DPS FRAMEWORK SCHEDULE 4: LETTER OF APPOINTMENT AND CONTRACT TERMS

Part 1: Letter of Appointment

Technopolis Limited
3 Pavilion Buildings,
Brighton,
UK,
BN11EE

Dear [redacted]

Letter of Appointment

This letter of Appointment dated Tuesday, 8th December 2020, is issued in accordance with the provisions of the DPS Agreement (RM6018) between CCS and the Supplier.

Capitalised terms and expressions used in this letter have the same meanings as in the Contract Terms unless the context otherwise requires.

Order Number:	CR20108
From:	**UK Space Agency (UKSA),** Polaris House, North Star Avenue, Swindon, Wiltshire, SN2 1SZ ("Customer")
To:	**Technopolis Limited,** 3 Pavilion Buildings, Brighton, UK, BN1 1EE ("Supplier")

Effective Date:	Monday, 14th December 2020
Expiry Date:	Thursday, 31st March 2022

Services required:	Set out in Section 2, Part B (Specification) of the DPS Agreement and refined by: The Customer's Project Specification attached at Appendix A and the Supplier's Proposal attached at Appendix B.

Contract Charges (including any applicable discount(s), but excluding VAT):	As per AW5.2 Price Schedule response highlighted within the RM6018 Contract Terms, section; Annex 1 - Contract Charges. The total value of this contract shall not exceed - Excluding VAT.
Insurance Requirements	Additional public liability insurance to cover all risks in the performance of the Contract, with a minimum limit of £5 million for each individual claim. Additional employers' liability insurance with a minimum limit of £5 million indemnity. Additional professional indemnity insurance adequate to cover all risks in the performance of the Contract with a minimum limit of indemnity of £2 million for each individual claim. Product liability insurance cover all risks in the provision of Deliverables under the Contract, with a minimum limit of £5 million for each individual claim.
Liability Requirements	**Suppliers limitation of Liability** (Clause 18.2 of the Contract Terms);

GDPR	As per Contract Terms Schedule 7 (Processing, Personal Data and Data Subjects.

FORMATION OF CONTRACT

BY SIGNING AND RETURNING THIS LETTER OF APPOINTMENT (which may be done by electronic means) the Supplier agrees to enter a Contract with the Customer to provide the Services in accordance with the terms of this letter and the Contract Terms.

The Parties hereby acknowledge and agree that they have read this letter and the Contract Terms.

The Parties hereby acknowledge and agree that this Contract shall be formed when the Customer acknowledges (which may be done by electronic means) the receipt of the signed copy of this letter from the Supplier within two (2) Working Days from such receipt

For and on behalf of the Supplier: **For and on behalf of the Customer:**

[redacted]

ANNEX A

Customer Project Specification

1. Background

The UK Space Agency is responsible for all strategic decisions on the UK civil space programme and provides a clear, single voice for UK space ambitions. The UK Space Agency is at the heart of UK efforts to explore and benefit from space. The UK's thriving space sector contributes £14.8 billion year to the UK economy and directly employs around 41,900 employees, with an average annual growth rate of almost 3.3% and 4.3% respectively.

Collaboration lies at the core of the UK Space Agency ethos and applies across Government as well as to external organisations including European and global partners such as the European Space Agency (ESA), national space agencies and the United Nations.

The case for UK investment in the European Space Agency

European Space Agency (ESA) is an inter-governmental organisation promoting cooperation in space research, technology and applications development.

The UK is a founding member of ESA and has collaborated on space with European partners for over fifty years. This is a relationship that predates the UK's membership of the European Union and that is independent of EU membership.

The European Space Agency is an important delivery route for UK government objectives for space since it is our single most important route to multilateral partnerships for scientific infrastructure in space with European and global partners. It is also a powerful vehicle for supporting European trade relationships in supply chains and customer bases; and is a unique source of technical expertise and bespoke test facilities to take forward national space programmes. ESA as a delivery route is complementary to a national programme that develops trade relationships including outside of Europe, and programmes which are specifically designed to meet national security and / or defence requirements at a higher technology readiness level (TRL).

UK investment in the European Space Agency

The UK is one of the "big 4" member states, investing £374M / €435M every year in its research and innovation programmes. This buys the UK access to ESA programmes and facilities based on ESA's annual budget of over €5bn a year. We invest in ESA to foster international sciencecollaboration, support the commercialisation of space and benefit society.

