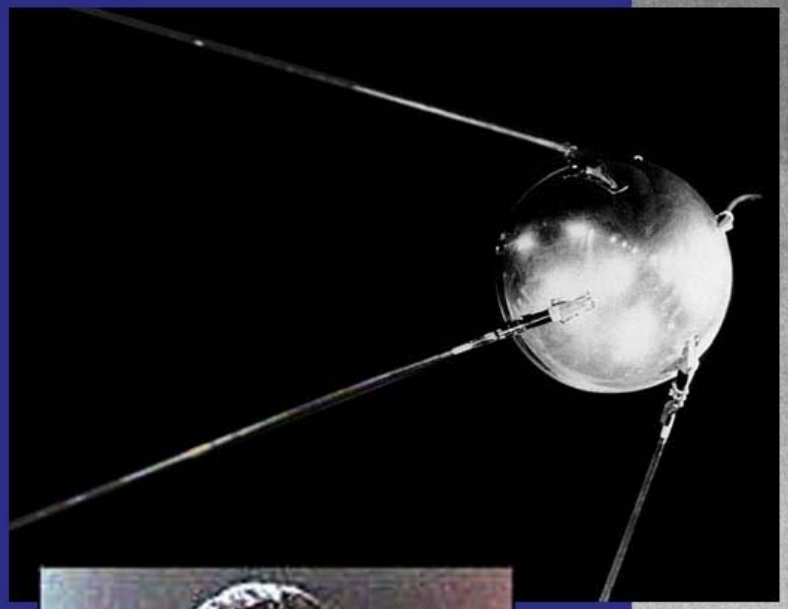
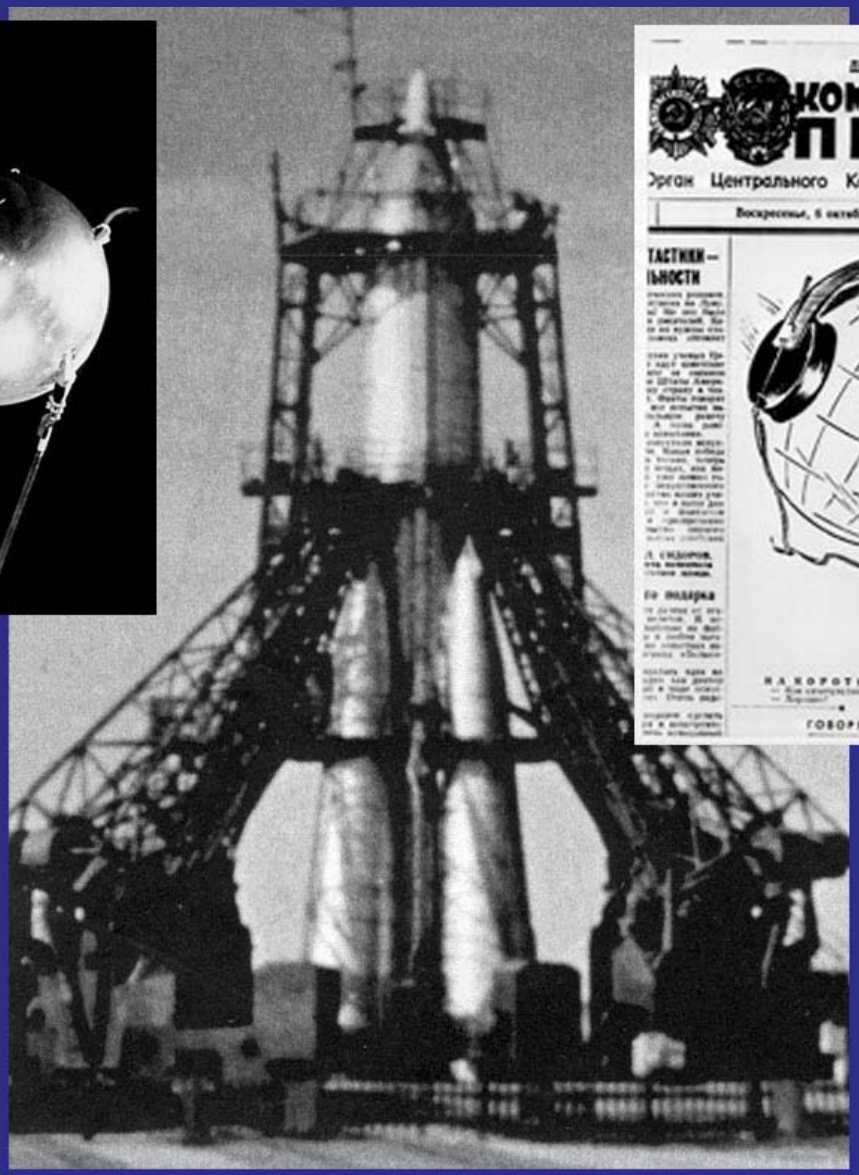
Space Exploration

