

Human Spaceflight: Past, Present, and Future (if any)

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Why *human* spaceflight?

Pros and cons of having humans on-board.

Pros

- More efficient than robots
- More versatile than robots
- Generate more public interest in the space program

Cons

- Hardware requires more safety testing
- Bumping about can interfere with some experiments
- Astronauts require life support – more consumables
- Astronauts require “gentle handling” on launch & landing
- Astronauts want to come home after the flight

An interesting/humorous reference:

Packing for Mars by Mary Roach.

A brief history of
human spaceflight
– the U.S. experience
(initially motivated by
the “Space Race”
with the U.S.S.R.)

Step 1 – Learning to get people into space, survive there, and get them back safely.

Stratospheric balloons in the “Manhigh” and “Excelsior” projects to test space suits and human exposure to cosmic radiation.

Rocket-plane X-15 flights to test high-speed Flight and set altitude records.

The edge of “outer space” is (somewhat artificially) defined as 100 km above the surface of the Earth.

Manhigh and Excelsior stratospheric balloon flights in the late 1950's and early 1960's.

Joseph Kittinger jumped from 102,800 ft in 1960.

That record was broken, very publically, by Felix Baumgartner in 2012, then again by Alan Eustace in 2014, in secret.



Felix Baumgartner

Oct. 14, 2012

Red Bull Stratos

127,852 feet

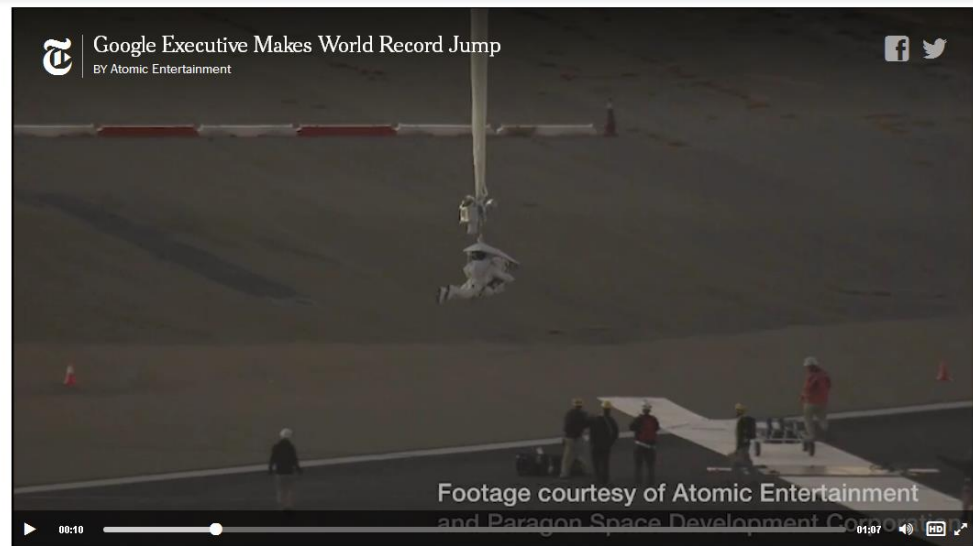


Alan Eustace

Oct. 24, 2014

Google executive

135,890 feet



Alan Eustace, a senior vice president at Google, broke the world record for high-altitude jumps. Video by Atomic Entertainment on October 24, 2014. Photo by Atomic Entertainment and Paragon Space Development Corporation.

North American X-15 rocket-plane flights
in the 1960's explored height and speed.

Two 1963 flights exceeded 100 km (outer space!).

The 1967 speed record still stands: 4519 mi/hr.





Yuri Gagarin of the USSR was the first person to orbit the Earth, on April 12, 1961, on Vostok 1.

The first U.S. outer-space flights were done by Mercury astronauts in one-person capsules.

First U.S. sub-orbital flight – Freedom 7:

Alan Shephard, May 5, 1961



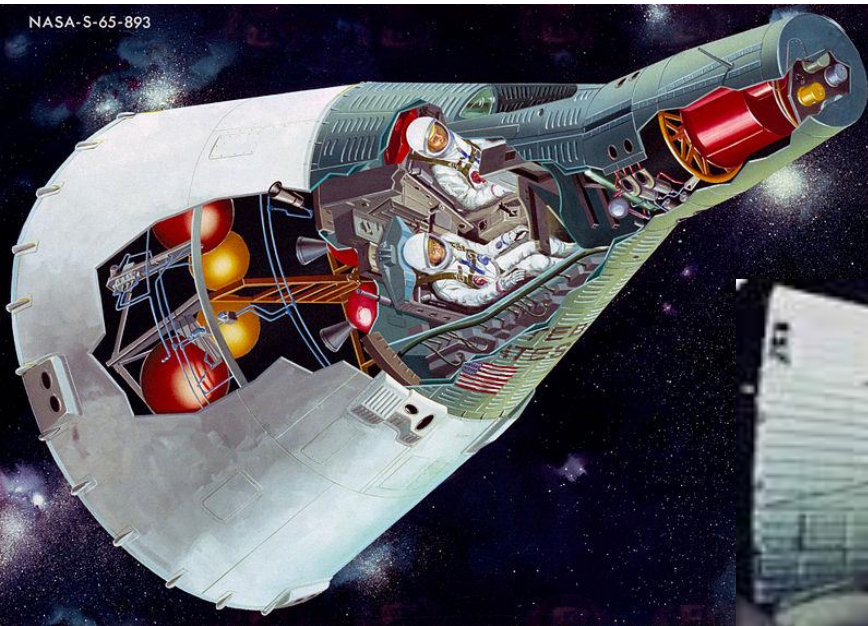
First U.S. orbital flight – Friendship 7:

John Glenn, February 20, 1962



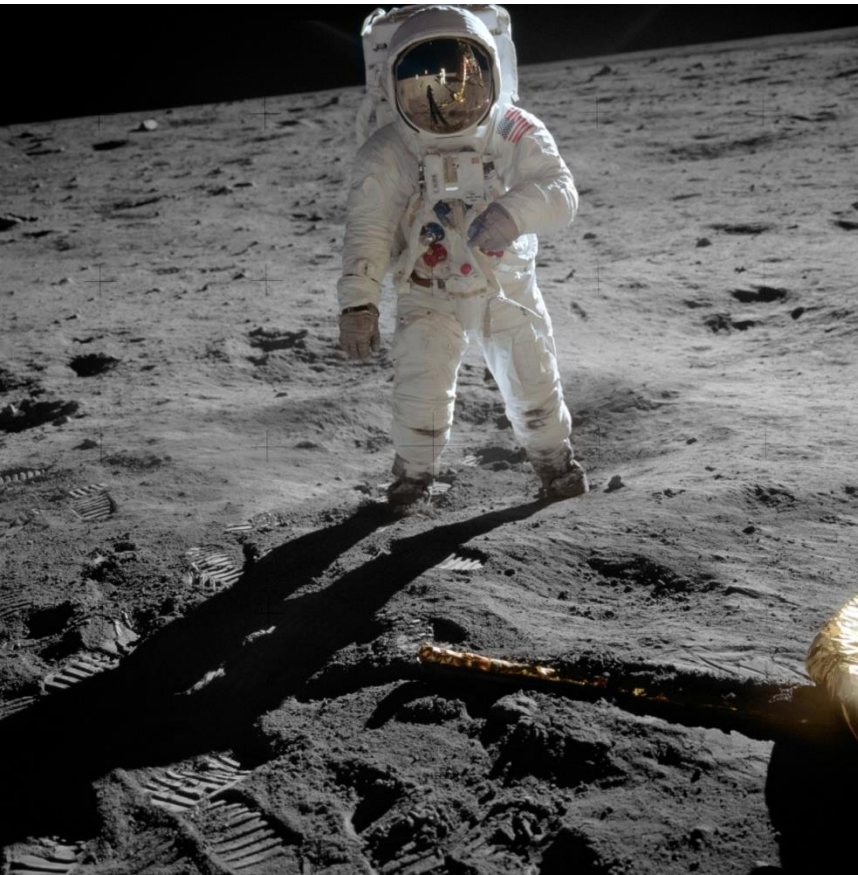
Step 2 – Practicing “long-duration” (up to 2 weeks) spaceflight, working in space (e.g. doing spacewalks, rendezvous and docking of spacecraft, etc.)

