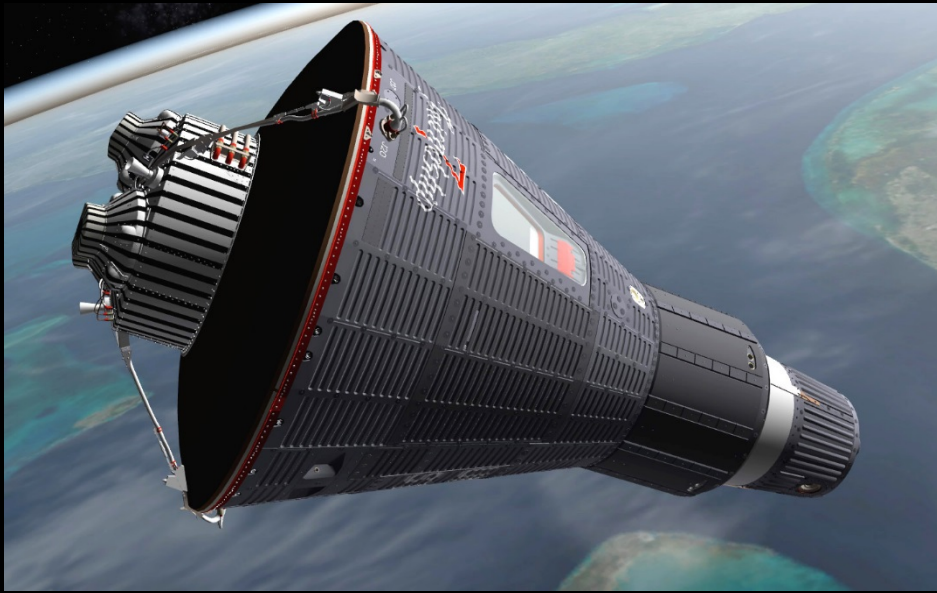




The Evolving Revolution in Manned Space Exploration

A black and white photograph of a desert landscape, likely a sand dune area. The image is overlaid with a grid of 15 crosshair markers arranged in three rows and five columns. The text "Where we have been." is superimposed in the lower right quadrant of the image.