A Visual History

Philip Stooke

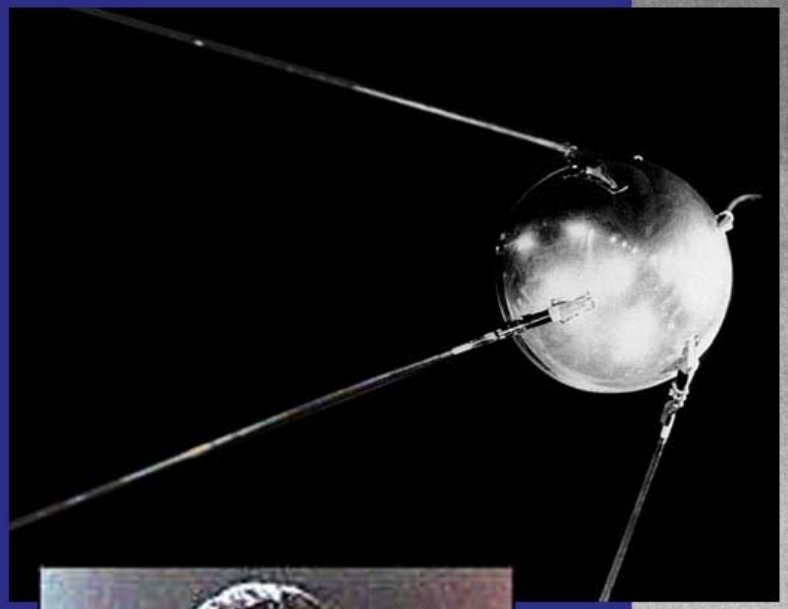
It all began with Sputnik…

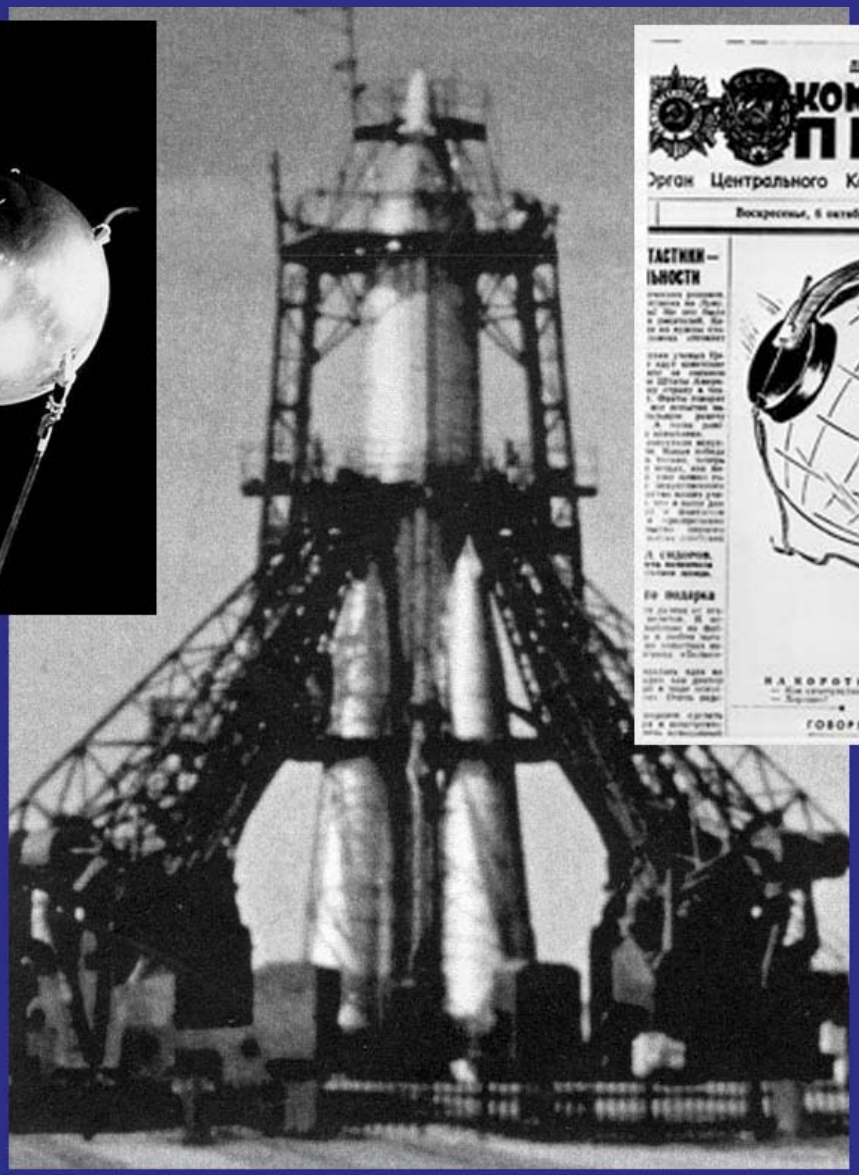




4th October 1957

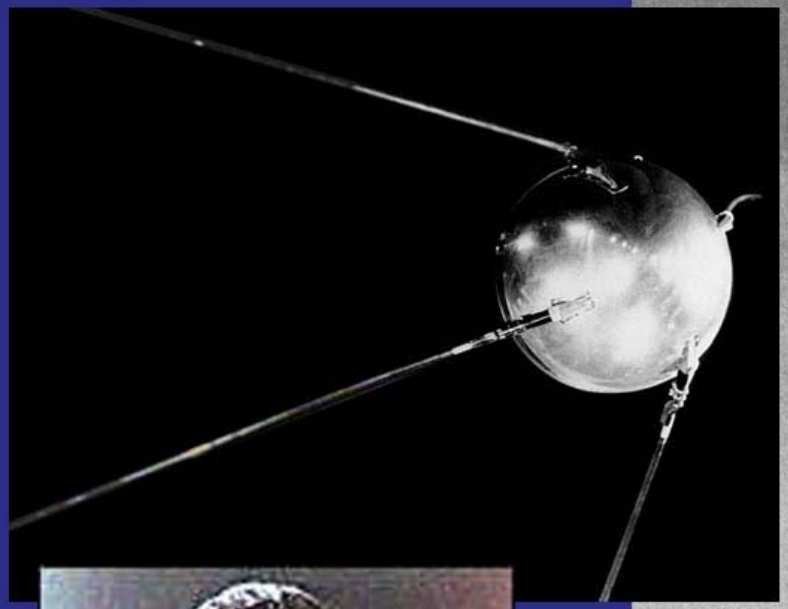
It all began with Sputnik…

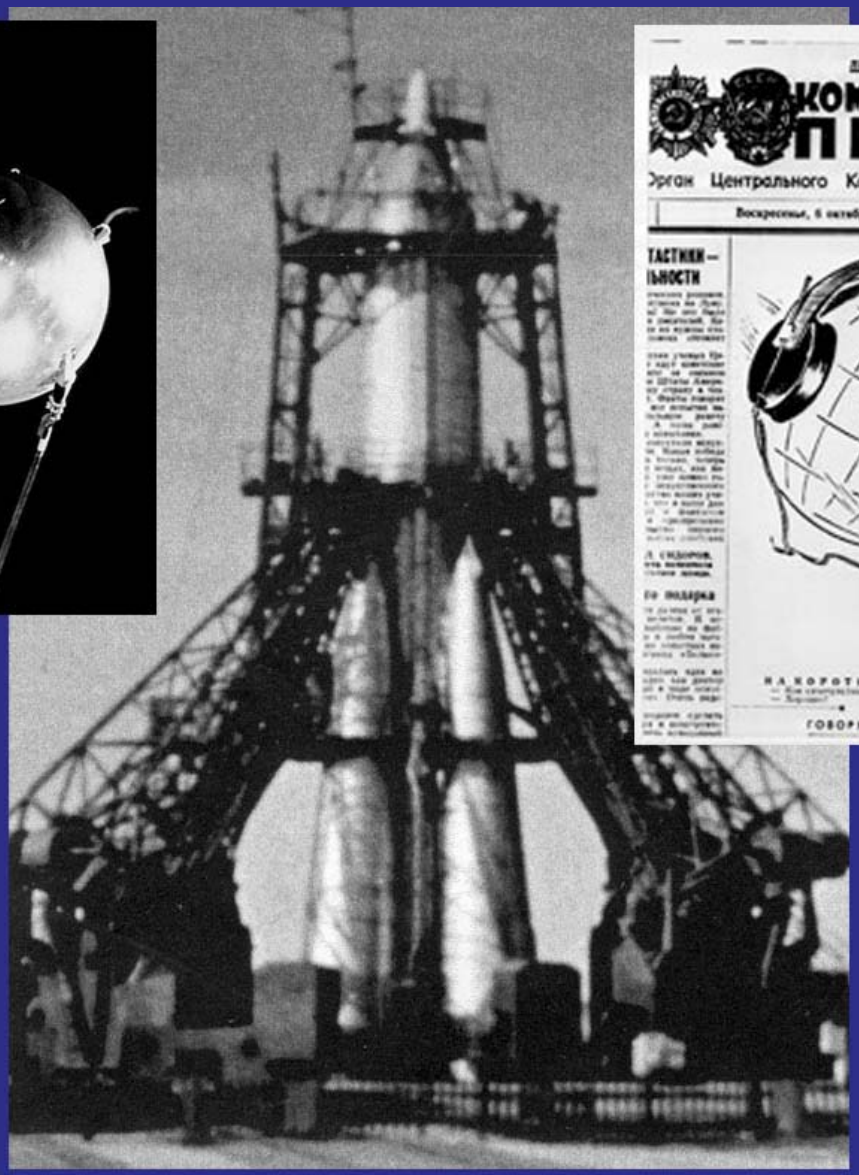




4th October 1957

It all began with Sputnik…

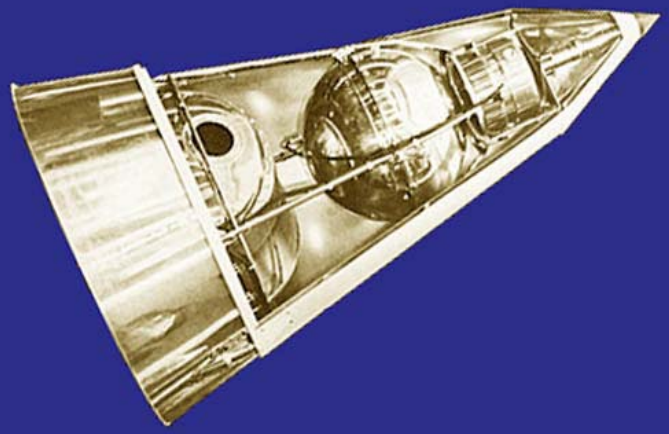




4th October 1957

… and Laika …

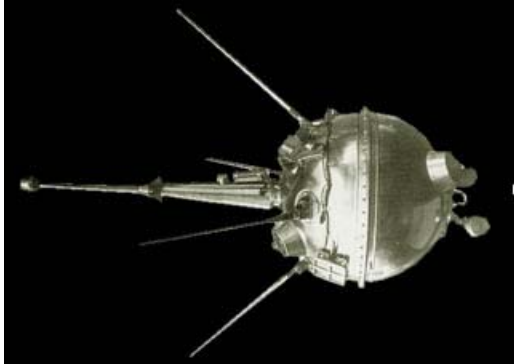
Laika on the Cosmonautics monument, Moscow



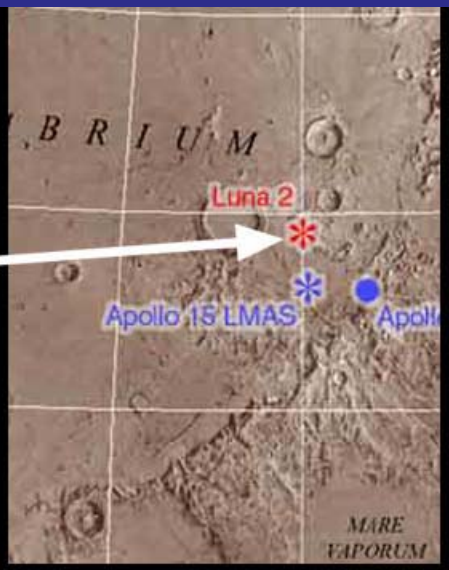
Sputnik 2

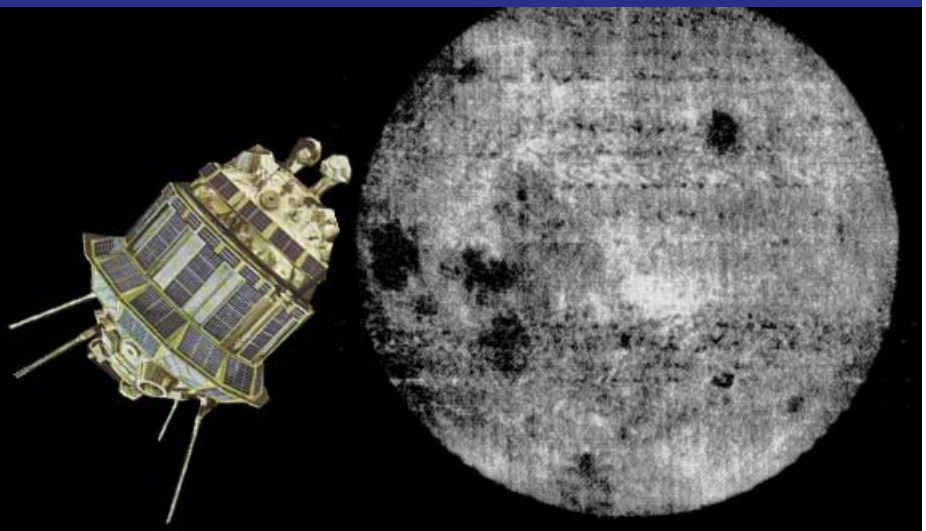
The first living creature in space
3rd November 1957

… and the first Moon probes …

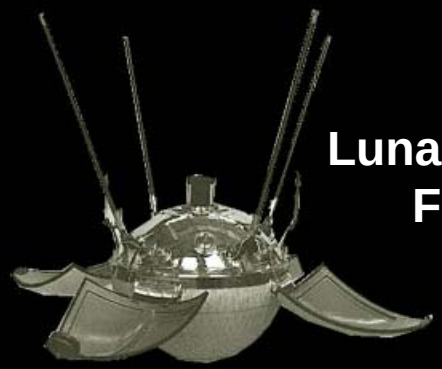


Luna 2 – first contact, September 1959





Luna 3 – first far side view, October 1959



Luna 9 – first landing, February 1966

… and Yuri Gagarin – the first person in space

April 12th 1961 – a single orbit of Earth

The Huntsville Times

Man Enters Space

'So Close, Yet So Far,' Sighs Cape

U.S. Had Hoped For Own Launch

Soviet Officer Orbits Globe In 5-Ton Ship

Maximum Height Reached Reported As 188 Miles

Hobbs Admits 1944 Slaying

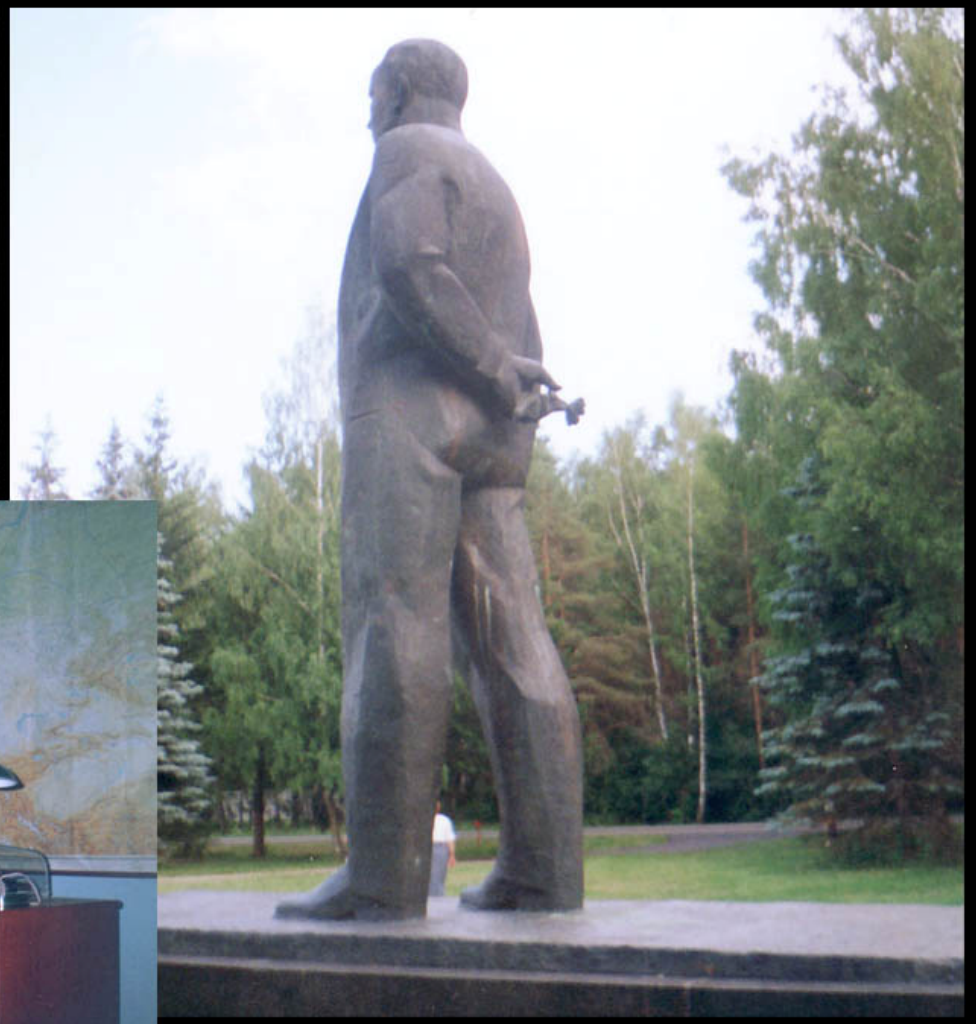
Praise Is Heaped On Major Gagarin

'Worker' Stands By Story

To Keep Up, U.S.A. Must Run Like Hell

Reds Deny Spacemen Have Died

Gagarin's office at Star City



Gagarin statue at Star City

Gagarin and Sergei Korolev, the ‘Chief Designer’ who put him into space, are still revered in Russia after 50 years

‘We go into space because whatever mankind must undertake, free men must fully share…. I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth’ JFK

‘We go into space because whatever mankind must undertake, free men must fully share…. I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth’ JFK

Project Mercury

NASA's first suborbital and orbital flights, doing everything for the first time: control, navigation, communication, life support, re-entry.

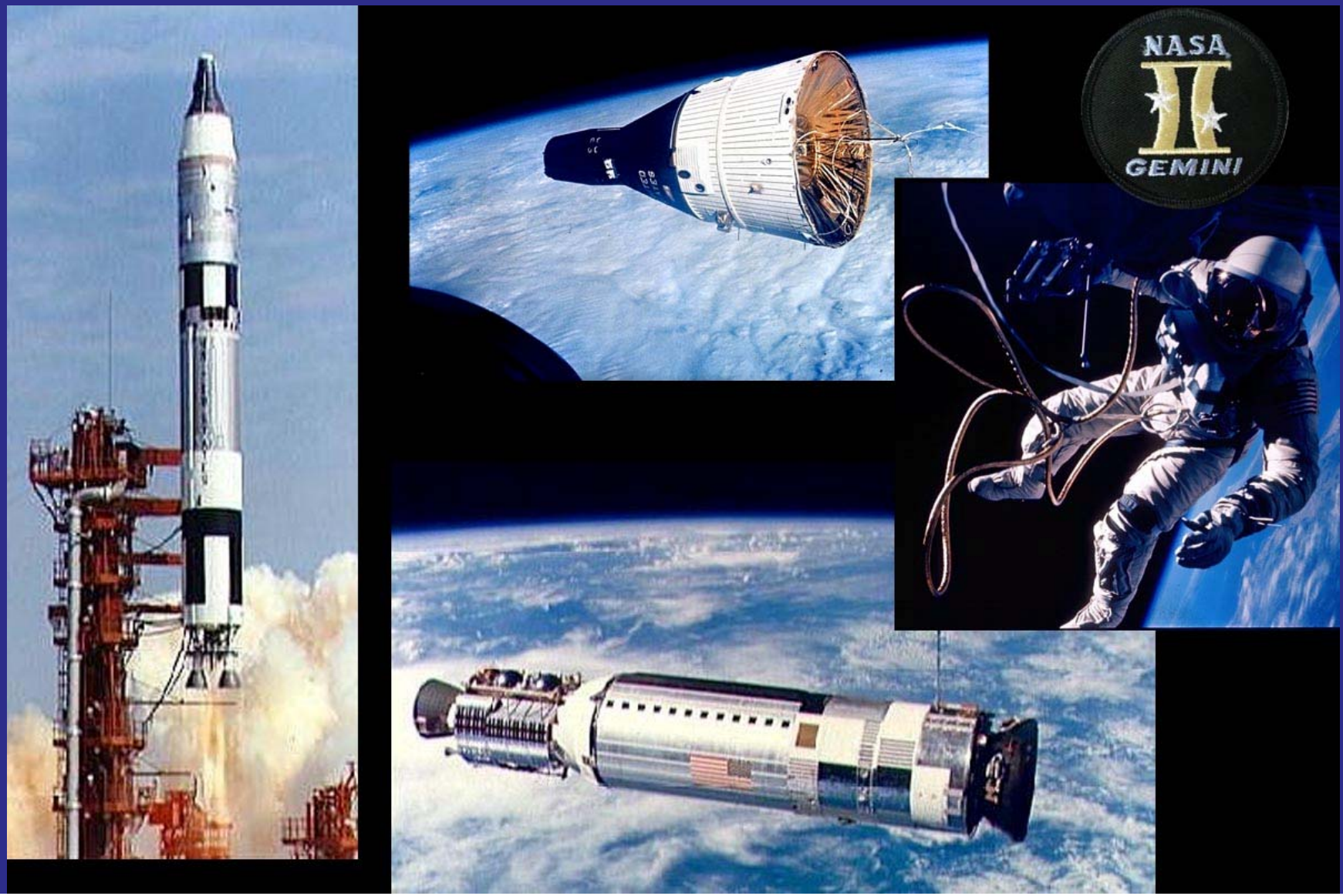
Alan Shepard
May 5, 1961
(suborbital)

