



The North Star Metric: Investment Outcomes from UK Space Agency funding

Report for  UK SPACE AGENCY

FINAL

know.space

April 2024

About us

know. /nəʊ/.

to understand clearly and with certainty

know.space¹ is a specialist space economics and strategy consultancy, based in London and Edinburgh. We are motivated by a single mission: to be the source of **authoritative economic knowledge for the space sector**.

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Cover image: A star trail photo taken at a remote location with Polaris (the North Star) as the centre star. Source: Shutterstock, photo ID 1647998554.

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Executive Summary

About the North Star Metric and this study

The UK Space Agency works to ensure that its investment in space brings about real benefit to the UK and its people. Against a backdrop of constrained finances and rising cost of living, it is critical to show that every pound of government funding not only represents value for money but that it catalyses maximum wider investment. This rationale underpins the Agency's principal measure of success: the **North Star Metric**.

The Metric aims to measure investment and revenue that the Agency catalyses in the UK space sector, but is not designed to capture other important benefits driven by Agency activity, such as leading pioneering scientific discovery. While it is the principal metric, it is not the only measure of success. The North Star Metric focuses on impacts through driving new private and internal investment, and revenue.

know.space were commissioned to support the Agency in the collation, collection and reporting of North Star Metric data. The scope for this study included all relevant national programmes and selected European Space Agency (ESA) programmes, and used a mix of primary and secondary research to collect evidence on Metric impacts. It is an exploratory study and represents the first comprehensive effort to measure North Star Metric outcomes across the Agency.

Caveats include challenges of attribution, coverage, aggregation, reliance on self-reported data and scope, with outcomes we see today often the results of activities from years ago. This means that it is difficult to estimate aggregate annual North Star Metric investment figures, particularly given the relatively early stage of data collection, with Metric reporting only having been introduced as a requirement of grant funding in August 2022 (and subsequently rolled out in new funding calls). Nevertheless, we find evidence that **the UK Space Agency is driving significant impacts in terms of the value of investment and income it brings into the sector**.

Overarching investment trends

Different programmes affect investment outcomes in different ways, and it is the combination of programmes and activities that influences sector-wide investment outcomes. Sectoral trends do not provide hard evidence of attribution to the Agency's funding but provide important context.

Recent years have seen a substantial increase in private investment in the UK space sector. For example, **over the 2012-22 period £11.7bn was invested in the UK space sector, with 83% of this having taken place since 2019**. In the decade to 2020/21, sector revenue (turnover) also grew by 58% in real terms.

We also researched c. 300 companies who received UK Space Agency or ESA funding in the last five years, finding that these **funding recipients collectively went on to secure £357m in investment** across 42 deals (excluding two 'mega-deals' valued at £7.2bn). While this does not determine causation (and we include it as contextual evidence rather than as a direct measure of performance against the North Star Metric), it is evidence that UK Space Agency-funded companies go on to secure significant private investment following Agency support.

Programme-level evidence

Given the August 2022 introduction of Metric reporting requirements, the Agency is in the relatively early stages of standardised evidence collection. While recognising this, to complement

top-down approaches, evidence at programme- and project-level was assessed, considering relevant UK national programmes and selected ESA programmes.

In all programmes we found clear evidence of a link between Agency funding and new investment and/or revenues. For example, in the ESA Boost! Programme, £18m funding through ESA has helped unlock £12m in match funding and nearly £78m in private investment in the UK.

Aggregate outcomes

While caveats apply when aggregating data across different programmes, £982m in UK Space Agency funding has so far generated **£533m in match funding, £51m in revenues, £286m in private investment and £32m in internal investment**, as well as **380 new jobs**. We expect these totals to significantly underestimate total Metric outcomes given that reporting requirements have only relatively recently been rolled out, often in new calls that are at early stages of delivery. This therefore represents a partial and evolving picture of impact.

Different programmes contribute to these observed outcomes in different ways, with (for example) match funding aggregate figures driven overwhelmingly by ARTES/BASS data, while private investment impacts are driven in a more even way, with evidence for more than £20m private investment occurring as a result of Agency funding in 5 different programme areas. Aggregate results - like programme-level results - often reflect the extent of data availability in a given area and should not be interpreted as a measure of a programme's performance against the Metric.

There are many tangible examples of significant investments as a direct result of Agency funding, yet many programmes are also at early stages of delivery and the **impact story is still unfolding**.

Forecast data should be used with caution and is not included in our central estimates, though if included (to 2027/28) then expected revenues as a result of Agency funding would rise to £1.2bn, private investment to £733m, and job creation to over 1,100, with much greater impacts expected to 2030 and beyond.

Next steps and recommendations

Monitoring and Evaluation (M&E) processes have been and are being put in place to capture North Star Metric impacts across the Agency's programmes, which will strengthen evidence over time, including on impacts beyond the scope of the Metric. This study represents a starting point, intended as an evidence stocktake and a platform from which to build in future. Our recommendations are that the Agency should:

- 1. Continue to improve Metric data collection through programme-level Monitoring & Evaluation**, including to assess attribution of reported impacts to Agency activity and to better understand the driving factors behind observed outcomes.
- 2. Combine 'bottom up' with 'top down' approaches to gain greater insight**, tracking sectoral trends and building a database of relevant investment events, using business information platforms, supplemented by programme team knowledge.
- 3. Leverage regular engagement with key UK space sector organisations** to probe and collect evidence on North Star Metric outcomes that may not relate to a single project or strand of activity.
- 4. Continue collaborative working with ESA to ensure that outcomes on revenues, investments and jobs impacts are captured** in socio-economic impact studies, where possible with impacts separated out at Member State level.
- 5. Improve consistency of data collection across programme areas** and develop the centralised Agency evidence base, ensuring common standards are implemented in line with best practice Metric outcome reporting.

1 Introduction

1.1 About the North Star Metric

The North Star Metric (“the Metric”) aims to measure investment and revenue that the UK Space Agency (“the Agency”) has catalysed in the UK Space Sector. It is the Agency’s principal metric of success. The Agency made a public commitment, via their Corporate Plan (2022-25), to generate private investment, deliver missions and capabilities, and champion space, with the Metric noted as being vital to assessing the Agency’s success in delivering on these promises.

Overseen by the UK Space Agency Executive Committee, the Metric is part of broader Agency Monitoring and Evaluation (M&E) activities, which enable them to assess progress, remain accountable, and proactively adjust their programmes and approach through evidence-based decision-making. Since August 2022, reporting on progress against the Metric has been a condition of Grant Funding Agreements. Funded organisations are required to provide data on the following core elements of the Metric:

Table 1: Key elements of the North Star Metric

Term	Definition
UK Space Agency funding	Total funding received or allocated from the UK Space Agency, or from the European Space Agency as a result of UK funding, for a given project.
Match funding	Matched contributions provided by the organisation, either as a condition of the funding agreement or as an additional contribution (total economic cost minus UKSA funding).
Private investment ²	Money invested by companies, individuals, or financial organisations through the following vehicles: equity, grant, prize, debt or alternative finance sources - excluding funding provided by UK Space Agency directly or via the European Space Agency. The source of the investment can be either foreign or domestic.
Internal investment	Investment within a company, or from a parent company to its subsidiary, to cover R&D, capital expenditures and other non-capital expenditures such development of intellectual property (not including any match funding contribution).
Revenue	Additional income generated from the creation of goods and services, as a result of the specified grant or contract. In the longer term, this may also include income generated from royalties and licenses.

Source: UK Space Agency

While not part of the North Star Metric, job creation estimates are collected alongside North Star Metric outcomes and are therefore included in our reporting. By job creation, we refer to full time equivalent (FTE) roles created directly as a result of funding. We do not include jobs retained or indirect job creation through the supply chain in our totals.

Further information about the Metric and guidance for funded organisations on what information should and should not be reported on is available in online guidance for specific programmes, such as for the [National Space Innovation Programme](#) open call in 2023. The Metric seeks to collect information on outcomes that would not have occurred in the absence of UK Space Agency

² Note: this category does include non-UK Space Agency/ESA public sources of investment (e.g. UK Research & Innovation funding).

funding and that are attributable to a given grant or contract. Organisations in receipt of funding through multiple grants are required to provide Metric data separately against each grant.

1.2 About this study

know.space were commissioned to support the UK Space Agency in the collation, collection and reporting of North Star Metric data. This is an exploratory study, to better understand the quality of data across different programmes, and to understand the potential for reporting an Agency-wide picture on success against the Metric. Indeed, this is the first comprehensive effort to measure North Star Metric outcomes across the Agency. As such, a core focus of the report is to discuss data quality and provide recommendations for Metric data collection and reporting in the future.

This report sets out our findings from the project, which ran from June 2023 to March 2024. It discusses the role of the Agency’s funding in driving Metric outcomes, and presents evidence at programme level (with project data received typically aggregated, to ensure confidentiality), and at the Agency-wide level. Beyond this report, we have provided underpinning data on the Metric collected through the course of this project to the Agency, for future use. The study scope included all relevant national programmes and selected European Space Agency (ESA) programmes.

1.3 Methodology

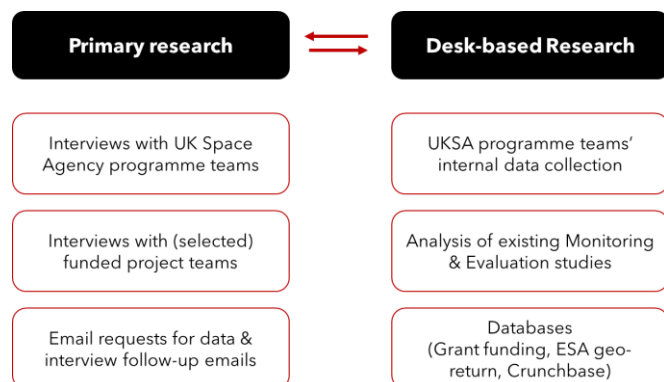
Our methodology used a combination of primary research, in which we engaged with UK Space Agency programme teams and funding recipients to collect data and evidence, and desk-based (secondary) research where data was assessed and (where possible) gaps filled using other sources such as published evaluation studies. This multi-faceted approach allowed significantly more coverage than would have been possible through a ‘one size fits all’ approach.

In addition to analysing UK Space Agency and ESA grants data, we conducted analysis using Crunchbase, a platform that provides detailed information on startups, private and public companies, including data on funding rounds, mergers and acquisitions. This tool was used to understand investment outcomes for companies that had previously received Agency funding and we did not attempt to attribute outcomes directly to Agency funding using this approach. These findings provide additional contextual evidence of Metric outcomes, but do not directly contribute to the North Star Metric aggregate figures that are presented.

Mindful of the need to avoid undue burden on funding recipients, in several areas it was agreed that analysis should concentrate on desk-based research using existing evidence only. In others, we sought to engage directly with funding recipients through email requests for data and interviews to understand outcomes of their project funding in more depth. The approach was tailored to - and agreed with - each programme team. In total, we contacted 87 funding recipients, with a 48% response rate. Implications of data limitations are discussed where relevant in programme sections below.

As the aim was to understand the strength of the evidence base in and across different programme areas, the study was flexible in the time period over which relevant outcomes were assessed, typically seeking to capture outcomes for projects funded over the last 3-5 years. We also analysed some retrospective data from earlier Agency funding, where this exists, and to the extent possible separated out ‘actual’

Figure 1 Approach to data collection



from 'forecast' data to ensure reporting is based on true outcomes.

While incorporating findings from desk-based research was often not straightforward, given differences in definitions, scope, methodologies and timelines, existing sources of evidence which provided useful inputs included studies such as:

- [Returns and Benefits from Public Space Investments 2021](#) (know.space, 2022)
- [Impact evaluation of UK investments into ESA](#) (Technopolis et al, 2022)
- [Evaluation of the Centre of Earth Observation Instrumentation \(WECD, 2022\)](#)

Synthesised data was then assessed for quality and limitations, with ongoing sense-checking of numbers, taking care to avoid duplicates, e.g. where the same investment deal could be identified both through primary and secondary research.

