ASSIGNMENT DESCRIPTION

Title of tender	**Civil Engineering Feasibility phase Einstein Telescope EMR**
Document number	**P2.1_019_V2.0**

H1. Introduction

Introduction project Einstein Telescope

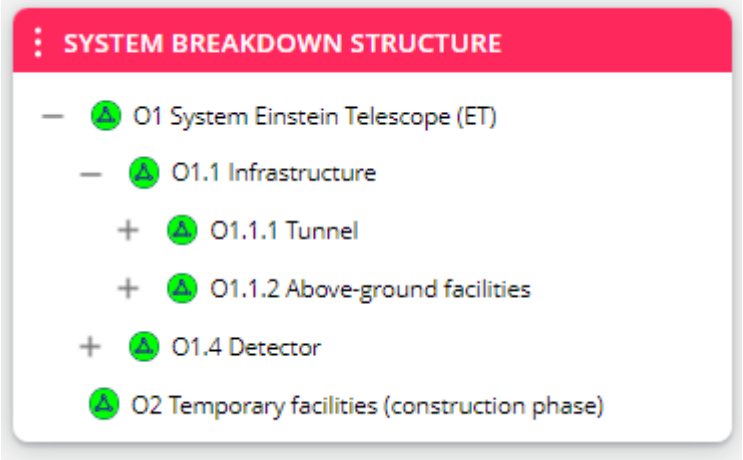
The Einstein Telescope will be an advanced observatory for gravitational waves. The border region of the Netherlands, Belgium and Germany is in the picture as a possible location. This is because of its tranquility, stable soil, and strong ecosystem of knowledge institutions and high-tech companies.
Researchers, companies and governments in the Netherlands, Belgium and Germany are jointly exploring the possibilities. The ultimate goal is to build the Einstein Telescope in the Meuse-Rhine Euroregion. For more info see https://www.einsteintelescope.nl/en/.

Project office ET

The Project Office ET, based in Maastricht, is carrying out a feasibility study, resulting in a contribution to the bid book, on the basis of which a final choice of location for the Einstein Telescope will be made. This phase includes activities within various disciplines (project management, contract management, technical management, environmental management, project control). The management of the project office is conducted jointly by the delegated principal on behalf of the Province of Limburg and the director of Nikhef.

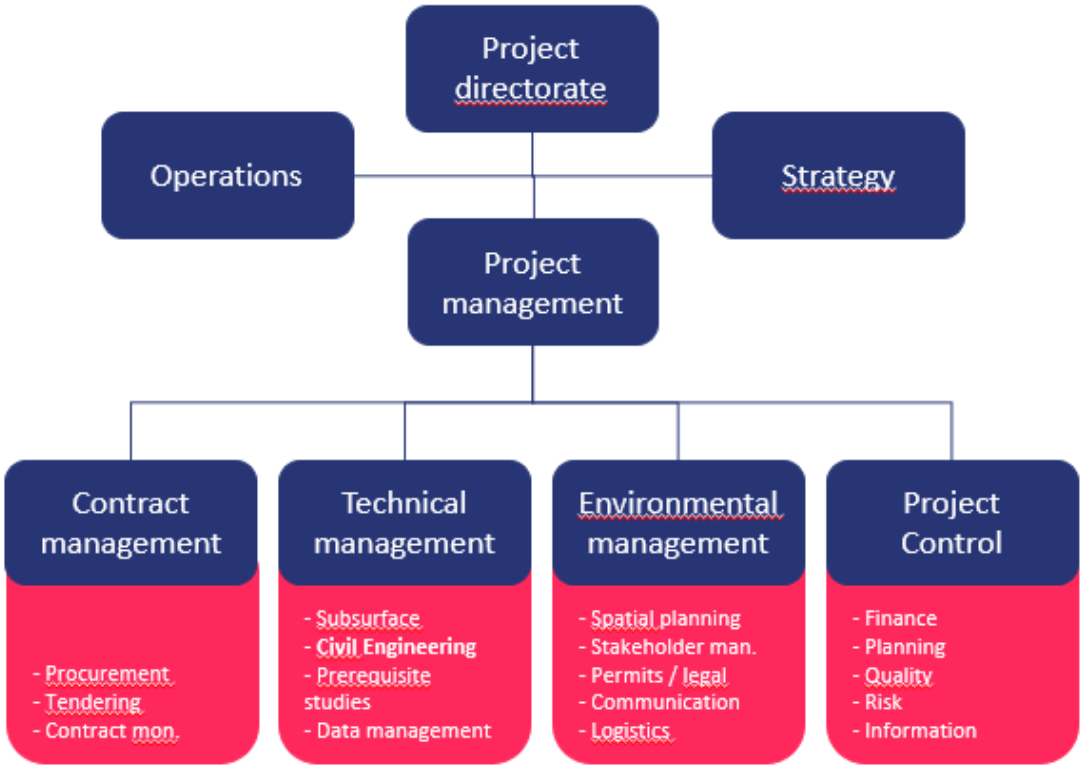
Scope

The system Einstein Telescope is shown schematically in the breakdown structure below. O1.4 Detector is not part of this tender.