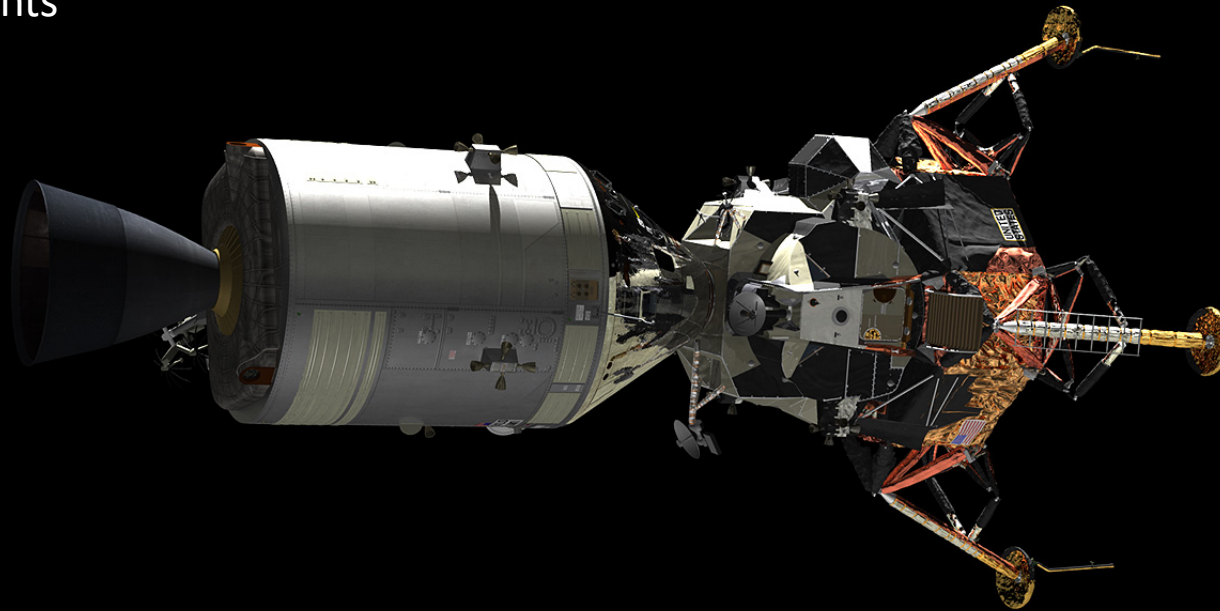
**Where we
have been.**



Mercury 1961-1963
6 Flights



Gemini 1965-1966
10 Flights



Apollo 1968 – 1972
11 Flights
9 Lunar Flights
6 Lunar Landings

1961-1972 Summary

27 Manned Space Missions
2.5 Manned Missions per year
2.25 Manned lunar missions
per year after Apollo 8



Apollo – Soyuz
One Flight – July 1975



Skylab
1973 – 1979
3 Crewed Missions – 9 Astronauts
28 – 59 – 84 Days



5 Space Shuttles
Columbia – Challenger
Discovery
Endeavour - Atlantis

Space Shuttle Program
1981 – 2011

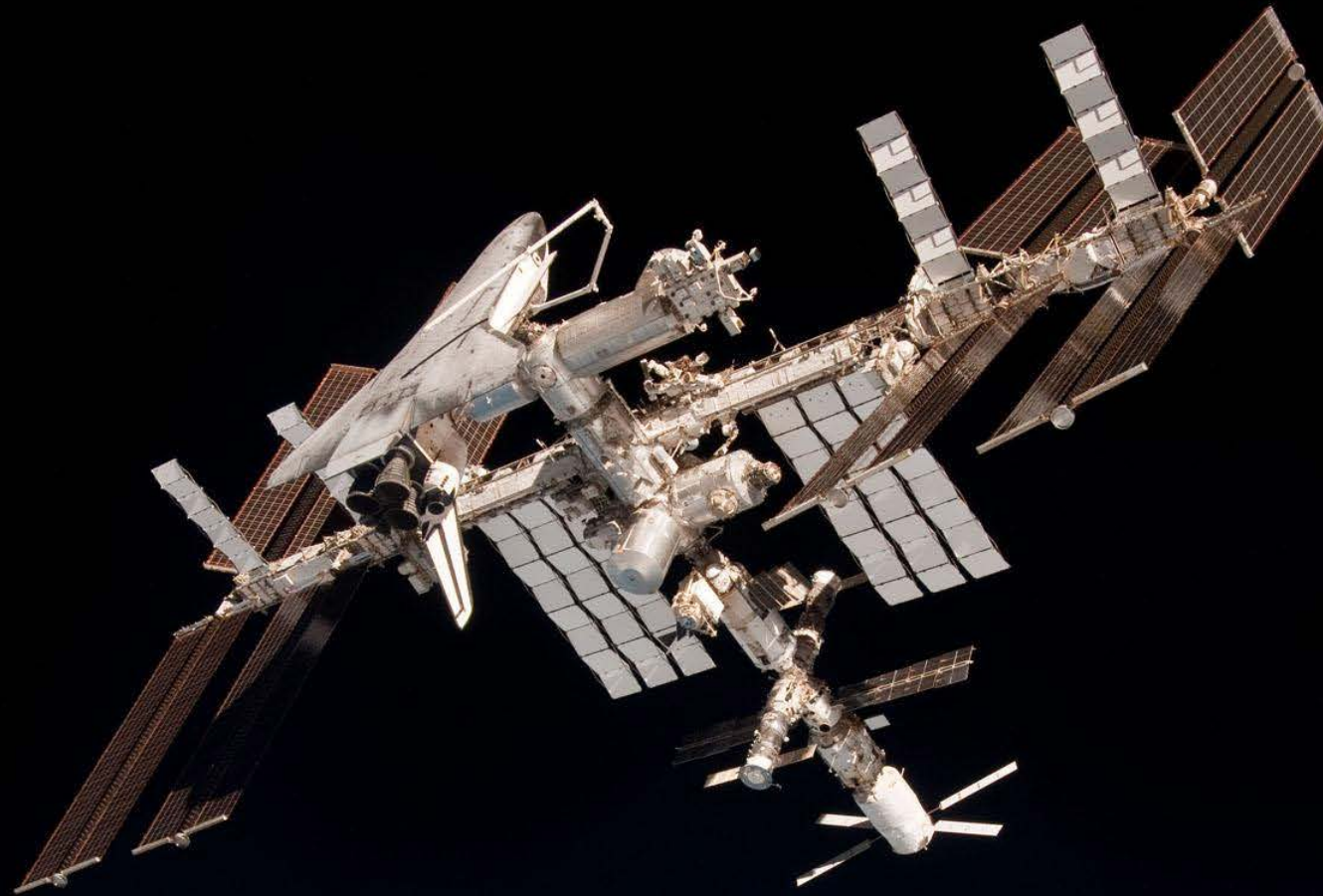
135 Missions

833 (536) Astronaut Flights

Avg. Cost Per Mission \$455 mil

Flights Per Year: 4.5

2 Crews Lost (14)
Challenger 1986 – Columbia 2003



International Space Station 1998 – Today
To date – 50 ISS Missions – 388 Astronauts



In Perspective:

Total astronaut DAYS
in low earth orbital space:
29,000 days

Total astronaut DAYS
In deep space
beyond the Van Allen belt:
96 days

Where are we now?

