National Centre for Polar and Ocean Research
Ministry of Earth Science
Headland Sada, Vasco-Da-Gama, Goa 403 804

GLOBAL DESIGN COMPETITION FOR REDEVELOPMENT AND CONSTRUCTION OF THE INDIAN RESEARCH STATION MAITRI IN ANTARCTICA

PROJECT MAITRI-II

(Ref No: NCPOR/09/2024 dated 25 July 2024)

The National Centre for Polar and Ocean Research (NCPOR) announces a Global Design Competition for redeveloping Maitri Station in Antarctica. Professional architects, architectural and engineering firms, or consortiums with experience in polar projects are invited.

The project includes conceptualizing energy-efficient building structures, life support utilities and a master plan for dispersed structures, with careful consideration of the Antarctic climate and ecology.

Important Dates

- Pre-registration Clarification Meeting: Monday, 19-Aug-2024
- Registration Deadline: Tuesday, 03-Sep-2024
- Submission Deadline: Tuesday, 05-Nov-2024

For detailed competition guidelines and submission procedures, visit NCPOR Website https://ncpor.res.in/tenders/details/13

Signed-
For and on behalf of Director, NCPOR

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National Centre for Polar and Ocean Research
Ministry of Earth Science, Government of India

Global Design Competition for Redevelopment and Construction of the Indian Research Station Maitri in Antarctica

Project Maitri-II

(Ref No: NCPOR/09/2024)
Thursday, 25 July 2024

Headland, Sada
Vasco Da Gama, Goa 403804
https://ncpor.res.in/

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Global Design Competition for Redevelopment and Construction of the Indian Research Station Maitri in Antarctica: Project Maitri-II

1. INTRODUCTION

The National Centre for Polar and Ocean Research, under the Ministry of Earth Sciences, India, is extending an invitation to Professional Architects, Architectural Firms or Engineering Firms with in-house architects to participate in this design competition. The aim is to design an Antarctic Research Station, intended as a replacement for the current Research Station Maitri situated in the Schirmacher Hills of central Dronning Maud Land, East Antarctica.

2. BACKGROUND

The National Centre for Polar and Ocean Research (NCPOR), situated on the picturesque west coast of India, in the state of Goa, is the nodal agency overseeing India's scientific studies, Operations and Infrastructure in the Polar Regions.

"Maitri", Indian Research Station in Antarctica, commissioned in 1988, symbolizes India's steadfast dedication to scientific exploration of Antarctica. Located amidst the Schirmacher Hills in central Dronning Maud Land (also known as Queen Maud Land), this research cum operational hub rests upon an ice-free rocky terrain, standing approximately 117 meters above sea level at coordinates 70°46'00''S; 11°43'51''E in East Antarctica. Maitri has exceeded its operational life of 25 years, displaying signs of wear and tear under the harsh Antarctic conditions. The station encounters distinct challenges due to its inland location, situated about 100 kilometres from the sea, with an intervening ice shelf.

The current infrastructure, exhibiting signs of aging and deterioration, poses risks to personnel safety and impedes valuable research endeavours. Outmoded operational systems, including fuel handling, energy generation and waste management, necessitate modernization in accordance with contemporary environmental standards. Furthermore, the newly enacted Indian Antarctic Act 2022 (https://ncpor.res.in/news/view/701) requires stringent measures for safeguarding the pristine Antarctic environment and its dependent and associated ecosystems. In response to these challenges, India proposes the construction of new structures and redevelopment of the area to adhere to current standards and stringent environmental protocols for the protection of Antarctica.
(https://www.ats.aq/e/protocol.html).

2.1. Geographic Location

Situated within the Schirmacher Hills, the designated area for Project Maitri-II spans approximately from 70° 45' 36.48" S, 11° 44' 8.23" E to 70° 45' 54.43" S, 11° 41' 59.37" E. Positioned around Priyadarshini Lake (Zub Lake), the site covers approximately 2.5 square kilometres, with elevations ranging from 20 to 165 meters above sea level.

2.2. Climate

The Schirmacher Hills undergoes distinct seasonal changes. Winters are long and harsh, characterized by continuous darkness, while summers are brief, featuring 24-hour daylight. Despite its scenic beauty, the region faces extreme cold, permafrost, and challenging environmental conditions, typical of Antarctica.

With an average annual wind speed of 31.5 km/h and maximum speeds reaching 200 km/h, strong winds prevail from the South-East direction. The temperatures remain consistently low, with an average of -9.7 °C annually. February experiences milder temperatures at -3 °C, while July sees the coldest conditions at -44 °C, highlighting the enduring extreme cold.

Precipitation is minimal, primarily in the form of snow, but water bodies in the Schirmacher Hills are sustained by ephemeral meltwater streams originating from the melting polar ice sheet to the south. The intense cold during winters leads to the freezing of these water bodies, including Priyadarshini Lake (Zub Lake).

2.3. Terrain

Schirmacher Hills at large and the areas under consideration are ice-free permafrost and rocky terrain marked by ancient metamorphic rocks like gneiss and schist, along with granitoids, creating a stark contrast to the ice-covered expanses that surround it. The landscape reveals the traces of glacial activity, showcasing moraines, glacial valleys, and landforms sculpted by historical glacial movements. Glacial moraines manifest as visible ridges and mounds across the terrain.

The soils are generally thin and poorly developed, primarily composed of detrital material resulting from rock weathering. This mix encompasses mineral material, weathered rock fragments, and organic matter. The presence of permafrost significantly influences soil characteristics, limiting soil development due to the prevailing cold climate.

Vegetation in Schirmacher Hills is scarce, devoid of higher plants. Mosses and algal mats thrive in perennial lakes and the moist periphery of lakes and streams, while scanty lichen growth adorns rock faces. These resilient organisms are well-adapted to the extreme conditions, capable of flourishing in areas with limited soil. The challenging environment underscores the Hills's unique ecological dynamics, where life perseveres in the face of harsh Antarctic conditions.

