the ground safety analysis. If any of the hazards listed in Schedule 1 are not applicable to your operations, you should make this clear in your analysis, with a justification for discounting them.

3.32 To perform it, you must follow the same six steps as in the flight safety analysis, i.e.:

- identifying major accident hazards
- identifying the conditions under which they could occur
- identifying causes
- assessing the likelihood
- assessing the consequences
- estimating the risk.

3.33 However, there are some differences in the way these steps should be applied.

3.34 The ground safety analysis should cover the period of time from when the launch vehicle or its components arrive at the spaceport, until all parts of the launch vehicle that return to the surface are known to be safe. You do not, for example, need to consider major accidents which might occur while the launch vehicle or its components were being assembled or tested before they are brought to the spaceport. On the other hand, the risk of an oxidiser explosion during propellant loading at the spaceport should be considered.

3.35 An example of a post-flight hazard could be discarded rocket stages that present a continuing hazard, even after they have returned to earth, e.g. if the stage is intact and there is a danger from any residual toxic, flammable or explosive substances or possible rupture of a pressure vessel. Similarly, if a part of the launch vehicle is to be recovered or made safe before processing for re-use, then the immediate risks of the initial recovery should be accounted for, especially where any risk is posed to third parties or persons who handle or move the part.

3.36 You do not need to include occupational health and safety concerns covered by the Health and Safety at Work Act 1974. However, there is likely to be some overlap.

3.37 All major accident hazards identified on the ground should be included in your safety case.

Applying the analysis: example

3.38 The following example is included as an illustration of how to apply the six steps of the ground safety analysis.

3.39 The applicant **identifies the major accident hazard** of a toxic release from the launch vehicle, while it is on the launch pad.

3.40 It **identifies the condition** that if the wind is from a westerly direction and above 30 knots / 15.4 metres per second, the emissions could pose a major accident hazard to a population downwind of the spaceport.

3.41 It identifies that such a toxic release could be **caused** by either the failure to attach an umbilical connector correctly, or an explosive failure during propellant loading. However, the quantity of material released is likely to be different in each scenario. It is likely that multiple controls will be in place to protect against either scenario, so multiple failures would then be required for the accident to occur. The deployment of multiple controls is a key step in demonstrating that the risk has been reduced to ALARP.

3.42 The applicant **assesses the likelihood** of the hazard resulting in a major accident. Given the controls and mitigations it has in place, it is confident that the worst-case plausible consequence is that the emissions would not result in serious casualties or fatalities, nor need any environmental response. It therefore does not conduct a quantitative assessment of the risk, and simply records a qualitative answer that the risk is low or minimal. It includes a short justification of this in its ground safety analysis.

3.43 Even though the likelihood is assessed as low, the applicant still **assesses the foreseeable consequences** of the toxic release, under the two circumstances identified at 3.41.

- It assesses the consequences of a release resulting from the failure to attach an umbilical connector correctly as minimal, because the control measures would effectively prevent any toxic emissions.
- It assesses the consequences of a release resulting from an explosive failure during propellant loading as more severe, as there would be a risk of toxic material travelling beyond the immediate area, under certain conditions. It identifies the potential consequences in further detail, in terms of the effect the toxic material released could have on neighbouring populations.

3.44 Finally, it **evaluates the risk**, whether qualitatively or quantitatively. (Unlike for the flight safety analysis, it is not mandatory for the applicant to provide a numerical, quantitative, estimate of the risks in its ground safety analysis). This evaluation then forms the starting point for the applicant to explain, in its safety case, how it will ensure that the risk is reduced to ALARP.

3.45 In this case, though the applicant has already identified a variety of control measures to prevent a potential explosion during propellant loading, it recognises the potential severity of the consequences if those measures were to fail. The risk is therefore evaluated as very high and the applicant will need to consider, in its safety case, how it can reduce it further to be ALARP.

Safety case

3.46 The safety case is the main way an applicant for a spaceflight operator licence demonstrates how the risks identified through the flight safety analysis and ground safety analysis will be managed.

3.47 The aim of the safety case is to show us that you understand the hazards associated with your proposed operations and have taken relevant steps to manage the risks arising from those hazards so that they are reduced to as low as reasonably practicable (ALARP), and that the residual risk is acceptable.

3.48 To that end, you must include in your safety case the outcome of the flight safety analysis and ground safety analysis and show how you identified hazards and assessed the risks, taking into account:

- human factors in the initiation, prevention, control and mitigation of the hazards, and
- the security risk assessment, as described in the separate document Guidance on security matters for applicants and licensees (CAP2217).

3.49 Figure 1 below shows how the flight safety analysis and ground safety analysis underpin the development of a safety case.

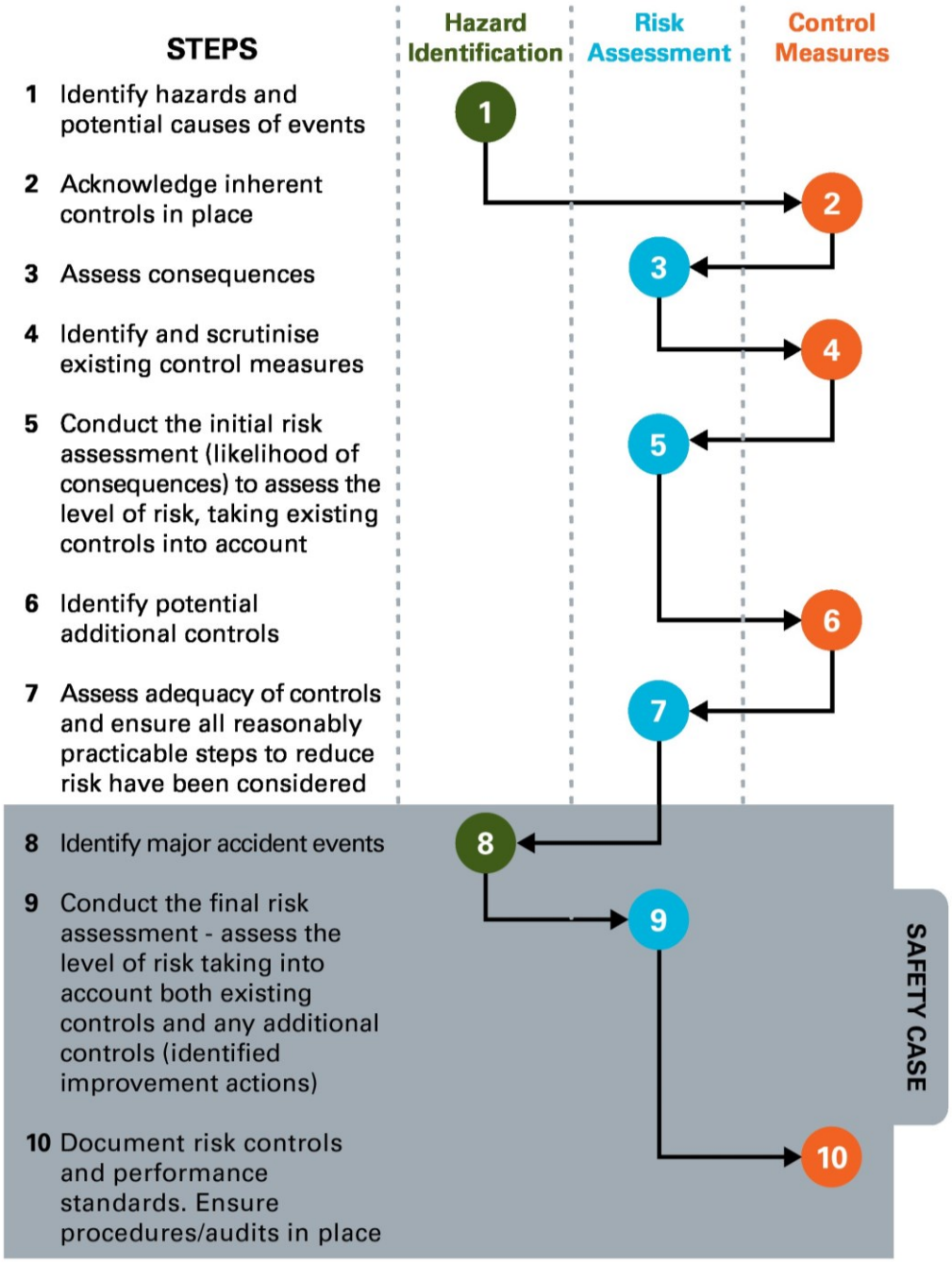

Figure 1: From flight safety and ground safety analysis to safety case

3.50 A safety case is an evolving, working process which should be referred to, and regularly updated when the operation or the context changes to assure continued safe performance of the activity.

3.51 Among other things, you will need to show that you have:

- identified all potential major accident hazards from your proposed activity

- assessed the likelihood of a major accident resulting from any of these hazards
- considered the severity of the consequences of any such major accident
- identified relevant and appropriate mitigation measures to manage those risks so that they are ALARP. These don't need to be in place at the time you're applying, but you will need to indicate how you would put them in place at the relevant time.

3.52 Your safety case should reflect your planned operations. For example, you should be clear from the outset whether your safety case is intended to cover:

- a single launch or return of a specific vehicle design
- multiple launches or returns of a specific vehicle on a specific trajectory
- multiple launches or returns of a specific vehicle using a range of trajectories
- multiple launches or returns of different vehicles using a range of trajectories

3.53 It should consider, among other matters:

- the design, construction, operation and maintenance of the launch vehicle(s)
- the design and operation of the mission(s)
- the design, construction, operation and maintenance of any installation, fuel storage or other storage facility, equipment and infrastructure connected with ground operations.

3.54 The focus of the safety case should be on the management of low-likelihood, high-severity events rather than on minor risks.

3.55 When we review the safety case, it will be an iterative process. You may be required to update the safety case and take extra steps, until you are able to provide a compelling demonstration that the risks have been reduced to as low as reasonably practicable.

3.56 Regulation 29 and Schedule 1 set out the minimum requirements for a safety case for a launch operator or return operator, but do not prescribe how you should fulfil these requirements. The guidance here is intended to help you structure your safety case and understand the type and level of detail we might need. It is based on the approaches taken in other regulatory regimes that require the submission of a safety case, and divides the safety case into four parts:

- general and technical information
- hazard identification and accident scenarios

- measures to prevent or limit the consequences of a major accident
- demonstrating that the risk is managed to ALARP (and any residual risk is acceptable).

3.57 You do not need to use this four-part structure in compiling your own safety case, but it may be a good basis.

We can offer applicants for a launch operator licence or return operator licence a safety case workshop, in which our experts talk through the requirements in more detail. Email commercialspaceflight@caa.co.uk to find out more.

General and technical information

3.58 As set out in Schedule 1 of the Space Industry Regulations, the safety case for a **launch operator** licence application must include the following information:

- a description of the launch location including any key infrastructure
- a description of the environment around the launch site and along the proposed trajectory
- a description of the launch vehicles and launch activities planned from the launch location, and any other major activities related to spaceflight (e.g. static testing)
- an inventory of all propellants and other hazardous materials that will be used as part of the launch vehicle
- details of all payloads that will be carried onboard
- if applicable, a description of any carrier aircraft to be used
- a description of the range control services needed
- a summary of the organisational structure and management arrangements.

3.59 The safety case for a **return operator** licence must include:

- details of the planned return, including a description of the location where you propose to return the spacecraft to earth, including any key infrastructure
- a description of the environment around the return site and along the proposed trajectory
- a description of the spacecraft
- an inventory of all propellants and other hazardous materials that will be used as part of the launch vehicle
- a description of the range control services needed

- a summary of the organisational structure and management arrangements.

3.60 The level of detail should be proportionate to the extent and severity of the major accident hazards identified, but sufficient to enable us to have a clear picture of the location, activities and intrinsic hazards associated with your proposed spaceflight activities.

Launch/return location and key infrastructure

3.61 The safety case must clearly identify which spaceport you propose to use and details of the spaceport licensee or licence applicant (Schedule 1 paragraph 3).

3.62 However, the description of the launch/return location requires more than simply naming the spaceport. It is likely to involve a combination of written text and appropriately scaled plans which clearly identify key infrastructure and facilities. The description should also include major items of equipment that you will need, including clarification of whether these belong to you or to the spaceport.

3.63 The focus of this description should be on what is important from the point of view of safety: in practice, this means the sources of major accident hazards and the conditions under which a major accident could happen. Reference can be made to the spaceport safety case where appropriate.

3.64 It is useful if maps and plans clearly differentiate between existing infrastructure and facilities (such as those that form part of an existing aerodrome) and any planned new infrastructure and facilities.

3.65 In addition to information about the launch location, you must also identify any site or facility other than a spaceport that has contributed or will contribute to the proposed activity (e.g. a mission control facility that is not located at the spaceport).

Environment around the site and along the proposed trajectory

3.66 You must provide a description of any areas of land or bodies of water which could be affected by a major accident during the proposed spaceflight activities. These areas will usually be those near the launch/return location and along the proposed trajectory.

3.67 Your description must include aspects of the natural and built environment as well as internal (i.e. on the space site) and external populations, particularly vulnerable populations[2] and where large numbers may gather. Similar information is likely to be needed for the assessment of environmental effects;

[2] The Health and Safety Executive (HSE) defines 'vulnerable populations' as people who require an element of care, protection or education. Examples include school children; residents of a care home; and hospital patients, among others. See www.hse.gov.uk/landuseplanning/methodology.htm

see the Guidance on the Assessment of Environmental Effects (CAP2215) for more details on what may be considered relevant.

3.68 The description should be supported by appropriately scaled maps showing the launch location, trajectory and surrounding land use within an area that could be affected by major accidents.

3.69 We will use the description to help us assess whether you have adequately considered:

- the hazards posed by the natural environment to the safe operation of your proposed spaceflight activities (e.g. impact of flooding where that is foreseeable), and
- the vulnerability of the area to the impact of a major accident.

Launch vehicles

3.70 You must provide details of the launch vehicle you intend to use, including for return operations. This must include the general information specified in Schedule 1 paragraph 2(b) and the "technical particulars" set out in Schedule 1 paragraphs 11 and 12.

3.71 The technical particulars should be presented with regard to the scope, detailed objectives and required level of safety of the proposed spaceflight activity.

Example

Information concerning the launch vehicle should provide details of the approach taken to ensure reliable functioning, the architecture chosen to establish vehicle and systems redundancy and the critical systems that will be used to ensure safety objectives and criteria are met.

We want to understand the engineering approach you have taken to satisfy your safety and utilisation philosophy over the lifespan of the vehicle and the various modes of operation, starting with ground preparation of the vehicle, through to disposal or return.

If you have adopted a particular standard (e.g. the US Range Commanders' Council (RCC) 319-19 for Flight Termination Systems commonality), you should clearly set out why the standard has been chosen, how it is to be implemented and how it is integrated into achieving the overall safety approach.

