



AFFORDABLE ACCESS TO LOW EARTH ORBIT (LEO)



EXOSPHERE
MIDDLE EARTH ORBIT 2,000 KM – 36,000 KM

RENEWED SPIRIT OF DISCOVERY

“Inspired by all that has come before, and guided by clear objectives, today we set a new course for America's space program. We will give NASA a new focus and vision for future exploration. We will build new ships to carry man forward into the universe, to gain a new foothold on the moon, and to prepare for new journeys to worlds beyond our own.”

President G. W. Bush addresses NASA and the nation, 14 January 2004



COMMERCIALIZATION OF SPACE

Future commercialization of space for communication, surveillance, and other businesses will require affordable access to LEO.

“Once you get to Earth orbit, you're halfway to anywhere in the solar system.”

Robert Heinlein

EXOSPHERE

THERMOSPHERE

LOW EARTH ORBIT 80 KM – 2,000 KM

REDUCING LAUNCH COSTS

Current launch vehicles are expensive to operate and limit access to LEO in terms of availability, payload size, number of annual launches, and destinations.

Space X has reduced launch costs considerably with reusable 1st stage vehicles, but annual launches are limited and small payloads gain access only through piggy-back services.



Falcon 9

Operator: SpaceX
Year of First Launch: 2010
Mass to LEO: 13,150 kg
Estimated Price/Kilogram: \$4,700
(\$24,000 less than average price/kg)

Pegasus XL

Operator: Orbital ATK
Year of First Launch: 1994
Mass to LEO: 450 kg
Estimated Price/Kilogram: \$89,000



A RACE TO THE KARMAN LINE

The next generation of launch vehicles will provide low-cost access to LEO. Single-stage-to-orbit (SSTO) vehicles will have the added benefits of being fully reusable and providing routine access to specific LEO destinations. Limited piggy-back launches will no longer be needed.

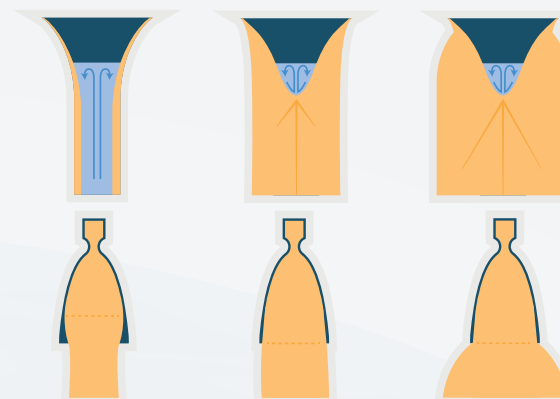
Haas 2CA

Operator: ARCA Space
Year of First Launch: 2018
Mass to LEO: 100 kg
Estimated Price/Kilogram: \$10,000
Potentially Reusable



Star Lord

Operator: RocketStar
Year of First Launch: 2018
Mass to LEO: 300 kg
Estimated Price/Kilogram: \$20,000
Fully Reusable SSTO



AEROSPIKE NOZZLES

Aerospikes nozzles are intrinsically altitude-compensating and eliminate the need for multiple rocket stages. Future costs to build vehicles and launch payloads are reduced, and vehicles will have the projected lifetime of current earth-based aircrafts.