John Glenn
February 20, 1962
(first orbital flight)

Project Gemini

Two-person spacecraft to practice what Apollo would need:

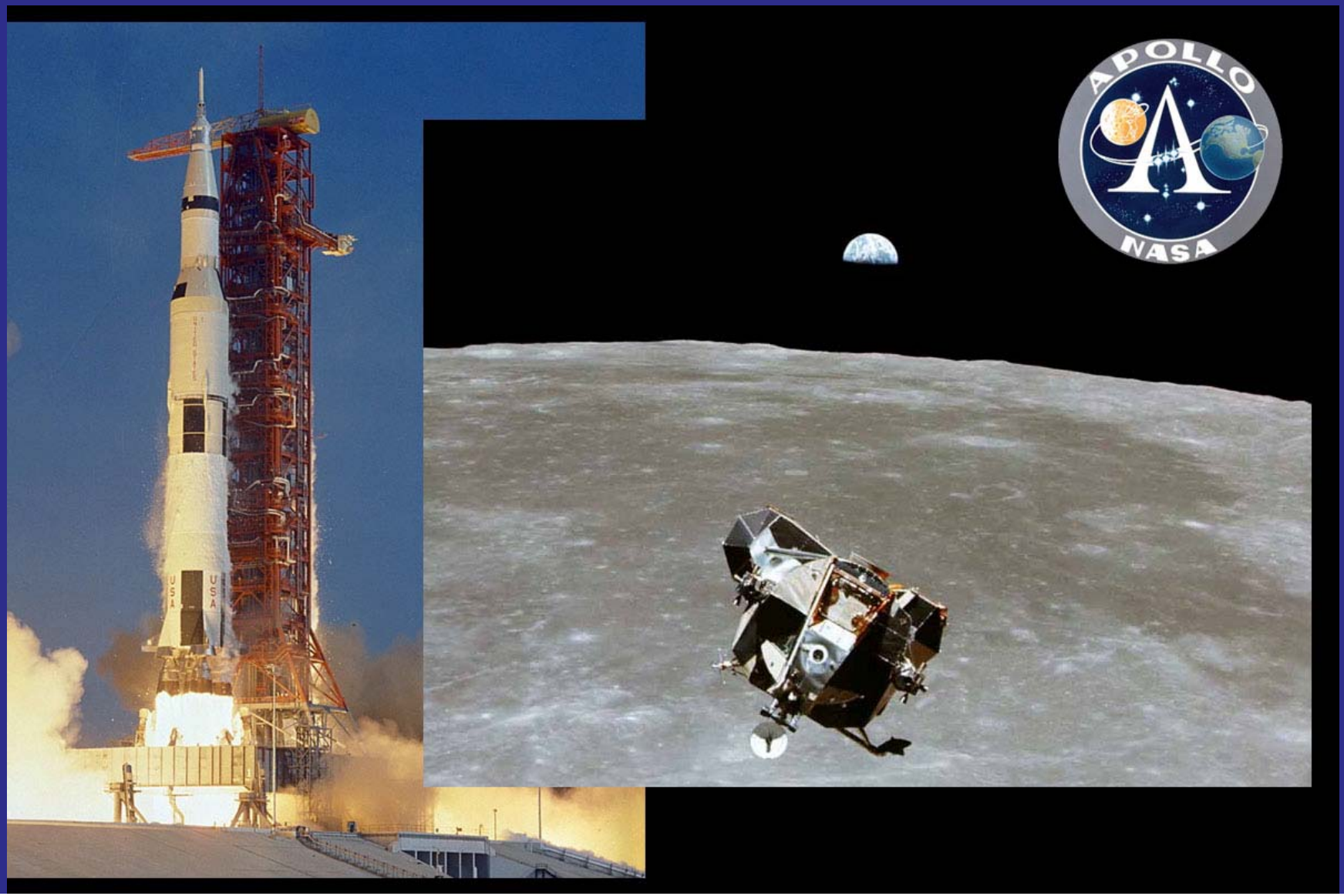
Two-week flights **Rendezvous and docking** **Spacewalks (EVA)**



Apollo – and the Saturn 5 rocket

took crews of three astronauts to the Moon nine times

- six times to the surface – between 1968 and 1972



Apollo landing video

The landing of Apollo 16 – April 21st 1972

Apollo landing video

The landing of Apollo 16 – April 21st 1972

Apollo 11

First steps and famous first words, Neil Armstrong on July 20th 1969

Apollo 11

First steps and famous first words, Neil Armstrong on July 20th 1969

Apollo lunar rover

Apollo 16, April 21st 1972

Apollo lunar rover

Apollo 16, April 21st 1972

(no sound)

Apollo 17 – lunar geological fieldwork

Gene Cernan - December 12th 1972

Apollo 17 – lunar geological fieldwork

Gene Cernan - December 12th 1972

The final takeoff – Apollo 17

Apollo astronauts leave the Moon for the last time,

December 14th 1972

The final takeoff – Apollo 17

Apollo astronauts leave the Moon for the last time, December 14th 1972

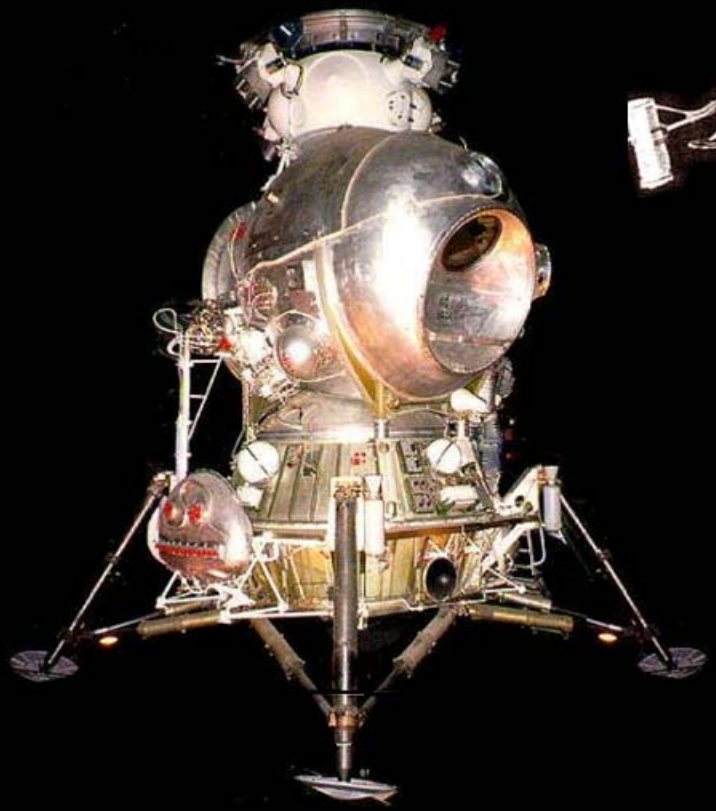
Fatalities on the road into space

Ed White, Gus Grissom &
Roger Chaffee, Apollo 1 crew
January 21st 1967

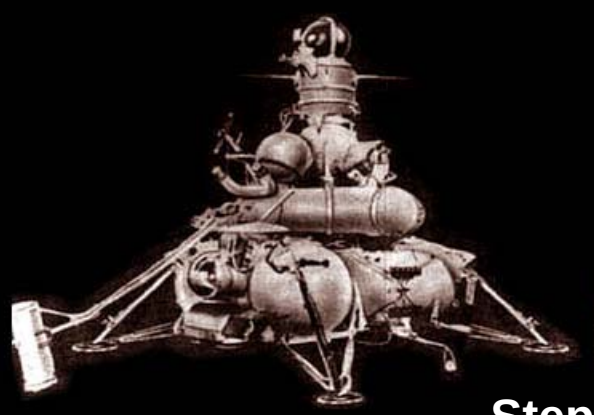
Vladimir Komarov, Soyuz 1
(pictured with Gagarin at left)
April 24th 1967

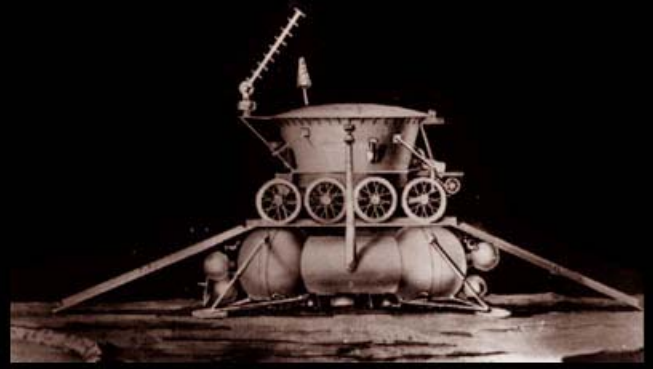
Not shown: USSR's second accident, three crew die in Soyuz 11, June 29th 1971

