



Invitation to Tender

Destination Earth Programme

Destination Earth Use Cases

Volume II

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| ITT Ref: DE_370 |
| ISSUED BY: ECMWF Administration Department Procurement Section |
| Date: 30 May 2022 |
| Version: Final |

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1 Introduction

Destination Earth (DestinE) is an initiative of the European Commission under the EU Digital Europe programme. By pushing the limits of computing, weather and climate sciences, DestinE is a cornerstone of the European Commission's efforts to boost Europe's digital capabilities and the Green Deal actions on climate change and to prevent environmental degradation. It aims at supporting climate change adaptation policies and decision-making for reducing the impacts of extremes.

DestinE will deploy several highly accurate thematic digital replicas (digital twins) of the Earth system to monitor and simulate natural and human activities as well as their interactions, to develop and test scenarios that would enable more sustainable developments and support European policy making. DestinE is intended to unlock the potential of observations and both physics-based and data-driven models for achieving a breakthrough in the resolution and realism of the simulation of Earth-system components.

Two high-priority digital twins will be implemented by the European Centre for Medium-Range Weather Forecast (ECMWF) – one on climate change adaptation and one on weather-induced and geophysical extremes. These will develop enhanced simulation systems, informed by observations, based on a new generation of Earth system models. These enhanced systems will not only allow to realistically represent the Earth system but will also produce information at precisely those scales where the impact of climate change and extremes are felt and where key processes are observed thus allowing users from impact-sectors to access and exploit such information for their specific application.

Rooted in both the European Commission's Green Deal and the Digital Strategies, DestinE will contribute to solving a range of societal challenges in Europe and globally. A prerequisite for success of DestinE will be the effective guidance of its orientation, development and implementation by the needs and requirements of user groups. For the first phase of DestinE the European Commission has determined that public policy user groups should be prioritized in this context.

DestinE Digital Twins (DT) shall impact a broad range of sectors through novel informing decision-making capabilities. To facilitate a targeted interaction with the diverse user groups in these sectors, a set of application use cases is intended to be developed with users from selected domains. These use cases will serve to collect information needs, including monitoring and forecasting needs, and gaps from users in selected sectors, identify necessary data analytics and data requirements, and implement prototypes that demonstrate how policy or decision makers interact with DestinE data. Use cases will thereby be an important element in the user engagement and co-design of DestinE. They will help guide the future development of the DestinE DT and also promote the value of DestinE and inspire other users.

Emphasis of these use cases will be on demonstrating the added value of DestinE capabilities compared to existing data and resources. DestinE will be developed to complement and enhance the existing national and European services, and in particular Copernicus. The developments in DestinE should thus be seen as capabilities and developments that will ultimately benefit specifically the service component of Copernicus. It will improve current operational capabilities, enable testing of new ideas and ultimately lead to better products. To aid this final overall scope, DestinE use cases will therefore address specific aspects of existing services, and be able to feed back to further improve them in the future. Use cases need to respect that ECMWF member states have exclusive responsibility to maintain National Meteorological, Hydrometeorological and Hydrological Services under the 1947 UN Convention of the World Meteorological Organization (WMO) and have the important mission of supporting national needs, including protecting life and property of citizens in the context of high impact meteorological events.

1.1 Definitions

General definitions can be found in Volume I. Definitions specific for this Invitation to Tender (ITT) are given below.

Application: An action, information product, or service, which makes use of one or more DestinE DT services or outputs as an input.

Co-design: Coordinated definition and implementation of a DestinE technical capability, use case, Application or Service between individual or all of the DestinE Entrusted Entities and Users or contractors.

Digital Twin (DT): Actionable digital representation of a physical system (for DestinE: in the context of an Earth system approach to extremes and climate change adaptation) that simulates the system behaviour at temporal and spatial scales relevant to decision-making in target sectors. A Digital Twin combines Earth-system models and Earth observations as well as advanced data analytics to monitor and predict environmental change, test scientific hypotheses and help to define adaptation scenarios. A DT is a self-standing DestinE system component offering a seamless production service of actionable knowledge for users that results from the fusion of observational and simulated data (from the physical Earth system to the impacts of change on relevant assets). Users interact with digital twins at different levels: where primary simulation-observation data are generated and combined, where such data can be accessed and upgraded with user specific models, tools and data to create user specific information, and where such information is turned into decision and policy making.

Entrusted Entity: Entity entrusted by the European Commission with the implementation of Destination Earth by means of Contribution Agreements, i.e. ECMWF, the European Space Agency (ESA), and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT).

