



Citizens in Space

Testing Interplanetary
CubeSat Payloads
Using
Reusable Suborbital Spacecraft

Reusable Suborbital Spacecraft: A New Paradigm

- Cheap, frequent access to space
- Aircraft-like" operations
- Reusability -> affordability
 - Reliability
 - Maintainability
 - "Save"-ability (intact abort)
 - Operability (ready response, rapid turn times)
 - Flexibility (many possible payloads)

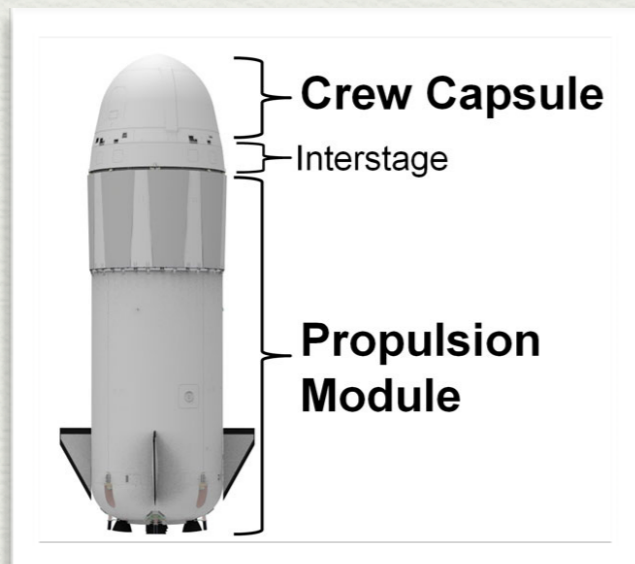
Commercial Competition



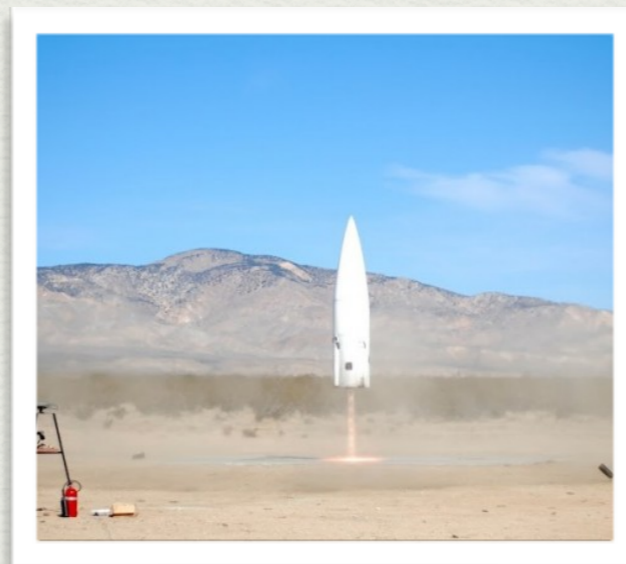
Virgin Galactic



XCOR Aerospace



Blue Origin



Masten Space



Exos Aerospace

DARPA Experimental Spaceplane (XS-1)

