Project Hyperion Design Contest

An Interstellar design challenge

CONTENTS

(...)

Humanity has overcome the great sustainability crisis in the 21st century and has transitioned into an era of sustainable abundance, both on Earth and in space.

Humanity has now reached the capacity to develop a generation ship without major sacrifices.

An Interstellar Starship flies by an icy planet in a nearby solar system. Going beyond the classical examination of the problem of Interstellar propulsion and structural design, for a voyage lasting multiple centuries, ***what might be the ideal type of habitat architecture and society in order to ensure a successful trip?***

INTRODUCTION

A generation ship is **a theoretical type of spacecraft designed for long-duration interstellar travel,** where the journey may take centuries or millennia to complete. The idea behind a generation ship is that the initial crew would live, reproduce, and die on the ship, with their descendants continuing the journey until reaching the destination.

This type of ships are often envisioned as **self-sustaining ecosystems, featuring agriculture, habitation, and other necessary life-support systems to ensure survival across multiple generations.** The concept stems from the challenges posed by traversing the vast cosmic distances.

Project Hyperion, works on a **preliminary study** that defines integrated concepts for a crewed interstellar starship or generation ship. The study aims to provide an assessment of the feasibility of crewed interstellar flight **using current and near-future technologies.** It also aims to guide future research and technology development plans as well as to inform the public about crewed interstellar travel.

TEAM COMPOSITION

Teams have to be multi-disciplinary. Each team must have:

// At least one architectural designer
// At least one engineer
// At least one social scientist
(sociologist, anthropologist, etc.)

* These are flexible recommendations, please submit a short bio and team organization description

OBJECTIVE

The team shall design the habitat of the generation ship, including its architecture and society (See Guideline no.1 for further details).

The habitat of the generation ship and its subsystems, shown in Fig. 1 “The system to be designed”.