Impact Sector: Policy domain in which the outputs of the DT are expected to enhance the ability to predict the effects of different policy scenarios and support the implementation of policies. Possible impact sectors include, for example, water management, agriculture and forestry, renewable energy management, air quality management, urban development, maritime or air transport, biodiversity protection, disaster risk mitigation, and climate impact assessments.

Service: Provision of technological capabilities, resources, methodologies, data and tools, including their management across a variety of digital infrastructures. DestinE handles and innovates complex workflows related to Earth system information generation and delivery, facilitates the management of complex monitoring, prediction and projection systems, and makes components available for use in different digital contexts to enable rich interaction in the wider digital environment. The services developed and implemented by DestinE provide free and open access to tools, software and platforms.

Users: Institutions or individuals interacting with the DestinE core Service Platform (DESP), Data Lake (DEDL) and/or a DT, thus exploiting DestinE capabilities, output products or services to achieve their objectives. These may include researchers, agencies implementing policies, or more generally civil society (companies, media, NGO, etc.). DestinE user institutions ingest DestinE output data for further processing in their own applications. These are typically expert users, e.g. in research, national hydro-meteorological services or environment agencies. DestinE is initially aimed at professional public sector users but is planned to evolve to encompass a wider user base including the scientific communities and the private sector.

2 Background

2.1 DestinE structure and implementation

DestinE is funded by the European Commission's Digital Europe programme and is implemented through a partnership between ECMWF, ESA, and EUMETSAT. The objective of this initiative is to develop – on a global scale – a highly accurate digital model of the Earth to monitor and predict the interaction between natural phenomena and human activities. In doing so, DestinE supports the European Commission in achieving sustainable development objectives and contributes to the Green Deal and Digital Strategies.

The entities implementing DestinE coordinate their efforts on the development of use cases. The goal of this effort is to support the implementation of complementary and collaborative projects. Proposals submitted in response to this tender should dedicate resources for the coordination with related projects funded by other entities in DestinE.

The first phase of DestinE, the implementation phase 1, covers the period 15 December 2021 – 14 June 2024. In this phase, the main building blocks of the infrastructure required to reach DestinE’s ambitious goals will be configured and deployed and their capability be demonstrated:

- The DestinE core Service Platform (DESP; responsibility ESA) for providing a large number of users with access to observations, simulations and models, evidence-based policy and decision-making tools, applications and services, based on an open, flexible, scalable and evolvable secure cloud-based architecture.
- The DestinE Data Lake (DEDL; responsibility EUMETSAT) for handling the storage and access requirements for any input and output DestinE data that is offered to DestinE users via seamless access through the DESP including near-data processing to maximize throughput and service scalability.
- The Digital Twin Engine (DTE; responsibility ECMWF) consisting of generic software infrastructures for extreme-scale simulation and data fusion, data handling and machine learning that allow exploiting the latest digital infrastructure technology for operating Earth-system digital twins.
- The two high-priority Digital Twins (DTs; responsibility ECMWF) for generating high-quality simulations and combining simulations and observations of the Earth system at unprecedented accuracy to serve the EU’s Green Deal policy priorities:
 - Weather-induced and geophysical extremes DT for providing capabilities for the assessment and prediction of environmental extremes at very high spatial resolution and close to real-time decision-making support at continental, country, coastline, catchment and city scales in response to meteorological, hydrological and air quality extremes.
 - Climate change adaptation DT for providing capabilities to support climate adaptation policy and scenario testing at multi-decadal timescales aiming at a real breakthrough at the level of reliability at regional and national levels.

In the following phases of DestinE, these building blocks will further evolve to enhance capabilities, add further thematic foci, ingest the latest scientific developments and observational information, and make use of the emerging digital infrastructure ecosystem supported by the Digital Europe programme in Europe.

The present ITT only relates to ECMWF’s contribution to DestinE.

2.2 DestinE DT capabilities

During phase 1 of DestinE, ECMWF and its contractors are establishing the two high-priority DT, on weather-induced extremes and on climate change adaptation.

The DT on weather-induced extremes will support decision-making at continental, country, coastline, catchment and city scales in response to meteorological, hydrological and air quality extremes. It aims to combine global with configurable (in terms of geographical extent, spatial resolution, temporal refresh and coverage, model components, boundary conditions, data assimilation), on-demand regional weather, hydrology and air-quality simulation and observation capabilities to drive user defined applications. The DT output will include meteorological variables (notably the ECMWF open data [RD8], e.g., air pressure, temperature, wind, humidity, atmospheric water content, clouds, precipitation, solar and thermal radiation) and represent kilometre scales or finer, produce predictions up to 5 days ahead and have (sub-) hourly data sampling.