This step was accomplished by Gemini astronauts in two-person capsules.



Step 3 – Going to the Moon, as promised by President Kennedy.

This step was accomplished by Apollo
astronauts in three-person capsules
and two-person lunar landers.



First lunar landing – Apollo 11:
Neil Armstrong and Buzz Aldrin
July 20, 1969



Saturn V launches, 1967 to 1973.

Step 4 – Living in Space – Space Stations (and constructing space stations) (and using reusable spacecraft)

Salyut (series)

Skylab

Mir

Shuttle

ISS

Skylab – first U.S. space station.

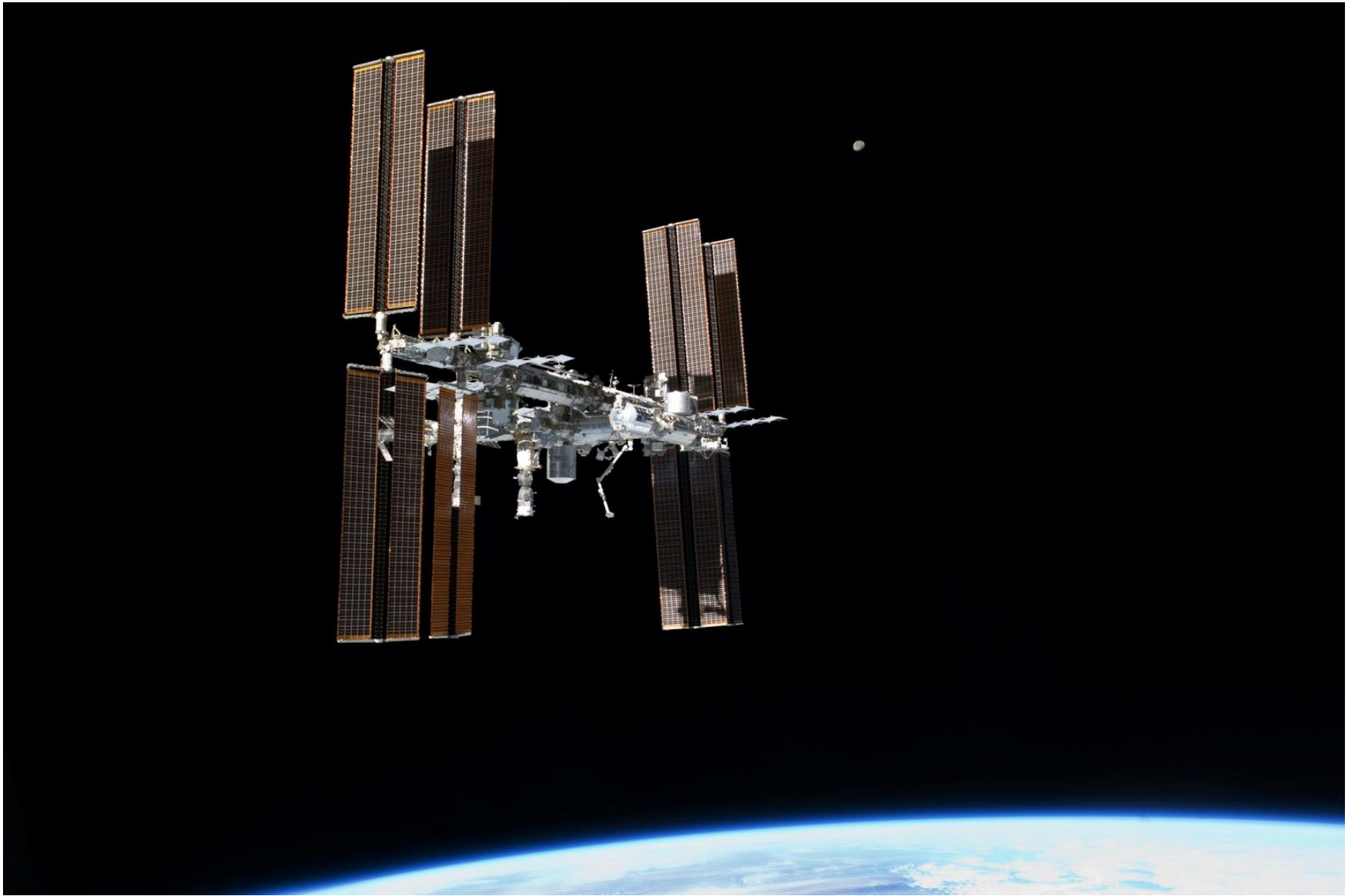




Mir – the first genuinely long-duration space station.



Space Shuttle Discovery
launching on STS-120.



ISS – continuously occupied since November 2000.

International Space Station

With the Space Shuttle Endeavor docked.
As seen from Soyuz TMA-20 after undocking
May 23, 2011 (USA time)

Truss numbering and SM MMOD Shields omitted for clarity

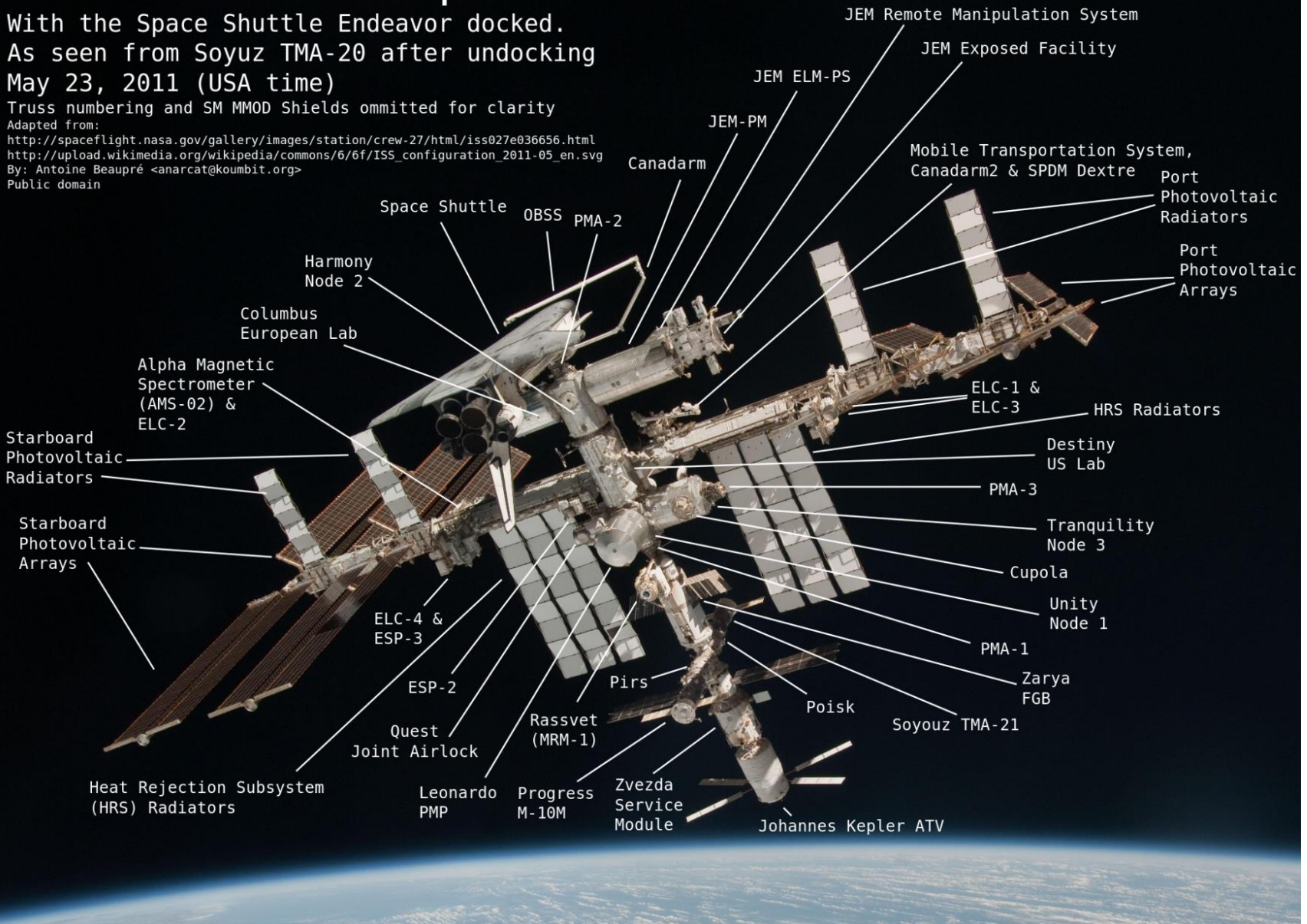
Adapted from:

<http://spaceflight.nasa.gov/gallery/images/station/crew-27/html/iss027e036656.html>

http://upload.wikimedia.org/wikipedia/commons/6/6f/ISS_configuration_2011-05_en.svg

By: Antoine Beaupré <anarcat@koumbit.org>

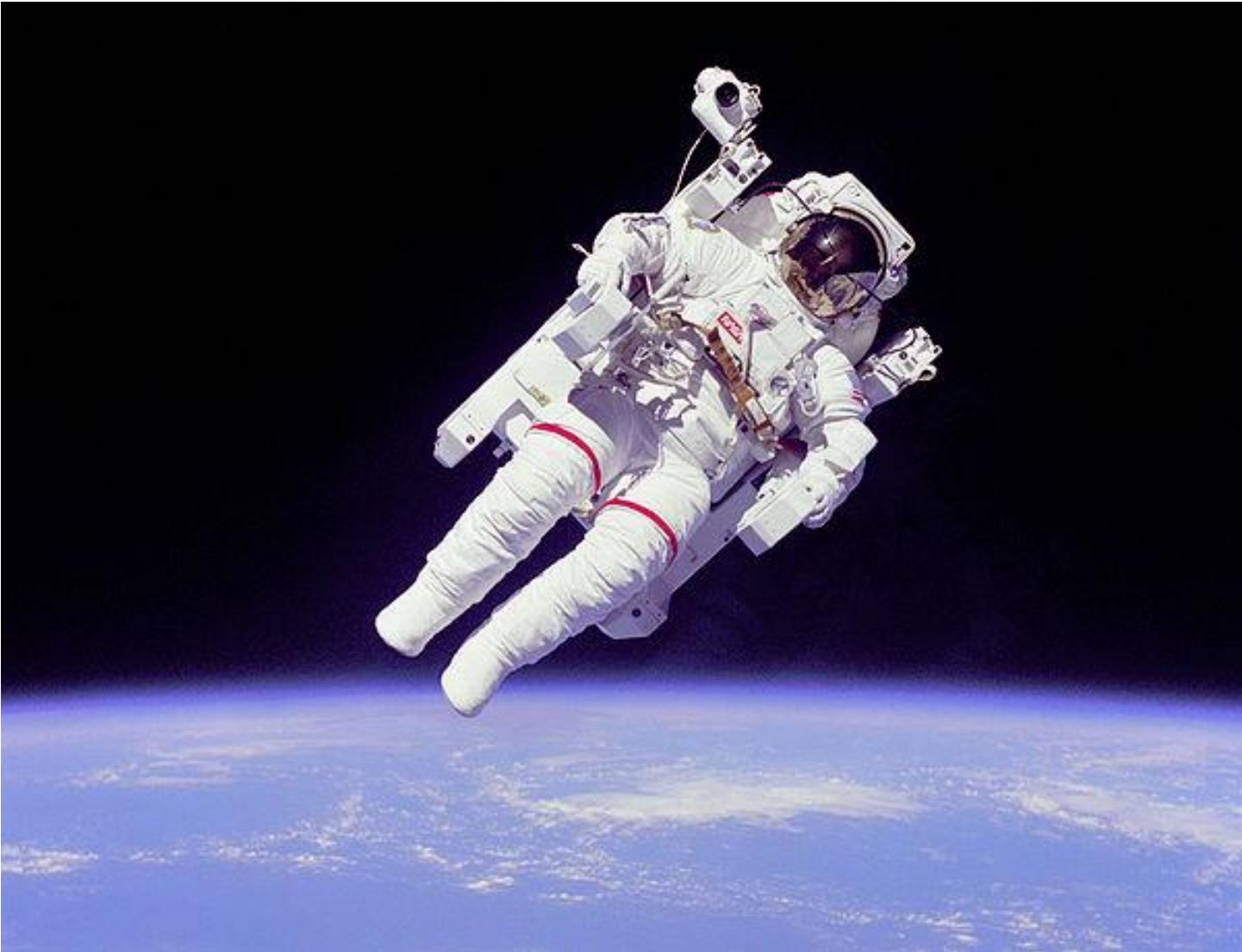
Public domain



ISS labeled photo, with shuttle Endeavour docked.



ISS testing segment at Marshall SFC in Huntsville, AL.



Astronaut Bruce McCandless using a Manned Maneuvering Unit (MMU).



Astronauts working on the ISS main truss.



Astronaut on the ISS, viewing the Earth at night.

Recent/Current Events: A foretaste of the future of human spaceflight

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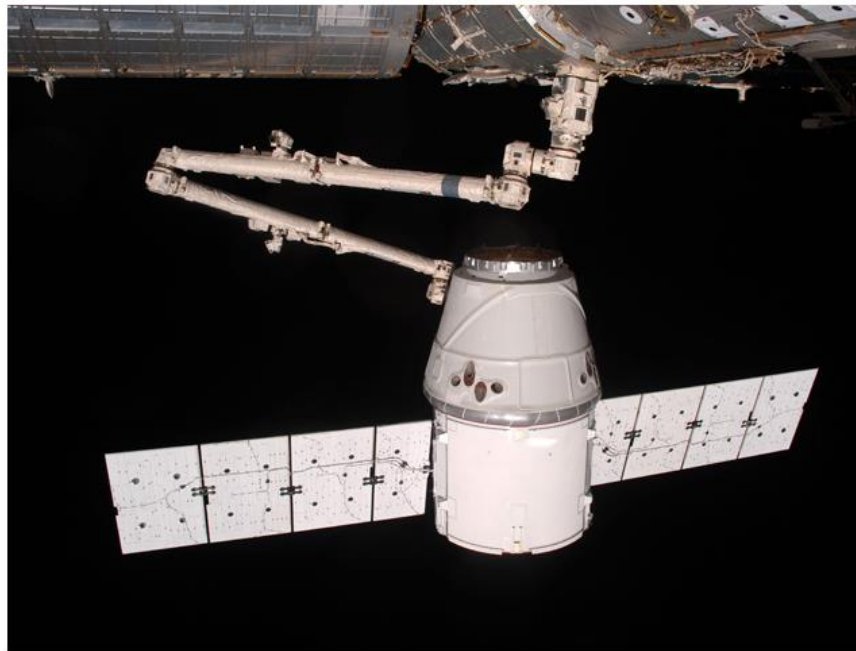


DRAGON OVERVIEW

[DragonLab DataSheet](#) (875 kb)

Dragon is a free-flying, reusable spacecraft developed by SpaceX under NASA's Commercial Orbital Transportation Services (COTS) program. Initiated internally by SpaceX in 2005, the Dragon spacecraft is made up of a pressurized capsule and unpressurized trunk used for Earth to LEO transport of pressurized cargo, unpressurized cargo, and/or crew members.

In May 2012, SpaceX made history when its Dragon spacecraft became the first commercial vehicle in history to successfully attach to the International Space Station. Previously only four governments -- the United States, Russia, Japan and the European Space Agency -- had



View from the International Space Station of the SpaceX Dragon spacecraft as the station's robotic arm moves Dragon into place for attachment to the station. May 25, 2012. Photo: NASA

SpaceX has flown cargo to the ISS starting in 2012.



