New Venice

Your Address In Space

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Imagine...

It is the year 2070.

The existing space economy is thriving.

There are many facilities scattered across Cislunar space providing services to space companies.

Colonies on the Moon and Mars have been running continuously for at least a decade.

Lunar and asteroid ISRU produce enough surplus material to be commercialized.

Humans are ready to begin deep space settlement.

Art by Robert McCall

In this context, there is a **growing demand for a large space facility** where multiple space companies can conduct their activities and offer their services, establish their market, and settle their workers.

This thesis presents one concept for such a facility :

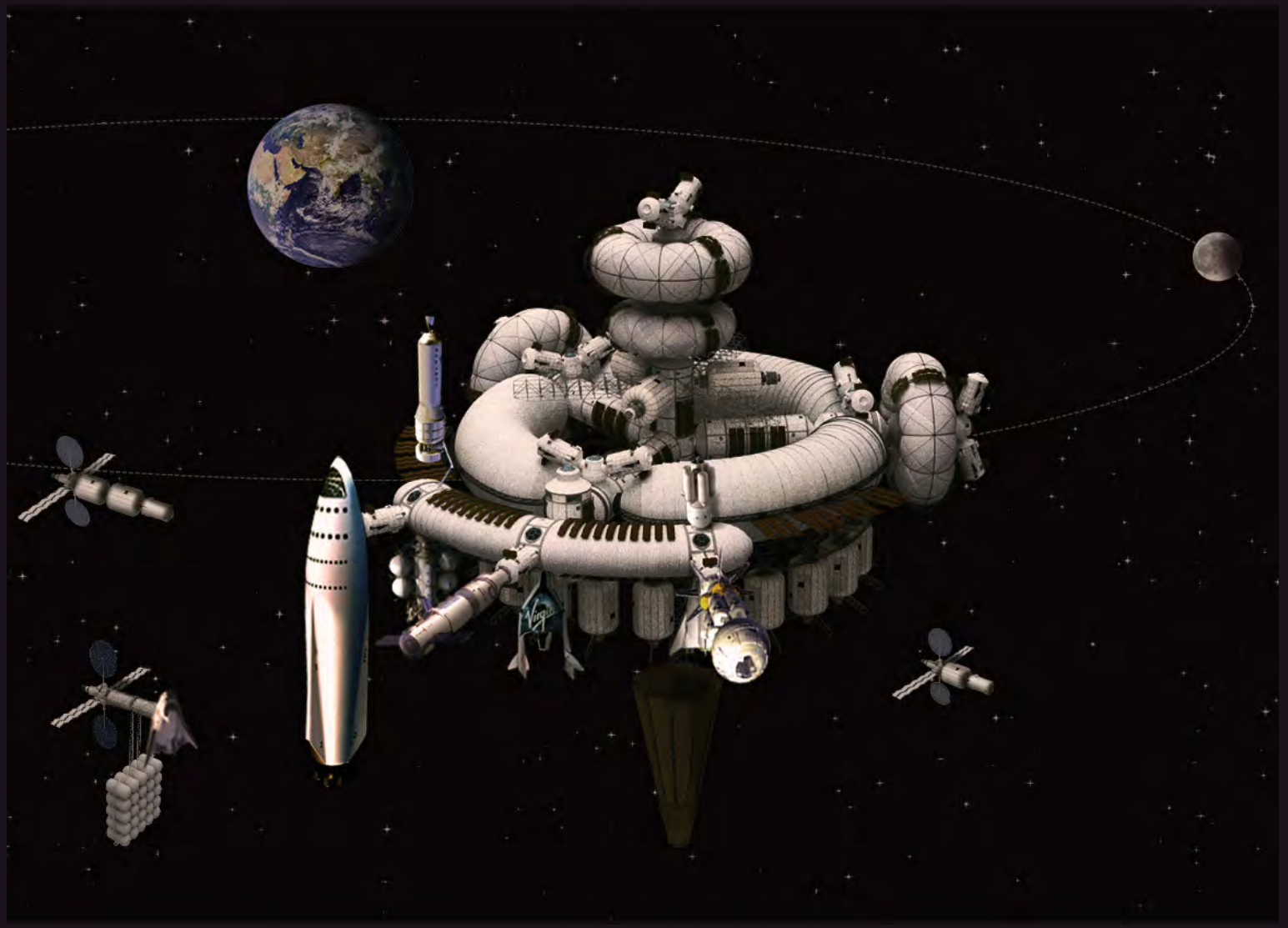
New Venice Multi-Industry Space Outpost

New Venice is a **physical address where companies can explore the space environment**. They will be able to lease space on-board without the cost and burden of constructing and launching their own space facilities. The community village offers comfortable amenities for the employers and visitors, and is a popular tourist destination.

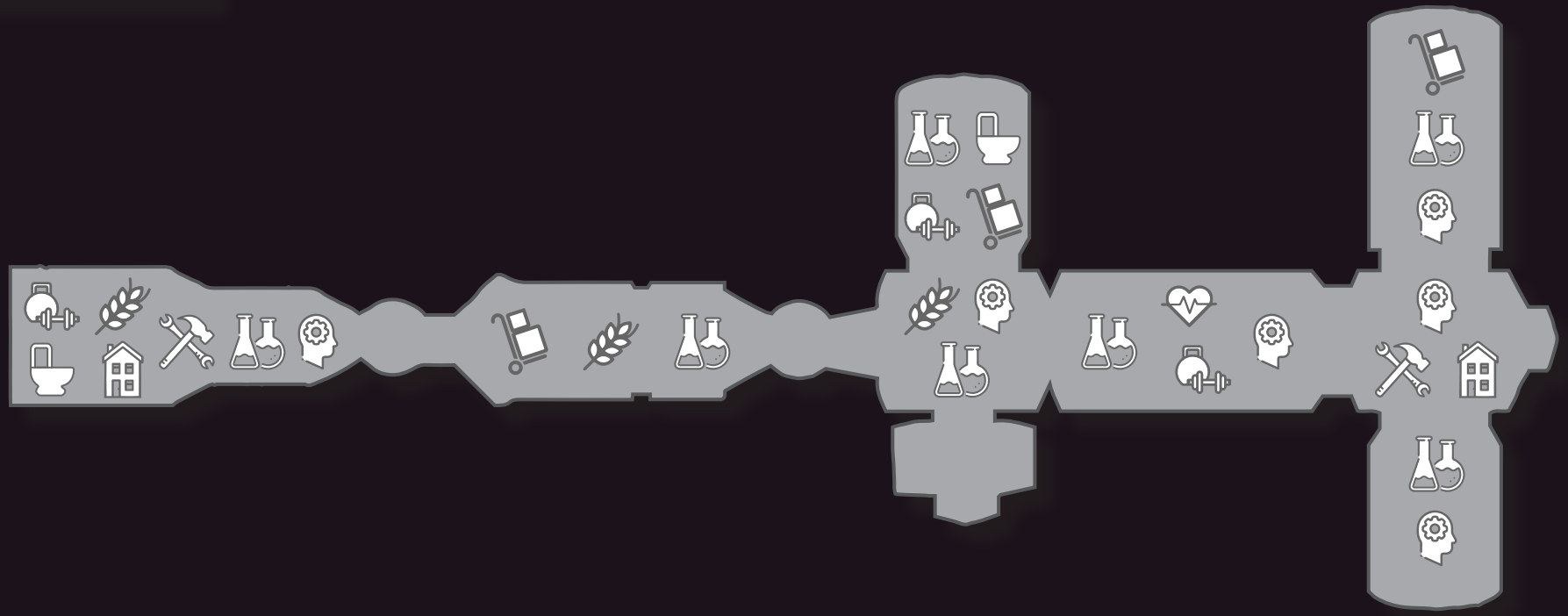
Art by Robert McCall

Agenda

- Problem Statement
- Design brief
- Phasing
- Economics and People
- Functional Allocation
- Design concept
- Life in the Community
- Conclusion



Problem statement



Problem 1

How to incorporate micro-gravity in comfortable, stimulating living environments, breaking free from the usual concepts of either adapting Earth to space or Humans to machines?

Problem 2

How to cater to the great diversity of functions and uses, each with its unique requirements, restrictions and peculiarities without interfering with each other?

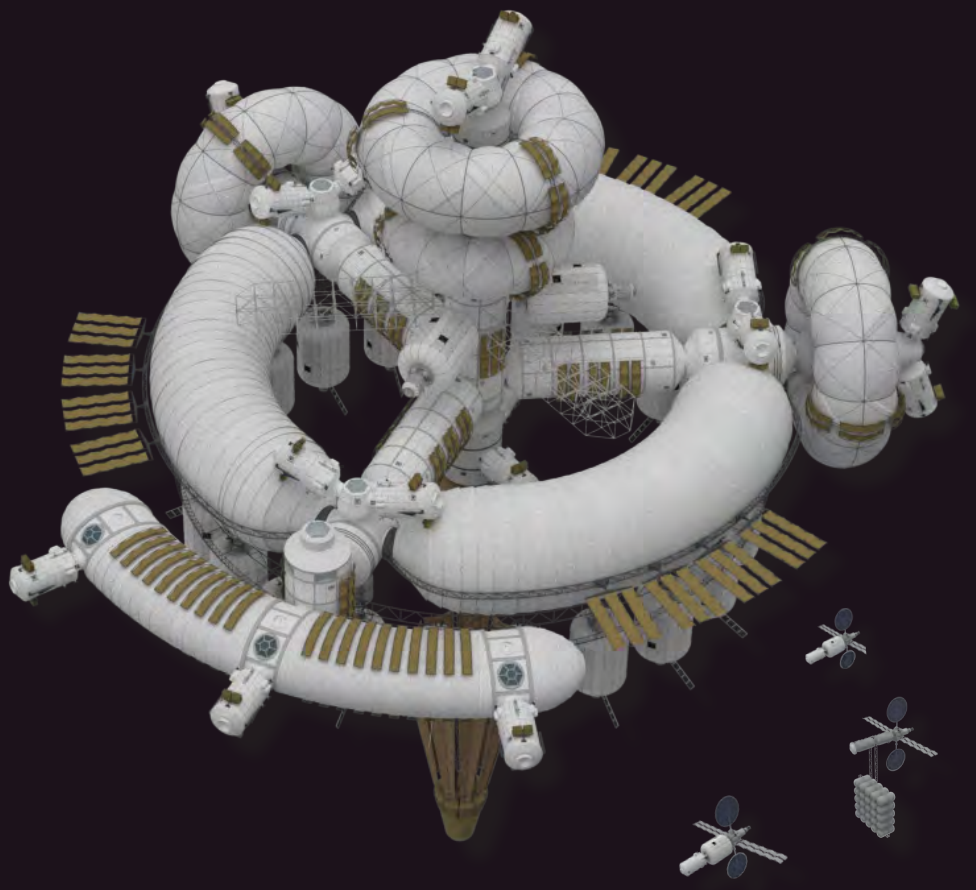
Problem 3

How to change the status quo of space station assembly based on chamber-to-chamber/corridor environments?

Design Brief

Concept

- Functional separation;
- Simultaneous activities;
- Balance of private vs public;
- Mix of launched modules and in-space construction;
- Commercially operational from start, no interruption for growth;
- Future expansion capabilities;
- Multiple circulation routes;
- Multiple escape possibilities.



Main Assumptions

- Year 2070;
- Thriving cislunar economy;
- Advanced colonies on the Moon and Mars;
- Lunar and asteroid ISRU are producing surplus;
- Space contractors build and outfit structures in space;
- Large inflatables are proven technology;
- NASA's SLS is the main large payload provider;
- New technologies in material and medicine offer sufficient protection against cosmic radiation;

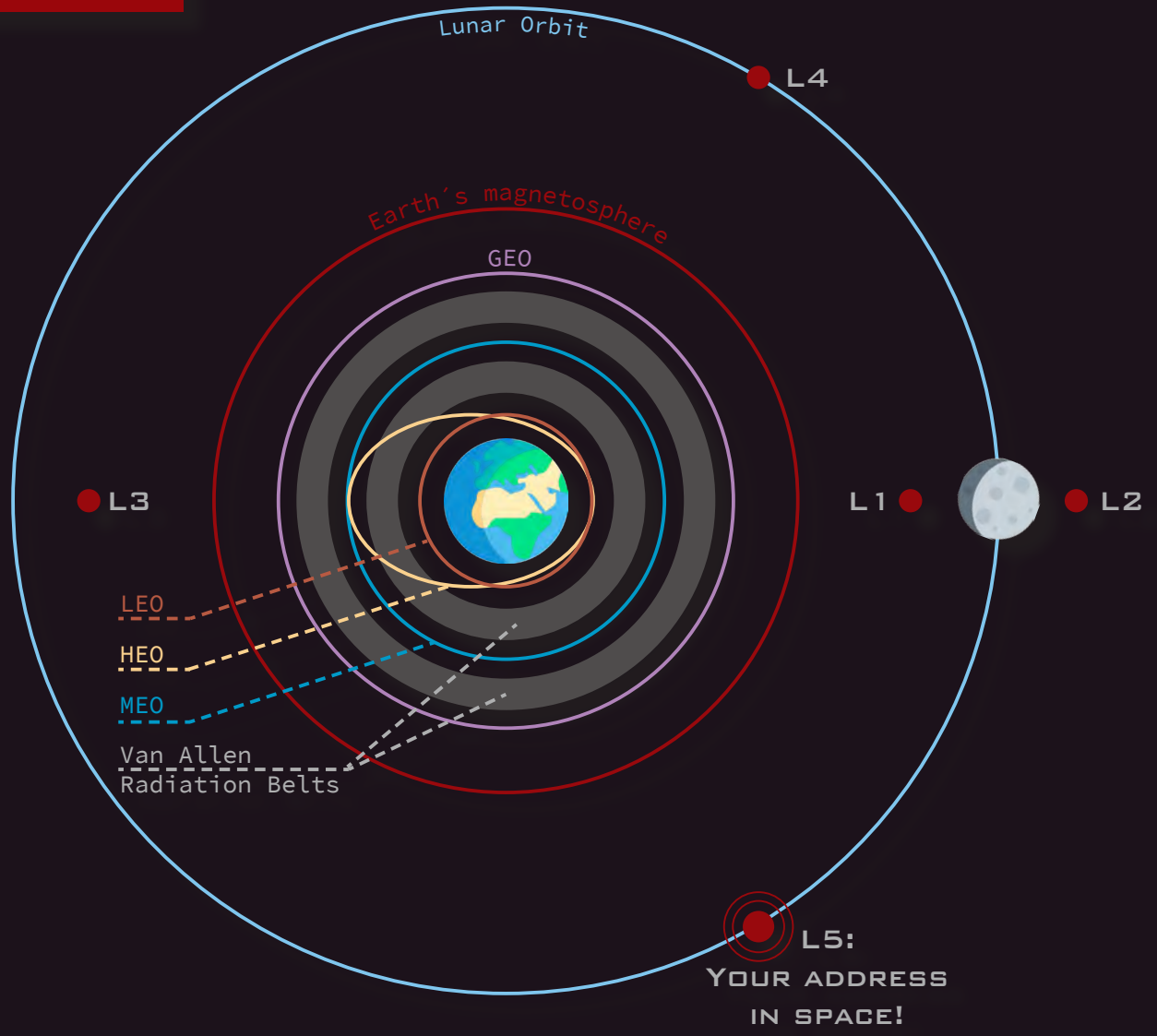
Project parameters:

- Population: 400 people;

  87% working (economic or support activities)

  13% visiting (tourists, training, students)
- 3 year permanence limit;
- Micro gravity environment;

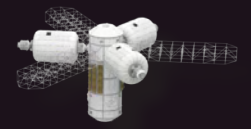
Location



Earth - Moon L5

- Stable orbit;
- Little to no attitude control and orbit correction boosts needed;
- Little to no gravity gradient;
- No atmospheric drag;
- No orbital debris;
- Advantageous ΔV for travel between Earth/Moon/Cislunar;
- Convenient location for commercialization of lunar and asteroid materials;
- Convenient location for way-station for deep space;
- Simultaneous Earth and Moon gazing opportunities.