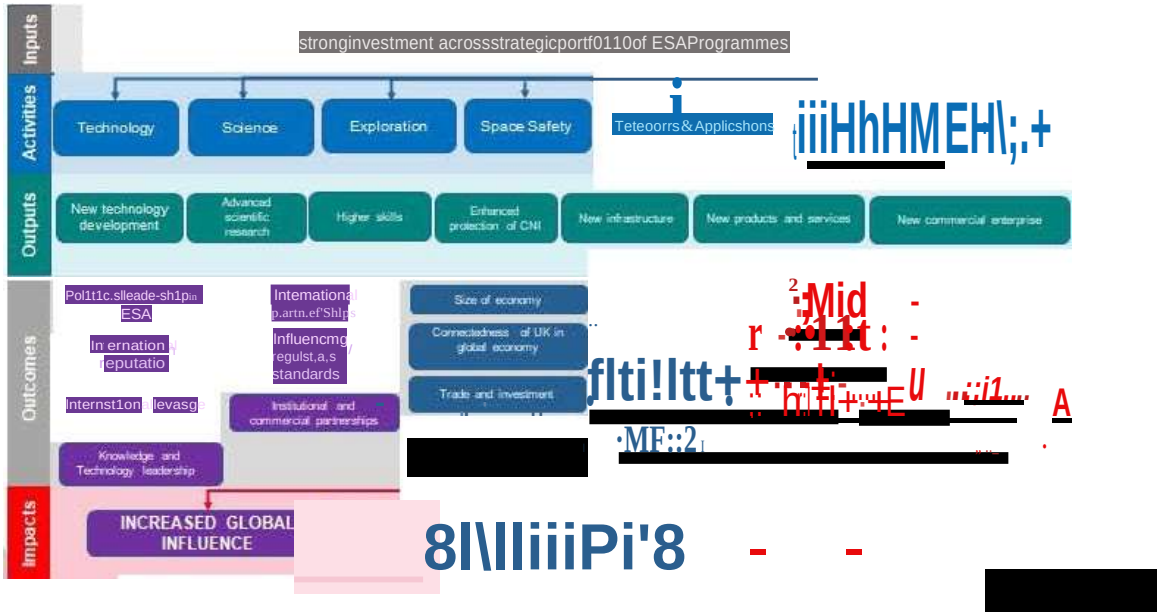
In November 2019, the UK showed its continued commitment to ESA with a total new investment of €1.66 billion to deliver international space programmes over the next five years. The funding, committed at the ESA Ministerial Council in Seville, Spain supports

UK ambitions to increase expenditure on research to 2.4 % of GDP and istargeted to support national priorities. Our investment covers a range of programmes including:

- £600m to support space science missions
- £250m in telecommunications to enable faster SG connectivity by integrating satellite and ground-based communications.
- £200m in Earth observation including £144m for the Copernicus Space Component and a UK-led mission to tackle climate change (TRUTHS)
- £180m into space exploration including a mission to bring the first samples back from Mars and securing a second flight for British Astronaut Tim Peake before2024.
- £80mintospace safety,includingamissiontoremovespacedebrisandaleadership roleina space weather mission withtheUS.
- £12 million to support UK commercial spaceflight, £16 m to support UK spaceflight and over £30 million to support space technology, including help for small businesses to take advantage of the space sector.

The logic model below provides a high level summary of how each of our ESA investments contributes to our strategic objectives. Each activity area is then explored in greater detail below.

Portfolio wide evaluation: ESA Theory of change



ESA Programmes

Space Science

Space science is part of the ESA mandatory budget and is a continuity of a programme that isanswering four fundamental questions about the Universe:

1. *What are the conditions for planet formation and the emergence of life?*

2. *How does the Solar System work?*

3. *What are thefundamental physical laws of the Universe?*

4. *How did the Universe originate and what is it made of?*

Some key future missions include:

- **F (Fast/Flexi) missions** following on from the recently selected UK-led "Comet Interceptor" which will observe pristine comets approaching from the farthest reaches of our Solar System.
- **M* or medium class mission** of opportunity with NASA which is proposed to investigate the ice giants Uranus and Neptune. This takes advantage of anunusual planetary conjunction in the next decade that will allow Jupiter gravity assists to be exploited, significantly minimising cost andrisk.
- **Multi-Messenger Astrophysics** exploiting the synergies between two large missions, ATHENA (Advanced Telescope for High-Energy Astropysics) and LISA (Laser Interferometer Space Antenna) **(Error! Reference source not found.).** ATHENA is a large area X ray telescope that will detect the violent emissions of hot gas swirling around stellar objects, while LISA is a gravitational wave observatory which will measure the vibrations in spacetime emitted during inspiralling and merging of gases onto back holes. It has been likened to combining sound (LISA gravity waves) with silent movies (ATHENA x-ray images). The UK has already secured strong roles in precursor studies for both missions and so are likelyto win major contracts to build the mission s.

The ESA subscription funds the spacecraft, launch and operations for science missions as well as early technology development for down-selected mission candidates.

Human and Robotic Exploration

The space exploration programme is about where humankind might one day live and work. It is the programme where Europe cooperates with NASA on their am bitiou s plans to have a sustainable presence on the moon fifty years after the Apollo landin gs and to go onto Mars. Global efforts in space exploration have centred on the International Space Station for the last 20 years meanin g our human exploration has been limited to work on a station orbiting the earth, now plans will extend to a station orbiting the moon, the lunar Gat eway, and beyond to Mars.