3. PROJECT DESCRIPTION

Designers are encouraged to create a cost-effective, environment friendly, and functional master plan. The plan should carefully place structures (Annexure-I) along the East-West route, from the polar ice edge to the present Maitri Station, including the layout of interconnecting roads, pipelines, and cableways. Utilizing the undulating terrain to its advantage, the design should prioritize minimal environmental impact and harmonious integration with the surrounding landscape.

The envisioned Maitri-II is an energy-efficient research base proposed as a series of dispersed structures situated on the northern and western sides of Priyadarshini (Zub) Lake in the Schirmacher Hills, spanning an area of approximately 2.5 square kilometres. Strategically positioned across the undulating hilly landscape, these distinct and independent structures will be interconnected through a network of roads, pipelines, and cableways.

The main building will include essential components such as living quarters, offices, laboratories and associated facilities, meticulously designed to ensure functionality and operational harmony. Additionally, the station will feature other amenities such as fuel storage, energy generation facilities, a vehicle workshop-garage, ample warehousing space, a helipad and a hangar, facilitating smooth operations within the challenging Antarctic environment. Detailed information about the structures and amenities will be provided in the Pre-Registration Clarification Meeting.

A crucial design facet should be adaptability to extreme seasonal variations with a designed life span of 40 years. The infrastructure should be divided into a summer section for up to 100 individuals and a winter section for up to 40 individuals, totalling 140. This design must align with the goal of resource optimization and energy conservation during harsh winter conditions. To enhance energy efficiency further, a deliberate operational approach will temporarily close down the summer section during winter, focusing resources solely on essential winter operations.

In summary, the planned Maitri-II research station envisions a thoughtfully designed, energy-efficient complex that encapsulates all vital aspects of modern scientific research, operations, and habitation. By capitalizing on unique topographical attributes and considering challenging environmental conditions, this infrastructure is poised to become a pivotal hub for advancing scientific knowledge in one of the world's most captivating landscapes.

4. ELIGIBILITY CRITERIA

4.1. Who can Apply

The competition is open to national and international professional architects, architectural firms with in-house engineering capabilities, engineering firms with in-house architects, or consortium of architectural and engineering firms. **For ease of reference, all of these combinations shall be referred to as 'Competing Entities '**

In the case of consortiums, participating Entities (not exceeding three) must be legally registered under the relevant companies' legislation in their respective countries. Additionally, they should have a legally registered document preceding the submission date, declaring the **Lead Partner**. This document must be enclosed with the submission***. It may be noted that the number of members in the consortium should not exceed three. Further, a member of one consortium cannot be a member in another competing consortium. In addition, only one design submission is permitted per Entity.***

The participating Entities should have demonstrated experience from project design to commissioning of temperature-insulated large structures that adhere to stringent environmental standards of Polar Regions and exhibit a high tolerance for extreme weather conditions. These structures must have been commissioned in Polar Regions (at latitudes greater than 66.6 degrees north and 66.6 degrees south), specifically in Arctic and/or Antarctic regions. Eligible structures encompass but not limited to Research Stations, Laboratories, Hotels, Hospitals, Airports and Industrial Buildings, all equipped with modern building management systems integrating power generation, heat and ventilation, as well as potable and waste water treatment facilities.

4.2. Exclusions

To avoid conflict of interest, any employee of National Centre for Polar and Ocean Research, the assessors engaged for the competition and any of their associates, partners or their employees, are prohibited from competing and/or assisting any Entity competing in the project.

4.3. Proof of Qualification

Participating Entities are required to submit proof of qualification and relevant experience, in Antarctica and/or the Arctic region, supported by copies of work orders and completion certificates for the design and supervision of buildings or structures in the polar regions.

5. COMPETITION TYPE

The competition is a fusion of "Projects" cum "Ideas." The primary objective of the project competition is to identify the optimal solution for an actual building project and the development of surrounding infrastructure in Antarctica. The winner of the competition will be awarded the contract to design and execute the project as detailed under section 7.7 Role and Responsibility of Winning Entity

5.1. Purpose of the competition and intention of NCPOR

The competition aims to identify the optimal approach for developing and constructing Maitri-II as a year-round scientific research base. This involves designing and integrating new structures with interconnecting roads, water/fuel pipelines and cableways. The proposed structures are to be strategically distributed across an area adjacent to the existing facility, characterized by undulating rolling topography, to prioritize minimal environmental impact and harmonious integration with the surrounding landscape.

Maitri-II is intended to replace the existing Indian station, Maitri, which has exceeded its operational lifespan. The current Maitri station will remain untouched for the time being.

5.2. Nature of the problem to be solved

In addition to the aging infrastructure of the existing Maitri station, which necessitates replacement with environment friendly, energy-efficient and weatherproof structures, the most significant challenge lies in the disposal of wastewater after treatment. Currently, the

main building of the present Maitri station is situated on the southern part of the catchment of Priyadarshini (Zub) Lake, the source of freshwater supply. This location requires continuous efforts to minimize wastewater seepage into the lake due to natural slopes.

To address this issue on a long-term basis, it is essential to find a cost-effective and workable solution. This could involve relocating the main building and associated structures, utilizing freshwater from the southern lake and facilitating the discharge of treated water onto the shelf ice in the North. Alternatively, implementing new technologies for wastewater management may be proposed.

5.3. Project Requirements

5.3.1. Environmental Sustainability

The design should prioritize environmental sustainability, focusing on energy efficiency, waste management, and minimizing ecological impact, in highly fragile and extreme Antarctic environment.

5.3.2. Weather Resilience

The designed structures should be capable of withstanding extreme Antarctic weather conditions, including high wind, snowfall, and low temperature as detailed in Section 2.2 Climate.