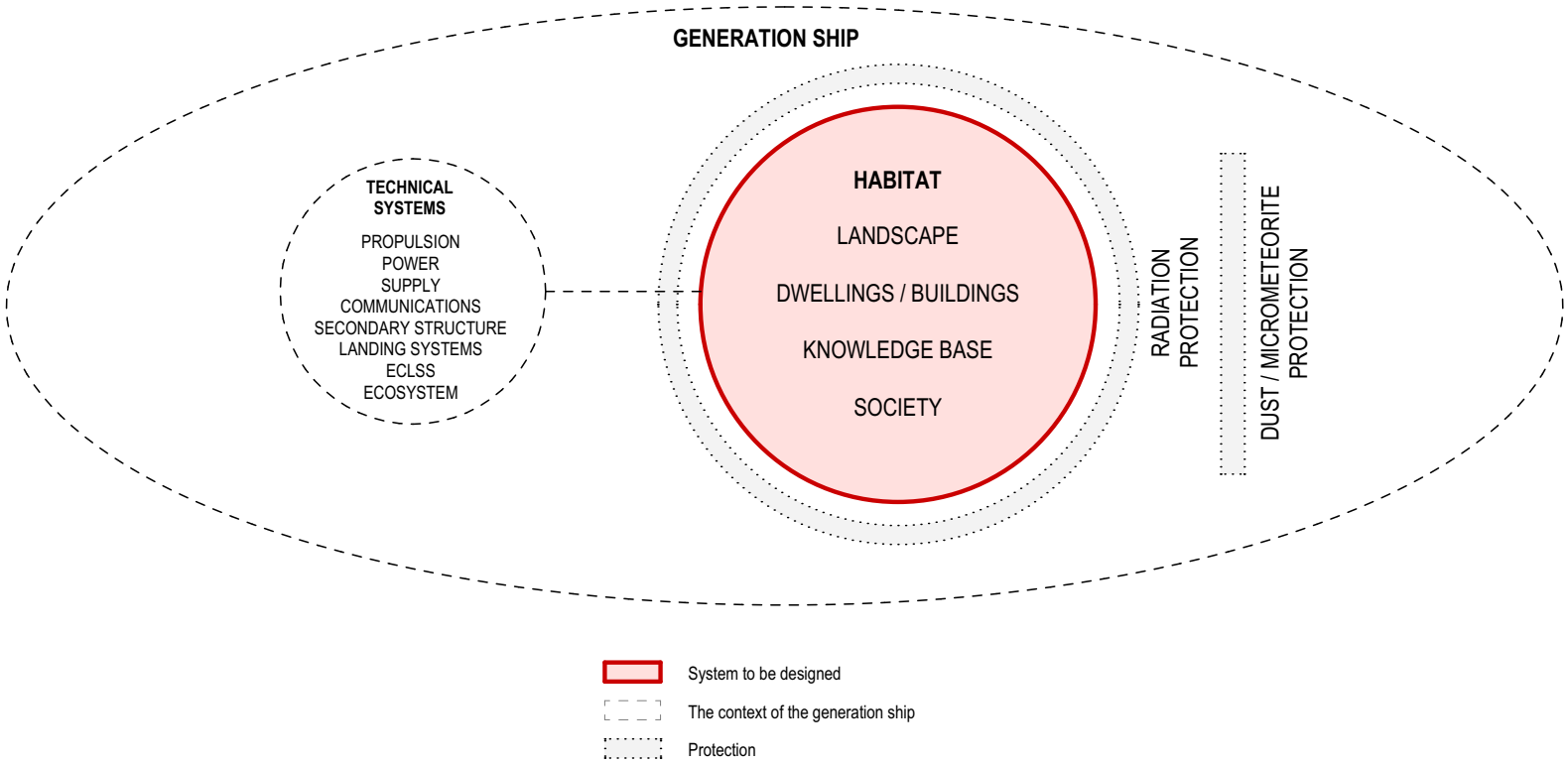


Fig. 1 : The System to be designed

BOUNDARY CONDITIONS

1 // Duration

The mission duration is 250 years from launch to arrival at the target star system. (Flight speeds of a few %c to the closest stars)

2 // Destination

The target destination of the generation ship is a rocky planet with an initial artificial ecosystem created by a precursor probe (or panspermia). No significant genetic / biological adaptations are required to survive in that ecosystem.

3 // Gravity

The habitat provides Earth gravity via artificial gravity via rotation but parts of the habitat can have reduced gravity.

4 // Atmosphere

The habitat provides atmospheric conditions similar to Earth.

5 // Radiation protection

The habitat shall provide radiation protection (predominantly protection from Galactic Cosmic Rays)

6 // Impact protection

The habitat shall provide micro meteorite and interstellar dust protection

7 // Society size

The habitat shall provide accommodation and decent living conditions for 1000 +-500 people over the entire trip duration.

>>>

8 // Internal architecture

It shall provide the possibility to be modified (e.g. dwellings can be reconstructed to meet changing needs).

9 // The society's structure

It shall select alternatives along the following cultural invariants:

// Language
// Ethics
// Social Roles
// The Supernatural
// Styles of Bodily Decoration
// Family Structure
// Course of Life Stages
// Reproductive Behavior
// Food Preferences
// Aesthetics
// Ultimate Cosmic Postulates

10 // Technologies

The technologies used shall have a TRL≥2.
(See Guideline no. 2 for further details).

11 // Means for knowledge transfer

They shall be defined and its consequences explored (the amount of knowledge retained in a society depends to an extent on population size. Knowledge loss compared to Earth is almost inevitable.)

The population shall have at least access to basic products such as clothing, shelter, etc. over the entire duration of the trip.

The mass of the habitat shall be as low as possible.

The habitat shall be reliable over the entire trip duration.