The Soviet response to Apollo

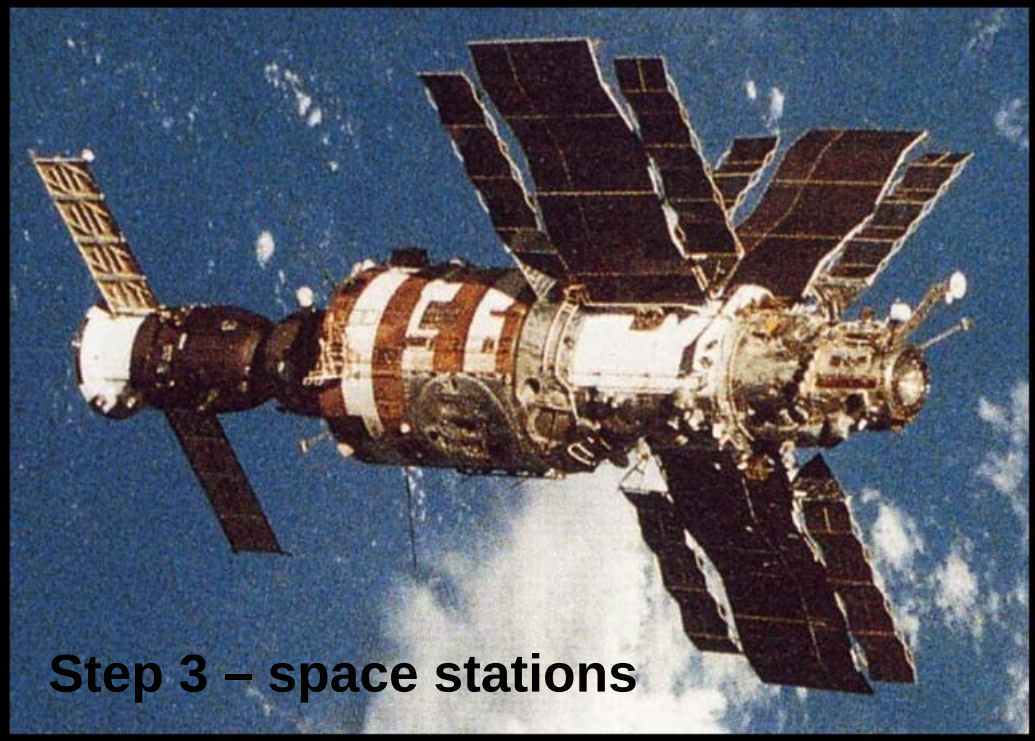


Step 1 – try to beat Apollo





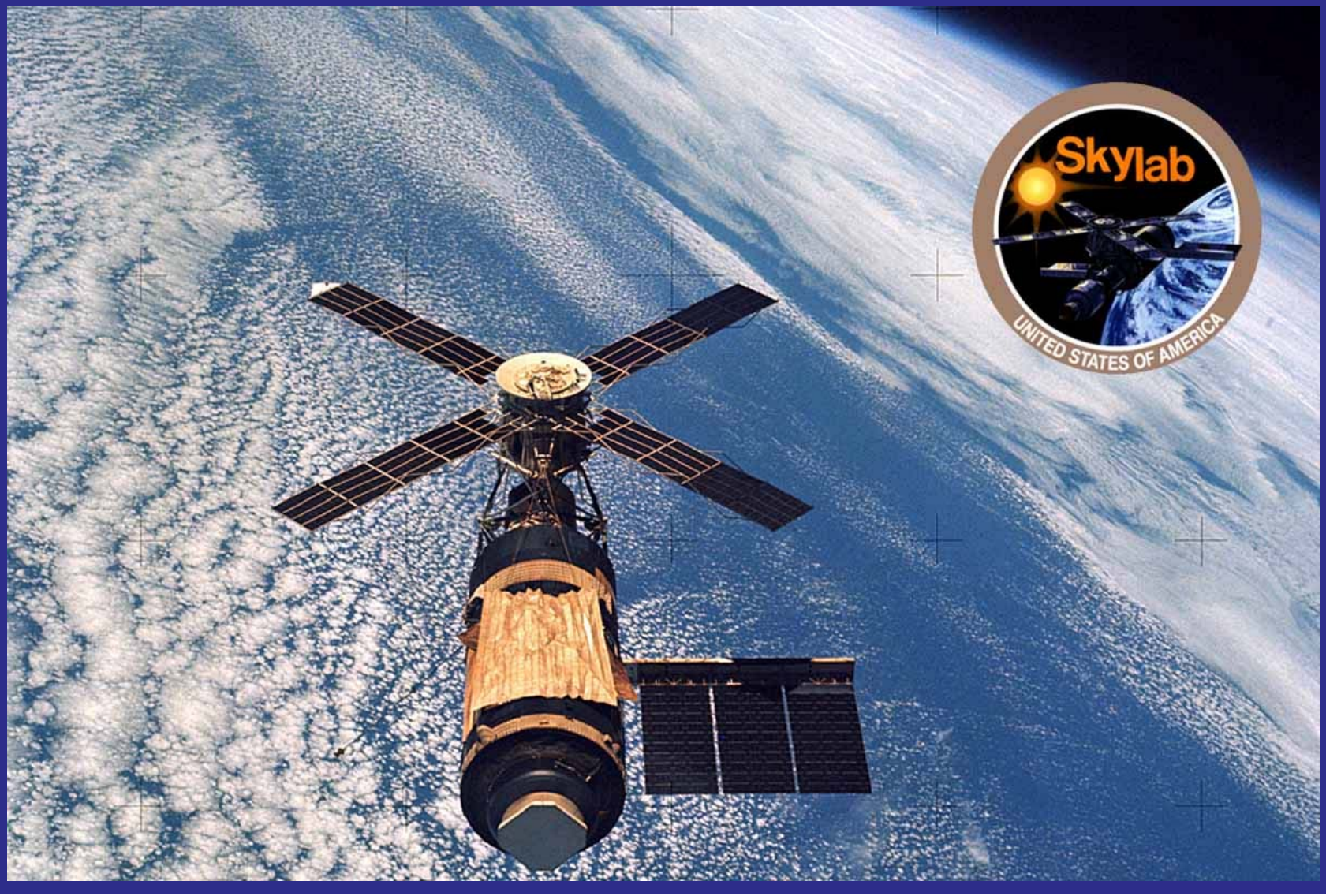
Step 2 – robotic alternatives



Step 3 – space stations

Skylab

NASA's first space station, the only remnant of an ambitious post-Apollo program. It was visited by three crews in 1973 and 1974



The Space Shuttle

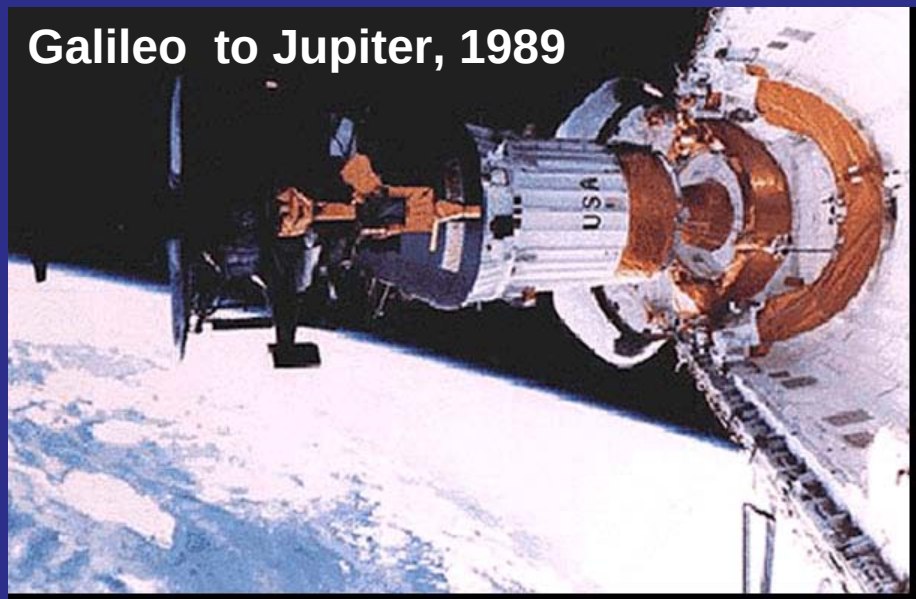
US space goals are set by Presidents. Kennedy sent NASA to the Moon. Nixon initiated the Space Shuttle program.