This is an envelope progr am me with 6 key sub-programmes. Three of these are focussed on continuing to support the International Space Station (Low Earth Orbit) whilst providing scienc e experimen ts to go on the station (Scispace) and developin g und erpinnin g technology for all space exploration (Expert). But the major par ts of the programme involv e Mars and the Moon (Robotic Mars Exploration, Lunar Gateway & Robotic Lunar Exploration). The UK plan s to play a key role in Mars Sample Return (MSR) the highest priority planetary science mission for the last 40 yearsi ii;and provide a communication system to the Lunar Gateway enablin g the first commercial lunar communication/navigation service (a pro ject likely to involve Goo nhill y Earth station in Cornwall and Surrey satellit es/SSTL in Guildford). Indeed, in July 2019 the UK and US Space

Agencies signed a statement of intent which paves the way for UK commercial satellite communication and navigation services to be used by future NASA missions to the Mooniii. However, the flagship programme for the UK is Mars Sample return which will work with NASA to return samples from Mars for studies on Earth.

The exploration programme is also important as a vehicle for inspiring young people to take-up and excel at STEM. For example, 1 in 3 schools participated in Tim Peake's Principia Campaign and 33 million people were engaged with Tim Peake's flight through communications activities. The programme will build onthis.

This programme has strong synergies with other ESA programmes, for example between the Lunar Gateway and Safety and Security programme, where common technology will be developed to underpin rendezvous and docking and servicing elements; as well as for monitoring space weather. Specific R&D activities planned within this envelope will contribute to several cross-cutting technology innovations such as in propulsion , energy, communications, guidance, navigation and control, rendezvous, docking, but also Artificial Intelligence and circular economy issues. Here synergies between Exploration and GSTP will ensure early concept studies are aligned. The Exploration envelope programme is supported by STFC, RAL, UKRI and NERC.

Space Safety and Security

Safety and Security has a core programme and four cornerstone missions These cover a range of research and technology developments needed to ensure that the space operating environment and infrastructure remain safe. As well as a 'core activities programme' ESA have a Space Weather mission to Lagrange point S (LS mission), activities focussed on addressing the increase in traffic expected in the space operating environment (Space Servicing, Collision Risk Estimation and Automated Mitigation (CREAM)); and a sub-programme supporting NASA's DART mission to deflect an asteroid (Hera).

The UK is leading the Space Weather mission to Lagrange point S (observing the Sun side-on) in partnership with the US NOAA (National Oceanographic and Atmospheric Administration) mission to Ll (observing the Sun straight-on). This mission is important to the UK because space weather is a risk on the BEIS risk register, the UK has the industrial and academic expertise to lead this mission(MSSLjUCL and RAL providing instruments and Airbus UK or TAS UK building the space craft) and the Met-office are one of only two organisations able to offer commercial forecasting services (currently using the US SOHO mission that is nearing the end of its life). Instruments supplied for the LS mission will be calibrated and flown on the Ll mission and vice versa demonstrating the truly global nature of this programme for the UK.

The other smaller programmes such as CREAM, which is the first stage of research to automate collision avoidance in space, could introduce game changing technology within the sphere of new space. Investing here would give the UK valuable first-mover advantages.

The other mission s include debris removal/in-orbit servicing. This is about the ability to de-orbit defunct spacecraft safely or to repair or repurpose those in orbit. This is a Swiss-led mission, but UK companies have an interest. UK is not participating in the Hera mission.

This programme shares technological complementarities with GSTP. Element of this programme, such as secure communications, will also be carried out specifically through both the ARTES and Future-ED programmes, supporting resilience and cybersecurity for the digital economy.

Earth Observation

There are two main programmes and a number of smaller EarthWatch missions (one of which is TRUTHS, a UK mission proposal). The two larger programmes are Future-ED - the core foundational programme which prepares all the future EO missions and addresses data management; and Copernicus - the world leading European-led EO global monitoring programme which offers the most comprehensive datasets for environmental monitoring in the world.

The four Earthwatch programmes are:

1. The Traceable Radiometry Underpinning Terrestrial & Helio Studies (TRUTHS): is an operational climate mission aiming to enhance by an order-of-magnitude our ability to estimate the Earth radiation budget and its composition through(primarily) direct measurements, and (secondarily) cross-calibration with other Satellites. Uk is leading this mission.
2. InCubed+ supports industry-led initiatives that are about bringinginnovative systems and products faster to market.
3. Global Development Assistance (GDA), a new programme, will create an ESA technical funding pot to enable ESA to unlock funds from the World Bank and the Asian Development Bank to support a programme 'Space in Support of Internationa l Development Aid'.
4. Altius is a "limb sounder mission" for the monitoring of distribution and evolution of stratospheric ozone at high vertical resolution in support of operational services and for long term trend monitoring.
5. CCI+: A programme led out of Harwell that measures a number of Core Climate Change Variable s that are only measurable from space.

This programme has numerous synergies with other programmes, particularly with both the science and exploration programmes where new observables, algorithms and data processin g tools will support the Future-ED mission. There are also stro ng synergies between the EO program mes, for example data from the Altius mission will be used to validate the Copernicus Atmospheric Monitoring Service model. This programme also delivers the goals of NERC and Met Office in the upstream space elements.

