



ASGARDIA'S FIRST SPACE SCIENCE AND INVESTMENT CONGRESS

Shape the future for living in space in Darmstadt, Germany, on October 14-16

Sustainable Space Colony Swarm Architecture

A SPACE COLONY AND ITS SUPPORTING SWARM ARCHITECTURE

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Architecture?

- Basic principles & preconditions
- Global solution
- Safety and Security Services
- Manufacturing Services
- Logistic Services
- Energy Services
- Coherence Services
- Habitat Services
- Emigrating to space

Basic principles & preconditions

- The needs and goals of people
- Holistic approach
- Safe & robust
- Sustainable
- Autonomous and self-supporting
- Evolutionary approach
- Learn from and mimicking nature
- International cooperation is a prerequisite
- Agile, flexible, modular, standards

Global solution

A collaborative network:

- multiple habitats with swarm architecture
- support from Earth, Moon, Venus, Mars and Asteroids
- and a space armada
- with settlements, manufacturing, energy supply and science stations
- plus a protecting swarm
- plus a logistics fleet

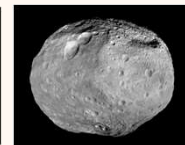
Safety and Security Services

- An object impact defense swarm
- A repairs fleet
- Environment sustainability services for humans, flora and fauna
- Information security

Manufacturing Services

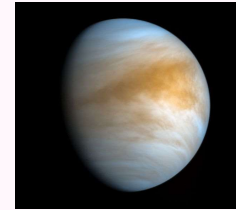
Creating, expanding and repairing

- on Earth
- on celestial bodies
- a manufacturing complex in space



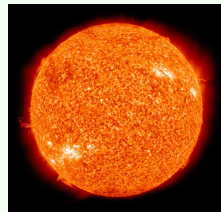
Logistic Services

- Launch and land
- Propulsion & maneuvering
- Transport and logistics services



Energy Services

- Abundant energy facilitates
- Generation
- Storage
- Transfer
- Usage



Coherence Services

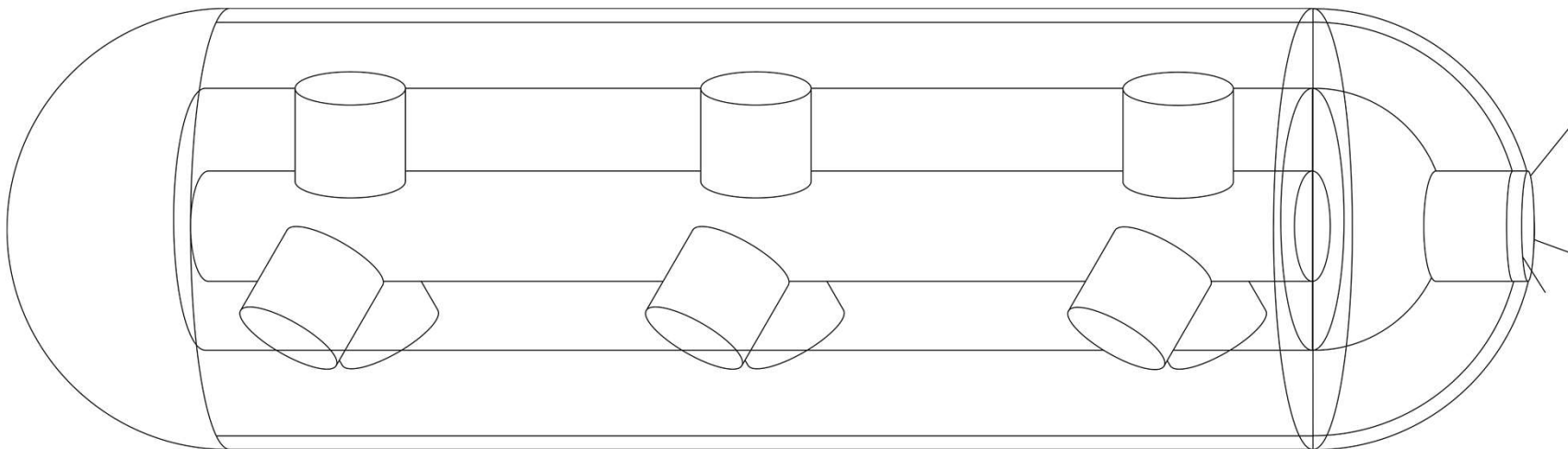
- Coordination and management
- Physical keep the armada together
- Communication
- Collect and share knowledge
- Energy balancing
- Standards