First flight, April 12th 1981

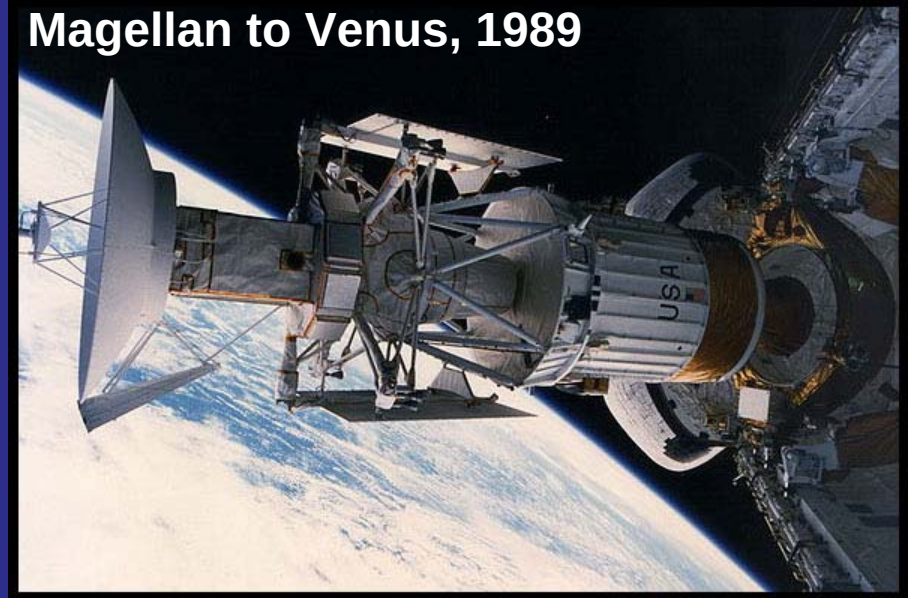
The Space Shuttle

Used to launch satellites and renovate the Hubble Space Telescope

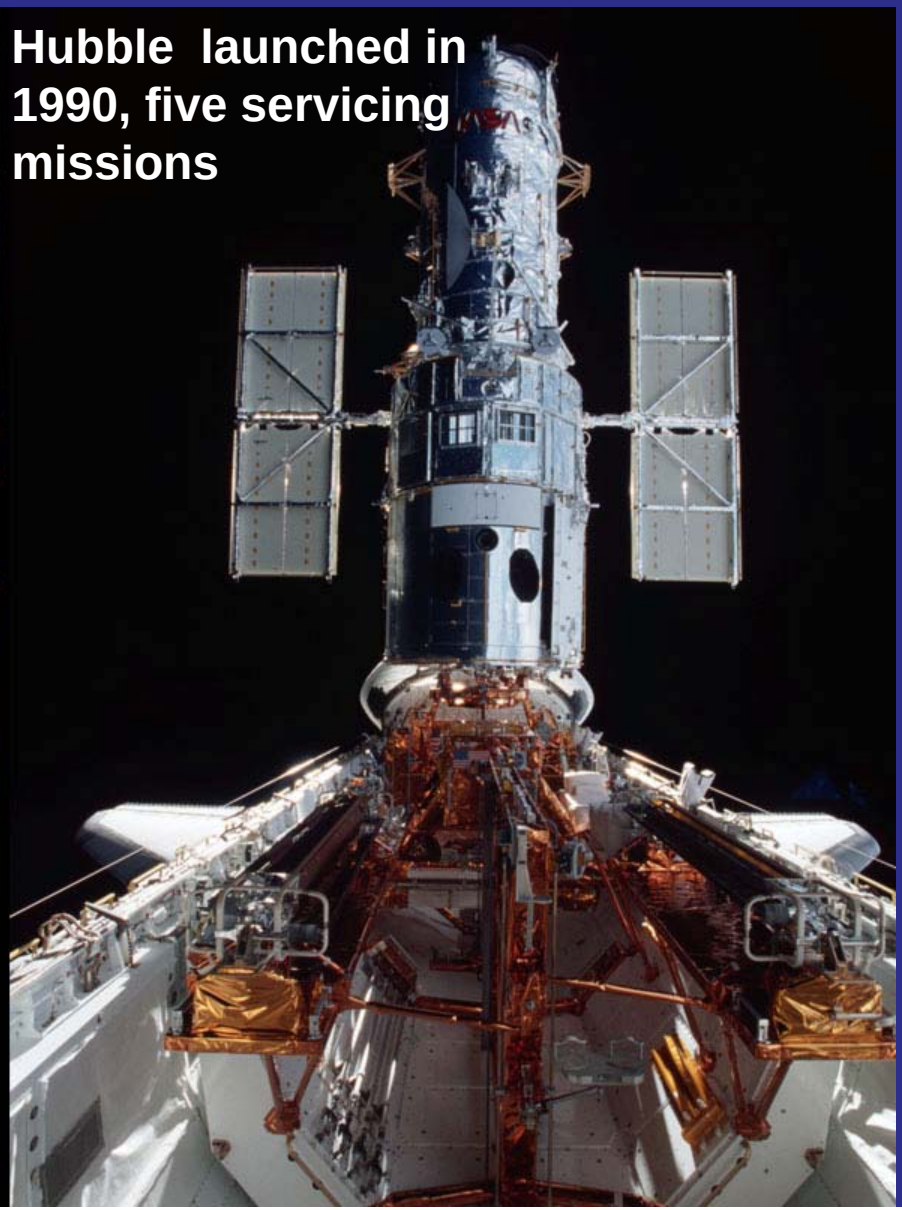
Galileo to Jupiter, 1989



Magellan to Venus, 1989

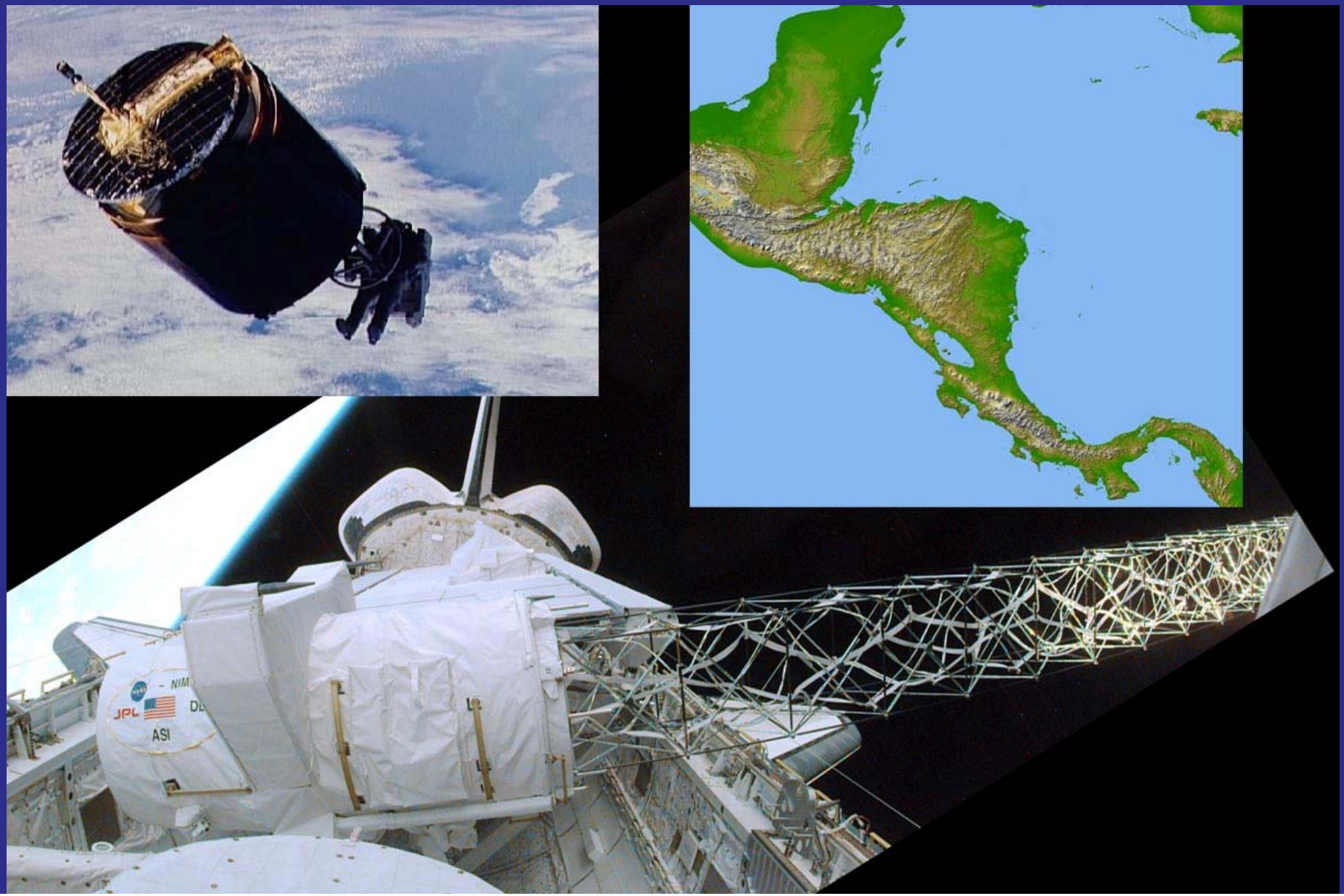


Hubble launched in 1990, five servicing missions



The Space Shuttle

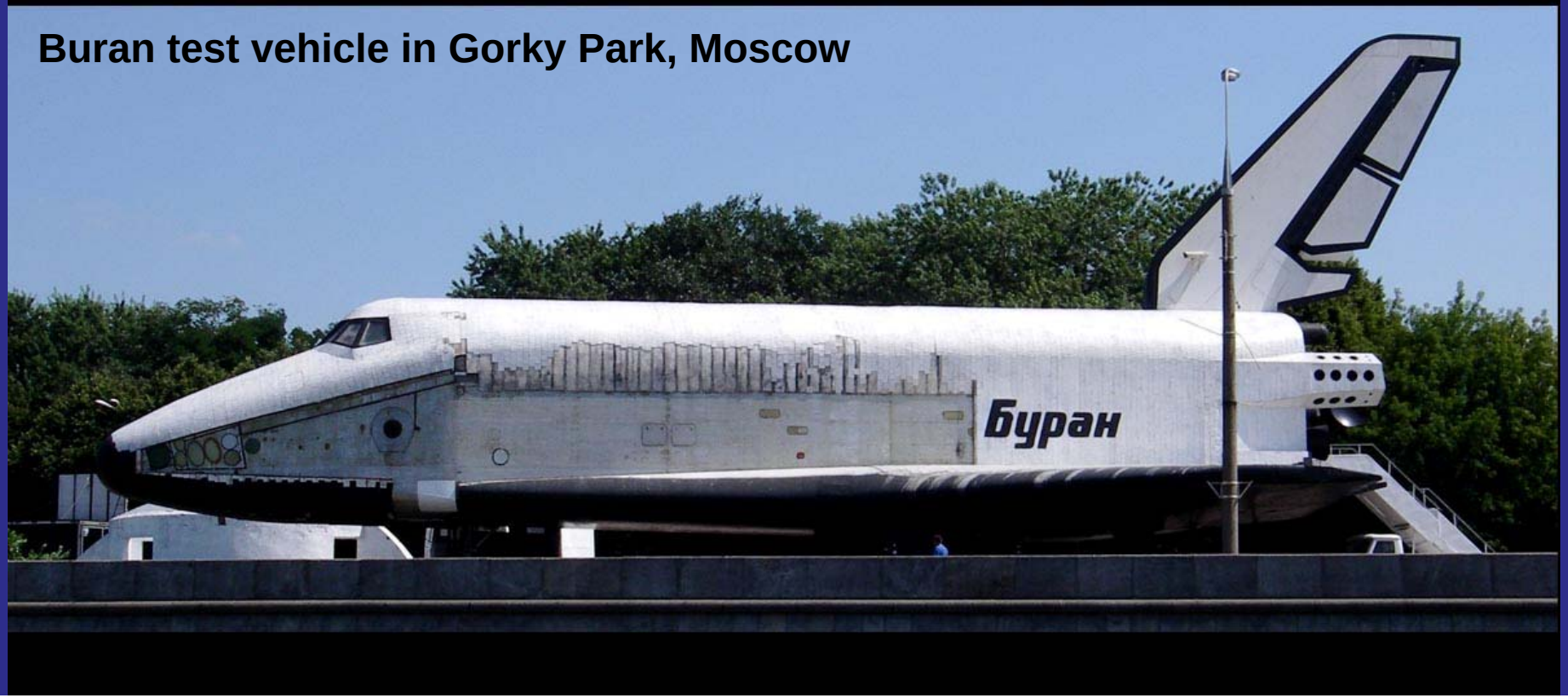
Satellite repair and the Shuttle Radar Topography Mission



The Soviet shuttle – Buran

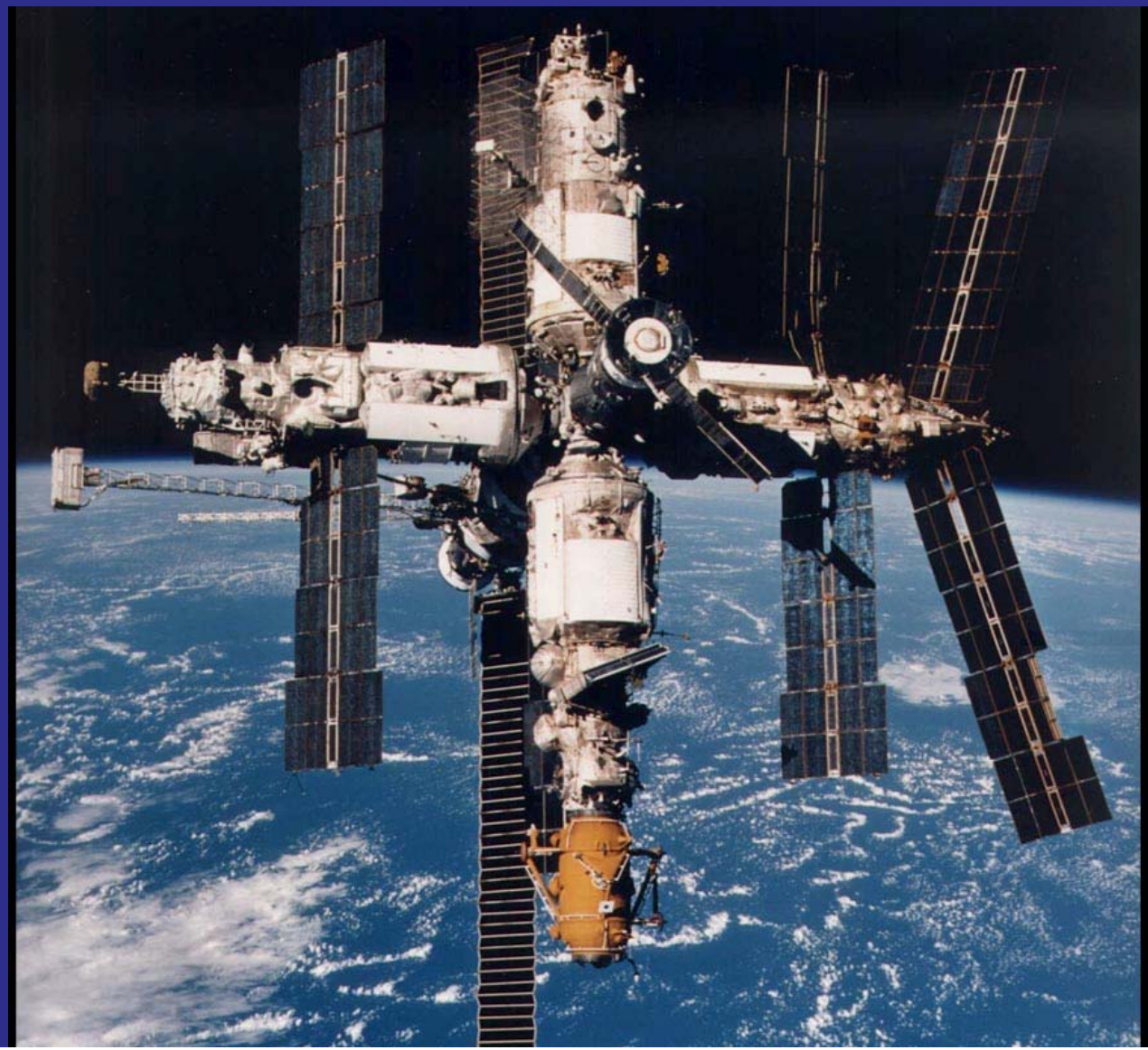
Flew only once, without a crew, in 1988 – technology development

Buran test vehicle in Gorky Park, Moscow



Mir

After a series of Salyut space stations the Soviet Union built a modular station called Mir (= world or peace)



First component launched on February 19th 1986

De-orbited on March 23rd 2001

Mir

Mir survived a fire and a collision with a cargo vehicle.

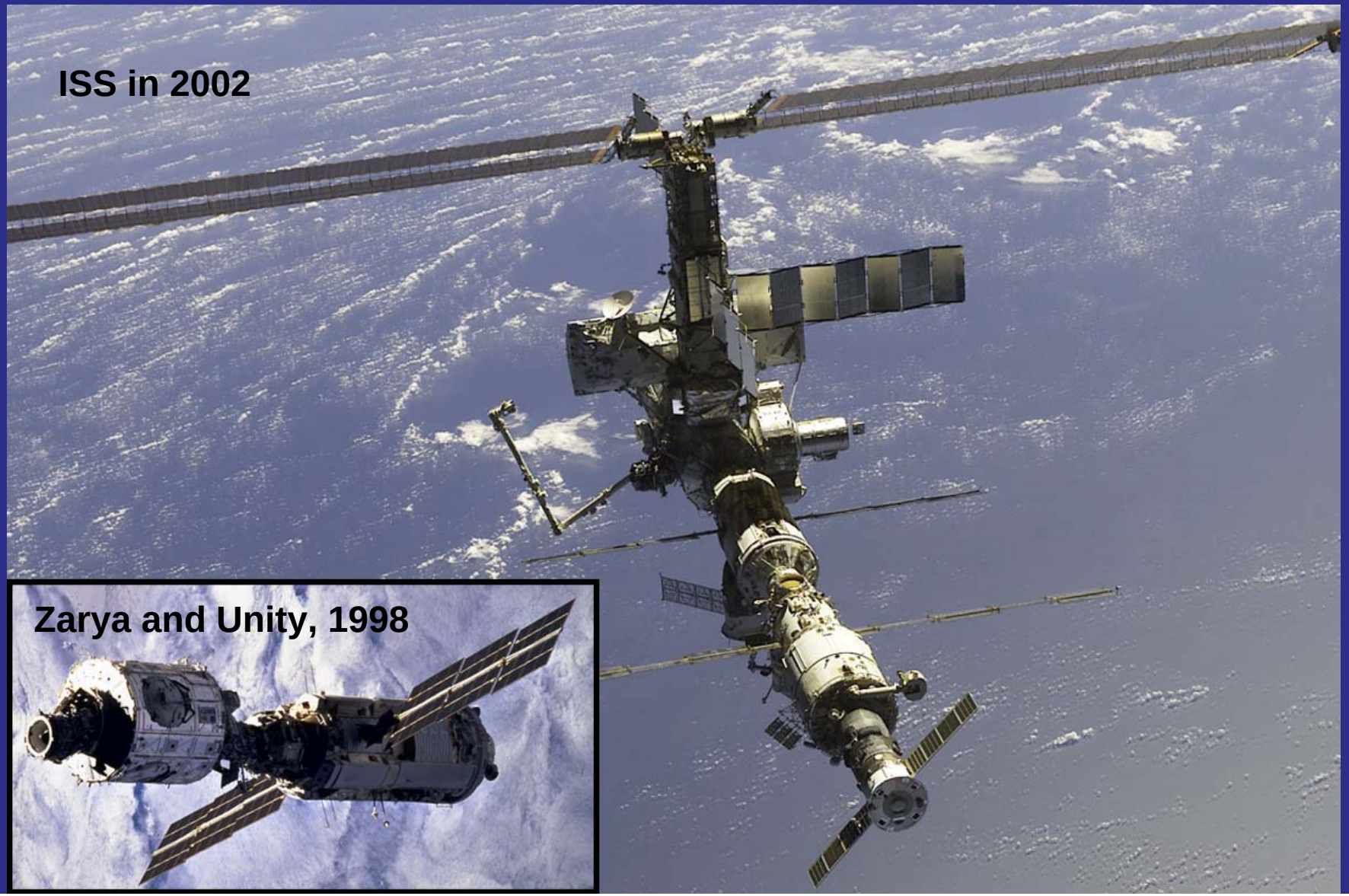
It taught us how to build and service multi-component space stations.