Initial Growth

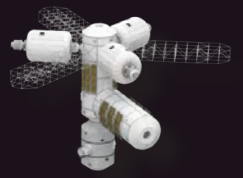


Phase 1

- Fuel depot
- Servicing
- Ore processing
- Heavy industries

Phase 2

- Logistics
- Shipyard
- Temp housing

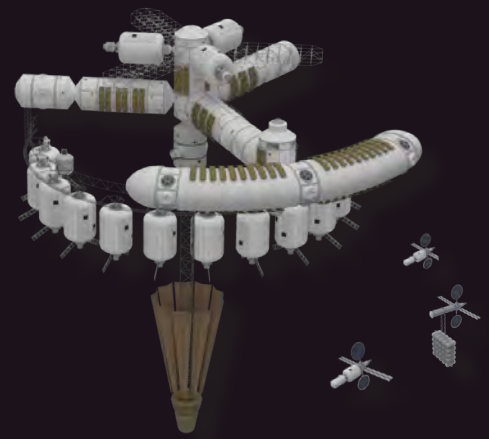


Phase 3

- Spaceport
- Light industries
- Nuclear power

Phase 4

- Research
- Space Health
- Institutional
- Temp housing



Community Growth

Phase 5

- Industry expansion
- Remote operation support

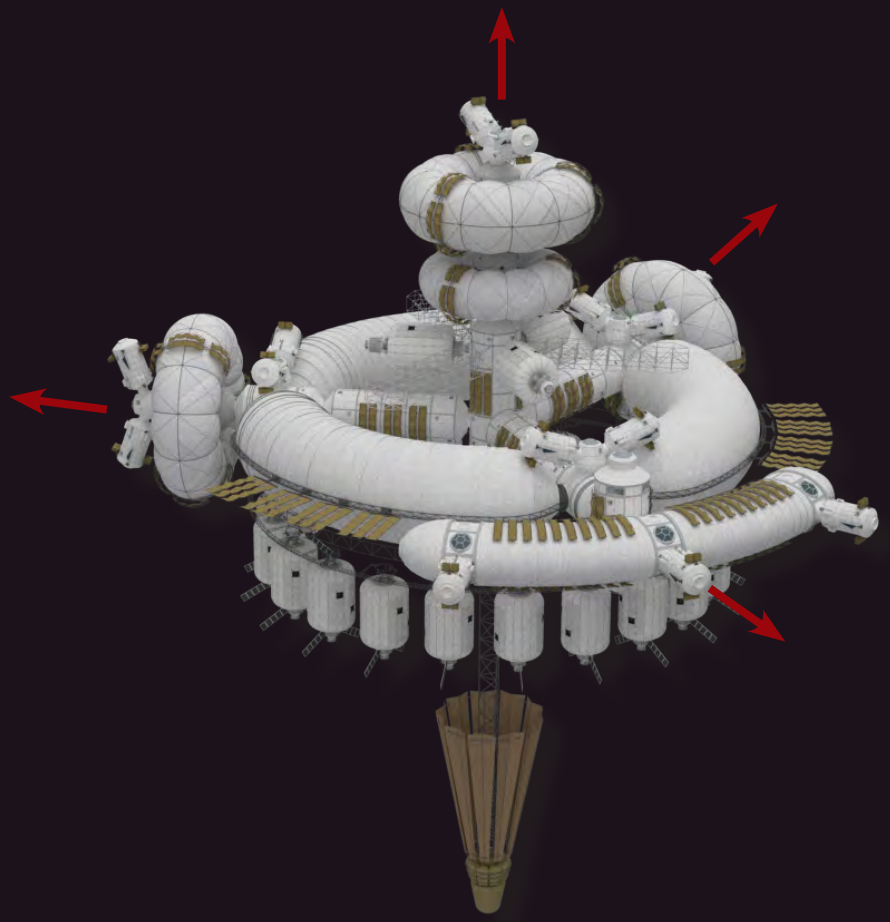
Phase 6

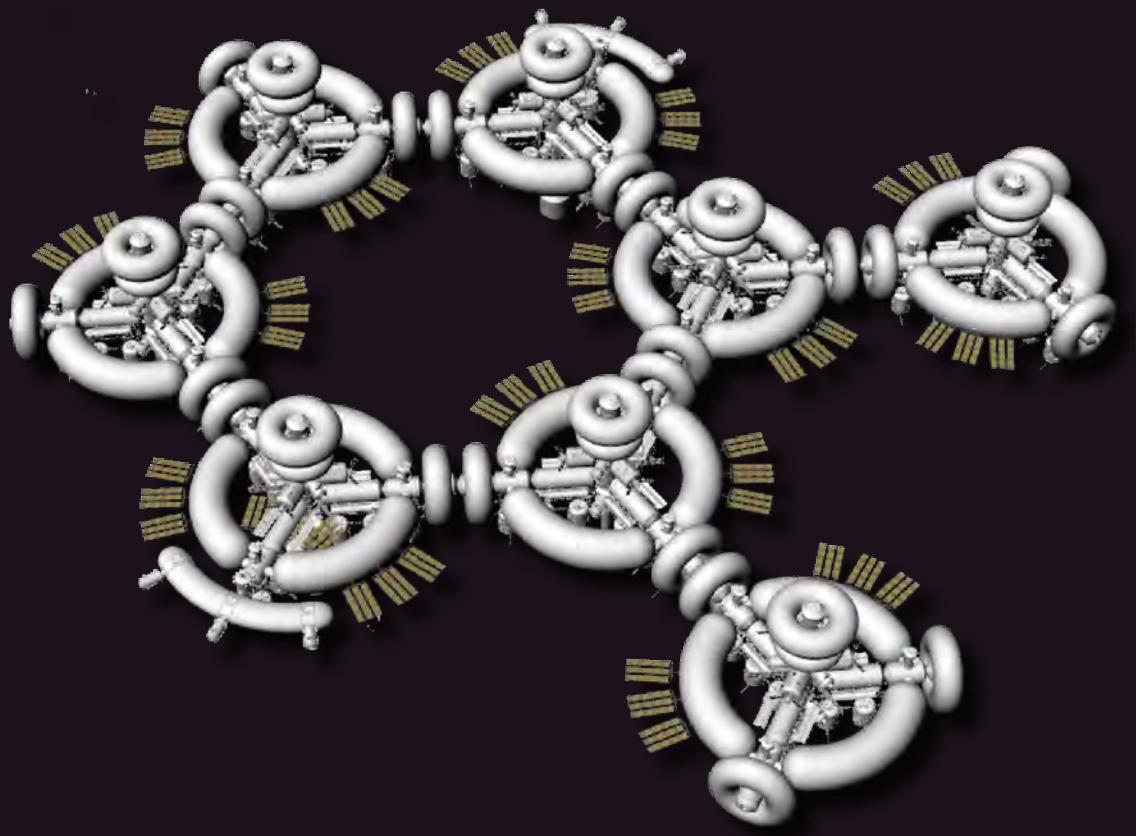
- Food/water production
- Space commerce

Phase 7

- Tourism
- Entertainment
- Shopping

Future expansion





Economic Activities

Primary Activities

Space mobility:
Shipyard
Spaceport

Production:
Manufacturing
Material processing
Food/Water
Energy

Research:
Education
Research
Health

Entertainment:
Tourism
Sports
Ceremonial
Space Experience
Film studio

Support Activities

Community:
Housing
Wellness
Leisure

Management:
Administration
Operations

Logistics:
Maintenance
Supply
Security
Mobility

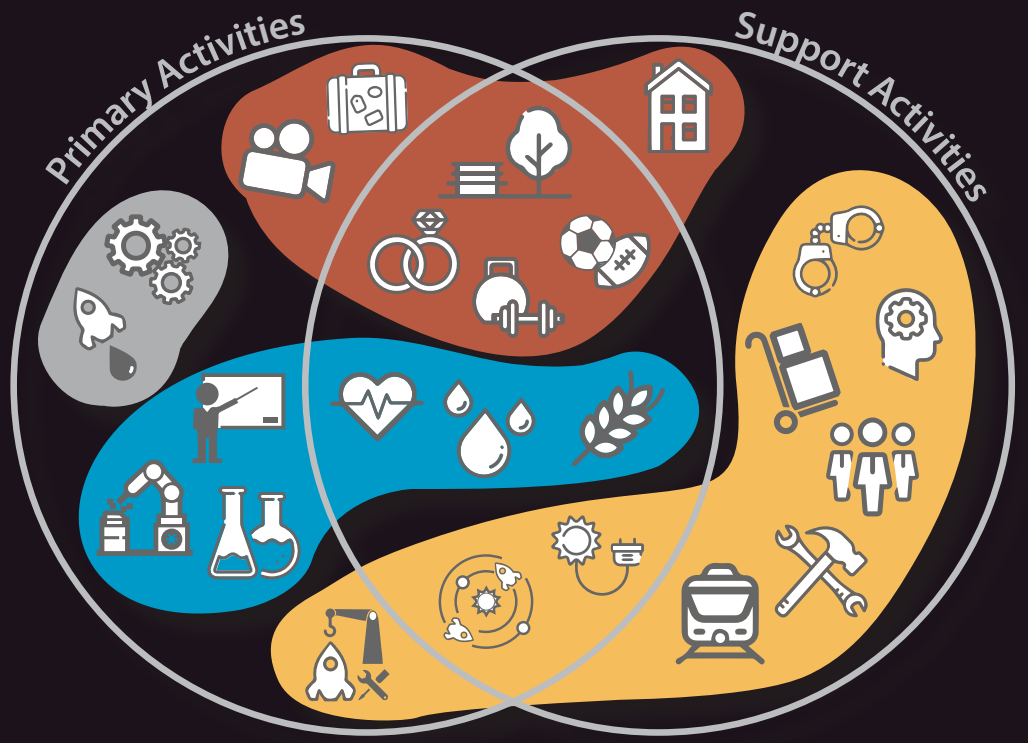
Functional Analysis

			Estimated Workforce
Primary Activities			**181**
Space Mobility			**52**
	Shipyard	Fuel depot	2
		Maintenance/ servicing	17
		Spacecraft assembly	17
	Spaceport	Interplanetary spaceport	2
		Cargo terminal	4
		Space traffic control	10
Production			**59**
	Manufacturing	Pharmaceuticals	4
		Crystal growth	4
		Nanostructures	4
		Spacecraft components	5
		Textiles (composites)	4
	Mat. Process.	Material processing	16
	Food/Water	Food production	16
		Water production	2
	Energy	Power plant/ export	3
Research			**59**
	Education	University	2
		Zero G training	2
	Research	Science	13
		Technology	13
		Institutional	13
		Health	13
	Health	Space tech treatment	4
Entertainment			**11**
	Tourism	Tourism	7
	Sports	Space sports	0
	Cerimonial	Marriage	1
		Burial	2
	Space exp.	Zero g/playground	0
	Film studio	Film studio	0

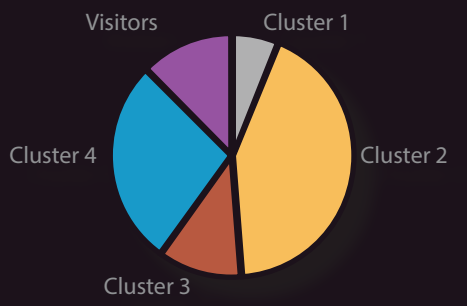
			Estimated Workforce
Support Activities			**169**
Community			**45**
	Housing	Housing	4
	Wellness	Medical	10
		Fitness	2
		Eating	5
	Leisure	Commerce	15
		Cultural	2
		Recreation	2
		Parks	5
Management			**58**
	Administration	Administration	37
	Operations	Operations	6
		Engineering	8
		Systems	6
Logistics			**66**
	Maintenance	Maintenance/ Repair	11
		Housekeeping	34
	Supply	Supply/distribution	5
	Security	Security	13
	Mobility	Internal circulation	3

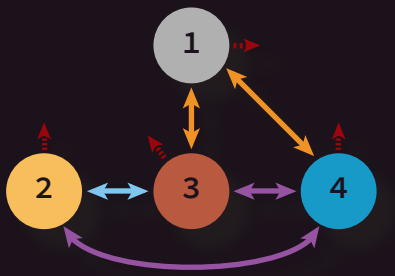
Total workforce	**350**
Simultaneous visitors limited to	**50**
Total population:	**400**

Functional allocation



Population





Cluster 1:
- Fuel depot
- Heavy Industry
- Sensitive Industry

Cluster 2:
- Space mobility
- Logistics
- Management

Cluster 3:
- Housing
- Leisure
- Entertainment

Cluster 4:
- Institutional
- Health
- Production

- 130-200 people/day
- 50-129 people/day
- 1-49 people/day
- Emergency escape

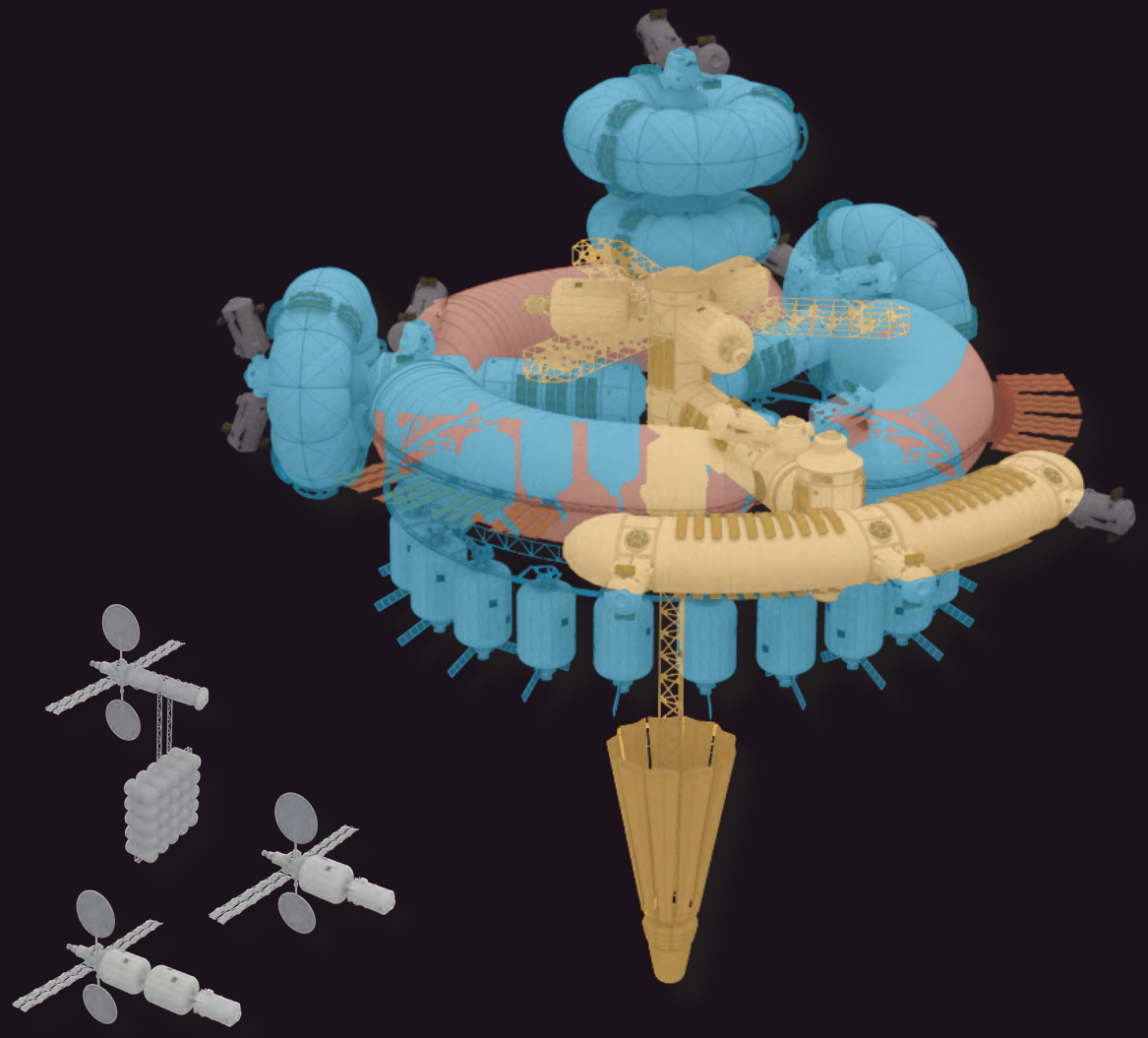
Cluster configuration

Cluster 1:
Fuel depot
Heavy Industry
Sensitive Industry

Cluster 2:
Space mobility
Logistics
Management

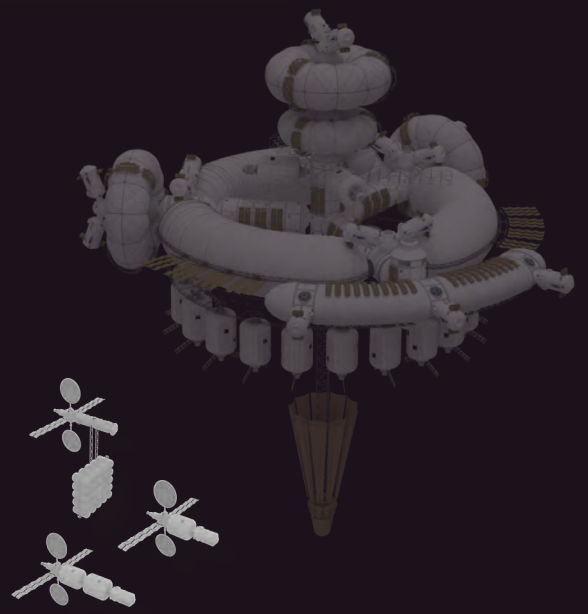
Cluster 3:
Housing
Leisure
Entertainment

Cluster 4:
Institutional
Health
Production



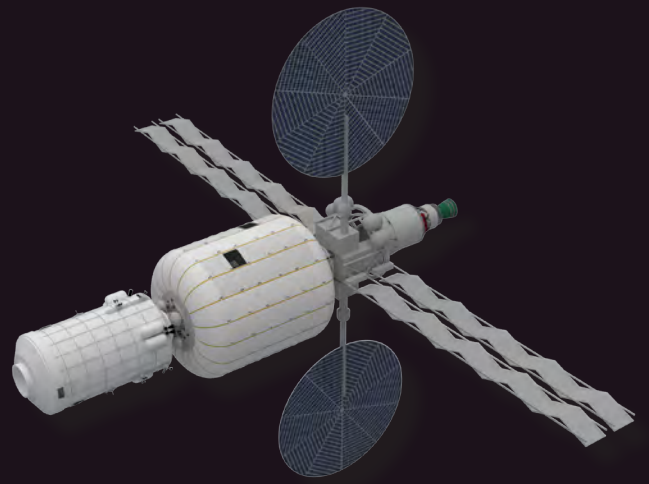
Cluster 1

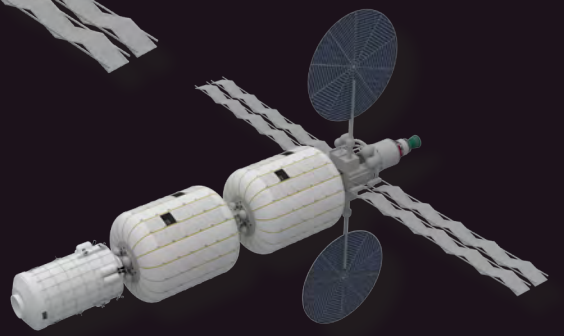
Workforce: 25 people



Satellite Industries:

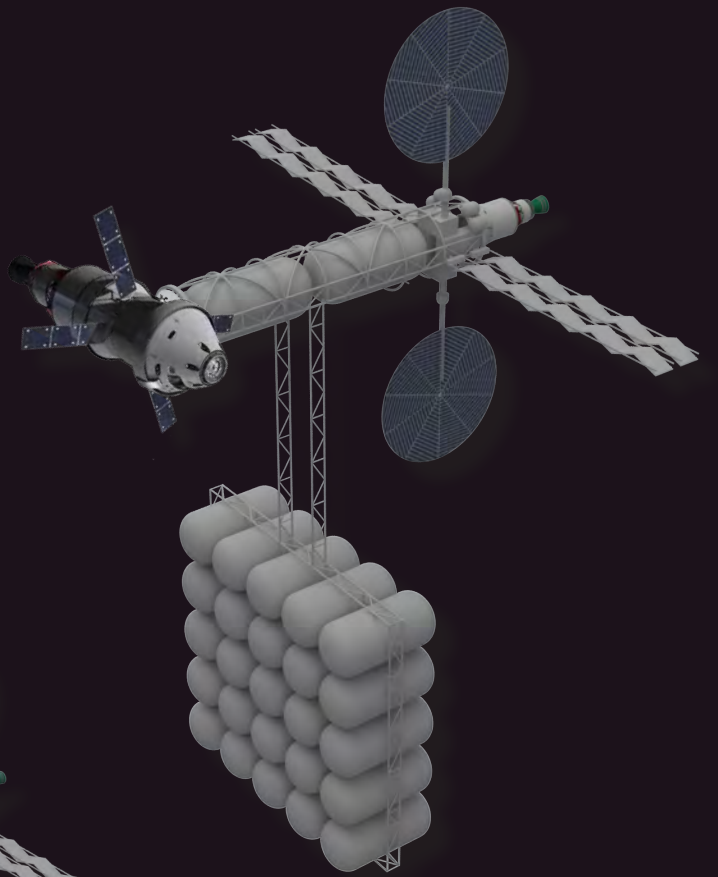
Production or research requiring absolute isolation





Fuel depot:

Fuel station and deposit



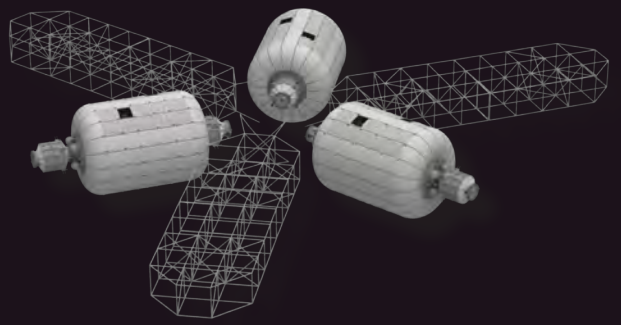
Orion MPCV courtesy of NASA

Cluster 2

Workforce: 170 people

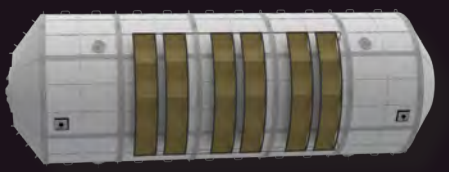
Mestre

Systems engineering, backup systems, control center



Colombo, Vespucci, Polo

Shipyard and maintenance workshops, warehouse.



Ufficio

Administrative offices and housekeeping

Command

Command center, bridge, customs, airlock and ceremonial venue

Guglie

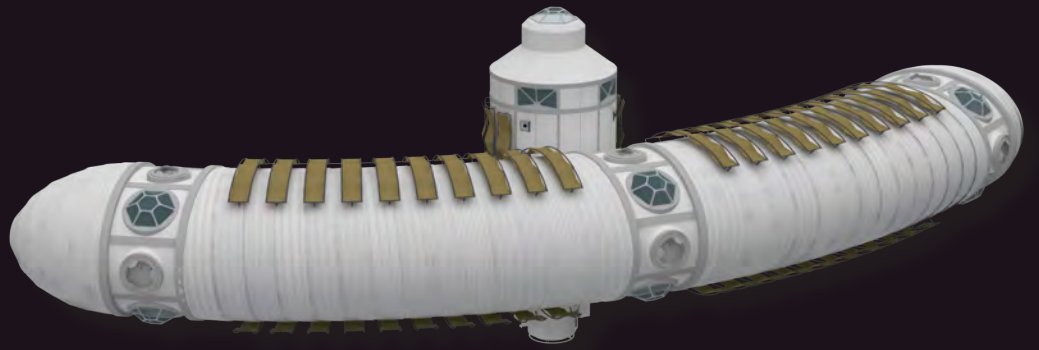
Transformers, electric panels and batteries, airlock

Rialto

Node, welcome center

Solarium

Space gazing, emergency escape

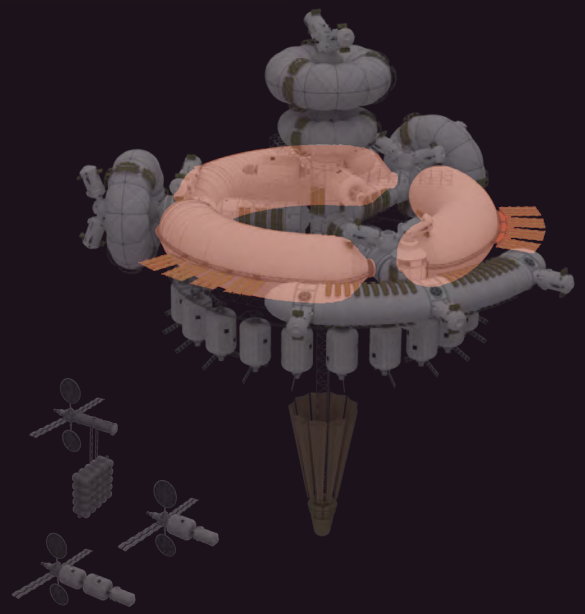


Porto:

Spaceport, cargo bays, security, brig, morgue

Cluster 3

Workforce: 45 people
Users: 400 people

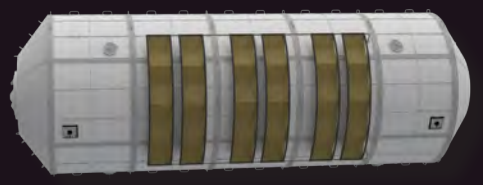


Murano, Giudeca, Lido

Community Islands
Living, wellness,
entertainment and tourismW

Cluster 4

Workforce: 110 people



Galileo, Cassini

Leased chambers

Paglia, Scalzi

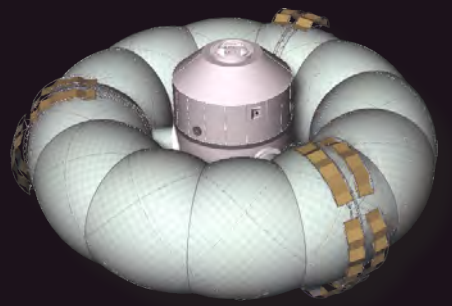
Nodes and leased chambers

Vaporetto

Pressurized cabs

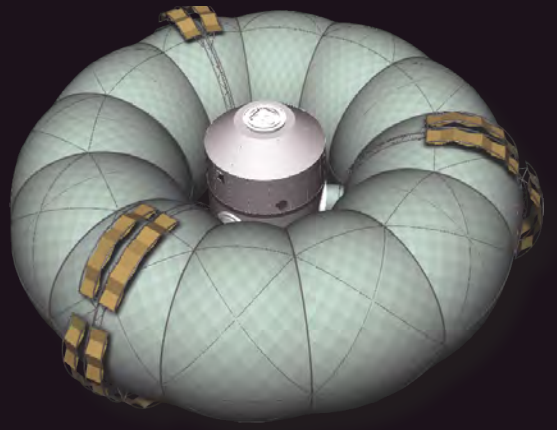
Industrial Belt

Leased modules



Laguna

Water treatment plant and fish culture



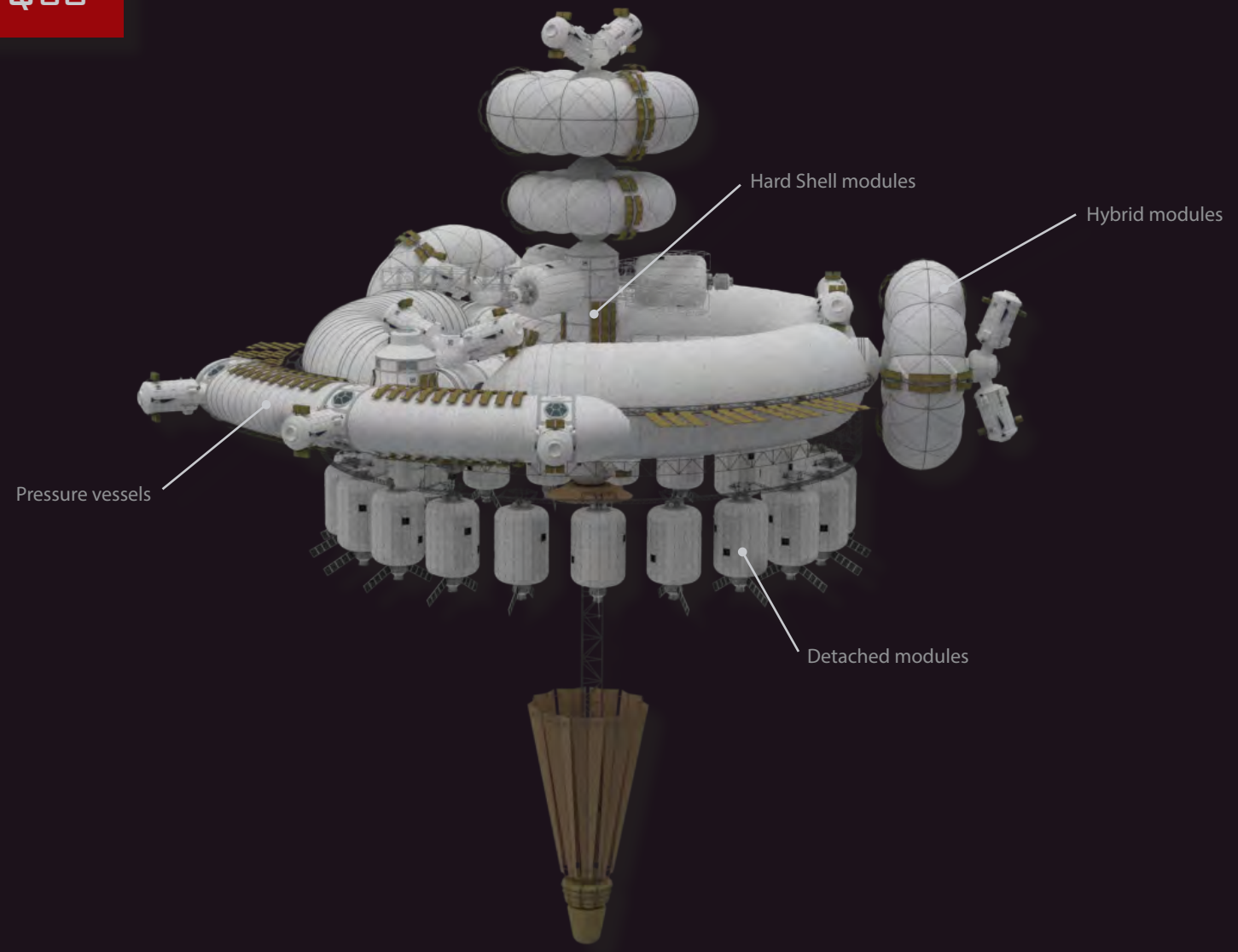
Sicilia, Asti, Campania

Green houses, Food processing and packaging, waste management

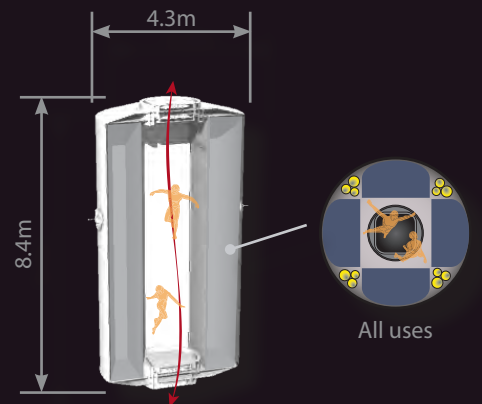
Solarium

Space gazing, emergency escape