Launch / return activities

3.72 As set out in Schedule 1 paragraph 1 of the Space Industry Regulations, the safety case must include a description of the proposed spaceflight activities. The level of detail should be proportionate to the complexity of the proposed activities.

3.73 Specific dates of launch windows etc. need not be included in the safety case. However, we will need these details well in advance of the intended launch.

3.74 You must also include information concerning any previous applications for a licence, or approval to carry out spaceflight activities similar to those for which you are now applying, along with outcome of each of those applications (Schedule 1 paragraph 9). If you are applying for a return operator licence, you should also include details of the authorisation or licence you hold, or have applied for, to launch outside the UK.

3.75 If you are applying for a licence to cover multiple missions, but you don't yet know all the details of each of those missions, the safety case should contain enough information to assure us that the proposed activities could be completed safely. We are likely to request additional details closer to individual launch dates as part of our ongoing monitoring of your activities. We can also set a licence condition that certain information must be provided.

3.76 For a launch operator licence, you must include a schedule of what is required to prepare the launch vehicle for launch, setting out how long before the launch each preparatory event should ideally take place. We recognise that this is likely to be a preliminary document, with the expectation that the schedule may need to change before the launch.

Propellants and hazardous materials

3.77 Propulsion systems for launch vehicles will typically utilise liquid, solid, or hybrid (liquid and solid) propellants.

3.78 Your safety case must include a full inventory of all propellants and hazardous materials that will be stored or used as part of the launch vehicle or payload (Schedule 1 paragraph 15).

3.79 Your inventory should include:

- the classification of each material under www.hse.gov.uk/chemical-classification/legal/clp-regulation.htm; the chemical name; its Chemical Abstracts Service (CAS) registry number; and its name according to International Union of Pure and Applied Chemistry (IUPAC) nomenclature
- the hazard type of each material (if applicable – see The Explosives Regulations 2014)
- the maximum quantity of each hazardous material present or likely to be present
- the physical, chemical, toxicological characteristics and indication of hazards, both immediate and delayed, to human health

- the physical and chemical behaviour of these materials under normal conditions of use and under foreseeable accident conditions.

Carrier aircraft

3.80 If your proposed activities involve the use of a carrier aircraft, your safety case must include a general description of the carrier aircraft and its concept of operations, any payload, and the layout of systems that are part of it. This can be supplemented by diagrams where appropriate.

3.81 Chapter 4 of this guidance includes more details on the requirements relating to carrier aircraft.

Range control services

3.82 Your safety case must describe the range control services needed for the proposed spaceflight activities. The level of detail should reflect the extent to which you will rely on the range control service provider to ensure your spaceflight activities will be carried out safely.

3.83 If you have selected the range control service provider that you propose to use, the safety case must include details of the nominated range control service provider.

Organisational structure and management systems

3.84 Your safety case must also outline your organisation and management structure. This is a separate requirement to the organisational information that you must provide on the standard application form. The focus should be on the elements of the organisational structure which will support the safe delivery of your operations.

3.85 The safety case must also include a description of the safety management system. The requirements and matters to be addressed by the safety management system are set out in Schedule 4 of the Space Industry Regulations. You do not have to submit the safety management system in full, but we can ask to review it as part of assessing your application.

3.86 The focus of the description should be on how the safety management system will deliver and maintain the measures described in the safety case. Specifically, the description should cover how you propose to:

- ensure co-operation and co-ordination with any other licensees or other organisations that you will need to interact during the provision of its licensed activities
- monitor the validity of assumptions made in the hazard identification and risk assessment process

- maintain quality control and quality assurance during design, manufacture, integration and test of the launch vehicle and its elements
- continually monitor control effectiveness and the performance of the control measures
- ensure that the control measures are not compromised.

3.87 The safety case should also make reference to your quality management system, to show how it will maintain quality control and quality assurance during design, manufacture, integration and test of the launch vehicle and its elements. Again, you do not have to submit the quality management system in full, but we can ask to review it as part of assessing your application.

Hazard identification and accident scenarios

3.88 In your safety case, you need to:

- identify all potential major accident hazards related to your operations
- assess the likelihood of a major accident resulting from any of these hazards
- consider the severity of the consequences of any such major accident.

3.89 The purpose of this process is to enable you to take relevant steps to mitigate the risks, so they are ALARP.

3.90 This section of the safety case should clearly build on the flight safety analysis and ground safety analysis. It must present the main results and main arguments of the hazard analysis and assessment of the risk.

3.91 You should refer to any underlying analysis reports and source documents, in particular those which contain information on the assumptions made and criteria used. We can request to see any or all of these documents, at any time, in reviewing your application.

3.92 You do not need to submit all of the analyses you conduct as part of your safety case, which should focus on the main results. However, where an assessment is based on a specific analysis, you should refer to it. We can then ask to see the supporting evidence for your assessment.

Measures to prevent or limit the consequences of a major accident hazard

3.93 Building on your assessment, your safety case then needs to explain the measures you have adopted, or will put in place, to manage and mitigate the identified risks. These can include:

- measures related to the design, construction and testing of the launch vehicle

- measures related to the mission, its timing and trajectory, such as checking meteorological and environmental conditions and conducting Launch Collision Avoidance (LCOLA) analysis
- measures related to the management of payloads, including around engagement with payload providers and the integration of payloads on the launch vehicle
- the use of appropriate range control services
- developing relevant safety procedures and detailing how you will ensure they are followed (for example, through documenting them in a safety management system, training, communication procedures including with third parties etc.)
- installing or making available relevant safety equipment to help respond to a major accident and limit the severity. This could include firefighting equipment, tools to assist with chemical spills, etc.

3.94 In your safety case, you should describe:

- what control and mitigation measures relate to which risks – there will often be more than one measure per risk
- how each measure is expected to work
- how the proposed measures together will either prevent a major accident from occurring or minimise the impacts if a major accident did occur.

3.95 There are numerous different established approaches that can be used in identifying and assessing hazards. You could use some, or all, of the following:

- Facilitated brainstorming
- Failure Modes, Effects and Criticality Analysis (FMECA)
- Hazard and Operability Studies (HAZOPs)
- Event Trees
- Goal Structured Notation (GSN)
- Hazard Logs
- Determination of the required level of confidence for evidence.

3.96 You can find more information on these methods in the appendices to the CAA publication Guidance on the Conduct of Hazard Identification, Risk Assessment and the Production of Safety Cases: For Aerodrome Operators and Air Traffic Service Providers (CAP760).

3.97 Once you have identified the different hazards, a risk matrix can be a useful tool to define the overall level of risk for each. Such a matrix typically maps the probability of a hazard occurring against the severity of the impact if it did.

3.98 This can then help you determine which hazards need to be addressed as the highest priority and what control and/or mitigation measures you should take.

3.99 You might find it useful to consider the requirements of regulations 91 to 101 when describing these measures.

3.100 You should clarify whether a control or mitigation measure is already in place – e.g. it is part of the launch vehicle's current design – whether it would need to be adopted before operations commenced, or whether it would be put in place solely for the duration of specific activities.

3.101 We recognise that spaceflight operators may not be responsible for implementing all the control and mitigation measures; some may depend on spaceports or range control service providers. In your safety case, you should clearly set out the roles and responsibilities of each licensee regarding mitigations.

3.102 You don't have to include a comprehensive emergency response plan in your safety case: you are only required to prepare such a plan after you have got a licence, ahead of your first launch. However, in your safety case you must:

- outline the emergency arrangements that will be put in place to limit the consequence of the major accident scenarios identified, and
- indicate the responsibilities of the emergency services and of your own staff, spaceport staff and other relevant local organisations.

Demonstrating that the risk is managed to ALARP

3.103 We can only grant a spaceflight operator licence if we are satisfied that the applicant has taken all reasonable steps to ensure that the risk to public safety arising from their operations is ALARP, and that the residual risk is acceptable. Your safety case is pivotal to enabling us to do this.

3.104 As well as setting out the control and mitigation measures you are proposing to take, you should also indicate what more could possibly be done and why you have determined that these extra steps are not reasonably practicable. A useful way to set this out is by reference to the hierarchy of control and mitigation measures, as shown in Figure 2.

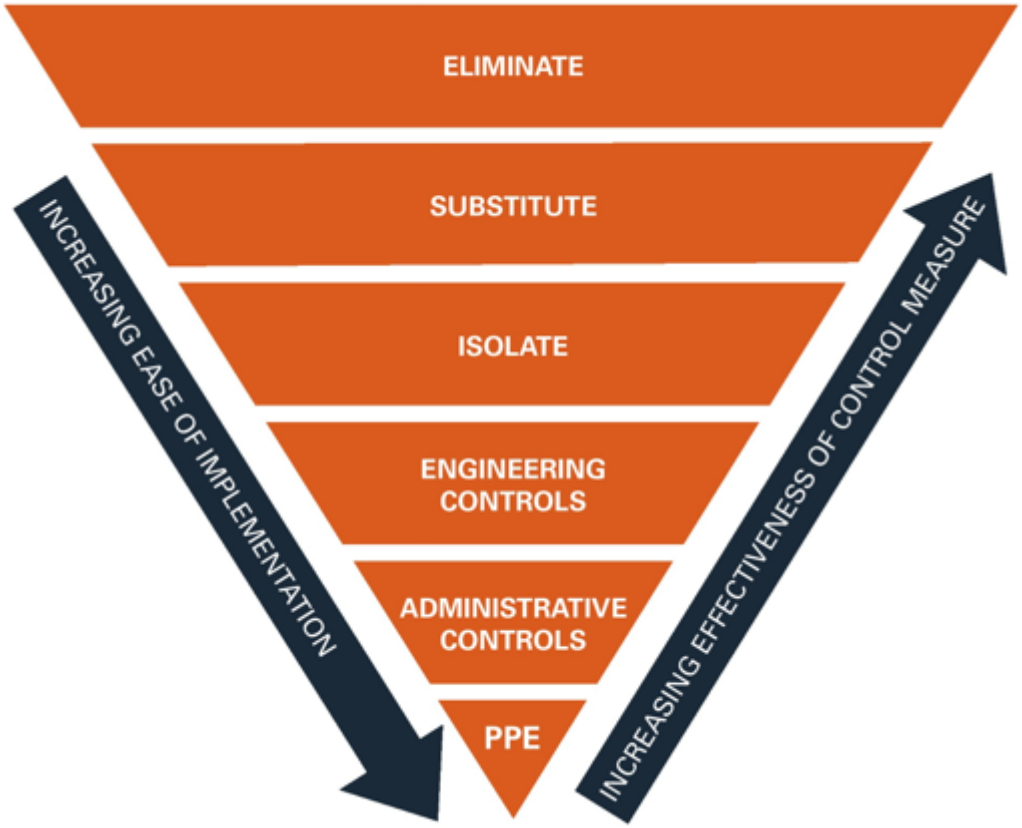

Figure 2: Hierarchy of control and mitigation measures[3]

3.105 Where you have identified additional potential measures, but chosen not to implement them, it is up to you to demonstrate that the cost of any additional measures (in terms of money, time or trouble) would be grossly disproportionate to the further risk reduction that would be achieved.

3.106 Further information on the requirements to demonstrate that the risks have been managed to be ALARP can be found in our ALARP acceptability policy (CAP2220).

Safety operations manual

3.107 All applicants for a spaceflight operator licence must submit a safety operations manual as part of their application. A draft version is acceptable at the application stage.

3.108 A safety operations manual is a document designed to be used by the operator's staff during the spaceflight activities, that includes the information, procedures and instructions necessary for those staff to carry out their duties safely.

[3] PPE here refers to personal protective equipment.

3.109 Regulation 90 and Schedule 5 set out the full requirements and minimum contents of the safety operations manual that must be developed once the licence is granted. At the point of application, it may not be possible to address all these matters. Instead, your manual should show how you will ensure safety through your operational procedures.

3.110 The document you submit should therefore show at least the structure and scope of the safety operations manual. It should detail whether it is to be made available electronically or as a printed document, and explain any link to procedures developed by the spaceport or range control provider. You should also indicate in the submitted document where the relevant content to ensure compliance with each part of Schedule 5 will be located.

3.111 If you are granted a licence, you will be required to update the safety operations manual and submit it to us within an appropriate timeframe, before you can start undertaking the licensed activities.

3.112 If for any reason you update or revise the safety operations manual after you have submitted it to us, but before a licence is granted, you must submit a copy of the revised manual to us without delay.

Chapter 4

Launch operator licence application: further requirements

4.1 This chapter summarises the additional matters that applicants for a launch operator licence must cover in their application.

Assessment of environmental effects

4.2 When you submit your application for a launch operator licence, you must include an assessment of environmental effects of your proposed launch(es).

4.3 This is a substantial task and, once submitted, your assessment of environmental effects will be subject to public consultation. You are strongly advised to begin this process as early as practical in planning your application.

4.4 There is a separate guidance document explaining more about what is required: see Guidance for the assessment of environmental effects (CAP2215).

Prescribed roles

4.5 Under Section 18 of the SIA, licensees must have suitably qualified people in specified roles relating to spaceflight activities. For a launch operator licence, these roles are:

- accountable manager
- launch director
- safety manager
- security manager
- training manager.

4.6 To help you appoint the right people for these roles, we set out the core functions of each role below.

4.7 The **accountable manager** is responsible for establishing and maintaining an effective management system, and for ensuring that your licensed activities can be financed and carried out in accordance with the provisions of the SIA and the Space Industry Regulations. The accountable manager has the authority to make final decisions on **all** aspects of your organisation and activities – meaning they have the highest level of authority when spaceflight activities are being prepared for or being carried out.

4.8 The **launch director** is the member of staff who oversees the launch, flight and other space operations of the launch vehicle. They must be present at a mission

management facility or ground control at the spaceport during your spaceflight activities. They also have a duty to check that all safety concerns reported to them have been addressed before a launch.

4.9 The **safety manager** is responsible for:

- the day-to-day development, administration and maintenance of an effective safety management system
- ensuring all aspects of your spaceflight activities are carried out safely, and
- monitoring all those involved in the spaceflight activities to ensure compliance with your safety policies and procedures.

4.10 The safety manager reports to the accountable manager.

4.11 The **security manager** is responsible for implementing your security programme. They must be an employee of your organisation, and undergo relevant UK security vetting. This means that the security manager should normally have been living in the UK for at least three years.

4.12 When you are applying for a launch operator licence, you must provide details of the individuals you have appointed, or are intending to appoint, to these roles. This includes information about their qualifications and experience, as well as confirming they meet the eligibility criteria set out in regulations 5 and 6.

4.13 You can appoint the same individual to more than one of these roles. However, the same individual cannot be appointed as both launch director and safety manager.

Training

4.14 Before you can start licensed activities, if you have not already done so, you must provide us with details of the person you propose to appoint as **training manager**. The person must be approved by us before you can start the licensed activities.

4.15 Regulations 61-65 cover the role and functions of the training manager. These include organising and, where appropriate, supervising the training programme and ensuring adequate records of training are kept.