The DT on climate change adaptation will deliver globally coupled Earth-system simulations at a qualitatively new level of resolution and interactivity. The DT will produce multi-decadal, (few) kilometre scale numerical Earth-system simulations from at least two modelling systems including atmosphere/land/sea-ice/ocean components providing selected model output variables characterising the evolution of these Earth-system components. An observation-based assessment framework for the purpose of Earth-system model assessment and uncertainty quantification will be part of this DT. For selected time slices, the DT on climate change adaptation will also generate ensemble simulations to assess extremes.

Both DT will already include elements of co-design with component models from impact sectors such as water management, agriculture and forestry, renewable energy management, air quality management, or disaster risk mitigation to demonstrate the benefit of the advanced DT framework for weather induced extremes and climate change adaptation-related policy and decision making. DT design and data output therefore prepare for the integration of further application-oriented use-case components and value adding. The configurations of the two DT will be defined during their development in phase 1. Specifications indicating the expected capabilities can be found in the corresponding tenders [RD6, RD7].

2.3 DestinE stakeholder engagement

During the first phase of DestinE, ECMWF, together with ESA and EUMETSAT, will also initiate a broad and continuous dialogue with users and other stakeholders, including from ECMWF and EU member states, to guide the implementation and evolution of DestinE. This will include:

1. An open stakeholder dialogue aimed at the wider community, e.g. through workshops, online fora or dedicated technical working groups. This will also be through formal interactions with the DestinE governance under responsibility of the European Commission.
2. Targeted user partnerships, including co-design of specific DT capabilities at technical level exploiting novel digital technologies and analytics, and use cases demonstrating the added value of DestinE in various impact sectors.

Use cases in this context are considered an effective way of engaging stakeholders in the development of the two initial DT and help guide the evolution of DTs in later phases of DestinE. Use cases will thus:

- extend from existing workflows and capabilities and be compelling demonstrations of the need for the unique features of the DT output capabilities (for reasons of timing, the initial work will be based on existing data/services to be scaled up as the DT implementation proceeds);
- involve impact sector users in active roles for defining the most effective workflows and interaction options that advance present-day capabilities;
- prepare and propose future DT design options that will further enhance data quality and user interactivity across applications.

2.4 Related activities and projects

The activity benefits from other initiatives, past and present, though no formal dependencies are foreseen between the contracts concluded under this tender and these other activities. These include user engagement workshops addressing critical issues and future needs in the user communities, as well as the targeted collection of user-defined proposed use cases resulting in the publications of potential candidates [RD3].

ECMWF has been realising a collection of use cases and demonstrators in the context of its Copernicus activities [RD4, RD5] and will be funding DestinE use cases integrated with the development of the two high-priority DT, which could cover domains such as renewable energy, hydrology, wildfires or heat stress, for example.

Similarly, ESA has conducted a series of activities as precursors to DestinE and potential future ESA programmes, both on thematic and technology aspects, including on climate impact, forestry, food systems, hydrology, Antarctica, ocean and the Alps.

2.5 Reference resources

- [RD1] Destination Earth website of the Commission
<https://digital-strategy.ec.europa.eu/en/policies/destination-earth>
- [RD2] ECMWF Destination Earth webpages
<https://www.ecmwf.int/en/about/what-we-do/environmental-services-and-future-vision/destination-earth>
and <https://stories.ecmwf.int/destination-earth/>
- [RD3] Summary report of the third DestinE user engagement workshop (held on 11 Feb 2021)
<https://ec.europa.eu/newsroom/dae/redirection/document/74335>
- [RD4] Sectoral impacts of the Copernicus Climate Change Service
<https://climate.copernicus.eu/sectoral-impacts>
- [RD5] Use cases of the Copernicus Atmosphere Monitoring Service
<https://atmosphere.copernicus.eu/use-cases>
- [RD6] Invitation to Tender, Destination Earth Programme, Climate Adaptation Digital Twin, Volume II; published on 22 March 2022
<https://www.ecmwf.int/en/about/suppliers/destine-procurement/past-itts>
- [RD7] Invitation to Tender, Destination Earth Programme, On-demand Extremes Digital Twin, Volume II; published on 30 March 2022
<https://www.ecmwf.int/en/about/suppliers/destine-procurement/past-itts>
- [RD8] Open data at ECMWF <https://www.ecmwf.int/en/forecasts/datasets/open-data>

3 Contract summary

This ITT aims at establishing a set of individual contracts to develop DestinE DT use cases that conceptualize and demonstrate concrete application benefits from future data and capability provisions of DestinE DTs. Since DestinE DT output data will only start becoming available towards the end of the first implementation phase, the use cases shall be demonstrated with existing data, e.g. from the Copernicus Services, through an investment in new methodologies (e.g. machine learning, user interactivity) to generate enhanced, use case specific information from different data sources, which may include user specific data/models/tools. As DestinE DT test datasets will become available, the added impact from DTs on, for example, enhanced data quality, co-designed workflows, better sampling and timeliness and smarter integration in configurable workflows shall be anticipated and demonstrated. This two-stage approach is an important criterion for the use case selection.