Government Manned Space Programs

United States

Russia

China

Private Space Programs (All USA)

SpaceX

Boeing

Blue Origin - New Glenn / New Shepard

Dream Chaser

Mars One

Government Programs:

USA

Maintaining ISS

Mars is the current primary exploration destination

Possible Asteroid Mission

Russia

Servicing ISS

Lunar Base Plans

China

Building Space Station

Lunar Base Plans

NASA Manned Space Exploration Programs



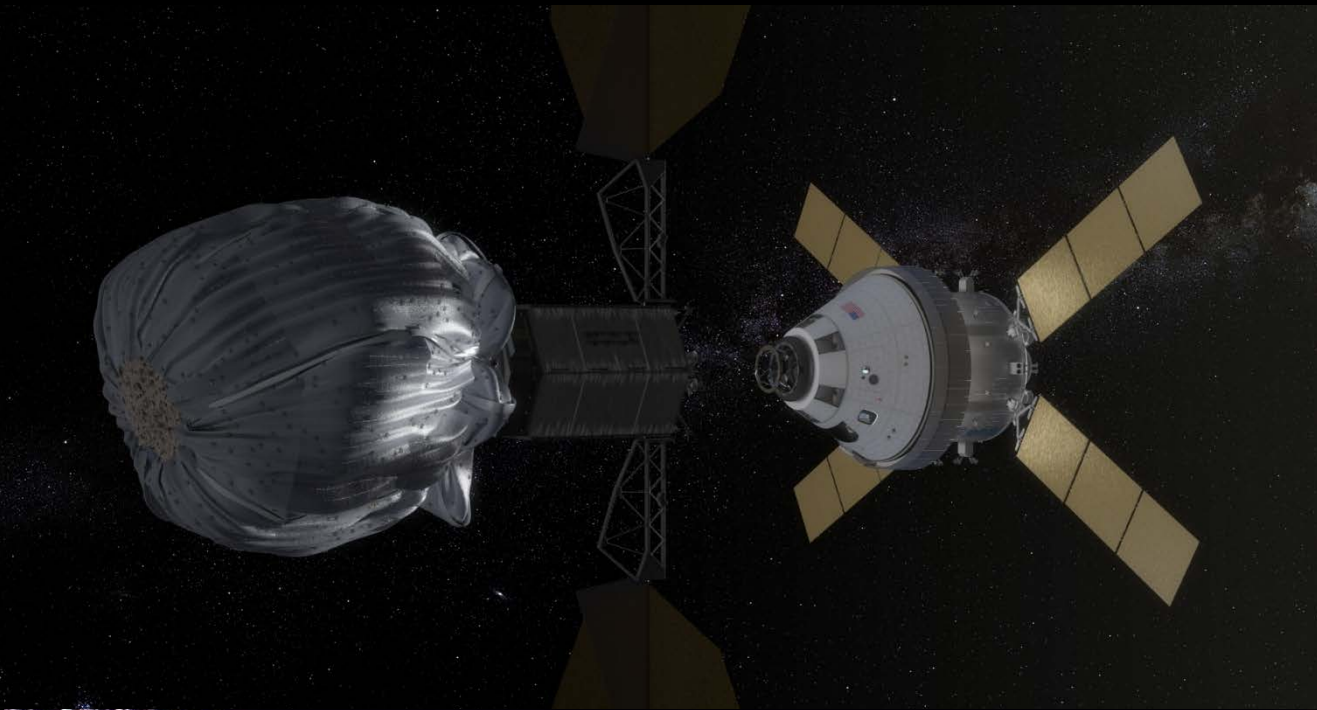


**1st SLS Launch
Scheduled
September 2018
KSC Pad 39B**



1st NASA Manned Mars
Mission
Scheduled for 2030's

JOURNEY TO MARS



Asteroid Mission?



Lunar Base?