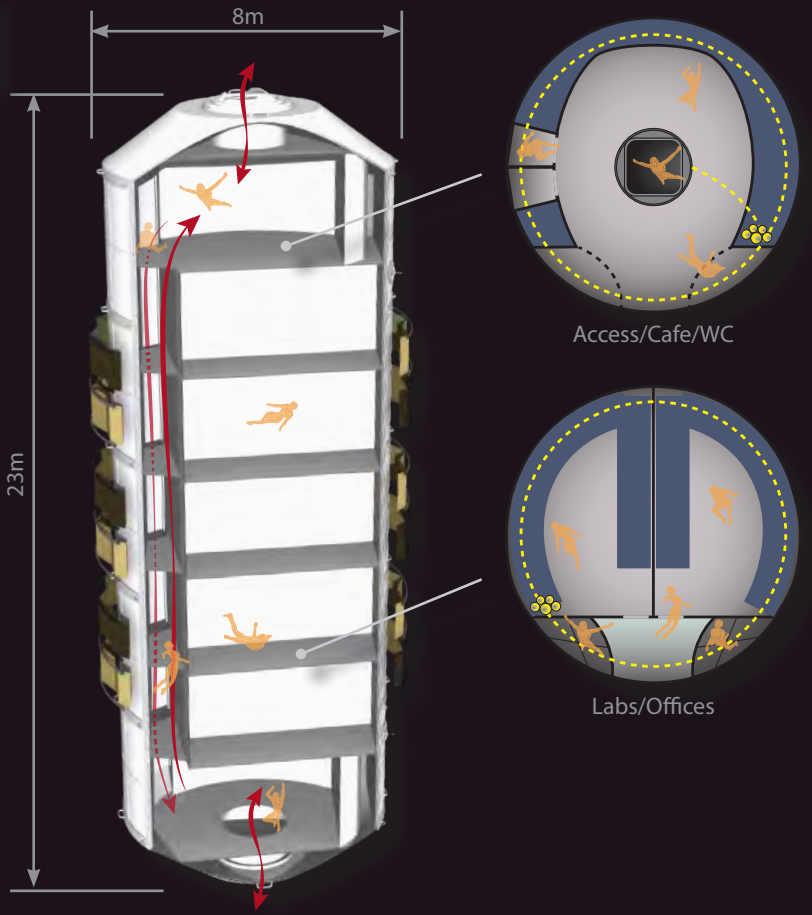
Breaking the Status Quo



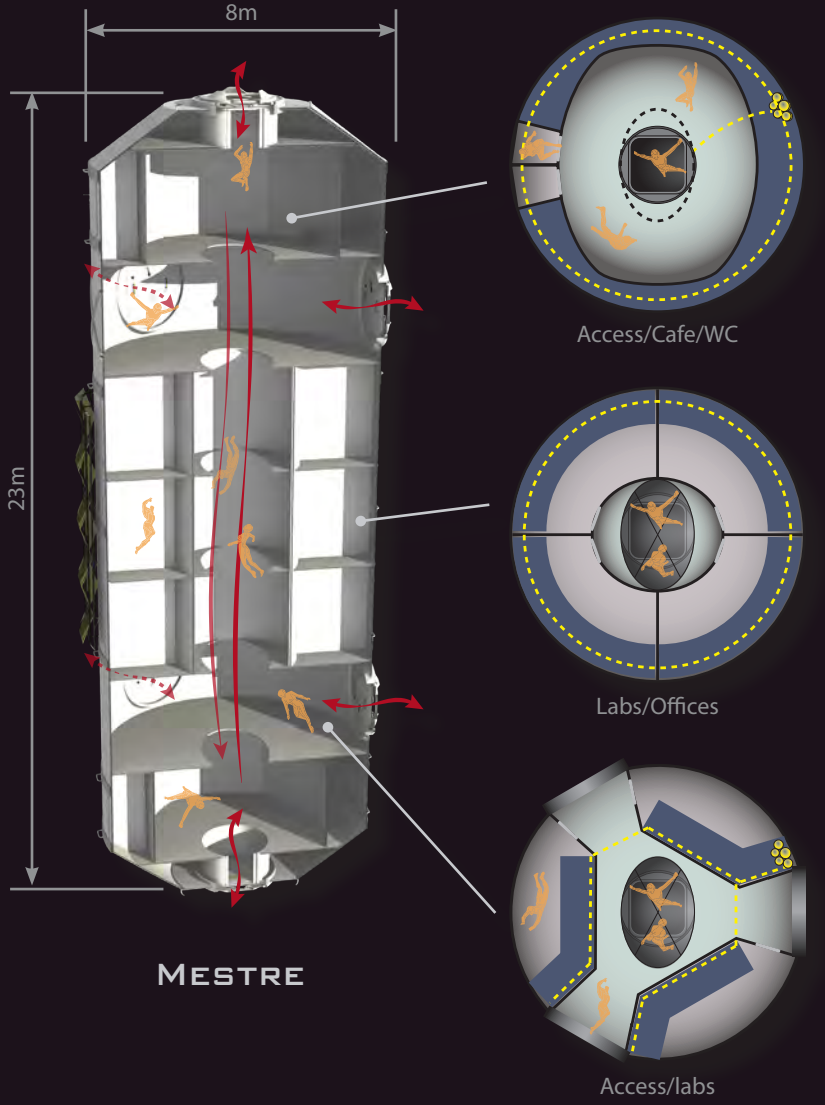
Hard Shell Modules



ISS Destiny Module



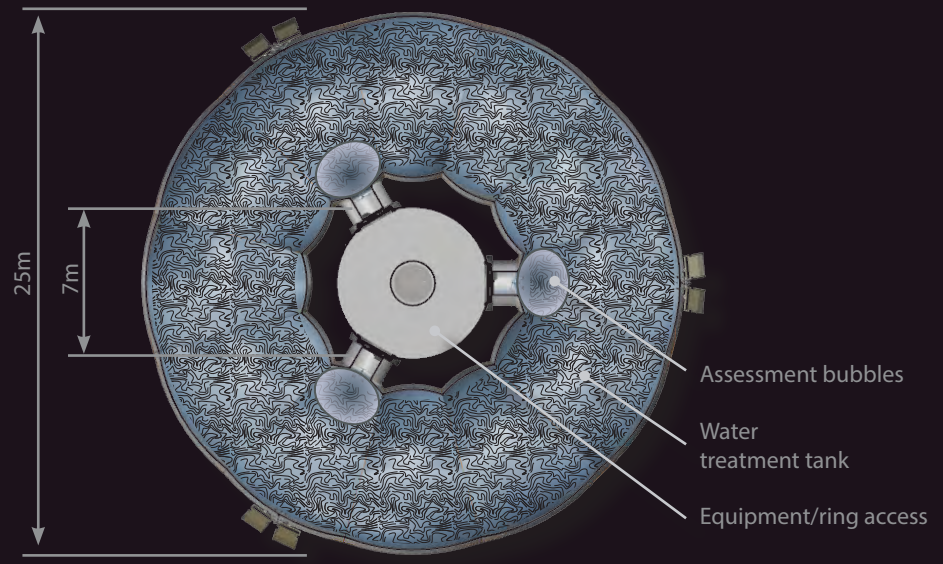
Ufficio, Galileo, Cassini

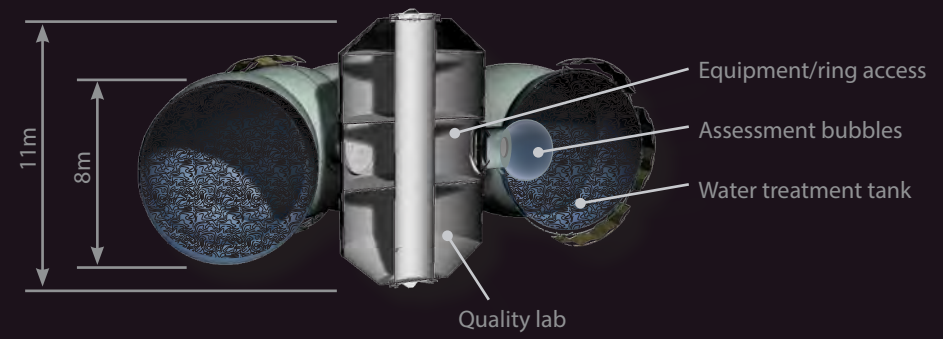


Mestre

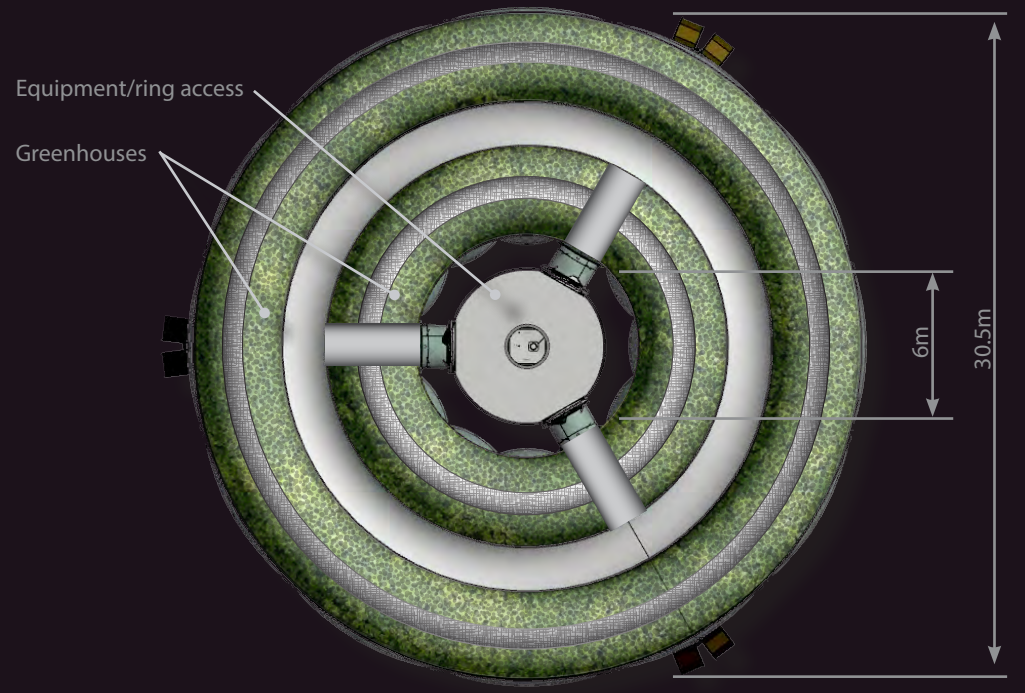
Chamber
Equipment
Utility run
People
Utility run
Circulation

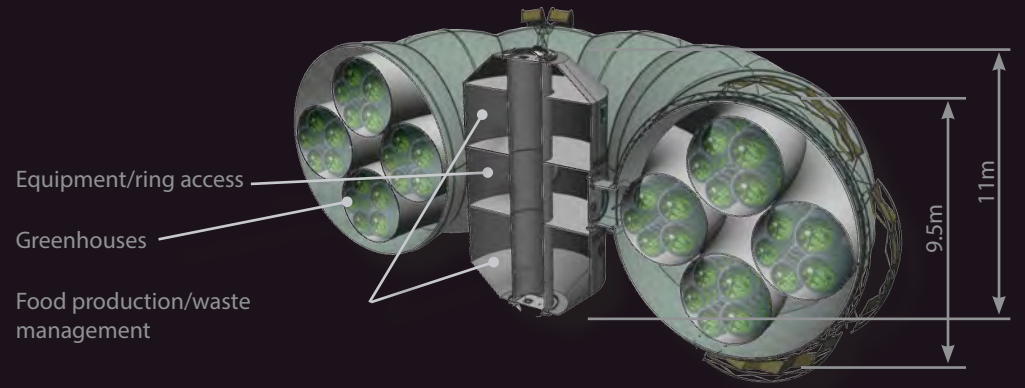
Hybrid modules





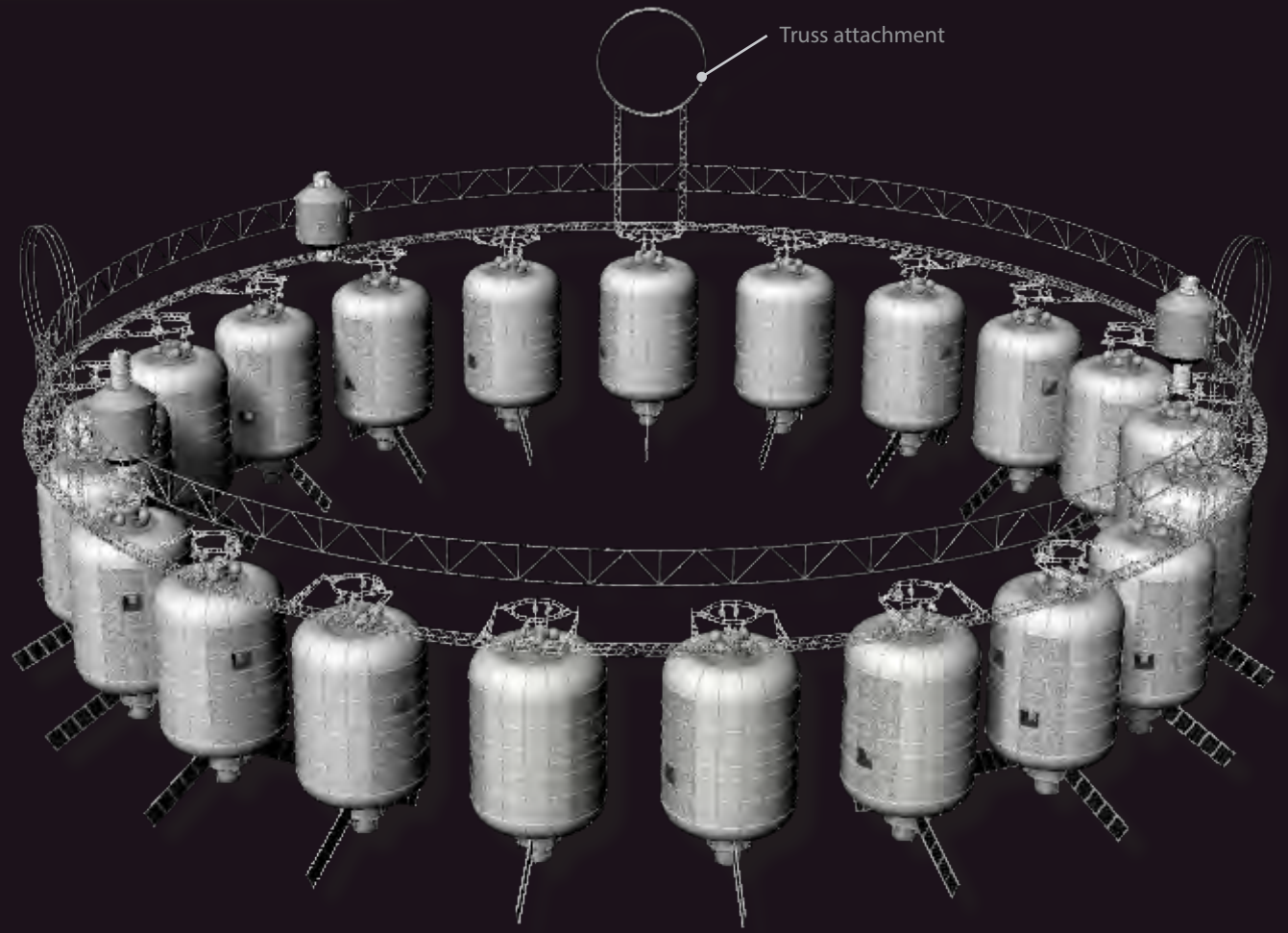
Laguna





Sicilia, Asti, Campania

Detached modules

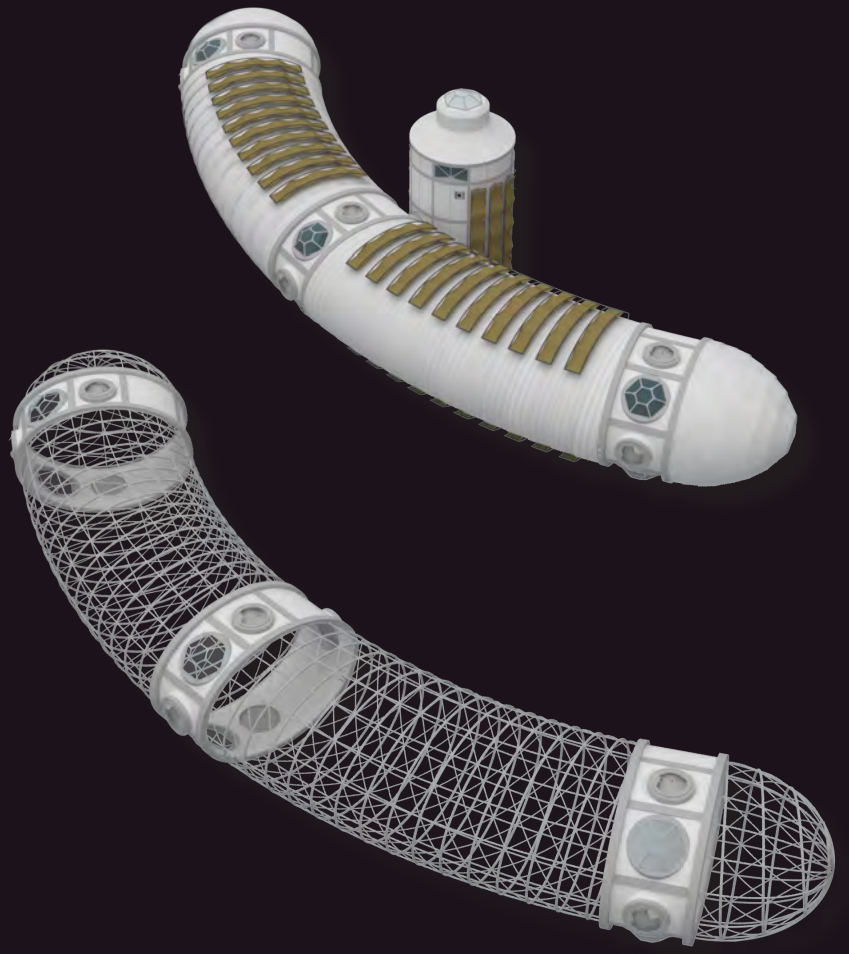


21 Inflatable modules similar to
B330 arranged in a ø 77m circle

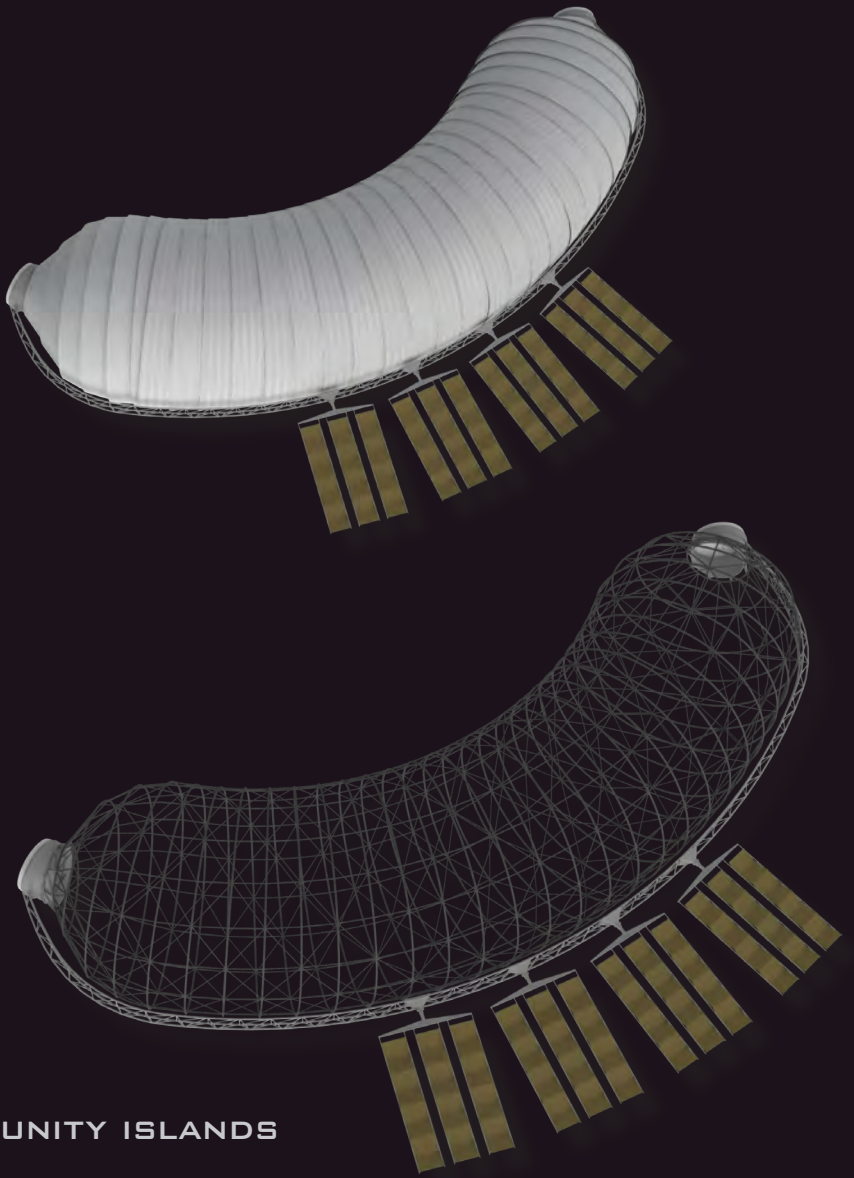
3 Vaporetto cabs
circling around the belt