Longest human flight: 438 days (Valeriy Polyakov, 1994-5)

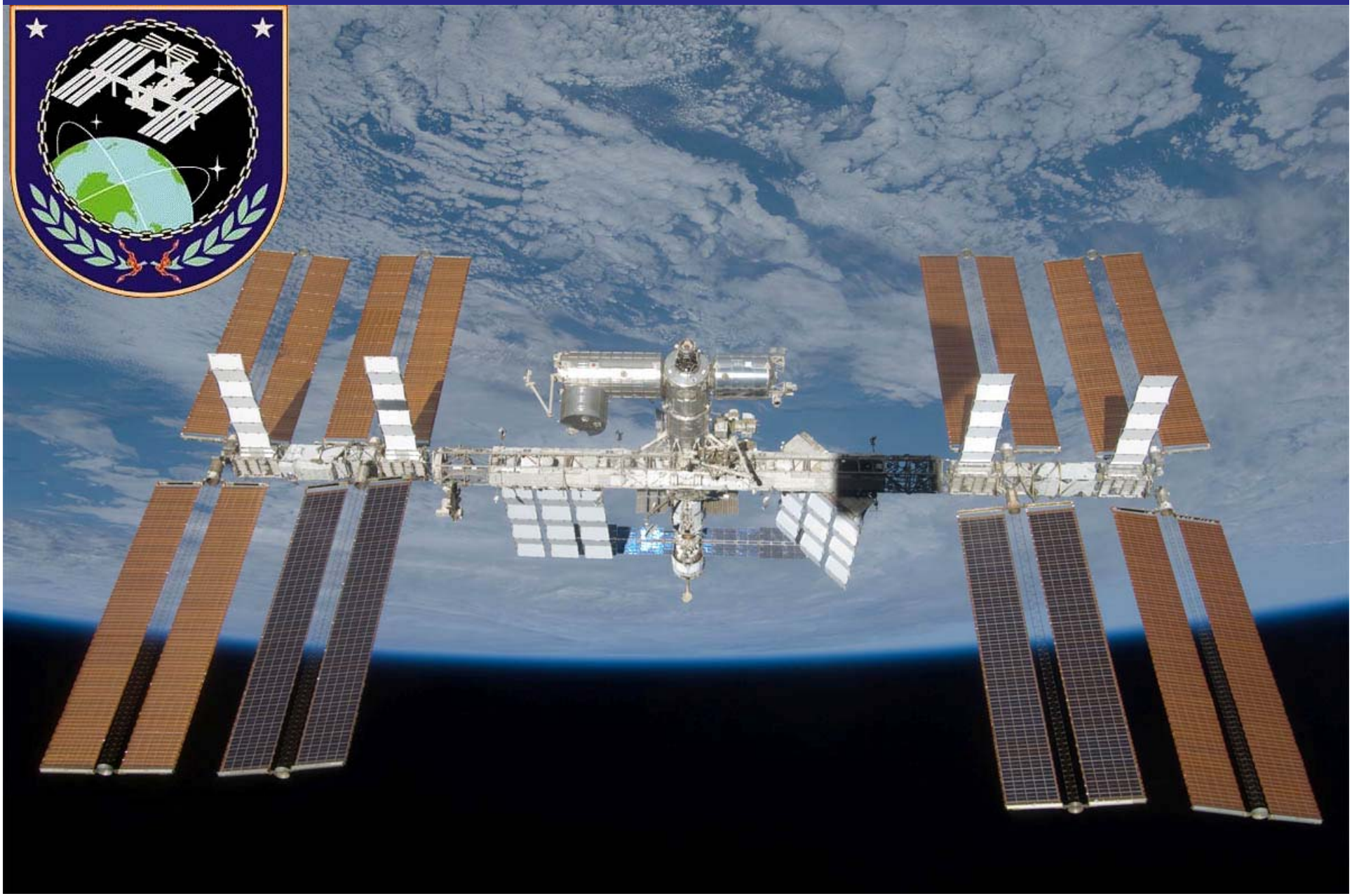
The International Space Station

Initiated by President Reagan, a laboratory in space.

First component, Zarya (= dawn), November 20th 1998.

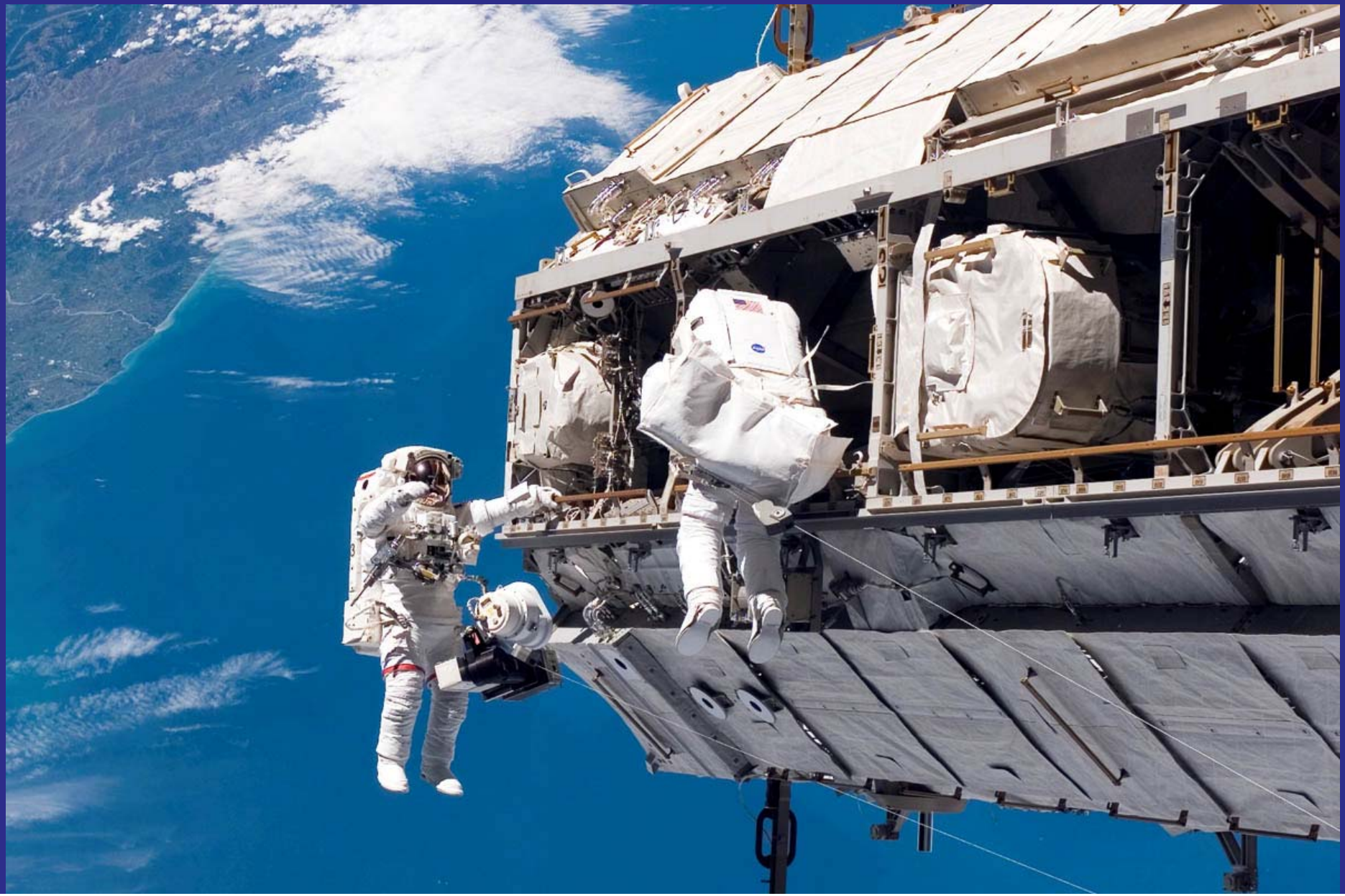


The Station Grows



The International Space Station

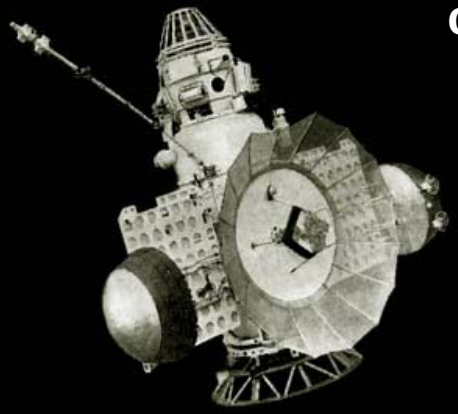
Used for research and planning for future space flights until 2020