To get an idea of the Einstein Telescope system, the 2020 design report is attached (ET-0007B-20_ETDesignReportUpdate2020, Annex 6).

H2. Project Office ET-EMR



The Projectmanager Civil Engineering (PMCE) will be part of the Technical team (led by the technical manager) and will be mainly responsible for (parts of) the following products of the product planning (H3):

- 1st assessment subsurface
- Location scenarios
- Structure design and cost estimation
- Logistics plan construction phase
- Risk register

The exact content and responsibility of said products will be mutually agreed upon during the feasibility phase. Section B1 provides an initial description of said products. The PMCE coordinates and oversees the project,

ensuring smooth collaboration among the team, adherence to timelines, and effective communication within the Project Office ET-EMR and with relevant stakeholders.

Besides the shared responsibility for the products mentioned and the coordination of the back office, the PMCE thinks along and plays an active role when drafting/specifying measurement activities and to what extent they are expected to contribute to the geomechanical understanding of a potential location for the Einstein Telescope.

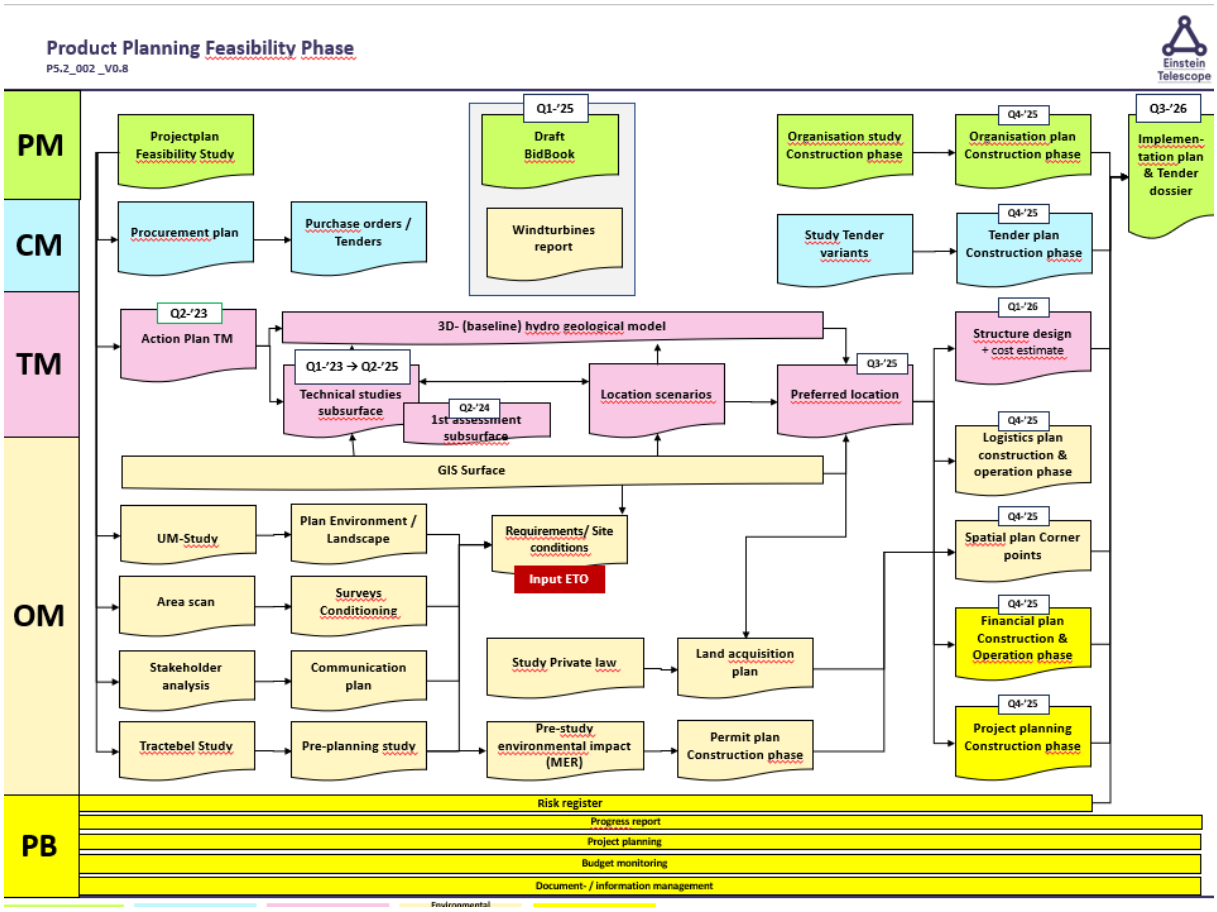
Geological and geophysical studies, to understand the geological formations, fault lines and other relevant geological aspects that impact the tunnel design are done by client and are input for the PMCE.