Industrial belt

Pressure Envelopes

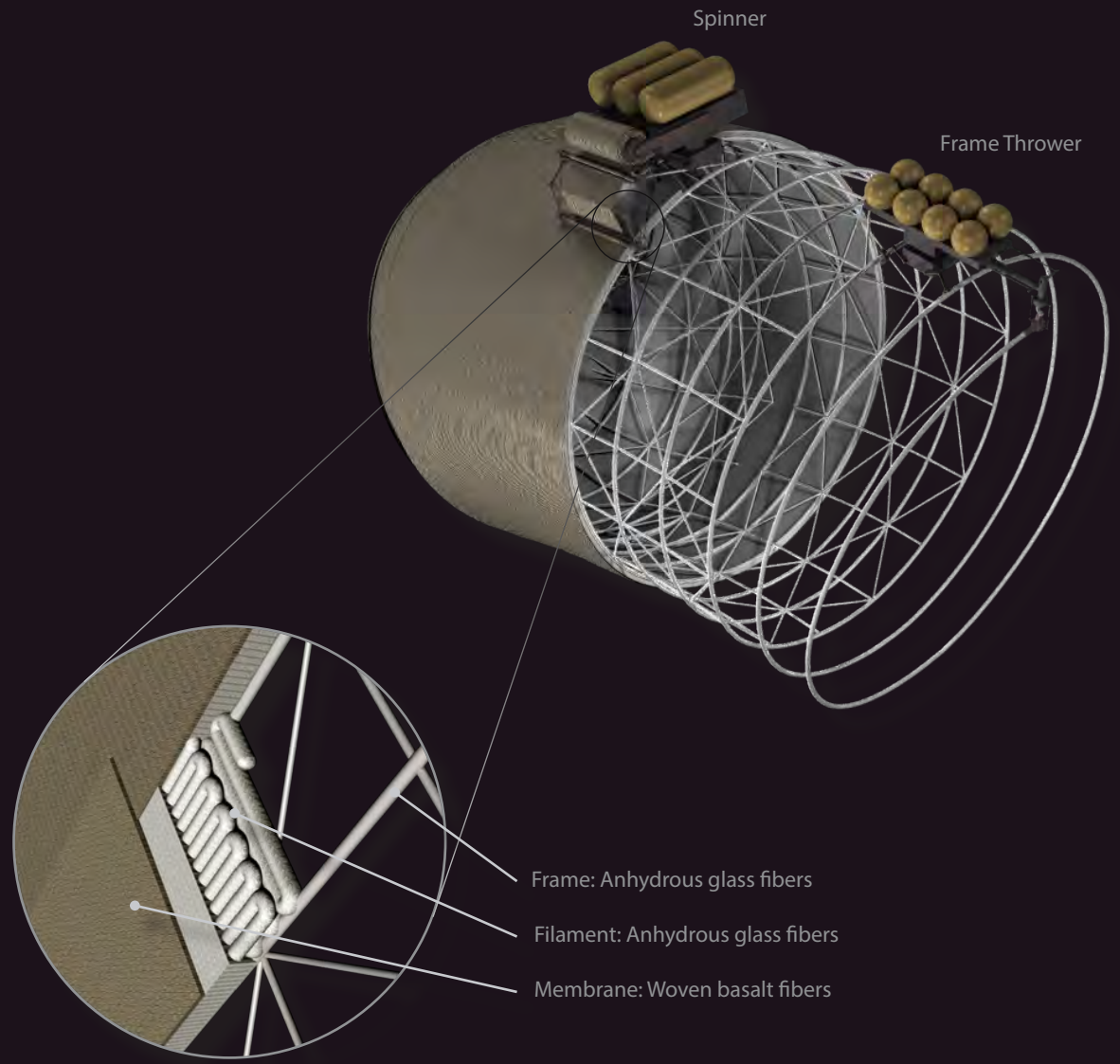


Spaceport

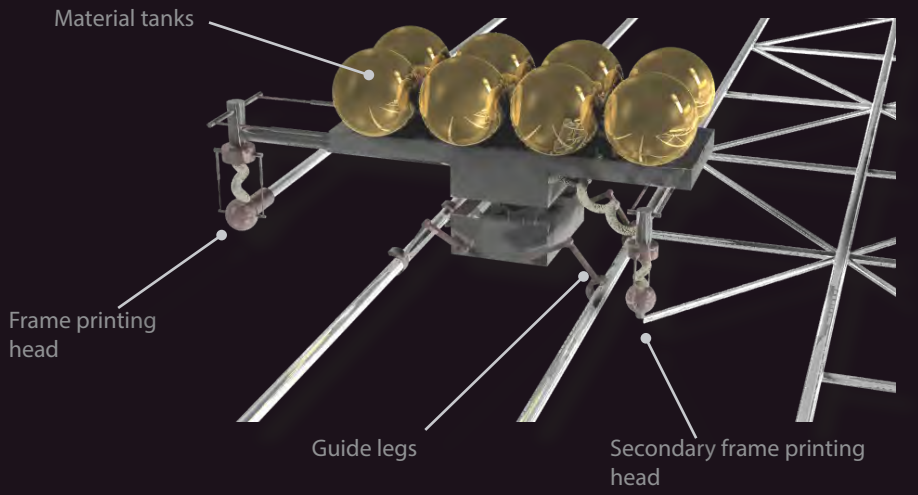


Community islands

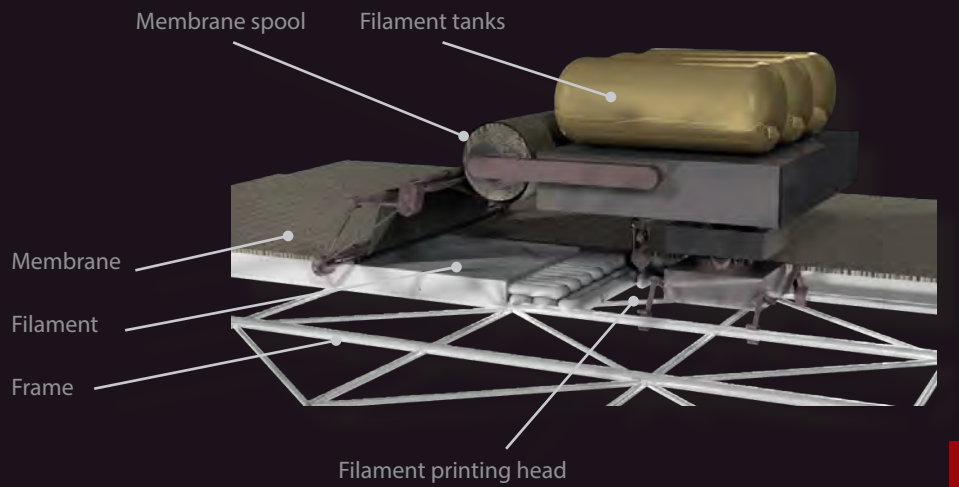
Pressure Envelopes



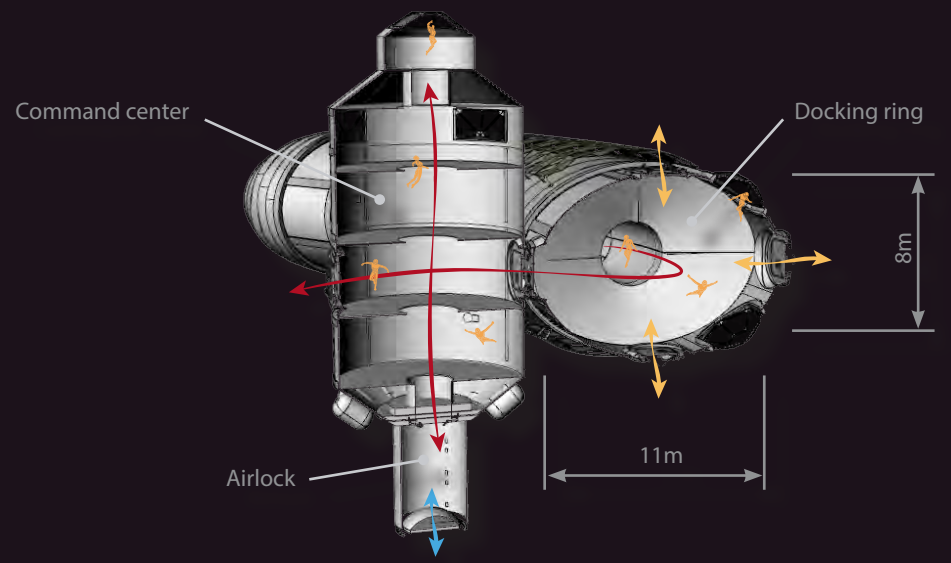
Frame Thrower



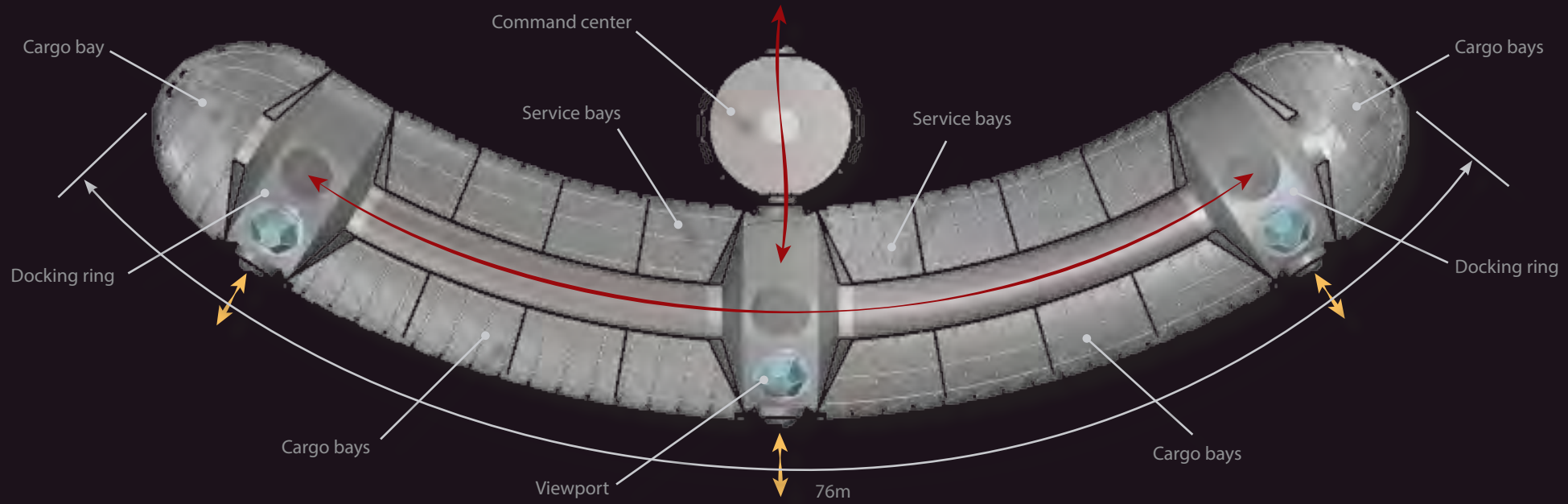
Spinner



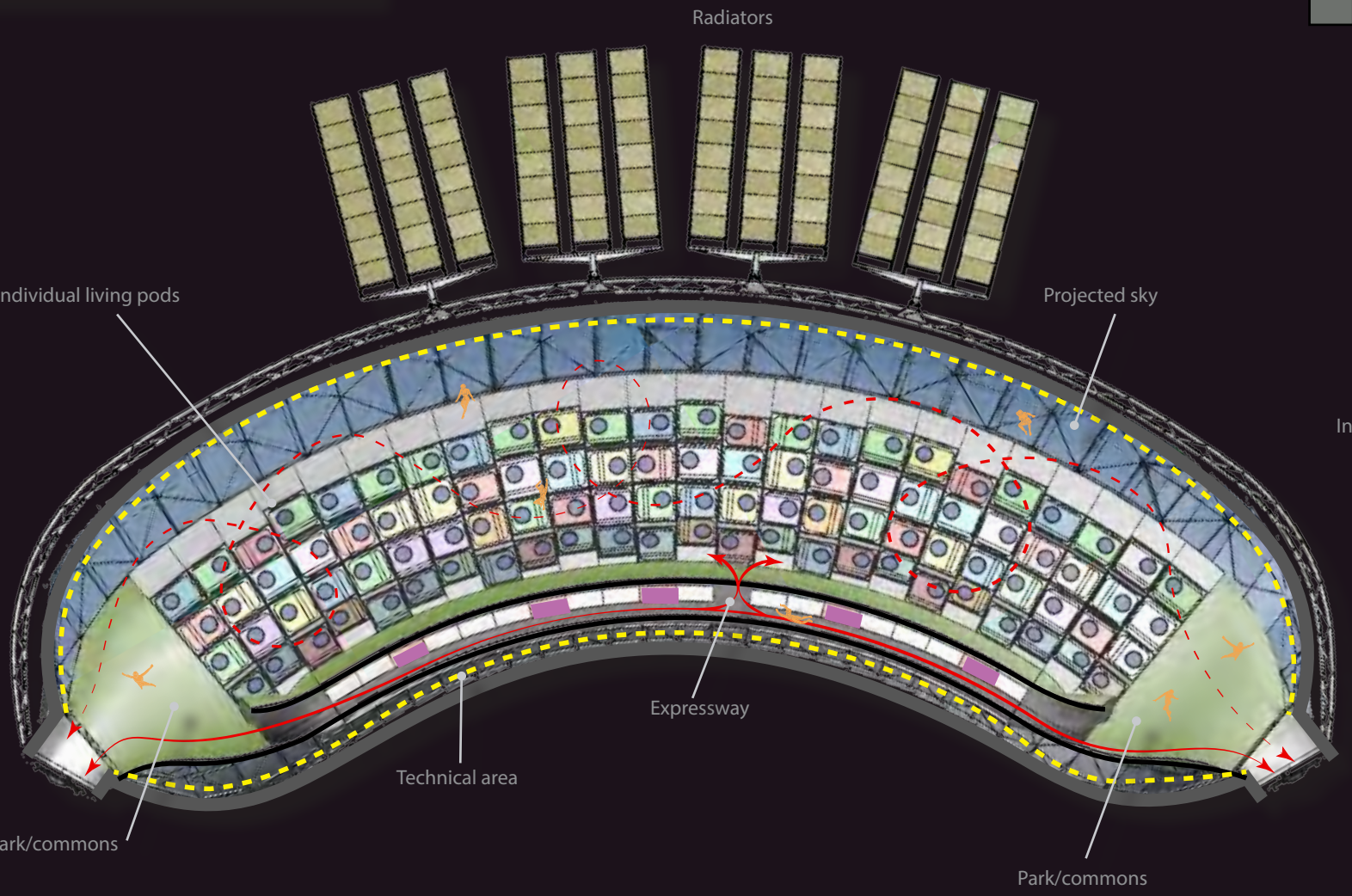
Spaceport



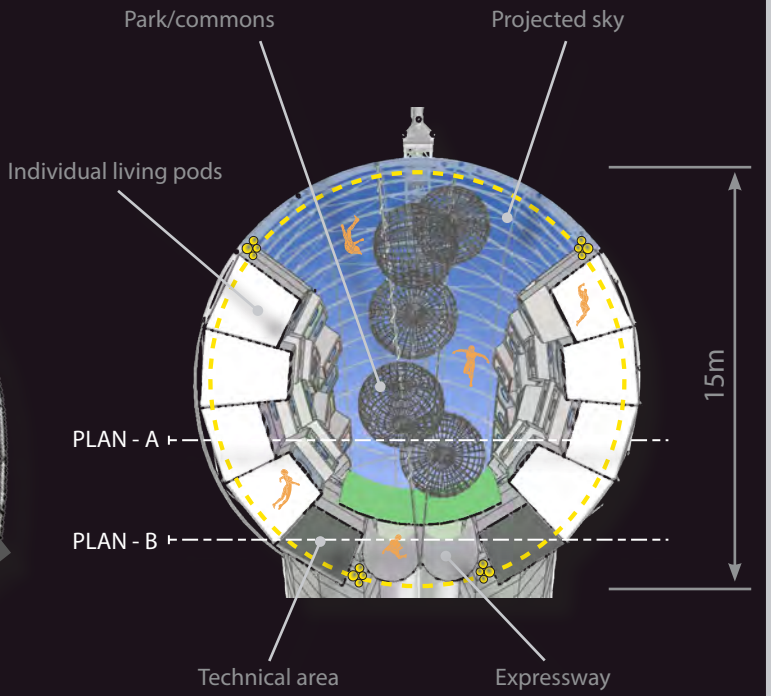
People
Docking
Circulation
Airlock



Community Island

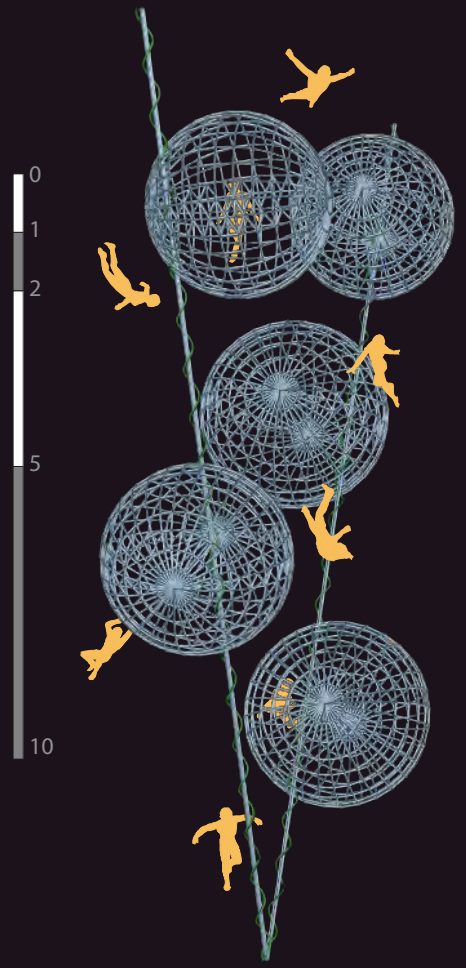


Toilets
Service/technical
Utility run
People
Utility run
Circulation

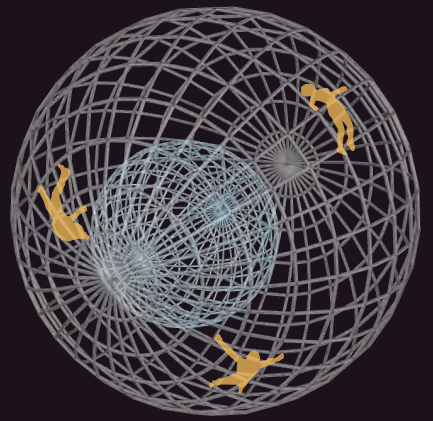


Arc length 76m

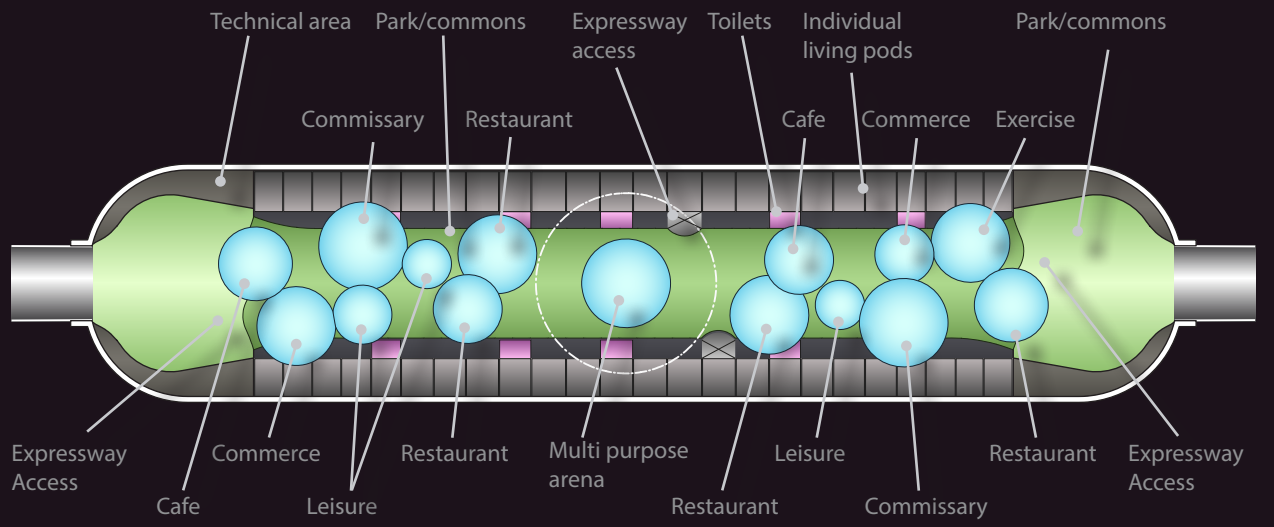
Life in the Community



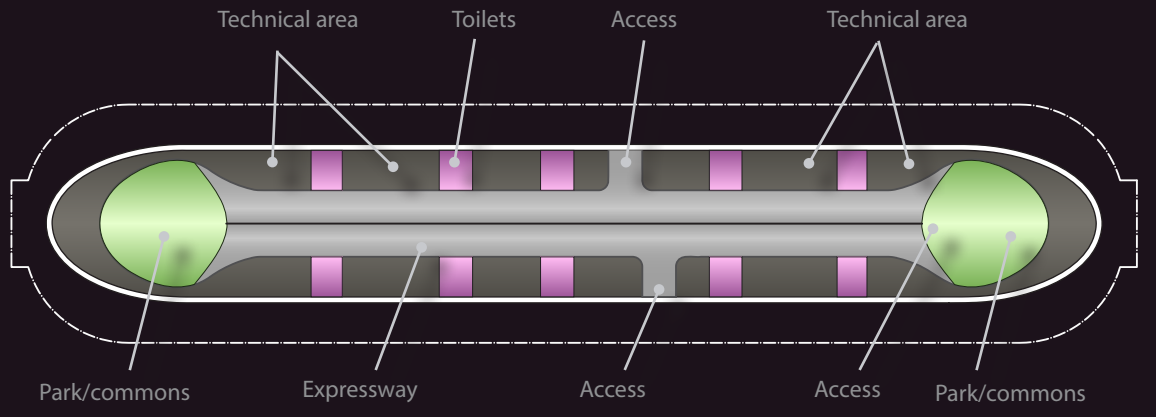
Frame Spheres for community activities such as: Commerce, restaurants, cafes, exercise, leisure.



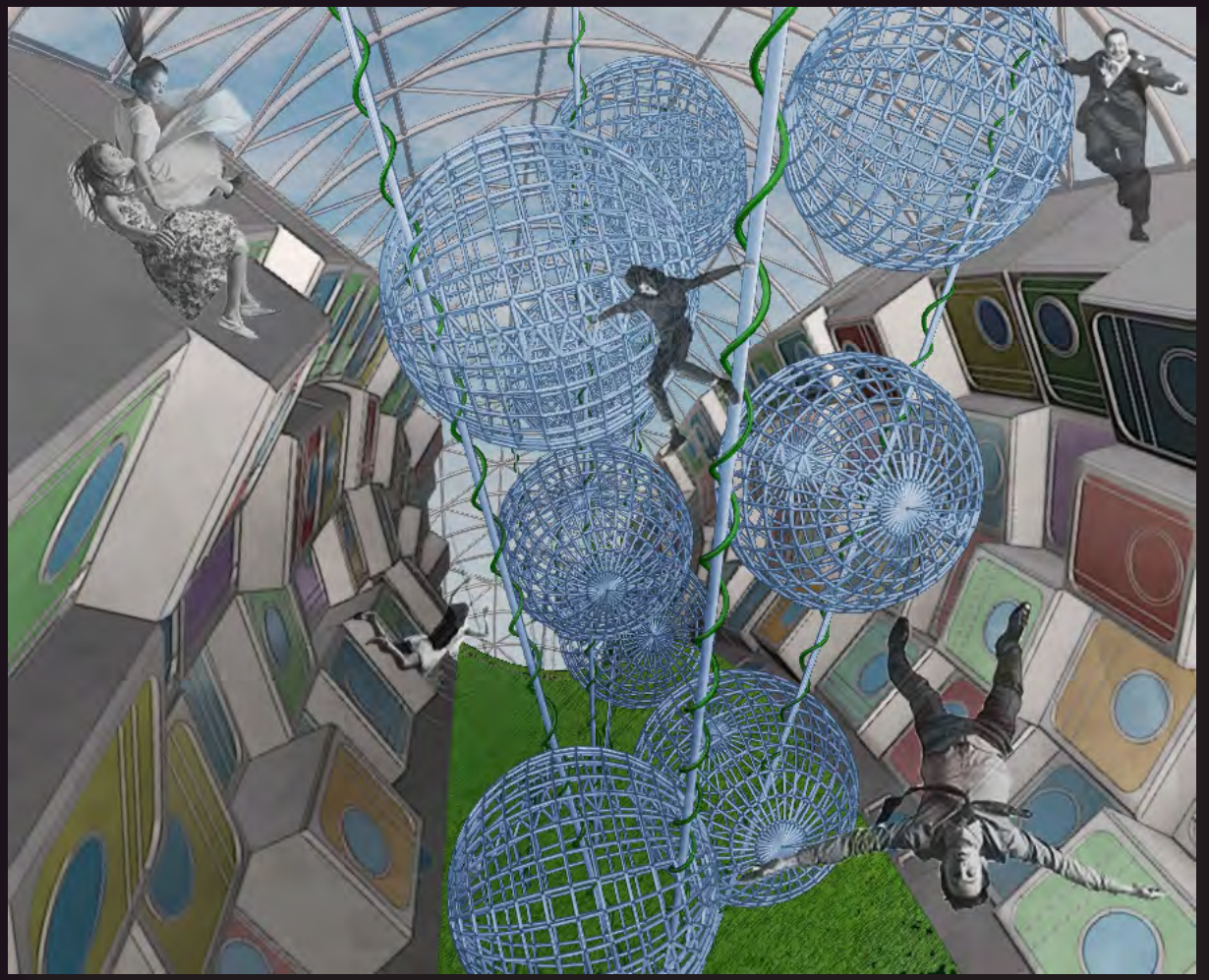
Multi-purpose arena
Expands to allow multiple types of activities such as: space sports, performances, space experience, training, public gatherings.