While the ability to use advanced statistical analysis was limited, due to data quality and coverage issues, we analysed North Star Metric impacts at **portfolio and programme level**, combining quantitative data with qualitative insight. Some data represented forecast rather than 'actual' data, which we report on separately, applying a 25% optimism bias adjustment³. We also developed three **case studies** to highlight key themes and to illustrate the routes to impact of UK Space Agency funding and activity. All underlying data has been quality assured. Limitations and caveats to the evidence presented in this report are set out below.


1.4 Caveats

Scope: The outcomes we see today are often the results of activities and investments from many years ago. When considering project-specific outcomes for current programmes only, therefore, any North Star Metric relevant outcomes that are attributable to projects under UK Space Agency programmes that no longer exist (such as the International Partnerships Programme, National Space Technology Programme, or Space for Smarter Government Programme) will not be captured. Similarly, in many cases, Agency programmes are relatively new (e.g. the International Bilateral Fund, Space Clusters and Infrastructure Fund, and National Space Innovation Programme) and - while in-progress monitoring and evaluation activity should lead to good evidence in future - there is only limited evidence on North Star Metric-style outcomes at the present time.

Attribution: Outcomes in terms of revenues, jobs and investment at organisational level are often the result of many different inputs, of which UK Space Agency project funding may be one. There is a risk that outcomes can be over- or under-attributed, given complex routes to impact. Respondents were asked to provide outcomes attributable to a given UK Space Agency-funded project only, though these are often inherently difficult to identify and separate out. The UK Space Agency developed guidance for funding recipients to improve understanding of what should be including (and what should not), such as the online guidance for the 2022 National Space Innovation Programme call. In some cases, interviews were carried out with funded organisations to unpack complex attribution stories. Additionally, our Crunchbase investment database offers a different lens with which to view Metric outcomes, where we do not attempt to narrowly define attribution.

Coverage: With North Star Metric reporting only having been mandated since August 2022 (and even then, not in all programme areas as its relevance varies), limited evidence on Metric impacts exists in many programme areas. It is therefore difficult to present a definitive, Agency-wide picture of success against the Metric, with data often reflecting the extent of data collection by programme area. The results presented here therefore often show evidence and examples of the link between UK Space Agency inputs and Metric outcomes, but do not seek to holistically measure the Agency's success. We cannot know the extent to which fuller coverage would increase results, though given substantial gaps in coverage, we would expect current totals to considerably

³ This assumption is commonly used in science and innovation appraisal, though we recommend it should be seen as a placeholder only, to be replaced when stronger evidence on how actual outcomes compare to forecasts is available.



underestimate total North Star Metric outcomes. The findings set out here are therefore recommended to be understood as a starting point from which to build in future.

Aggregation: Analysis involved aggregation of data collected by Agency programme teams where interpretation of the Metric reporting ask may have differed from case to case. It combines data that comes from different sources with different methodologies, definitions and timelines. For example, we incorporate evidence from selection evaluation studies which were run prior to the introduction of the Metric - while we take care to only incorporate relevant and robust evidence, these studies were run with different approaches.

Self-reporting: Metric reporting relies on self-reporting, which can carry risks from bias, misinterpretation of questions, selective reporting, and/or incomplete awareness of outcomes. While we tried to verify information using information in the public domain where possible, inevitably the analysis involves some 'taking as given' of reported values. Optimism bias will also apply to forecast data (we discuss this in more depth in section 3.1).

2 Overarching investment trends in the UK space sector

The UK Space Agency's [Corporate Plan 2022-25](#) sets out how the Agency's programmes help meet the ambitions set out in the [National Space Strategy](#). The three elements of the UK Space Agency Value Proposition set out how the Agency aims to (i) catalyse investment, (ii) deliver missions and capabilities, and (iii) champion space. Related primarily to the first of these elements, the North Star Metric is stated as being the most important measure that the Agency's leadership will use to ensure they remain on course, through maximising total investment into the UK space sector.

Agency programmes cover a wide range of activities. In the 2022-23 financial year, 79% of funding was allocated through ESA programmes, with 20% for national programmes (the National Space Innovation Programme, Launch, the National Space Operations Centre, Space Clusters Infrastructure Fund, and other discretionary programmes under the national programme).⁴

Different programmes affect investment and growth in different ways. Some are focused on technology development (e.g. the Centre for Earth Observation Instrumentation, or the ESA General Support Technology Programme), while others, such as those focused on skills and inspiration, are centred on developing cross-cutting capabilities and building for the future.

For example, programmes focused on low Technology Readiness Levels (TRLs) (e.g. the Enabling Technologies Programme) can be further away from commercial outcomes than those focused at higher TRLs (e.g. in-orbit demonstrator activities). While a given programme area may have fewer direct Metric-related outcomes to report on, this does not mean that the role of that programme in supporting UK space sector growth and investment is any less important. Other programme areas may have a less direct commercial focus but can still help grow capabilities and skills that can generate investment and revenues in the future. Ultimately, it is **the combination of these different activities and programmes that influence sector-wide investment outcomes.**

In the sections that follow, we discuss how different programmes play a role in driving outcomes against the North Star Metric. We heavily caution against any direct comparison between programmes or interpretation that larger outcomes captured are an indication of 'better' performance against the Metric, given the differences in focus between programmes. Furthermore, while the Metric represents the Agency's principal metric of success, it is of course not the only key performance indicator. Environmental benefits unlocked by satellite services, improved disaster response, and advancing the frontiers of human knowledge through space science missions are all goals set out in the National Space Strategy, though are outside of the direct scope of the Metric.

The analysis in Section 3 focuses on project-specific outcomes, which can miss bigger picture outcomes that may not be the result of a single project. Additional insight can be gained by looking at **overarching private investment trends** in the sector. Observed trends are not necessarily a result of UK Space Agency funding, though provide a way to consider these trends. **Figure 2** presents results from the *Size and Health of the UK Space Industry 2022* study on UK investment trends⁵. While year-on-year changes can be volatile, **recent years have seen a substantial increase in investment** (e.g. over the 11-year period analysed here, 83% of investment was in 2019-22, albeit with a more recent dip). While these results will inevitably be

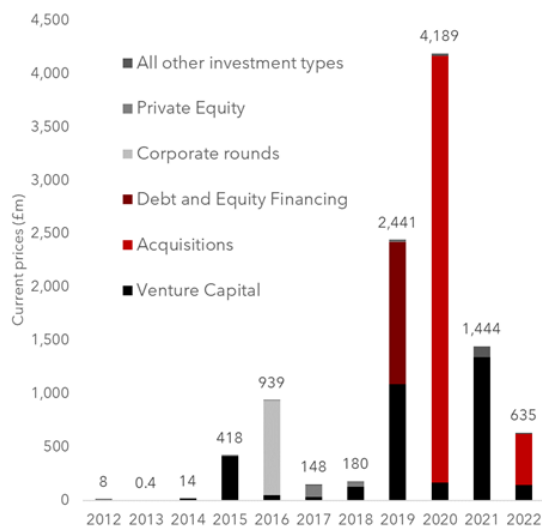
⁴ UK Space Agency Annual Report and Accounts 2022-23, published July 2023. The remaining 1% is for admin spend.

⁵ This investment analysis is subject to its own limitations. Notably, only UK-headquartered space organisations are included, only publicly announced investments are included and results are influenced by a small number of 'mega deals'.

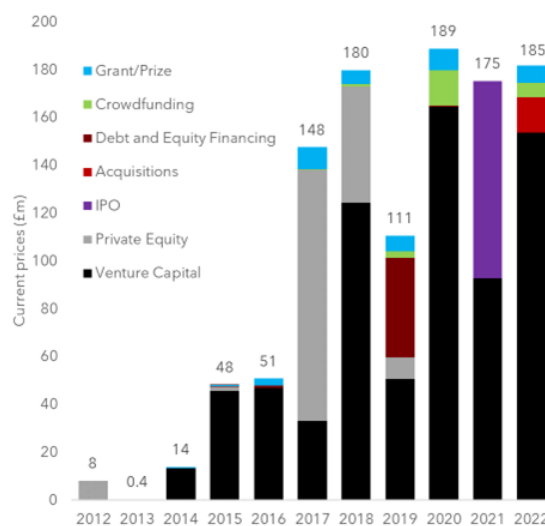
influenced heavily by other factors such the broader UK and global macroeconomic and political landscape, they are important contextual indicators for understanding the Agency's impacts on investment.

Figure 2: UK space sector investment, 2012-2022

Total invested (all deals), 2012-2022



Total invested (deals <£100m only), 2012-2022



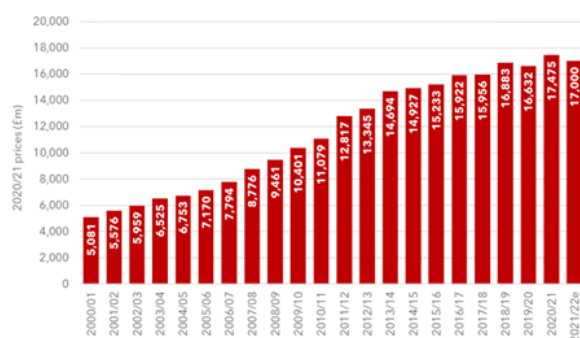
Source: know.space analysis of Crunchbase data, as presented in the *Size and Health of the UK Space Industry 2022* report (published March 2023), produced by know.space for the UK Space Agency

Similar analysis can be conducted for other constituent elements of the Metric, such as sector **revenue** (turnover) as shown in Figure 3 below. For example, estimated space sector turnover (in 2020/21 prices) grew from £11.1bn in 2010/11 to £17.5bn in 2020/21. This is equivalent to a **58%** increase over the decade, in real terms.

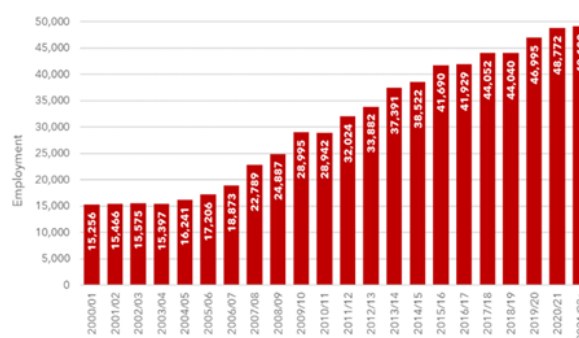
Taking a similar approach for **jobs** impacts, sector employment grew from 28,900 in 2010/11 to 48,800 in 2020/21, equivalent to a **69%** increase over the decade. Again, this is not intended to be interpreted as solely attributable to UK Space Agency activity, but provides context and a broader lens through which impacts can be considered. While job creation and employment are not directly captured by the North Star Metric, they provide useful additional information on impact.

Figure 3: Trends in UK space sector revenue and employment, 2000-2021

UK space sector revenue (2020/21 prices)



UK space sector employment



Source: know.space (2023), *Size and Health of the UK Space Industry*, report for the UK Space Agency. 2021/22 figures are estimates.

The Agency's success against the North Star Metric should be considered by looking at these broader sectoral trends, as well as by looking at programme-specific evidence, which we present below.

3 Data and evidence on North Star Metric outcomes

In this section we present the data and evidence collected on North Star Metric outcomes. Compared to the discussion presented in the previous section, this represents a more ‘bottom up’ approach to analysing outcomes for funded organisations in terms of investment and revenue, as well as job creation. Typically, information is collected on a case-by-case basis from funding recipients, exploring the investment-relevant outcomes that stemmed from their project funding. We provide best estimates of Metric outcomes based on the available data, though note that these estimates are likely underestimates, given that they rely on a sample of outcome data only.

While recognising that there are typically close links between national and ESA programmes, we present these separately. **National** programmes cover the following:

- The **Launch** Programme;
- **Innovation** funding for the National Space Innovation Programme (NSIP) and Enabling Technologies Programme (ETP);
- **International** funding, principally the International Bilateral Fund (IBF);
- **Earth Observation** funding, such as for the Centre for Earth Observation Instrumentation (CEOI) and other national EO programmes;
- **Sustainability and Safety** activities, such as the UK Active Debris Removal Mission;
- **The Inspiration** Priority, including the Space Placements in Industry (SPIN) scheme; and
- **Local growth and clusters** funding.