Habitat Services

- Multiple permanent residential settlements
- Example form:
 - a rotating cylindrical capsule with half spheres at the ends
 - with a counter-rotating skin layer
 - a cylindrical decks layer
 - an axis and spokes

A self-supporting village of some 1000 people, flora & fauna
- Temporary settlement facilities
- Usage and construction is modular, flexible and expandable



Emigrating to space

- I plan to emigrate to a space colony
- I need to, some 15 years from now:
'Gravitationally challenged', gravity squeezes my spine
- You are going to help me
- Consultancy from MADmelange.Space
- CGI has the power to implement
- Together we can accomplish our dream
Sustainable Space Colony and its supporting Swarm Architecture
- One unity, for one humanity
- The sky is absolutely no limit!

More info

Sustainable Space Colony Swarm Architecture

A SPACE COLONY AND ITS SUPPORTING SWARM ARCHITECTURE

Basic principles & preconditions

Main focus
the needs and goals of people
efficient rooms and the natural habitat that our body and mind needs
with a sufficiently large population, with a large variety in ages, types of people and skills
extensively supported on many levels

Holistic approach
multi-layer architecture
Safe & robust
artificial gravity, radiation protection, atmosphere, water, food and light
redundancy by default
compartmentalization
distributed implementation
multi-layer redundancy with fallback
backup facilities & resources
impact and collision prevention

Mitigated
either safe or not, with regular internal and external evacuation drills

Sustainable
renew critical resources (building, equipment, parts, air, food, water...)

Autonomous
and self-supporting stations, segments and modules

Evolutionary approach
standing on the shoulders of the scientists before us
(CNSA, ESA, NASA, Roscosmos, ISRO and CNSA...)
combining the work of organizations
like ESA, NASA, Roscosmos, ISRO and CNSA
and commercial organizations like Virgin Galactic, Blue Origin and SpaceX

Learn from mimicking nature
photosynthesis, self-replication, symbiotic mutualism, multi-layer collaborative networks
international cooperation is a prerequisite
using the power of economy and business, the power of collaboration,
standardization and a modular approach

Spirit
learning and progressing, with optimism and determination,
right and feasible, also in development and maintenance,
assuming a Moore's Law and anticipating great new discoveries and inventions

Global solution

A collaborative network
of a space colony
and its supporting swarm architecture
with multiple habitats, with
support from celestial bodies:
Moon, Venus, Mars and Asteroids
support in space:
safety, energy
logistics, manufacturing
with a space armada
strategic points
clusters of space stations,
with settlements,
manufacturing,
energy and science stations
around that cloud a protecting swarm
and a generic logistics fleet

Safety and Security Services

Collision Prevention Services
for object impact defense,
redundant observation, consisting of
multiple types of telescopes
distributed observation
and knowledge processing
flight vector adjustment services,
by autonomous units
cloud overhead facility

Remote controlled repairs fleet

Environment sustainability services
for humans, flora and fauna
air and water purification
artificial gravity providing
radiation protection
temperature control
medical services

Information security
confidentiality, integrity and availability

Manufacturing Services

**Creating, expanding
and repairing**
on Earth
initial implementation
and later special components
on celestial bodies
permanent settlements on Moon,
later on Mars and Asteroids,
using local resources and new materials
to deliver high-quality building material
in form of standard modules

from Venus
propellant gas from Venus atmosphere
in space
a manufacturing complex with
a harbor for incoming materials
and product delivery
storage space
manufacturing space
assembly in absence of
gravity and atmosphere
support facilities
energy supply
material processing
and recycling
ICT
living quarters