Training manual

4.16 The training manual will document the training programme. Part 2 of Schedule 3 of the Space Industry Regulations sets out the information that must be in the training manual.

4.17 If you are applying for a launch operator licence, then, before you start your licensed activities, you must submit to us for approval the sections of the training manual that describe the training that will be provided to the launch director and

any flight termination personnel, flight crew/remote pilots and sub-orbital aircraft engineers. These sections must address the specified training criteria set out in Part 1 of Schedule 3 of the Space Industry Regulations (paragraphs 1 to 21).

4.18 We must approve these sections of the training manual, before you can start the licensed activities. This is in addition to the requirement to seek approval of the training manager.

4.19 You can apply for these approvals when you apply for a licence, or once you have a licence.

4.20 You don't have to send the complete training manual for approval. If you send us the complete manual, you must list or clearly mark the relevant sections. However, we can ask to see the training manual, as part of assessing your application.

Security

4.21 When applying for a launch operator licence, you are required to submit:

- a draft security programme, that addresses the issues listed in regulation 171(6)
- the security risk assessment on which the programme is based
- a site plan, including proposals for any security restricted and controlled areas[4]
- a draft cyber security strategy for the proposed operation
- the cyber security risk assessment on which the strategy is based
- details of a nominated security manager, responsible for the implementation of security measures.

4.22 The extent and detail of your risk assessments should be appropriate and proportionate to the risks identified with the activities taking place. We can provide more guidance on this at the pre-application stage, including on how to undertake a security risk assessment.

4.23 Any sensitive documentation including a security programme or cyber security strategy with associated documentation should not be submitted via the CAA's

[4] Security restricted areas include all areas at space sites that will be used for assembling and integration of launch vehicles or carrier aircraft and the mating of launch vehicles or carrier aircraft to their payloads. Controlled areas are space site security restricted areas, that have been designated as such, where US technology, data and equipment is being used, and US launch activity is taking place. The applicant or licensee who owns/manages the site is required to identify the location and size of all proposed controlled areas. You therefore may need to work with your proposed spaceport to agree these areas.

online portal. Please contact commercialspaceflight@caa.co.uk to arrange how your information will be delivered to the security assessment teams.

4.24 We recognise that some aspects of your security programme and risk assessments will depend on the exact details of any payloads that you intend to carry on the launch vehicle. These details are unlikely to be known at the point of application. That is one reason why you are asked for a draft security programme.

Security manager

4.25 In your application, you must also provide information about the person you propose to appoint as security manager and provide details of their qualifications and experience. As well as meeting the basic eligibility criteria (see regulations 5-6), the security manager will have to attain relevant national security clearance before they can take up the post.

4.26 Regulation 169 sets out the responsibilities of the security manager. These include acting as the focal point for the security programme and managing the development, administration, and maintenance of an effective security operation for the licensee, with responsibility for physical, personnel and cyber security.

IMPORTANT: If you intend to use US spacecraft or US launch vehicles, you must inform us of the nationality of any person who has contributed money, equipment, technology or personnel to the production or acquisition of any essential and integral part of the launch vehicle, or the business, at the application stage. (See regulation 202)

4.27 There is more information on security requirements in the separate document Guidance on security matters for applicants and licensees (CAP2217).

Insurance

4.28 As set out in sections 34-38 of the SIA, all licensees are required to:

- indemnify the UK government for any claims for third-party damage brought against the government which arise from their spaceflight activities.

4.29 The level of cover required will depend on the proposed activities and should be based on a risk assessment. Broadly, for a launch operator, it must cover at least the entire duration of the spaceflight activities, from and including launch, and any re-entry activities permitted by the licence. However, in most cases, we would expect the policy to cover the launch plus 30 days, which could account for de-orbiting of spent stages from the launch vehicle.

4.30 There are no mandatory requirements for licensees to hold pre-launch insurance. This will be a commercial decision for operators.

4.31 The CAA and UK government must be named as additional insureds on the insurance policy.

4.32 We recognise that organisations are unlikely to take out insurance cover until they have a licence. Therefore, in your application, you are expected to provide evidence of your engagement with prospective insurance providers.

4.33 Further details about the insurance requirements can be found in the separate document Guidance on insurance requirements and liabilities under the Space Industry Act 2018 (CAP2218) and at https://www.caa.co.uk/space/guidance-and-resources/insurance-and-liability/

Carrier aircraft

4.34 This section applies if you are planning to use carrier aircraft in your launch operations.

4.35 Carrier aircraft will either be:

- an existing aircraft type that has been modified to carry and launch the launch vehicle, or
- new, specifically-developed aircraft.

4.36 The use of civil aircraft in the UK is governed by existing UK and international legislation and agreements. The SIA and Space Industry Regulations do not replace or alter this legislation. Instead, unless we grant specific exemptions, operators of carrier aircraft are expected to comply with any legislation which applies to them.

4.37 To help identify what does apply, if you plan to use carrier aircraft it is recommended you contact us as early as possible to discuss your proposals and provide us with information about the aircraft you propose to use. If you don't give us these details until you submit your application, this can slow the process down.

4.38 We need information to establish:

- what civil certification, if any, the aircraft currently has and the operations for which it is authorised
- if the aircraft is currently operated or registered outside the UK, what limitations on the aircraft or operator have been imposed by its own national aviation authority
- what UK regulations or restrictions would normally be applied to such an aircraft flying in the UK
- whether the safe use of the aircraft in the proposed spaceflight activity is supported by the safety case

- what exemptions from UK aviation regulations, or permissions granted by the regulator for its use in the UK, may be needed either for the aircraft operator or the aircraft before it can be used for the proposed spaceflight activity.

4.39 Based on this core information, we can then assess whether, using this aircraft as a carrier, you would be able to fulfil any obligations or conditions imposed under the SIA or Space Industry Regulations. We can also identify what further information and investigations might be needed to satisfy any of the points above.

4.40 If your carrier aircraft has been modified to the extent that it no longer meets the aviation certification requirements of its type, or it is an 'experimental' or one-of-a-kind design, then you may need to get additional authorisation from us, such as a Permit to Fly, or provide us with evidence of certification via another country's regulator.

4.41 During the licensing process, we will work with you to determine what exemptions, permissions and other aviation-specific requirements will be needed to ensure that the use of the carrier aircraft will be compatible with both spaceflight and aviation regulations.

Example

Most existing large transport aircraft have been type-certificated for airworthiness in compliance with ICAO Annex 8[5] and may already have approved modifications. Aircraft that are not certified to be compliant with ICAO Annex 8 typically include:

- ex-military aircraft designed to military specifications
- aircraft that have been extensively modified, but whose modification has not been approved for incorporation into the previous Certificate of Airworthiness (C of A)
- aircraft specifically designed or modified for research, experimental or scientific purposes and likely to be produced in very limited numbers. Such aircraft can be authorised for highly specialised purposes on a commercial basis, such as acting as carrier aircraft.

Examples of this latter category include:

- the modified Lockheed L-1011 TriStar, which is used to carry the Northrup Grumman Pegasus rocket, and
- the Scaled Composites carrier aircraft White Knight 2 (WK2) for Virgin Galactic's SpaceShipTwo.

[5] Annex 8 (International Standards and Recommended Practices) 'Airworthiness of aircraft' to the Convention on International Civil Aviation www.icao.int/safety/airnavigation/NationalityMarks/annexes_booklet_en.pdf

These aircraft would not meet a certification standard but may well rely on, or incorporate, some component parts that have been previously certified (e.g. powerplants) and have been developed following aeronautical design and build 'best practice' to the extent that it is compatible with their purpose.

Unmanned aircraft systems

4.42 It is also possible that an unmanned aircraft system (UAS) could be used as a carrier aircraft.

4.43 If you are planning to use a UAS as carrier aircraft, you will need to submit the same kind of technical information required in the safety case as for human-occupied aircraft.

4.44 We will then need to assess which category of UAS it falls under (likely to be either the "Specific" category or "Certified" category) if this has not already been determined by the CAA Unmanned Aircraft Systems department.

4.45 Under the existing UK legislative regime, there are clear restrictions on the type of operations that UAS can be used for and locations where they can fly. Therefore, **if you are planning to use a UAS as a carrier aircraft, you are strongly encouraged to talk to us about your proposals as early as possible**, before you apply. This is so the special circumstances relating to UAS operations can be examined and explained, particularly if you are proposing to use a unique UAS. Contact us by emailing commercialspaceflight@caa.co.uk.

4.46 For more details on the existing UK aviation regime, read our guidance document Unmanned Aircraft System Operations in UK Airspace – Guidance (CAP 722)

Unmanned free balloons used as carrier aircraft

4.47 If you are proposing to use an unmanned free balloon as a carrier aircraft, it must comply with the relevant articles and requirements of the Standardised European Rules of the Air Regulation ("SERA") (EU 923/2012) that have been retained in UK law after the UK left the European Union. The requirements for unmanned free balloons are set out at Appendix II to Annex I of the SERA.

4.48 SERA requires that any such balloon must be operated in a way that minimises hazards to people, property and other aircraft, and in accordance with the conditions specified in its Appendix II.

4.49 These requirements apply to free balloons used as carrier aircraft and must be taken into account in developing your safety case.

Carrier aircraft operations that do not need a licence

4.50 Under regulation 15, you do not need a licence to use a carrier aircraft to transport a space object, launch vehicle or the component parts of either from one place to another, as long as:

- the flight does **not** include the launch of a space object or launch vehicle
- the operator of the carrier aircraft has either an air operator certificate acceptable to the CAA, or the necessary approvals, authorisations or permissions for the flight required by the state in which the operator is based, and which are acceptable to the CAA.

Visit of carrier aircraft to the UK without associated launch activity

4.51 Some spaceflight operators, applicants, or prospective applicants may wish to bring a carrier aircraft that is not compliant with ICAO Annex 8 airworthiness provisions to the UK, without intending to launch a spaceflight at that time. For example, this could be for testing or demonstration purposes, or to reconnoitre UK facilities for possible future launch operations.

4.52 If you wish to do this, you must:

- contact us as soon as possible to discuss your plans, by emailing commercialspaceflight@caa.co.uk
- apply for a foreign carrier permit. See https://www.caa.co.uk/commercial-industry/airlines/licensing/foreign-carrier-permits/applying-for-a-foreign-carrier-permit/ for more details.

4.53 We will then decide whether to grant the exemption. We may set further restrictions on the aircraft's use, including time limits for any single exemption.

Chapter 5

Return operator licence application: further requirements

5.1 This chapter summarises the additional matters that applicants for a return operator licence must cover in their application.

Prescribed roles

5.2 Under section 18 of the SIA, licensees must have suitably qualified people in specified roles relating to spaceflight activities. For a return operator licence, these roles are:

- accountable manager
- safety manager
- security manager, if your proposed activities may give rise to an issue of national security.

5.3 Broadly, activities are likely to give rise to issues of national security where:

- sensitive or classified information is involved, or
- where the operator, the asset being licensed, or the mission management facility are designated as critical national infrastructure.

5.4 The decision of whether activities may give rise to an issue of national security is made through the UK Space Agency. It will be made as soon as possible during the application process, so you have sufficient time to identify a security manager.

5.5 To help you appoint the right people for these roles, we set out the core functions of each role below.

5.6 The **accountable manager** is responsible for establishing and maintaining an effective management system, and for ensuring that your licensed activities can be financed and carried out in accordance with the provisions of the SIA and the Space Industry Regulations. The accountable manager has the authority to make final decisions on **all** aspects of your organisation and activities – meaning they have the highest level of authority when spaceflight activities are being prepared for or being carried out.

5.7 The **safety manager** is responsible for:

- the day-to-day development, administration and maintenance of an effective safety management system

- ensuring all aspects of your spaceflight activities are carried out safely, and
- monitoring all those involved in the spaceflight activities to ensure compliance with your safety policies and procedures.

5.8 The safety manager reports to the accountable manager.

5.9 The **security manager** is responsible for implementing your security programme. They must be an employee of your organisation, and have to undergo relevant UK security vetting. This means that the security manager should normally have been living in the UK for at least three years

5.10 When you are applying for a return operator licence, you must provide details of the individuals you have appointed, or are intending to appoint, to these roles. This includes information about their qualifications and experience, as well as confirming they meet the eligibility criteria set out in regulations 5 and 6.

5.11 You can appoint the same individual to more than one of these roles.

Security

Cyber security

5.12 When applying for a return operator licence, you must submit a draft cyber security strategy for your proposed activities, and the cyber security risk assessment on which the strategy is based. The cyber security strategy should be appropriate and proportionate for the risk and the type of systems operated.

5.13 For further details, read our publication Guidance on Cyber Security Strategies for applicants and licensees (CAP2535) .

If your activities may give rise to an issue of national security

5.14 If it has been determined that your proposed activities may give rise to an issue of national security, you are required to submit:

- a draft security programme, that addresses the issues listed in regulation 171(6)
- the security risk assessment on which the programme is based
- a site plan, including proposals for any security restricted and controlled areas
- details of a nominated security manager, responsible for the implementation of security measures.

5.15 The extent and detail of your risk assessment should be appropriate and proportionate to the risks identified with the activities taking place. We can provide more guidance on this at the pre-application stage, including on how to undertake a security risk assessment.

5.16 Any sensitive documentation including a security programme or cyber security strategy with associated documentation should not be submitted via the CAA's online portal. Please contact commercialspaceflight@caa.co.uk to arrange how your information will be delivered to the security assessment teams.

Security manager

5.17 In your application, you must also provide information about the person you propose to appoint as security manager and provide details of their qualifications and experience. As well as meeting the basic eligibility criteria (see regulations 5-6), the security manager will have to attain relevant national security clearance before they can take up the post.

5.18 Regulation 169 sets out the responsibilities of the security manager. These include acting as the focal point for the security programme and managing the development, administration, and maintenance of an effective security operation for the licensee, with responsibility for physical, personnel and cyber security.

IMPORTANT: If you intend to use US spacecraft or US launch vehicles, you must inform us of the nationality of any person who has contributed money, equipment, technology or personnel to the production or acquisition of any essential and integral part of the launch vehicle, or the business, at the application stage. (See regulation 202)

5.19 There is more information on security requirements in the separate document Guidance on security matters for applicants and licensees (CAP2217).

Insurance

5.20 As set out in sections 34-38 of the SIA, all licensees are required to:

- indemnify the UK government for any claims for third-party damage brought against the government which arise from their licensed spaceflight activities.

5.21 The level of cover required will depend on the proposed activities and should be based on a risk assessment.

5.22 The CAA and UK government must be named as additional insureds on the insurance policy.

5.23 We recognise that organisations are unlikely to take out insurance cover until they have a licence. Therefore, in your application, you are expected to provide evidence of your engagement with prospective insurance providers.

5.24 Further details about the insurance requirements can be found in the separate document Guidance on insurance requirements and liabilities under the Space Industry Act 2018 (CAP2218) and at https://www.caa.co.uk/space/guidance-and-resources/insurance-and-liability/.