The following **ESA** programmes are analysed:

- **Space Science and Exploration;**
- **ARTES** (Advanced Research in Telecommunications Systems) and **BASS** (Business Applications and Space Solutions);
- **GSTP** (General Support Technology Programme);
- **Boost! / CSTS** (Commercial Space Transportation Services and Support); and
- **Earth Observation.**

Data was collected in a two-phased approach. The first phase (June - December 2023) focused on those programmes with a direct North Star Metric focus, such as programmes with an explicit aim to bring new products and services to market. The scope was then broadened in the second phase (January - March 2024), reflecting the Agency’s desire to demonstrate North Star Metric benefits in less commercially-focused activities, such as in Inspiration, Space Science and Exploration. As such, there are minor differences in methodology and timing of data collection between programmes.

3.1 UK Space Agency national programmes

3.1.1 Launch

The government’s vision is for the UK to be at the global forefront of small satellite launch and emerging space transportation markets - providing world-leading capability, bringing new markets to the UK and inspiring the next generation of British space scientists, engineers and

entrepreneurs.⁶ Beyond the direct National Space Strategy aim of capturing the European market in commercial small satellite launch, UK launch capability is also expected to lead to wider growth impacts through attracting new business and investment from around the world, while creating highly skilled jobs across the UK.⁷

The UK Launch Programme is targeted at delivering pathfinder UK launches, co-funding the development of critical launch infrastructure and technology, managing international agreements with other governments, and raising awareness of UK launch activities to inspire new STEM students and professionals, space customers and investors.

To date, the Agency has made £50m of grant funding available⁸ to kick-start commercial activity, including £31.5m to help establish vertical launch services from Scotland. As part of the pilot round of Launch UK Technology Grants, 14 projects were funded in late 2022, at a total of £2.9m, with individual projects funded at a maximum of £400k.

So far, we have received evidence for 10 of these projects, representing £1.9m in UK Space Agency grant funding. These projects reported private investment of approximately £930k since receiving funding in late 2022. Another company is currently in discussions with various firms for a potential £5m+ investment, with approximately 80% expected to go to the UK branch of the firm. We received limited evidence on new internal investment as a result of UK Space Agency grants, with one firm noting they secured £13k in internal investment for software development.

For revenues, one company reported that the grant 'significantly improved' their chances of securing an £800k contract⁹. Another company has secured two contracts worth £230k, which could increase in value in the future to £1.3m. Lastly, one company forecasts revenues of £3.4m (2023-29) for a product developed under the programme¹⁰. These grants also led to the creation of 10 new FTE positions, spread across multiple regions (London, the East of England, and Scotland).

As projects progress and more projects with awarded funding are able to report on Metric outcomes, the evidence picture will strengthen. With the above based on £1.9m of Agency funding, it should be interpreted as examples of impacts taken from the 10 projects we have evidence for, rather than a comprehensive assessment of outcomes from all launch activities.

While Launch funding is already driving North Star Metric outcomes in terms of leveraging companies' contributions to deliver new R&D (which in turn will lead to innovation benefits), it will take time for this funding - and the UK launch capability as a whole - to translate through to industry growth effects. At the time of writing, the first launch from UK soil to successfully reach orbit has not yet taken place, and policy is focused on the longer-term objective for the UK to become a leader in small satellite launches by 2030. Many of the expected benefits in terms of (for example) increased Foreign Direct Investment and catalysing domestic industry growth will therefore play out over longer timescales.

To capture these longer-term North Star Metric outcomes, the Agency has developed a Monitoring and Evaluation plan for the Launch Programme. This plan will allow the Agency to gather information throughout the programme's duration, to be able to amend programme design to maximise value for money, evaluate the extent to which the programme is delivering against its objectives, provide assurance that benefits are on track to be realised, and gather evidence for future investments into the launch sector. The evaluation will be carried out both at programme level (understanding how the overall design of the programme contributes to meeting objectives

⁶ See: <https://www.gov.uk/guidance/how-we-are-promoting-and-regulating-spaceflight-from-the-uk>

⁷ UK Space Agency Corporate Plan 2022-25

⁸ <https://www.gov.uk/government/publications/launchuk-brochure-the-uk-spaceflight-programme/launchuk-the-european-leader-in-commercial-small-satellite-launch>

⁹ For calculating aggregate figures, we applied 50% attribution based on this qualitative description.

¹⁰ As forecast data, this does not directly contribute to the North Star Metric totality.

and delivering benefits) and at project level (understanding which specific approaches in terms of specific interventions work best in achieving the objectives).

The plan also recognises that one of the key challenges for evaluation is that some of the most significant impacts will only be realised in the longer term. As such, the Agency plan to continue monitoring beyond completion of the programme so that further evaluation can be conducted.

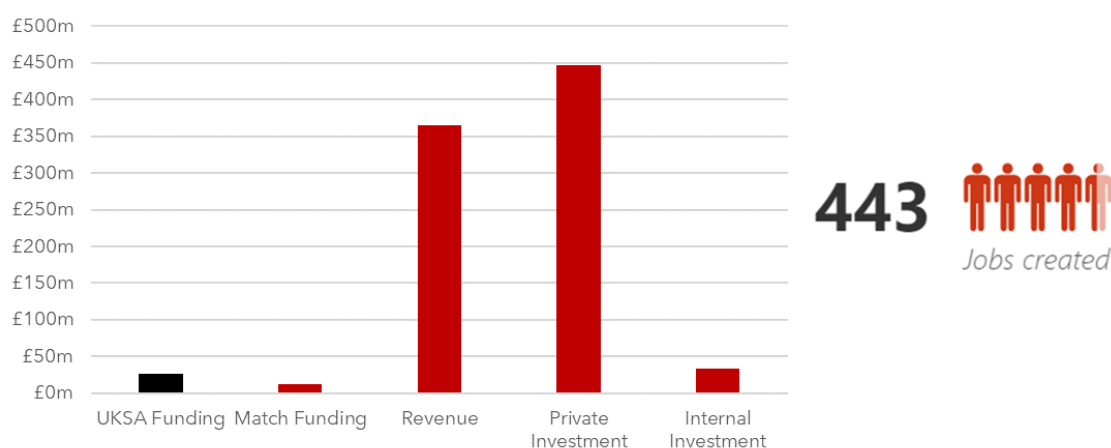
3.1.2 Innovation

The programmes we consider in this category are the **National Space Innovation Programme (NSIP)** and the **Enabling Technologies Programme (ETP)**. Launched in pilot form in 2020, NSIP offers funding to high-risk projects with potential for high returns. The programme has so far consisted of three funding rounds, totalling over £25m in funding, with a £65m funding call launched in September 2023.¹¹ ETP is a newer UK Space Agency programme, launching its first funding round in 2022. The programme provides opportunities for the research and development of emerging and innovative technologies across the UK space sector. So far, the programme has completed two calls, with funding totalling £5m, with further funding rounds ongoing.

Both programmes have strong North Star Metric data monitoring procedures in place, with funding recipients required to provide projections for all relevant metrics at the proposal stage and updates at intervals thereafter. Funding recipients provide quarterly projections for the next three years and yearly estimates for an additional three years, with confidence estimates.

Inevitably, as a relatively new programme, Metric impacts are overwhelmingly based on **forecast data** rather than already-realised outcomes. The analysis presented here is based on data provided by funding recipients (covering £26m of funding) regarding their future expectations. As self-reported forecast data, as agreed with UK Space Agency analysts an **optimism bias** adjustment of 25% was applied. Note that all figures are in nominal, undiscounted terms.¹²

Figure 4: Forecast North Star Metric impacts for NSIP



The £26m in Agency funding has generated £12m in match funding and is **forecast to generate over £350m in revenues, nearly £450m in private investment and over £30m in internal investment, as well as nearly 450 jobs** from the 2022/23 financial year through to 2027/28. As forecasts, these are outside the scope of the North Star Metric (which focuses on actual outcomes)

¹¹ UK Space Agency (2023). *UK launches £65 million funding call for space technologies and applications*. Available at: <https://www.gov.uk/government/news/uk-launches-65-million-funding-call-for-space-technologies-and-applications>

¹² Due to differences in methodologies and format of data across projects and programmes, it is difficult to apply a consistent price base year (as the original is not always known) and discount rate (as the time period for forecasts was not always clear). It was agreed therefore that results should be presented in nominal, undiscounted terms.

and we do not include them in aggregate figures (see Section 4) but include them to show recipients' expectations on what future impacts may be.

There is no guarantee that forecasts will become reality, and even with optimism bias adjustments, it is likely that true values will be lower than those reported here (e.g. few businesses expect that they will fail, and/or there may be incentives to over-report on impact). Nevertheless, this can be interpreted as **evidence that NSIP is expected to deliver significant Metric outcomes.**

Case study: D-Orbit

Interplay between UK Space Agency and ESA programmes, together with internal company investment, contributing to UK company growth

D-Orbit's journey in the UK started in 2019 by inward investment after a Series 'A' round in which Seraphim took a stake. The UK business is now engaged in several diverse projects and is self-sustaining. Recent streams of activity include:

- An [National Space Innovation Programme \(NSIP\) 'Census' project](#) looking at space-based Space Situational Awareness (SSA)
- A 50% co-funded [ESA CSTS/Boost! project](#) focused on development of an end-to-end space transportation service
- A 50% co-funded ESA Pioneer as a partner on the AAC Clyde Space [XPANCIION](#) project
- Internal investment (i.e. no public funding) in Space Cloud Computing

The Boost! and Pioneer funding relate to different aspects of the UK-based launch service, but together resulted in a competent UK team able to deliver launch and In-Orbit Demonstration/Validation services, and built links with UK launch service providers and spaceports.

The NSIP project aimed at exploiting D-Orbit existing orbital assets to gain commercial advantage in the emerging market for SSA. While few Metric-relevant outcomes have yet materialised, D-Orbit highlight the value of the project in "learning very valuable lessons about both the market and technical aspects of the challenge". The experience gained in hosted payloads in this project was deployed to good effect in an internally funded UK initiative to deploy and demonstrate a "cloud" data processing engine on a 2021 mission.

Together, these activities have all played a role in the company's success in securing commercially-delivered service contracts including:

- A "hosted payload" [contract with STFC/UK Met Office](#) under open competition.
- [In Orbit Demonstration / Validation for ODIN Space](#)
- [A major contract with AWS](#)
- [A commercial hosted payload contract with Privateer](#)

Looking to the future, the team remains ready for when UK launch providers reach their commercial stage, and following the recent raising of €100m Series C funding announced in January 2024, they aim to deploy manufacturing, integration and operations facilities in UK, as a portion of the group's scaled up commercial service delivery.

While these outcomes are difficult to attribute to a single project or activity, there is a strong company capability and growth story here that has a clear link to UK support in the round for commercial space sustainability services.

For ETP, forecast impacts against the Metric are smaller, reflecting the relatively small size of the programme and its focus on emerging (lower Technology Readiness Level, i.e. further from commercial/ mission readiness) and innovative space technologies. For £4.8m in UK Space Agency funding, organisations estimate they will generate an optimism bias-adjusted total of £11.9m in revenues from 2022/23 to 2027/28. No organisations reported any actual or expected private investment, but forecast an optimism bias-adjusted £1.3m in internal investment. For employment, funded organisations expect that ETP will facilitate the creation of **60 jobs** (optimism bias-adjusted). Again, as forecast data, these estimates do not contribute directly to the North Star Metric but are included for context on future expectations.

The UK Space Agency has externally commissioned Monitoring and Evaluation activity for NSIP and ETP, with a strong focus on ensuring that data and evidence on North Star Metric impacts are

fully captured. With the £65m funding call only having recently launched, tracking these impacts will be a long-term activity. Forecast data should not be taken as hard evidence of Metric outcomes, though provide an indication of future expectations. Tracking NSIP/ETP outcomes and comparing these to the forecasts set out here will - in time - also provide useful hard evidence on optimism bias that can be used to better predict future impacts.