Private Space Ventures in Low Earth Orbit

SpaceX

Dragon



Boeing

Starliner



Sierra Nevada

Dreamchaser



Boeing at the Kennedy Space Center



Ken Kremer
kenkremer.com

Blue Origin at the Kennedy Space Center

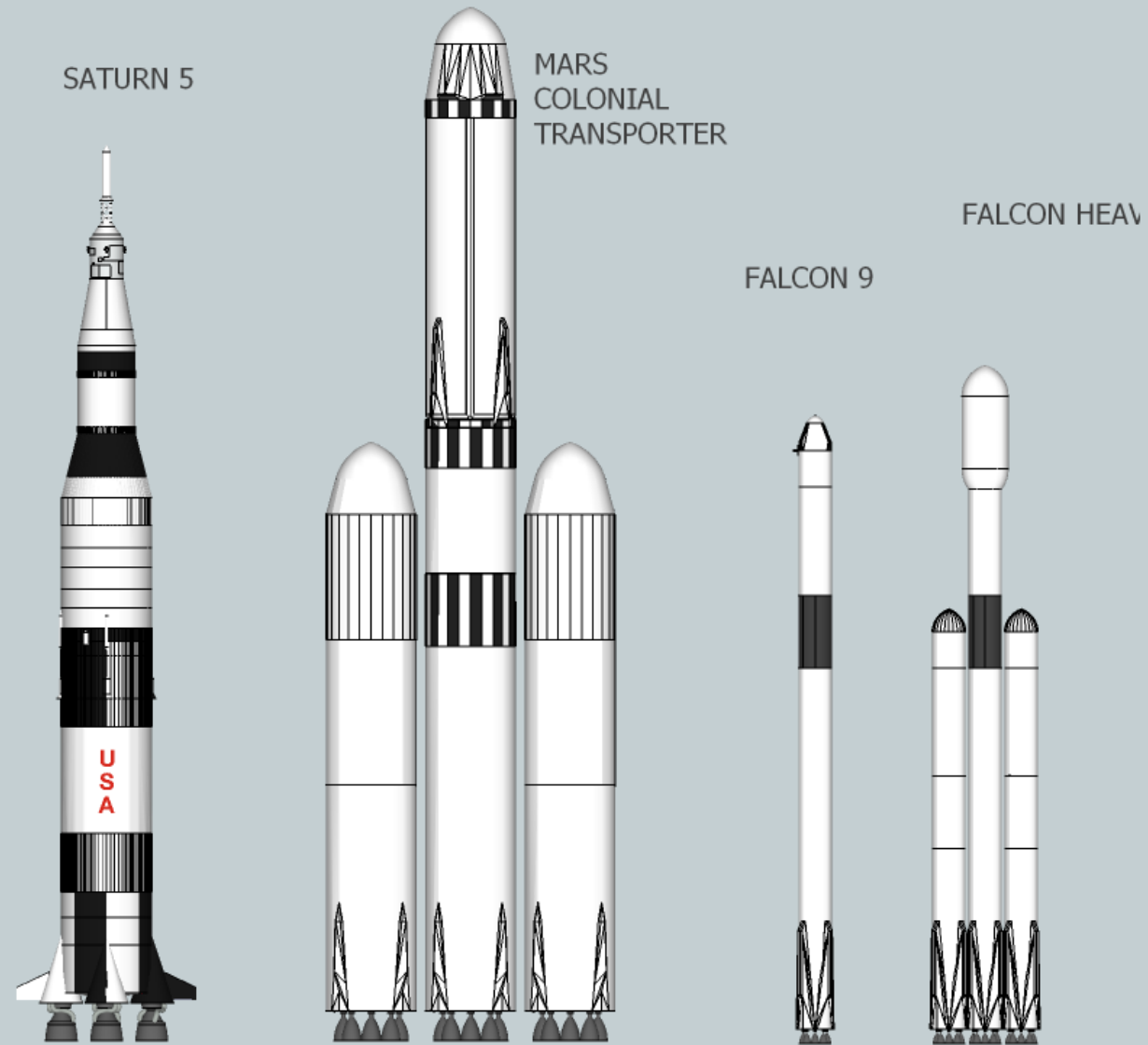


New Shepherd Suborbital Rocket

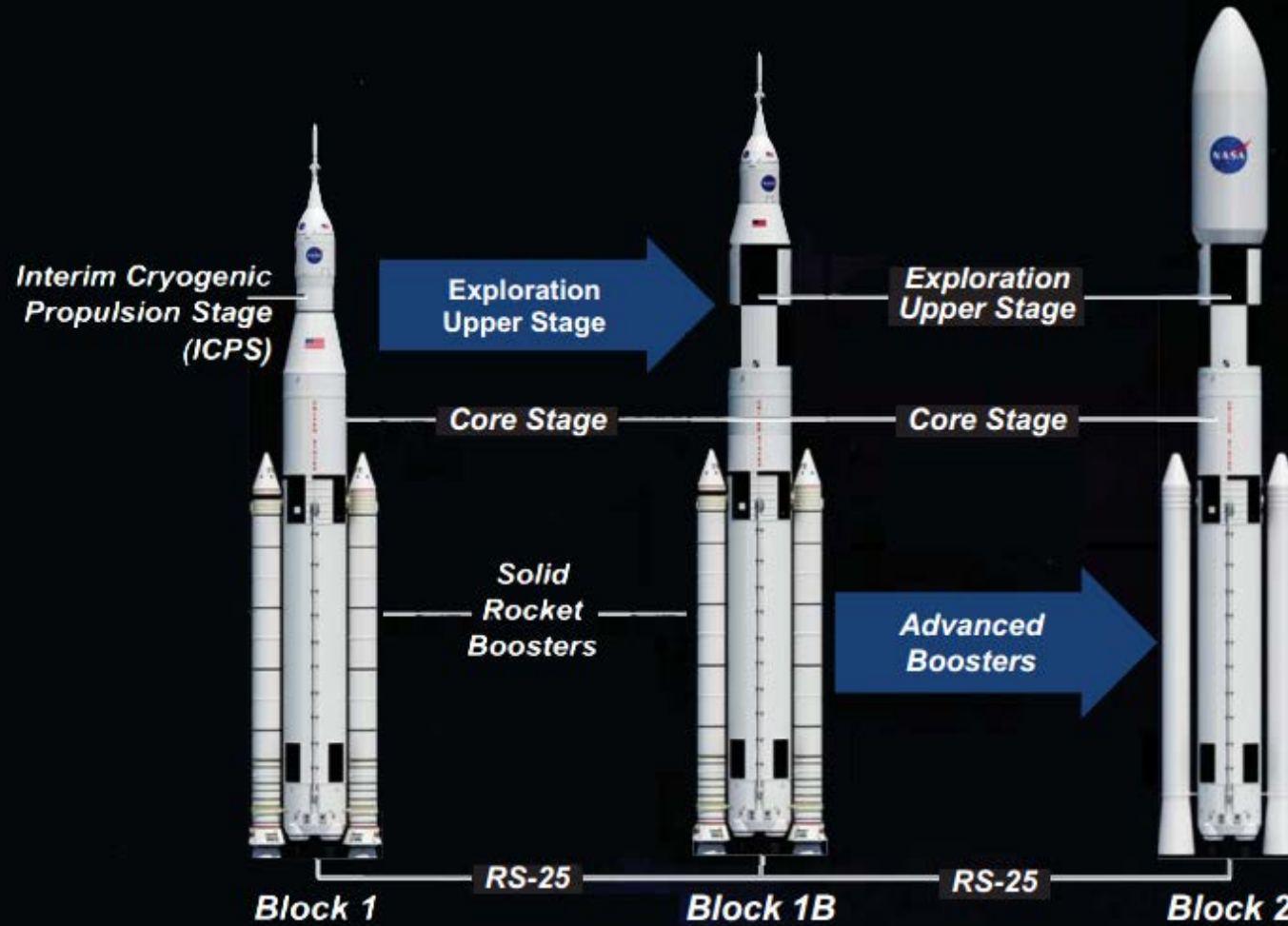




The Future in Space – View 1



The Future in Space – View 2



The Future in Space – View 3