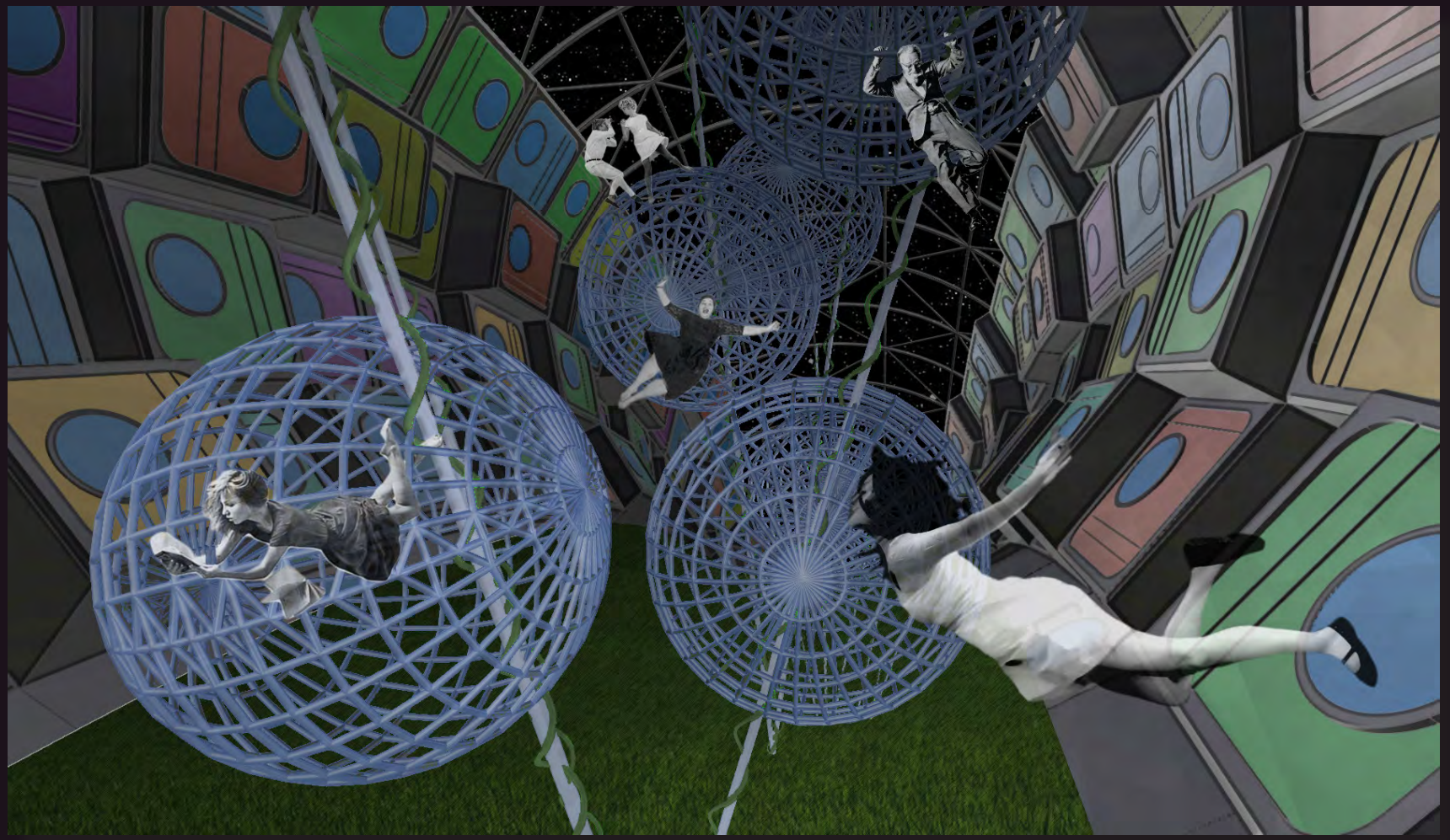


Plan - A

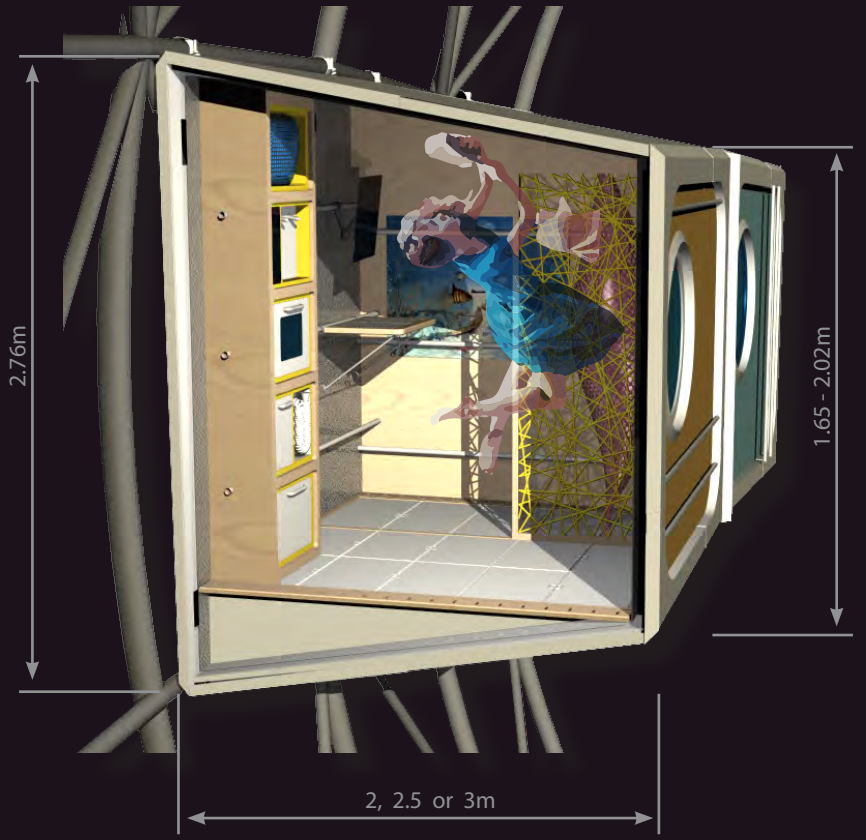


Plan - B





Individual Living Pods

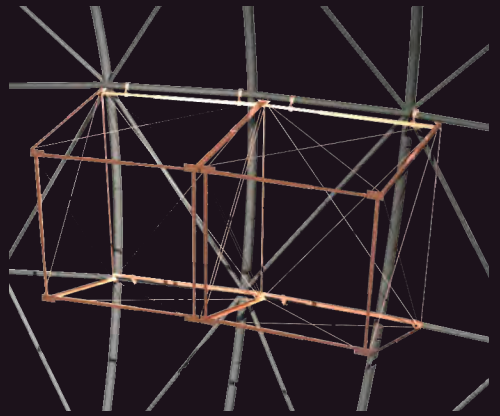


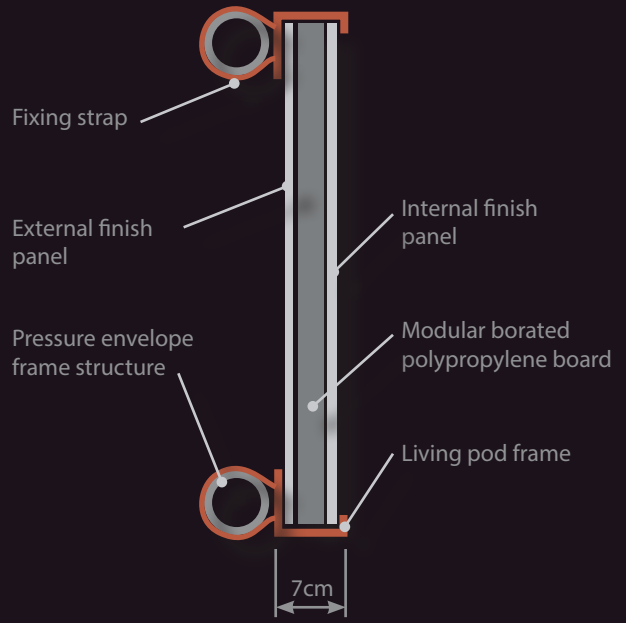
Volume: 8.30m^3 - 14m^3

ISS volume ~3m^3

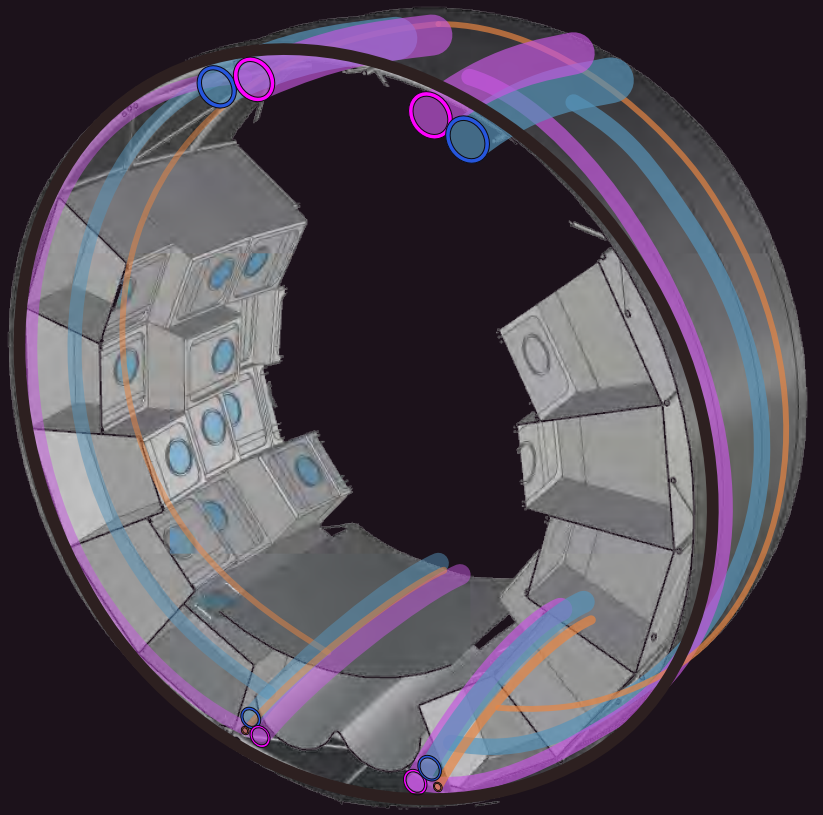
192 single pods/Island

576 single pods total



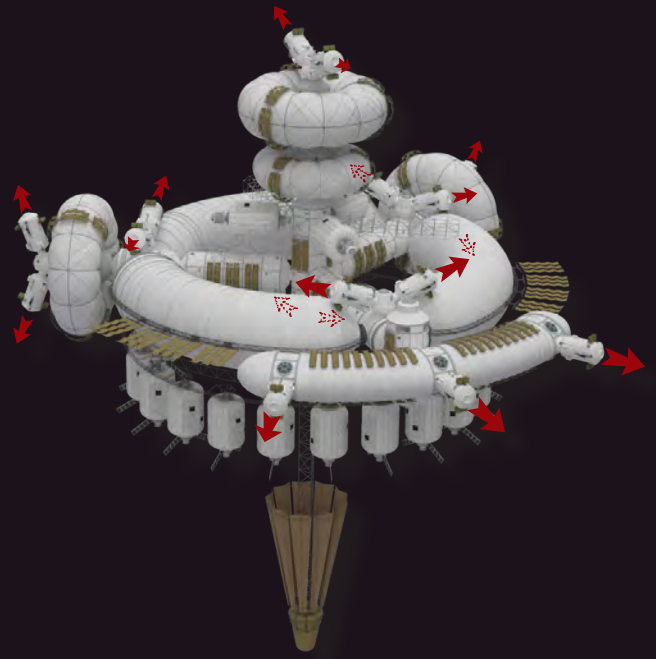


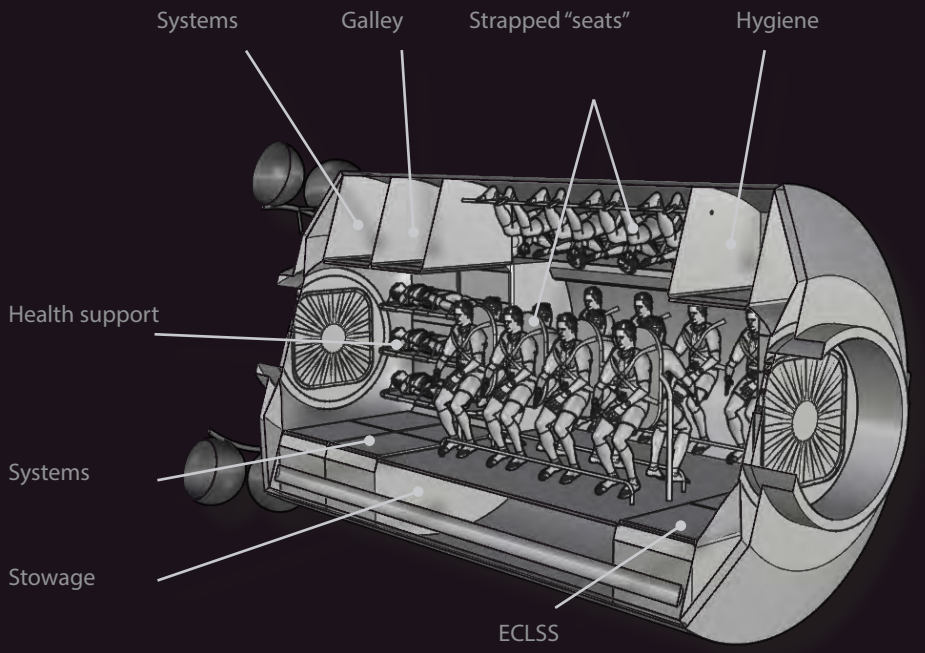
Living pod frame



Utilities distribution

Emergency Egress





Deployed

Undeployed

17 Emergency escape vehicles

24 "seated" people
+ 3 people in health support

Autonomous standby for up to 6 days

Conclusion

Problem 1

How to incorporate micro-gravity in comfortable, stimulating living environments, breaking free from the usual concepts of either adapting Earth to space or Humans to machines?

- Abandon the minimalistic design approach that provides only the bare minimum for the astronauts.
- Space is a harsh enough environment - the space habitats don't have to be.
- Create large open spaces to allow different internal configurations.
- Create visual diversity by making use of architectural design principles.
- Break monotony in the design by incorporating unusual elements.
- Play with the possibilities - there is no gravity, make use of that!
- Maintain a good balance of private/ public spaces.

Problem 2

How to cater to the great diversity of functions and uses, each with its unique requirements, restrictions and peculiarities without interfering with each other?

- Define clear functional allocation to avoid interference.
- Utilize detached modules to avoid direct contact with outpost, but affording shirt-sleeve transfers through pressurized cabs.
- Have module diameter large enough to allow private areas to be closed off.
- Create specific spaces for living/exercise/recreation to keep people off the restricted areas.
- Create clear public pathways through each module.

Problem 3

How to change the status quo of space station assembly based on chamber-to-chamber/corridor environments?

- Use modules with larger diameter, launch them using new generation rockets such as the SLS.
- Use different types of modules - hard shells, inflatables, hybrids, pressure vessels to allow flexible station configurations.
- Further develop the pressure vessel concept to build in space.
- Further develop the detached module concept to make networks of modules not directly connected to each other.


Thank You!

ISS Module

Destiny laboratory:

Primary research laboratory for U.S. payloads, supporting a wide range of experiments and studies contributing to health, safety, and quality of life for people all over the world

Material Science Research Rack

Exercise
Cycle Ergometer

Crew health care system

Window Observational Research Facility

Laboratory freezer

Micro-gravity science glove box

Combustion integrated Rack

Fluids integrated Rack

Robotics workstation

Critical circulation path:
Labs > logistics
Crew quarters > galley and toilets
International modules > Russian modules

A

Image courtesy of JPL-NASA

Program

						Users of the area		
	Sector	Market	Sub service	Operator	Final Client	Types	Large scale Automation	Facilities required
Industries - economic activities	1 - Space mobility	Shipyard	Fuel depot	Venice	Space missionsVenice fleet	Spaceships crew, operators	Automated	Fuel station
			Mechanical: maintenance/ repair / sattelite deployment	Venice	Space missionsVenice outpost	Spaceships crew, operators, maintenance team	Robotic arm, Space tugs, airlock	Control roomGarageMaintenance bayWarehouseToolshop
			Spacecraft assembly	Venice	Spacecraft companies	Construction team	Robotics	Construction bayWarehouse
		Spaceport	Planetary spaceport	Venice	Earth/cislunar missionsVenice outpost	Crews, residents, tourists	no	TerminalDocking port
			Interplanetary spaceport	Venice	Deep Space missions	Crews, tourists	no	TerminalDocking port
			Cargo terminal	Venice	Space missionsVenice outpost	Crews, operators	Automated	Cargo bays (10)
			Space traffic control	Venice	Space missionsVenice outpost	Traffic controllers	no	Control center
	2 - Production	Manufacturing	Pharmaceuticals	External	Other players	Technicians	Robotics	Facility
			Crystal growth	External	Other players	Technicians	Robotics	Facility
			nanostructures	External	Other players	Technicians	Robotics	Facility
			Spacecraft components	External	Spacecraft companies	Operators	Robotics	Large facility
			Textiles (composites)	External	Other players	Technicians	Robotics	Facility
		Material processing	Raw material processing	External	Other players	Technicians	Robotic	3 processing plants
		Food/Water	Food production	Venice	Space missionsVenice outpost	Food preppers, food growth workers	Automated	Food prep and Package facilityGreenhouse facilities
			Water production	Venice	Space missionsVenice outpost	Operators	Automated	Water plants
		Energy	Power generation/ exporting	Venice	Space missionsVenice outpost	Operators	Automated	Power plantBattery/ storage areas
	3 - Research	Education	University	External	Universities/ InstitutesVnice outpost	Instructors, students	no	Multi purpose space/classroom
			Zero G training	External	Space missionsVenice outpost	Instructors, trainees	no	Multi purpose space/classroom
		Research	Science	External	Other players	Scientists	no	3 Labs
			Technology	External	Other players	Scientists	no	3 Labs
			Institutional	External	Other players	Scientists	no	2 Labs
			Health	External	Other players	Scientists	no	2 Labs
		Health	Space technology treatment	External	Other players	Doctors, visiting patients	no	3 facilities
	4 - Entertainment	Hotel	Hotel	External	Tourists	Hotel personnel, tourists	no	Hotel facility
		Sports	Space sports	External	Tourists/ Venice Outpost	Players, spectators	no	Multipurpose sports venue/ arena
		Cerimonial	Marriage	External	Tourists/ Venice Outpost	Cerimonialist, couple, spectators	no	Ecumenic chapel/ venue
			Burial	External	Tourists/ Venice Outpost	Cerimonialist, body handling personnel, family	no	Ecumenic chapel/ venueBody prep facilityCrematoryAirlock (?)
		Space experience	Zero g/playground	External	Tourists	Tourists, people in general	no	Earh gazing facilityZero-G playground
		Film studio	Film studio	External	Other players/ Venice Outpost	Film crews, actors	no	Large multipurpose area
Support activities	5 - Community	Housing	Housing	Venice	Venice Outpost	Residents	no	Resident quartersVisitor qurtersHygiene areas
		Wellness	Medical	Venice	Venice Outpost	Residents, health workers	no	Medical bay
			Fitness	Venice	Venice Outpost	Residents, phys ed professional	no	Exercise facility
			Eating	Venice	Venice Outpost	Residents, service	no	Meal prep facilityMess hall
		Leisure	Commerce	Venice	Venice Outpost	Residents, clerks	no	MarketplaceShopsBar
			Cultural	Venice	Venice Outpost	Residents	no	Theater/auditoriumLibrary/ Media
			Recreation	Venice	Venice Outpost	Residents	no	Games rooms/ Virtual reality
			Parks	Venice	Venice Outpost	Residents	no	Park facility
	6 - Adminis	Administration	Administration	Venice	Venice Outpost	Personnel	no	OfficeData serversCommunication hubs
		Operations	Operations	Venice	Venice Outpost	Deck Personnel	no	BridgeAvionics control centerPropulsion system hardware
			Engineering	Venice	Venice Outpost	Personnel	no	Office
			Systems	Venice	Venice Outpost	Personnel	no	OfficeControl room
	7 - Logistics	Maintenance	Maintenance/ Repair	Venice	Venice Outpost	Personnel	SpacetugRobotic arm	Control roomGarageMaintenance bayWarehouseToolshop
			Housekeeping	Venice	Venice Outpost	Personnel	no	StorageHousekeeping bay
		Supply	Supply/distribution	Venice	Venice Outpost	Personnel	no	Cargo bays
		Security	Security	Venice	Venice Outpost	Personnel / inmates	no	Brig
		Mobility	Internal circulation	Venice	Venice Outpost	Everyone (all 400 users)	Automated	Transport hubs and cabs

B

Relationship matrix

Sector	Sub service 0- No relationship 1- Should stay away 2- Should be close 3- Should be connected 4- Can share the same space	1 - Space mobility						2 - Production									3 - Research							4 - Entertainment							5 - Community								6- Administration				7 - Logistics				
		Fuel depot	Mechanical: maintenance/ repair / sattelite deployment	Spacecraft assembly	Planetary spaceport	Interplanetary spaceport	Cargo terminal	Space traffic control	Pharmaceuticals	Crystal growth	nanostructures	Spacecraft components	Textiles (composites)	Raw material processing	Food production	Water production	Power generation/ exporting	University	Zero G training	Science	Technology	Institutional	Health	Space technology treatment	Hotel	Space sports	Marriage	Burial	Zero g/playground	Film studio	Housing	Medical	Fitness	Eating	Commerce	Cultural	Recreation	Parks	Administration	Operations	Engineering	Systems	Maintenance/ Repair	Housekeeping	Supply/distribution	Security	Internal circulation
1 - Space mobility	Fuel depot		2	2	2	2	2	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	2	0	0	2	0	2	0	3
	Mechanical: maintenance/ repair / sattelite deployment			2	2	2	2	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	2	0	4	2	2	0	3
	Spacecraft assembly				0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	2	0	3
	Planetary spaceport					4	3	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	2	2	2	3
	Interplanetary spaceport						3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	0	0	0	0	0	1	1	1	1	1	1	1	0	2	2	2	0	2	2	2	3
	Cargo terminal							3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	2	2	2	0	2	3	2	3
	Space traffic control								0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	2	2	2	2	0	2	2	2	3
2 - Production	Pharmaceuticals									2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	2	0	3
	Crystal growth										2	2	2	1	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	2	0	3
	nanostructures											2	2	1	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	2	0	3
	Spacecraft components												2	1	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	2	0	3
	Textiles (composites)													1	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	2	0	3
	Raw material processing														1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1
	Food production															2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	2	2	0	3
	Water production																2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	2	2	0	3
	Power generation/																	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	2	0	3
3 - Research	University																		2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	2	0	3
	Zero G training																			2	2	2	2	2	1	4	1	1	4	4	1	1	1	1	1	1	1	0	0	0	0	0	0	2	0	3
	Science																				2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	2	0	3
	Technology																					2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	2	0	3
	Institutional																						2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	2	0	3
	Health																							3	1	1	1	1	1	1	1	3	1	1	1	1	1	0	0	0	0	0	0	2	0	3
	Space technology																								2	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	2	0	3
4 - Entertainment	Hotel																									2	2	2	2	2	0	0	0	2	2	2	2	0	0	0	0	0	0	2	0	3
	Space sports																										2	2	4	4	2	2	2	0	0	0	2	0	0	0	0	0	0	2	0	3
	Marriage																											4	2	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3
	Burial																												2	2	0	2	0	0	0	0	0	0	0	0	0	0	2	0	3
	Zero g/playground																													4	0	0	2	0	0	0	2	0	0	0	0	0	2	0	3
	Film studio																														0	0	0	0	2	2	2	0	0	0	0	0	2	0	3
5 - Community	Housing																															2	3	3	3	3	3	2	0	0	0	0	2	2	2	3
	Medical																																2	2	2	2	2	2	0	0	0	0	2	2	2	3
	Fitness																																	2	3	3	4	4	2	0	0	0	0	2	2	2	3
	Eating																																		3	3	3	3	2	0	0	0	0	2	2	2	3
	Commerce																																			3	3	3	2	0	0	0	0	2	2	2	3
	Cultural																																				3	3	2	0	0	0	0	2	2	2	3
	Recreation																																					3	2	0	0	0	0	2	2	2	3
	Parks																																						2	0	0	0	0	2	2	2	3
6 - Administration	Administration																																							2	2	2	0	2	2	2	3
	Operations																																								2	2	2	2	2	2	3
	Engineering																																									2	2	2	2	2	3
	Systems																																										2	2	2	2	3
7 - Logistics	Maintenance/ Repair																																										2	2	2	3
	Housekeeping																																											2	2	3
	Supply/distribution																																												2	3
	Security																																													3
	Internal circulation																																													