The objective of each of the use-case contracts resulting from this ITT is to develop and implement concrete examples for applications eventually benefitting from the full DestinE capabilities. Each use case must respond to a well-defined, specific problem and user objective within the relevant user mandate, set out the current workflows including their limitations and the information gaps/shortcomings to be addressed, define the approach and the required DestinE products and capabilities, implement a demonstration based on existing and (prospective) DestinE capabilities, and assess output quality, uncertainties, fitness-for-purpose and user benefit.

Criteria for selection will be the relevance of the problem addressed for public policy users in Europe and the expected value added by the unique DestinE capabilities, the effective involvement of policy-mandated users,

the credibility and feasibility of the use case, and the realistic planning of the continued exploitation of the results.

The selected use cases shall contribute to the requirements definition of future DT and, where appropriate, the evolution of the first high-priority DTs beyond phase 1. Successful bidders will thus be required by ECMWF to contribute to relevant workshops and requirements collection actions.

Within this ITT, ECMWF targets a selection of use cases in different impact sectors including, but not limited to:

- water management,
- agriculture and forestry,
- renewable energy management,
- air quality management,
- maritime or air transport,
- disaster risk mitigation.

This ITT is open to bids addressing application domains that can demonstrate the relevance for European public policies and the compelling added value presented by DestinE. Use cases may target one or both high-priority DT for their developments.

Several independent contracts are foreseen, each of them led by one prime contractor, which may engage with one or more subcontractors. Tenderers may submit more than one bid. However, selection of one bid must not rely on the selection of any other bid a Tenderer may have submitted. In striving for thematic diversity ECMWF will select a set of use cases covering several of the application domains listed above to ensure representation of diverse applications in terms of domains and user groups addressed. There may be more than one use case funded in any of the impact sector, provided they address different applications or users. It is expected that user institutions with tasks in the definition and/or implementation of public policies, e.g. government agencies or entities contracted by them, will assume a prominent role in the delivery of the use case.

ECMWF expects that individual tenders, with a total price between € 200,000 and € 600,000 will be adequate to achieve the objectives of individual thematic use cases, depending on the scope of the individual use cases. This may include highly focused cases with a relatively small budget. However, ECMWF may consider bids outside the above range, if duly justified by the bidder. Prices should be based on economy, efficiency and effectiveness. Bids will be assessed against the expected value for money.

4 Technical specification

This ITT addresses Tenderers that develop innovative technical solutions for specific public policy challenges exploiting the novel data, services and capabilities of the DestinE DT. Use cases development should be planned to allow accommodating evolutions of DestinE during the development phase. Each use case shall focus on a specific topic and implement an application and workflow that demonstrates how the output products of the DestinE DT benefit a documented user need.

A mandatory requirement for the use cases is to include:

- A description of the current, existing frameworks and mandates, capabilities and data, the improvement expected from DestinE capabilities, including a socio-economic and policy gap and benefit analysis;
- Prototype mechanisms supporting decision-making demonstrating how policy and decision makers can interact with DestinE data and workflows, whilst respecting existing frameworks such as the 1947 United Nations Convention of the World Meteorological Organization (WMO) (if applicable);

- Demonstrations that these mechanisms and workflows add benefits to existing (e.g. national services, Copernicus, WMO, Group on Earth Observations) capabilities and mandates, first through new methodologies applied to existing data, second through additional selected DT output according to availability;
- Roadmaps and implementation strategies for successful end-to-end user community engagement including the necessary communication and engagement plans, capacity, interoperability and training needs, legal/political frameworks and documentation material.

Specific deliverables for each use case are:

- a use case description (report);
- a technical design specification (report);
- a pilot implementation (software demonstrator);
- a performance and impact assessment (report).

These are described in detail in subsections 4.1-4.4. In addition to the delivery of the use case implementation and demonstration, successful Tenderers will be required to contribute to user engagement, requirements definition, and communication activities of ECMWF or the European Commission.

4.1 Use case description

The use case description must set out the policy objective that the use case addresses and define its relevance in the context of weather induced extremes and/or climate change adaptation applications. It must define and list the intended users including their mandates and contribution to achieving a more sustainable European policy-making and support framework. It should be noted that public policy users in Europe are prioritized by the European Commission during this first phase of DestinE; however, commercial entities and public-private partnerships are fully eligible.