3.1.3 International

The UK Space Agency's programme dedicated to fostering international relationships is the **International Bilateral Fund (IBF)**. The IBF was introduced in 2023, with projects starting in the summer, aiming to strengthen the UK space sector's partnerships with strategic and emerging nations. At the time of writing in early 2024, Phase 1 projects of up to £75k for up to 4 months in duration have recently concluded, with larger Phase 2 projects (up to £1.5m over 12 months) expected to run from March 2024 to March 2025, together with additional direct-award projects.¹³

Monitoring and Evaluation (M&E) activity is ongoing. In addition to internal Agency project management processes, M&E support has been externally commissioned. Naturally, **reflecting the relatively early stage of programme delivery there are not yet significant North Star Metric outcomes to report on**. The IBF M&E data monitoring framework, which sets out the plan for evaluation activity to 2025, notes that the specified indicators and data collection plans have been deliberately designed to align with and inform the Metric. Expected pathways to impact include new products, businesses and services in the UK, new Foreign Direct Investment, new exports, and space sector growth.

Data received indicates that for £18.3m in UK Space Agency funding allocated so far, there has been £13.8m in match funding. It is too early to assess North Star Metric outcomes for the programme, but there is already evidence of some internal investment, with substantial Metric outcomes expected from the much larger Phase 2 projects. Some early indications of revenues and investment are likely to emerge in 2024, though will only be the start of a longer-term impact story.

3.1.4 Earth Observation


While the vast majority of the UK's Earth Observation (EO) funding is spent via ESA (see ESA Earth Observation), the UK Space Agency also runs National EO activities that span the value chain, including (but not limited to):

- The [Centre for Earth Observation Instrumentation \(CEOI\)](#)
- The [Committee on Earth Observation Satellites \(CEOS\)](#)
- The [Remote Sensing & Photogrammetry Society \(RSPSoc\)](#)
- [Space4Climate \(S4C\)](#)
- [MicroCarb](#), a joint UK / France mission
- Measures under the [Earth Observation Investment Package \(EOIP\)](#)

These activities are aimed at growing the UK's EO capabilities, developing the supply chain, convening key actors in academia, government and industry, and positioning UK teams for leading roles in major EO missions. They have a direct impact on North Star Metric outcomes through catalysing co-funding, generating revenues for increased revenues through bringing products closer to commercial readiness, and growing EO companies which in turn can increase the likelihood of - and company readiness for - external investment.

There is no single, consolidated approach to North Star Metric data collection across the Agency's EO funding, given that programmes and activities are very different in their nature. For example, the funding for MicroCarb - aimed at running the first European space mission designed to

¹³ <https://www.gov.uk/government/publications/international-bilateral-fund/guidance-international-bilateral-fund-ibf>



monitor carbon fluxes on Earth by precisely measuring carbon dioxide in the atmosphere – is focused on mission delivery, where the UK has a key role. MicroCarb is currently being stored ready for launch. By contrast, the CEOI is a long-running technology development programme providing match funded grants and with a community building element. The CEOI was established in 2007 (with the 16th call run in 2023) aimed at the development and delivery of world class instrumentation for ESA, national and international EO missions. North Star Metric outcomes therefore materialise in different ways, and the programmes necessarily have different approaches to evidence collection. This in turn means that our Metric data for national EO are skewed towards CEOI outcomes, with only examples of impact for other elements of EO funding.

The impacts of the CEOI programme were explored in a 2022 evaluation by WECD, which concluded that the programme has delivered important outputs and outcomes to strengthen the UK EO sector.¹⁴ While North Star Metric outcomes were not assessed in depth (as the study and the activities it evaluated predate the Metric's introduction), the evaluation discusses the role of the programme in setting the necessary foundation for building UK capabilities in EO, ultimately leading to economic growth through new jobs and improved productivity and income. The evaluation found evidence of **over £8m in match funding and £44m in private investment** as a result of £18.5m in CEOI funding over the 2016-21 period, with (qualitative) examples of spin-outs, job creation, investment and revenue increases in funded organisations.

For other national EO activities, funding recipients were contacted directly to collect evidence on North Star Metric outcomes as a result of the funding they had received from the UK Space Agency. Many of these stakeholders consulted – representing leading figures from across the UK EO community – stressed the difficulty of reporting Metric outcomes related to a single project, noting that programmes often feed into each other and that impacts can take years to materialise, while stemming from multiple inputs. Data we received from funding recipients therefore represents examples of Metric outcomes, rather than a holistic picture of impact. Funding recipients reported that £28m in UK Space Agency funding has so far led to over **£28m in revenues and over £500k in internal investment**.¹⁵

One notable example of impact provided by the Agency comes from SSTL's NovaSAR mission, in which the UK Space Agency invested £21m between 2013 and 2018. As a technology demonstration mission, NovaSAR-1 was the first SAR (Synthetic Aperture Radar) spacecraft to be manufactured entirely in the UK. This project has since led to considerable follow-on opportunities for SSTL. NovaSAR has helped establish SSTL as a go-to provider for small Synthetic Aperture Radar satellites, with the company receiving several serious enquires for follow-on and derivative spacecraft. Notably, Space Norway selected SSTL to supply a satellite to the MicroSAR mission in 2022, in a contract similar in value to the original grant funding. SSTL directly link this contract to their work on NovaSAR and hope to supply a further 7 satellites to Space Norway to complete the constellation.

While data collection was focused on the direct / first-order impacts for UK Space Agency funding recipients, it is essential not to overlook the second-order effect through the use of EO data in the wider economy. Any bottom-up approach to funding recipients will not capture (for example) growth that is unlocked in companies that use new/better EO data for their products and services that may stem from UK Space Agency funding. EO satellites support an estimated £106 billion of UK GDP (5.1%),¹⁶ and beyond its roles in climate change, environmental protection and humanitarian purposes, better data can help generate new revenues, jobs, investment and growth through multiple different channels.

¹⁴ WECD (2022), *Evaluation of the CEOI Programme*, report for the UK Space Agency

¹⁵ The timeframe for these impacts will vary, as the data request covered projects which started at different points. We asked for data from projects covering up to the last 3-5 years, so these represent examples from (approximately) 2018-23.

¹⁶ [know.space \(2023\), Size and Health of the UK Space Industry 2022](#)

3.1.5 Sustainability and Safety

The UK Space Agency's space safety and sustainability activities are linked to the National Space Strategy 10-point plan commitment to lead the global effort to make space more sustainable. The Agency's stated aim is to deliver capabilities to track objects in orbit and reduce or remove debris, and to lead global regulation and best practice to make space activities more sustainable.

With the UK's critical national infrastructure depending on space, these activities play an important role in safeguarding space assets. As discussed above, hundreds of billions of UK GDP depend on satellite services, and the economic loss due to a GNSS outage for 7 days has, for example, been estimated at over £1bn per day.¹⁷ Beyond direct Metric outcomes, therefore, the programme has an essential role in protecting economic value in the space industry and wider economy.

ClearSpace and Astroscale were awarded £4m from the UK Space Agency in 2022 to design missions to remove existing pieces of space debris, following earlier smaller grants through the Agency (and ESA CSTS).¹⁸ Data received in evidence-collection for the purposes of this study indicates that £6.1m in Agency funding has generated **£1.8m of match funding, £61m in private investment and £3m of internal investment, as well as creating 30 new jobs since 2022.**¹⁹

UK Space Agency activity in sustainability and safety is also realised in the upcoming formation of the *National Space Operations Centre* (NSpOC), a joint civil-military endeavour. The primary function of the NSpOC is to support the UK's space domain awareness (SDA) objectives, with a particular focus on the exploitation of SST data and its wider dissemination to industry, seeking to increase space surveillance, and traffic coordination capabilities. The programme focuses on the delivery of a safety critical capability through direct commercial contracts and engagement, thereby limiting North Star Metric outcomes: a reflection of the operational, rather than commercial development of the NSpOC.

Monitoring and Evaluation activity is underway to track impacts from the Agency's sustainability and safety activities, which will include capturing North Star Metric outcomes as they unfold.

3.1.6 Inspiration

The Inspiration Priority is one of 8 priorities set out in the 2022-25 Corporate Plan. One of the aims set out in the Inspiration Priority is to inspire and support young people from all backgrounds and stages of education to pursue STEM (Science, Technology, Engineering and Maths), and to address and improve diversity in STEM and the space sector. The UK Space Agency aim to do this by supporting greater awareness and positivity for the importance and value of space, demonstrating and promoting rewarding careers in the space sector, providing coherent careers support, and ensuring the availability of a diverse and skilled workforce to support the resilience and growth of the space sector. For clarity, in this section we focus specifically on the Skills for Space Programme rather than the wider Priority. There are other activities that contribute to this priority, notably the Unlocking Space for Business programme launched in late 2023 (which therefore has few North Star Metric outcomes to report on yet).

Skills for Space aims to address key issues in the space sector by delivering high-quality space interactions and opportunities across the UK and across all ages. While the focal point is young people, critically the influencers in the lives of young people - parents, teachers, lecturers, club leaders, and role models - are also targeted.

Given that the programme does not directly target the development of new products and services with commercial potential, the North Star Metric outcomes in terms of new revenues and

¹⁷ London Economics (2023), *The Economic Impact on the UK of a Disruption to GNSS*

¹⁸ <https://www.gov.uk/government/news/uk-builds-leadership-in-space-debris-removal-and-in-orbit-manufacturing-with-national-mission-and-funding-boost>

¹⁹ Again, jobs impacts are not in scope of the North Star Metric but are included as additional evidence on impact.

investment as a direct, attributable result of grant funding are limited (though funded placement participants may contribute to these at an organisation-level). Routes to outcomes are likely to be through more indirect and often longer-term channels, in particular through improving the availability of a diverse and skilled workforce.

The programme generated **73 internships in 2023**, through the SPIN programme. We received evidence from a previous evaluation of the SPIN programme that suggests that many of these are likely to go on to employment in the sector. Of those who participated in a SPIN Programme placement between 2013 and 2022 who responded to a UK Space Agency survey (n = 85), 68% (n = 58) are 'currently working in the space sector'. 21 companies provided internal investment to fund SPIN Programme placements themselves, and we also received evidence of **in-kind contributions worth approximately £430k**.²⁰

The UK Space Agency has commissioned the National Centre for Social Research (NatCen) to complete an evaluation of programmes in the Inspiration Priority. This evaluation project will focus on understanding the impact of its Space to Inspire, Space to Learn and Space for Skills workstreams, as well as establishing how effectively the constituent projects under each workstream are being delivered and evaluating their impact - including any outcomes relevant for North Star Metric reporting - and value for money.

3.1.7 Local growth and clusters

The UK Space Agency's activities in this area are focused on the National Space Strategy goal to grow and level-up the space economy, supporting the sector to develop more opportunities outside of its traditional heartlands. By accelerating the growth of local space clusters, the UK Space Agency aim to multiply and spread space investment and jobs.

In 2023, the Space Clusters Infrastructure Fund (SCIF) awarded more than £47m in public funding for 12 projects which will be more than **doubled by match funding** (£51m) from the sector. This will in total represent over £98 million of new private/public investment in space research and development infrastructure by the time projects conclude in March 2025.²¹ With funding announced in November 2023 it is too early to comment on investment and revenue outcomes, though Monitoring and Evaluation (M&E) activities are in progress and will capture these impacts as they emerge. This M&E activity - provided by an external provider for independence and depth of analysis - will also cover other elements of the Local Growth programme. This includes the Space Cluster Development Funding Call aimed at developing a well-connected UK space ecosystem, which launched in 2022 targeting locally-led, high impact projects.²² The programme also includes the Space Cluster Partnership funding call launched in late 2023, which aims to strengthen the UK's national space ecosystem through pan-regional or capability-focused space cluster partnerships.²³

The Agency is also providing £1.5m for an expert consortium of business support providers to work with entrepreneurs from all over the UK and help them get involved in the space sector. A previous collaboration between the Agency and Entrepreneurial Spark, aimed at space start-ups, generated almost **£9m in private investment and created 80 new jobs** between January 2020 and April 2022 for those who took part in the business support programme.²⁴ The current UK Space Agency Accelerator is in progress, with independent M&E reporting part of the programme's activity. Again, evidence from this will strengthen the evidence base on North Star Metric outcomes as it becomes available.