Chapter 6

Duties of a spaceflight operator licensee

6.1 As set out in chapter 2 of this document, if you are granted a **launch operator** or **return operator** licence, there are various duties you must fulfil to remain compliant with that licence. These include:

- duties that apply to all licensees under the SIA
- duties that are based on part 8 of the Space Industry Regulations, Safety of operator's spaceflight activities. This chapter is mostly focused on these duties.

The chapter covers duties of both launch and return operator licensees. Most duties apply to both types of licensee; where something is only applicable to either launch or return operators, this is clearly stated.

6.2 In addition, once you have been granted a licence, you must secure insurance cover for your operations, that meets the level / requirements we stipulate. Further details about the insurance requirements can be found in the separate document Guidance on insurance requirements and liabilities under the Space Industry Act 2018 (CAP2218) and at https://www.caa.co.uk/space/guidance-and-resources/insurance-and-liability/.

6.3 Some of the duties of a spaceflight operator must be fulfilled on an ongoing basis – e.g. the duty to operate in line with your safety operations manual, and the duty to ensure all staff are suitably trained. Others relate specifically to phases of the mission: launch preparation, during the spaceflight, return to Earth, or immediately after landing.

6.4 We will conduct ongoing monitoring of your licensed activities, to check for compliance with these duties and any conditions on your licence. For example, we can carry out inspections and site visits. We appoint inspectors to do this.

6.5 As detailed in regulations 241-249, inspectors have a range of legal powers to enable them to do their work. These include being able examine relevant items, take photographs and samples, request documents etc. They can take materials off site for further examination. They can also bring relevant experts in different matters with them, to assist in their work.

6.6 You are legally required to give inspectors the access they request and not obstruct them in their work.

6.7 Inspectors will, where possible, give you advance notice of any inspection. However, if there is a situation which in the inspector's opinion may be

dangerous, or where delay might be prejudicial to public safety or UK national security, they can demand to access a site at ANY time and must be granted access without delay.

6.8 If you don't fulfil any of these duties, we can take enforcement action, that could result in you being prevented from conducting the activities you are licensed to carry out. More details on the action we can take is included in our Spaceflight enforcement policy (CAP 2987)

If you have any questions about what you are required to do to fulfil any of your duties, you are encouraged to contact us as soon as possible, by emailing commercialspaceflight@caa.co.uk.

Duties of all licensees and how they apply to spaceflight operators

6.9 All licensees under the SIA are required to:

- provide information to us, so we can fulfil the UK's international obligations to supervise space activities under our jurisdiction
- keep records of, and in relation to, licensed activities
- report occurrences.

6.10 An occurrence is any spaceflight accident, a major accident, or any incident during or in preparation for licensed activities which, if not corrected or addressed, could result in a spaceflight accident or a major accident.

6.11 These duties are covered in the document Working with the regulator as a licensee under The Space Industry Act 2018 (CAP2214).

6.12 The information you are required to provide us will be set out in the reporting plan we send you with your licence.

6.13 As well as these core reporting requirements, you must also inform us of any proposed changes to your licensed activities that affect (or might affect) the basis on which we granted the licence. For example, this could mean changes to the safety case, or in key personnel.

Registration

6.14 **This section is not applicable to return operators.**

6.15 The UK is party to the UN Convention on Registration of Objects Launched into Outer Space 1975 (the "Registration Convention"). The Registration Convention imposes international obligations on 'launching States' to register space objects.

6.16 In line with these, the Secretary of State must maintain:

- a register of launches that have taken place from spaceports in the UK. This includes both space and suborbital launches. (see section 61(1) of the SIA)
- a register of space objects, whether launched in the UK or elsewhere (see section 7 of the OSA, as amended by Schedule 12 of the SIA)

6.17 In practice, these duties have been delegated to us to manage, as the regulator.

6.18 To enable us to fulfil these duties, you must provide us with information about each launch, including:

- the date of the launch
- the site from which the launch took place
- the nature of each launch vehicle launched
- the purpose of the launch
- name, designation, and catalogue number of the space objects launched (i.e. any payloads carried on the launch vehicle)
- orbital position and orbital parameters of the space objects launched
- general function of the space objects launched.

6.19 We can also request further information, as we deem appropriate. The information provided may also be used to notify other international bodies or organisations of UK launches and space objects as is required.

6.20 Post-launch, information is needed for the UK registry of space objects (where the UK is the launching state). In practice, the requirement to notify the regulator about launch and any orbital objects is set out in the reporting plan associated with an individual launch licence. Typically, a launch operator is expected to supply this information within 10 days of the launch.

6.21 The registers will be available online for the public to view, free of charge. You can view the UK registry of space objects on the CAA website.

Duties based on part 8 of the Space Industry Regulations

6.22 For all spaceflight operators, your core duty is to carry out your spaceflight activities safely, in accordance with your current safety case, by:

- preventing a major accident occurring, and
- mitigating the consequences of such an accident if it does occur.

6.23 If you are conducting spaceflight activities involving human occupants, then you are also required to carry out those activities in accordance with your current risk

assessment for the safety of a human occupant. The requirements for the risk assessment are set out in chapter 7 of this chapter.

6.24 This duty effectively means that the safety case you compiled, through which you demonstrated that the levels of risk of the spaceflight activity are as low as reasonably practicable (ALARP) and that an acceptable level of residual risk remains, becomes the standard of safety in relation to the safety regulations.

Review and revision of the safety case

6.25 Chapter 3 of Part 8 of the Space Industry Regulations (regulations 80-82) sets out the requirements for reviewing and where necessary revising your safety case.

6.26 Broadly, you must review your safety case if any of the circumstances listed in regulation 80 apply. These include before you make **any** change to your licensed operations, including changes to procedures set out in your safety operations manual, modifications to the launch vehicle or carrier aircraft and changes to any flight safety system, as well as changes to the proposed mission. More broadly, they also include if any information comes to light that could alter your assessment of major accident hazards.

6.27 Any change to the safety case could alter the underlying basis of safety on which the licence was granted. Therefore, you must submit your revised safety case – including details of any additional mitigation measures you propose to put in place – before you make any change to your operations. You can't then make the change until we have provided written confirmation that your revised safety case is acceptable.

6.28 If the safety case has been reviewed but not revised, you must also inform us, in writing, without delay. We would expect you to explain why you reviewed the safety case and why you determined that no revision was necessary.

6.29 In addition to any circumstances in which you recognise the need to review your safety case, we can direct you to review and, where necessary, revise the safety case at any time.

Information about payloads in your safety case

6.30 This section is applicable to launch operators only.

6.31 In the safety case you submit with your application, you are required to provide information about the intended payloads for your mission(s). Because the exact payloads may not have been identified at that point, the information may be in a generic form, describing the class of payload.

6.32 Before each launch, the specific details of these payloads will be established, and you must provide them to us. Where the details are in line with the existing safety case and do not change the level of risk of a major accident, you do not

have to revise the safety case. However, you would be expected to review the safety case, to check that the confirmed payload does not in fact increase risk.

Organisation and management

6.33 Regulation 84 sets out requirements relating to the spaceflight operator's organisation and management. Broadly, these require you to ensure you have in place all the financial, technical and organisational resources needed to conduct your activities safely. This includes acquiring/leasing the launch vehicle and any carrier aircraft you need, appointing sufficient operating staff and acquiring or leasing the relevant facilities and equipment.

6.34 These requirements are intended to be proportionate to your activities and may evolve over time.

Safety management system

6.35 As set out in regulation 85, you must put in place a safety management system (SMS) that meets the requirements of schedule 4 of the Space Industry Regulations.

6.36 The SMS is a crucial mechanism for managing the safety of licenced activities in line with your safety case. In your safety case, you were required to include a description of the SMS you intended to put in place. If the SMS you now develop differs from this, you must let us know. We can ask to review the SMS.

6.37 The SMS should reflect the risks and mitigations set out in your safety case, and help you manage your licensed activities safely. It should clearly set out the licensee's safety policy, the roles and responsibilities for safe operations and how to report and respond to occurrences where safety was compromised. It should also contain procedures to enable continuous safety improvement.

6.38 Figure 3 shows the core elements of an SMS.

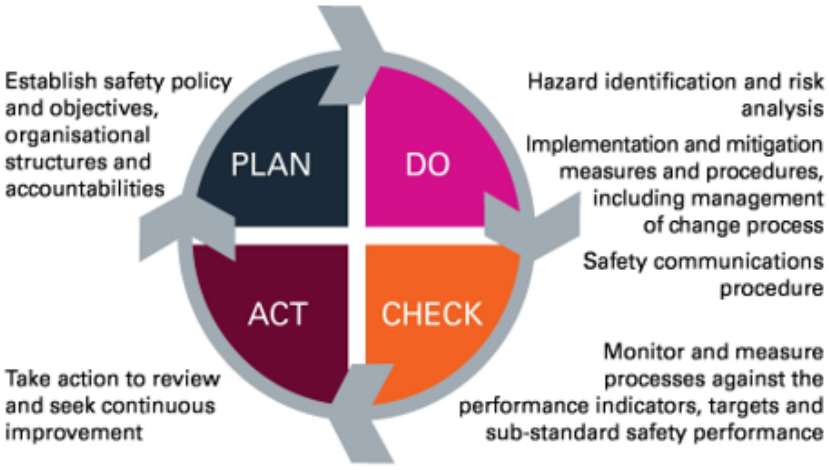

Figure 3: Development and maintenance of a safety management system

6.39 The SMS can be based wholly on your own processes/procedures, or include the procedures of another licensee, where appropriate. The decision should be whichever is best suited to supporting the safety of the overall operation. Documentation should be kept functional and concise, with the focus on addressing the operational and human elements of its implementation in practically controlling the risks.

6.40 The accountable manager is responsible for the implementation of and continuing compliance with the SMS, even if this is overseen day-to-day by the safety manager.

6.41 However, safety is a shared responsibility across the whole organisation and needs the involvement of all staff at all levels. The success of whatever process or system is in place hinges on the attitudes and behaviours of people in the organisation (this is sometimes referred to as the 'safety culture').

6.42 As part of our monitoring, we will look for evidence of a safety culture, and that the whole organisation understands their roles and responsibilities for safety.

For more information on how to implement and maintain an effective SMS, read CAP 795: Safety Management Systems - Guidance to Organisations | Civil Aviation Authority (caa.co.uk) We can also provide further information on this at pre-application and after you have obtained a licence.

Appointment of relevant individuals

6.43 Once you have been granted a licence, you must take steps to appoint people to the specific roles for your licence type.

6.44 For a **launch operator**, these are:

- accountable manager
- launch director
- safety manager
- security manager
- training manager, and
- flight termination personnel (if the launch vehicle has a flight safety system and that system is not autonomous).

6.45 For a **return operator**, these are:

- accountable manager
- safety manager, and

- security manager, if it has been deemed that your activities may give rise to issues of national security.

6.46 These should be the people we accepted as 'fit and proper' as part of your application. If for any reason you can no longer appoint any of them to the roles, you will need to provide us with details of the individuals you have appointed, or are intending to appoint, to these roles.

6.47 The responsibilities of the security manager and training manager are covered in further detail later in this chapter.

6.48 Under regulation 58, once people have started in these roles, you are responsible for ensuring that they:

- have the qualifications, skills, experience, and competencies required under Part 7 of the Space Industry Regulations
- have received training which satisfies the criteria specified in regulation 56(2) and otherwise complies with Part 7 of the Space Industry Regulations
- where applicable, are medically fit to perform their assigned duties.

6.49 As well as appointing these individuals and training them, you must put in place relevant processes and procedures for:

- communication between these key roles, including during missions
- recording, reporting and addressing safety concerns.

Recording, reporting and addressing safety concerns

6.50 Any safety concerns identified by individuals in these key roles, or reported to them, must be recorded in writing.

6.51 The safety manager has a duty to inform the accountable manager and – for a launch operator licensee – the launch director of all safety concerns, including those reported to the safety manager by a member of the operating staff, whether before a launch or during any other part of the licensed activities. As licensee, you must ensure that the safety manager can report directly to the accountable manager.

6.52 The accountable manager has a duty to address all safety concerns reported to them, either before or during the licensed spaceflight activities.

6.53 The launch director has a duty to check that all safety concerns reported to them have been addressed before a launch.

6.54 Safety concerns should be dealt with in line with the safety management system. Written records must then be made of how the safety concerns have been addressed.

6.55 The responsibility for making records of safety concerns and how they have been addressed lies equally with the safety manager, the accountable manager and (where applicable) the launch director.

Role of flight termination personnel

6.56 Under regulation 89, if the launch vehicle you're using has a non-autonomous flight safety system, you must appoint flight termination personnel. This requirement applies to launch and return operators.

6.57 The flight termination personnel must receive training and be qualified in accordance with Part 7 of the Space Industry Regulations.

6.58 The role of flight termination personnel is to make a flight termination decision in the interests of the spaceflight operator's safety duty, and not for any other reasons. In support of this, you must:

- authorise flight termination personnel to make such a decision without needing approval from any other operating staff, including (for a launch operator licensee) the launch director
- provide them with the information they need to determine whether the flight safety system for which they are responsible is ready to be used
- set out instructions and procedures in the safety operations manual concerning flight termination decisions and various aspects of the use of any flight safety system.

6.59 The flight termination personnel must be present at a mission management facility or ground control at the spaceport for the duration of the flight. For a launch operator licensee, the launch director must also be present at the same location.

The safety operations manual

6.60 As set out in chapter 3 of this guidance, when you apply for a launch operator or return operator licence, you must submit a safety operations manual, which details the information, procedures and instructions necessary for staff to carry out their duties safely.

6.61 At the application stage, this can be a draft only. Once you have a licence, you must update the safety operations manual to meet the requirements and minimum contents detailed in Schedule 5 of the Space Industry Regulations. These include:

- fatigue and other human factors related to the ability of any member of the operating staff to carry out their spaceflight duties safely
- preparations for launch, return and other operations (including joint procedures)

- launch and other operations
- launch vehicles with crew or a remote pilot
- emergency response
- ground support equipment
- making, collecting, retaining and preserving information.

6.62 The safety operations manual need only address the requirements that are relevant to your operations (i.e. return operators are not required by UK legislation to include details of preparations for launch.) However, this information may be required by the authorities in the country you are launching from. In practice, therefore, it may be most appropriate for return operators to compile a safety operations manual that meets the UK requirements and the requirements of the country you are launching from.

6.63 The safety operations manual embodies the instructions for the practical measures that need to be followed to achieve the levels of risk that have been accepted for the grant of a licence. It is particularly useful for setting out joint procedures i.e. those that also involve other licensees such as spaceport licensees or range control service providers, and other participating agencies.

6.64 The safety operations manual must be reserved for matters with an important safety element; it is not the place for general administrative information such as financial reporting, terms and conditions of employment and other business-related company policy.