5.3.3. Functional Design

The design should optimize space utilization and workflow efficiency for scientific research activities through functional design solutions. It is imperative to consider that all structures except fuel farm and vehicle garage are to be temperature controlled, with a provision for minimizing the energy consumption by partially shutting down unused facilities/ areas during the winter months as a measure of energy/fuel saving.

5.3.4. Safety and Security

The design should incorporate state-of-the-art safety measures and security protocols to protect all structures, personnel, research equipment and data.

5.3.5. Accessibility and Mobility

The design should address functional accessibility and mobility needs within the research base, including provisions for individuals with disabilities and efficient internal transportation.

5.3.6. Integration of Appropriate Technology

The design should utilize effective and workable technology for energy generation, communication systems, data management, and research equipment integration.

5.3.7. Compliance with Regulations

The design should ensure compliance with relevant national and international regulations, standards, and codes of practice governing construction, environmental protection, and research activities in Antarctica. *[Indian Antarctic Act 2022*

(https://ncpor.res.in/news/view/701) and Environmental protocols for the protection of Antarctica (https://www.ats.aq/e/protocol.html)].

5.3.8. Adaptability and Flexibility

The design should ensure adaptability to changing research requirements and potential future expansions or modifications of the facility.

5.3.9. Aesthetics and Cultural Sensitivity

The design should consider aesthetic integration with natural surroundings and cultural sensitivity to respect the heritage and traditions of Antarctica.

5.3.10. Budget Estimates

Competing Entities should provide realistic cost estimate for the total project but not limited to construction materials, technology and specialized labour. The cost of transportation from mainland to Antarctica will be managed by NCPOR and should be excluded from the estimate.

5.4. Document, Plan & Model Requirements

The Entities should submit a conceptual design that is both practical and capable of being developed into a fully operational plan with further detailing. It is crucial to carefully consider the size and placement of structures in relation to the terrain. Living rooms, laboratories, halls, offices, garages, and generators should be realistically sized and compatible with the suggested technology. Each structure must be described clearly, including the materials and technology proposed, along with their advantages and disadvantages. This ensures that the assessors can fully understand and evaluate the concept in relation to the chosen materials and technology. Detailed explanation of the concept and technology should be provided for roadways, pipelines, and cable layouts. All entries should be accompanied by design statement, plans and physical models, ensuring suitability and comprehensiveness.

5.4.1. Scale and Dimensions

The scheme will be judged at two scales (i) the master plan and (ii) individual buildings. Depending on the dispersal of buildings on the site, a site/context model of 1:1000 scale is recommended. For the individual buildings, recommended scale for the architectural drawings and models is 1:100 or 1:200.

5.4.2. Architectural Drawings/ Renderings

Total number of architectural drawings and renderings should not exceed 20, and should include floor plans, elevations, sections, and site plans. These drawings should comprehensively depict the main building, living quarters, office spaces, laboratories, dining and recreation areas. The design must accommodate a population as described in Section 2 PROJECT DESCRIPTION.

5.4.3. Engineering Plans

In addition, the design should also consist of 5 engineering plans, detailing the generator block, fuel farm, water intake/pump house, warehouse, workshop cum garage, helipads and

helicopter hanger. These plans should encompass layouts, schematics, and equipment specifications.

5.4.4. 3D Model

The design submission should include a 3D digital model and walk-through of the entire project, offering a visual representation of the proposed design, spatial arrangements and contextual integration.

Participants must ensure that the submitted documents, plans, and models are comprehensive, accurate, and aligned with the project requirements.

5.4.5. Consultancy Fee Proposal

The design submission must include a duly filled format (to be supplied post registration) detailing the proposed consultancy fee for execution of the consultancy project excluding travel expenses. The consultancy fee as a percentage of cost of the project shall be submitted in a separate sealed envelope. Taxes as applicable shall be paid extra to the Entity.

6. PARTICIPATION PROCEDURE

The Design Competition is given wide circulation through leading Indian newspapers, Indian missions abroad, member states of COMNAP (Council of Managers of National Antarctic Programs) and the NCPOR website.

6.1. Participation Timelines

These timelines provide a structured framework for the various stages of the design competition, ensuring transparency and efficiency in the evaluation process.

Competition Stage(s)	**Deadline / Date***
Announcement of Competition	Thu, 25-Jul-2024
Pre-registration Clarification Meeting	Mon, 19-Aug-2024
Registration Deadline	Tue, 03-Sep-2024
Submission Deadline	Tue, 05-Nov-2024
Shortlist Announcement	Mon, 25-Nov-2024
In person Presentation	Tue, 10-Dec-2024
Winner Notification	Mon, 30-Dec-2024

**** Please keep an eye on the NCPOR website for any possible date changes or related announcements.***

6.1.1. Announcement of Competition

For record purposes, the date of announcement is considered the date on which the Design Competition is hosted on the NCPOR website **https://ncpor.res.in/tenders/details/13** However, the announcement of this Design Competition through leading Indian newspapers, Indian missions abroad, and member states of COMNAP (Council of Managers of National Antarctic Programs) may be on different dates.

6.1.2. Pre-registration Clarification Meeting

Entities interested in participating and eager to learn about the project, climatic conditions of Antarctica, logistics involved, etc., are encouraged to attend a Pre-Registration Clarification Meeting for doubt clarifications. This session will be exclusively announced on the NCPOR website at https://ncpor.res.in/. It will be a closed hybrid event, allowing only authorized representatives to participate. For those wishing to attend remotely, a meeting link will be provided to authorised representatives, upon request via email to **maitri2@ncpor.res.in** **Queries via email will be entertained up to two days prior to the date of the pre-registration meeting. Queries raised during the meeting or via email, along with the clarifications provided by NCPOR, will be uploaded on the NCPOR website.**

6.1.3. Registration Deadline

Interested Entities must register within 15 days of the Pre-Registration Clarification Meeting. **Please refer to the NCPOR website for any change in the date. Participation in the Design Competition is limited to Entities duly registered.** Registered Entities will be provided with the formats for the submission of design competition entries, along with additional documents, data and maps as requested.