The use case description must (if applicable) demonstrate how it ensures that member states have the exclusive responsibility to maintain National Meteorological, Hydrometeorological and Hydrological Services under the 1947 UN Convention of the WMO and have the important mission of supporting national needs, including protecting life and property of citizens in the context of high impact meteorological and hydrological events (with a specific reference to the subsidiarity principle (Article 5(3) of the Treaty on European Union (TEU) and Protocol (No 2) on the application of the principles of subsidiarity and proportionality).

It is further expected that the use case description includes a detailed analysis on how the use case complements existing Copernicus services and data (if applicable).

The description must set out a compelling story-line on how the users are intended to use DestinE DT in their work and how this will improve on the status quo. Identifying the impact of the future capabilities of the DestinE DT (see section 2.2) is an important selection criterion for the use case.

The description must also include a detailed description of the existing decision-making process, including the “data value chain” of how observations and simulations inform these decisions, and identify where and how this could benefit from adding DestinE capabilities. The description should include an assessment of the present skillset of the user institutions in terms of their own scientific, technical and operational readiness to exploit complex DT workflows and to benefit from the advanced DT capabilities. The assessment shall explain how present capabilities are being used, where main bottlenecks exist and what solutions are being explored for overcoming such bottlenecks.

Use cases should be presented as innovative approaches towards creating better information quality and facilitating decision making, e.g. by adapting information to specific user needs or improving the user interaction with information. The use case description shall include how uncertainty and quality are

quantified and translated into decision making. It shall also present a possible avenue for an evolution of use cases towards their potential future operational implementation.

A Use Case Description report must be delivered by the successful Tenderers. The description will also be used in support of the wider DestinE partnership activities (see section 2.3).

4.2 Technical design specification

The technical design of the use case:

- Defines the required input data and information specifications including their sources and interfaces. Note that these are not generally expected to be limited to output products of the two high-priority DT, but may include other data, e.g. data provided by existing services and the users themselves. Since the DT output data are only expected to become available towards the end of the contract, the design shall foresee the use of existing data for the initial development, e.g. available via the Copernicus Climate Data Store, the Global Flood Forecasting System, the European Flood Awareness System, or the European Forest Fire Information System, both provided in the context of the Copernicus Emergency Management Service.
- Defines the analytical and modelling methodologies that will be implemented for the use case to create progress over existing capabilities. The successful Tenderers shall define clearly, which software components exist and which will need to be newly developed or adapted.
- Specifies the technical requirements that must be met to satisfy the needs of users for supporting their decision-making, including infrastructural capability and service provision requirements.
- Defines the user interfaces including a distinction between one-way and two-way interaction between use case and DT workflows.
- Defines any specific software, hardware and data volume requirements. Specific resolution and output frequency requirements must be specified.
- Defines the output data, metadata and services, including how these are accessed by users.
- Defines performance indicators for the use case, including, but not limited to, indicators on timeliness, throughput, robustness, availability. These indicators shall reflect the needs and requirements of the users.
- Defines applicable uncertainty quantification and quality indicators for the use case.
- Provides a detailed analysis of operational feasibility within the context of DestinE with a particular focus on software and processes.

Where the use case has specific requirements on interfaces and functionalities of DestinE, these shall be discussed with ECMWF.

The technical design will be the reference for the pilot implementation (demonstrator) of the use case by the successful Tenderers.

A Technical Design report must be delivered by the successful Tenderers.

4.3 Pilot implementation / demonstrator

The Tenderers are expected to deliver a fully functional implementation of the use case based on the accepted technical design specification (report). It is expected that DT output data will not be available for the initial use case demonstration. The successful Tenderers shall therefore implement a pilot demonstrator with data from existing sources and should then adapt the use case as DT data becomes available along the duration of the contract. This two-stage approach allows an efficient use of resources for both use-case specific methodological developments and uptake of DestinE DT outcomes produced elsewhere.

To the extent possible the implementation shall be based on open-source software. Where the Tenderers intend to use proprietary software or data with licences restricting the use of the software or output, this must be agreed specifically with ECMWF, since it may impede the continued development, extension and exploitation of the use case results in the future evolution of DestinE.

The implementation shall be developed and tested on systems and infrastructures available to the Tenderers, which may include available resources, e.g. on the Copernicus DIAS or other platforms for hosted processing close to large relevant data holdings. ECMWF expects that the implementation achieves a Technology Readiness Level (TRL) of 5-7 at the end of the contract. The resources and their present use by the Tenderers shall be described. Where a use case requires close co-development with the DT this should be indicated and explained in the technical proposal such that the impact on DT development can be assessed.