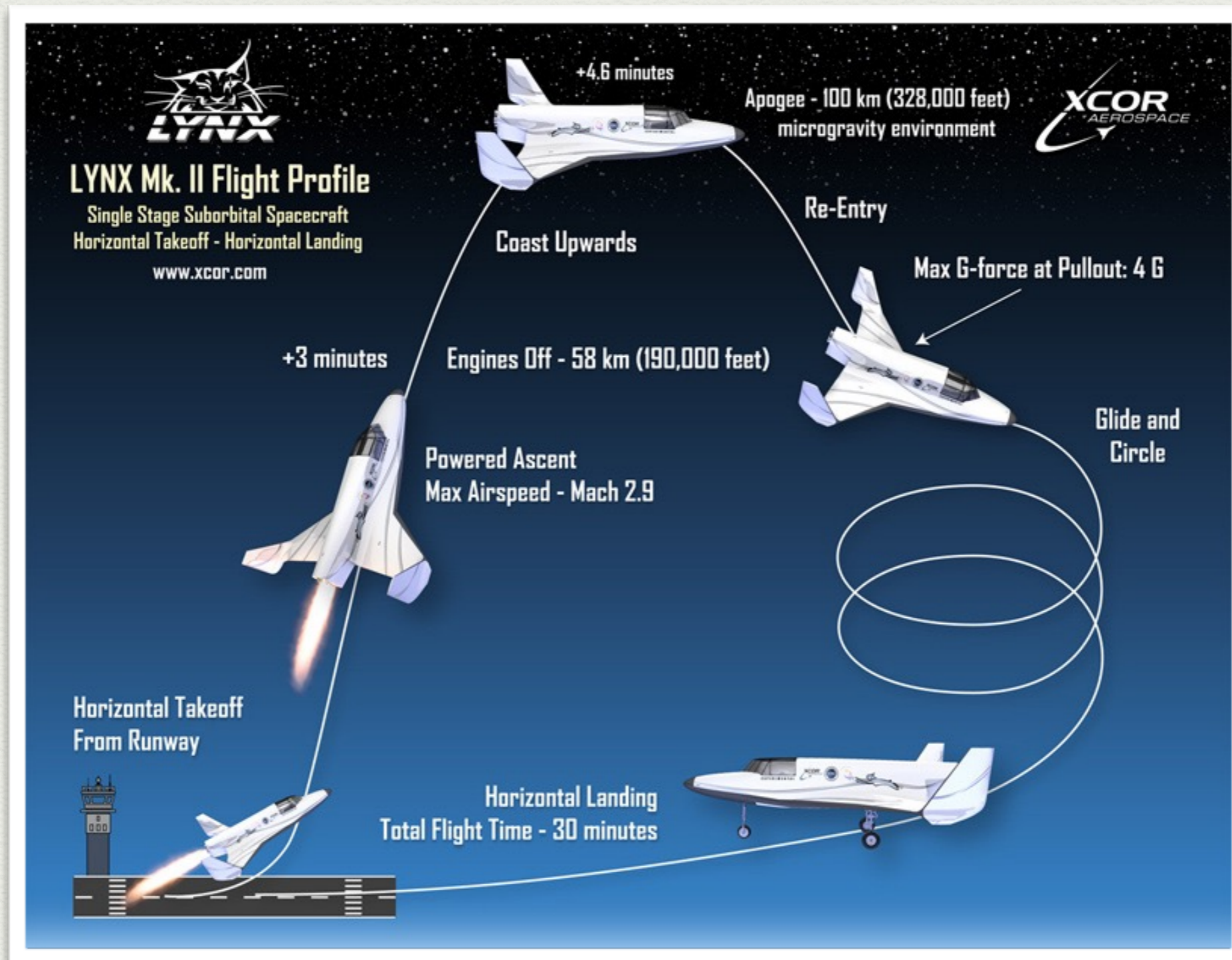


XCOR Lynx

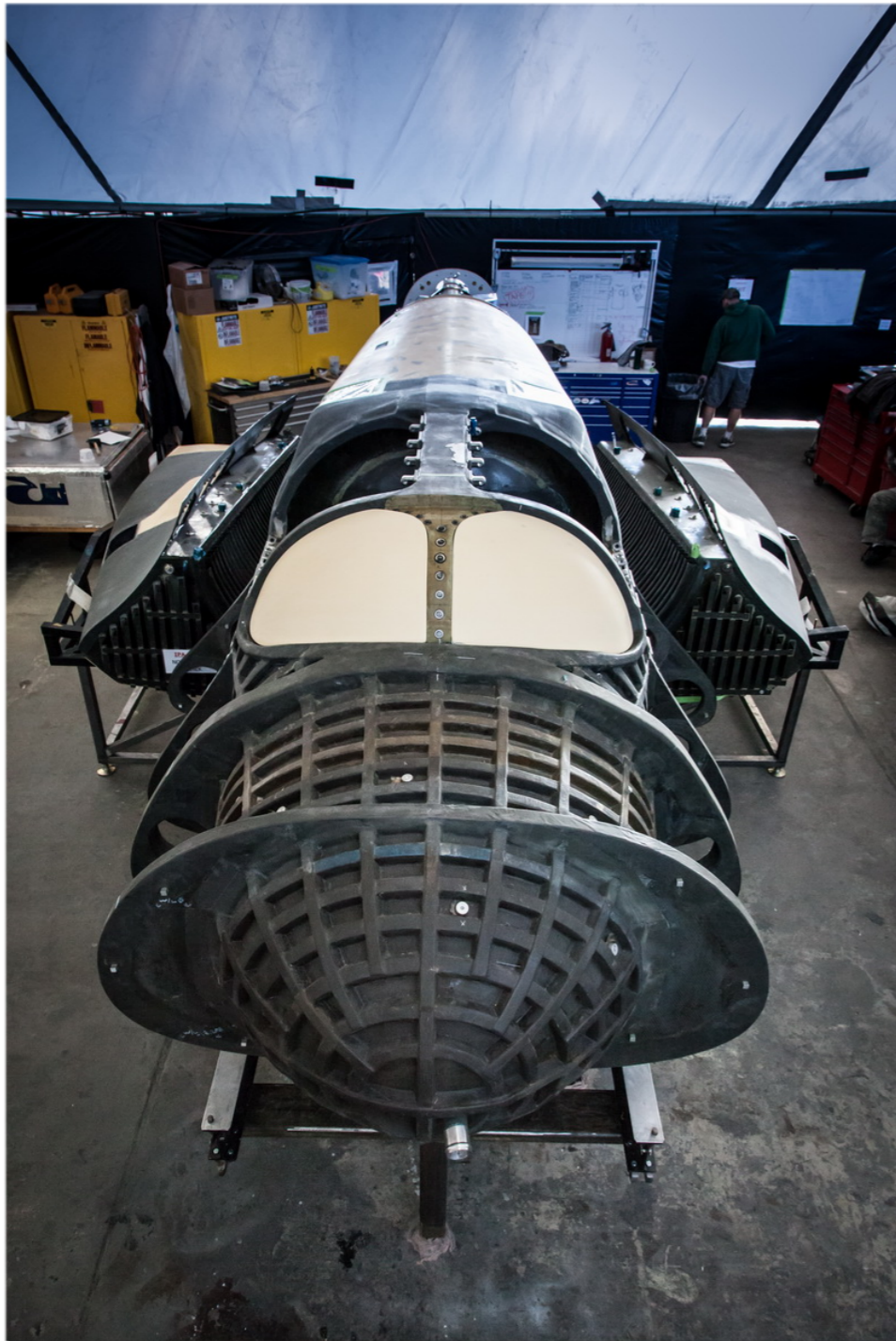


- Low Cost (~\$100K / flight)
- Rapid Turn-around / High Flight Rate (4x per day)
- 1 pilot, 1 payload operator / spaceflight participant