<https://www.youtube.com/watch?v=9pillaOxGCo>



<https://www.youtube.com/watch?v=1sJIFzUQVmY>

Upright landing of rocket boosters – Blue Origin’s New Shepard (Nov. 2015) and SpaceX’s Falcon-9 (Apr. 2016).

Space crew does China's fir...

Space on msnbc.com

Space crew performs China's first manual docking

Capsule backs away from module, then links up again with astronauts at the controls

Jump to video
China's first female astronaut a national heroine

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BEIJING — A Chinese spacecraft carrying three astronauts docked manually with an orbiting module on Sunday, a first for the country as it strives to match American and Russian exploits in space.

The Shenzhou 9 capsule's maneuver with the Tiangong 1 module was shown live on national television. It follows a docking last week that was carried out by remote control from a ground base in China.

The Chinese astronauts have been living and working in the module for the past week as part of preparations for

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Chinese first manned docking, June 2012.

First US woman in space, Sally Ride, dies at 61 - Technology & science - Space - NBCNews.com - SeaMonkey

http://www.nbc.com/id/48292643/ns/technology_and_science-space/first-us-woman-space-sally-ride-dies/#.UUA

Space on NBCNEWS.com

First American woman in space, Sally Ride, dies at 61

Former astronaut loses 17-month battle against cancer; hailed as role model

Jump to video Tributes pour in for first US woman in space

Recommend 5.7k
Tweet 230
Share 1.5K

By Alan Boyle
Science editor


NBC News updated 7/23/2012 7:13:44 PM ET

The first American woman to go into space, Sally Ride, died Monday after a 17-month battle against pancreatic cancer, her company said.

Ride made history in 1983 as a crew member on the space shuttle Challenger, breaking the gender barrier for U.S. spaceflight. Soviet cosmonaut Valentina Tereshkova became the first woman in space in 1963, but it took another 20 years for NASA to follow suit.

Word of Ride's death came in an announcement from Sally Ride Science, the educational venture she founded after leaving NASA.

President Barack Obama said he and his wife, Michelle, were "deeply saddened" by the news.



Nasa / Reuters

Astronaut Sally Ride monitors control panels from the pilot's chair on the flight deck of the space shuttle Challenger during her historic space mission in 1983. Floating in front of her is a flight procedures notebook. Ride died on Monday after a 17-month battle with pancreatic cancer.

Famous astronauts Sally Ride and Neil Armstrong both died in 2012. Scott Carpenter died Oct. 10, 2013.

Neil Armstrong, First Man on Moon, Dies at 82 - NYTimes.com - SeaMonkey

http://www.nytimes.com/2012/08/...

The New York Times

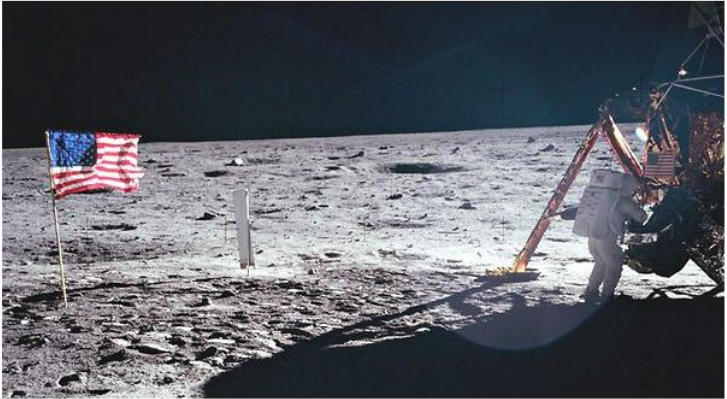
Space & Cosmos

WORLD U.S. N.Y. / REGION BUSINESS TECHNOLOGY SCIENCE HEALTH SPORTS OPINION

ENVIRONMENT SPACE & COSMOS

It's beginning to look a lot like Christmas... HARLEQUIN

Neil Armstrong, First Man on the Moon, Dies at 82



NASA


Neil Armstrong, as photographed by Buzz Aldrin, working near the Eagle lunar module after the landing on July 20, 1969. More Photos >

By JOHN NOBLE WILFORD
Published: August 25, 2012 | 822 Comments

Neil Armstrong, who made the "giant leap for mankind" as the first human to set foot on the moon, died on Saturday. He was 82.

His family said in a statement that the cause was "complications resulting from cardiovascular procedures." He had undergone heart bypass surgery this month in Cincinnati, near where he lived. His recovery had been going well, according to those who spoke with him after the surgery, and his

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Themes for the future of human spaceflight

Theme 1 – “Space Tourism” – Commercial sub-orbital (and other) flights for paying customers

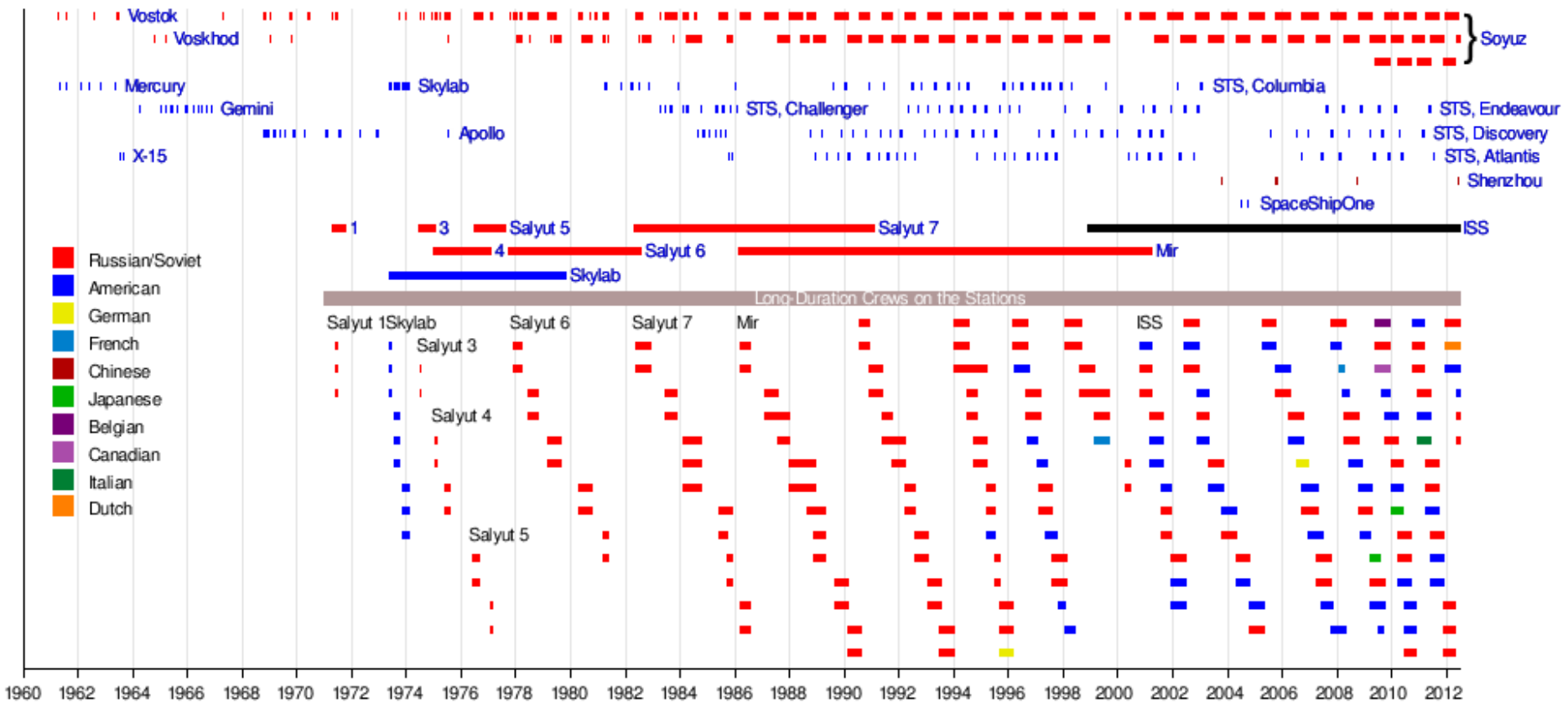


An animation of sub-orbital spaceflight on SpaceShipTwo by Virgin Galactic. Coming soon; tickets only \$200K!