Telecommunications and Business Applications (ARTES)

Telecomm unicat ion s and Satellite Applications are commercially driven ESA programmes focussed on sustainin g a globally competitive telecommunications space sector . A further goal is to support socio-economic aims, for example through the development and adoption of SG Space t echnologie s and connectivity for all and optical telecommunications. ARTES also contributes to the ESA Space Safety and Security framewo rk. Supporting Critical

National Infrastructure providing space solutions for secure satcom to support Safety and Security from Space and for increased cyber-resilience.

The ARTES programme is unique for its ability to move funding within the individual programme lines during the subscription period. This offers an incredibly flexible method of taking new ideas and getting them to market early and allows funding to be transferred to meet emerging markets and novel technologies quickly. Unlike many other ESA programmes, it is mainly industry led and each project carried out within the lines requires Authorisation of Funding from the UK Delegation. There are three generic sub-elements of the programme and three strategic themes that member states can exploit depending on the projects seeking funding. The Core Competitiveness element is for projects focussed on lowering the cost of space through smart manufacturing and significantly reducing the size, weight, power and cost of spacecraft and terminals to attract a wider market for satellite communications. The Business Applications Space Solutions (BASS) element is for companies developing applications from satellite data, while the Public-Private Partnership element is for projects that linking customers and suppliers. The three key strategic areas are focussed on SG, optical telecommunications, and secure satellite communications.

There are two key projects the UK invests in through the Partnership Programme elements:

- IRIS: which uses satellite communication, satellite navigation and security applications to improve efficiency and security in air traffic management operated by Inmarsat. It will start flight trails in late 2020 and will see on average 30 miles cut from every flight within Europe.
- Oneweb: Oneweb is seeking to develop its constellation of 700 satellites in low earth orbit for the next generation to keep ahead of the nascent competition.

Navigation Innovation Programme (NAVISP)

NAVISP is ESA's flagship navigation programme. The extent of the UK' s dependency on GNSS was highlighted in the Blackett Reviewiv as underpinning 13% of the UK' s GDP. Building resilience to this vulnerability requires a strong, innovative and enabled industry. In the UK this programme supports 60% SME primes overall and with the UK as the lead investor in the programme to date, we have been able drive its commercial focus (using ECSAT) and align the programme to our national priorities, focussing on both space and non-space position navigation and timing(PNT) solutions and services. This approach drives innovation in the sectorv.

This programme is not aligned to our membership of the EU's Galileo satellite programme but is about supporting generic research to underpin the exploitation of any global navigation system (GPS, Galileo, Domestic system). Participation in this programme will help UK companies access ESA support for the underpinning technology to keep the UK competitive in building inst rument s for satellite navigation and to exploit the data from navigation satellites.

General Support for Technology Programme:

General Support for Technology Programme (GSTP) allows the UK to access ESA expertise to solve technology problems with UK companies and allow them to demonstrate the space credentials of their products leading to increased ability to supply all other ESA programmes (EO, ground segment, exploration, navigation, launcher technologies etc.) or wider national and international programmes. GSTP thus sits at the centre of a web of European technology development, and allows UK the better to compete with, but also partner with, its peers across Europe. An over-arching aim is to drive European competence, competitiveness and non-dependence in global space markets. GSTP has three main elements - 'Develop', 'Make' and 'Fly' with the full benefit from the programme derived from careful and flexible serial use of all three. This programme is highly flexible and has also allowed the UK to access ESA technology support for purely national programmes, including SABRE, the air breathing rocket, where the UK put £10m of the £60m funding through ESA to access technical expertise and testing facilities which were not available nationally. Reaction Engines (the Company behind SABRE) acknowledge that they would not have been able to develop this engine without ESA'shelp.

Commercial Space Transportation Support Services

The UK has traditionally not invested in any of the ESA launch programmes which provide heavy lift capability, and where member state investments were often drive by objectives to have independent European capabilities for defence purposes. However we have recently invested in an ESA programme to support the national ambitions of participating states in the development of commercial micro-launchers and launch-related infrastructure. Utilising ESA's extensive launch heritage to grow the domestic market would put the UK at the forefront of European small launch. This programme would complement and enhance our existing national grant-funding by leveraging UK ESA investment in a privately-led, co-funded programme. Although this is a new programme, it has attracted strong interest from industry from companies such as Orbex, Deimos UK, Orbital Access and Skyrora. It de-risks the Orbex project who, if successful, will directly employ up to 130 people in the UK, in addition to those created in the supplychain.

Evaluation and evidence building

The UK Space Agency works to ensure that all UK investment in civil space brings about real economic and scientific benefits. For this reason, high quality impact assessment and evaluation is vital to strengthen our existing body of evidence on the outcomes of space programmes. To reflect this commitment, the Agency has published our Evaluation Strat egy[1] in August 2015[2] where it sets out the processes we follow when evaluating our activities and programmes. Moreover, better evidence on the anticipated impact from our space investments will prove important when shaping future strategicdirection.