Lynx Flight Profile

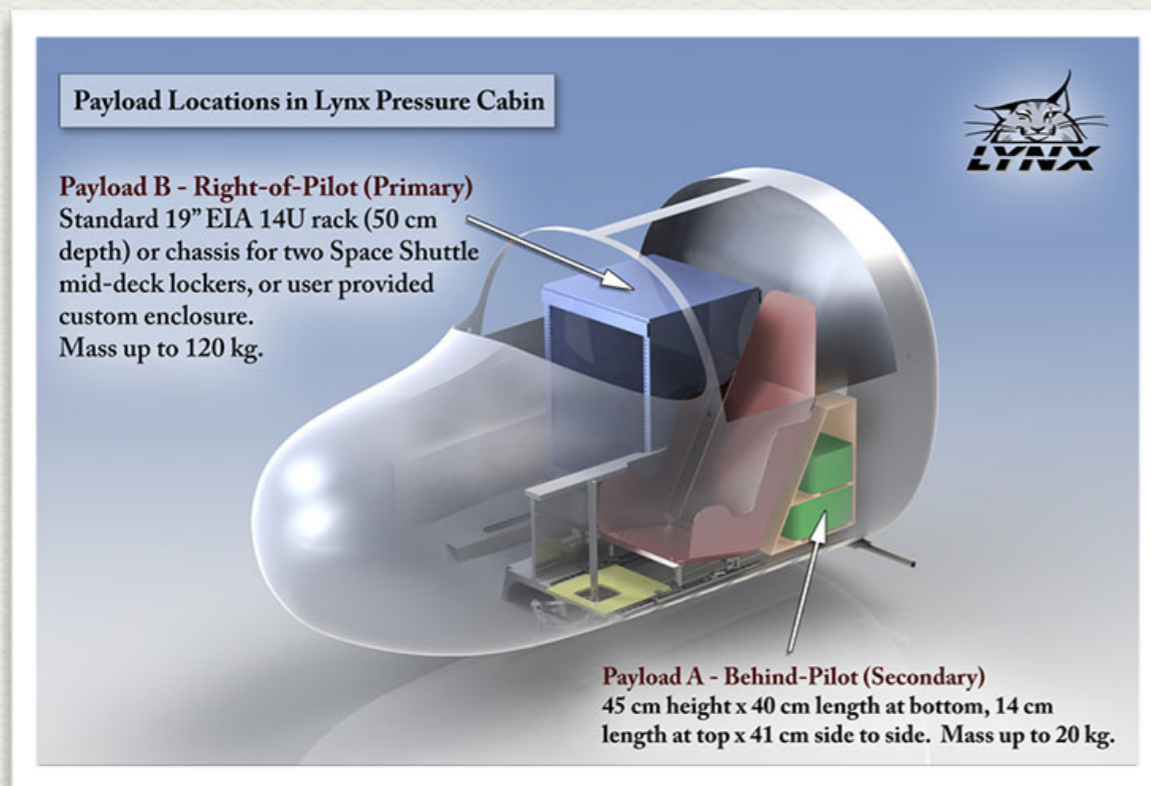


Lynx Spacecraft Status



- Mark 1 (prototype) now under construction
- First flight – 2015
- 12-18 month flight test program
- The time to start building payloads is now

In-Cockpit Payloads

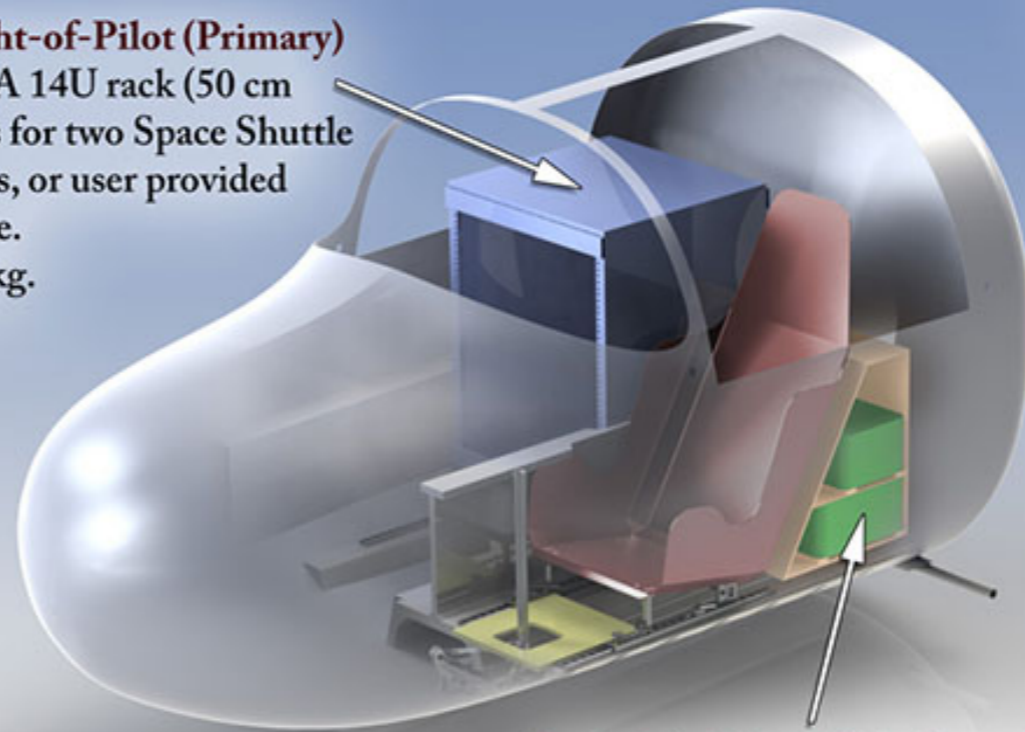


- Pressurized environment
- Short-duration microgravity, radiation
- Low cost (~\$3,000/U)
- Repeatable