<http://www.youtube.com/watch?v=lytjSl6voP0>

Theme 2 – Growth of countries training astronauts and developing their own human space programs.

Who has been in outer space so far?



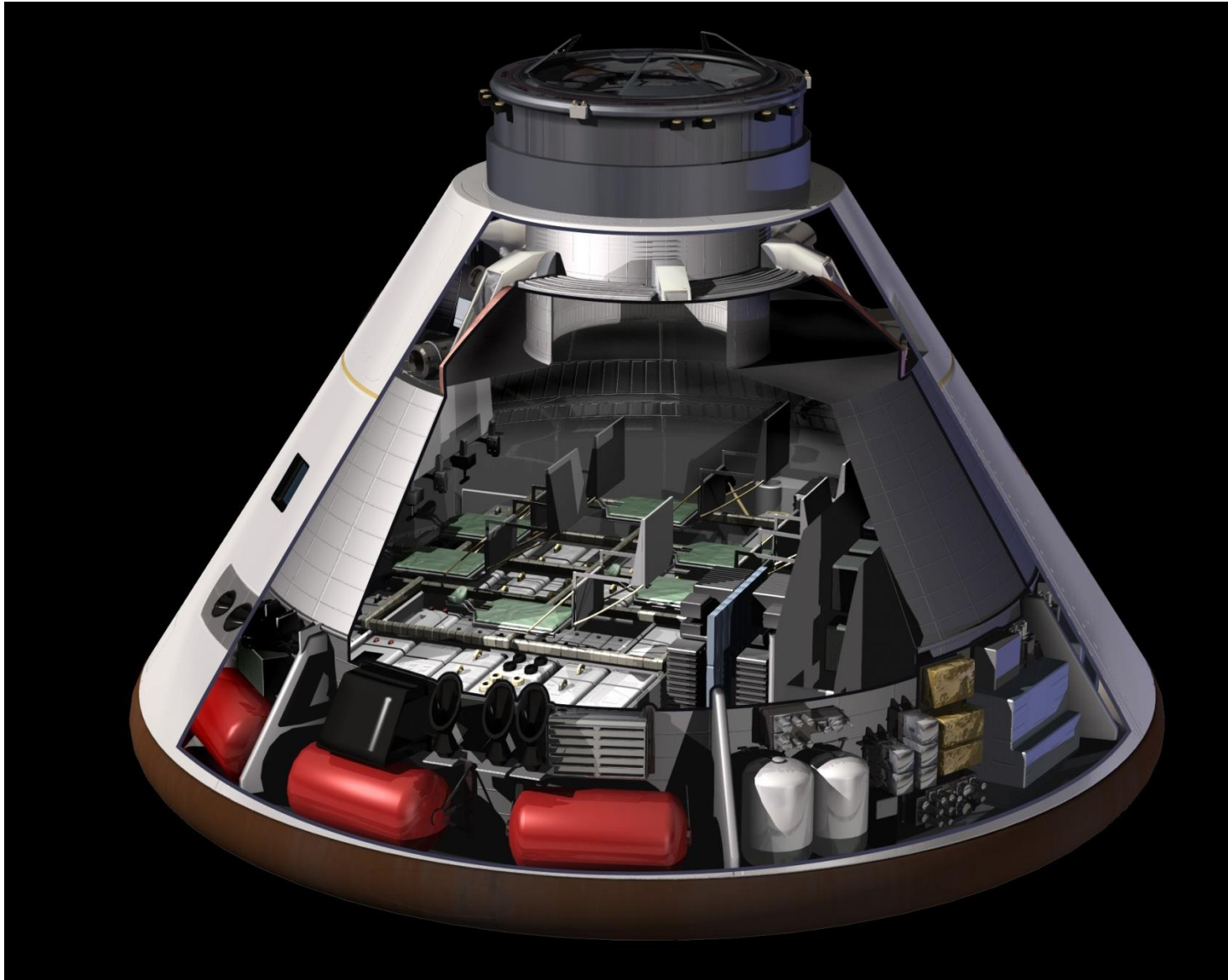
http://en.wikipedia.org/wiki/Human_spaceflight

Progress on sending their own people to outer space.

- USSR (then Russia) – 1960's – success to LEO
- USA – 1960's – success to LEO then to the Moon
- China – 1970's – abandoned
- China – 1980's – abandoned
- European Space Agency – 1990's – abandoned
- Iraq (Ba'athist) – 2000's – abandoned
- Japan – 2000's – abandoned
- China – 2000's – success to LEO
- India – 2010's – planned
- Iran – 2010's – planned
- European Space Agency – 2020's – planned
- Japan – 2020's – planned

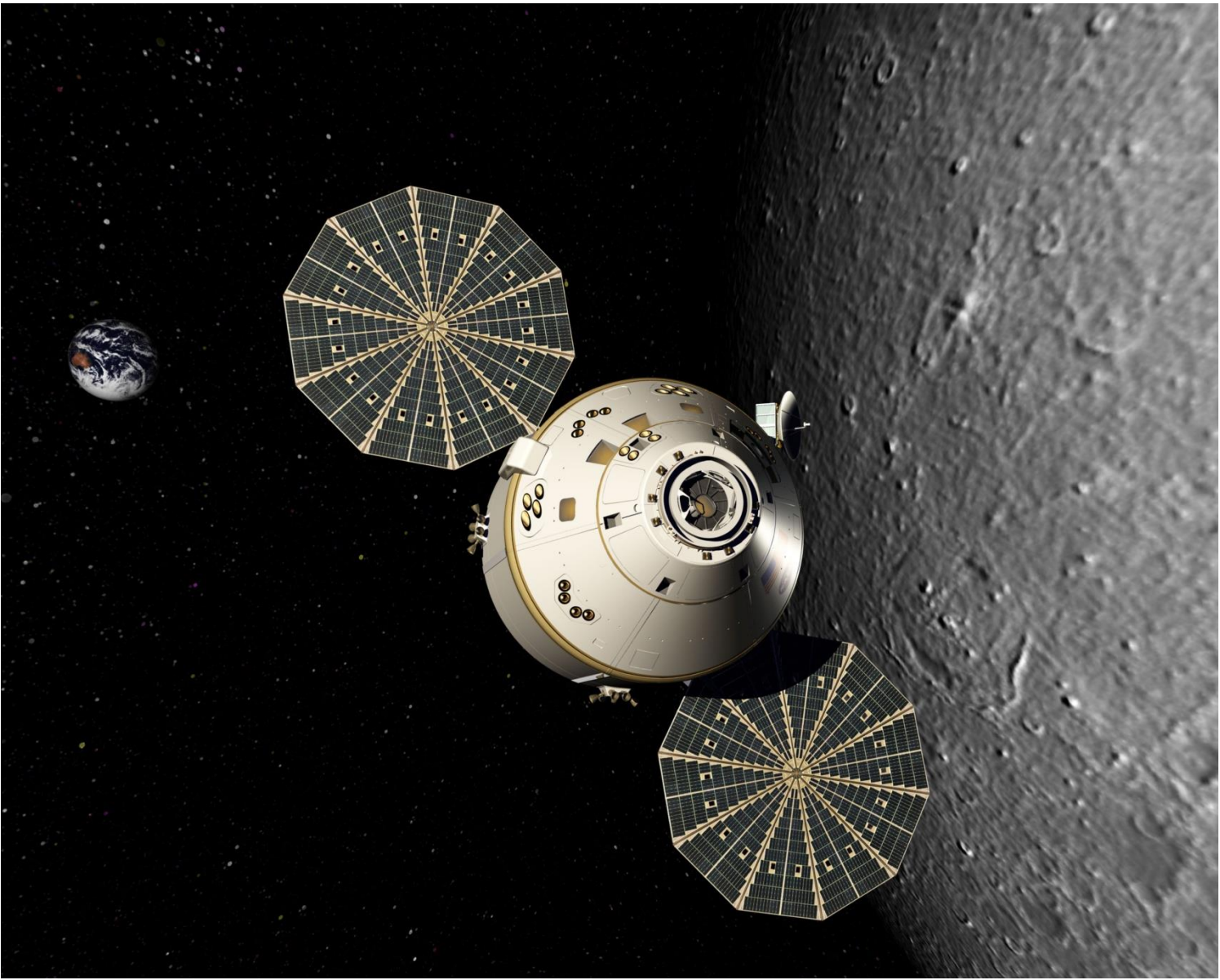


Chinese Shenzhou 5 launch in 2003.



