

# Space sustainability – Launch – Guide

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BSI Flex 1971 v1.0:2025-04



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# Foreword

This BSI Flex was sponsored by the UK Space Agency. Its development was facilitated by BSI Standards Limited and it was released under licence from The British Standards Institution. It came into effect on 30 April 2025.

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The content in this version is part of an iterative process. It is likely to change from time to time with subsequent iterations.

## Relationship with other publications

This BSI Flex forms part of a suite of documents relating to space sustainability. The suite comprises:

- BSI Flex 1969 v1.0:2025-03, *Space sustainability – Overarching principles and framework – Guide*; and
- BSI Flex 1971 v1.0:2025-04, *Space sustainability – Launch – Guide*.

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## Use of this document

As a guide, this BSI Flex takes the form of guidance and advisory recommendations. It is not to be quoted as if it were a specification or a code of practice.

## Presentational conventions

The guidance in this document is presented in roman (i.e. upright) type. Any recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

*Additional commentary, explanation and general informative material is presented in smaller italic type.*

Where words have alternative spellings, the preferred spelling of the *Shorter Oxford English Dictionary* is used (e.g. “organization” rather than “organisation”).

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# Introduction

Space economic activities involve upstream (scientific and technological foundations) and downstream (data and applications) elements. Orbital launch is critical to delivering, replacing and occasionally returning upstream elements. Suborbital launch is also critical to vehicle development and science.

This BSI Flex aims to reduce the environmental impacts of space launch on Earth, Earth's orbit, other celestial bodies and the orbits around them and outer space.

This BSI Flex does not supplant any relevant legislation or regulation, and safety has primacy over any of the guidance contained herein.

This document aims to enable best practice, not stifle innovation. Where the cost of implementing this guidance is considered harmful to an organization's progress toward a launch solution and/or the guidance might undermine technical performance, organizations can apply a balanced view.

It is important to be clear on the aspects of launch in the context of this BSI Flex as this extends well beyond the impacts of simply operating a vehicle. Many of the decisions that configure the environmental impacts of a launch are made very early in the launch vehicle design and launch operations planning processes. The level of environmental impact of a launch campaign is materially affected by the way that the spaceport and launch operator provide launch and recovery support, and respond if there is an off-nominal event. The range has a key role in managing the launch and monitoring the launch environment. Payload providers define the materials and environmental characteristics of the payloads being launched and how their payloads are decommissioned, which might have an environmental impact on the launch phase of a mission.

Establishing the environmental impact of launch requires consideration of the entire mission, encompassing upstream and downstream. The guidance pertaining to launch activities and their sustainability in this BSI Flex can be considered in the end-to-end and holistic context of a space mission, and its associated economic, social or environmental benefits or disbenefits. It covers the entire production chain from material sourcing to end-of-life disposal.

Applying the principles within this BSI Flex can assist organizations to meet environmental goals by encouraging the design, manufacture, operation and disposal of spaceports and launch vehicles to be undertaken sustainably. Many of the responsibilities are not generic or relevant to some organizations, e.g. launch service providers are not responsible for the payload. For this reason, the guidance is set out by responsible organization.

Launch activities and launch vehicle operations can impact the environment in a variety of ways, including (but not limited to):

- a) emission of pollutants, such as combusting quantities of propellant and/or releasing greenhouse gases;
- b) effects of the production of components, structures, propellants, oxidizers and other liquids and gases utilized in launch vehicles; and
- c) impacts on the immediate local area, such as:
  - 1) the jettisoning of returning launch vehicle components, e.g. fairings and boosters, potentially including heavy metals into the sea or land areas;
  - 2) discarding further objects such as stages into orbit, which have the potential to become hazardous space debris and/or re-enter the atmosphere and potentially reach the ground causing further hazards at a later date;

- 3) the noise and vibration generated by the take-off, operation and flight of launch vehicles; and
- 4) the potential to generate fragments, blast waves and heat radiation effects on persons or property both for nominal flights and in the event of a catastrophic failure.

This BSI Flex advocates for minimizing these impacts through employment of mitigating design, operations or offsetting measures.