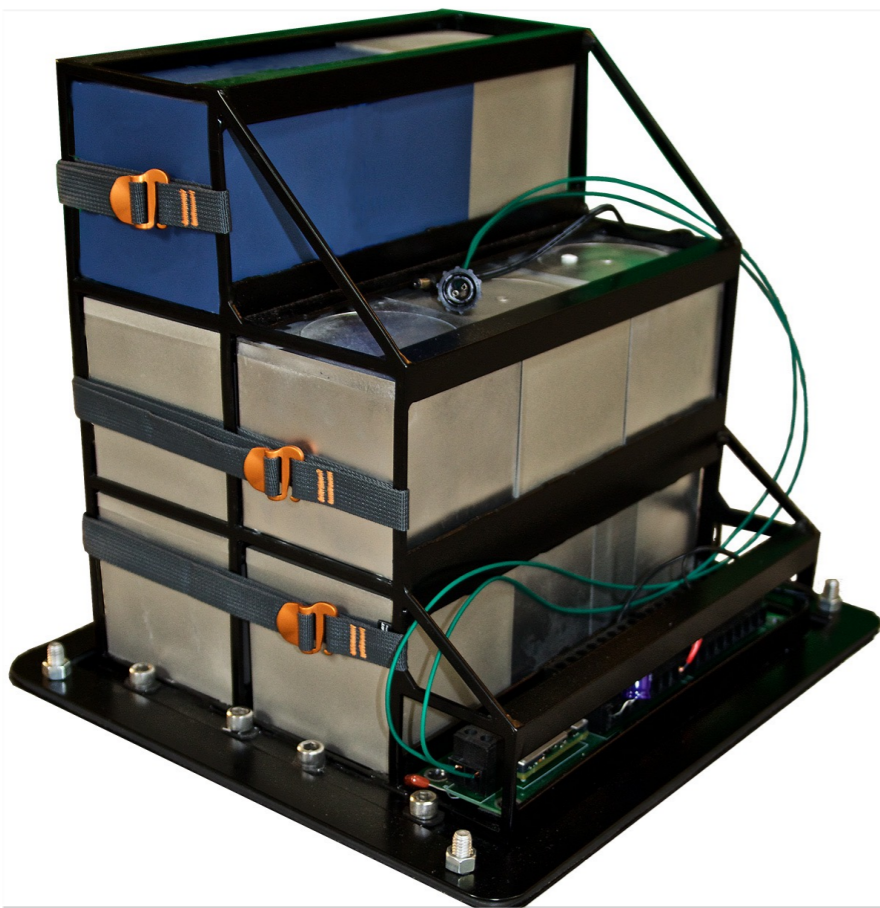
Lynx Cub Payload Carrier

Payload Locations in Lynx Pressure Cabin

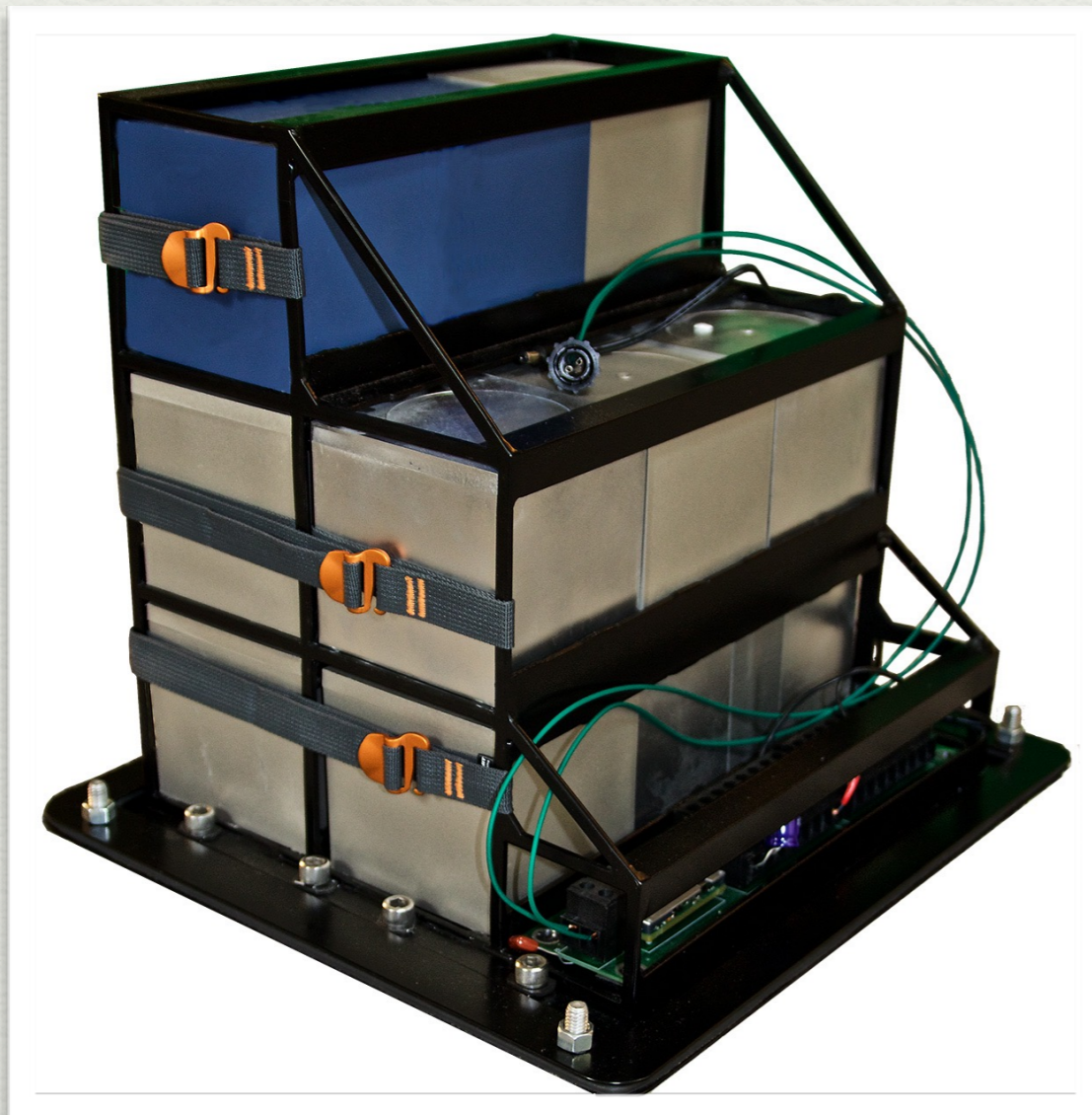
Payload B - Right-of-Pilot (Primary)
Standard 19" EIA 14U rack (50 cm depth) or chassis for two Space Shuttle mid-deck lockers, or user provided custom enclosure.
Mass up to 120 kg.



Payload A - Behind-Pilot (Secondary)
45 cm height x 40 cm length at bottom, 14 cm length at top x 41 cm side to side. Mass up to 20 kg.