Distributing the safety operations manual

6.65 The safety operations manual, or the sections of the manual that are relevant to their duties, must be available to all your operating staff.

6.66 You must take all reasonable steps to ensure that all members of operating staff:

- are aware of the contents of every part of the safety operations manual which is relevant to their spaceflight duties
- undertake those duties in line with the relevant provisions of the safety operations manual
- are working from and referring to the most up-to-date released revision of the safety operations manual.

6.67 The safety operations manual can be a printed document or accessed digitally.

Updating the safety operations manual

6.68 The safety operations manual must be kept up-to-date, and amended to reflect changes in procedures.

6.69 As a guiding principle, any revision of the safety case would normally need to be reflected in an equivalent revision of relevant information or procedures in the safety operations manual.

6.70 When updating the safety operations manual, the spaceflight operator must:

- consult the spaceport licensee, if any
- consult the range control service provider, if any.

6.71 Once you have updated your safety operations manual, you must submit the updated version to us without delay.

6.72 You should also ensure that the updated version is shared with all operating staff and any older versions amended or removed from use.

Preparations for launch, return and other operations

6.73 Regulations 91-98 of the Space Industry Regulations contain requirements for the preparations for launch, verification and validation by testing, communications etc., and other related operations such as returning reusable launch vehicles to service.

The launch vehicle

6.74 Under regulation 91, you must not use a launch vehicle in your spaceflight activities unless the vehicle is fit for those activities. A launch vehicle is deemed fit if it complies with **all** the following conditions:

- it has been designed to a specification that meets the technical requirements of the vehicle
- it has been built consistently with that specification
- it has been through the verification and validation processes set out in regulation 94, which demonstrate that it:
  - conforms with the technical requirements
  - is free from workmanship errors which could prevent the vehicle carrying out the operator's spaceflight activities safely
  - is otherwise ready to take part in those activities and
  - is capable of carrying out those activities safely
- if it has a human occupant, the systems and flight recorder referred to in regulation 109 have been installed in the vehicle.

6.75 You must also ensure that you comply with any specific conditions about the launch vehicle that we placed when we granted you a licence.

The launch vehicle's ground support equipment

6.76 Regulation 92 mirrors regulation 91 but focuses on the vehicle's ground support equipment (GSE). It requires you to ensure that all GSE is fit to support your spaceflight activities, following the same criteria as listed in paragraph 6.74 above.

6.77 Because the safe use and functioning of GSE is an important part of launch preparations, it is likely that we will wish to check GSE in any site visits and inspections, to ensure it is suitable for the purpose, and is correctly operated and maintained.

Reusable launch vehicles

6.78 The Space Industry Regulations allow for the use of reusable launch vehicles, meaning any launch vehicle that is capable of being used in more than one flight. However, before reusing a launch vehicle, you must meet the maintenance, servicing and repair criteria set out in regulation 93.

6.79 You must also make full records of the work undertaken for the purpose of returning the reusable launch vehicle to service before a subsequent launch. This includes a written confirmation that the vehicle:

- conforms with the technical requirements, and has been returned to a condition which conforms with those requirements, and
- otherwise complies with regulation 91 and is fit for the spaceflight activities.

6.80 This requirement also applies to any part of a launch vehicle which is capable of being reused.

Verification and validation by testing etc. of the launch vehicle and ground support equipment

6.81 Under regulation 94, you must complete adequate verification and validation of the launch vehicle and GSE before each launch. This includes:

- testing, analysing, reviewing or inspecting the launch vehicle and GSE, **and**
- integrated testing of that vehicle and equipment, to monitor how the launch vehicle and its GSE, and any systems of either, function together.

6.82 Relevant methods of verification may include:

- functional testing of the whole vehicle and systems and subsystems
- analysis of post-flight data
- testing required by new operational procedures
- testing of payloads and their proper integration, and

- testing related to the use of a flight safety system including any ground component or range requirements etc.

6.83 You must include instructions and procedures for the verification in your safety operations manual. These must include procedures for addressing any failure or anomaly in the verification, which could necessitate a review of the safety case. Any occurrences in testing must also be reported to us.

6.84 You must record the results of the verification and validation in writing and, before each launch, ensure copies of these results are shared with any member of the operating staff who has duties which are relevant to the results.

The spaceport and the range

6.85 Under regulation 95, it is your responsibility to ensure that the spaceport[6] you are using and the range identified are fit for your spaceflight activities.

6.86 To meet this requirement, you should, as a minimum, ensure that:

- the spaceport and range control service provider(s) are licensed under the SIA
- the spaceport and range control licensees have the necessary capabilities to meet all the relevant requirements and safety measures set out in your safety case
- the spaceport and range control service provider(s) have adequate facilities, technical resources, personnel and security arrangements in place to support your operations
- you have mutually agreed operations and working arrangements, and ensured there is no conflict with any other users of the facilities
- the arrangements made for the co-ordination of ongoing safety management are jointly agreed and are practicable
- the roles of any necessary third parties are clearly understood and integrated into the activities
- the spaceport and range control licensees are available to participate in readiness reviews, rehearsals and emergency response plan exercises, as the spaceflight operator deems necessary.

[6] The Space Industry Regulations refer to “the spaceport, or other place”. This allows for launches from, or landings on, a ship or platform at sea in UK territorial waters. If you intend to conduct launches from a ship, you are strongly advised to contact us as early as possible in your application, so we can advise you on how the regulations would apply. Email commercialspaceflight@caa.co.uk.

6.87 This is an ongoing duty that requires you to check that all agreed services and resources are in place, and to review your safety case if there is any change in the spaceport or range activities. Your safety operations manual should include joint procedures for co-ordinating and communicating with the range control service provider and the spaceport licensee, so that these sorts of changes can become known. This co-ordination is a responsibility of the accountable manager, safety manager and, for launch operator licensees, the launch director.

Communication during spaceflight activities

6.88 If your safety case includes any communication between the mission management facility or ground control facility you are using for your activities and:

- the range control service provider and any site used in connection with range control services
- the spaceport licensee
- relevant meteorological service providers
- relevant air navigation service providers and
- relevant emergency services

then under regulation 96, you must ensure that the means of communication you intend to use are reliable.

6.89 Similarly, if your safety case includes communication between the launch vehicle, carrier aircraft and any other aircraft taking part in the operator's spaceflight activities, and the mission management facility or ground control at the spaceport, you must ensure that the means of communication are reliable.

6.90 This could be a means of constant communication, or means of communications at intervals, dependant on what is needed to carry out the spaceflight activity, safely.

6.91 You must record all such communications.

Monitoring the environmental and meteorological conditions

6.92 The environmental and meteorological conditions that exist at the spaceport at the time of launch, along the launch trajectory and in the space environment, are critical to ensuring your spaceflight activities can be conducted safely.

6.93 Under regulation 97, you must monitor environmental and meteorological conditions during your spaceflight activities in so far as is necessary to carry out those activities safely.

6.94 "Environmental and meteorological conditions" includes (as necessary for carrying out the operator's spaceflight activities safely):

- temperature and humidity
- air pressure
- precipitation and visibility
- wind speeds and directions
- lightning, and
- where applicable, space weather that may affect your activity.

It is your responsibility to determine what aspects of the conditions need to be monitored to carry out the activities safely, where and how frequently monitoring should happen, and the methods that are needed to do so.

6.95 For **launch operators**, the safety operations manual must contain instructions and procedures concerning the meteorological and environmental conditions needed to safely load propellants and any other hazardous materials on the launch vehicle.

6.96 **Launch operators** are expected to use detailed weather forecasts during planning towards the day and hour of launch, particularly in relation to the flight safety analysis, and to compare these to actual weather data collected just before and during the launch window. This duty includes making the latest environmental and meteorological information available without delay to:

- the accountable manager, the safety manager, the launch director and any other members of the operating staff who require such information to carry out their spaceflight duties safely
- the range control service provider, the spaceport licensee and any other person who requires such information to support your spaceflight activities being carried out safely.

Example
The flight safety analysis conducted to underpin the safety case is likely to result in wind limitations set out in the safety operations manual for various purposes.

You will need to establish the actual wind conditions in various places, including at high altitude, at the time of launch, so that the launch and flight can be carried out within those wind limitations.

In your safety case, you must demonstrate that the risks of any particular weather conditions are ALARP and show how you will monitor meteorological and environmental conditions.

Instructions to operating staff (such as conducting weather balloon radiosonde measurements etc.) must be provided in your safety operations manual for practical use during the launch period.

Dangerous goods

6.97 Under regulation 98, you can only load dangerous goods onto the launch vehicle if you are permitted to by your licence.

6.98 In terms of these safety regulations, "dangerous goods" means any article or substance which is identified as such in the most recent English language edition of the ICAO publication Technical Instructions for the Safe Transport of Dangerous Goods by Air. It does not include propellants or other substances necessary for the normal functioning of the launch vehicle.

Launch, return and other operations

6.99 Regulations 99-101 contain requirements for the launch, the return from orbit of launch vehicles (not originally launched from the UK) and other related operations.

Conditions for commencing spaceflight activities: launch operators

6.100 Regulation 99 sets out a requirement that, before you start your spaceflight activities, the launch director must be satisfied that the activities can be carried out safely (i.e. in accordance with the safety case and, if the launch vehicle has human occupants, the risk assessment). In support of this, the regulation lists 12 conditions that the launch director must be satisfied with.

6.101 For **return operators**, regulation 99 similarly applies, but to the relevant activities. So before you start your spaceflight activities, you must be satisfied that the activities can be carried out safely (i.e. in accordance with the safety case and, if the launch vehicle has human occupants, the risk assessment).

During launch and flight: monitoring and termination

6.102 If monitoring the launch vehicle is necessary (in terms of the accepted safety case) to ensure that your spaceflight activities are carried out safely, you must monitor the launch vehicle in real time:

- until it reaches a stable orbit or completes sub-orbital activities, and/or
- until it has safely returned to land in the UK

6.103 The means of monitoring is up to you. Methods could include external tracking of the vehicle, reception of telemetry or other signals from the launch vehicle or visual means where appropriate.

6.104 If the launch vehicle has a flight safety system which is not automated, flight termination personnel must make a flight termination decision during the flight of that vehicle if:

- at any time that vehicle malfunctions and that malfunction prevents the spaceflight activities being carried out safely,
- at any time, a system used to detect a malfunction, or monitor whether the launch vehicle remains fit for the spaceflight activities, fails, and that failure could compromise your ability to carry out activities safely, or
- it is necessary for any other safety reason.

Operators should include specific guidance on the circumstances in which flights should be terminated in their Safety Operations Manual.

Additional requirements relating to the launch vehicle during the operator's spaceflight activities

6.105 Regulation 101 sets out a series of requirements that apply to activities after the launch vehicle or its component stages have reached a stable orbit, including a requirement to:

- monitor the trajectory of the launch vehicle in so far as it is possible to do so
- monitor the basic orbital parameters of that vehicle, including nodal period, inclination, apogee and perigee.

6.106 These requirements are necessary to ensure that an operator's spaceflight activities are carried out safely or to secure compliance with the UK's international obligations, including by:

- ensuring that the mission can safely meet its objectives
- enabling the spaceflight operator to identify in advance any possibility that the launch vehicle operations will interfere with other space users, and if necessary, alert them, and
- providing information for the purposes of meeting the UK's international obligations as a "launching state" to notify the UN and maintain a register of launches under section 61 of the SIA and a register of space objects under section 7 of the Outer Space Act 1986.

6.107 The ability to monitor in this way must therefore be considered during the design, development and proposed operation of the launch vehicle.

6.108 The bullet points below each include one of the requirements in regulation 101(1)(c), followed by guidance on how that requirement should be considered within the mission or launch vehicle design. Under this regulation, you must take reasonable steps to:

- **Avoid the launch vehicle interfering with the space activities of other persons in the peaceful exploration and use of outer space.**
  The operation of a launch vehicle may interfere with other space objects through its physical presence (e.g. requiring additional manoeuvres to be performed by other space users to prevent collisions) or through the use of payloads or subsystems on the launch vehicle (e.g. a communication system on a launch vehicle may operate on a specific band and may interfere with the telemetry sent from another space object). In the design and operation of the mission and vehicle, you should look to minimise this interference through co-ordination with bodies such as Ofcom.
- **Limit or prevent major accident hazards to the health, safety and property of persons arising from the launch vehicle in orbit.**
  In the orbital environment, this is largely connected with preventing collisions, either directly, or as a result of debris that may be intentionally or unintentionally released during the mission. Therefore, you should adopt best practice on approaches to collision avoidance once in orbit, to minimise the debris released during normal operations and to make design choices to prevent the potential for break-ups in orbit.
- **Prevent contamination of outer space arising from the launch vehicle in orbit or adverse changes in the environment of the Earth from that vehicle in orbit.**
  When planning your launch, you should take systematic actions to reduce adverse effects on the orbital environment by introducing space debris mitigation measures[7] into the launch vehicle's lifecycle. This consideration of space debris mitigation measures should start at the beginning of the design process (e.g. mission requirement analysis and definition phases).

6.109 Reasonable steps in relation to this could include:

- avoiding the release of space debris
- avoiding a collision between the launch vehicle and its payload after the release or separation of that payload from the vehicle
- manoeuvring the vehicle
- deactivating a component part of the vehicle, or

[7] The UK is strongly committed to ensuring that all its authorised space activities adhere to international best practice on space debris mitigation such as the Inter-Agency Space Debris Coordination Committee (IADC) Space Debris Mitigation Guidelines. You should take these guidelines and other best practice into account when considering what "reasonable steps" need to be taken to satisfy the requirements in regulation 101(1)(c) and 101(3).

- passivating the vehicle, by dissipating the hazardous materials carried on board or preventing their accumulation.

6.110 Regulation 101(2) covers disposal of the launch vehicle, if this is planned to be done by causing it to re-enter through the Earth's atmosphere. You must ensure that such activities are carried out safely. For example, when de-orbiting into the atmosphere, you can typically choose:

- an uncontrolled re-entry, where the rocket stage is allowed to decay and re-enter the atmosphere over an undefined point on the Earth, or
- a controlled de-orbit manoeuvre or sequence of manoeuvres, to cause the stage to re-enter and impact in a safe area on the surface of the Earth.

6.111 In deciding which approach to take, you must consider both the impacts on the environment (see space debris mitigation) and the safety to the general public and property from the re-entering stage (or any part thereof). To select the re-entry approach for a launch vehicle orbital stage (or any part thereof), a casualty risk analysis must be performed by modelling the survivability of the debris during re-entry.

6.112 The safety case must justify the approach you have chosen. For an uncontrolled re-entry, you should explain why this will not result in injury to the public or damage to property. For a controlled re-entry, you will need to include a plan for the re-entry considering the reliability of the operations and the mitigation approach to reduce the risks to the public and property.