While it is beyond the scope of this document to cover the associated environmental, social and governance (ESG) aspects, ESG is included in Clause 24 because of the environmental element and its strategic importance moving forward. Adopting best ESG practice is likely to become increasingly relevant to the industry, especially when engaging with the insurance and finance sectors. The more insight and transparency these sectors have of launch, the more they are likely to stimulate investment and innovation, enhancing success of the space sector.

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# 1 Scope

This BSI Flex provides guidance on the environmental considerations for organizations planning, designing and/or operating any part of the orbital and suborbital space launch lifecycle. Its focus is to promote sustainable launch through identification of launch lifecycle environmental impacts and planning for mitigation actions leading to minimizing such impacts.

**NOTE 1** *The guidance contained in this document is aligned with the UK space and town and country planning regulatory regimes; however, it does not replace them. Safety and regulatory compliance have primacy over the guidance in this BSI Flex.*

It covers how organizations:

- a) incorporate environmental considerations and mitigations into their designs, supply chain, manufacturing and/or constructions;
- b) incorporate environmental considerations and mitigations into their planning and execution of operations;
- c) assess engineering and operational options to reduce environmental impact; and
- d) minimize the environmental impact of all phases of the launch lifecycle, from material extraction, through production and operation to decommissioning.

**NOTE 2** *PD ISO IWA 42, Net zero guidelines, provides guidance on development of credible, holistic, net zero strategies.*

This BSI Flex provides a guidance framework for launch organizations to help them deliver the least environmentally impacting products and operations.

**NOTE 3** *This is intended to increase the transparency and sustainability of organizations, and supports the journey towards ESG best practice and industry standardization.*

This BSI Flex is applicable to both orbital and suborbital launch systems and operations.

This BSI Flex is intended for use by launch service providers, spaceports, ranges and payload providers, launch brokers and their supply chains. It might also be of interest to those concerned with commissioning launches and/or seeking payload capacity. It is applicable UK-wide, and its guidance is available to be used by organizations internationally.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions, or limits the application, of this document<sup>1)</sup>. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BSI Flex 1969 v1.0:2025-03, *Space sustainability – Overarching principles and framework – Guide*

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<sup>1)</sup> Documents that are referred to solely in an informative manner are listed in the Bibliography.

## 3 Terms, definitions and abbreviated terms

### 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in BSI Flex 1969 v1.0:2025-03 and the following apply.

#### 3.1.1 acceptance tests

required formal tests conducted on flight hardware to ascertain that the materials, manufacturing processes and workmanship meet specifications and that the hardware is acceptable for intended usage

[SOURCE: BS ISO 14623:2003, 2.2]

#### 3.1.2 Concept of Operations (ConOps)

document describing how the operational system or process will be used from the viewpoint of an individual who will use that system or process

EXAMPLE A spaceport launch ConOps describes every activity undertaken to deliver a launch campaign, for both nominal and off-nominal launches.

#### 3.1.3 disposal phase

interval between the end of mission of a spacecraft or launch vehicle orbital stage and its end of life

[SOURCE: BS ISO 24113:2023, 3.6]

#### 3.1.4 end of life

instant when a spacecraft or launch vehicle orbital stage

- a) is permanently turned off, nominally as it completes its disposal phase,
- b) completes its manoeuvres to perform a controlled re-entry, or
- c) can no longer be controlled by the operator

[SOURCE: BS ISO 24113:2023, 3.8, modified – Note 1 to entry has been removed]

#### 3.1.5 end of mission

instant when a spacecraft or launch vehicle orbital stage

- a) completes the tasks or functions for which it has been designed, other than its disposal,
- b) becomes incapable of accomplishing its mission, or
- c) has its mission permanently halted through a voluntary decision

[SOURCE: BS ISO 24113:2023, 3.9, modified – Note 1 to entry has been removed]

#### 3.1.6 environmental management system

part of the management system used to manage environmental aspects, fulfil compliance obligations, and address risks and opportunities

[SOURCE: BS EN ISO 14001:2015+A1:2024, 3.1.2]

### 3.1.7 fairing

technical device intended to protect a spacecraft or a space nose section from external influences during transportation on a launch vehicle, and to keep it on trajectory when launching into orbit

[SOURCE: BS ISO 24917:2020, 3.7, modified – “launcher” has been changed to “launch vehicle”]