²⁰ UK Space Agency internal estimates, based on 2020 Space Census data (Space Skills Alliance, 2021)

²¹ <https://www.gov.uk/government/news/47-million-investment-to-supercharge-space-infrastructure-across-the-uk>

²² <https://www.gov.uk/government/publications/announcement-of-opportunity-space-cluster-development-funding-call>

²³ <https://www.gov.uk/government/publications/space-cluster-partnership-funding-call-2023>

²⁴ <https://www.gov.uk/government/news/space-accelerator-catalyses-multi-million-pound-investment>

3.2 ESA programmes

3.2.1 Space science

The fundamental rationale for the UK's investments into the ESA Space Science programme is based on the scientific benefits that they help unlock, rather than investment outcomes. The programme allows the UK access to global missions of discovery that would not be possible or affordable by a single country, including JUICE (to study the icy moons of Jupiter), Euclid (to study dark matter), Plato and Ariel (to study exoplanets). However, as a result of UK funding for the programme, UK companies receive industrial contracts through the 'georeturn' system, helping to drive UK jobs and company growth. Capabilities developed through involvement in science missions can also lead to growth in other areas, while activity at the cutting-edge of technical capabilities also generates new knowledge and know-how that can be applied elsewhere.

While we leverage a published evaluation and researchfish data (see below) which capture Metric outcomes arising from UK space science funding, our analysis is necessarily based on the snapshots of outcomes these provide. At the present time comprehensive evidence on Metric outcomes is not available and, as such, our results will be skewed towards areas where we do have data and overall will therefore likely underestimate total Metric outcomes.

In 2020, the UK Space Agency published an assessment of the industrial impacts of UK funding through the programme.²⁵ Covering the 2000-2018 period, this study concluded that the £523m of funding in scope has delivered benefits worth almost £1.4bn of achieved, fully attributed impact, together with a further £1.2bn of partially-attributable impact. While based on a sample of beneficiaries who have received contracts (i.e. covering part of UK-funded activity only), the study estimated that the funding it considered has led to:

- **Revenue:** £3.3m
- **Private investment:** £47.3m (new, non-ESA/UK Space Agency public funding)
- **Internal investment:** £4.6m
- **Jobs created:** 919 person-years of employment (plus 9,080 person-years safeguarded)

know.space's 2023 evaluation of the UK's national funding for the ESA Gaia mission explored how UK funding for space science can enhance UK competitiveness, leverage additional funding from beyond the UK, and develop sought-after skills. The study also discusses how the UK funding led to the development of new advanced statistical methods, algorithms, and capabilities, which - while commercialisation of innovations is yet to be realised - generates innovation and know-how that can be applied elsewhere and creating 'spillover' benefits in areas such as medical science.²⁶

In addition to internal programme team monitoring of outcomes, the UK Space Agency have also externally commissioned monitoring and evaluation activities for missions such as Comet Interceptor and Ariel, due to launch in 2029. The evaluation frameworks ensure that data is collected to ensure that impacts are captured - including impacts relevant for Metric reporting.

ESA have also conducted and commissioned numerous studies on the impact of the space science programme, finding for example that **ESA's investments in the science programme resulted in 1.6 and 2.1 GDP and employment multipliers**, respectively.²⁷ While Europe-wide and not UK-specific, these studies explore the link between ESA funding and outcomes such as company growth, new jobs, new investment, and spillover impacts from space science funding.

By leveraging data from **researchfish** - an online reporting system for researchers to document their outputs and outcomes - we can gain insight into how Agency funding can lead to investment outcomes. Although the data covers a good proportion of research funding activities, entries are

²⁵ [Winning Moves \(2020\), An Assessment of Industrial Impacts of UK funding through the ESA Space Science Programme](#)

²⁶ [know.space \(2023\), Gaia Interim Impact Evaluation](#)

²⁷ https://esamultimedia.esa.int/docs/business_with_esa/ESA_IA_of_Science_programmes_Executive_Summary.pdf

self-reported and should be caveated as such. Outcomes are also not comprehensively reported on, meaning that results should be interpreted as *examples of* Metric outcomes rather than hard estimates of aggregate impact. We identified £6.8m of funding associated with entries which noted at least one Metric impact from 2012-24. For these, we identified **£8.3m in private investment**, with £2.4m of this (29%) from overseas sources (inward investment).

Analysis of impact case studies from the Research Excellence Framework (REF) 2021 – a system used for assessing the outcomes and impacts of research in UK higher education providers – found examples of Metric outcomes relating to revenue, as well as evidence of job creation.²⁸ These include the University of Dundee’s funding (c. €1.5m from 2001-20) from ESA for PANGU (Planet and Asteroid Natural scene Generation Utility), a software package crucial for testing and developing autonomous navigation, guidance, and landing technologies for space missions. Revenue is generated through PANGU licenses sold for non-ESA missions by spin-off company, STAR-Dundee. The company was founded in 2002 and has grown to 25 employees, with the company’s technology used in over 100 space missions either in orbit or under development.²⁹

Another example is the growth of Teledyne e2v. Headquartered in Chelmsford, Essex, Teledyne e2v is the pre-eminent supplier of imaging to some of the World’s most advanced and ambitious space missions. Representing a UK success story, the company’s capabilities have been continually developed over decades, with outcomes related to investment, revenues and jobs all part of this long-term story. In discussions with the company, it became clear that while only limited North Star Metric data could be provided, primarily as the company has received little direct funding from the UK Space Agency in recent years, the Agency’s funding has played an important role in the company’s story. Involvement in space science missions such as Euclid (launched in July 2023), Juice (April 2023) and over the longer-term Gaia (2013) has generated IP and capabilities that are directly applicable to Earth Observation and other domains where the company is also highly successful. The REF case study highlights how the company’s work with UCL’s Department of Space and Climate Physics has helped the company to secure major contracts and business with substantial value.³⁰

3.2.2 Exploration

ESA’s Human and Robotic Exploration programme, also known as Terrae Novae, aims to explore Low Earth Orbit, the Moon and Mars through ground-breaking research. The UK has chosen to be an important European player in the programme, contributing £217m to the European Exploration Envelope programme (E3P) at the 2022 ESA Council of Ministers. Activities funded through the programme are focused on enhancing our knowledge of the universe, and so the largest economic benefits could be expected to accrue to future generations as the programme acts as a long-term enabler. However, the programme is also generating economic impact today through funding scientific research and industrial activity. For example, the UK-built Rosalind Franklin rover, vital to the ExoMars mission, was developed through a contract to Airbus Defence and Space.

ESA have commissioned studies which consider industrial impact from Exploration activities. While these are again Europe-wide rather than UK-specific, they provide evidence of the links between UK Space Agency / ESA funding and socioeconomic outcomes. While the HSTS/ISS studies focus on broader socioeconomic returns, which is conceptually different to (broader than) North Star Metric outcomes³¹, we include them for context. These studies include:

- A 2022 Euroconsult socio-economic impact and benefit assessment of Terrae Novae programme activities, which estimated that 7,500 jobs are expected to be supported in

²⁸ A keyword search employing over 10 relevant search terms revealed 3 impact case studies relevant to space science that the UK Space Agency/ESA funded. Among these, 2 case studies featured North Star Metric outcomes.

²⁹ REF (2021). PANGU (planet and asteroid natural scene generation utility). Available at: <https://results2021.ref.ac.uk/impact/ad862888-36d3-4fa8-809d-546a63ea16a2?page=1>

³⁰ REF (2021) Supporting T-e2v Ltd. In developing capability as a supplier for major space science missions. Available at: <https://results2021.ref.ac.uk/impact/381324e0-43d4-475b-8a84-0d846db30590?page=1>

³¹ For example, downstream socioeconomic benefits such as productivity enhancements from use of satellite data would be out of scope of the North Star Metric but included in estimates of socioeconomic return.

the 2023-25 period, over €100m of internal investment catalysed, and set out evidence of additional commercial sales as a result of participation in Terrae Novae.³²

- A 2023 PwC study on technological, social and strategic benefits from European Human Space Transportation (HSTS), which estimates that €5.9 to €9.9bn will be generated by European Industry thanks to autonomous European HSTS capacities from 2028-40;³³
- A 2016 Assessment of the socio-economic impact of ESA participation in the International Space Station (ISS) Programme, which estimated a value-added multiplier of 1.8.³⁴

As above for Space Science, we investigated researchfish and REF data too for evidence on UK impacts. Again, we found evidence of impacts in researchfish relating to private investment following on from Agency funding. There was £4m of funding associated with researchfish entries which noted at least one Metric impact from 2012-24. For these, we identified **£9.6m in private investment**, with £2.4m (29%) from overseas sources (inward investment). As for space science, these should be seen as examples of Metric outcomes, rather than any form of holistic assessment.

In the REF 2021 impact case studies, two cases studies highlight the link between UK Space Agency funding and revenue and jobs³⁵. Firstly, the University of Leicester received £2.3m in ESA funding to successfully demonstrate the viability of Americium-241 as a space power system. The case study discusses how a direct collaboration with European Thermodynamics Ltd (ETL) led to annual sales of £150k in 2019, with projections to reach £5m by 2030. It also notes that partnership with the National Nuclear Laboratory “has directly resulted in the creation of new export markets for Americium sealed heat sources...with both ESA and South Korea” (as of 2019). Between 2021 and 2026, “the economic value in sales alone is estimated to be more than [GBP] 50,000,000”. This growth is also expected to result in the creation of additional jobs.³⁶

A second case study is the Open University (OU), who secured £486k in funding from the UK Space Agency between 2017 and 2019 to develop a novel method for water extraction for extraterrestrial samples. Collaborative efforts with OU accounted for more than half of the revenue generated by UK-based company, Dynamic Imaging Analytics, from 2016 to 2020. This collaboration also led to the hiring of 4 new employees and 10 interns on 6-month contracts.³⁷

3.2.3 ARTES & BASS

ESA’s Advanced Research in Telecommunications Systems (ARTES) is a commercially orientated programme supporting research and development in satellite communications to help create successful products. The programme is designed to catalyse innovation and investment and has supported some of the UK’s largest telecoms players. ESA Business Applications and Space Solutions (BASS) is part of ARTES, providing a range of funding opportunities (Kick-Starts, Feasibility Studies and Demonstration Projects) to support innovative uses of space assets.

For ARTES and BASS, we received comprehensive data on UK Space Agency and match funding. North Star Metric outcome data is based a sample of email responses from industry, which provide examples of impacts, as well as a sample of forecast revenue data on ARTES projects funded since 2022, which funding recipients provided as part of the proposal process. We received details for ARTES and BASS for nearly £270m in Agency funding and **over £440m in match funding**,

³² <https://youbenefit.spaceflight.esa.int/sei-2022/>

³³ <https://space-economy.esa.int/article/185/european-human-space-transportation-technological-social-and-strategic-benefits>

³⁴ <http://youbenefit.spaceflight.esa.int/pdf/ISS%20programme%20socioeconomic%20impact%20study%20-%20executive%20summary.pdf>

³⁵ A keyword search employing over 10 relevant search terms revealed 5 impact case studies relevant to exploration that the UK Space Agency/ESA funded. Among these, 2 case studies featured North Star Metric outcomes.

³⁶ REF (2021). *Transforming space power generation & thermal management in space*. Available at:

<https://results2021.ref.ac.uk/impact/c9ee1962-e07b-4b65-b463-1bf3b081201d?page=1>

³⁷ Source: REF (2021). *A wet moon: a paradigm shift in European lunar exploration policy, business & understanding*.

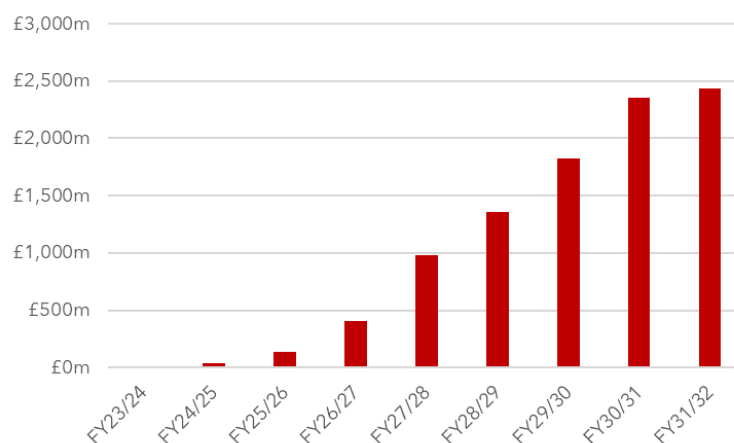
Available at: <https://results2021.ref.ac.uk/impact/f50552df-7cbf-4fdb-8a17-6aeb5d1a9798?page=1>

covering approximately the last 5 years³⁸. Of this, most data relate to ARTES (£240m in Agency funding and £410m in match funding).