Entities fulfilling the eligibility criteria and interested in participating in the competition must formally register. For Indian citizens or companies registered in India, a non-refundable registration fee of **Rs 40,000/-** will be payable to NCPOR. For foreign Entities the non-refundable registration fee is **US$ 500**, excluding bank transaction charges. **Should the registration fee be remitted through online bank transfer, the transaction details must be conveyed over email to maitri2@ncpor.res.in**

Payment can be made via Bank Draft drawn in favour of the Director, NCPOR, payable at Vasco Da Gama, Goa, or through bank transfer using the provided bank account details:

Name of the Beneficiary:	**National Centre for Polar and Ocean Research**
Name & Address:	**State Bank of India** Commercial Branch Shree Vidyadiraj Bhavan, Francisco Luis Gomes Road, Vasco-Da-Gama Goa – 403 802, India
Bank Account Number:	**10153336180**
Bank Branch Code:	04116
IFS Code:	**SBIN0004116**
MICR No:	403002047
SWIFT CODE:	**SBININBB229**
PAN No:	AACFN4991P
TAN No:	BLRN01981A

6.1.4. Submission Procedure

Project proposal must include the design concept, master plan, models, props and cost estimates for the entire project with a structure-wise breakup, along with the Consultancy Fee and all relevant documents. All documents must be submitted to NCPOR on or before the scheduled deadline. Please refer to the NCPOR website for any changes in the deadline.

The project proposal can be submitted in person by the registered participant or their authorized representative at NCPOR, or through post/courier, between **10:00 to 17:00 hrs on weekdays.** Please address the submission to **the Group Director, Antarctic Operations Group, National Centre for Polar and Ocean Research, Headland, Sada, Vasco-Da-Gama, Goa 403 804 India,** on or before the due date and time.

NCPOR shall not be responsible for postal delays. Proposals received after the due date and time shall not be considered.

6.1.5. Shortlist Announcement

Projects submitted by the registered Entities will be evaluated by NCPOR, focused on the design concept and the Entity's experience in polar engineering in a techno-commercial evaluation and the consultancy fees for the execution of the project. Entities shortlisted for in-person presentation shall be notified and invited for an in-person presentation.

6.1.6. In-person Presentation

The shortlisted Entities will be required to deliver a comprehensive in-person presentation to the NCPOR, encompassing various aspects of their conceptual design. This includes detailing the merits of their design, explaining the master plan and its rationale, revealing the proposed technology and its robustness and discussing the cost-effectiveness of their approach. Additionally, they will need to provide detailed explanations and justifications for the construction materials proposed for different structures. Any update or change in schedule will be communicated through the NCPOR website or emails to the registered Entities.

6.1.7. Winner Notification

After thorough evaluation of the techno commercial proposal, the winners will be notified by NCPOR.

7. COMPETITION TERMS AND CONDITIONS

7.1. Language

The competition will be conducted in English only. All designs, accompanying documents, models, and props must have captions and explanations written in English.

7.2. Design Selection

Designs will be evaluated based on the following parameters:

- Experience in Designing Polar Structures: Including the number and size of projects, financial turnover, and the covered area of the project.
- Environmental Considerations: Adherence to environmental protocols, usage of green technology and capitalizing on unique topographical attributes.
- Master Plan: Layout of structures and interconnecting roads, pipelines and cable ways.
- Architecture and Aesthetics
- Functionality and Safety Considerations

- Documentation and Presentation
- Estimated Cost of the Project: Reasonableness of the cost estimate and proposed consultancy fees.

NCPOR reserves the right to select or reject any submitted proposal. The decision of NCPOR will be final and binding, with no provision for arbitration or legal recourse.

7.3. Declarations

Each proposal should be accompanied by a declaration in the prescribed format signed by the competing Entity that the design is his bonafide work and that the drawings have been prepared under their supervision and that they undertake to accept the award by NCPOR as final.

Every Competing Entity should give a Non-Disclosure Declaration, in a format to be provided to the registered Entities, that the information provided by NCPOR will be used only for the purpose of this competition and shall not be shared with others.

7.4. Nature of prizes

- First Prize: The Entity awarded the first prize will secure the contract to execute the project through a contractual agreement subject to conditions under Section 7.5 and Section 7.6.
- Second Prize: - Rs. 25 Lakh / USD 30,000
- Third Prize: - Rs. 17 Lakh/ USD 20,000

Indian Entities will receive payments in Indian Rupees via bank draft or bank transfer. Foreign Entities will receive payments in US$ through bank transfer.

7.5. Compensation for Project Interruption

In the event of unforeseen circumstances resulting in the project being cancelled/ shelved, the winner will receive an amount of Rs. 42 Lakh. / USD 50,000 and shall have no right for any other compensation.

7.6. Winner's Contractual Decline

If the winning Entity declines to enter into the contractual agreement, no compensation shall be paid. In this case, NCPOR reserves the right to offer the project to the second or third-place winners, as considered appropriate.

7.7. Role and Responsibility of Winning Entity

The Entity selected will enter into a contractual agreement with NCPOR, assuming pivotal responsibilities at every stage to ensure successful project realization. Thereafter, the Entity shall be referred to as the ‘Consultant’ and their role begins with conceptualization, aligning with environmental protocols and collaborating closely with the team to develop a sustainable and harmoniously integrated design. Subsequently, they shall refine the conceptual design into detailed architectural and engineering plans, crafting plans in stages to facilitate continuous review and refinement.

Additionally, the Consultant will prepare the Detailed Project Report (DPR) and Tender Documents for construction activities in consultation with NCPOR, ensuring clarity and comprehensiveness in project requirements. They will assist in evaluating tenders, approving working drawings, and verifying the Bill of Quantities (BOQ) outlining materials, quantities, and costs for the construction phases. They will also fulfil any other NCPOR requirements related to verifications and day to day supervision to ensure smooth progress of construction activities. This collaborative effort ensures a transparent and competitive bidding process for construction companies.