Recording, retaining and preserving information

6.113 Regulations 102 and 103 set out requirements for recording, collecting, retaining and preserving information about your spaceflight activities, including for safety purposes.

6.114 These requirements are in addition to any data we ask you to collect and provide us as part of your reporting plan. However, we may also ask for some of this information, including as part of any investigation.

Information on any human occupants and dangerous goods on board a launch vehicle

6.115 Under regulation 102, you must compile:

- a list of the names and addresses of all human occupants on board the launch vehicle and of individuals on board any carrier aircraft, and
- a list of all dangerous goods on board the launch vehicle and any carrier aircraft.

6.116 This requirement applies to return operators as well as launch operators.

6.117 You must keep these lists for a period of three years from the day of launch.

Information made before or during the operator's spaceflight activities

6.118 Under regulation 103, you must record the following information made before or during your spaceflight activities:

- records of communications between parties involved in the spaceflight activity such as between the launch operator and the range control, spaceport and relevant air navigation service providers etc.
- where the launch vehicle has a flight recorder, data relating to conditions and events on board the launch vehicle that have been recorded on the flight recorder
- any tracking and telemetry data about the launch vehicle that was obtained during the spaceflight activities, and
- any other data collected or used during the spaceflight activities. An example of such data includes internal messaging between controller's stations at the ground control at a spaceport or mission management facility.

6.119 In addition, you must keep:

- records of any correspondence with us before launch and during your spaceflight activities
- the most up-to-date safety case and risk assessment and a written record of all revisions to the safety case or the risk assessment
- any written records of safety concerns or occurrences
- meteorological and environmental information from monitoring during the spaceflight activity
- reports of maintenance work carried out on communication and recording systems, and of checks made to such systems to ensure the launch vehicle is fit, and
- any other information which is relevant to your spaceflight activities being carried out safely.

6.120 You must retain all such information from the date your licence is granted until three years after the date on which the licence expires. The exception is data from a flight recorder, which – unless there was an accident – does not need to be kept.

6.121 This information is needed for several purposes:

- to maintain and improve your safety performance, where such records and information can assist in doing this

- to enable us to perform our duties concerning the monitoring and ongoing oversight of spaceflight activities
- to enable you to comply with the requirement to make an occurrence report
- to enable you to comply with any demands for such information from an investigator-in-charge of the Spaceflight Accident Investigation Authority (SAIA), in accordance with regulation 23 of the Spaceflight Activities (Investigation of Spaceflight Accidents) Regulations 2021.

6.122 In line with these purposes, we can ask you for any of this information at any time, if we deem it necessary.

Emergency response

6.123 Regulation 104 requires all spaceflight operators to have in place an emergency response plan and sets out the key matters this plan must address. The emergency response plan should reflect your safety case. Once you have a licence, you must therefore develop your emergency response plan, including acquiring any necessary equipment and providing relevant training.

6.124 You should consult with other relevant organisations in developing your emergency response plan, to ensure coordination with their emergency response plans.

6.125 It is your responsibility to ensure that key personnel have easy access to the emergency response plan at all times.

6.126 The emergency response plan must be tested as far as practicable (e.g. the component elements of the emergency plan) at least every three years. It must also be reviewed at least every three years and revised as necessary. You must supply us with the results of any test of the emergency response plan.

6.127 If you propose to make any changes to your emergency response plan, whether as a result of a test or the review, you must inform us – ideally before you make the change, but if this is not possible, immediately after.

Training

6.128 Spaceflight operators are responsible for ensuring that, before any launch can take place, **everyone** who is involved in your licensed activities has:

- taken part in a training programme which is appropriate to their role, and which includes instruction on safety. This is likely to include practical and theoretical training, at an appropriate level for each employee.
- been assessed as competent to perform their duties.

6.129 The minimum requirements for the training programme are specified in regulation 69.

6.130 For **launch operators**, role-specific training is required for:

- the launch director
- the flight termination personnel (if any are necessary)
- the sub-orbital aircraft engineer (if one is necessary).

6.131 The training criteria for each of these roles are set out in Part 1 of Schedule 3, of the Space Industry Regulations, which details the areas in which an individual must demonstrate understanding, knowledge or ability or have completed training, to be qualified as competent for the role.

6.132 There are also specific training requirements for any human occupants of a launch vehicle. These are different for flight crew and for any spaceflight participants. These requirements are detailed further in chapter 7 of this guidance.

Training manager

6.133 For **launch operators**, the training manager should organise and manage the training provided.

6.134 As documented in paragraphs 4.14-4.20 of this guidance, before you start licensed activities, you must provide us with:

- details of the person you propose to appoint as training manager
- the sections of your training manual that describe the training that will be provided to the individuals in specified roles.

6.135 We must approve the proposed appointment of the training manager, and the relevant sections of the training manual before you can start the licensed activities.

6.136 You can apply for these approvals when you apply for a licence, or once you have a licence. So, if you have not already provided us with details of your training manager, you must now do so before starting your licensed activities.

6.137 Under regulation 61(3), the training manager is responsible for:

- establishing and maintaining a training programme that provides appropriate training for individuals carrying out licenced activities
- ensuring that the licensee complies with the requirements in the Space Industry Regulations in relation to the qualification, training and medical fitness of individuals performing specified roles and spaceflight participants
- establishing and running a system for managing the provision of training and where appropriate, qualifications, for individuals who participate in the licensed activities

- ensuring the medical fitness of individuals performing specified roles and spaceflight participants, and
- carrying out the functions referred to in regulation 63.

Training manual

6.138 **Launch operators** must compile a training manual, which complies with Schedule 3 Part 2 of the Space Industry Regulations.

6.139 We can ask for evidence that training is being provided in line with your training manual. If we find evidence that you are not providing training in line with your training manual, we can take enforcement action.

6.140 It's important that you keep your training manual up to date with any changes to the training programme, and make the manual available to all staff and contractors. If you provide printed copies of the manual to staff, it's your responsibility to ensure they are all kept up to date.

Record keeping

6.141 Regulation 60 sets out the requirements for keeping records relating to training. **These requirements apply to launch and return operators**. Required records include details of the training provided to each individual participant in the training and results of any assessments.

6.142 Record keeping should be part of the training management system. The system should include arrangements for retaining records for the appropriate length of times (minimum two years).

Assessments

6.143 **Launch operators** are required to ensure that everyone involved in their licensed activities has been assessed as competent. Regulation 70 specifies the requirements for competence assessments. These include how assessments should be conducted and what you need to do if anyone fails a competence assessment.

Equipment

6.144 You are responsible for ensuring you have access to sufficient training equipment to provide any practical training required.

6.145 Training equipment used for this purpose may include devices which are capable of simulating a launch vehicle, or any equipment or facilities which are used in the licensed activities ("a simulated training device"). There are requirements for the fidelity of simulated training devices. Any difference between the simulated training device and the actual launch vehicle, equipment or facilities which it is simulating must be identified and described as part of the training programme.

6.146 You must establish and maintain a system for monitoring any simulated training device (e.g. capability, configuration, effectiveness) or other device which you are using in your training programme.

Medical fitness

6.147 You must also ensure that individuals are medically fit to perform their assigned duties. Occupational health advisory services can advise on how to assess fitness, in accordance with health and safety best practice.

6.148 There are additional medical fitness requirements for anyone involved in human spaceflight. These are detailed in chapter 7 of this guidance and include medical examinations and assessments by an approved aeromedical examiner (AME) or an approved medical assessor.

Security

6.149 This section applies to:

- **all launch operators**, and
- **return operators where it has been deemed that the activities may give rise to an issue of national security**. This will have been determined before a licence is granted.

6.150 Spaceflight operators are responsible for a range of security matters, including aspects of the security of the launch vehicle, carrier aircraft and payloads; flight safety systems; and personnel working for them. These matters should have been covered in your draft security programme, which you submitted as part of your application. The requirements of a spaceflight operator's programme are set out in regulation 171.

6.151 Once you have a licence, you are required to finalise this programme and put it into effect. You must also appoint a security manager.

6.152 The security manager is then responsible for keeping your security programme maintained and up to date in response to any material changes of operations, or incidents that occur that require changes to be made to the programme.

6.153 The security manager should review the security programme on an annual basis, from the date the licence has been granted, to ensure that any changes during the year have been captured. They should then provide us with a copy of the most up-to-date version.

6.154 A spaceflight operator's security programme must be integrated with the space site security programme. The intent is to ensure a holistic approach to security across licensed activities. The Space Industry Regulations also clearly delineate between security responsibilities around launch vehicles, carrier aircraft and payloads. In broad terms:

- Before carrier aircraft, launch vehicles and payloads are integrated with each other, the spaceport licensee (working with the operator licensee) is responsible for their security.
- After they are integrated, the launch operator licensee will be responsible for maintaining security.

US technology

6.155 There are additional security requirements if your operations involve the use of US technology (as defined in regulation 168). Among these, regulation 194 requires that a person who owns or is in possession of US technology must ensure that access to that technology is controlled by a person authorised to do so by the US Government.

6.156 For more details of security requirements, read Guidance on security matters for applicants and licensees (CAP 2217).

Cyber security

6.157 **All licensees** must also put in place a cyber security strategy for the network and information systems used in relation to your spaceflight operations, as set out in regulations 185 – 186. Again, this is something that you were required to provide, in draft, as part of your licence application. Once you have a licence, you are required to finalise this programme and put it into effect.

6.158 For more details of what is required in this strategy, read Guidance on Cyber Security Strategies for applicants and licensees (CAP2535).

Chapter 7

Requirements for launches involving human spaceflight

7.1 This chapter examines the additional requirements for launch operators wishing to conduct launches involving human spaceflight. These requirements apply to operations involving just a flight crew on the launch vehicle and those which also involve carrying spaceflight participants. The requirements may also apply to a return operator licensee if that operation involves human spaceflight.

7.2 As part of an application for a licence to conduct launches involving human spaceflight, you must conduct a **risk assessment** for the proposed activity/activities, and provide us details of this.

7.3 After getting a licence, you must continue to assess the risks and manage them on an ongoing basis. In addition, you must:

- meet the **additional safety requirements for launch vehicles with human occupants** set out in regulations 105-123
- ensure all flight crew and spaceflight participants have received **training** relevant to their role
- obtain **informed consent** from each person who will be on board the spacecraft, at a relevant time before the launch
- assess the **medical fitness** of each person who will be on board, at relevant times before the launch
- monitor and manage the risks of exposure to **cosmic radiation**.

Risk assessment

7.4 The risk assessment for human spaceflight is designed to identify the risks to the health and safety of anybody who will on board the launch vehicle. It is in addition to the requirement to produce the flight safety analysis, ground safety analysis and safety case.

7.5 As set out in regulation 32, in carrying out the risk assessment, you must identify all hazards that could harm the health or safety of human occupants from the time they board the launch vehicle for the proposed spaceflight activity to the point when all human occupants have disembarked.

7.6 These hazards not only include accidents, but also hazards that may occur during normal operations, such as during rapid acceleration, free-falling in circumstances equivalent to reduced gravity and effects that result from disorientation or anxiety.

7.7 You must consider hazards that could arise in both normal operations and emergency situations. Schedule 2 of the Space Industry Regulations lists the matters you must take into account.

7.8 For each hazard you identify, you then must:

- identify the conditions under which it could occur
- identify what could cause it or contribute to it
- assess the likelihood of it arising
- assess its foreseeable consequences.

7.9 You must then use this information to evaluate the risks to the health or safety of the human occupants and define any appropriate measures to prevent the hazard occurring and mitigate the consequences if it does occur.

7.10 When considering these measures, you must take into account:

- the training that will be provided
- the medical requirements for the occupants
- the technical requirements of the launch vehicle.

7.11 Once you have defined appropriate measures, you must then set out how you will monitor the effectiveness of these measures and how you will review them.

7.12 The Space Industry Regulations do not define any set standard or acceptability requirements concerning the levels of risk that crew members and spaceflight participants may be exposed to, and there is no other UK legislation that sets out standards and medical criteria for human occupants of spacecraft. To assist applicants, the following information and recommendations from the US may be of use:

- **FAA-AST** Recommended Practices for Human Space Flight Occupant Safety

  A compilation of practices that the Federal Aviation Administration (FAA) Office of Commercial Space Transportation (AST) recommends for commercial human spaceflight occupant safety.

- **NASA Space Flight Human System Standards** (Volume 1 & 2) NASA-STD-3001

  The two Standard documents used by NASA for its professional astronaut cadre. They establish requirements for providing a healthy and safe environment for crew members during all phases of spaceflight.

- **NASA** Human Integration Design Handbook

A companion document to NASA Standard 3001, this serves as a compendium of human spaceflight history, lessons learned and design information for a wide variety of disciplines and provides background information on the rationale for human-system design standards including natural and induced environments.

Information to be submitted about the risk assessment, as part of your application

7.13 You must submit a written record of the risk assessment as part of your application, along with evidence that, if granted the licence, you will be able to meet any of the requirements of regulations 106-123 that apply.

7.14 The written record must also set out any measures that you considered taking to prevent the various hazards occurring and/or to mitigate the consequences if those hazards did occur, but ultimately decided not to implement. You must explain why you decided not to implement those measures.

7.15 We can ask for further details of the risk assessment, including asking for the risk assessment to be explain in an easily understandable form. This is because you will need to provide any potential human occupants with details of the risk assessment in such a format, so they can make an informed decision about whether to consent to accept those risks.

7.16 The easily understandable form of the risk assessment must set out in writing the outcome of each of the steps that you have taken in the risk assessment, including the measures to prevent hazards occurring and to mitigate the consequences if they do occur.

7.17 In making the risk assessment easily understandable, you may consider using relevant numerical data (estimated probabilities/frequencies related to the hazard occurring) when suitable. It is likely that some of this information will already have been accumulated as part of conducting the flight safety analysis.

Ongoing risk management

7.18 Once a licence has been granted, you must review your risk assessment on an ongoing basis, up the point of the launch. In particular, you must review it if any of the circumstances listed in regulation 80 apply. These include before you make any change to your licensed activities or to the launch vehicle or flight safety systems. More broadly, they also include if any information comes to light that could alter your risk assessment.

7.19 Any change to the risk assessment could alter the underlying basis of safety on which the licence was granted. Therefore, you must submit your revised risk assessment to us – including details of any additional mitigation measures you propose to put in place – before you make any change to your operations. You can’t then make the change until we have provided written confirmation that your revised risk assessment is acceptable.

7.20 If the risk assessment has been reviewed but not revised, you must also inform us, in writing, without delay. We would expect you to explain why you reviewed the risk assessment and why you determined that no revision was necessary.

Duties relating to human spaceflight after a launch operator licence is granted

Additional safety requirements for launch vehicles with human occupants

7.21 Regulations 105-123 detail additional safety requirements that must be met for launch vehicles with human occupants. These must be met after you have obtained a licence. However, under regulation 33, you are required to set out, in your application, how you intend to meet these requirements. Further, many of them will have been considered, or addressed, as part of the measures used to minimise risks to human occupants, in your initial risk assessment.