[1] https://Www.gov.uk/government/uploads/system/uploads/attachment data/file/456513/Evaluation Strategy August 2015 FINAl v 2.pdf

[2] https:/lwww.gov.uk/govemment/pub licatiom;levaluation -strate gy-uk-space-agency

As one of our most significant areas of investment, representing a substantial amount of public money, it is essential that our ESA activities are underpinned by a robust programme of monitoring and evaluation.

This will allow the UK Space Agency to demonstrate how successfully ESA funded activities have been delivered, what actual difference it has made in terms of benefits, and whether this reflects value for money, which is a critical requirement in order to make the case for continued investments in ESA related activities.

The UKSA is committed to ensuring our ESA investments are properly evaluated, not least since it was an explicit condition underpinning the approval of the business case for funding commitments at CMIN19.

The evidence from this evaluation will be essential in informing a range of strategic, policy and investment decisions. This includes both intermediate programme design and delivery decisions, as well forming key criteria for decisions making as part of major fiscal events such as the next ministerial (CMIN22), and future spending reviews (SR). A number of our historic ESA investments have already had been evaluated in some form, including published research into ARTES[3], Space Science[4], GSTP[5]. Whilst these evaluations provided useful data, they were commissioned ad-hoc and not developed at the start of these programmes, limiting their usefulness.

Now is the ideal time to start thinking about how the activities arising from our CMIN19 investments can be evaluated, since evaluation provides the most valuable data when embedded into the programmes from the start, rather than retrospectively. We are in a particularly strong position to ensure that these activities are properly evaluated over the longer term.

Our overall requirement principally involves the design, development, and implementation of an evaluation framework to underpin our ESA activities. This would then allow for the collection of this evaluation evidence across the portfolio of our ESA programmes.

2. Aims and Objectives of the Project

https://www.gov.uk/government/publications/an-evaluation-of-uk-funding-through-the-artes-programme

4 https://www.gov.uk/government/publications/an-assessment-of-the-industrial-impacts-of-uk-funding-through-the-esa-space-science-programme

5 https://www.gov.uk/government/publications/evaluation-report-general-support-technology-programme-gstp

The overall objective for this piece of work will be to **design, develop and implement a comprehensive monitoring and evaluation framework to underpin UK investments with ESA particularly those from the 2019 ESA council of ministers.**

The framework will need to cover a variety of different areas including;

The identification of detailed and specific evaluation objectivesand questions for each of the ESA programme investments, as well as the evaluation of the portfolio.
An appropriate and robust proposed evaluation methodology in order to provide the necessary data to meet our requirements, covering elements including indicators, frequency and measurement approach.
To identify and implement requirements of baseline data for the range of ESA programmes at this early stage of their lifecycle, and collect this data inpractice.
Subsequent on-going evaluation implementation and data collection across the portfolio of ESA programming to provide evidence on their delivery andimpact.

To clarify, a key focus of this research will be to actually implement and manage the agreed evaluation framework. This will likely involve the implementation of key data collection methods (i.e. surveys with grant-recipients), and the collection and analysis and reporting of data at various points throughout each ESA activities lifecycle.

Much of the detail of our approach will be id enti fied and agr eed thro ugh th e initial method development work, and so we are not able to describe extensively at t his stage, outside of some general principles/ key considerations.

Evaluation planning

The individual aims and objectives of the evaluation should be developed as part of this project, and should be tailored to the activities and the associated outcomes and impacts in question. That said, we require that the broad approach should follow the principles and consideration s outlined in the Magenta book and our publi shed evaluation strat egy, consistin g of proces s, impa ct, and value for money evaluation.

Proc ess evaluat ion should provide eviden ce on how effectively the UKSA funded ESA acti viti es are being deliver ed in practic e, what obstacle s th ere were to delivery, wheth er anything could have been done diff erently, and what worked particularly well? This element of evaluation will be parti cularly useful in id enti fyin g changes or improvem ent s to implementation of these activities in future.

The central aim of impact evaluation will be to identify the actual difference that this funded activity has made. More specifically, what are the longer-term impacts and benefits associated with it, and critically, how certain can we be that these impacts are a direct result of the activity in question (i.e. what would have happened in a counterfactual scenario?) and any unforeseen impacts/ benefits. One key question to ask here is how each activity has contributed towards the UKSA and National Space Strategy objecti ves [we should be able to share National Strategy in some form when commissioning]

Finally, economic evaluation will be important in order to understand how effectively money is being spent. More specifically, what is the return on investment of the funded activity and do these benefits justify the costs of investment?

It is important that these general evaluation principles are tailored and made relevant to the activities that we are seeking to evaluate, not least due to their associated range and diversity.