During the construction phase, the Consultant will oversee fabrication and construction activities, ensuring adherence to design, quality, and safety standards. They shall verify bills and invoices, assure financial transparency and prevent deviations from approved plans. Post-construction, they shall verify testing and commissioning protocols to ensure functionality and compliance, confirming the readiness of the station for scientific activities.

Upon successful completion of the Project, the Consultant shall provide the final certification of accomplishment, certifying structural stability, environmental compliance, architectural excellence, and meticulous execution. In summary, the Entity's comprehensive role ensures that Project Maitri-II meets the highest standards and thrives in the challenging Antarctic environment. The time period of this consultancy will be co-terminus with the completion of the Project plus two years of defect liability period.

7.8. Copyright & Right of Ownership

The design awarded the first prize only and no other design shall be used by NCPOR. Subject to fulfilment of section 7.6 Winner's Contractual Decline.

7.8.1. Design Usage

The competition design selected for execution shall be used by NCPOR and the Consultant exclusively for Project Maitri-II and no other Project.

7.8.2. Academic Rights

The Entity of the selected design and NCPOR shall have complete liberty to use the executed design and shall enjoy unrestricted rights for academic and promotional purposes within the legal framework in any form or format that serves their interests.

7.9. Project Insurance

If deemed necessary the participant(s) may choose to insure their project work (including drawings, plans, models, etc.) against loss and damage during transit. Each Entity is required to submit their project entries before the deadline and collect them after the conclusion of the competition at their own cost and expense.

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Maitri-II: Buildings and Associated infrastructure

The contents of Annexure -1 are only indicative in nature. An attempt is made here to give the minimal requirements and expectations of NCPOR. The contents of Annexure -1 are not intended to restrict the imagination and freedom of the Competing Entities. Hence, Annexure-I has to be taken only as a general guideline.

The parameters provided here give the Competing Entities an overview of the expected scale and amenities for constructing various buildings within the research base. However, we urge the Competing Entities unleash their creativity and innovation in their designs. The goal is to create cost-effective, environment friendly, feasible, and sustainable structures, ideally not exceeding three floors in height. Utilizing proven and reliable technologies is paramount, while also considering the logistics of material transportation from mainland to Antarctica via ship and within Antarctica using snow crawler trucks over a distance of approximately 125 km to the construction site. Let your imagination flourish as you strive to develop designs that not only meet but exceed expectations. Furthermore, the distribution of buildings and layout plan for the entire station area should be meticulously crafted, taking into account the general topography, as well as factors such as sun and wind direction. These considerations will contribute to the overall functionality, safety, and sustainability of the research base design.

1. Main Building

1.1. Building Size and Layout: Participants must determine the total floor area based on the proposed capacity and functional requirements of living quarters, office spaces, laboratories, medical room (including area for minor surgeries), kitchen, dining, bathrooms, toilets, laundry, sauna, meeting room, communication room, stores, main electrical control room, Integrated Building Management System (IBMS) control room, recreation area, etc.

1.2. Design the layout of the main building to accommodate the specified capacity during both austral summers and winters, ensuring optimal space utilization and functionality.

1.3. Proposed Capacity: 140 individuals during austral summers, 40 individuals during austral winter season.

1.4. Living Quarters: Provide adequate residential space for the specified number of individuals, including sleeping areas, common spaces, and personal storage.

1.5. Office Spaces: Allocate areas for administrative offices, research facilities, and workstations to support scientific activities and collaboration.

1.6. Laboratories: Design laboratories such as Atmospheric, Space Physics, Biological and Earth Sciences equipped for various research tasks, ensuring safety and efficiency in experimentation.

1.7. Dining Area: Plan a dining facility capable of serving meals to the entire population, with provisions for food preparation, storage, and seating arrangements.

1.8. Recreation Areas: Include spaces for relaxation and leisure activities, such as lounges, libraries, fitness rooms, and outdoor areas.

1.9. Ventilation and Climate Control: Participants must design efficient ventilation systems to maintain indoor air quality and circulation throughout the main building.

1.10. Implement temperature control systems to regulate indoor temperatures and ensure occupant comfort during extreme weather conditions.
1.11. Utilities and Infrastructure: Provide adequate water supply, sanitation facilities, and wastewater treatment systems to meet the needs of occupants.
1.12. Ensure reliable power supply with proper outdoor cabling from Generator Block.
1.13. Establish communication infrastructure for internal and external connectivity, including internet access, telecommunication, and satellite communication.
1.14. Safety and Security: Install fire detection and suppression systems, emergency evacuation routes, and signage to enhance fire safety measures. Implement access control measures, surveillance systems, and security protocols to protect occupants and property.
1.15. Accessibility and Mobility: Incorporate features for accessibility, including ramps, elevators, and designated spaces for individuals with disabilities. Provide convenient access to transportation facilities and storage areas for vehicles, equipment, and supplies.
1.16. Environmental Sustainability: Integrate energy-efficient design principles and renewable energy sources to minimize environmental impact and reduce operational costs. Implement waste management strategies, including waste segregation and recycling programs, to promote sustainability. Use environmentally friendly construction materials and practices to reduce resource consumption and design buildings with the capability to shut down a few sections during winter to save energy and minimize the environmental footprint.

By adhering to these specifications, participants can develop innovative designs for the main building of the research base that prioritize functionality, comfort, and sustainability for its occupants throughout the year.