While covering only a small part (4%) of this funding, we received responses with data (on actual outcomes to date rather than forecast data) on Metric impacts for organisations receiving just over £10m in funding³⁹. These responses contain details of **£6m of private investment and over £2m in revenues**, with examples of a £3.4m investment into an ARTES-funded company, and a £10m investment into a BASS-funded company (attributed by the respondent at 20% to this funding). Companies also report over **£2.5m in internal investment and 39 new jobs** as a result of their funding. Again, given the small sample size these should be interpreted as examples of impacts, rather than estimates of aggregate impact.

Forecast data indicates potential for large future revenue impacts, though does not directly contribute to the North Star Metric (i.e. it is not included in aggregate totals presented below) and will be subject to optimism bias. We have forecast data for 24 ARTES projects funded since 2022, with UK Space Agency funding of £21m (around half of this having already been dispersed). Cumulatively, **project teams forecast that they will generate an enormous £9.5bn in revenues** (£7.7bn in Present Value (PV) terms⁴⁰) in the period to FY31/32, with **one project alone forecasting £4.8bn in revenues**. While the attribution to UK Space Agency funding is unclear, this shows potential for substantial commercial benefit and North Star Metric style outcomes if ambitions are realised.

Figure 5 Forecasted ARTES revenues (sample of 24 projects)⁴¹



A 2019 ESA study evaluated the socio-economic benefits enabled by the implementation of eleven ARTES Partnership Projects, in which ESA invested around €2bn, estimating **€13.5bn of additional sales** to satellite manufacturers, operators and subcontractors due to the projects over the 2007-32 period.⁴² While this is not UK-specific (and we do not include results in aggregate figures presented below), it again shows the links between ARTES funding and North Star Metric outcomes.

³⁸ ARTES data covers the Dec 2018 - Sept 2023 period. BASS data covers the Jan 2021 - Aug 2023 period.

³⁹ The timeframe for these impacts will vary, as the data request covered projects which started at different points. We asked for data from projects covering up to the last 3-5 years, so these represent examples from (approximately) 2018-23.

⁴⁰ Where possible, forecast data has been discounted at a standard HM Treasury Green Book 3.5% discount rate.

Unfortunately, this is had not generally been possible for forecast data, since the data often lacks dates.

⁴¹ Note: this data is not presented in discounted or optimism-adjusted terms. Source: Data provided by the UK Space Agency programme team, using funding recipient forecast data

⁴² <https://space-economy.esa.int/article/64/value-created-by-esa-telecommunication-partnership-projects>

Case study: AAC ClydeSpace

Emerging outcomes from a potentially transformational project that could deliver much larger longer term benefits

AAC Clyde Space received €9.5m (£8.2m) funding from the UK Space Agency through ESA for the xSPANCION project.

The project is structured as a Public Private Partnership between ESA, the UK Space Agency and AAC Clyde Space with their partners (Bright Ascension Ltd., University of Strathclyde, D-Orbit UK, Alden Legal and the Satellite Applications Catapult) funded under the ARTES Pioneer programme.

AAC Clyde Space told us how the project is “transformational”, laying the groundwork for the company to provide space data and services quickly, at low cost, to organisations who are eager to harness the power of satellites to tackle problems on-earth, from climate change to maritime communications, without investing in space-based architecture or expertise themselves.

It has enabled the formation of the Data and Services team within AAC Clyde Space with 4 new positions created. The forecast is for the creation of an additional 12 roles over the next 18 months.

The project will enable AAC Clyde Space to scale up production as well as developing new spacecraft technologies and form factors to service the constellation market.

The project kicked off in 2020. While there are already North Star Metric-relevant outcomes (included in the aggregated figures presented in this report), it is clear that the UK investment could help generate much larger, longer-term benefits. As with many other projects, therefore, North Star Metric reporting only showcases the beginnings of an impact story that could potentially be exponentially larger.

3.2.4 General Support Technology Programme

ESA’s General Support Technology Programme (GSTP) is an optional ESA programme which helps to develop promising engineering concepts and technologies to be used in future missions. The UK subscribed €83m at the 2022 ESA Council of Ministers, with the UK Space Agency managing UK proposals to the programme.

The most recent UK evaluation of GSTP (2017) found that there was a minimum return on investment of around **£7 for every £1 invested** into the programme.⁴³ This evaluation pre-dates the North Star Metric, but provides some insight into metric outcomes. **From a sample of 40 GSTP grant beneficiaries, 36 (90%) noted increased revenues as a result of participating** in the programme, while 25 (63%) mentioned employment benefits (including job creation and job support). While jobs are outside the direct scope of the Metric, this evaluation estimated that GSTP 5 and 6 Element 1 funding alone will create or safeguard 295 FTE jobs in the UK up to 2030.

At a European level, ESA estimate that €1 invested through the Programme results, on average, in €3.5 of additional commercial benefits and each €102k of GSTP contracts creates 1 additional job⁴⁴. As a rough estimate if we were to apply these number to the UK’s €83m investment in GSTP

⁴³ Databuild (2017). *Evaluation of GSTP 5 and GSTP 6 Element 1: final Report*. Available at: https://assets.publishing.service.gov.uk/media/5a8d426ae5274a5e64c54522/GSTP_evaluation_final_report.pdf

⁴⁴ ESA (n.d.) *About the General Support Technology Programme (GSTP)*. Available at: https://www.esa.int/Enabling_Support/Space_Engineering_Technology/Shaping_the_Future/About_the_General_Support_Technology_Programme_GSTP

at CMIN22, this could imply approximately 800 jobs to result from this funding (though we do not include this in our aggregated analysis as it is speculative / assumptions-based).

We received examples of impact from the 2018-23 period covering £5.7m in funding across 6 projects. In terms of private investment, two companies reported non-zero **private investment, totalling £20.3m**. Another two organisations reported **£11.3m in revenues** following their participation. One company reported **£1.5m in internal investment** and **31 new jobs** were recorded across 5 projects.⁴⁵ These examples, though patchy, offer a different perspective on GSTP impacts.

Besides this, there are qualitative accounts of company expansion enabled by GSTP, where funding played a pivotal role in product and even company development. iCOMAT, a University of Bristol spin-out company developing state-of-the-art lightweight solutions, received around £940k in GSTP funding from 2020-23, marking the company's entry into the space sector. The company has since received \$22m in private investment, of which they attribute one third to their space activities, which can be directly traced back to their original GSTP contract. The company is also in discussions with space sector primes for potential contracts in the sector.

Another example is Mars Space, a UK company developing electric propulsion systems and plasma-related devices. The company received €300k in GSTP funding in 2016 to develop and validate a gridded ion engine. Since then, the company has leveraged this work to win several other ESA and UK Space Agency contracts, as well as private contracts totalling £5.6m. In 2019, the company was acquired by Aerospazio and has since more than tripled its workforce from 5 to 16, whilst also tripling its revenues. The company noted that without GSTP, it is likely the company would not have been sold and these benefits would not have materialised.

Again, as the evidence on Metric outcomes is based on case study examples rather than a holistic assessment, we would expect the picture to change as and when further evidence is available.

3.2.5 CSTS / Boost!

ESA's Commercial Space Transportation Services and Support (CSTS) Programme, known also as Boost!, was introduced as a new optional ESA programme in 2019. Compared to other programmes discussed in this report the programme is relatively small, with the UK having committed £12m at the 2019 ESA Council of Ministers, followed by another £12m in 2022. The funding is designed to complement UK national funding through the Launch programme, which is discussed above, and has been used to fund both launchers and prospective customers.

Given the relatively small number of funded organisations, we were able to gather evidence on North Star Metric impacts for the programme through a combination of interviews, email responses, evidence from the 2022 impact evaluation of UK investment in ESA⁴⁶, together with further desk-based research to fill gaps. As such, there were no coverage issues as faced by some other programme areas (e.g. lower risk of skew or bias).

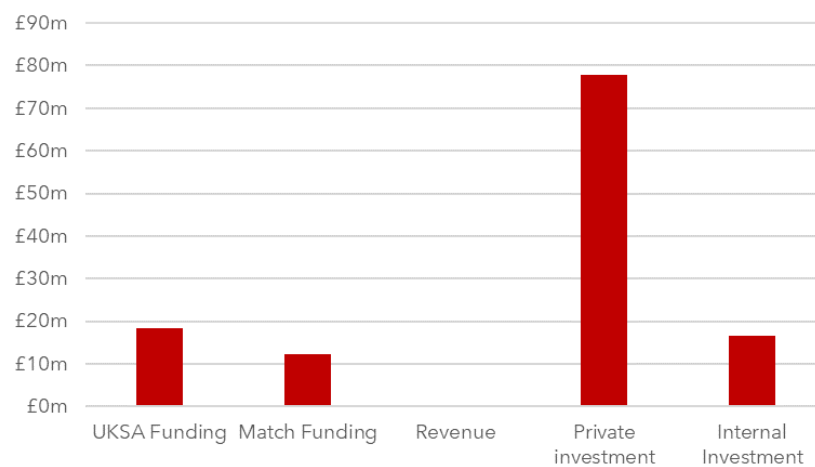
For £18.3m in ESA funding from 2019 onwards, there was **£12.2m in match funding** (see **Figure 6**). As funding recipients are typically pre-revenue, there is no evidence at this stage on new revenues attributable to ESA, though the data we received suggests that **CSTS has contributed to £77.8m in private investment in the UK** (with supplementary Crunchbase analysis showing that investors include a number of Europe's largest venture capital firms). One company reported their grant had led to significant **internal investment of £16.6m**, with others noting that their pre-revenue nature meant that it was too early for this (i.e. without profits, firms cannot engage in

⁴⁵ As above, the timeframe for these impacts varies, as the data request covered projects starting at different points. We asked for data from projects covering up to the last 3-5 years, so these represent examples from approximately 2018-23.

⁴⁶ Technopolis, know.space, Cambridge Econometrics & Science-Matrix (2022), *Impact Evaluation of UK Investment in ESA*, report for the UK Space Agency

significant internal investment). **43 new jobs** were reported, though this data likely only paints a partial picture of jobs impacts across funded organisations.

Figure 6 CSTS / Boost! impacts across key metrics



3.2.6 ESA Earth Observation

The UK invests in Earth Observation (EO) programmes within ESA to enhance understanding of our planet and mitigate the impact of climate change. ESA EO programmes cover 15 operational satellites, with 40 more in development across meteorology, climate change and environment. This includes EO satellites that ESA is developing in cooperation with EUMETSAT, Copernicus satellites developed under the leadership of the European Commission, Sentinels, and Earth science satellites. At the 2022 ESA Council of Ministers, the UK committed £315m to ESA EO and climate programmes. There are also synergies between ESA EO funding and national EO funding in the UK, discussed above.

As with national EO activities, ESA EO funding has a clear link to North Star Metric impacts, enabling internal investment, whilst supporting companies to leverage private investment and revenues, and non-commercial organisations to generate follow-on funding from other sources.

Reflecting the range of activities delivered through the programme, there is currently no consolidated approach to gathering North Star Metric data across ESA EO programmes, and our approach to gathering data relied on reaching out to funding recipients via email to request information. While not possible at the current time to report on overarching North Star Metric impacts from the different elements of ESA EO funding, organisations in receipt of £26m in funding provided **examples of around £300k of match funding and over £5m of revenues, as well as reporting 52 new jobs created**. These benefits represent examples from the last 5 years, i.e. the 2018-23 period.

ESA have conducted socio-economic studies on the impact of this EO funding. For example, a 2022 study considered the impact of the FutureEO programme, finding that over the 2018-21 period the programme generated a value-added of €1.8bn in ESA Member States, from an initial investment of €954m.⁴⁷ The study also notes the role of the programme in acting as a foundation upon which Europe can build its EO infrastructure, which will support Metric impacts in future.