Each programme has its own individual aims, objectives and activities, and will lead to both shared and distinct outcomes and impacts as a result. The evaluation should be designed accordingly in a way that measures individual programme outputs, outcomes and impacts, whilst identifying common or shared measures where possible. For example; the science programme is geared to UK scientific leadership objectives as measur ed by field weighted citation indices, whereas the closer to market technology funding programmes (i.e. ARTES), are anticipated to lead to direct commercial growth within grant-funding recipients (increased income, employment etc).

Many of these programmes are at different stages -some are a continuations of long term projects and others are new, requiring a flexible and varied approach to evaluating different components of the portfolio that still provides an overall/aggregate picture. For each individual area we would anticipate requiring;

An initial, comprehensive assessment of the overall programm e theory / logic; including how the key objectives , inputs , activities, outcomes and impacts all int eract.

An assessment of how these outcomes and impacts can be quantified, monetised, and measured through key metrics.

A set of det ail ed resear ch questions to form the basis for subs equ ent monitoring and evaluation activity, including data requirements.

An overall proposal outlining the required monitoring and evaluation activities required to answer above questions, includin g key information onmethodology, scope, timing, and any other critical considerations.

Implementation of any data collection approaches including collection of baseline data

On-going operation of our evaluation framework including data collection, reporting and synt hesis of evidence into a portfolio level evaluation.

Theory of Change

An important first step for evaluation planning is to establish a clear definition of the programme/activity that is being evaluated, and by what criteria we will measure against. This can be effectively achieved through a visual representation of the various activities, outputs, outcomes and longer term impacts associated with the programme - often termed a logic model or theory of change. A further aim of such models is to explore the causal relationships between these factors, and how they interact and lead to the overall programme objectives. The benefit of the theory of change is that it subsequently allows us to see how the activities/impacts fit together and where we need to focus our monitoring and evaluation.

Developing a comprehensive theory of change for the overarching ESA programme, followed by detailed ones for each individual programme would be the first step for this work. This process would then inform the review and develop the UK Space Agency's proposed evaluation methodology and wider ESA benefits management.

Evaluation and method development

The next step for this work will be to develop and refine the key questions that need to be answered as part of the evaluation.

As previously mentioned, our ESA investment consists of distinct strands of activities, which lead to their own distinct sets of outcomes and impacts. In order to fully understand the full impact and delivery of these programme, evaluation questions will likely need to be developed in line with the individual programme theories of change - i.e. the theory of change outlines what change the programme is anticipated to elicit, and the evaluation questions relate to the extent to which these have occurred or not.

Without pre-specifying these in too much detail prior to this work, we envisage they can broadly be split into questions of **impact** and **process.**

Impact evaluation

Being able to demonstrate the actual difference that ESA funded activities have had would be a central aim of any future evaluation work. As previously described this will be particularly useful in justifying the investment to date, making bids for any future investment, and strategic decision making.

At a high level, we require an evaluation that would allow us to assess the extent to which impacts have occurred as a **direct result** of the activities. Though part of this work will entail scoping and quantifying potential impacts to be measured, they will likely relate to the overall programme objective. We are also interested in indirect benefits including spill-overs.

The overall indicators that should be measured here can be identified by clearly establishing the overall logic of the given programme in theories of change. This will produce a range of different outputs, outcomes and impacts that could be measured here but might include

- Outputs in the form of new technology, applications, or scientific publications.
- Outcomes in the form of direct benefits to UK industry/academic ESA grant-recipients (increased income, employment, enhanced reputation and competitiveness etc)
- Spillover impacts through the generation and application of new knowledge and technology which contribute to economic and societal wellbeing/ health.

More generally, the following elements of the impact evaluation will be particularly important to consider as part of the development process;

What data/metrics do we need to collect?

One of the most important parts of an impact evaluation will be to identify a set of measurable metrics and indicators. For example, commercial impacts may require data and information on revenue / exports / employment that have occurred within an organisation as a direct result of receiving a grant/contract.

Who to collect this data from?

Understanding where practically this data can be sourced from is important. For example,

Does the data require primary consultation with ESA grant-funding recipients or can it be sourced from other available data sources?

How should this data be collected?

This question should provide information on the appropriate methodology for collecting this information. At a high level this might involve establishing the overall evaluation method (i.e. is a difference-in-difference out approach feasible? What about theory based evaluation approaches),

It would also involve the more specific question of identifying suitable vehicles through which to collect this information, i.e. should a given research question collect information through a survey, interview or focus group or established data sources.

Thefrequency/ timing of data collection

This simply refers to identifying when specific bits of activity should take plac e, and how frequently (if at all) they should be repeat ed. Some impact s will take longer than others to be realised (i.e. spillover impacts vs commercial impacts) and should therefore be measured at a later point in time.

Baselining

An important aim of this work would be to collect the necessary **data** at this early stage of each of the ESA investments in order to establish **baselines** for future evaluation activity. Establishing a b aseline at this early stage of the programme is critical because it will allow us to monitor changes over time that result from these activities.

The exact nature of this data to be collected through the baselining process will be identified through the wider evaluation planning activities associated with this work. These specific data requirement s will also depend on the program me in qu estion but it i s par ticul arly import an t that we make the most of the early implem entation of this evaluation and avoid having to retrospectively collect it.