2. Generator Block

It should be designed to meet the power generation needs of the research base efficiently and reliably, with a focus on safety, accessibility, and environmental sustainability. The floor area and layout will be determined based on the following parameters:

2.1. Generator Capacity: A total of 6 generators/Combined Heat and Power (CHP) units with capacities ranging from 100 to 125 kVA each, resulting in a combined capacity of 600 to 750 kVA.
2.2. Floor Area: The Generator Block should have adequate floor space to accommodate six generators/CHP units, along with additional space for day storage fuel tanks, control panels, and maintenance areas.
2.3. Layout: The layout of the Generator Block should optimize space utilization and ensure efficient operation and maintenance of the equipment. Considerations should include sufficient space for generator placement, maintenance access, and safety measures.
2.4. Fuel Storage and Distribution: Install a day storage tank with sufficient capacity to meet the daily fuel consumption requirements of all generators/CHP units. Implement a fuel distribution system to supply fuel from the main Fuel Farm/Storage tank to each generator/CHP unit efficiently and safely.

2.5. Ventilation and Exhaust Systems: Design an effective ventilation system to provide proper airflow and cooling for the generators/CHP units, ensuring optimal performance and safety.
2.6. Exhaust Systems: Install exhaust systems to safely remove exhaust gases generated by the generators/CHP units, preventing buildup and ensuring compliance with safety regulations.
2.7. Control Panels: Equip each generator/CHP unit with a dedicated control panel for monitoring and controlling its operation, including start-up, shutdown, and load management.
2.8. Monitoring Systems: Implement monitoring systems to track fuel levels, generator performance, and other critical parameters, facilitating proactive maintenance and troubleshooting.
2.9. Maintenance Areas: Allocate dedicated areas within the Generator Block for routine maintenance and repair tasks, equipped with tools, equipment, and spare parts.
2.10. Access: Ensure easy access to all generators/CHP units and equipment for maintenance personnel, facilitating efficient servicing and repairs.
2.11. Fire Suppression Systems: Install fire suppression systems to mitigate the risk of fire accidents and protect personnel and equipment.
2.12. Emergency Shutdown Procedures: Develop and implement emergency shutdown procedures to safely shut down generators/CHP units in case of emergencies.
2.13. Noise Reduction: Implement noise reduction measures to minimize the impact of generator/CHP unit operation on the surrounding environment and personnel.
2.14. Environmental Compliance: Ensure compliance with environmental regulations regarding emissions, fuel storage, and waste management.

3. **Multi-Compartment Warehouse**

The multi-compartment warehouse, totalling approximately 25,000 cubic meters, is designed with separate compartments tailored to specific storage needs, ensuring efficient organization and accessibility. Here is a breakdown of the compartments:

3.1. Vehicle Parts and Spares Compartment: Dedicated space for storing spare parts and components for vehicles, including snowmobiles, trucks, and other equipment used in Antarctic operations.
3.2. Generator Parts and Spares Compartment: Segregated area for storing spare parts and components for power generators, ensuring quick access during maintenance and repair tasks.
3.3. Plumbing and Carpentry Supplies Compartment: Designated storage area for plumbing materials, carpentry tools, and supplies required for maintenance and repair of infrastructure and facilities.
3.4. Sanitary Supplies Compartment: Storage space for sanitation-related items such as toiletries, cleaning supplies, and personal hygiene products.
3.5. Food Storage Compartment: Refrigerated containers or cold storage units for storing perishable food items, ensuring proper preservation in the harsh Antarctic climate.

3.6. Polar Gear Compartment: Dedicated section for storing polar gear, including clothing, footwear, and other protective equipment required for personnel working in extreme cold conditions.
3.7. Transit Storage Compartment: Temporary storage area for personal belongings of personnel arriving or departing from the research base, facilitating smooth transition and logistics management.
3.8. Scientific Equipment Compartment: Secure storage space for scientific instruments, research equipment, and laboratory supplies, ensuring proper organization and protection from environmental factors.
3.9. Chemical Storage Compartment: Segregated area for storing chemicals and hazardous materials used in scientific experiments and research activities, with proper ventilation and safety protocols in place.
3.10. Electrical and Electronic Parts and Accessories Compartment: Dedicated space for storing electrical and electronic components, cables, and accessories required for infrastructure maintenance and equipment repair.
3.11. Communication and Satellite Navigation Compartment: Storage area for communication devices, satellite navigation equipment, antennas, and related accessories, ensuring reliable communication and navigation capabilities.
3.12. Medical Supplies Compartment: Specialized storage space for medical supplies, first aid kits, medications, and emergency medical equipment, facilitating prompt medical assistance and healthcare provision in remote Antarctic conditions.
3.13. Miscellaneous Items Compartment: Flexible storage space for any additional items or supplies deemed necessary for the research base, ensuring adaptability to changing needs and requirements.

These specifications aim to provide a comprehensive storage solution for the diverse needs of the research base, promoting efficiency, organization, and safety in storage and logistics management.

4. **Fuel Farm**

The fuel farm, envisioned to accommodate JET A1 fuel with a storage capacity of approximately 600,000 liters, integrates cutting-edge automation technology to optimize fuel management. Here are the specifications tailored for participant consideration:

4.1. Capacity and Configuration Options: Could be modular arrays of double-hulled tank containers, each holding 24,000 litters or larger tanks, enabling flexibility based on design preferences and justification.
4.2. Advanced Automation and Pumping System: Embrace full automation to facilitate seamless fuel intake from tank containers and its distribution through secure fuel lines to designated areas. Ensure sophisticated pumping systems for efficient and controlled fuel transfer to the power house/generator block, helipad, and vehicle workshop.
4.3. Safety Measures: Employ double-hulled tank containers or equivalent measures to enhance environmental safety, mitigating risks of fuel spills or leaks. Implement robust

safety protocols and monitoring systems to promptly detect and address any irregularities in fuel storage or distribution.

4.4. Integration with Power House/Generator Block: Optimize integration with the power house/generator block for continuous fuel supply to sustain operations and power generation, leveraging automated systems for timely replenishment as per consumption levels.