The back office available to the PMCE includes the following specialists:

- **Geotechnical engineer**: specialized in assessing geological conditions, soil properties, and rock formations to determine the feasibility of tunneling and the design of appropriate support systems.
- **Structural engineer**: responsible for designing the structural elements of the tunnel, including shafts, caverns, supports, liners, and reinforcement strategies to ensure stability and safety.
- **Tunneling and excavation specialist**: experts in tunneling methods (e.g., TBMs, conventional tunneling) and excavation techniques, providing insights into the most suitable methods for the geological conditions at the site.
- **Hydrogeologist**: analyze groundwater behavior, potential risks, and design effective dewatering and drainage systems to manage water within the tunnel.
- **Environmental engineer:** address environmental impact assessments, sustainability, and compliance with environmental regulations, ensuring minimal disruption to the ecosystem.
- **Safety and Risk management specialist**: focus on safety protocols, risk assessments, and emergency procedures to mitigate potential hazards during construction and operation.
- **Cost estimator**: calculate project costs, material quantities, and provide cost estimates to aid in budgeting and financial planning.
- **CAD Technician / BIM Modeler**: Utilize computer-aided design (CAD) and Building Information Modeling (BIM) software to create designs, models, and visualizations of the tunnel and associated structures.

H3. Product Planning Feasibility Phase

Below a representation of the Product Planning Feasibility Phase, showing the scope of the Project Office ET-EMR. In particular, the technical team works on the TM products (pink shapes).



H4. Assignment

The assignment consists of:

- Services (1.1)

1.1. Services

1.1.1. Project manager Civil Engineering (PMCE)

Services	Project manager Civil Engineering (+/- 1 FTE)	
Description	Fulfilling the role of projectmanager Civil Engineering (PMCE) in the technical team of the Project Office ET-EMR. The PMCE reports to the technical manager of the Project Office ET-EMR	
Planning	Start 13-1-2023, end 31-12-2025 with option to extend	
Requirements	1	The PMCE participates physically in the weekly technical meeting in Maastricht, Duboisdomein 30.
	2	The PMCE plays an active role in de technical team when drafting/specifying measurement activities and to what extent they are expected to contribute to the geomechanical understanding of a potential location for the Einstein Telescope.
	3	On average, the PMCE should be on site 2 days per week (Maastricht, Duboisdomein 30).
	4	The PMCE manages the back office.
	5	The project manager's CV should demonstrate competence and experience.

1.1.2. Backoffice

Services	Backoffice (+/- 2,5 FTE)	
Description	The backoffice acts as a support system for the PMCE and the technical team.	
Planning	Start 13-1-2023, end 31-12-2025, with option to extend	
Requirements	1	The back office should at a minimum oversee the following fields of knowledge: - Geotechnical engineering - Structural engineering - Tunneling - Hydrogeology - Environmental engineering - Safety and risk management - Cost estimation - CAD / BIM
	2	The backoffice should be available on demand.
	3	Deployment of the back office is possible only with the explicit approval of the technical manager of the Project office ET-EMR.
	4	CV of the members of the backoffice should demonstrate competence and experience.

B1. Initial product description

1st Assessment subsurface

Product	1st Assessment subsurface	
Description	Interim evaluation report of the results and analyses of the technical investigations in relation to the suitability of the subsurface in the search area for the realization of the Einstein Telescope.	
Requirements	1	Data available as of the end of Q1-2024 from the different surveys should be included in the assessment.
	2	The aspects of geophysics, geotechnical properties, geology and stratigraphy, geohydrology and available noise measurements should be included in the assessment.
Format to be delivered		Draft versions in MS Word, final version in MS Word and PDF