The habitat shall include redundancy

REGISTRATION PERIOD

Competition announcement : 1st November 2024

Phase 1 Deadline : 2nd of February 2025

Phase 2 Deadline : 4th May 2025

Winners Announcement : 2nd June 2025

Q & A PERIOD

Until the 1st December 2024

Q & A CONTACT ADRESS

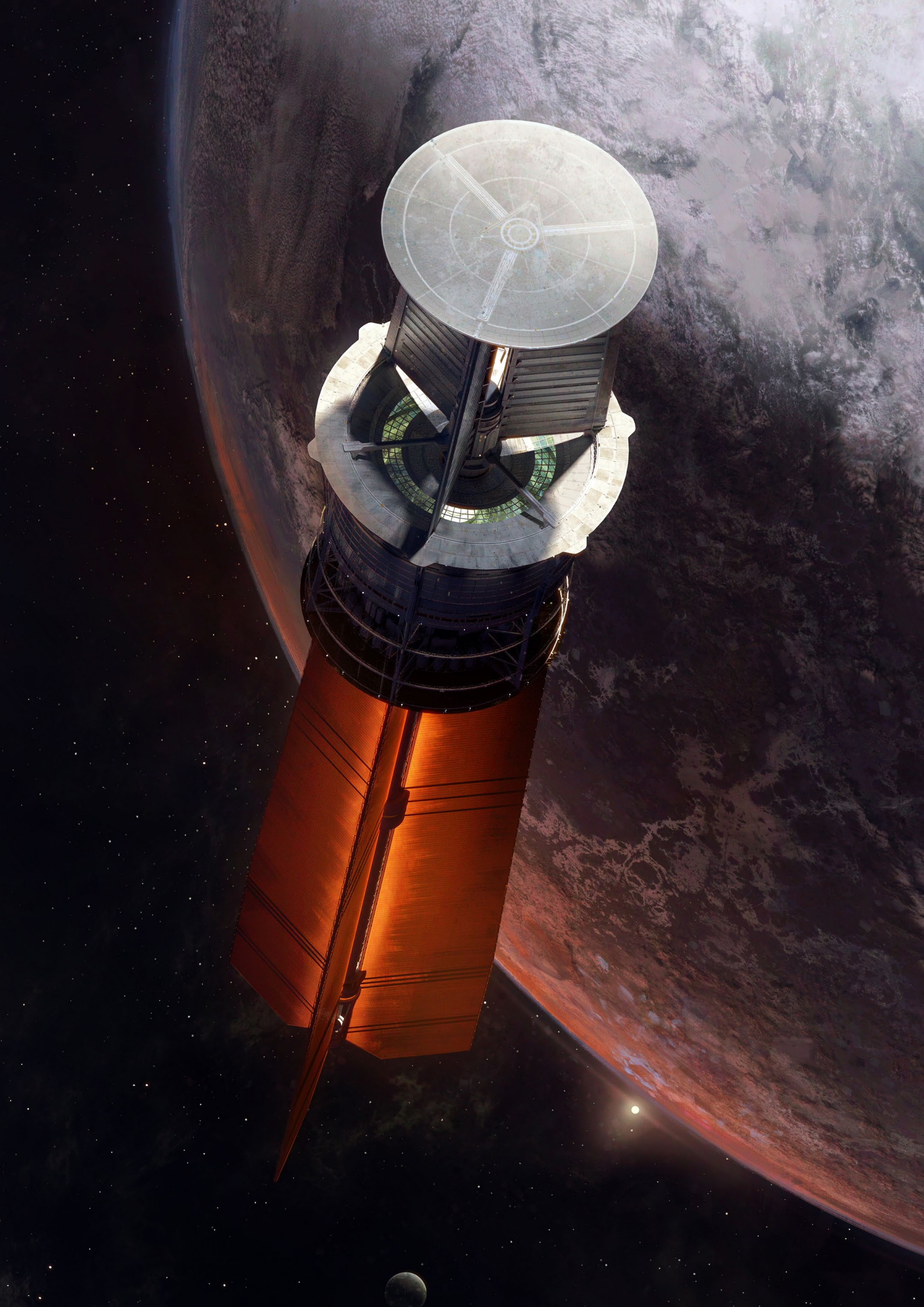
info@i4is.org

PARTICIPATION FEE

· 20$ participation fee for registration

CASH AWARD

· 1st: 5000$
· 2nd: 3000$
· 3rd: 2000$
· 10 honorary mentions



DELIVERABLES FOR PHASE 1

A3 Project Booklet
Maximum 30 pages

It shall contain :

// Sketches, 3D renderings of the habitat interior and exterior
// Plans, sections, 3D diagrams that best describes the project (Scale is to decide by the team)
// Technical diagram describing the different components, subsystems, societal structure, etc.
// Requirements satisfaction matrix (how requirements are satisfied in design)
// First order mass budget
// A short descriptive text of the project (500 words max) Key design decisions shall be explained, including which alternatives and trade-offs have been considered.

** Participants are encouraged and will be supported in submitting their work to a journal for publication.

EVALUATION CRITERIA FOR PHASE 1

A // Architectural Evaluation Criteria

Logical integration of form, function, and aesthetics (Architectural Quality): Competitors must elucidate how the chosen volumes' forms functionally or aesthetically align with their core concepts.

Flexibility and modularity: Given the ship-city's multi-generational use, the modularity of designed spaces holds significance. Competitors must elaborate on the reasons and methods for incorporating flexibility and modularity into their designs.

Innovation & Technology: These factors are pivotal, and their influence on architectural design must be clearly defined.

Graphic quality: Deliverables should be presented in clear and comprehensible architectural graphic design.

B // Technical Evaluation Criteria

Gravity: The habitat shall provide Earth gravity via artificial gravity via rotation but parts of the habitat can have reduced gravity

Protection: The habitat shall provide radiation protection (predominantly protection from Galactic Cosmic Rays) as well as micro meteorite and interstellar dust protection.