4.5. Helipad and Vehicle Workshop Fuelling Facilities: Establish dedicated fuelling stations at the helipad and vehicle workshop to facilitate efficient refuelling of helicopters and vehicles, prioritizing safety and operational effectiveness.

4.6. Environmental Considerations: Justify the selected fuel storage configuration (modular tank containers or larger tanks) based on environmental concerns, cost-efficiency, transportation logistics, and other pertinent factors. Integrate environmentally friendly practices to minimize the ecological footprint of fuel storage and handling, prioritizing the preservation of the surrounding ecosystem and wildlife.

By considering these specifications, participants can devise innovative and sustainable designs for the fuel farm, ensuring reliable fuel supply for the research base while minimizing environmental impact and effectively managing logistical complexities.

5. Workshop cum Garage

The workshop cum garage is a vital component of the research base, designed to cater to the maintenance and repair needs of essential vehicles, including Pisten bully vehicles, in Antarctica's challenging environment. Here's an overview of its specifications:

5.1. Functionality and Design: The workshop needs to be strategically designed, temperature-controlled and securely insulated against harsh winds, ensuring optimal working conditions for maintenance tasks.

It features a spacious interior capable of accommodating at least two Pisten bully vehicles simultaneously for repairs, with provisions for a dedicated repair ramp to facilitate undercarriage work.

5.2. Height and Layout: With a minimum of two storeys in height, the workshop provides ample vertical space to operate gantry cranes or winches comfortably, enabling efficient movement of personnel and equipment.

The layout prioritizes functionality, with designated areas for pneumatic and power tools, ensuring easy access and efficient utilization during repair operations.

5.3. Office and Amenities: Integrated office space within the workshop caters to administrative tasks, record-keeping, and provides a comfortable seating and leisure area for up to ten mechanics during breaks.

Adequate provisions for proper lighting ensure optimal visibility during repair work, enhancing safety and efficiency in the workshop environment.

5.4. Storage and Accessibility: The workshop is equipped with sufficient storage space for tools, oils, lubricants, and fast-moving spare parts, facilitating quick access and efficient inventory management.

Large entry gates facilitate the seamless movement of vehicles, cranes, and equipment in and out of the workshop, while a separate walk-in door ensures convenient access for personnel.

5.5. Garage Space: Adjacent to the workshop, a garage area is designated for the storage of at least 15 Pisten bully vehicles. Doesn't require to be heated or temperature controlled but needs to be wind proof to avoid snow ingress during winter months.

Large doors provide easy entry and exit for vehicles, ensuring the preservation and readiness of the fleet for operational use.

The workshop cum garage serves as a critical hub for vehicle maintenance and storage, equipped with state-of-the-art facilities and amenities to support the operational requirements of the research base in Antarctica's challenging environment.

6. Helicopter Hanger

6.1. Size: The helicopter hangar should be large enough to accommodate one KAMOV 32-sized helicopter comfortably. The dimensions should be approximately 20 meters in length, 15 meters in width, and 8 meters in height.

6.2. Temperature Control: The hangar does not need to be temperature-controlled but should provide protection from high winds and other environmental elements.

6.3. Illumination: Suitable illumination arrangements should be provided for carrying out service and repairs on the helicopter. This includes overhead lighting fixtures strategically placed to ensure proper visibility during maintenance activities.

6.4. Ventilation: Adequate ventilation should be incorporated into the design to ensure air circulation within the hangar, preventing the buildup of fumes and ensuring a safe working environment.

6.5. Access: The hangar should have large doors or openings to allow easy entry and exit of the helicopter. The doors should be designed to withstand strong winds and provide secure closure when not in use.

6.6. Personnel Door: Alongside the large doors for helicopter entry and exit, a small personnel door to facilitate the entry and exit of pilots and engineers. This additional access point should be strategically positioned for convenience and should be designed to withstand Antarctic weather conditions while ensuring secure and reliable operation.

6.7. Security: Security measures such as locking mechanisms and surveillance systems should be included to ensure the safety and security of the helicopter when stored in the hangar.

6.8. Durability: The hangar structure should be constructed using durable materials capable of withstanding harsh Antarctic conditions, including extreme temperatures and strong winds.

6.9. Maintenance Area: A designated area within the hangar should be allocated for conducting routine maintenance and repairs on the helicopter. This area should be equipped with necessary tools, equipment, and storage space for spare parts.
6.10. Accessibility: Accessibility for maintenance personnel should be ensured with the provision of safe and convenient pathways and platforms within the hangar.
6.11. Compliance: The design and construction of the hangar should comply with relevant safety regulations and standards to ensure the protection of personnel and equipment.

By adhering to these specifications, the helicopter hangar will provide a safe and functional environment for the storage and maintenance of the KAMOV 32 sized helicopter in Antarctica.

7. Helipad

7.1. Material: Rough, anti-skid precast concrete slabs to ensure durability and strength capable of withstanding the harsh Antarctic conditions.
7.2. Size: Design the helipad to accommodate the size of a KAMOV 32 helicopter, with dimensions suitable (Approximately 30 x 30 metres) for safe take-off and landing operations.
7.3. Levelling: The helipad surface to be perfectly levelled to facilitate safe landings and take-offs, minimizing the risk of accidents.
7.4. Drainage: Incorporate a gradual, very gentle slope on the helipad surface to facilitate the drainage of melted snow and water, preventing accumulation and ensuring safe operations in all weather conditions.
7.5. Load Capacity: Engineer the helipad to bear the take-off and landing load of at least 15000 kg, providing sufficient strength and stability for helicopter operations.
7.6. Steel Anchor Hooks: Embed steel anchor hooks within the concrete slabs of the helipad to secure helicopters during gusty winds, ensuring the safety of both aircraft and personnel. Install a sufficient number of steel anchor hooks across the helipad surface to provide multiple anchoring points, enhancing stability and security during adverse weather conditions.