The implementation shall be reproducible by ECMWF and the required software and required data shall be delivered to ECMWF, including any required licenses (cf. section 4.6 of this Volume II).

An Implementation Report documenting the full implementation of the demonstrator shall be delivered by the successful Tenderers.

4.4 Performance and impact assessment

The purpose of the use case performance and impact assessment is to:

- Report on the performance, reliability of production and output quality assessment defined in the Technical Design;
- Assess the usability and fitness-for-purpose of the implementation for the user;
- Make recommendations for the evolution of (a) the use cases and their own technical framework and (b) the DestinE DT, DESP or DEDL to improve future performance, reliability and quality.

Offers shall include a separate work package on performance and impact assessment that includes the testing of the implementation to measure the agreed performance, reliability and quality indicators. The approach to quality and uncertainty quantification shall be defined in close relation to the impact sector specific requirements. Uncertainty estimates shall be derived from objective error estimation methods and make use of independent reference data and statistical uncertainty quantification tools. The choice of reference datasets and methods shall be explained in detail.

Usability and fitness-for-purpose of the use-case outcomes shall be assessed by end users and be demonstrated at decision making level.

Based on the evaluation results and their experience with the development of the use case, the successful Tenderers shall make recommendations on the future evolution of the use case and its implementation, the DT and the other DestinE components, as appropriate.

A Performance and Impact Assessment Report shall be delivered.

4.5 User engagement and communication

The use cases are an important element for user engagement in DestinE. A roadmap for the engagement of user communities associated with the use case shall be developed as a part of this tender. The Tenderers are further expected to support ECMWF and the European Commission in overarching DestinE user engagement and communication activities. To this end, successful Tenderers will be required to:

- Support workshops and other events organized by ECMWF, the Commission or other parties by presenting the use case;

- Advertise the use case in relevant fora and communications (publications, websites, newsletters, social media, workshops, conferences, etc.) within the impact sectors for which the use case is relevant;
- Contribute to the ECMWF and European Commission communication work on DestinE as required.

Specifically, the successful Tenderers shall deliver at a minimum:

- A roadmap for community engagement, ensuring appropriate engagement throughout the development;
- A description/story map of the use case suitable for presentation on the web, including text and visuals (updated every 3 months);
- Presentation material on the use case to be maintained up-to-date over the duration of the contract;
- Regular posts on/for relevant social media channels within the impact sector;
- A short video presentation of the use case to be included on a DestinE web presence.

A plan for the communication activities carried out by the Tenderers shall be included in the proposal. An initial version will be agreed with ECMWF during negotiation and will form part of the contract. The implementation of this plan and any subsequent update will need to be agreed with ECMWF on a regular basis during the contract implementation. This includes, but does not exhaustively cover, communication planning, contributions to DestinE media outreach, websites and social media activity, externally facing written and graphical contents and events.

4.6 Data and IPR

ECMWF shall be the owner of all Deliverables (as defined in Volume V Agreement) from the date of creation. ECMWF is obliged to assign ownership of Deliverables to the European Union.

Contractor and its licensors shall remain owners of their respective Background IPRs. If any Deliverable is dependent upon continued association with Contractor's Background IPR the Contractor shall grant a non-exclusive, irrevocable, worldwide perpetual licence to ECMWF under the conditions set out in Volume V Agreement.

All Improvements to ECMWF's Background IPR shall vest in ECMWF on creation. If the Contractor considers that any Deliverable produced is an Improvement to the Contractor's Background IPR, it may request that ECMWF assigns the IPR subsisting in such Deliverable back to the Contractor, this is granted at the discretion of ECMWF and subject to the approval of the European Commission.

5 General requirements

5.1 Implementation schedule

ECMWF intends to award one or more contracts for a maximum duration of 19 months, expected to commence by October 2022, and with an end date not later than 30 April 2024.

The Tenderer is expected to provide a detailed schedule as part of the tender response. The proposed schedule shall address the main tasks, milestones and deliverables. Regular progress meetings will be held with ECMWF during the contract to assess contract status, risks and actions. A perspective on possible future developments beyond the contracted period is also highly desirable.

5.2 Meetings

5.2.1 Physical / face-to-face meetings

A kick-off meeting will be held at ECMWF premises in Bonn no later than one month after contract signature. Key personnel from the successful Tenderers should plan on being there, while additional people could attend via web-conference if necessary.

At least one physical progress meeting shall be foreseen in the offer at an advanced stage of implementation (indicatively, KO+15). The location of this meeting will be agreed between ECMWF and the contractor, preferably at a user institution.