7.22 Regulations 106-108 set out additional safety requirements for the crew of launch vehicles including:

- the responsibility of the pilot in command, pilot or remote pilot to carry out the flight safely in accordance with the current risk assessment and safety case, by preventing a major accident from occurring or mitigating the consequences of such an accident if it does occur
- the responsibility of the launch operator to:
  - clearly define the roles and duties of each member of the crew or remote pilot
  - make information about the flight available to the crew and the pilot in command
  - authorise the pilot in command or remote pilot to give commands, make decisions or take actions.

7.23 The Space Industry Regulations don't specify how you must meet these requirements. Some are likely to be addressed through training and in the safety operations manual.

The launch vehicle

7.24 Regulation 109 sets out additional system requirements which are necessary if human occupants are on board a launch vehicle. These system requirements are specified due to the heightened risks involved when carrying human occupants. Any launch vehicle carrying human occupants must have systems capable of:

- providing on-board power and atmospheric conditions which are adequate to sustain life and consciousness of a human occupant, or equipment to provide such conditions to each human occupant
- supplying oxygen to a human occupant and preventing depressurisation, or the harmful effects of depressurisation
- warning the pilot in command or a remote pilot of any significant accumulation of ice on the exterior of the launch vehicle
- enabling the spaceflight operator or any crew to detect smoke in the inhabited areas of the launch vehicle and to assist in preventing or suppressing a fire in that area
- displaying any information necessary to any flight crew to ensure the flight is carried out safely (e.g. flight and on-board system status instrumentation and information concerning the flight profile, predicted arrival point or other navigational information)
- restraining any member of the crew or any spaceflight participant in their seat when necessary to ensure that the flight is carried out safely.

7.25 The systems chosen must be suited to your spaceflight activities and be functioning and capable of functioning during those activities.

7.26 If a launch vehicle has a human occupant, it must have a flight recorder.

Example

You could meet the requirement for a "system or equipment capable of providing atmospheric conditions which are adequate to sustain life and consciousness of a human occupant" in different ways. For example, the requirement could be met by pressure-suits for each human occupant; by full pressurisation of the cabin; or by a combination of the two, such as lightweight or partial pressure suits that are activated temporarily in the event that a dangerous reduction of pressure occurs.

7.27 Further regulations in this section focus on ensuring the launch vehicle is designed in such a way that the right crew members have access to the instruments and equipment they need and that the launch vehicle is equipped with emergency equipment. All human occupants must be trained in evacuation procedures and the use of that equipment.

Specific obligations of crew and spaceflight participants

7.28 Regulations 114-119 set out the obligations of the pilot in command, flight crew or remote pilot. These include:

- the requirement for a pilot in command or a remote pilot to perform, where suitable, an inspection of the launch vehicle and its systems prior to launch

- the obligations on the pilot in command or a remote pilot to carry out the flight safely by giving commands, making appropriate decisions and taking appropriate actions during the flight of the launch vehicle
- the responsibility of the flight crew to remain at their stations and be secured in their seat in certain circumstances, and
- how you will ensure spaceflight participants remain at their assigned stations if there are no crew members on board.

7.29 Again, it is likely that these requirements will be addressed through a combination of training and in the safety operations manual.

Cosmic radiation

7.30 Cosmic radiation is the collective term for the radiation which comes from the Sun (the solar component) and from the galaxies of the Universe (the galactic component).

7.31 Part 9 of the Space Industry Regulations 2021 sets out requirements relating to exposure to cosmic radiation for any crew of a launch vehicle and the crew of carrier aircraft. These requirements are adapted from the requirements set out in a 2013 EU Directive (Council Directive 2013/59/EURATOM of 5 December 2013), which lays down basic safety standards for protection against the dangers arising from exposure to ionising radiation, in so far as they apply to the crew of aircraft and spacecraft.

7.32 Chapter 2 of Part 9 (regulations 135-142) contains cosmic radiation provisions applying to all crew members. These include:

- prohibitions on a spaceflight operator causing the crew to be exposed to various doses of cosmic radiation
- requirements to assess the risk of exposure of crew members to cosmic radiation (an “exposure assessment”) resulting from the spaceflight activity
- requirements to assess the actual exposure of each crew member, take account of the assessed exposure when organising work schedules – including not scheduling a crew member to perform duties on board a launch vehicle or a carrier aircraft if those duties would mean they receive a dose of cosmic radiation that exceeds the limit calculated for the remainder of the calendar year
- the requirement to inform each crew member about the health risks of exposure to cosmic radiation and the spaceflight operator’s procedures concerning exposure assessments and monitoring, before performing their duties, plus to inform them of their dose as assessed
- measures for the protection of pregnant crew members

- the necessity to conduct an immediate investigation when a spaceflight operator has reasonable cause to believe that a crew member has received an overexposure while performing their duties. It also sets out what you must do if overexposure has occurred (or you cannot confirm beyond reasonable doubt that no overexposure has occurred).

Provisions relating to classified crew

7.33 Chapter 3 of Part 9 (regulations 143-148) contains provisions relating to "classified crew". These are individuals who are liable to receive an effective dose of cosmic radiation of more than 6 mSv[8] in a calendar year. These provisions include the spaceflight operator:

- identifying any crew members who should be classified crew
- conducting an additional medical examination or health review that determines the fitness of that crew member and any conditions to work as a classified crew member
- ensuring that medical surveillance, such as examinations and health checks, are carried out before classifying a member of crew, and that each classified crew member has at least one health review a year by an approved doctor to determine whether they are still fit to perform their duties
- monitoring the exposure to cosmic radiation of each classified crew member
- keeping relevant health records for each classified crew member and maintaining a record of all exposure monitoring undertaken, for the period specified in regulation 147(3).

7.34 The spaceflight operator must not allow any crew member to receive a dose of cosmic radiation of more than 20 mSv in a calendar year.

Other non-health-related effects of cosmic radiation

7.35 Operators should also be aware of the ways in which cosmic radiation in various forms can affect space weather.

7.36 More information on these issues can be found in our publication Impacts of space weather on aviation (CAP1428).

[8] mSv is the abbreviated term for "millisievert". A millisievert is a radioprotection unit of an ionizing radiation dose represented as a derived unit in the International System of Units (SI). It is a measure of the health effect of low levels of ionizing radiation on the human body. A dose described in millisieverts is generally a whole-body effective dose, but it may also be an equivalent dose received by a particular tissue or organ.

Informed consent

7.37 Because of the intrinsic risks of human spaceflight, section 17 (Informed Consent) of the SIA prohibits a spaceflight operator from allowing anyone (crew or spaceflight participant) to fly on board a launch vehicle, unless the individual:

- has given their signed consent to accept the risks involved
- is over 18 years old, and
- fulfils the criteria related to mental capacity.

7.38 Such consent must be obtained via a signed consent form, that gives the individual details of the risk assessment carried out for those activities by the spaceflight operator.

For an example consent form that sets out the details the participant should include, as well as what information the operator should provide so that consent is informed, please contact us by emailing commercialspaceflight@caa.co.uk.

7.39 Part 12 of the Space Industry Regulations sets out the information that you must provide to a prospective human occupant of a launch vehicle, to ensure that when the individual gives their written consent to take part in spaceflight activities, that consent is informed.

Recognising that spaceflight is inherently risky

7.40 Anyone who chooses to fly on board a launch vehicle, return vehicle or carrier aircraft needs to understand the risks – which include the risk of death or injury. They must be made aware that, even with the safety regime established through the SIA and Space Industry Regulations, it is likely that substantial risks to their lives will remain.

7.41 The informed consent process is designed to enable these risks to be communicated to the individual by the spaceflight operator, and for the individual to confirm that they accept them, before taking part in spaceflight activities. For this purpose, each individual must give their consent before they board the carrier aircraft or launch vehicle, for the spaceflight.

Prescribed criteria with respect to age and mental capacity

7.42 Reflecting the requirement for consent to be informed, all human occupants must be at least 18 years of age when signing the consent form. There is no upper age limit in regulation. It is your responsibility to obtain suitable evidence of age, for example by requiring occupants to show legally recognised documents such as a birth certificate, passport or driving licence.

7.43 A human occupant must also have the mental capacity to understand the risks involved in the spaceflight activities, and the meaning of giving their consent to take part.

7.44 An underlying principle of mental capacity law is that an individual is presumed to have capacity, unless it is established that they do not. It is therefore your responsibility to establish whether an individual lacks capacity. We recommend you get legal advice on how to do this.

7.45 The training programme for human occupants may form part of the process of identifying if any individual may lack capacity to give their consent. For example, if during training an individual:

- exhibits an inability to make decisions or understand or retain information relevant to that understanding
- shows a sustained inability to comprehend or follow instructions

then this may indicate a need for a formal assessment of their capacity.

7.46 You only need to establish the human occupant's capacity to:

- understand the risks involved in the operator's spaceflight activities which they want to take part in,
- give informed consent to take part in those activities.

Their capacity to make other decisions may be relevant to determining whether to assess their capacity to give informed consent.

The consent form

7.47 The consent form is the document that individual crew members or spaceflight participants must sign before you permit them to take part in spaceflight activities. The form must be completed correctly, after the individual has been provided with all mandatory information, otherwise it may be determined that informed consent was not properly given or signified.

7.48 All human occupants must sign the consent form and a duplicate, no more than 24 hours before taking part in the spaceflight activities.

7.49 The details that must be contained in the consent form are set out at in regulation 206. For **all** human occupants, the form must include:

- the full name, address, and date of birth of the human occupant
- the name and address of the spaceflight operator
- the design specification of the launch vehicle to be used
- the details of the current risk assessment, in an easily understandable form.

7.50 For prospective spaceflight participants, the form must also include details of:

- the spaceport or other place which the launch vehicle is to be launched. In the case of a launch vehicle launched from a carrier aircraft, this will be the last location from which carrier aircraft took off
- the spaceport or other place at which a controlled or planned landing is to take place
- the planned date of the flight
- the flight nomenclature. This could be your organisation's serial number or code designating a type of flight or place in a series of flights. If the spaceflight is cancelled, reference may be made to this nomenclature accompanied by the rescheduled date of the flight
- the planned trajectory and duration of the flight. This should include the flight of any carrier aircraft (if used) and any powered, glide or parachute descent portion of the flight.

For an example consent form that sets out the details the participant should include, as well as what information the operator should provide so that consent is informed, please contact us by emailing commercialspaceflight@caa.co.uk.

7.51 Consent forms for crew members may relate to more than one flight, as long as all the flights are to take place in a launch vehicle of the same design specification, and the current risk assessment relates to all the flights. This allows crew members to make multiple flights in the same design specification of launch vehicle without having to complete a consent form before every flight.

7.52 The consent form must contain certain statements which the prospective human occupant reads and as necessary confirms when they sign the form. These include statements to confirm that the individual has read and understood the information concerning the spaceflight activities your organisation has carried out and about the activities they are to take part in. They also require the individual to confirm that they accept and understand that the spaceflight activities carry an inherent risk of danger and in particular that:

- the activities may result in death or injury
- the regulator has not certified that the launch vehicle complies with any national or international safety standards.

7.53 The individual will also be confirming that they accept and understand that they (or their families) will not be entitled to receive damages, without proof of negligence or intention or other cause of action on the part of the operator, in the event of them dying or sustaining injury by taking part in the spaceflight activities. Further details of this provision, and the fact that it does not apply to individuals who have signed their informed consent, can be found in the separate document Guidance on liabilities under the Space Industry Act 2018 (CAP2218).

Information to be given to a human occupant

7.54 Before being given the consent form, prospective human occupants must be given information about the spaceflight activities your organisation has previously carried out. The required information is set out in regulation 209. The information must relate to all the kinds of spaceflight activities your organisation has undertaken, including those (if any) that do not involve human occupants.

7.55 You must also give prospective human occupants details of the current risk assessment in an easily understandable form, plus information about the availability of emergency services in the event of an accident or medical emergency.

7.56 The consent form and supporting information will normally be provided in English. However, if the prospective human occupant is not sufficiently proficient in English to read and understand the consent form and the information that accompanies it, you should provide an adequate translation, so that the prospective human occupant can give **informed** consent.

When this information must be provided

7.57 As noted above, the consent form must be signed no more than 24 hours before a human occupant takes part in spaceflight activities. If the spaceflight is delayed, this may require a new consent form to be signed.

7.58 The information must be given to the human occupant **at least 24 hours**, but not more than one month, **before that occupant signs the consent form**. This provision exists to ensure that the occupants have time to read and consider the information before activities begin.

7.59 You must also give all human occupants the opportunity to ask questions about the information, and receive answers, before they sign the consent form.

7.60 To meet these requirements and ensure that you give individuals sufficient time to consider the information, you may decide to supply the bulk of the information in advance (e.g. that information which is not likely to change within the month) and then provide final details shortly before the 24-hour period begins.

7.61 If any information changes between the time you first give it to human occupants and the start of the 24-hour period, you must make the human occupant receiving the information aware of what parts have been updated. Similarly, if anything changes after they have signed the consent form but before the spaceflight activities begin, you must let all human occupants know.

7.62 The training programme for the spaceflight is an integral part of providing human occupants with knowledge and understanding of the risks of the intended spaceflight.

7.63 For example, human occupants must be given training in the physical rigours of spaceflight, the emergency procedures that they may have to perform, and the general hazards presented by a space environment. All this training will have a bearing on an individual's understanding of the risks. Because of this, you must not ask human occupants to sign the consent form until they have finished their training.

7.64 In support of this, there is a statement in the consent form asking the human occupant to confirm they have received training in withstanding the stresses of spaceflight activities and the functions they may have to perform.

7.65 You may wish to have a separate form asking prospective occupants to give their consent to participating in training, especially any training which involves simulating the physical rigours of spaceflight.

Information for crew members

7.66 Crew members must receive at least the same information as spaceflight participants.

7.67 However, because crew members will also undergo more training, and may even be involved in preparing your ongoing risk assessment activity for spaceflights, you may choose to provide this information in a different way – such as including in your safety management system and training manual.

Withdrawal from taking part

7.68 Signification of consent does not mean that an individual human occupant must take part in the spaceflight. Any individual occupant may withdraw from participating, at any time prior to the carrier aircraft or the launch vehicle moving for the purpose of launching.

7.69 Once the spaceflight is underway, decisions on stopping the spaceflight will be made in the best interests of the safety as these relate to all occupants of the launch vehicle and those uninvolved persons who may otherwise be adversely affected by the spaceflight ending prematurely.