Orion 4 to 6-person crew capsule.

<http://www.nasa.gov/exploration/systems/orion/videos>



Artist's conception of Orion on a lunar mission.



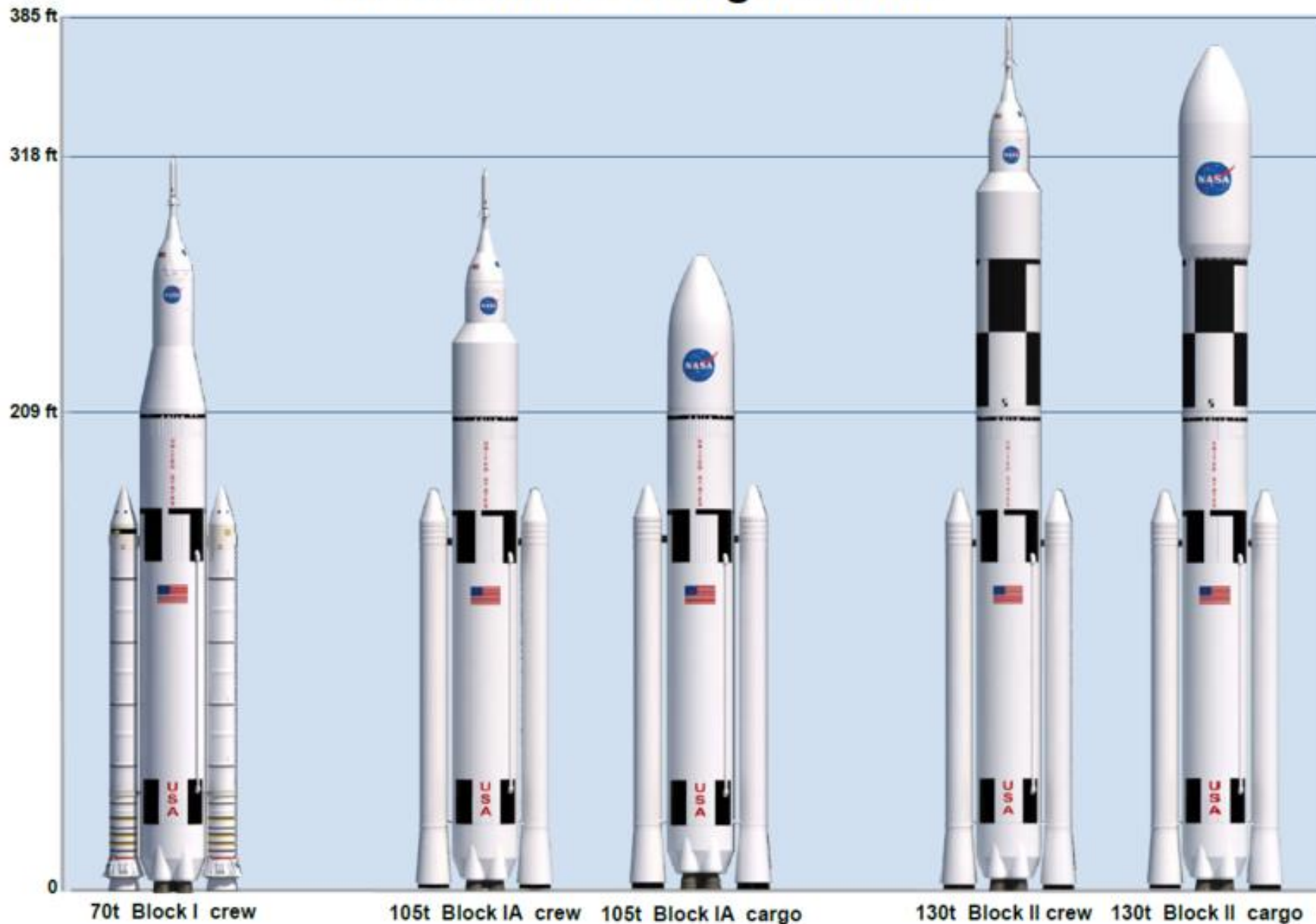
Space Launch System
(SLS) Block 1 crewed
variant launching.

Theme 3 – Commercialization of US flights to LEO so NASA can concentrate on more-distant targets with the new Orion crew capsule and SLS rockets.



Animation of an SLS Block 1 crewed launch and Exploration Flight Test 1.