Evaluation best practice

As previously mentioned, it will be important that the design and development of this evaluation is informed by best practice, both in the sector and wider academic evaluation context. One way this could be achieved is through a small-scale literature review of available evidence and the subsequent application of findings to this work.

Attribution and the counter/actual

One of the key considerations in impact evaluation is being able to accurately identify the proportion of impact that is directly attributable to the specific intervention being considered. Simply taking a measurement of a relevant impact before and after the introduction of an intervention is problematic due to the presence of other potential factors that could influence that impact, meaning that not all change in impact measure can be said to result from the intervention.

Contractors should identify how they propose approach the issue of the counterfactual as part of this work - particularly given the complexity of the programmes in question (which may not always be conducive to experimental design).

Economic evaluation

As one of the overall strategic objectives of the UK space agency is to contribute the growth of the UK space sector, it is important to understand the extent to which our funding has facilitated this. In order to understand this, we need to establish **value for money** provided by the programme.

Any programme of monitoring and evaluation will need to be designed in such a way that allows the UK space agency to understand the economic impact of ESA programmes, and should be in line with the UK government Green Book standar d, more specifically;

- A full cost-benefit analysis of the programme. Did the benefits of the policy justify the costs?
- Return on investment analysis of the overall programme impact

Process evaluation

Process evaluation would likely involve establishing how successfully each of these activities are being delivered in practice. The more specific aims of this part of the evaluation might ask questions including;

- How successfully have the various ESA activities been delivered?
- Does the delivery (ie ESA management through key stage reviews)add value to the project?
- What have been the factors underpinning their delivery been, in termsof what has worked well and what hasn't, any obstacles to their implementation?
- What learning might be taken from these activities in order to inform implementation?

The majority of the key questions outlined under impacts evaluation - i.e. what methodologies and approaches (i.e. surveys vs interviews) to be used, how and when they should be adm instered, would be equally applicable to this section.

Evaluation Scope

It is important to note that the proposed programme of monitoring and evaluation will need to cover the full breadth of activities associated with our investment s from the lat est minist erial. The evaluation plan should be two-fold to provide botha;

- Tailored monitoring and evaluation plans for **each individual programme investments;** Space science, Exploration programme (E3P), Telecommunicat ions programme (Artes), Earth Observation(EO), Navigation Innovation (NAVISP), Commercial Space Transportation Support (CSTS), General Support for Technology programme (GSTP), and Space Safety Programme (SSA)
- **The ESA portfolio of investments as a whole**

Similarly, the scope of this work relates to both the design and development of an evaluation framework, and critically its im plem ent at ion. Whilst less detail has be en

provided at this point around its implementation, this is simply because that will necessarily develop through the initial phases of this work.

General considerations

We would also want to ensure that this evaluation draws on best practice from up to date evaluation methodologies of comparable programmes in related contexts, not necessarily limited to space. For example, any recommended evaluation methodology should follow best practice from the magenta book/ green book.

The contractor should also draw on ESA's own research and evaluation of programmes.

3. Suggested Methodology

If applicable:	Insert numbers:
Total number of Interviews (survey)	**40**
Total number of Interviews (qualitative)	**20**
Total number of Focus Groups	**2**
Total number of Case Studies	**8**
	These numbers apply to the earlier stages of the research in terms of method development. Later required numbers of interviews/surveys will be agreed as part of this work.

At this stage, it is anticipated that the work will consistent of a number of distinct phases and will involve the following;

i) *Inception phase:* (3-4 months); This will involve evaluation objective and method development, including the identification of detailed data collection plans and schedules. Anticipated outputs would include quality assured quantitative and qualitative survey modules, counterfactual/comparison groups approach agreed, and evaluation analysis plan for impact measurement and VFM (value for money analysis). All of these components will be delivered within an **Inception Report**

ii) *Baselining phase:* (3-6 months) - Administration of agreed data collection methodologies to secure baseline data, including for counterfactual assessment. This information should be analysed, and all present ed in a **Baseline Report** covering all components and overall UK contribution to ESA

iii) *Implementation phase (on-going):* Following on from approval/publication of Baseline Report, this phase will primarily involve the subsequent on-going collection of data through agreed methods (i.e. surveys) resulting from previous phases. This should produce **Interim Evaluation Reports** reporting progressand delivery issues, recommendations for enhancingprogramme

delivery and effectiveness, and indications of impact (and **Final Report** at end of contract drawing all monitoring and evaluation data together to overall assessment of impact and VFM, with illustrative case studies, recommendations for future contributions - report suitable for publication.

Finance for Reporting:

The contractor reserves the right to cancel the contract at the end of each of these stages depending on progress. The contractor will have paid no more than £125,000 for completion of the inception phase, an additional £125,000 on completion of the baselining phase and a further £250,000 for the implementation phase.

Developing a full monitoring and evaluation plan will require a multi-stranded programme of activity including;

Desk-based research of key programme documentation , an asessment of available data sources, and a review of the available evaluation lit eratur e to inform best practice.