⁴⁷ <https://space-economy.esa.int/article/169/futureeo-critical-enabler-of-eo-benefits-for-the-european-economy-and-society>

Case study: Open Cosmos

Leveraging £5.5m UK Space Agency and ESA funding into a \$50m investment

Founded in 2015 with the vision of simplifying access to space using small satellites, Open Cosmos (headquartered in Harwell, Oxfordshire) has in recent years received approximately **£5.5m of UK Space Agency and ESA R&D funding** (not including a recently-awarded £5m grant under the SCIF, announced in November 2023), across several different calls and projects. This has led to:

New revenues: While difficult to attribute outcomes to any single project, together they helped the company multiply this to over £35m worth of business in the UK in 2022.

New jobs: UK Space Agency and ESA funding has also helped the company to grow rapidly. The workforce currently stands at 65, with plans to increase to over 150 engineers and professionals over the next few years.

New investment: The interplay between UK Space Agency and ESA funding also played a pivotal role in the recent announcement in September 2023 that the company has secured \$50m in Series B funding from three leading impact investors: ETF Partners, Trill Impact and A&G (plus others). The funding represents one of Europe's biggest ever rounds for a space company, and will be used to accelerate the company's growth internationally, generating export revenues. The company also expect to pursue further investment in coming years.

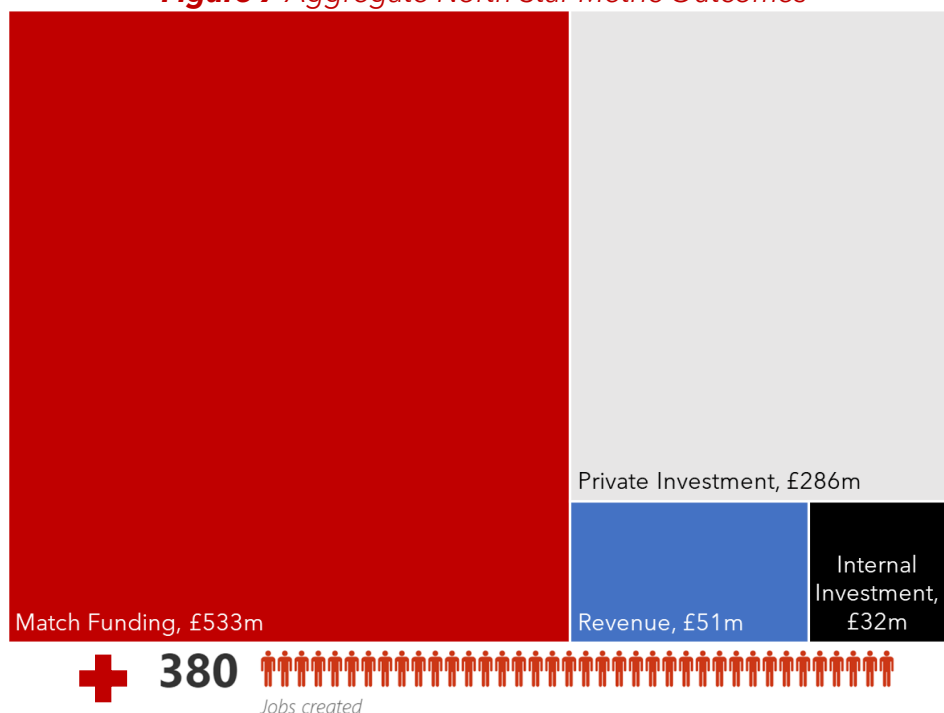
4 The aggregate picture

In this section we aggregate Metric outcomes across the Agency’s programmes to estimate the totality of North Star Metric outcomes to date. This entails aggregating data from different sources, covering different time periods and reliant on differing methodologies. Data is far more comprehensive for some programmes (and elements within programmes) than others and therefore aggregate totals will be skewed towards those programmes for which we have better data. Results should therefore be seen as a **first attempt** to estimate aggregate outcomes from currently available data, rather than hard estimates of total impact from the Agency’s activities. It can, and should, be built on in future as new evidence is generated (reflecting that Metric reporting has only been in place since 2022).

Focussing on realised outcomes only, in total we analysed the distribution and nature of impacts arising from **nearly £1bn (£982m) in UK Space Agency and ESA funding across at least 354 funding events**⁴⁸ concentrated over the past 3-5 years.⁴⁹ This represents a sample rather than the totality of UK Space Agency spending. We explored match funding outcomes, private investment, internal investment and attributed revenues, as well as additional jobs created.

The **headline figures presented exclude forecast data**⁵⁰, which is largely associated with NSIP, ETP, ARTES and GSTP⁵¹. Where useful, forecast data is presented alongside our core results, discounted at 25% to account for optimism bias.⁵²

Figure 7 Aggregate North Star Metric Outcomes



Source: know.space analysis

⁴⁸ Note: for some data sources we could not disaggregate impacts by funded project.

⁴⁹ Specifically, since Q3 2018, as the earliest data requests were circulated in Q3 2023, asking for data from the last 5 years.

⁵⁰ Note: there are some instances where it is not clear whether the data is forecast or actual. We have assumed that all NSIP and ETP outcome data is forecast. Elsewhere, data has been treated as actual unless explicitly stated as otherwise.

⁵¹ In some cases, it was unclear whether data represented realised or forecast values.

⁵² This approach was agreed with UK Space Agency analysts, on the basis it is a commonly-used placeholder value in science and innovation appraisal).

The £982m funding is associated with **£533m in match funding**.⁵³ Funding for these projects generated almost **£51m in revenues**, as well as **£286m in private investment** and **£32m in internal investment**. In total in our sample, we received evidence of **380 jobs** created due to UK Space Agency funding (though job creation lies outside the direct scope of the Metric).

Data on revenues, private investment, internal investment, and job creation is patchier than that on Agency and matched funding. Often, respondents did not provide values. **Overall findings, both in terms of totals and averages, tend to be disproportionately influenced by a small number of large events.** Hence, these values are partial only and provide limited insights into aggregate North Star Metric impacts. We recommend they are considered together with the 'top down' analysis presented in Section 2, and interpreted as a starting point for future analysis.

In part, this reflects that our approach relied on collecting evidence from UK Space Agency programme teams and funding recipients for projects that generally started before North Star Metric reporting requirements were introduced (and for projects that started since 2022, they are often at relatively early stages of project delivery with few outcomes to report on yet). Funding recipients were typically under no obligation to report on outcomes, and often focused on providing the relatively easier-to-compile information on how much funding they received and their match funding contributions. Indeed, both private investment and revenues were concentrated in a relatively small number of funding events.⁵⁴ We expect that this evidence should improve in future, as more time elapses since reporting requirements were brought in.

Figure 8 below presents the aggregate picture broken down by each programme's contribution. In interpreting these charts a critical consideration is that **this reflects the extent to which data was able to be collected in a given area, rather than an assessment of each programme's performance against the North Star Metric.** For example, the existence of published evaluation studies covering relevant outcomes – such as in space science and for the CEOI element of national Earth Observation funding – can boost the representation of that programme area in aggregate results. Again, with Metric reporting only introduced in August 2022 (and rolled out in funding calls that launched after then), the lack of data at this stage should not be interpreted as a given programme area not having any relevant impacts.

Adding to this, we (re)emphasise the point discussed in Section 2 that it is the combination of different activities and programmes that influence investment outcomes. One example would be the formation of the National Space Operations Centre (NSpOC). Whilst the centre is not expected to directly generate revenues or private investment, it provides a crucial underpinning safety capability, enabling commercial activity elsewhere.

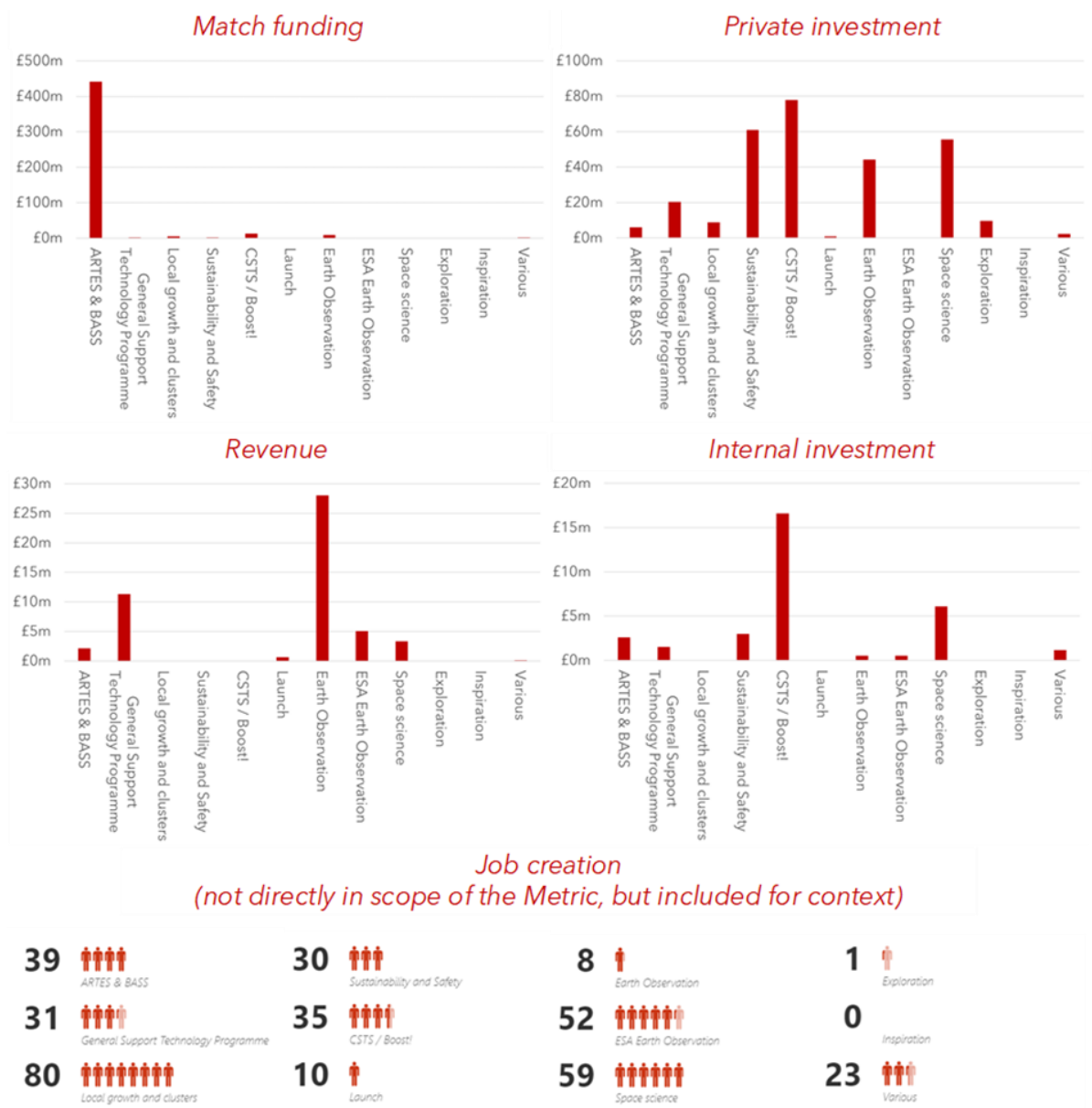
- **Match funding** figures are dominated by ARTES & BASS, reflecting that we had strong evidence in these areas and more limited information in others.
- **Revenue** figures are driven by Earth Observation (EO) funding, and to a lesser extent ESA GSTP.
- **Private investment** is more evenly driven by a range of programmes, with the launch-focused CSTS/Boost! Programme the biggest single contributor.
- **Internal investment** is again driven by CSTS/Boost!, followed by Space Science, ARTES & BASS, Sustainability and Safety, and GSTP.

Job creation (noting this does not directly contribute towards the Metric) is more evenly driven across programmes, with Local Growth and Clusters representing the single biggest contributor.

⁵³ Note: in the analysis presented here, we use past tense, though note that there may be some forecasts included in the 'actual' data (e.g. where funding recipients reported on expectations rather than actuals).