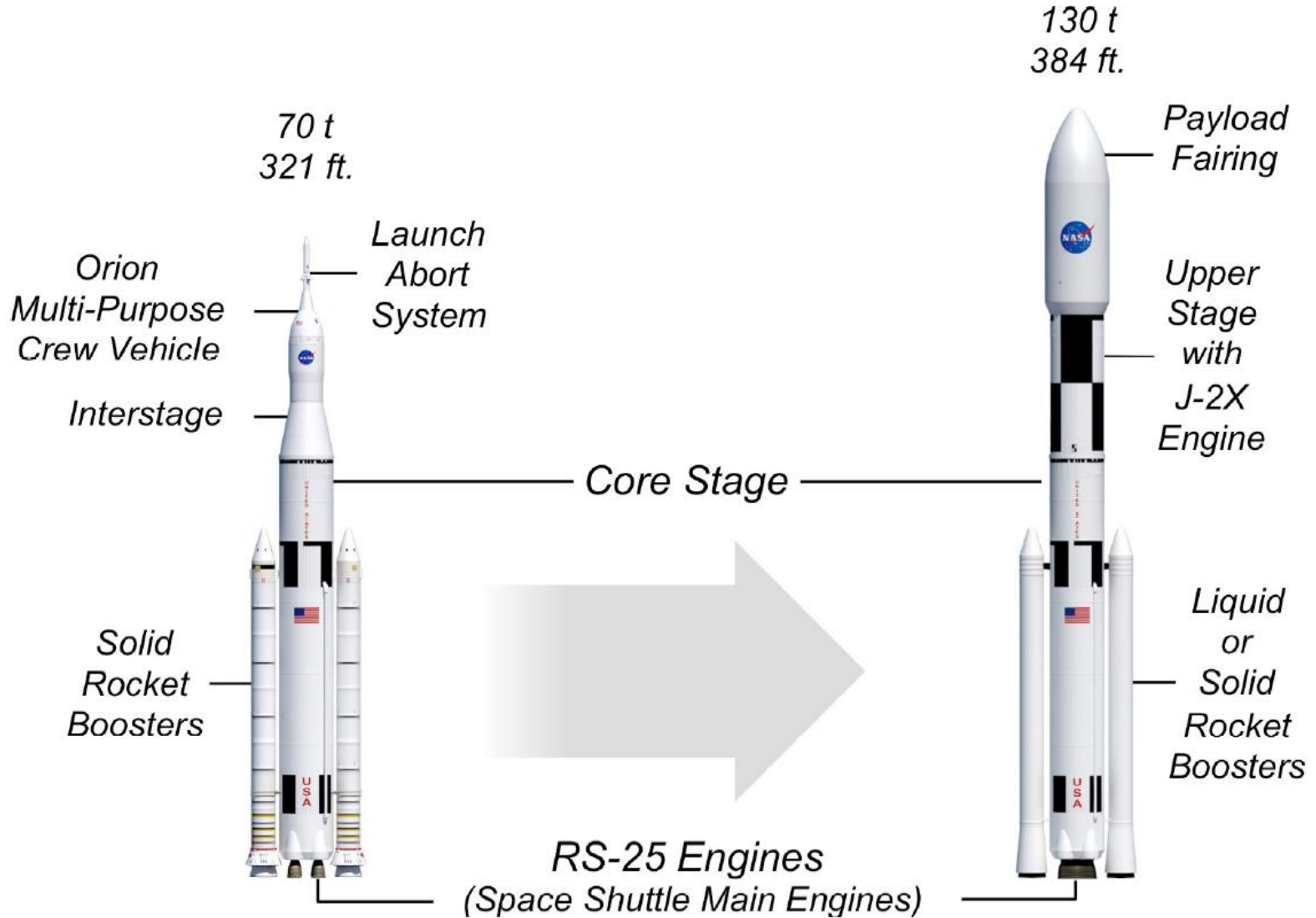
SLS Vehicle Configurations



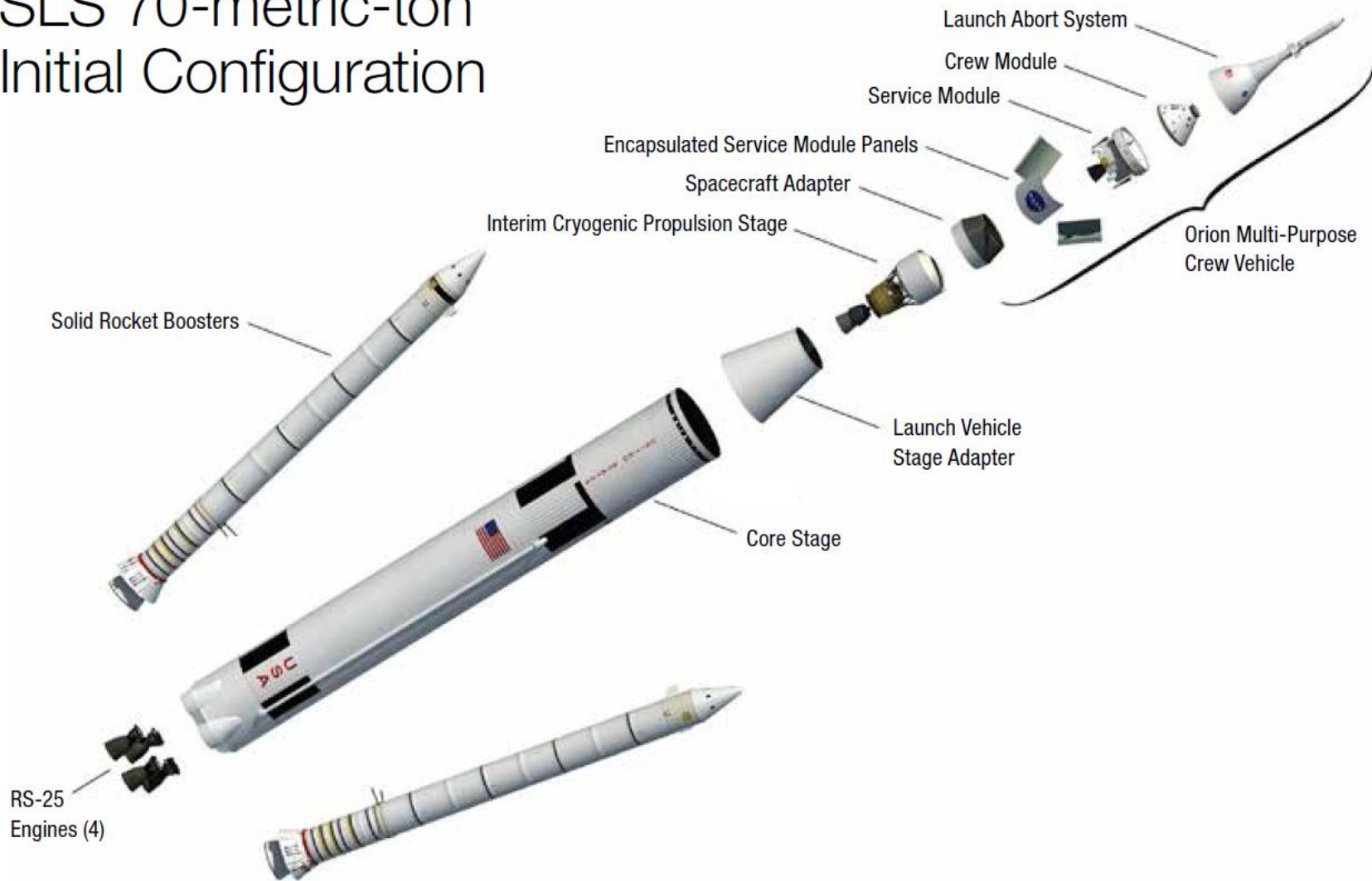
SLS Initial Lift Capability - 70 metric tons (t)

*More than double any operational vehicle today
(Crew Configuration Shown)*

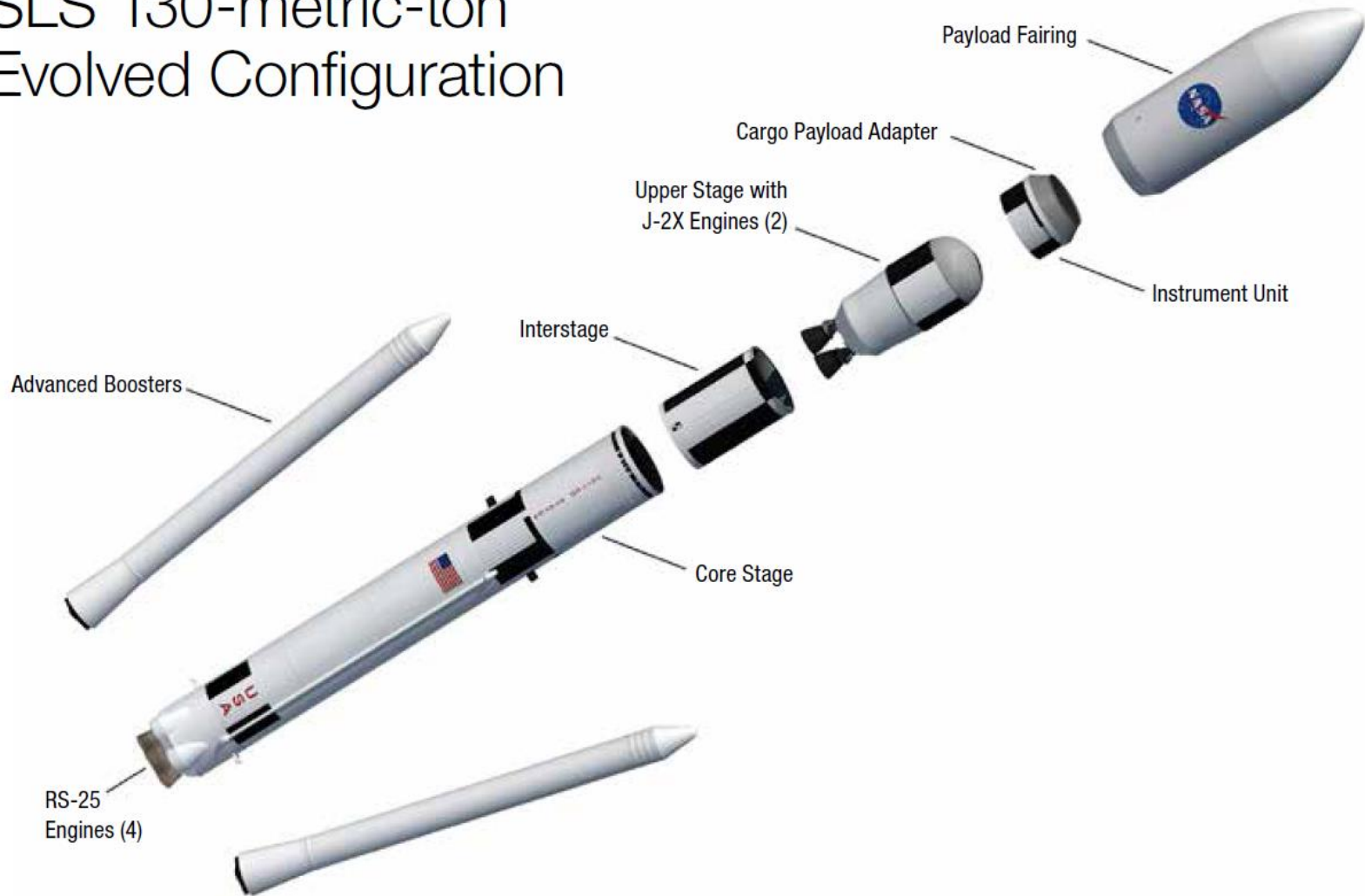
SLS Evolved Lift Capability - 130 t
*More than any past, present or planned vehicle
(Cargo Configuration Shown)*