SpaceX at the Kennedy Space Center



The Future of Space Exploration



Landing at Sea



The Technical Secret of the Booster Landings

Hypersonic Thrust Reversal



Reduces atmospheric vehicle heating, terminal velocity and damage.

Recovering Boosters – An Essential New Exploration Architecture



SpaceX Cost Analysis:

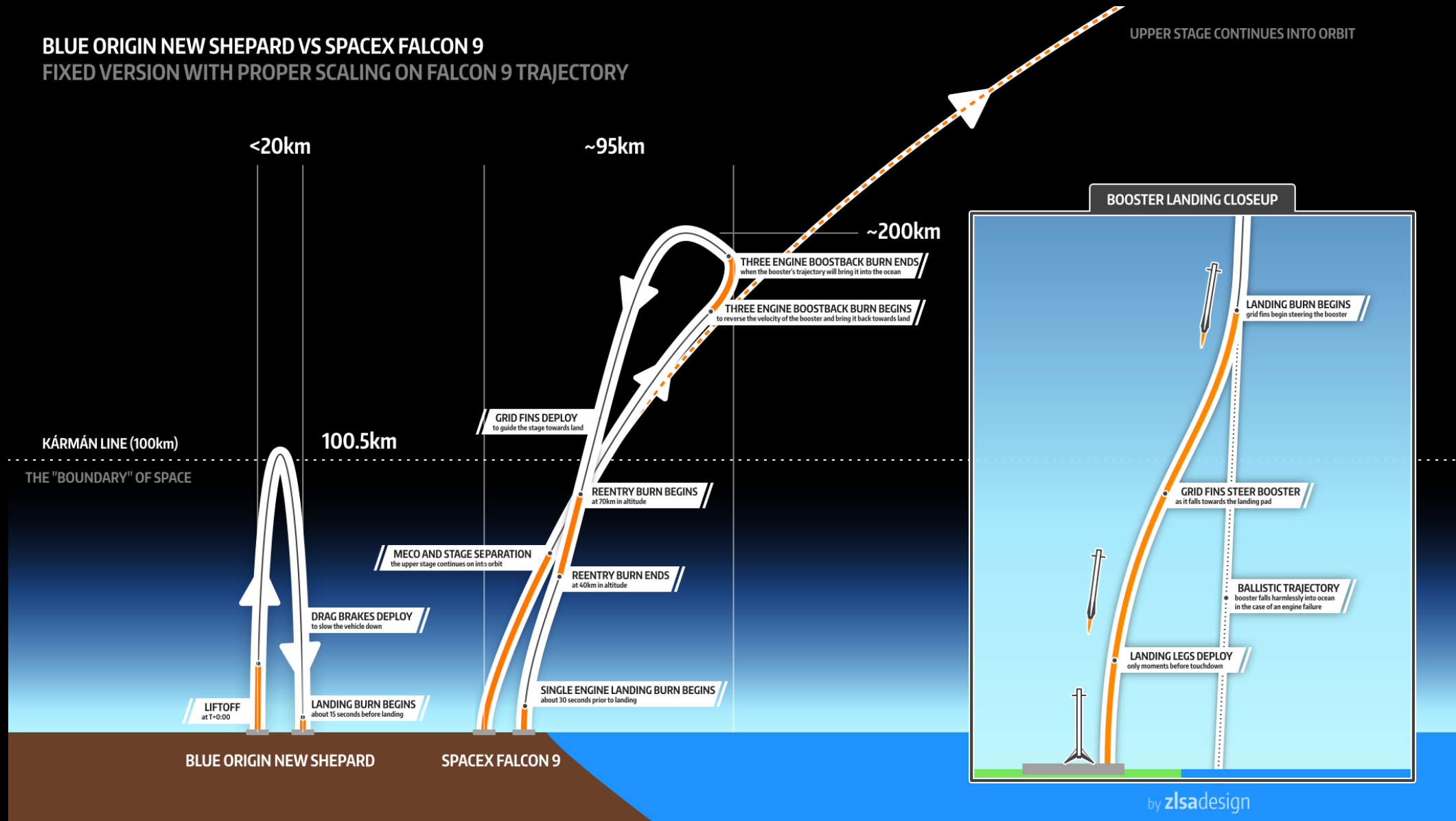
Cost of Falcon-9 Mission without re-use: **\$61 million**