Location scenarios

Product	Location scenarios	
Description	Log of surveyed sites including a conclusion on the suitability of respective site based on a multi criteria analysis of above and below ground criteria / preconditions / requirements / construction cost / other constraints.	
Requirements	1	The Contractor should take its own initiative to identify the interfaces between topsoil and subsoil and obtain the necessary information.
	2	The Contractor must submit the format for the multi-criteria analysis to the client for approval.
	3	The following criteria should be considered as a possible part of the multi criteria analysis: - Geology and topography: Assess the geological conditions of potential shafts, caverns, tunnel routes, including rock type, soil stability, and water tables. Assess the effects on hydrological resources of constructing and operating Einstein Telescope (above and below ground) - Engineering feasibility: Evaluate the technical feasibility of constructing Einstein Telescope in each potential location, considering factors like tunnel length, alignment, depth, and potential construction methods. - Construction costs: Estimate the construction costs for each potential location, taking into account excavation expenses, support structures, ventilation, and safety / security measures. - Environmental Impact: Analyze the environmental impact of Einstein Telescope in each location, including effects on air and water quality, wildlife habitats, and nearby ecosystems. - Safety and Risk: Assess the safety and security risks associated with each location, considering potential hazards during construction and operational phases. - Urban Planning and Land Use: Examine how Einstein Telescope aligns with existing urban planning and land use policies, and if it enhances or disrupts development plans. - Resilience and Climate Adaptation: Consider Einstein Telescope's resilience to natural disasters, climate change, and its ability to withstand extreme weather events. - Emergency and Evacuation Plans: Assess the effectiveness of emergency response and evacuation plans in each location to ensure the safety. - Regulatory and Legal Constraints: Account for any legal requirements, permits, and approvals needed for construction and operation in each potential location. - Cultural and Heritage Preservation: Consider the impact of Einstein Telescope on cultural heritage sites or historical landmarks in the vicinity.

		- Public Acceptance and Perception: Gauge public opinion and acceptance of the Einstein telescope project in each location to identify potential social challenges. - Long-Term Sustainability: Examine the long-term sustainability of Einstein Telescope, including its lifespan, maintenance costs, and potential for future upgrades. Collaborating with experts in (hydro)geology, engineering, environmental science, urban planning, and other relevant fields is essential to conducting a robust multi-criteria analysis for Einstein Telescope locations.
	4	Based on the multi criteria analysis, the contractor should provide a reasoned opinion on which location scenario is preferred.
Format to be delivered		Draft versions in MS Word, final version in MS Word and PDF GIS files – ArcGis compatible

Structure Design

Product	Structure Design (suitable for an AACE Class 3 cost estimate)	
Description	Structure design of the above-ground and underground infrastructure for the Einstein Telescope Meuse-Rhine Euregio.	
Requirements	1	The structure design should be developed to serve as the basis for a Class 3 estimate in accordance with the Cost Estimate Classification system (AACE International, 18R-97, see Annex 5)
	2	The structure design should include: - Project Scope Definition: system breakdown structure with a brief description for each object. - Design note: A detailed description of the design, the assumptions and design choices made and the technical aspects of the project. - Drawings and Conceptual Designs. - Object requirements (per object). - Risks and mitigating measures.
Format to be delivered		Draft versions in MS Word, final version in MS Word and PDF Drawings in Autocad 2024 or compatible GIS files – ArcGis compatible

Cost Estimate

Product	Cost Estimate	
Description	Class 3 estimate in accordance with the Cost Estimate Classification system (AACE International, 18R-97, see Annex 5)	
Format to be delivered		Draft versions in MS Word and MS Excel, final version in MS Word. MS Excel and PDF

Logistics Plan Construction Phase

Product	Logistics Plan Construction Phase	
Description	Plan which describes the flow of materials, equipment, and personnel during the construction phase of Einstein Telescope.	
Requirements	1	The plan should include the following components:

		- site access and infrastructure (suitable access points to the construction site, considering transportation routes, road conditions, and potential impact on local communities. Necessary infrastructure, electricity and water supply, temporary storage facilities, to facilitate the movement of equipment and materials). - The layout of the construction site (including the necessary provisions). - Equipment / material (list of equipment and materials required for the construction phase, including their quantities, specifications, and delivery schedules). - Transportation network (an efficient transportation network to transport equipment and materials to and from the construction site). - Transport of tunnel components from ground level to the underground site level. - Personnel logistics (transportation to and from the construction site, accommodation arrangements, healthcare facilities). - Safety and Security (safety protocols to ensure the well-being of workers and the security of equipment and materials). - Environmental considerations (assessment of and mitigation measures for the potential environmental impact of the construction phase).
Format to be delivered		Draft versions in MS Word, final version in MS Word and PDF GIS – ArcGis compatible

Risk Register

Product	Risk Register	
Description	Overview of identified risks for the construction and operating phase	
Requirements	1	The risk register should describe: - cause - unwanted event - consequence Each risk should be quantified (probability * consequence), with the following consequence classes: time, money, quality, environment, image, safety.
	2	Each risk should be allocated to either a process or an object.
Format to be delivered		Format will be provided by Client.