Logistic Services

Launch and land
on Earth
ongoing evolution of current devices
on Moon and later on Asteroids
launch via induction based
electromagnetic mass driver
landing assisted by
a swarm of autonomous vehicles,
together extending a landing net,
resisting the impact vector,
optionally extended with
a cushion structure,
launched from a mobile platform
towards the approaching object
and automatically surrounding it
(for Asteroids:
train tracks instead of vehicles)
on Mars
swarm of drones
connected to the approaching object
and facilitating smooth descent
and touchdown

Propulsion & maneuvering
gas based propulsion
no debris (future impact prevention)
harvesting gas for orbital fuel
by balloons in Venus atmosphere,
or chemically from raw materials
modular reconfigurable self-reflecting
steering structures,
including autonomous
replacement services
redundant thrust nozzles,
steering structures,
including autonomous
replacement services
object push services

Transport and logistics
to and from surface, high atmosphere,
ISS and locations in space
to and from space colony
and its supporting swarm architecture,
and existing space objects
the ISS, satellites, research facilities
with repeated service or parked

Energy Services

Abundant energy facilities

Generation
default solar
on alpha
in medium outer arrays
in space and near settlements
for robustness and redundancy
also some chemical and nuclear

Storage
energy storage
also using inertia (rotating masses)

Transfer
energy transfer services
between colonies,
wired or contactless
energy beam transfer services
(laserlight - chemical - nuclear)

Usage
mainly electricity,
gas for propulsion
modular & replaceable,
using standard
small manufacturing thrusters
and large repairable rockets

Habitat Services

Multiple permanent residential settlements
starting with 2
building in different sizes and shapes, reusing villages
sufficiently large multifarious population
each 500-1000 people of all ages, blue flora and fauna
sufficient room and the natural habitat
and the human body and mind needs,
including both individual and shared areas
for privacy, work and leisure
with a main focus on wellbeing and sustainability
improving psychology, spirituality and quality of life

Example form:
a rotating capsule
of a cylinder of 400 m long, a radius of 50 m,
off-axis of the endopole, 3 times 3 spokes and a thick skin,
surrounded by counter-rotating reticulate skin layer.
this could support 1000 people and the cylinder is large enough
to prevent motion sickness due to Coriolis forces acting on the inner ear
the skin layer:
containing solar panels, cameras
a shield with apertures (e.g. moon sand), fluids and gasses
protecting against object impacts and radiation
power storage, harvesting energy derived & supply,
among others by using temperature of skin elements
and pressure in gaps between batteries
counter-rotating to cancel out and use gyroscopic effects,
using wedge-shaped segments in a flexible outer layer,
for 3D mass distribution adjustment, for adjustment of the gyroscopic effect
(changes in orbit height, resisting radiation shielding)

the cylindrical decks layer
multiple decks with living quarters, work areas, stored spaces and agriculture
standard dimensions, can be flexibly combined
flow of air, water, contents in four vertical stages
for replacement, supply and disposal and temperature control
central layer with water and air, for purification, storage and temperature control
windows in the inner rim looking towards the sky, spokes and hangers
decks responsible to inside
the skin layer and decks layer
different angular velocity
ensured by electropropulsion
which is also used to transfer power between layers via induction

the spokes and the skin
mainly used for science, industry and supporting systems
control facilities including storage, power processing, chemical processing, IT equipment
also some manufacturing and repairs, facilitated by the low gravity

the staff quarters
contain docking stations with rails leading to internal harbors
and with intermediate stops

angular rotation
generated via strategic docking during construction

Temporary settlement facilities
also are needed,
with its or limited artificial gravity
for temporary work like construction and repair
but also as emergency escape space for evacuation

Usage and construction
is modular, flexible and expandable



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