0 No relationship
1 Should stay away
2 Should be close
3 Should be connected
4 Can share the same space

C

Requirement Matrix

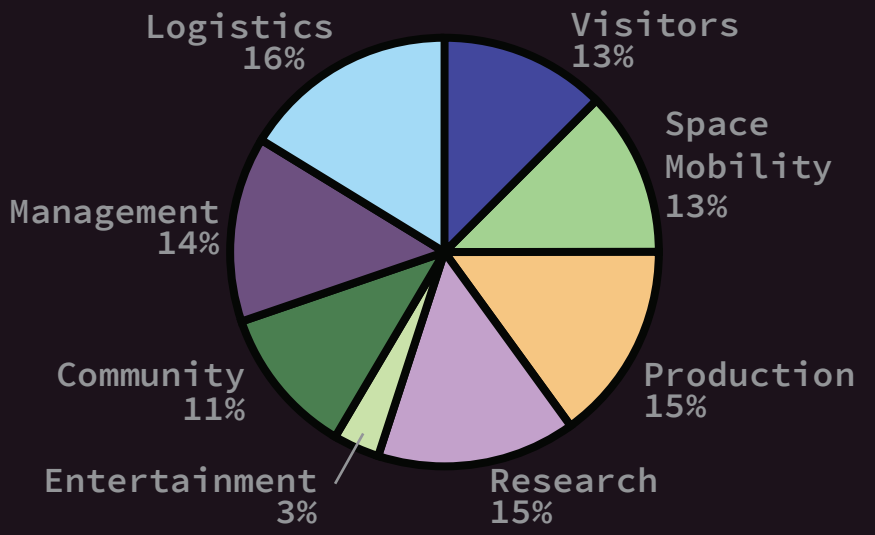
Sector	Does the function individually require this? 0 - No, it doesn't require it at all 1 - No, can feed off the station 2 - Yes, needs it on the module 3 - Yes, needs one just for itself	Systems requirements									Facility requirements							
		Power	Navigation & attitude control	Propulsion	Thermal control	Utilities distribution (water, energy, data, oxygen, other specifics)	Communications	External servicing capabilities	MMOD	ECLSS	Airlock (human or larger)	Multiple docking	Large volume	Vibration mitigation	Vaccuum exposure	People flux control	Dual egress	Radiation protection
1 - Space mobility	Fuel depot	2	2	2	2	2	2	2	2	0	0	3	3	2	0	0	2	1
	Mechanical: maintenance/ repair / sattelite deployment	2	1	1	2	2	2	2	1	1	3	2	3	2	0	0	2	1
	Spacecraft assembly	2	1	1	2	2	2	2	1	1	3	2	3	2	0	0	2	1
	Planetary spaceport	1	1	1	2	2	2	2	1	1	2	3	2	2	0	2	2	1
	Interplanetary spaceport	1	1	1	2	2	2	2	1	1	2	3	2	2	0	2	2	1
	Cargo terminal	1	1	1	2	2	2	2	1	1	3	3	3	2	0	0	2	1
	Space traffic control	1	1	1	1	2	3	1	1	1	0	0	0	0	0	0	2	1
2 - Production	Pharmaceuticals	1	1	1	1	2	2	1	1	1	0	0	0	2	0	1	2	2
	Crystal growth	1	1	1	1	2	2	1	1	1	0	0	0	2	2	1	2	2
	Nanostructures	1	1	1	1	2	2	1	1	1	0	0	0	2	2	1	2	2
	Spacecraft components	1	1	1	1	2	2	1	1	1	3	2	0	2	2	1	2	2
	Textiles (composites)	1	1	1	1	2	2	1	1	1	0	0	0	2	2	1	2	2
	Raw material processing	2	3	3	2	2	2	2	2	2	2	2	2	3	2	1	2	2
	Food production	3	1	1	3	2	2	1	1	3	0	0	3	2	0	1	2	2
	Water production / waste treatment	3	1	1	3	2	2	1	1	1	0	0	2	2	0	1	2	2
	Power generation/ exporting	3	2	2	3	2	2	1	2	0	0	0	2	2	2	1	2	2
3 - Research	University	1	1	1	1	2	2	1	1	1	0	0	0	2	0	1	2	2
	Zero G training	1	1	1	1	2	2	1	1	2	0	0	2	2	2	1	2	2
	Science research	1	1	1	1	2	2	1	1	2	0	0	0	2	2	1	2	2
	Technology research	1	1	1	1	2	2	1	1	2	0	0	0	2	2	1	2	2
	Institutional research	1	1	1	1	2	2	1	1	2	0	0	0	2	2	1	2	2
	Health research	1	1	1	1	2	2	1	1	2	0	0	0	2	2	1	2	2
	Space technology treatment	1	1	1	1	2	2	1	1	2	0	0	0	2	2	1	2	2
4 - Entertainment	Hotel	1	1	1	1	2	2	1	1	1	0	0	0	1	0	1	2	2
	Space sports	1	1	1	1	2	2	1	1	1	0	0	2	3	0	1	2	1
	Marriage	1	1	1	1	2	1	1	1	1	0	0	1	1	0	1	2	1
	Burial	1	1	1	1	2	1	1	1	1	2	0	0	1	0	1	2	1
	Zero g/playground	1	1	1	1	2	1	1	1	1	0	0	2	1	0	1	2	1
	Film studio	1	1	1	1	2	2	1	1	1	0	0	2	1	0	1	2	1
5 - Community	Housing	1	1	1	1	2	1	1	1	1	0	0	2	1	0	1	2	3
	Medical	1	1	1	1	2	1	1	1	1	0	0	0	1	0	1	2	1
	Fitness	1	1	1	1	2	1	1	1	1	0	0	0	2	0	1	2	1
	Eating	1	1	1	1	2	1	1	1	1	0	0	1	1	0	1	2	1
	Commerce	1	1	1	1	2	1	1	1	1	0	0	0	1	0	1	2	1
	Cultural	1	1	1	1	2	1	1	1	1	0	0	0	1	0	1	2	1
	Recreation	1	1	1	1	2	1	1	1	1	0	0	2	1	0	1	2	1
	Parks	1	1	1	1	2	1	1	1	2	0	0	2	1	0	1	2	1
6 - Administration	Administration	1	1	1	1	2	2	1	1	1	0	0	0	1	0	1	2	1
	Operations	1	1	1	1	2	2	1	1	1	0	0	0	1	0	1	2	1
	Engineering	1	1	1	1	2	2	1	1	1	0	0	0	1	0	1	2	1
	Systems	1	1	1	1	2	2	1	1	1	0	0	0	1	0	1	2	1
7 - Logistics	Maintenance/ Repair	2	1	1	1	2	2	1	1	1	2	2	3	2	0	1	2	1
	Housekeeping	1	1	1	1	2	1	1	1	1	0	0	0	1	0	0	2	1
	Supply/distribution	1	1	1	1	2	2	1	1	1	1	1	1	1	0	2	2	1
	Security	1	1	1	1	2	2	1	1	1	0	0	0	1	0	0	2	1
	Internal circulation	2	1	1	2	2	2	1	1	3	3	2	1	2	0	3	2	1

0	No, it doesn't require it at all
1	No, can feed off the station
2	Yes, needs it on the module
3	Yes, needs one just for itself

D

Population

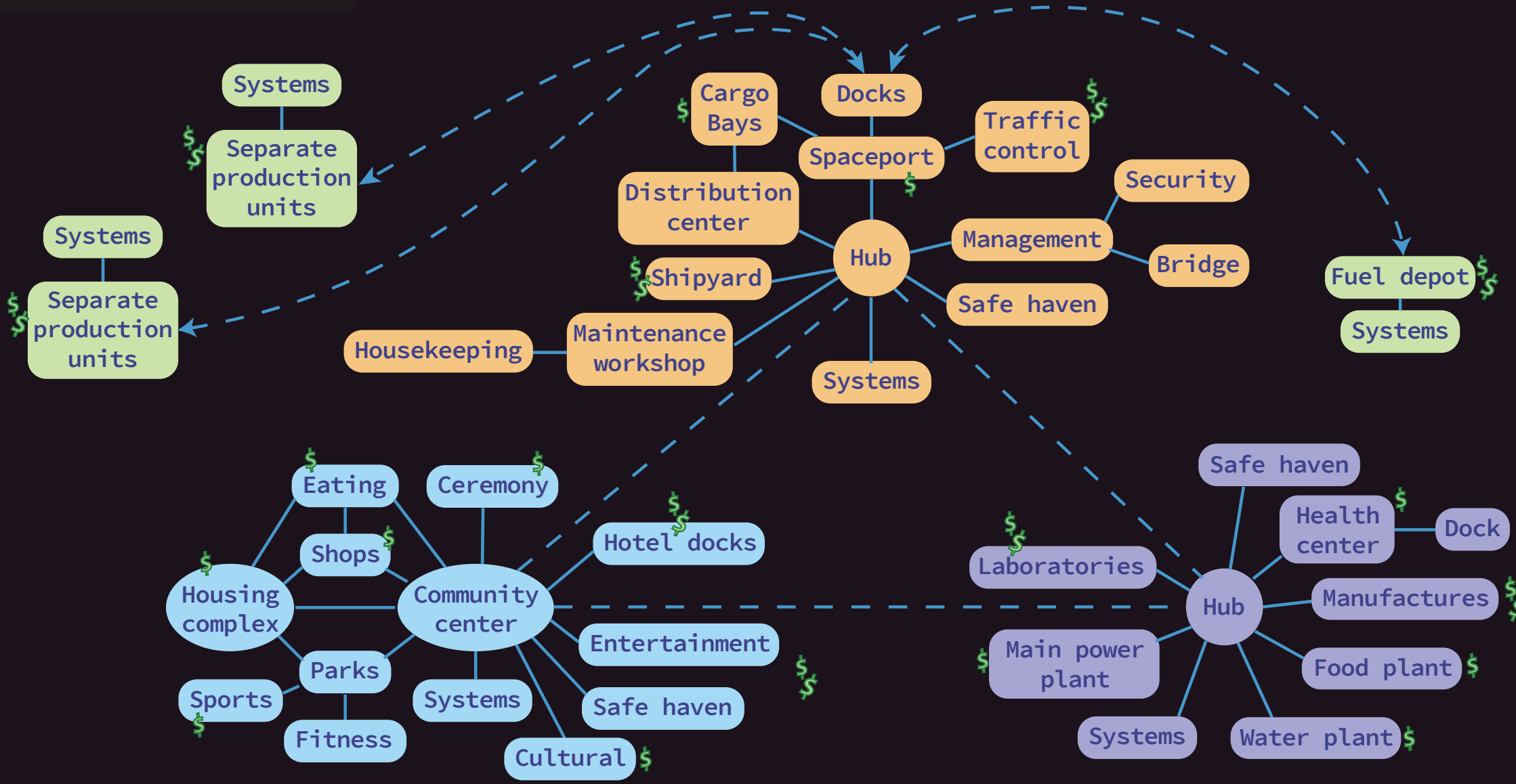
	Service	Sub service	Workforce
	Total		350
	1 - Space mobility		52
Primary	Shipyard	Fuel depot	2
		Mechanical: maintenance/ repair / sattelite deployment	17
		Spacecraft assembly	17
	Spaceport	Planetary spaceport	1
		Interplanetary spaceport	1
		Cargo terminal	4
		Space traffic control	10
	3 - Production		59
	Manufacturing	Pharmaceuticals	4
		Crystal growth	4
		nanostructures	4
		Spacecraft components	5
		Textiles (composites)	4
	Material processing	Raw material processing	16
	Food/Water	Food production	16
		Water production	2
	Energy	Power generation/ exporting	3
	2 - Research		59
	Education	University	2
		Zero G training	2
	Research	Science	13
		Technology	13
		Institutional	13
		Health	13
	Health	Space technology treatment	4
	4 - Entertainment		11
	Hotel	Hotel	7
	Sports	Space sports	0
	Cerimonial	Marriage	1
		Burial	2
	Space experience	Zero g/playground	0
	Film studio	Film studio	0
Community	5 - Community		45
	Housing	Housing	4
	Wellness	Medical	10
		Fitness	2
		Eating	5
	Leisure	Commerce	15
		Cultural	2
		Recreation	2
		Parks	5
	6 - Administration		58
	Administration	Administration	37
	Operations	Operations	6
		Engineering	8
		Systems	6
	7 - Logistics		66
	Maintenance	Maintenance/ Repair	11
		Housekeeping	34
	Supply	Supply/distribution	5
	Security	Security	13
	Mobility	Internal circulation	3



13% Visitors
87% Residents
of which:
52% Primary
48% Support

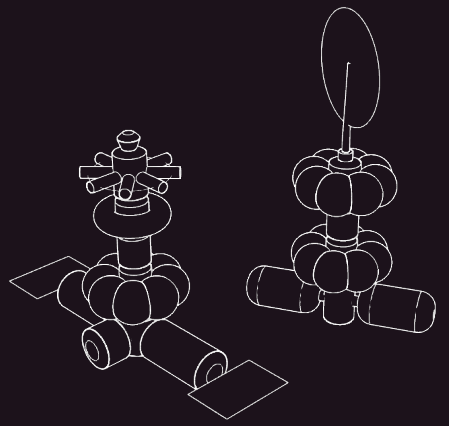
E

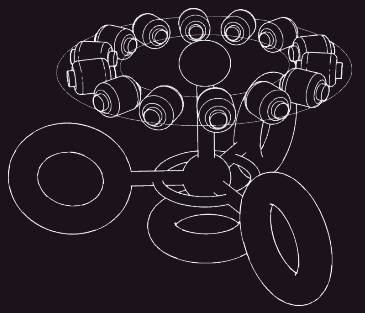
Clusters organization

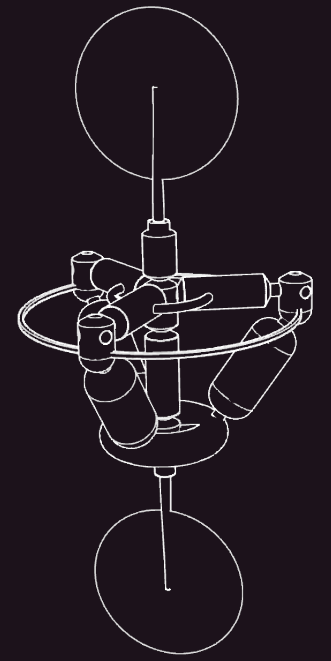


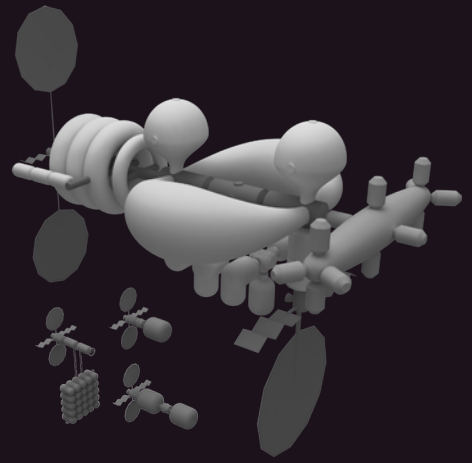
F

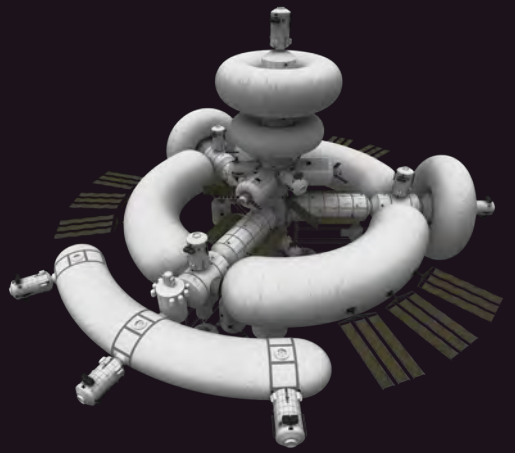
Concept Evolution

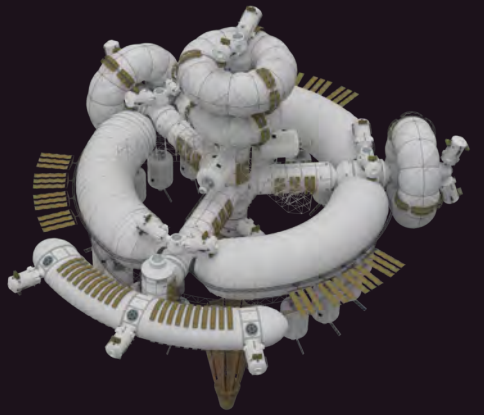




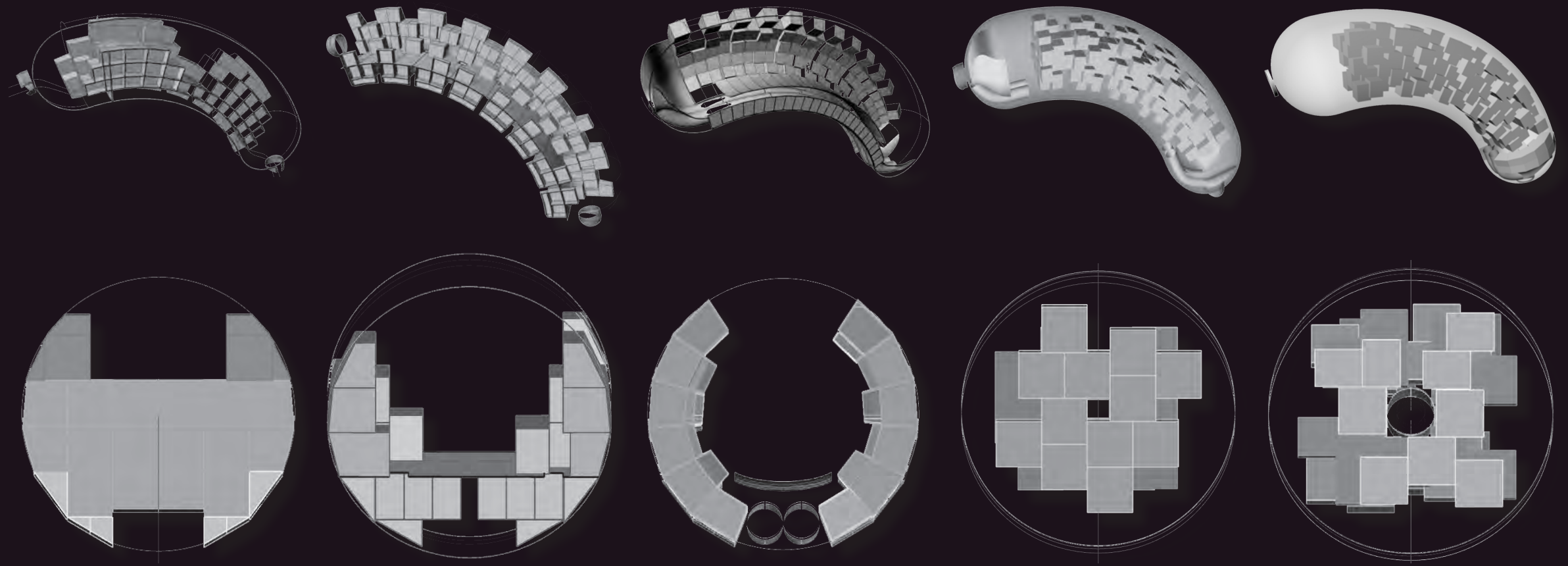








Island Studies



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