A final meeting shall also be foreseen at the end of the contract. ECMWF may decide to combine the final meetings of different use case contracts at the same time in the frame of a larger event.

In addition, Tenderers should foresee active participation in at least two relevant physical events per year in the DestinE context.

5.2.2 Regular meetings by web-conference

The successful Tenderers are expected to organize monthly progress meetings by videoconference and prepare corresponding summary minutes of these meetings and maintain a list of agreed actions and their status.

Successful Tenderers may also be invited to contribute to additional technical working groups on issues relating to the requirements and evolution of DestinE. These are expected to be held generally by web-conference.

5.3 Deliverables and milestones

At a minimum the successful Tenderers are expected to deliver:

| Deliverable | Section reference | Format | Due |
|---|-------------------|--|--|
| Use case description | 4.1 | Report | KO + 3 months |
| Use case technical design specification | 4.2 | Report | KO + 6 months |
| Mid-term report | All | Report | KO + 12 months |
| Demonstrator | 4.3 | Software and data access and corresponding documentation | KO + 16 months |
| Performance and Impact Assessment Report | 4.4 | Report | KO + 18 months |
| Communication material to support ECMWF communication: <ul style="list-style-type: none">– Website content– Presentation– Social media content– Video presentation | 4.5 | text and visuals ppt or compatible posts Video | KO + 3 months (plus updates every 3 months) KO (plus regular updates, as needed) Regular KO + 18 months |

Further deliverables may be defined by the Tenderer based on the requirements above. The Tenderer is encouraged to limit the number of any further deliverables and milestones to a reasonable amount so that their preparation, review and revision remains manageable.

Each deliverable shall have an associated resource allocation (person-months and financial budget). The total of these allocated resources shall amount to the requested budget associated with payroll as detailed in Volume IIIA of this ITT.

Milestones should be designed as markers of demonstrable progress in capability development and/or quality of capability delivery, as applicable. They should not duplicate deliverables.

5.3.1 Documents and reports

All project reports shall be produced in English. The quality of reports and deliverables shall be equivalent to the standard of peer-reviewed publications and practice. Unless otherwise specified in the specific contract, deliverables shall be made available to ECMWF in electronic format (Microsoft Word/PDF/Microsoft Excel or compatible), via the DestinE Deliverables Repository portal; the details will be agreed at the negotiation stage.

Please refer to Clause 2.3 and the Annex 5 of the Volume V Agreement for details on Reporting Obligations.

5.3.2 Graphical material and content for communication

All content shall be produced at least in English, unless specifically agreed by ECMWF. Additional languages may be used if justified. The successful Tenderers shall ensure that all material (text, visuals, videos, etc.) is duly licensed for use by ECMWF and the European Commission.

Outreach activities will be organised by ECMWF during the period of the contract. In such instances, the successful Tenderers will be approached by ECMWF for support on developing and delivering contents.

Successful Tenderers shall not establish their own brand for the selected use case but rely on and use DestinE and ECMWF pre-defined wording and branding. A communications package (including guidelines, logos and templates) will be provided by ECMWF at the start of the contract.

6 Tender format and content

General guidelines for the tender are described in Volume IIIB. Specific requirements to prepare the proposal for this particular tender are described in the next sub-sections.

6.1 Page limits

As a guideline, it is expected that individual sections of the Tenderer's response do not exceed the page limits listed below. These are advisory limits and should be followed wherever possible, to avoid excessive or wordy responses.

| <i>Section</i> | <i>Page Limit</i> |
|--|--|
| <i>Executive Summary</i> | 2 |
| <i>Track Record</i> | 2 (for general) and 2 (per entity) |
| <i>Quality of resources to be Deployed</i> | 1 (excluding Table 1 in Volume IIIB and CVs with a maximum length of 2 pages each) |
| <i>Technical Solution Proposed</i> | 10 (Table 2 in Volume IIIB, the section on references, publications, patents and any pre-existing IPR is excluded from the page limit and has no page limit) |
| <i>Management and Implementation</i> | 4 (excluding Table 4 and Table 5 in Volume IIIB) + 2 per each Work package description (Table 3 in Volume IIIB) |
| <i>Pricing Table</i> | No limitation |

Table 1: Page limits

6.2 Specific additional instructions for the Tenderer's response

The following is a guide to the minimum content expected to be included in each section, additional to the content described in the general guidelines of Volume IIIB. This is not an exhaustive description and additional information may be necessary depending on the Tenderer's response.

6.2.1 Executive summary

The Tenderer shall provide an executive summary of the proposal, describing the objectives, team and summarising the proposed technical solution, user engagement and capability demonstration.