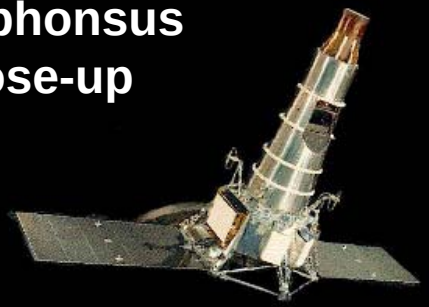
Robotic solar system exploration

One of the defining scientific achievements of our time

Zond 3, 1965:
Lunar far side



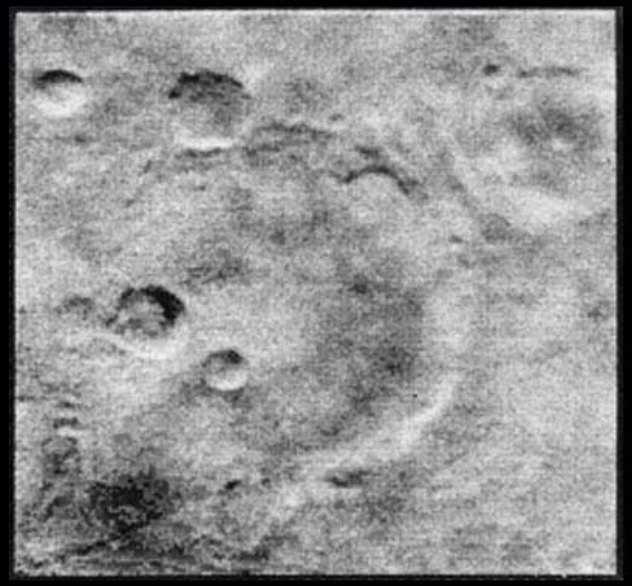
Ranger 9, 1965:
Alphonsus
close-up



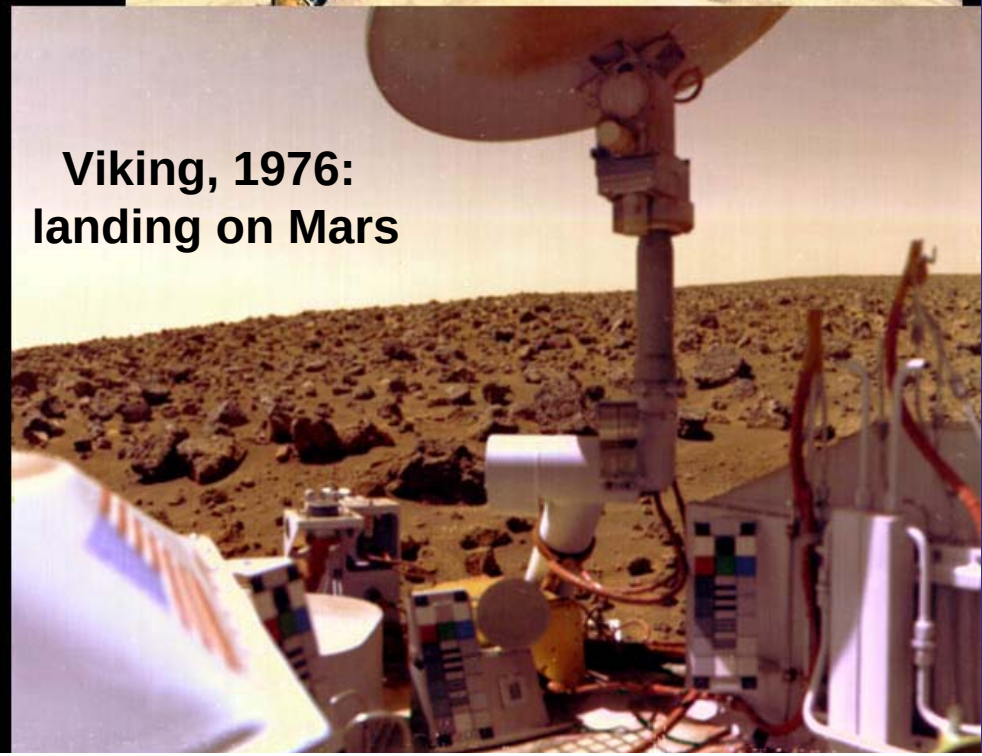
LRO, 2009:
Apollo 15 tracks

From the Moon to Mars

Mariner 4, 1965:
craters on Mars

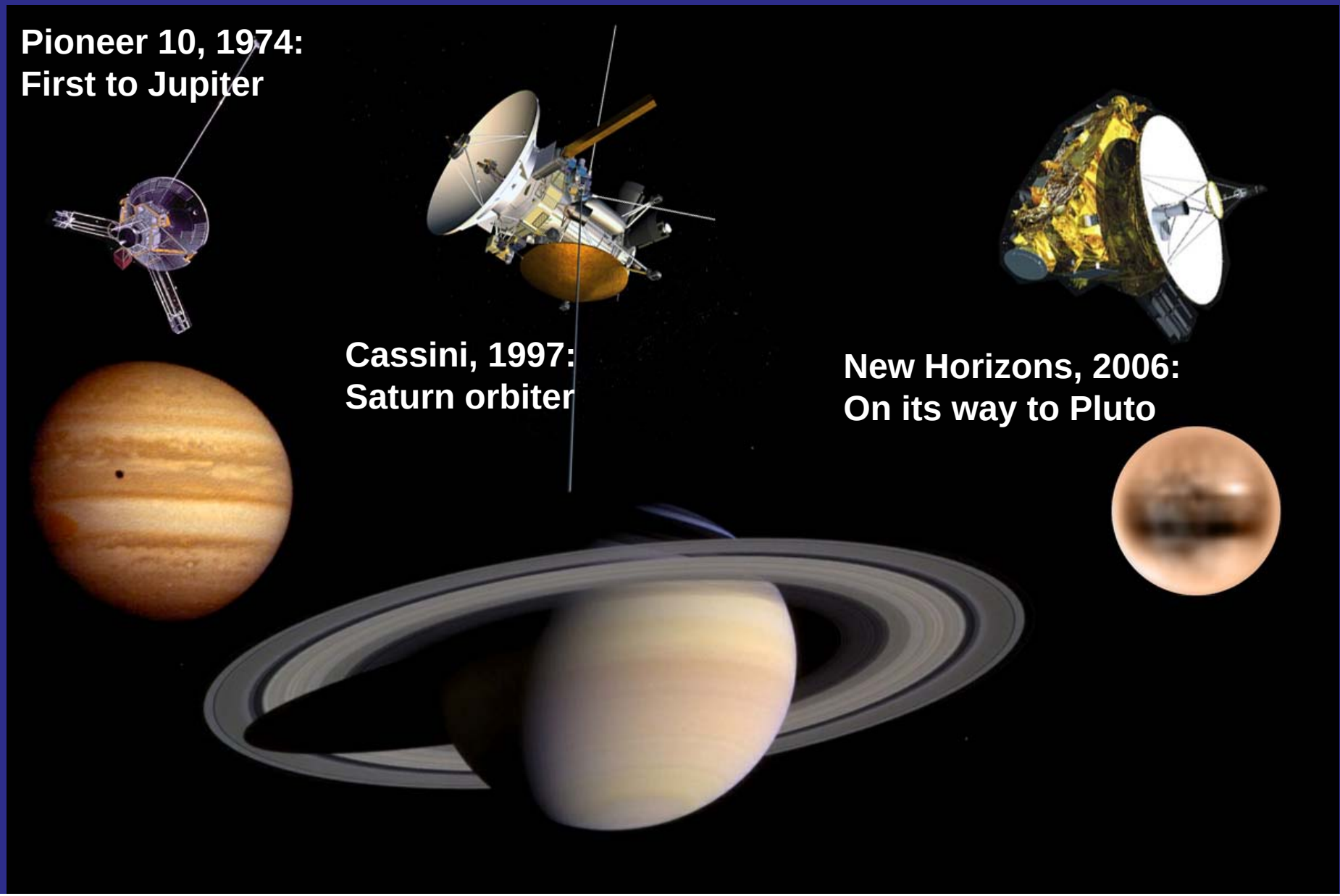


Viking, 1976:
landing on Mars



And out past the asteroid belt

into the wilderness of the outer solar system



Exploration is difficult and dangerous

The Challenger accident – January 28th 1986

A seam in the solid rocket booster fails

The Columbia accident

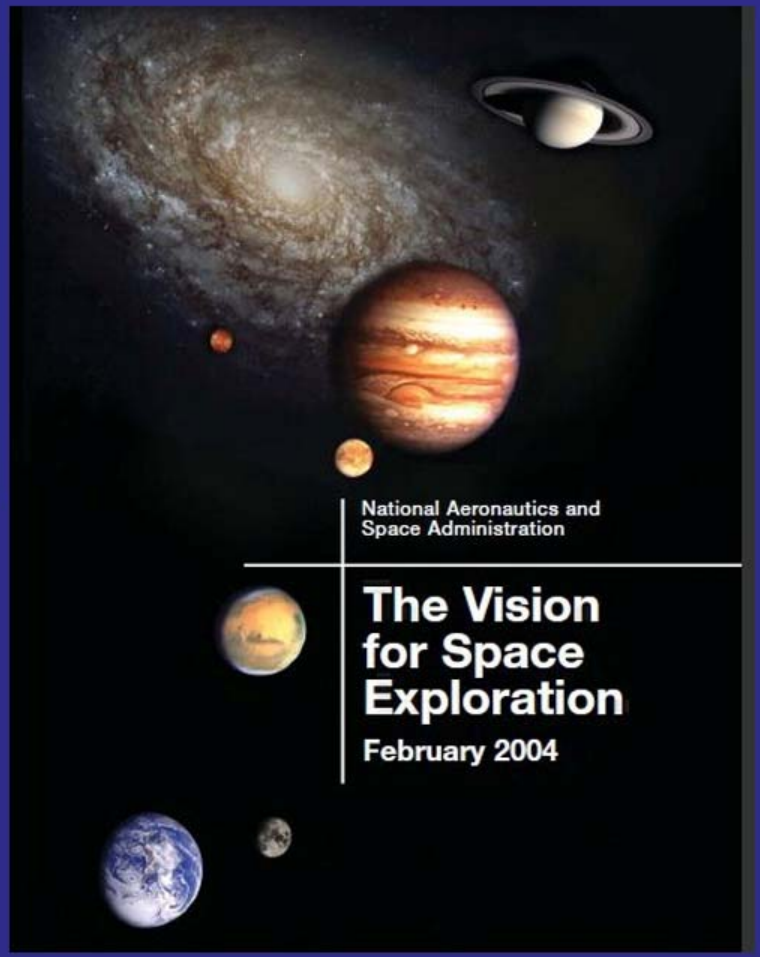
Heat protection tiles on the wing are damaged during launch.

Columbia is destroyed during re-entry, February 1st 2003.

A new *Vision for Space Exploration*

George W. Bush outlines a new path beyond Earth orbit.

Fix the Shuttle, finish the Station, back to the Moon, prepare for Mars



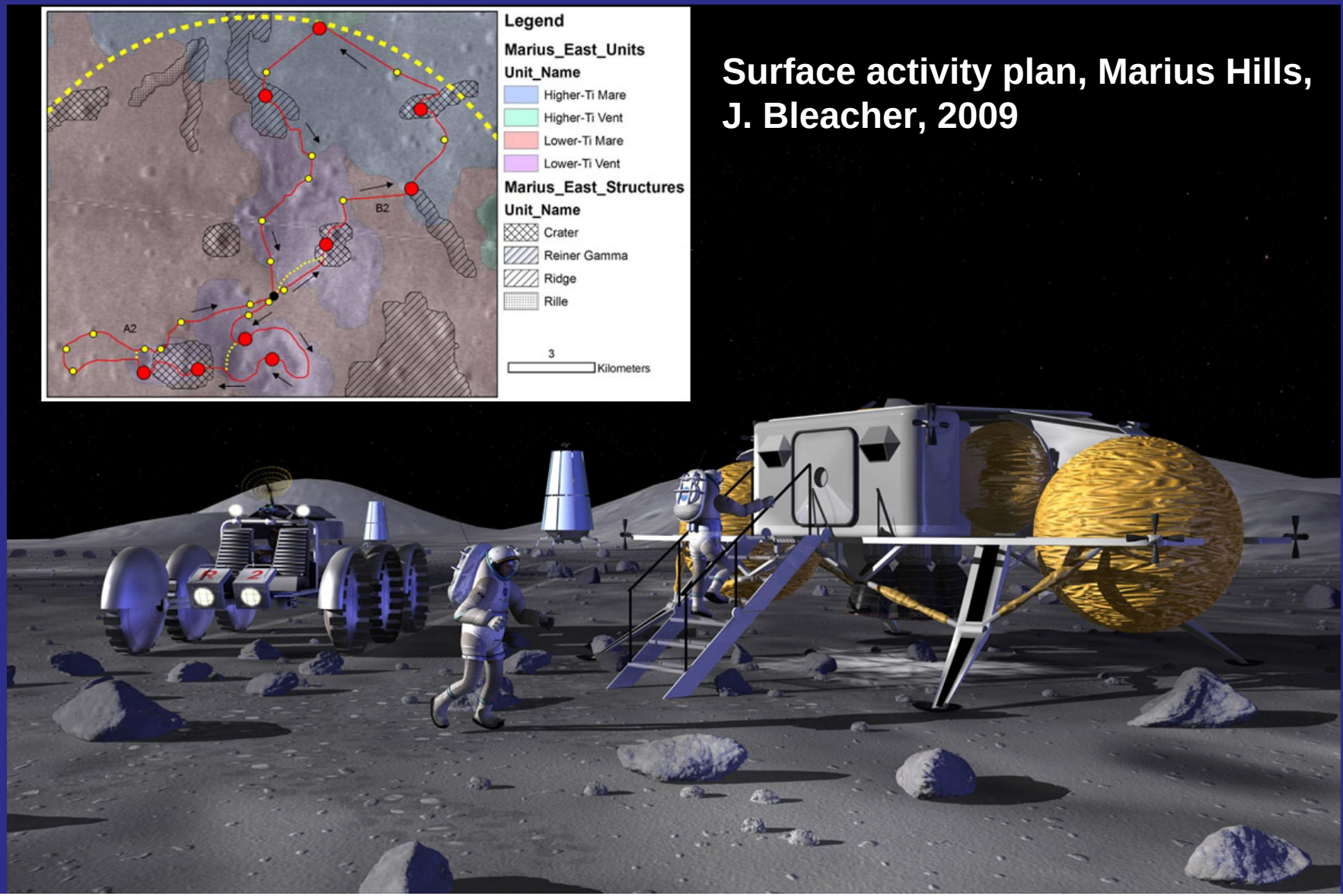
Constellation

NASA's program to accomplish the Vision

Ares 1 **Orion and Altair**

Constellation missions

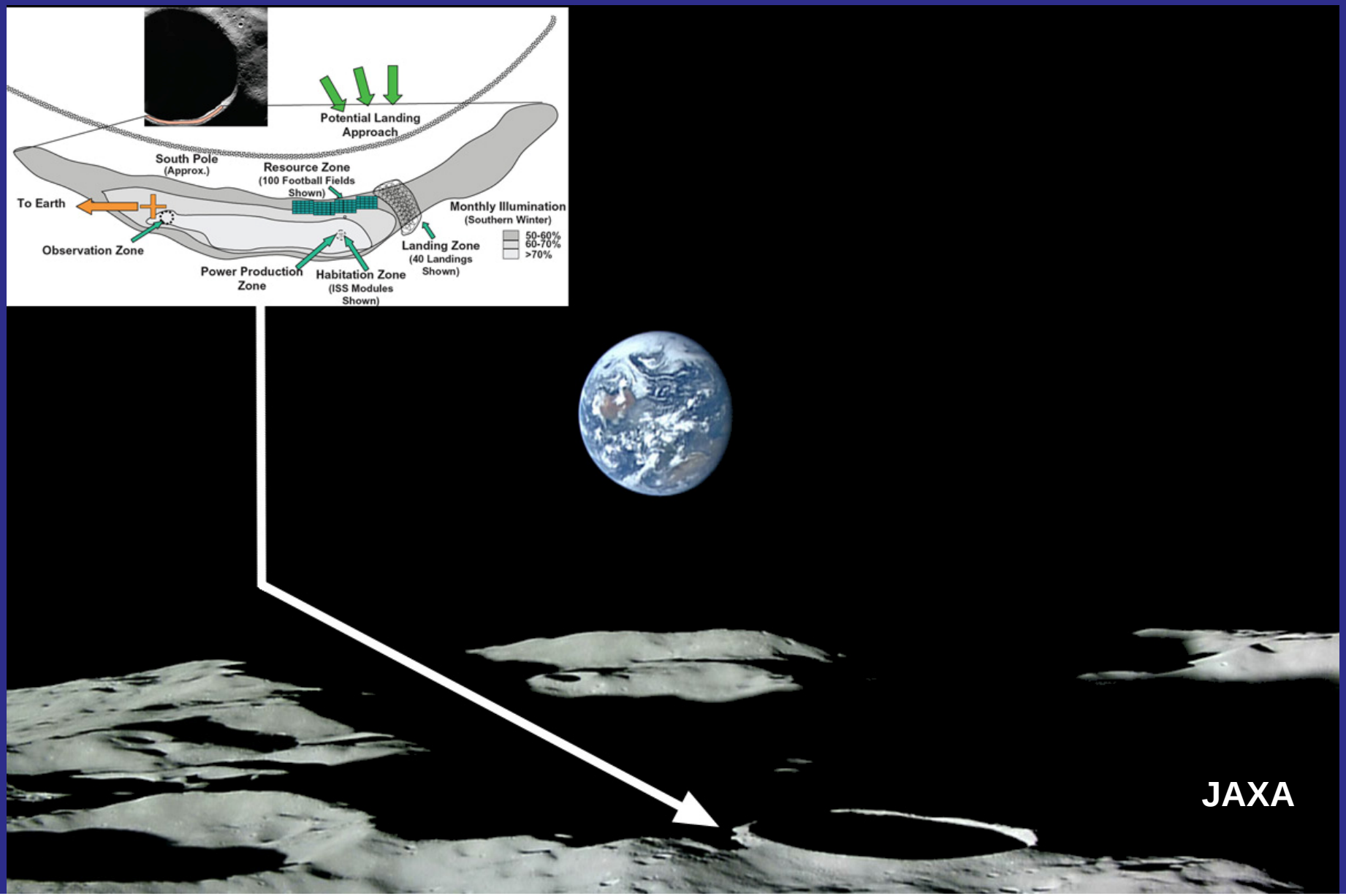
1. Apollo-style ‘sorties’ to different science targets