SLS 70-metric-ton Initial Configuration



SLS 130-metric-ton Evolved Configuration



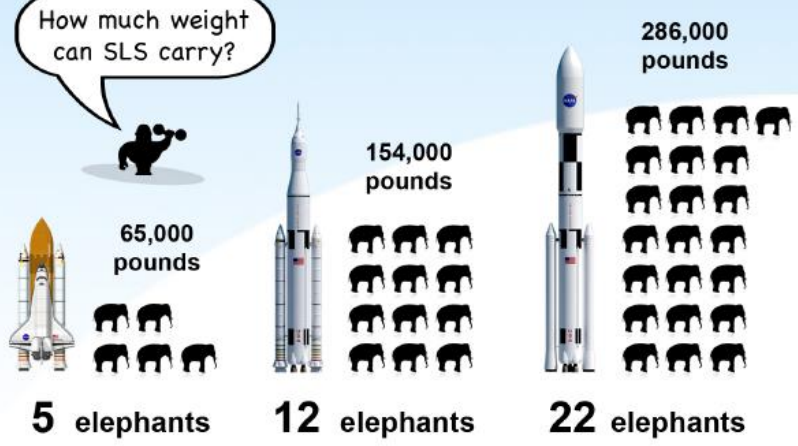
How **TALL** will SLS be?



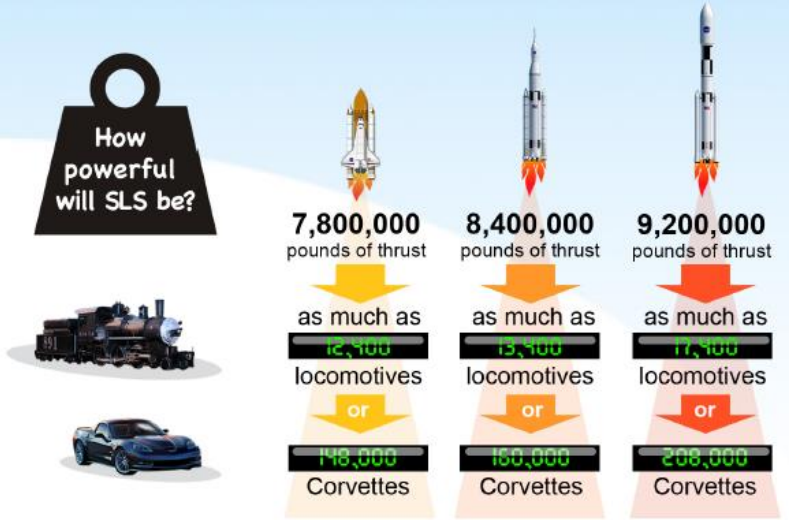
How much will SLS weigh?



How much weight can SLS carry?



How powerful will SLS be?

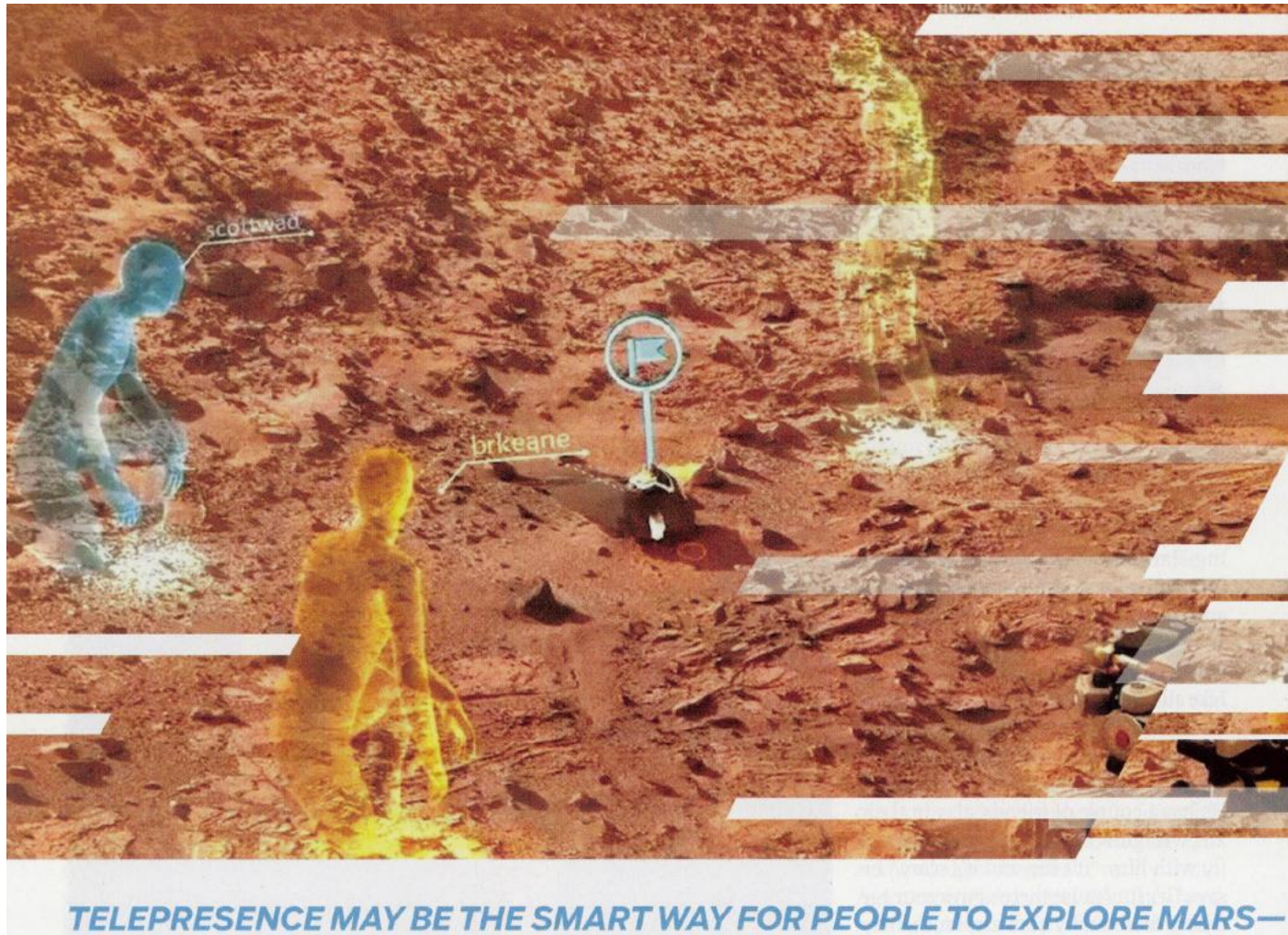


NASA's Space Launch System will take astronauts and science experiments farther into space than ever before.

www.nasa.gov/sls

LG-2012-03-27-MSFC
April 2012

Theme 4 – Exploration by Telepresence



Air & Space Smithsonian magazine, *“Almost Like Being There”*, January 2016, p. 32, Tony Reichhardt.