Asteroid Mining AstroForge, Karman+

1: Launch / Re-supply

Equipment launched from Earth. Raw materials & consumables from:

- 1) Earth
- 2) recycling
- 3) Moon
- 4) asteroids

Space Resources Transportation

Momentus, TransAstra, Orbit Fab, Lunasa, Impulse, Atomos, Astroscale, Coactum, ClearSpace, D-Orbit, Exotrail



Redwire, CisLunar Industries, Orbit Recycling, Tethers Unlimited

Re-Supply Vechicles (1-way)

Cygnus, Progress, HTV, Tianzhou

Re-Supply Vechicles (2-way)

Dragon, Starship, Starliner, Dream Chaser, Sojuz

Path 1: Space Stations ISM Services

1) Launch orbital factory to the ISS or commercial station. product or infrastructure in microgravity.

1) Launch (reusable) spacecraft or capsule (e.g. Cargo 3) Enter atmosphere and retrieve the (reusable) capsule.

In-Space Manufacturing

2: On-Orbit Manufacturing

Using microgravity environment to manufacture new products and materials, on or nearby multi-use or dedicated:

- 1) space stations
- 2) free-flying spacecraft

Commercial Space Stations

Axiom, Nanoracks, Orbital Reef,

SpaceX, Space Tango, Space Forge, Varda, Space Rider, Sierra Space, The Exploration Company

Microgravity End-to-End Services

Nanoracks, Ice Cubes, Bartolomeo, Space Tango, Yuri, Space Cargo Unlimited

In-Space Manufacturing

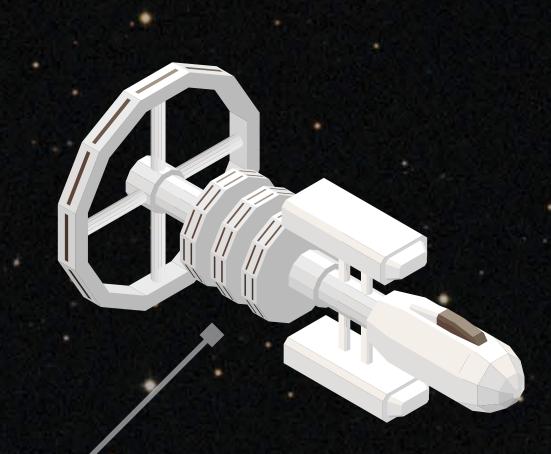
Redwire, FOMS, Flawless Photonics, Sierra Space, Nanoracks, Apsidal, LambdaVision, Maana Electric

In-Space Assembly/Construction

Redwire, Tethers Unlimited, Arkisys, Orbital Assembly, ThinkOrbital, Space Applications Services

3: Use in Orbit / Re-Entry

- 1) Large-scale space structures, space solar power stations, space food etc will remain for use in space. In some cases, better called in-space assembly or construction.
- 2) Re-entry vehicles (can be same) to bring samples and products to Earth, which will likely be the largest market for many materials.



Large Space Structures

Redwire, Tethers Unlimited, Orbital Assembly, Skycorp, United Space Structures, Blue Origin, Orbital Matter

Space Food

Nanoracks, Starlab Oasis, Sierra Space, Interstellar Lab, Aleph Farms



Re-Entry Spacecraft & Capsules

Varda, Space Forge, In Orbit Aerospace, The Exploration Company, Outpost, Downmass, Space Cargo Unlimited, Elevation Space, Inversion, Reenter Space

Space Station > Free-Flyer

- Recurring Dragon, Starliner, Starship etc flights.
- Extra 1-2 months is small difference for near-future.
- Product quantinities likely small for the short term.
- Multi-use and more consumables due to resupply.
- More electrical power thanks to larger solar arrays.
- Fast 24/7 telecommunications and mission control.
- Capsule retrival (tracking, legal, transport) handled.
- Lower costs all around to help with ISM economics.

Free-Flyer > Space Station

- Re-usable satellites or dedicated capsules are flexible.
- Independence when aiming for vertical integration.

Erik Kulu, 2023-02-26

• Full use of payload capacity and 100% automation.



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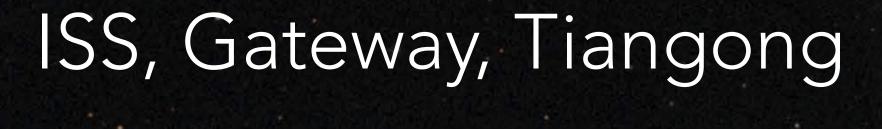
As a preparation or equipment with supplies together. 1a) Resupply raw materials & consumables (optional). 2) Use the largely automated space factory and help from (commercial) astronauts to manufacture the material,

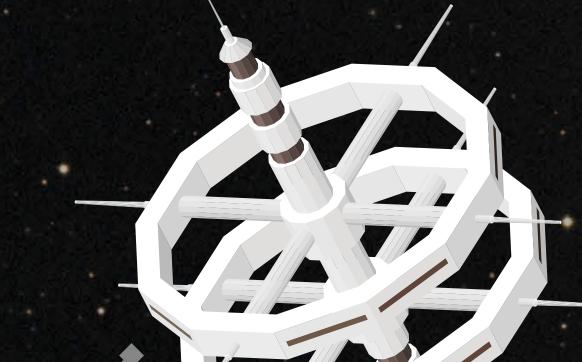
3) Use (the same) re-entry vehicles to return the products.

Path 2: Dedicated Free-Flyers

Dragon) with raw materials, consumables and fully automated manufacturing apparatus included. 2) Use the free-flying spacecraft as space factories i microgravity environment for in-space manufacturing.

Space Stations





Starlab, Gravitics, VAST

Dedicated Free-Flyer Spacecraft

*Lists of example commpanies are not exhaustive