Lynx Cub Payload Carrier



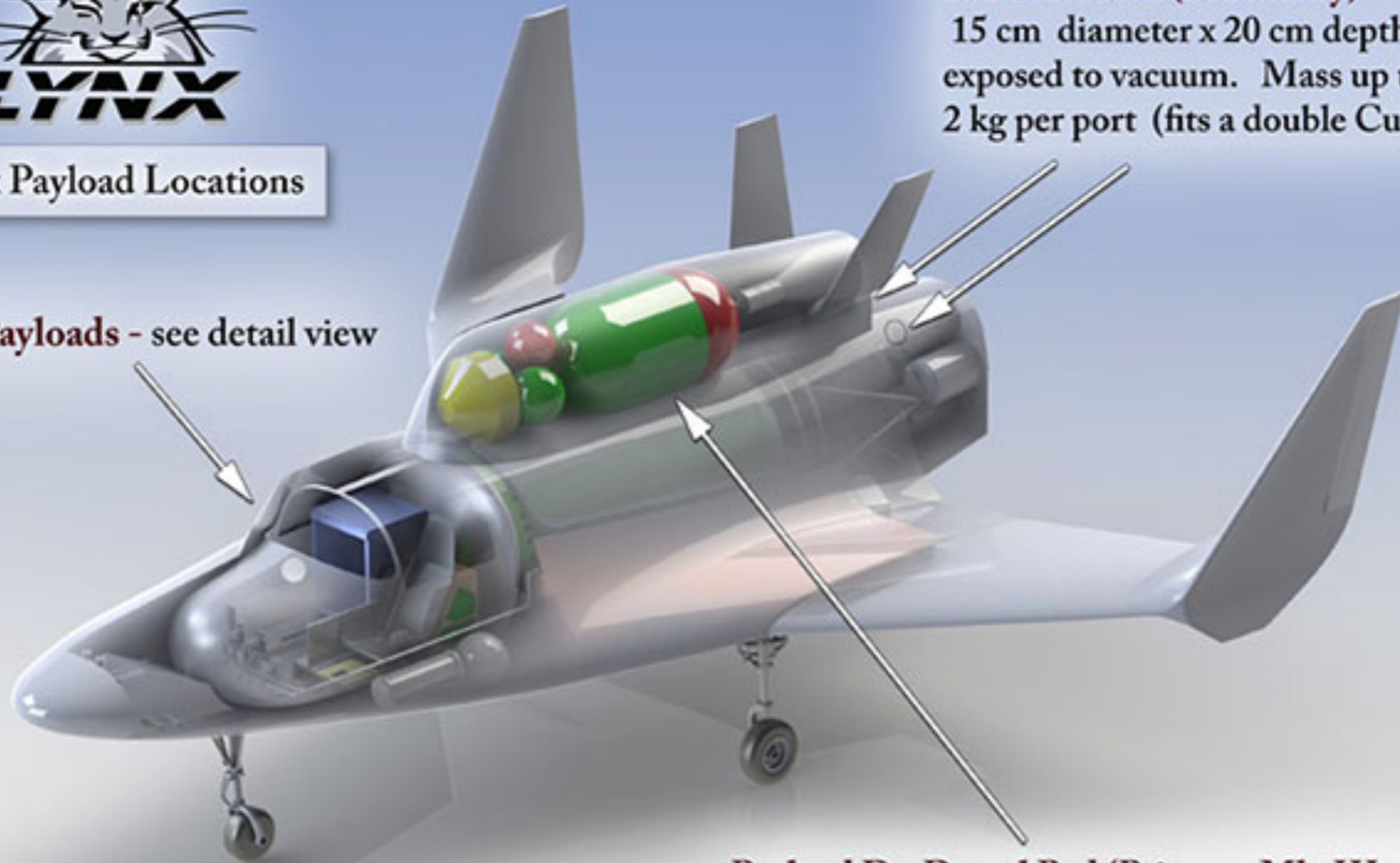
- Accommodates 1U, 2U, 3U payloads
 - Up to 15U total
 - 1 unit = 10 cm or 4", 1 kg max
- 5V or 12V electrical power
 - Configurable prior to flight
 - 2.1mm center-positive barrel connector
- 140W maximum electrical power
- 200W maximum thermal
- Double containment (soft cover not shown)
- Payloads can be autonomous or controlled by payload operator (wireless or wired; iOS, Android, or arm panel)

Aft Cowling Payloads



Lynx Payload Locations

Cabin Payloads - see detail view



Payloads CP and CS - Cowling Port and Starboard (Secondary)

15 cm diameter x 20 cm depth, exposed to vacuum. Mass up to 2 kg per port (fits a double CubeSat).

Payload D - Dorsal Pod (Primary, Mk. III only)
Cylindrical volume: 76 cm diameter x 340 cm long.
Mass up to 650 kg.

Aft Cowling Payloads

- Exposed to the space environment (temperature, pressure, radiation)
- Hatch opens in flight, allowing
 - Sensors -- direct view of Earth/space
 - Extendable probes, antennas, etc.
- Payloads are optionally ejectable

Example: High-Altitude Astrobiology Challenge

- Demonstrate the ability to collect microorganisms from extreme altitudes from a suborbital spacecraft
 - Global epidemiology
 - Bioprospecting
 - Astrobiology
- Enable repeatable science
- Greater reliability than high-altitude balloons
- Trajectory can be tailored to mission requirements
- Automated or manual control (payload operator astronaut)

Citizen Astronaut Training



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