⁵⁴ Less than 18% of funding events associated with non-zero private investment (64 investment events). 6% of investment events (22 events) were associated with reported private investment of zero and the remainder do not report private investment. Revenues were reported in a similar way, with 19 non-zero revenue estimates in our dataset (5%), 19 investment events reporting zero revenues (5%) and the remainder not reporting revenues.

Figure 8 Outcomes by programme⁵⁵



While out of scope of North Star Metric reporting (which is based on 'actuals'), **the inclusion of forecast data would drastically increase results for revenues, private investment, and internal investment.** Including these forecasts from ARTES, NSIP, ETP and GSTP:

- Revenues increase from £51m to £1.2bn, largely reflecting the inclusion of ARTES forecasts.
- Private investment rises from £286m to £733m, reflecting the inclusion of NSIP forecasts.

Job creation also more than triples, from 330 to 1,104, largely reflecting NSIP and GSTP forecasts.

For consistency, and on the basis that forecasts further out are both more speculative and less attributable, **these figures include forecasts up to the end of the 2027/28 Financial Year only.** We note (for example) that this excludes £7bn+ of ARTES forecast data on revenues beyond this

⁵⁵ New programmes (the IBF, NSIP, ETP and the Space Clusters Infrastructure Fund) have been excluded from this chart as they have yet to generate significant North Star outcomes.

period - we do not assess credibility of these forecasts and the extent to which they are attributable to UK Space Agency funding, though note that if realised they would have a major impact on expected North Star Metric outcomes. The figures above are also optimism-bias adjusted and converted to present values using standard HM Treasury Green Book discount rate (3.5%).

There is of course no guarantee that these forecasts will become reality, and even with an adjustment for optimism bias, it is likely that true values will be lower than those reported here. They are therefore excluded from the totality of North Star Metric outcomes. Nevertheless, this can be interpreted as strong evidence that **funding recipients expect significant North Star Metric outcomes to be delivered in coming years.**

4.1 Investment database analysis

Crunchbase is a platform compiling investment data for private companies, using resources such as press releases associated with new investment deals. Alongside our core analysis, we investigated the potential of Crunchbase to offer a different lens with which to assess North Star Metric impacts, investigating the amount of investment secured by companies after their receipt of UK Space Agency funding. This is intended to show investment events and correlation with Agency funding, but not causation, i.e. in what follows we do not attribute these outcomes directly to UK Space Agency funding. It is intended as an exploratory analysis to test future potential for use to understand Metric outcomes and totals to do directly contribute towards Metric totals, but provide valuable contextual evidence. The analysis presented here would also be possible using other tools such as the Pitchbook platform.

4.1.1 Approach

The Crunchbase platform allows users to search for a timeline of investments per company and extract the results, containing data on investment type (e.g., seed, grant funding, acquisition, post-IPO debt etc.), the date the investment was announced, investors involved and investment amount.

Using UK Space Agency databases of grants awarded, we restricted these to private companies (as non-commercial organisations are unlikely to generate private investment), and set a minimum threshold for funding of £100k for UK Space Agency grants and £200k for ESA grants, in order to create a manageable list of organisations to research.⁵⁶ Grants over the last 5 years⁵⁷ (2019-23) were assessed. In total, we researched **299 funded companies, who were cumulatively in receipt of £1.1bn in funding** from UK Space Agency and ESA programmes⁵⁸.

Data on investment evidence was then collated, only considering events that occurred after a given company had received UK Space Agency/ ESA funding (i.e. as events before receiving funding logically cannot be a result of funding). Events were manually verified using news articles, press releases and company websites to check that they could be considered investments into the UK

⁵⁶ The decision was taken to use a different cut-off for UKSA national funding and funding via ESA in order to balance the need to research a manageable number of organisations, with the aim of capturing as many relevant investment events as possible. From 2019-23, there were 92 companies in receipt of UKSA funding totalling >£100k (in total receiving £92m in funding). Equivalently, over this period, there were 334 companies in receipt of UK funding via ESA >£100k (in total receiving £984m in funding) and 246 in receipt of funding >£200k (in total receiving £972m in funding). It was deemed unmanageable within the constraints of this project to research all 334 organisations in receipt of >£100k in funding via ESA. Yet, it was deemed manageable to research only organisations receiving >£100k in UKSA funding and to exclude these organisations, would be to exclude potentially important investment outcomes. Meanwhile, organisations receiving £100-200k in ESA funding only account for £14m in overall funding. Therefore, different cut-offs were chosen depending on whether funding came via ESA or UKSA national programmes. Note that there is some duplication in these numbers, with a minority of organisations funded through ESA and UKSA programmes.

⁵⁷ This cut-off was chosen to provide a sensible limit to research, balancing the need to look far enough back in time to capture lagged outcomes, without capturing impacts arising from funding awarded many years ago.

⁵⁸ Our investment database analysis has a wider scope than our core analysis, including all UKSA funding for national programmes and via ESA programmes.

space sector.⁵⁹ Where the UK Space Agency or ESA were listed as investors, these contributions were subtracted from totals, to maintain a focus on new sources of investment in line with North Star Metric methodology.

4.1.2 Limitations and advantages

This approach overcomes the reliance on self-reporting and the difficulties inherent in aggregating data from different sources. Its main advantage is that by offering a more holistic view of the investment impacts of UK Space Agency funding, the approach goes some way to overcoming the potential underestimation of Metric impacts that may not hinge on a single project.

The key limitation of this approach is that it cannot be used to determine attribution. The approach captures all relevant UK investment events, regardless of whether they have a link to Agency funding. It also still only presents a partial picture of impacts: the platform only contains data on investments which have been publicly announced, and the investment amounts are also regularly not disclosed (so are counted as zero). True investment will therefore be underestimated. The analysis is also focused only on one strand of the North Star Metric, i.e. private investment.

As noted in other analyses of space sector investment (e.g. the *Size and Health* series), a small number of 'mega-deals' drive investment outcomes. These are separated from our core analysis, but it could be argued they should be included. Additionally, it is questionable whether some investment events included truly constitute an investment, such as debt-financed deals. Finally, some of the same limitations apply as in our core analysis, notably that investment outcomes we see today are often the results of activities and investments from many years ago⁶⁰.

4.1.3 Results and discussion

In total, we found evidence of **£357m in investment across 42 deals going to 32 companies** who had received Agency funding in the last 5 years. Of this, £190m went to companies who had received UK funding through ESA programmes, £75m to companies who had received money through UK Space Agency national programmes and £88m to companies who had received funding from both sources. These numbers exclude two 'mega-deals' valued at £7.2bn: the 2019 acquisition of Inmarsat by a consortium led by Apax and Warburg Pincus and the 2023 Viasat acquisition of Inmarsat. These deals are excluded due to the skew they would otherwise have on results (it could also be argued they represent transfers rather than 'true' investment).

There is a large spread in deal size, with **investments ranging from £73k to £96m in value**, excluding two 'mega-deals' worth £5.8bn and £1.4bn respectively. The data is positively skewed with a large number of smaller investment events. Excluding mega deals, **the median investment value was £2.9m**, though the impact of the tendency of companies to not publicly announce smaller investment deals on results is unknown. Of the 42 deals, the investment amount was undisclosed in 10 cases (and has been treated as zero).

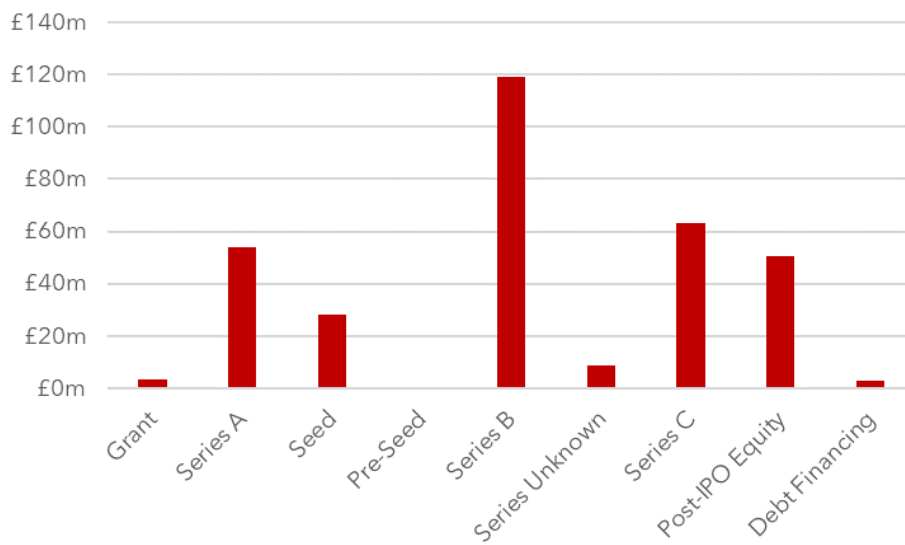
There was some variety in type of investment, as shown in **Figure 9**, but the vast majority of private investment was private, with the exception of three UK government grants⁶¹. The most common investment type was Series B financing.

⁵⁹ Investments into companies with a global presence were included only where it could be demonstrated that the investment would be going towards UK activities.

⁶⁰ With a wider scope, this approach could enable the investigation of North Star Metric impacts stemming from UK Space Agency investment many years ago, though here we focus on the past 5 years.

⁶¹ This in part reflects the decision to exclude follow-on UK Space Agency and ESA funding from our totals.

Figure 9: Investment outcomes by type



Source: know.space analysis using Crunchbase data

While causation cannot be determined, this is evidence that **UK Space Agency-funded companies go on to secure significant private investment following Agency support.** This is 'proof of concept' analysis that could be extended in future.

5 Conclusions & recommendations

In all programme areas assessed, we found evidence of the link between UK Space Agency funding and new investment and/or revenues. The routes to impact are varied. There are direct impacts as, for example, new products and services are delivered that generate revenue and investment. There are also more indirect impacts as cross-cutting capabilities and skills are developed, and activities taken forward that can have catalytic growth effects in the wider UK space sector and beyond. Our central conclusion is that **UK Space Agency activity is driving significant impacts in terms of the value of investment and income it brings into the sector.**

With North Star Metric reporting only having been introduced as a requirement of grant funding in August 2022, we are in the relatively early stages of standardised evidence collection. The results presented here will underestimate true impact, as the evidence base is still being built. Results should be interpreted as examples of North Star Metric impacts, and as a base from which to build in future. This said, there is already evidence of **substantial impacts in terms of new revenues and investment** both at programme-level, and in aggregate across the Agency's activities.

The insight developed through this 'bottom up' analysis is important, though understanding can also be improved by looking at overarching investment trends in the sector. **The last five years have seen major increases in UK space sector investment** – both in terms of aggregate amounts invested and the number of investors. The picture is one of increasing global and UK investment activity. UK companies who received UK Space Agency or ESA funding also collectively went on to secure hundreds of millions in investment. While this 'top down' analysis alone cannot be used to determine attribution, combined with the evidence on North Star Metric impacts at programme level, it is strongly suggestive of a link between the UK Space Agency's funding and activity and the sector-wide outcomes we see.

Engagement with programme teams highlighted that **robust Monitoring and Evaluation processes have been put in place to capture Metric outcomes across Agency programmes**, which will lead to stronger evidence over time. Most funding awarded since Metric reporting was introduced is through new programmes such as the International Bilateral Fund and National Space Innovation Programme, which are at relatively early stages in their routes to impact.

The following **recommendations** are aimed at improving the flow of new data and robust evidence in future:

- 1. Continue to improve Metric data collection through programme-level Monitoring & Evaluation**, including to assess attribution of reported impacts to Agency activity and to better understand the driving factors behind observed outcomes.
- 2. Combine 'bottom up' with 'top down' approaches to gain greater insight**, tracking sectoral trends and building a database of relevant investment events, using business information platforms, supplemented by programme team knowledge.
- 3. Leverage regular engagement with key UK space sector organisations** to probe and collect evidence on North Star Metric outcomes that may not relate to a single project or strand of activity.
- 4. Continue collaborative working with ESA to ensure that outcomes on revenues, investments and jobs impacts are captured** in socio-economic impact studies, where possible with impacts separated out at Member State level.
- 5. Improve consistency of data collection across programme areas** and develop the centralised Agency evidence base, ensuring common standards are implemented in line with best practice Metric outcome reporting.



... now you **know.**