### 3.1.8 ground support equipment

non-flight systems, equipment or devices necessary to support the operations of transporting, receiving, handling, assembly, inspection, test, checkout, servicing, launch and recovery of a space system at launch, landing or retrieval sites

[SOURCE: BS ISO 14625:2023, 3.1.5]

### 3.1.9 launch campaign

period between when the launch service provider initially deploys for the launch operation to the end of the deployment

### 3.1.10 launch service provider

private or institutional entity that operates and manages the launch of spacecraft in accordance with the needs of its clients

*NOTE Launch service providers can provide a range of services, including one or more of the following: launch vehicle development, launch vehicle operations, launch site management, licensing and regulatory compliance, customer support, and multi-manifesting.*

### 3.1.11 launch site

site at which controlled and planned launches of launch vehicles, or elements thereof, take place

### 3.1.12 launch system

system made up of a launch vehicle, the associated launch site, payload, ground support equipment and associated airborne equipment (including software), control systems, navigation system, trajectories, procedures, necessary personnel, and any other associated items

[SOURCE: BS ISO 14620-2:2019, 3.13, modified – “launch complex” has been removed from the definition]

### 3.1.13 life cycle assessment (LCA)

compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle

[SOURCE: BS EN ISO 14040:2006+A1:2020, 3.2]

### 3.1.14 management system

set of interrelated or interacting elements of an organization to establish policies and objectives and processes to achieve those objectives

[SOURCE: BS EN ISO 14001:2015+A1:2024, 3.1.1, modified – Notes 1 to 3 to entry have been removed]

### 3.1.15 multi-manifesting

practice where multiple payload elements, usually from different customers or organizations, share a single launch vehicle to reach their respective orbits

### 3.1.16 nominal

reference to launch vehicle performance, trajectory, or stage impact point, a launch vehicle flight where all launch vehicle aerodynamic parameters are as expected, all vehicle internal and external systems perform as planned, within an acceptable tolerance of a given (named) value

### 3.1.17 off-nominal

launch related event which does not perform within expected/acceptable tolerance of a given (named) value

### 3.1.18 orbital

relating to the orbit of an object in space

### 3.1.19 payload provider

entity that designs, builds and prepares a payload for operations in accordance with the needs of its clients

*NOTE Payload service providers can provide a range of services, including one or more of the following: spacecraft development, spacecraft manufacture, licensing and regulatory compliance, customer support, and manifesting.*

### 3.1.20 propellant

combination of fuel and oxidizer

### 3.1.21 qualification tests

formal contractual tests used to demonstrate that the design, manufacturing, and assembly have resulted in hardware designs conforming to specification requirements

[SOURCE: BS ISO 14623:2003, 2.52]

### 3.1.22 rocket engine

reaction engine producing thrust for vehicle movement with the help of substances and energy sources contained within the vehicle being moved

[SOURCE: BS ISO 17540:2016, 2.1.1]

### 3.1.23 spaceport

site or airport from which launch related vehicles are operated

*NOTE Temporary installations at sea which are to be used only for landings are not "sites" and so cannot be spaceports.*

### 3.1.24 space sustainability

ability to maintain the conduct of space activities indefinitely into the future in a manner that realizes the objectives of equitable access to the benefits of the exploration and use of outer space for peaceful purposes, in order to meet the needs of the present generations while preserving the outer space environment for future generations

[SOURCE: United Nations. *Guidelines for the long-term sustainability of outer space activities of the Committee on the Peaceful Uses of Outer Space* [1]]

### 3.1.25 sustainability

meets the needs of the present without compromising the ability of future generations to meet their own needs

[SOURCE: Brundtland, *Our common future* [2]]

### 3.1.26 touch down

point or area at which controlled and planned landings of launch vehicles, or elements thereof, take place

## 3.2 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

|       |                                           |
|-------|-------------------------------------------|
| AEE   | assessment of environmental effects       |
| EIA   | environmental impact assessment           |
| ESG   | environmental, social and governance      |
| GWP   | Global Warming Potential                  |
| ICAO  | International Civil Aviation Organization |
| LCA   | life cycle assessment                     |
| LCOLA | launch collision avoidance                |