8. Associated Infrastructure

Efficient infrastructure is crucial for supporting operations in Antarctica, where extreme weather conditions and remote locations pose unique challenges. As part of our commitment to sustainable and effective research facilities, the Competing Entity should ensure that all aspects of the station's infrastructure, including roads, pipelines and cables, meet the highest standards of design and functionality. In this section, we outline specific requirements for the design and construction of roads, pipelines cables, covering fuel, water, and wastewater systems. By adhering to these guidelines, we aim to create a robust and reliable infrastructure that supports research activities while minimizing environmental impact and maximizing efficiency

8.1 Roads

Roads in Antarctica are vital arteries connecting various facilities within the research base. Here are the indicative specifications for designing these roads:

8.1.1 Nature and Surface: Antarctic roads are not conventional city roads; they are primarily levelled earth, snow, or ice surfaces. They are not expected to be paved with tar or concrete. The road surface should be properly levelled and aligned with the topographic contours of the terrain. This alignment ensures easy driving and minimizes fuel consumption due to gradual slopes and gentle turns.

8.1.2 Alignment and Considerations: Road alignment should avoid obliterating fragile vegetation, such as moss fields, and should steer clear of water streams wherever possible. Culverts may be necessary to facilitate the passage of water under the road surface, preventing disruption to the natural flow and ecology of the environment.

8.1.3 Functionality and Protection of Biota: Roads also serve as saviours of biota by directing pedestrian and vehicular traffic along designated paths. This practice preserves untouched areas, including moss fields and bird nesting sites, leaving them undisturbed.

Design considerations should prioritize the comfort and safety of individuals traversing these roads while minimizing ecological impact. The design of Antarctic roads should strike a balance between functionality, safety, and environmental conservation, ensuring efficient transportation while safeguarding the unique ecosystems of the region.

8.2 Fuel and Water Pipelines

Fuel pipelines typically run from the fuel farm to various facilities (generator complex, helipad, workshop/garage). Water pipelines extend from the pump house to the main building for freshwater supply and from the main building to the discharge point for treated wastewater.

8.2.1 Pipeline Design: All pipelines (fuel, water, wastewater) must ensure optimal fluid flow. Different colours should distinguish the pipelines. Elevated supports (steel frame pillars or concrete blocks) should be used.

8.2.2 Insulation and Heating: Water and wastewater pipelines must be trace heated and insulated to prevent freezing and blockages. Fuel pipelines should include leak detection mechanisms.

8.2.3 Quality Assurance: All pipelines must meet high-quality standards to guarantee that they are leak-proof.

8.2.4 Routing and Alignment: Pipelines should align along roads for easy maintenance and leak detection.

8.2.5 Valves and Access Points: Gate valves and optional tapping points should be strategically placed at regular intervals along the pipelines.

8.3 Cables

8.3.1 Types of Cables: There will be two main types of cables: electrical and communication. This includes cables such as Cat-6, optic fibre, and coaxial cables.

8.3.2 Quality and Specification: Cables must meet the highest standards of quality and specification, ensuring reliability and durability in extreme environments. All cables must be rated for arctic conditions, capable of withstanding temperatures as low as -40 degrees Celsius. Cables should be color-coded for easy identification and maintenance.

8.3.3 Routing and Alignment: Cables should be laid along the network of roads for accessibility and observation purposes. They should be aligned with pipelines and roads wherever possible to streamline maintenance and management. Cables should be laid on elevated cable trays to protect them from ground-level hazards and facilitate inspection and repair.

8.3.4 Road Crossings: Robust trenches should be provided for road crossings to protect the cables and ensure uninterrupted service.

8.3.5 Safety Measures: Arctic-grade circuit breakers should be installed at regular intervals along the cable routes to prevent overloads and ensure safety.

8.3.6 Access Points and Junction Boxes: Access point sockets and junction boxes should be strategically placed at regular intervals along the cable routes for easy access and maintenance.

By following these specifications, we aim to establish a reliable and efficient cable infrastructure that supports the research activities of the station while minimizing downtime and ensuring safety.

Maitri-II : Project Cost Estimate for construction of Buildings and Associated infrastructure

Competing Entities are required to furnish cost estimates for the construction of buildings and associated infrastructure, as detailed in Annexure-1. They must specify their consultancy charges for overseeing the project from inception to completion, as outlined in the document under Clause 7.7 Role and Responsibility of Winning Entity. It is important to note that these estimates should exclude expenses related to personnel travel and transportation of goods from the mainland to Antarctica, as these costs will be covered by the National Centre for Polar and Ocean Research.

Item Description in brief	Total Estimated Cost (₹)
1. Main Building Living quarters, offices, laboratories, dining, and recreation areas (Capacity: 140 individuals during austral summers, 40 during austral winters)	
2. Generator Complex Power generation facility with capacity for 6 generators/CHP units (Total capacity: 600-750 kVA)	
3. Multi-Compartment Warehouse Storage facility with compartments for various supplies and equipment	
4. Fuel Farm Storage and distribution facility for JET A1 fuel (Capacity: 600 kL)	
5. Workshop cum Garage Temperature-controlled workshop with space for at least 2 Pistenbully vehicles and garage space for 15 Pistenbully vehicles	
6. Helicopter Hanger 20 meters in length, 15 meters in width, and 8 meters in clear-height	
7. Helipads 30 x 30 metres	
8. Roads Network of roads designed for optimal flow and minimal environmental impact	
9. Pipelines (Fuel, Water, Waste) Network of pipelines for fuel and trace heated water and wastewater systems	
10. Cables Network of electrical and communication cables of Arctic-grade rated for -40 deg.C	
Total Project Cost	

Project Consultancy Fees

Consultancy charges for architectural firms overseeing the project from inception to completion may be structured as a percentage of the project cost and must be clearly specified. Payments will be made in milestone instalments, disbursed over the duration of the project (format to be provided to registered entities only).