ECLSS: The habitat shall provide environmental control and life support: How are essential physical needs of the population provided? Food, water, air, waste recycling. How far is closure ensured?

Ecosystem: The ecosystem in which humans are living shall be defined at different levels: animals, plants, microbiomes.

Mass: The mass of the habitat shall be as low as possible.

C // Social Evaluation Criteria

The design must address the fact that interstellar voyages would be multigenerational. Both biology and culture must be accounted for on such a timescale. Design criteria include:

// Realistic multigenerational design considering the departure, travel and arrival population

// Capacity for the biocultural system to adapt to change over time

// Commentary on some expected changes to biology and culture over multiple generations

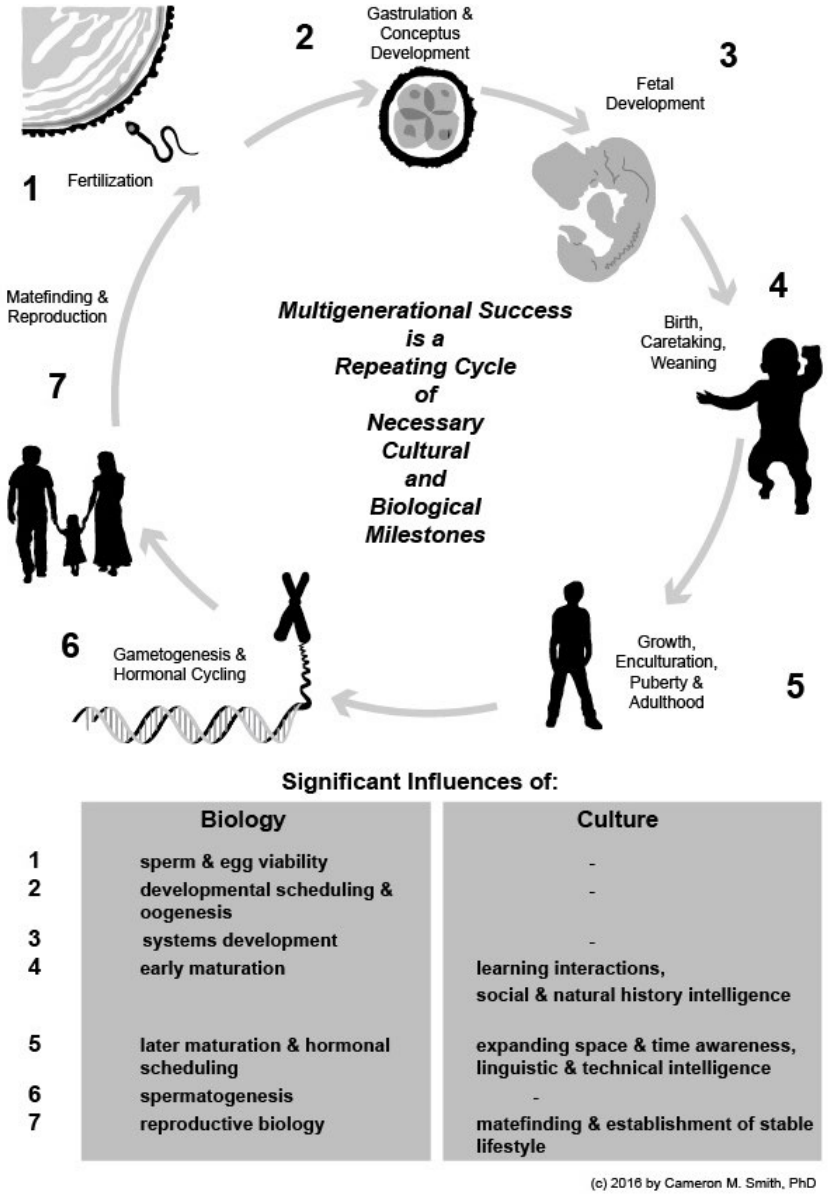


Fig. 2 : The challenges in maintaining biocultural health over multiple generations

ORGANISATION TEAM

Andreas Hein
Aerospace engineer

Yazgı Demirbaş Pech
Architect, Illustrator

Dan Fries
Aerospace engineer

Michel Lamontagne
Illustrator, Designer

Cameron Smith
Anthropologist

Maciej Rebisz
Concept Artist

Steeve Summerford
Landscape Architect

Good luck, Ad Astra!