



CASE STUDY

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The Challenge

Until recently, the environmental impacts of space activities, particularly those occurring terrestrially, have largely fallen outside mainstream legislative and regulatory frameworks. This historical exclusion has meant that environmental performance has not been systematically measured or managed within the space sector, allowing impacts to remain secondary to safety, reliability and mission success. In some cases, regulatory exemptions have been relied upon to justify the continued use of restricted substances and carbon-intensive practices, reinforcing a lack of incentive to quantify or reduce environmental burdens.

A direct consequence of this regulatory and methodological gap is that the space sector has lagged behind other industries in its ability to account for greenhouse gas (GHG) emissions and wider environmental impacts. Unlike other sectors, the space industry lacks an established evidence base, consistent data collection practices and agreed methodologies for carbon accounting, particularly for complex Scope 3 emissions. While life cycle assessment (LCA) approaches are increasingly recognised as essential decision-making tools, their application within the space sector remains fragmented and at an early stage of development.

As a result, the true carbon footprint of space activities has, until now, remained largely unknown at a sectoral level. This lack of baseline information presents a fundamental barrier to effective policy development, target setting and the design of credible decarbonisation pathways. This project directly addresses this problem by establishing the first systematic, evidence-based assessment of the UK space sector's GHG emissions, providing the foundation required to inform regulation, guide industry action and support alignment with national Net Zero commitments.

Innovation

The study began with a comprehensive review of UK Net Zero legislation and existing space sustainability initiatives to establish the current regulatory and strategic context in which the UK space sector operates. This was complemented by semi-structured interviews with representatives from government, regulators, industry and research organisations. Together, these activities were used to identify gaps in policy coverage, inconsistencies in carbon accounting practices and priority areas where innovation, guidance or regulation are required to better address Earth-based environmental impacts of space activities.

Building on this contextual analysis, the project undertook individual carbon audits with a sample of UK space organisations that voluntarily participated in the study. These audits enabled participating organisations to better understand their own GHG emissions, while also generating primary activity data for the research. To protect commercial confidentiality, all organisational data was anonymised and aggregated before being used to construct a model of the UK space sector's upstream and downstream emissions. Emission factors were sourced from UK Government conversion factors, peer-reviewed literature and the Strathclyde Space Systems Database (SSSD), enabling improved coverage of complex space-specific Scope 3 emissions.

The resulting carbon baseline was then extrapolated to explore how sectoral emissions may evolve to 2050 under different growth and policy scenarios. Based on these projections, a Net Zero-consistent decarbonisation strategy was developed, identifying key emission hotspots and practical intervention pathways. Overall, the findings demonstrate that while Net Zero is technically feasible for the UK space sector, delivering it will require coordinated policy action, with sustained commitment from industry and government alike.

Result

The literature indicated that the UK is not on track to achieve net zero and lags behind Europe in carbon accounting, particularly for organisational coverage and Scope 3 emissions. Despite previously leading in space-sector carbon accounting, the UK has been

overtaken by France and risks falling further behind unless Earth-based space sustainability is treated as a strategic priority. The interviews indicate that Earth-based space sustainability in the UK is fragmented, with a strong emphasis on in-orbit impacts over terrestrial emissions. Stakeholders stress that harmonised standards, clearer regulation and economic incentives are needed to embed carbon accounting while supporting sector growth.

The quantitative analysis indicates that the UK space sector generated approximately 0.85 million tonnes of carbon dioxide equivalent (MtCO₂e) in 2024. Scenario modelling shows that, in the absence of significant policy or technological intervention, sectoral emissions could increase substantially, reaching up to 3.64 MtCO₂e by 2050 under a high-growth, low-mitigation (worst-case) scenario. These findings underscore the scale of the challenge facing the sector as it continues to grow.

In response, a Net Zero consistent decarbonisation strategy was formulated, structured around seven thematic areas addressing: energy consumption; data processing & storage; products, processes & services; launch; transportation; waste & end of life; and regulation, policy & initiatives. The success of this strategy will depend not only on the deployment of emerging technologies but also on the cultivation of a new sustainability culture within the UK space ecosystem: one that treats environmental stewardship as integral to competitiveness and leadership on the global stage.

Impact

This research provides the first credible evidence base on the GHG emissions of the UK space sector, addressing a long-standing blind spot in both policy and industry decision-making. By establishing a robust carbon baseline and projecting how emissions could evolve under different growth and policy scenarios, the work moves the conversation beyond aspiration and into measurable action. Without intervention, emissions could rise sharply, but with targeted, coordinated action, Net Zero alignment is technically achievable.

By distributing this research in the form of a technical report to the Civil Aviation Authority, UK Space Agency, UKspace and UKRI (as well as presenting the findings to Space Scotland and the Cross-Party Group of the Scottish parliament on Space), its immediate impact lies in giving regulators, funders and

industry a common reference point and practical decarbonisation roadmap for the UK space sector that can be integrated into existing governance, funding criteria and innovation programmes. Additionally, the participating organisations gained an understanding of how to measure and manage their own carbon footprint, allowing them to begin their journey into sustainability.

More broadly, the research has the potential to reshape how sustainability is treated within the sector. Rather than being viewed as a compliance burden or secondary consideration, it can become a strategic driver for competitiveness, resilience and international leadership. In the longer term, this work positions the UK to regain leadership in Earth-based space sustainability by influencing international best practice and supporting the development of tools, standards and policies that align sector growth with Net Zero commitments.



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“This work has provided an estimate into the GHG emissions of the UK space sector for the first time and shown how it could evolve in the coming decades. The research suggests that achieving Net Zero is possible, but it will not happen by default. It requires urgent and coordinated action, better data and a shift in how environmental performance is considered alongside innovation and growth. By identifying where emissions actually occur and what interventions matter most, this work provides a practical foundation for policymakers and industry to act with confidence.”

“Working with Andrew as Researcher in Residence has been extremely valuable. His analytical strength and practical, solution-focused approach underpinned a robust baseline of UK space sector emissions and a clear set of recommendations. With a deep understanding of sector-specific emissions, risks and opportunities, he consistently navigated complex data challenges and delivered work that is both credible and directly relevant to real-world decision-making.” - Luisa Doughty (Satellite Applications Catapult, Mission Manager, Nature Restoration - Sustainable Earth)