

# SERAPHIM IN-SPACE ECONOMY ECOSYSTEM MAP 2023

## IN SPACE SERVICES

Servicing the needs of satellites in orbit by providing transport, communication, life extension, situational awareness, or removing debris.

### ORBITAL TUGS

Transport satellites to the correct orbit after launch.



### ORBITAL SERVICING, LIFE EXTENSION & REFUELING

Help satellites live longer by providing power or fuel in orbit.



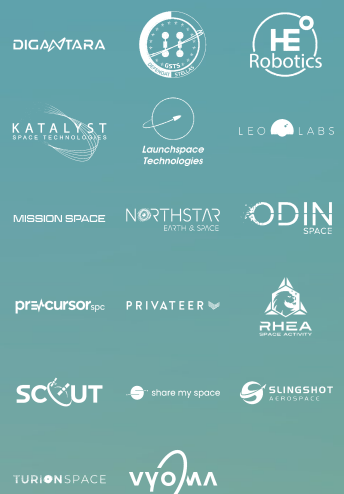
### DEBRIS REMOVAL

Protect existing satellites by removing debris or dead satellites.



### SPACE SITUATIONAL AWARENESS

Companies improving our understanding of the orbital environment. Forecasting space weather, tracking debris and satellites.



## IN-SPACE COMMUNICATIONS

Intra-satellite communications, that allow satellites to communicate with Earth more frequently and for longer. Also includes companies that are bidding to replace NASA's deep space communications network.



## SPACE INFRASTRUCTURE

Basic building blocks and facilities needed to enable the in-space economy.

### SPACE STATIONS

Manned space stations in LEO. Typically replacements for ISS though some have artificial gravity.



### FREE FLYERS & RETURN

Autonomous satellites, structures, or capsules used to perform manufacturing and R&D. Typically targeting return to Earth capability.



### SPACE PLANES

Differs from a launch vehicle in that it tends to move to different orbits and then return to Earth. High reusability.



### SPACE ENERGY

Provides power for other operators in space, e.g. to power lunar rovers or mining. Typically nuclear or radioisotope sources.



## LUNAR

All activity focused on the lunar economy.

### LUNAR LOGISTICS

Combines transport and mobility. Anything that get spacecraft to the moon or around the moon.



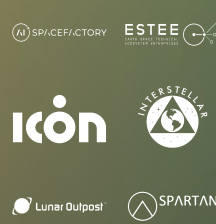
### LUNAR LANDERS

Will land people and large structures on the moon.



### LUNAR HABITATS

Facilities for human habitation on the moon.



### LUNAR RESOURCE UTILISATION

In-situ resource utilisation i.e. turning materials readily available on the moon into useful compounds.



## IN-SPACE R&D & MANUFACTURING

Companies performing R&D and manufacturing in space

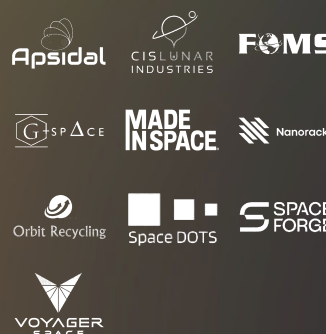
### PHARMA, LIFE SCIENCES & BIOENGINEERING

Companies working on any biotech activities in space including drug development, tissue growth, and manufacturing.



### MATERIALS

Developing and manufacturing new or improved materials in space e.g. optics or semiconductors.



### LARGE STRUCTURES

Making or assembling large structures in space, often using robotic assembly.



## MANNED SPACEFLIGHT

Companies transporting and supporting humans in space.

### MANNED SPACE TRAVEL

Companies transporting humans to space for short or long duration missions. Includes space station companies focused on space tourism or astronauts.



### SERVICES

Companies that will support humans in space including training.



## SPACE EXPLORATION & UTILISATION

Focused on interplanetary exploration or exploiting the resources on other planets and asteroids.

### NEXT GENERATION PROPULSION

Advanced propulsion systems required to access other planets or solar systems. Typically nuclear or radioisotope powered.



### PLANETARY & ASTEROID MINING

Companies that will mine on other planets, for return to Earth or use in space.