Cost of Falcon-9 Mission with re-use : **\$37 million**

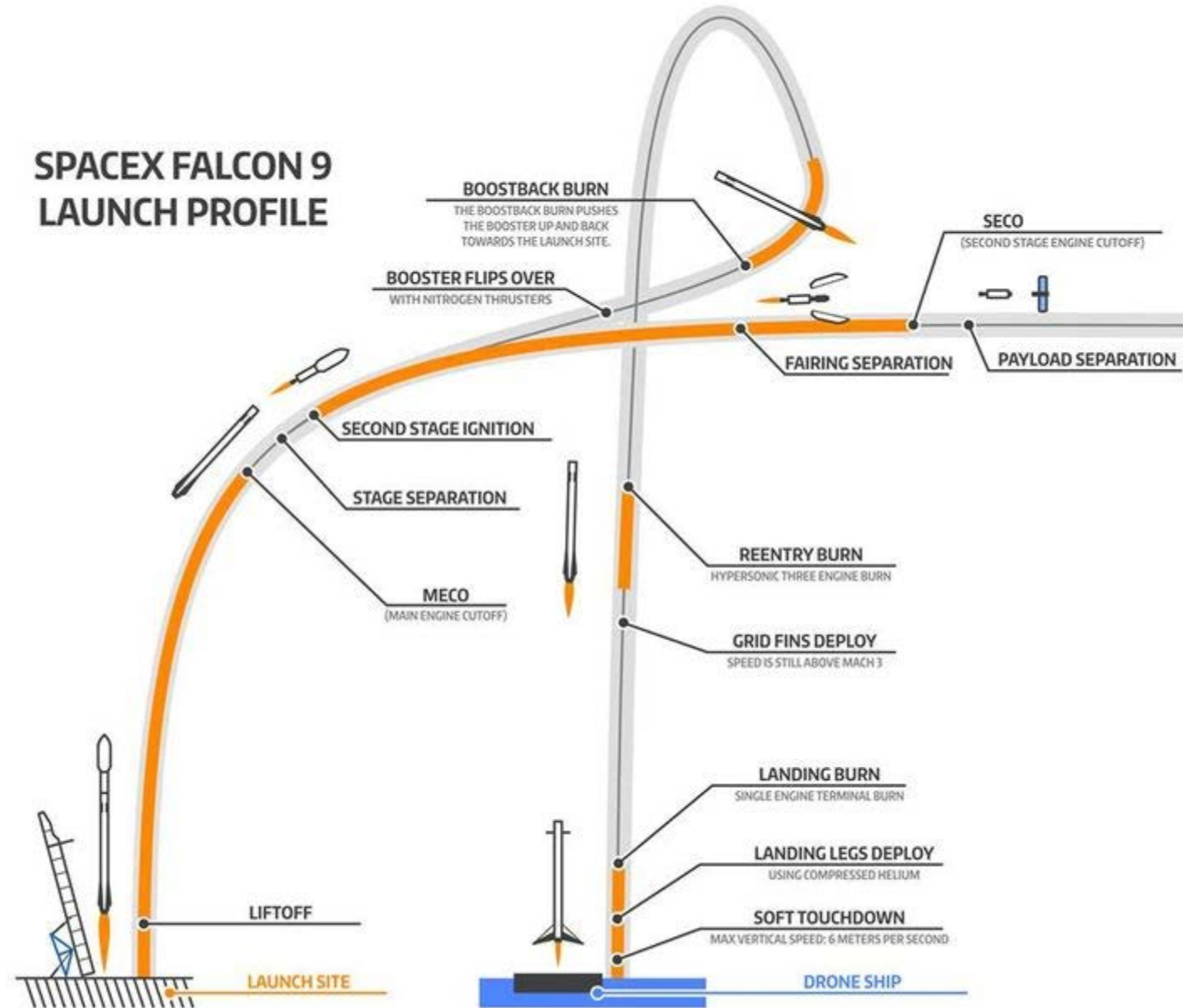
40% Net Cost Reduction per Launch
\$1,220 per pound vs. \$740 to LEO
\$3,390 per pound vs. \$ 2,056 to GTO