6.2.2 Track record

The Tenderer shall demonstrate for themselves and for any proposed subcontractors that they have experience and knowledge relevant for the proposed solution. This includes experience in relevant projects in the public or private sector at national or international level as well as engagement with – and access to – relevant user communities in the targeted impact sector of the use case.

User institutions that are part of the bid shall describe their mandates and roles, including in formal and informal impact sector fora.

ECMWF may ask for evidence of performance in the form of certificates issued or countersigned by the competent authority.

6.2.3 Quality of resources to be deployed

The Tenderer shall propose a team providing the skills required for developing, demonstrating and evaluating the solutions complying with technical requirements set out in Section 4. The team shall include a dedicated Project Manager with experience in management of similar-size projects. The Tenderer shall describe the experience of the Project Manager and the technical project team in performing activities related to all aspects of this tender.

6.2.4 Technical solution proposed

The Tenderer shall give an introduction to demonstrate their understanding of the DestinE context and the specific requirements of this tender.

The Tenderer shall describe the use case objective, relevant policy context, define the user groups involved and specify the addressable needs in the impact sector.

A separate sub-section shall include a particular focus on complementarity to existing Copernicus Services and relevant WMO mandate of ECMWF member states.

This section shall describe the proposed technical solution and identify the qualitative and quantitative improvements expected from DestinE for the needs of the users addressed by the proposed use case.

A separate sub-section shall be included on user engagement to describe how the Tenderers will ensure effective links with relevant user communities, both those entities directly involved in the bid and in the impact sector beyond. This should further contain a perspective on how the developments in the proposed use case could be exploited and continued beyond the end of the contract.

This section shall also include information on other third-party suppliers that are proposed for delivering the technical solution.

6.2.5 Management and implementation plan

The Tenderer shall provide a detailed implementation plan of proposed activities for the duration of the contract. Deliverables should be consistent with the technical requirements specified in Section 4.

The Tenderer is requested to include management and implementation activities within a dedicated work package (WP0). The number of milestones is not prescribed, but they should be designed as markers of demonstrable progress in capabilities development and/or quality of capability delivery to keep progress monitoring manageable.

Adjustments to the proposed implementation plan can be proposed by the successful Tenderer during the course of the contract, but must be agreed to by ECMWF.

As part of the general project management description the Tenderer shall consider the following elements (this is not an exhaustive list):

- Semestrial, annual and final reports shall be provided in accordance with the Volume V Agreement Clause 2.3 and Annex 5.
- An annual work plan is expected to be agreed at negotiation for 2023. The work plan for 2024 shall be provided in August 2023.
- Monthly video-conferencing with ECMWF and a proposal for involvement of ECMWF in major project reviews shall be provided as part of the management plan. The contractor is responsible for the organisation of such meetings, including provision of minutes.
- If relevant, a list of sub-contractors and details of their contribution, key technical personnel involved in the contract, legal names and addresses shall be provided. The Tenderer shall describe how the Volume V Agreement, in particular Clause 2.9, has been communicated to all their sub-contractors.
- The Tenderer shall describe in the Proposal the management of personal data and how this meets the requirements of Clause 2.8 and Annex 6 of Volume V Agreement.

The table below provides the template to be used by the Tenderer to describe the complete list of deliverables, milestones and schedules for this work package. All milestones and deliverables shall be numbered as indicated. All document deliverables shall be periodically updated and versioned as described in the table. Tenderers shall provide preliminary versions of the completed tables as part of their bid.

Deliverables for this work package shall include the following reports:

| WP0 Contractual Obligations Template | | | |
|--------------------------------------|--------|--|-------------------------------|
| # | Nature | Title | Due |
| D0.y.z-YYYY | Report | Semestrial Implementation Report (January-June YYYY) YYYY being the Year n This includes a specific Financial Report | Annually on 15/07 |
| D0.y.z-YYYY | Report | Annual Implementation Report YYYY YYYY being the Year n-1 This includes a specific Financial Report | Annually on 15/01 |
| D0.y.z | Report | Final Implementation Report | 60 days after end of contract |
| D0.y.z-YYYY | Report | Annual Work Plan YYYY YYYY being the Year n+1 | Annually on 31/08 |
| D0.y.z-YYYY | Other | Copy of prime contractor's general financial statements and audit report YYYY, YYYY being the Year n-1 | Annually (no-cost associated) |

6.2.6 Key performance indicators

The successful Tenderers shall report to ECMWF on a set of Key Performance Indicators (KPIs) and performance targets for the activities covered by this ITT and taking the requirements described above into account. The KPIs and performance targets, to be proposed by the Tenderer in the bid, will be agreed in contract negotiation and may be updated by mutual agreement, if necessary.