Request for Proposal

19th March 2072

Orbital Transhab

INTRODUCTION

Inflatable Innovations has commissioned a longer-term, semi-inflatable structure to be used as a crew-residence during the construction of orbitals and deep-space infrastructure. The structure must follow the tried and tested *Transhab* architecture. The unit should aim to minimise cost, while being robust and reusable. As the structure will be redeployed around the solar-system, efforts to minimise its shipping mass should be made.

STATEMENT OF WORK

1. Basic Requirements - The contractor will describe the design, development, and factory manufacture of an Orbital Transhab (OT) and any support infrastructure.

1.1 The OT will support an initial maximum population of 12 individuals, with an additional transient population of 2 people.

1.2 The OT must be equipped with two miniaturised airlocks for ingress and egress from the module. The airlocks will be purchased from Lossless Airlocks and may be assumed to be cylindrical with a diameter of 1.2 metres and a length of 1 metre.

1.3 The OT must be easily re-stowable at the end of its 12 month use period, including all standard internal equipment and furnishings.

2. Structural Design - The OT must provide safe and habitable working environments.

2.1 Overall design drawings must identify core structural elements of all enclosed volumes; identify those volumes' uses at initiation; show key features; and clearly show dimensions of major structural features in metric units. Indicate how features of the design help to make it easily inflatable and re-stowable. Consider that the Transhab will undergo extreme accelerations during launch.
Minimum requirement: Show overall exterior views of the OT's structure and associated features, showing the locations of, and sizes for habitable and pressurised volumes alongside entry/exit locations, and locations of core systems. Indicate how the module will collapse and expand to and from stowage.

2.2 Describe and show the locations of features that protect internal volumes from environmental hazards and that distribute critical commodities within the OT. Consider the effects of zero-g on these systems. Indicate the composition of the inflatable wall and any shielding external to the pressure-retaining layer.
Minimum requirement: Show diagrams of critical commodity storage and routing within the OT. Describe the structure and operation of features that provide environmental protection (active or passive).

3. Operations and Infrastructure - Describe facilities and infrastructure necessary to operate the OT. As it will always operate on construction sites, the OT will receive electrical power from the site's generators.

3.1 Describe elements of basic infrastructure needed to operate the settlement, including:

- Water and waste management. Detail water management and reclamation processes to deal with the expected water usage rate for the OT. A zero-g shower from Space Kettle must be installed in the OT: this will introduce soap-related chemicals into the waste-water. Additionally, specify how solid waste materials will be removed from the structure.
- Atmospheric regulation, including composition and monitoring. The pressure should be maintained at a minimum of 0.7 bar in residential areas. Specify humidity and mechanisms for its control.

Minimum requirement: Drawing(s) showing locations and natures of systems which provide core infrastructure, and, as appropriate, their configurations (e.g., show routings of water and purified air).

3.2 Describe a procedure for detecting and repairing damage to the pressure-retaining layer of the OT or any structures external to it. Describe an additional procedure for making repairs to the internal supportive structure in the event of damage causing cracking.
Minimum requirement: Procedures describing the repair of the pressure-retaining-layer and any external protection and for the repair of the load-bearing internal structure.

4. Human Factors - Residents of the OT must have access to good quality living and working spaces. The OT should have all the amenities expected in an equivalently sized house of multiple occupancy.

4.1 Provide a layout of the OT's residential and recreational spaces. Show the locations of all mandatory equipment, sleeping locations, communal spaces, and operational infrastructure. Show how residents are protected from any hazardous infrastructure (e.g. high-pressure chemical storage, bioreactors, etc.).
Minimum requirement: Concept map(s) and illustration(s) of the community layout (2D and 3D).

4.2 The OT will be a working settlement where residents will be engaged in either construction or site management. The OT will primarily operate as a residential facility, but may in some cases need to be repurposed as a site office, with all relevant equipment.This will require the removal of residential facilities and the installation of secure storage and administration spaces.
Minimum requirement: Descriptions of the procedures necessary for refitting an OT to become a site office and of the facilities made available in this configuration.

5. Automation and Control Systems - Specify mechatronic and data processing systems to support the OT and enable its core functions. Given the zero-g nature of the settlement, all robotic systems must be tethered to a rigid surface (i.e. not the inflatable wall).

5.1 The OT must be designed for rapid (<6 hours) deployment and re-stowage to provide an efficient habitation solution during major settlement construction. Explain, in detail, how automated procedures assist with the inflation and deflation of the OT, including use of air pressure, robotic systems, and hydraulic actuators.
Minimum requirement: Provide a flowchart detailing the processes involved deployment and re-stowage of the OT, including the installation of internal systems and furnishings.

5.2 Weld spatter and particulates from the construction site risks contaminating the OT in the same way that regolith would on the Moon or Mars, or dust would on Earth. In order to reduce the burden and learning curve for residents, the OT will be fitted with an automatic cleaning system to remove airborne and surface dirt. Describe these systems, indicating how they will operate without imposing an excessive burden on the waste handling systems or being an inconvenience to residents.
Minimum requirement: Diagrams showing the internal autonomous cleaning system and descriptions of its mechanism and modes of operation.

6. Scheduling and Cost - The tendering organisation has not stipulated any special requirements for the OT beyond cost-effectiveness and convenient assembly in a factory on Earth.

DEMAND VERBS

Show: provide a visual representation adequate to clearly explain a requested item.
Show how: support explanations, either visually or textually, of how a requirement is fulfilled.
Describe: include a visual or textual summary to clearly explain compliance to a requirement.
Detail: same as ‘describe’ but requiring information pertinent to even the lowest level of the item.
Justify: provide an on-slide reasoning for decisions made.
No verb: provide the requested item(s) on the slides of the presentation.
Specify: include the results of specific design-decisions made, justifying as appropriate.
Indicate: same as ‘specify’ but requiring less precision.