A comprehensive programme of consultation across th e key UK Space Agency programme stakeholders, ESA, ESA stakeholders , industry and academic grant/contract recipients, and wider space sector experts.

<u>Evaluation methodology development</u>

There are a number of key documents the UK Space Agency hold s that would provide useful information on our historic ESA investments and it's evaluation requirements. This list would be confirmed in discussion but might include high level programme information including,

The approved business case from the 2019 Council of M inist ers, which includes information on

The overall strategic and economic rationale for investment, including a summary of what exactly was invested in, and so what is the focus of the evaluation.

Programmatic information on the nature of each investment includingtiming, financial information such as spend and key milestones.

The underlying economic analysis including information on the key anticipated benefits

A preliminary (and high level) evaluation plan and theory of change outlining activities, outputs, outcomes and impacts,

Proposed summary of indicators corresponding to outputs expected fromthe work.

This list of relevant documentation should also include also include wider analytical sources such as;

The UK Space Agency's evaluation strategy and the Magenta book. This wi II provide guidance on the general principles that the evaluation should follow, and critical considerations such as establishing a credible counterfactual that should be addressed as part of the evaluation design.

The UKSA results framework. This is a list of cross-cutting UKSA output and outcome indicators that the UKSA use to consistently assess the impact of our activities and the health of the sector. Where appropriate the ESA evaluation should aim to draw on these metrics in a consistent manner so our impact can be better understood across the range of our activities.

Previous evaluations of ESA investments (including from CMIN16). Whilst a number of these evaluations were designed and administered retrospectively (rather than being built in from the start), they still provide a wealth of information on actual programme impact and delivery, often for programmes that have been continued in some form at cmin19.

ESA's own internal socioeconomic research.

Next we need to ensure that our monitoring and evaluation plan conforms to the highest standard of rigour and best practice. In order to achieve this, the work will require a brief literature review of the available evidence on evaluation best practice to inform the work.

This should not be limited to space as useful information might be obtained on evaluation in related contexts (such as aerospace / transport), as well as wider evaluation work conducted by ESA and other national space agencies.

Consultation and engagement

Close consultation with the ESA programme colleagues and analysts will be vital in ensuring that the monitoring and evaluation plans are relevant and fit for purpose. A detailed understanding of the programme will be required in order to develop a theory of change, including an assessment of the key inputs, activities, outcomes and expected impacts of the programme.

This programme of consultation should likely consist of face to face / telephone interviews to elicit the required detail on the programme, and test the logic and assumptions of the evaluation framework / theory of change. This will likely need to take place in multiple stages due to the iterative nature of the work (i.e. initial evaluation questions can be developed through initial consultation with individual teams, but may require follow up consultation at a later date following data collection to reassess the assumptions / logic).

As previously mentioned, a core part of this work should involve the collection of baseline evidence on impact and longer term data collection. The specific approach taken to collect this information depends on the outcomes of the earlier development phases of this work.

This is a suggested methodology and we would welcome bidders' alternative suggestions providing that they also meet the project aims and objectives outlined above. Bidders should also justify why they have suggested an alternative approach.

4. Deliverables

i) **inception phase** report summarising all initial programme theories of change, agreed evaluation methodology, and indicators to be collected and literature reivew of best practice for evaluation.

ii) **baselining report** outlning the results from baseline data collection other data including assessment of the counterfactual. Report should cover both individual programme components and overall UK contribution to ESA.

iii) **implementation reports: Interim Evaluation Reports** reporting progress and findings from on-going evaluation activity, including delivery issues, recommendations for enhancing programme delivery and effectiveness, and indications of impact. A **Final Report** at end of contract drawing all monitoring and evaluation data together to overall assessment of impact and VFM, with illustrative case studies, recommendations for future contributions. This report must be suitable for publication.

Additional Deliverables:

- Regular (weekly/fortnightly) updates on emerging finding and projectprogress
- A final presentation to the ESA colleagues

Publication

The final report for this research/ evaluation project must be formatted according to BEIS publication guidelines, therefore within the Research paper series template and adhering to BEIS accessibility requirements for all publications on GOV.UK. The publication template will be provided by the project manager. Please ensure you note the following in terms of accessibility:

Checklist for Word accessibility

Word documents supplied to BEIS will be assessed for accessibility upon receipt. Documents which do not meet one or more of the following checkpoints will be returned to you for re-working at your own cost.

- document reads logically when reflowed or rendered by text-to- speechsoft war e
- language is set to English (in File > Properties> Advanced)
- structural elements of document are properly tagged (heading s, tit les, listsetc)
- all images/figures have either alternative text or an appropriate caption
- tables are correctly tagged to represent the tablestructure
- text is left aligned, not justified
- document avoids excessive use of capit alised, underlined or italicised text
- hyperlinks are spelt out (e.g. in a footnote or endnote)
- Datasets to support those to be published in the final report must be provided in an accessible format (CVS, Excel) on submission of the report.

Part 2: Contract Terms