Blue Origin Landing

BLUE ORIGIN NEW SHEPARD VS SPACEX FALCON 9 FIXED VERSION WITH PROPER SCALING ON FALCON 9 TRAJECTORY



SPACEX FALCON 9 LAUNCH PROFILE



Used Rockets Ready to Re-fly



The New Private Space Transportation System

SpaceX and Boeing

1st Flight – SpaceX - May 2018

Russia Soyuz Contract Ends Sept. 2018

CURRENT COSTS:

Soyuz Flight: \$81 million per seat

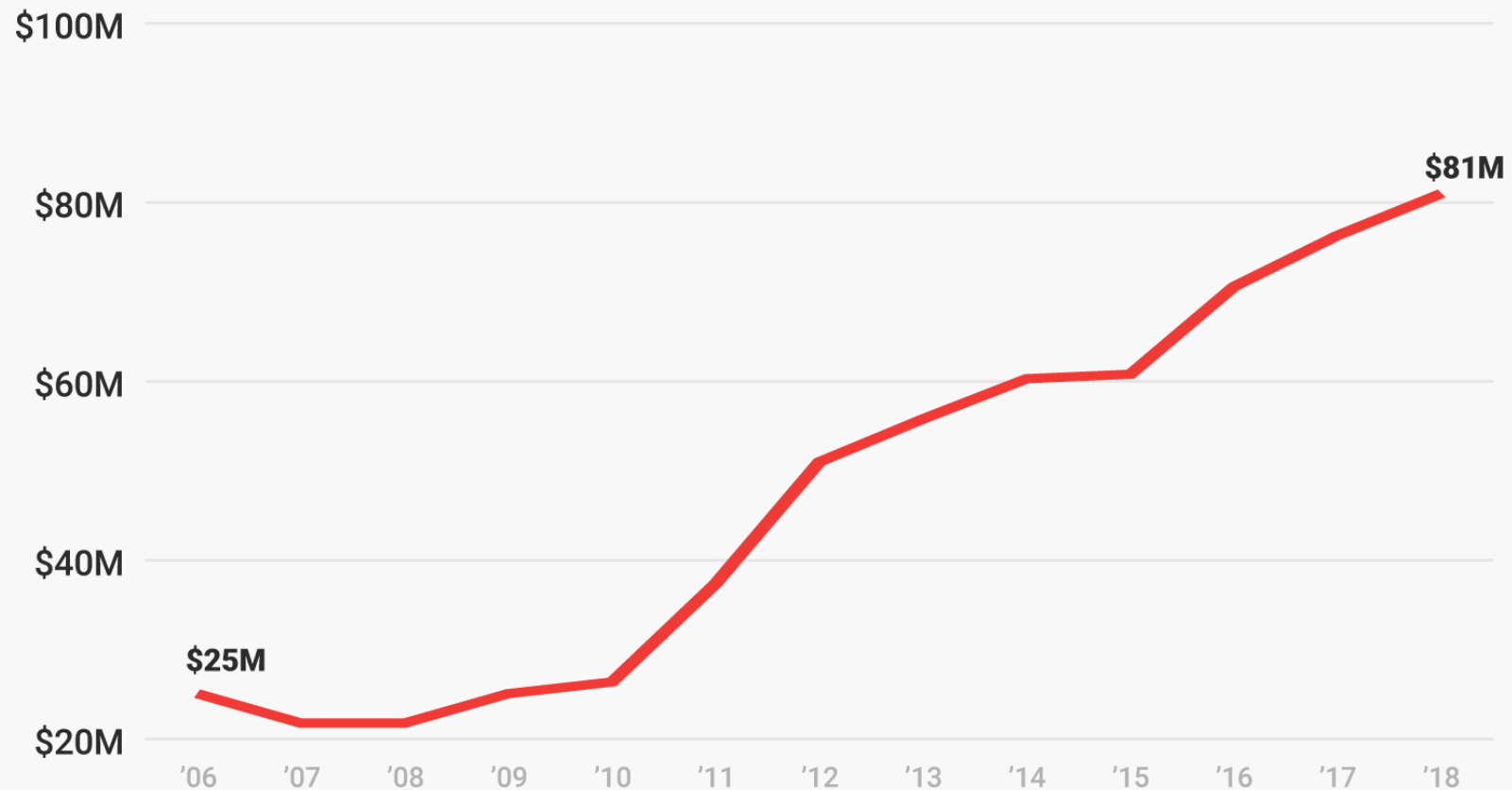
Seven Astronauts Transport Costs to ISS:

\$567,000,000

(Compared to cost of Space Shuttle
Mission: \$455 million)



HOW MUCH NASA IS PAYING RUSSIA TO SEND ASTRONAUTS INTO SPACE, PER SEAT



SOURCE: NASA

BUSINESS INSIDER



Estimated Cost per Seat:
\$50 million

Estimated annual savings: \$217 million

Problems and setbacks.... (September 2016)





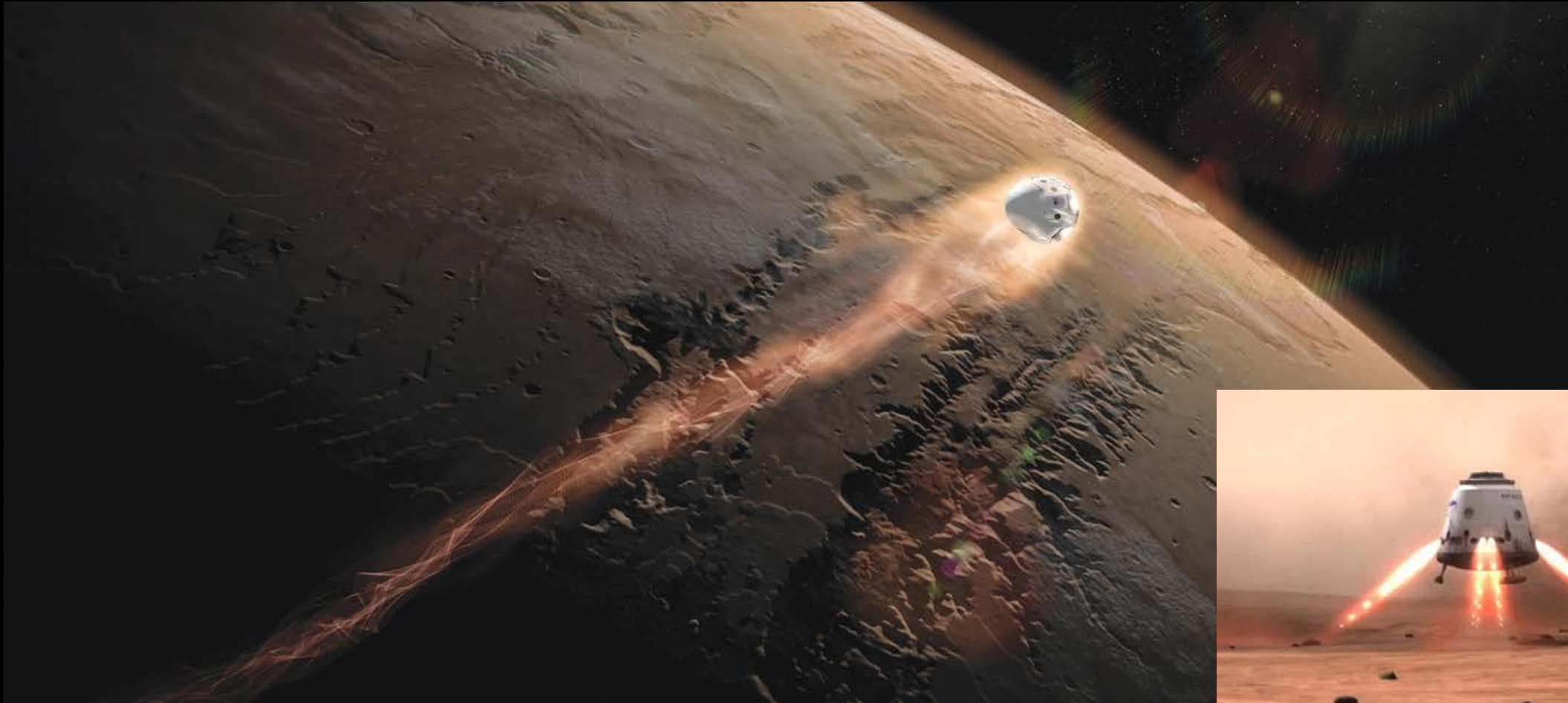
SpaceX Falcon Heavy Scheduled for Launch early to mid 2017 from KSC

Artist's View



The Real Thing – January 3, 2017

The Future is Now!
Unmanned SpaceX Red Dragon to Mars
2018-2020



A black and white photograph of a desert landscape, likely a sand dune field. The image is overlaid with a grid of 15 crosshair markers arranged in three rows of five. The word "Questions?" is centered in the middle of the image in a large, bold, black font.

Questions?