7.70 Figure 4 summarises the informed consent process.

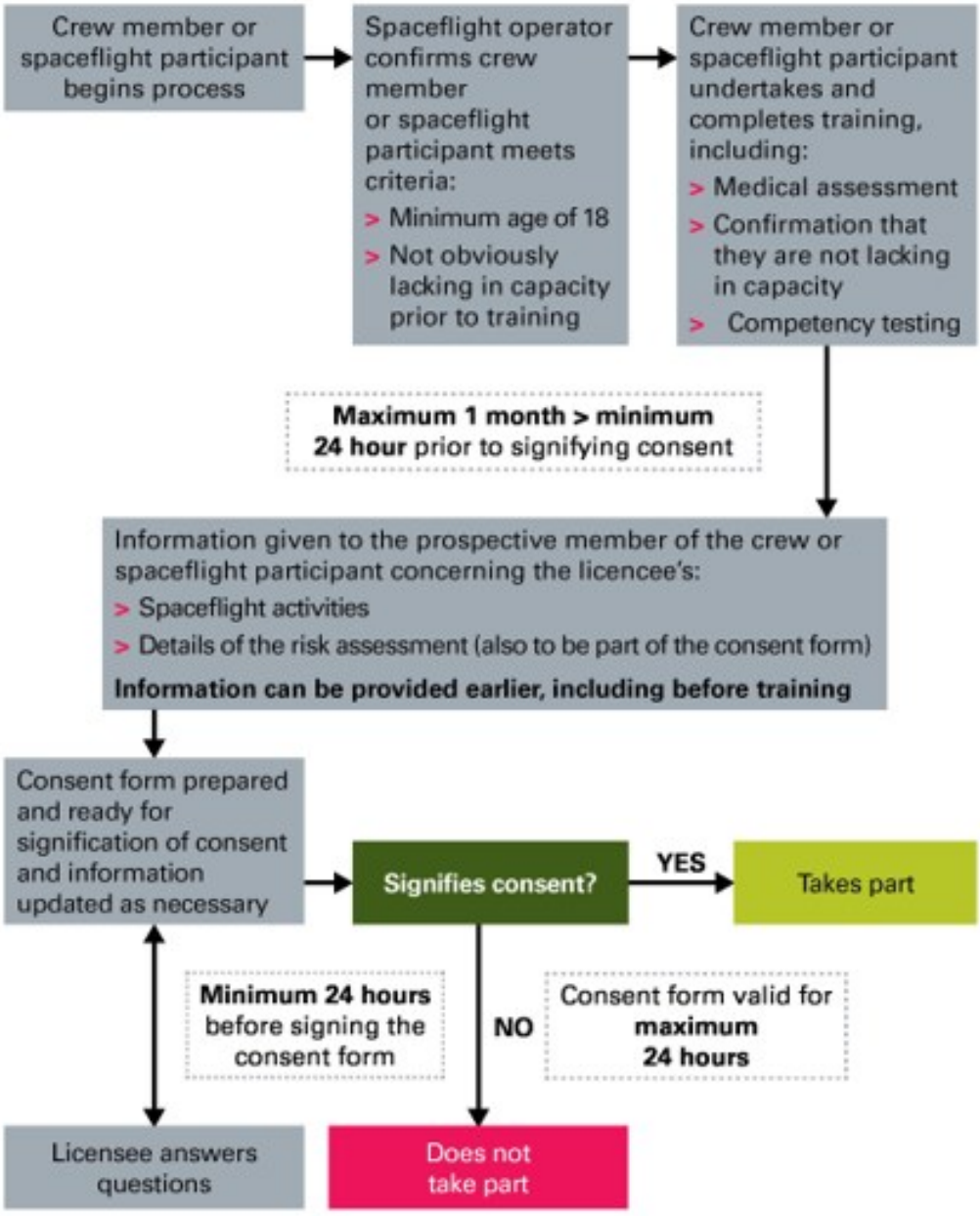

Figure 4: Informed consent process flow

Evidence of consent

7.71 The consent form must be prepared in writing and in duplicate. Each human occupant must sign and date both copies of their consent form, and record on both copies the time at which it was signed. An electronic signature is acceptable for this purpose.

7.72 After signing the consent form, the human occupant must give you one copy of the consent form. The other is for them to keep.

7.73 You must keep records of all parts of the informed consent process, including:

- what information you gave to human occupants, when
- when they were given the consent form, and
- the signed consent form for each individual.

Both the informed consent process and the evidence of a signed consent form are legal requirement under the SIA. Allowing crew members and spaceflight participants to take part in spaceflight activities without obtaining informed consent in accordance with the Space Industry Regulations is an offence. If you have any doubt about how to comply with the regulations for informed consent, contact us to seek advice.

Training requirements for human occupants

7.74 All human occupants of a launch vehicle must receive role-specific training.

7.75 If your activities involve spaceflight participants, you must also ensure that each participant has received training which meets the criteria specified in regulation 57(2) and is medically fit to take part.

7.76 As set out in regulation 68, training for human occupants must go beyond the broad initial training programme that is required for all staff. It must further include:

- proficiency training for each specified role, in line with the requirements for each role as set out in Schedule 3 of the Space Industry Regulations
- readiness training for each mission, for all individuals who are to take part in that mission. Readiness training must include a mission rehearsal before a launch, which as nearly as possible reproduces the intended spaceflight, spaceport and range control activities which would be carried out on the mission. Because this requirement applies to launch operator, spaceport and range control licensee, it would be helpful for the relevant licensees to work together to carry out joint rehearsals.

7.77 All individuals who will be on board a launch vehicle or carrier aircraft must also have received training on withstanding the stresses of spaceflight.

7.78 Part 3 of Schedule 3 contains specific training requirements for crew, remote pilots and spaceflight participants. It builds on the flight crew and remote pilot qualification criteria set out at Part 1 of Schedule 3. Required training for crew members and remote pilots also includes:

- crew co-ordination
- recognising and responding to human error
- identifying dangerous goods, and
- the procedures to be used on board the suborbital launch vehicle.

7.79 Due to the limited period of time that spaceflight participants will take part in any licensed suborbital human spaceflight activity, the training programme for these individuals may be restricted and tailored to training in “withstanding the stress of the suborbital activity” and “the functions they must perform or may be called upon to perform during the flight”.

Use of simulation equipment

7.80 If you are using training equipment which is capable of simulating a launch vehicle, or any equipment or facilities which will be used, you must ensure that the equipment meets fidelity requirements. Any difference between the simulated training device and the actual launch vehicle, equipment or facilities which it is simulating must be identified and described as part of the training programme.

7.81 For crew and spaceflight participants, you can also use devices designed to reproduce the effects of spaceflight on the human body, such as the effects of acceleration, disorientation, loss of pressurisation or other adverse physical effects connected with spaceflight.

7.82 It is your responsibility to ensure that any such devices are of the quality required and are operated safely.

Assessments

7.83 Licensees are required to ensure that everyone involved in the licensed activities has been assessed as competent. Regulation 70 specifies the requirements for competence assessments. These include how assessments should be conducted and what you need to do if anyone fails a competence assessment.

7.84 Regulation 70 also sets out the methods by which flight crew and remote pilots can be assessed, including the use of simulated training devices and aircraft.

7.85 Given the variety of launch campaigns, their respective levels of complexity and possibly prolonged intervals between launches, the Space Industry Regulations do not specify standardised intervals for competence assessments. This should be determined by the training manager and set out in the training manual.

Medical fitness

7.86 Licensees must ensure that no-one participates in licensed activities if they are not fit to do so. This applies to everyone working on the licensed activities, including those who are not performing a specified role (for example, ground operations staff, persons handling hazardous materials or who have a role in assembling, checking or handling propellants pre-and-post flight).

7.87 The arrangements for assessing fitness should be made through your occupational health advisory service(s), in accordance with health and safety best practice.

7.88 There are additional duties in relation to the medical fitness of crew members (including remote pilots) and spaceflight participants.

Medical fitness of flight crew and remote pilots

7.89 In line with regulation 72, you must ensure that all flight crew members and any remote pilots hold a valid medical certificate, issued by an approved aeromedical examiner (AME) or approved medical assessor.

7.90 An AME can only issue a medical certificate if they have carried out a medical examination and assessed the individual's medical history. The AME must be satisfied that the crew member or remote pilot is medically fit to participate in the proposed spaceflight activities and will be able to carry out the duties assigned to them.

7.91 You can either:

- appoint an AME / medical assessor to carry out the relevant medical examinations and medical assessments, or
- require crew members and remote pilots who already hold valid medical certificates to complete self-declarations of fitness.

7.92 All medical certificates are granted for a set period, which will be shown on the certificate. When the period of validity ends, members of flight crew, remote pilots and other crew members will need to be medically re-examined or assessed.

7.93 It is your responsibility to ensure that none of the crew has suffered a decrease in fitness due to illness or injury since the date of the issue of their medical certificate. Relevant decreases in fitness are those which might affect the ability of the crew members to:

- withstand the physical and mental rigours of spaceflight
- perform any safety-critical functions reliably during the spaceflight activities
- carry out any emergency procedures which may be required during the spaceflight activities, including evacuating the launch vehicle.

7.94 Due to the harsh conditions and stresses on the human body, individuals must not act as a member of crew on a launch vehicle, or as a remote pilot, if they know or suspect that their physical or mental condition renders them temporarily or permanently unfit to perform their role and responsibilities. Regulation 74(1) sets out some of the conditions that might render a crew member or remote pilot unfit.

7.95 Failing to comply with this requirement is an offence.

7.96 If an individual holding a medical certificate has any of the illnesses, injuries or conditions listed, they must inform the licensee's approved AME as soon as possible about the condition and seek medical advice. Once an individual has recovered from the injury or illness, or the condition no longer applies, the individual must undergo a medical assessment by an approved AME to confirm whether they are fit to take part in spaceflight activities. The AME must consult a regulator-approved medical assessor in relation to that assessment and may only determine that the individual is fit if the approved medical assessor agrees.

Fitness to fly

7.97 Beyond the requirement for crew members and any remote pilots to hold a valid medical certificate, you must additionally ensure that no person takes part in spaceflight activities, either as a crew member or a spaceflight participant, if that person is not medically fit to do so.

7.98 Broadly, this means that an AME or medical assessor must be satisfied that the individual's health and fitness will not:

- compromise the safety of any spaceflight activities in which the individual will be participating
- compromise the safety of any other individual on board the launch vehicle, or
- prevent the individual from performing the tasks assigned to them.

7.99 In determining whether an individual is medically fit for the spaceflight activity, the approved AME must take into account any operational or environmental conditions identified by the licensee which:

- are likely to apply in relation to the spaceflight activities in which the individual would be participating or acting as a crew member, and
- are relevant to the individual's state of fitness.

Such operational and environmental conditions could result in one individual being more susceptible than another; particularly where these relate to cumulative effects or age-related risks or are more pronounced due to an individual's medical history.

7.100 These conditions will depend on the type of spaceflight activities that will be conducted and the conditions that will be encountered during the flight. It is your responsibility to provide the AME with sufficient details of any such operational or environmental conditions, before they make their determination.

Spaceflight participant medical fitness

7.101 If your operations involve spaceflight participants, you are responsible for confirming their medical fitness to fly.

7.102 Spaceflight participants do not need to meet the requirements for a formal aviation medical certificate in the same way that crew members do, but they must nevertheless be confirmed as being medically fit to fly by an approved AME.

7.103 As with crew members, an approved AME may only confirm that a spaceflight participant is medically fit to fly, if:

- the AME has carried out a medical examination of the applicant and an assessment of that individual's medical history, and
- following that assessment and examination, the AME is satisfied that the individual concerned is medically fit to participate in the spaceflight activities proposed, and to carry out any duties that are they are expected to do in relation to those activities.

7.104 As with crew members, the approved AME must take into account any operational or environmental conditions identified by the licensee which:

- are likely to apply in relation to the spaceflight activities in which the individual would be participating or acting as a crew member, and
- are relevant to the individual's state of fitness.

7.105 The examination and assessment of each spaceflight participants must be completed before they board the launch vehicle.

7.106 It is up to you to decide the actual length of time between making the examination and assessments and the individual boarding the launch vehicle, taking into account any applicable regulation or guidance. You must also establish a procedure to ensure that, on the day of the flight, no spaceflight participant has suffered a decrease in medical fitness due to illness or injury.

Crew and spaceflight participant fitness immediately prior to flight

7.107 You can require all members of the flight crew and spaceflight participants to provide a declaration of continued fitness, or undergo a brief medical examination or assessment, as part of your immediate pre-flight procedures. If adopted, such a final check procedure must be completed before members of the flight crew and other crew members perform any duty on board a launch vehicle during spaceflight.

Spaceflight participants with disabilities

7.108 When in all other respects it has been determined that a spaceflight participant is medically fit to participate in the spaceflight activity and has capacity to give informed consent to take part in the operator's spaceflight activities, a licensee may make suitable arrangements for spaceflight participants with reduced mobility or disability to take part in a flight if:

- doing so would not compromise the safety of the flight, and
- the person with reduced mobility or disability, and any equipment they need in relation to that disability, would not impede or obstruct any flight crew, crew member or spaceflight participant in carrying out their functions, including executing emergency procedures or entering or leaving the spacecraft.

Fitness for training activities

7.109 The training programme for flight crew and spaceflight participants may include exposure to high-G, microgravity or any other physical experience or ambulatory requirement that can be replicated on the ground or during an aeroplane flight. You must determine the level of medical fitness required for these activities, under the advice of your AME and/or any other guidance we issue.

Licensees' decisions on fitness

7.110 Even when an individual holds a valid medical certificate, it remains your prerogative to decide on who operates as a pilot during its spaceflight activities. A licensee will have its own policies and procedures (particularly regarding examination or assessment before any particular flight) that can exclude pilots who may be developing, or have developed, a condition that is not compatible with the specific kind of spaceflight activity.

Medical records

7.111 Every medical assessment or examination of an individual intending to be carried on board a launch vehicle (and any made for a remote pilot) must be recorded by the approved AME who carried it out. The result of the assessment or examination must be reported to the individual concerned and to the spaceflight operator. In addition, the AME must send copies of records of medical assessments and examinations carried out for flight crew to us.

7.112 You must make the records of other kinds of medical assessments and examinations carried out available to us on request.

7.113 All medical records must be protected as confidential information, and not disclosed, otherwise than in accordance with regulations.

Medical instructions in the licensee's training manual

7.114 Your training manual must include details of how you will satisfy the medical regulations. The minimum content to be included in in relation to training, qualifications and medical fitness is:

- your policy in relation to medical fitness
- information on the responsibilities of the licensee, and the training manager in relation to medical fitness

- information on the responsibilities of the AME and medical staff taking part in the licensee's medical programme
- the medical requirements for any flight crew, remote pilots and spaceflight participants
- information for the approved AME, any flight crew and spaceflight participants and their medical advisers on:
  - when medical examinations and assessments will be held, and how they will be conducted
  - where medical examinations will be conducted, and what equipment and facilities are available for them
  - what medical reports will be required for the purpose of medical assessments
  - what conditions may be imposed on a certificate or confirmation of medical fitness
- the obligations of any flight crew, remote pilots and spaceflight participants
- a list of the medical records kept by the licensee.