Surface activity plan, Marius Hills, J. Bleacher, 2009

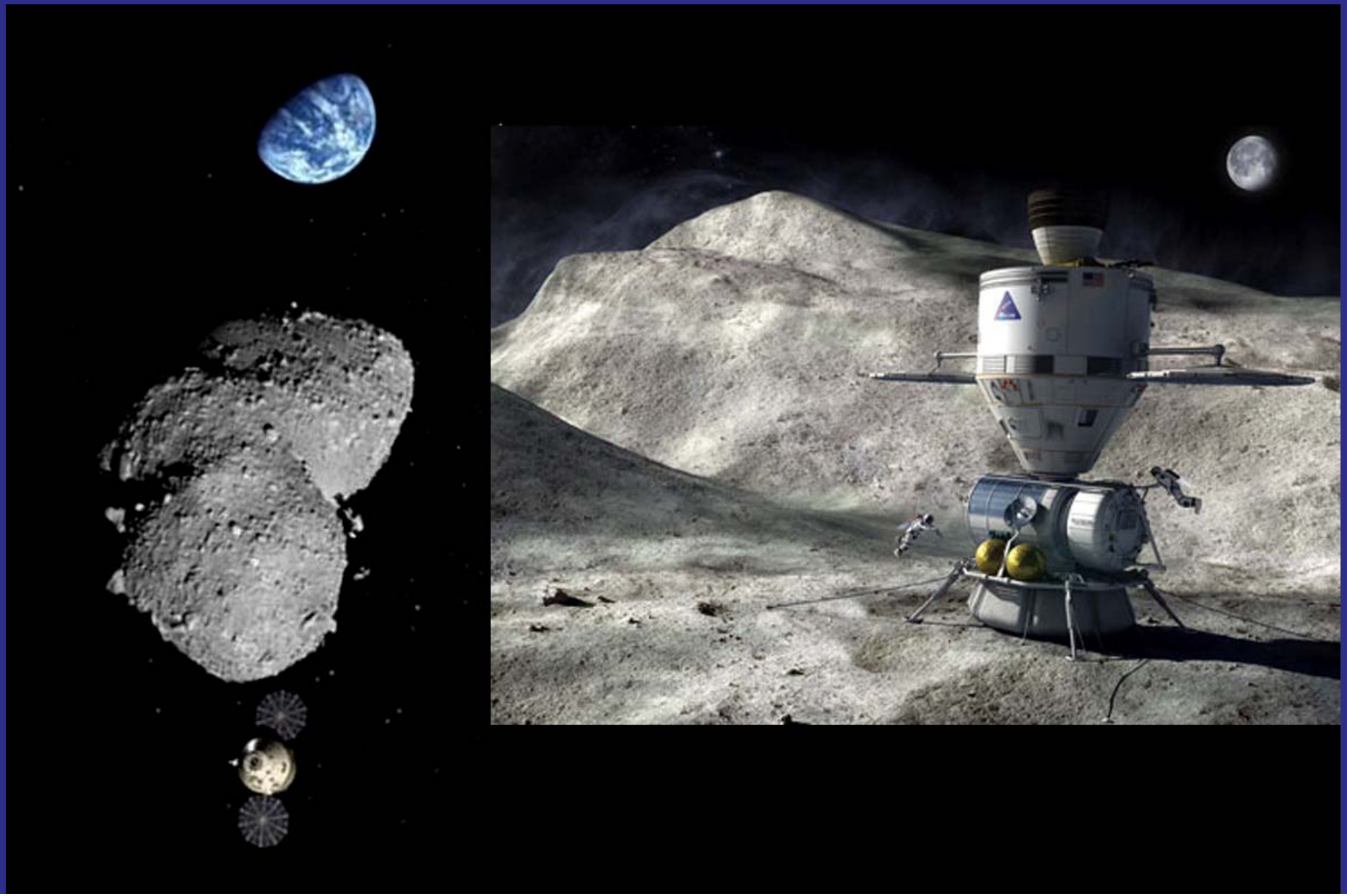
Constellation missions

2. Build a lunar outpost, probably at the south pole



Asteroid expeditions

Learning to operate at greater distances

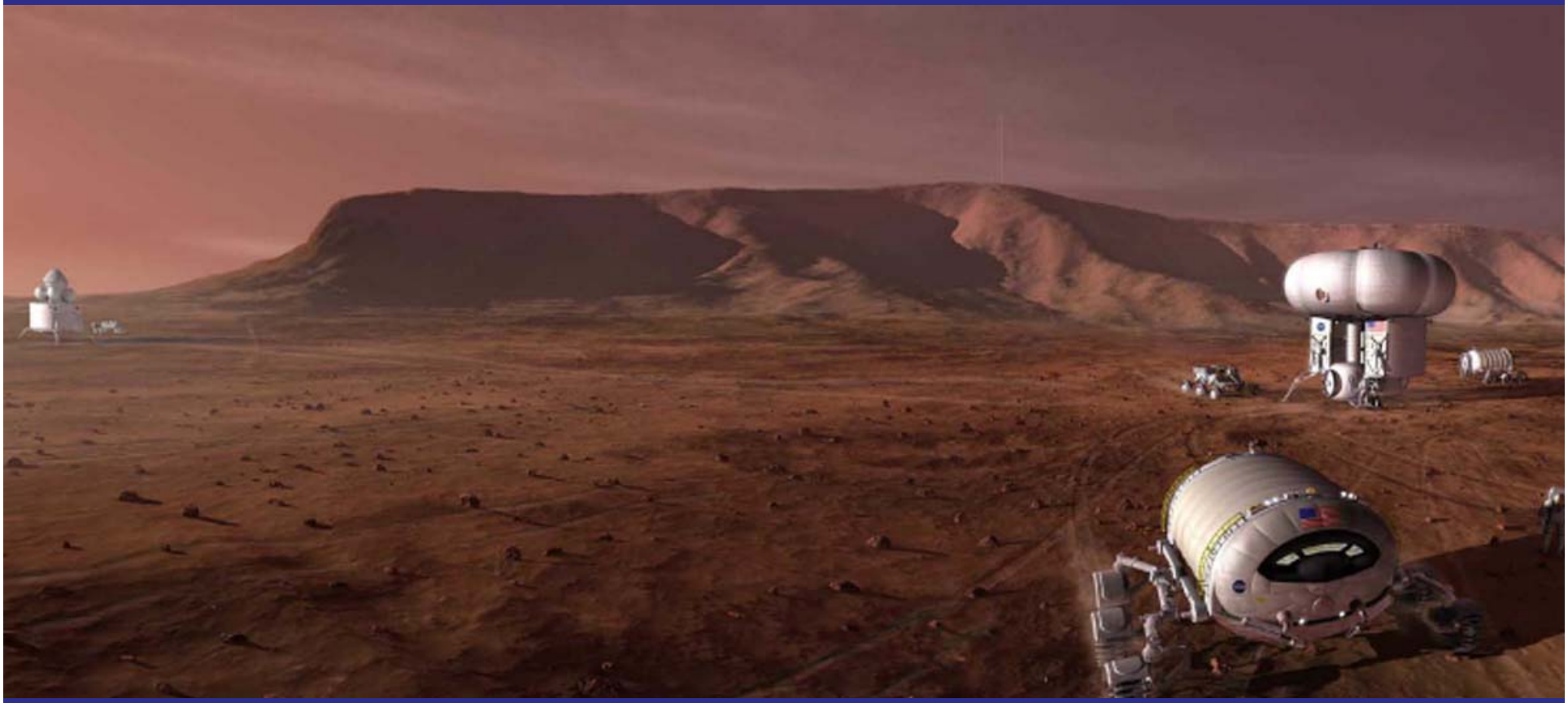


A giant leap – to Mars

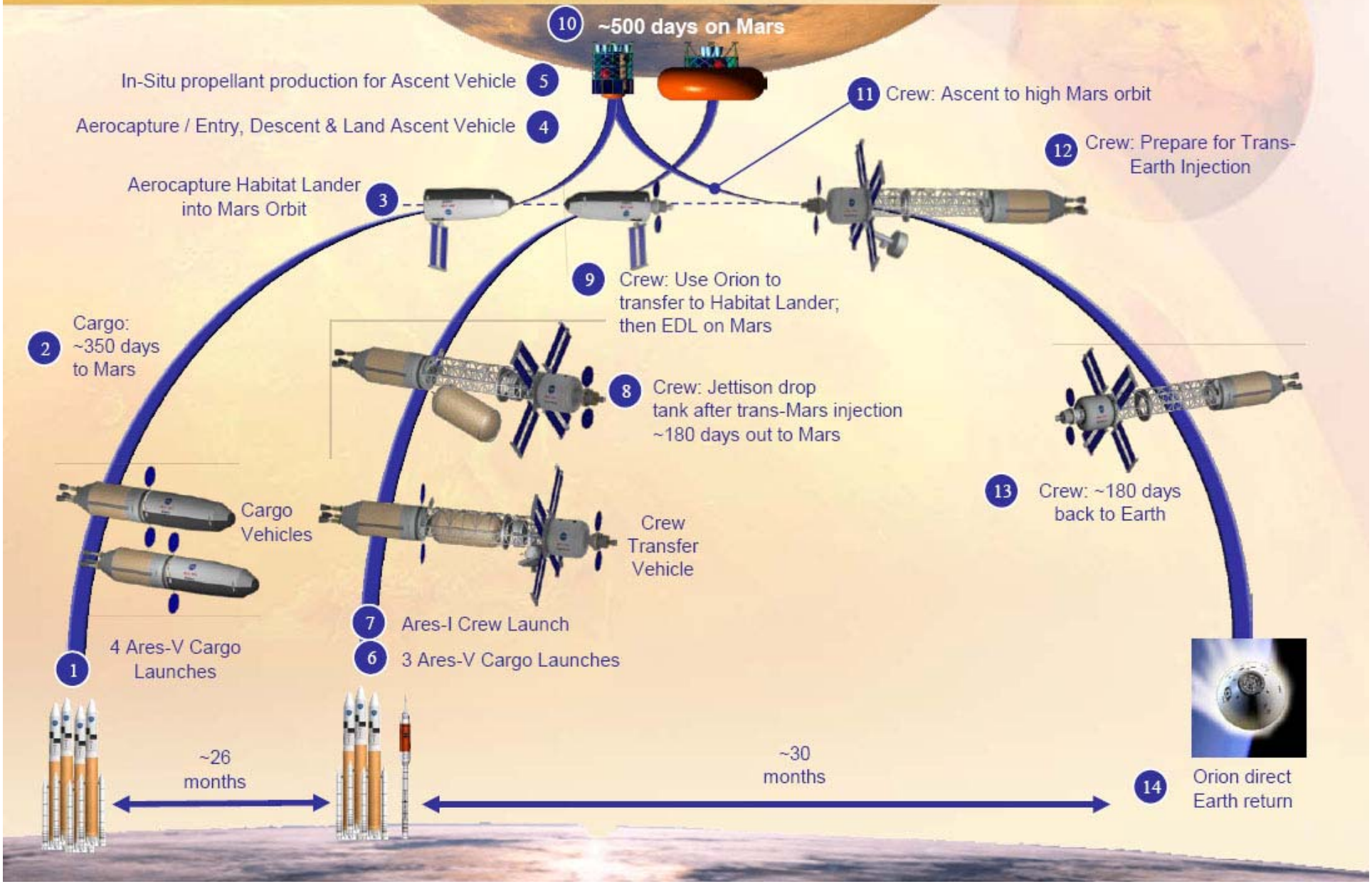
We are not ready to do this yet, but it is probably in our future.

A Mars trip would take two or three years, with 500 days on the planet.

An intermediate step might be landing on the little moons of Mars.

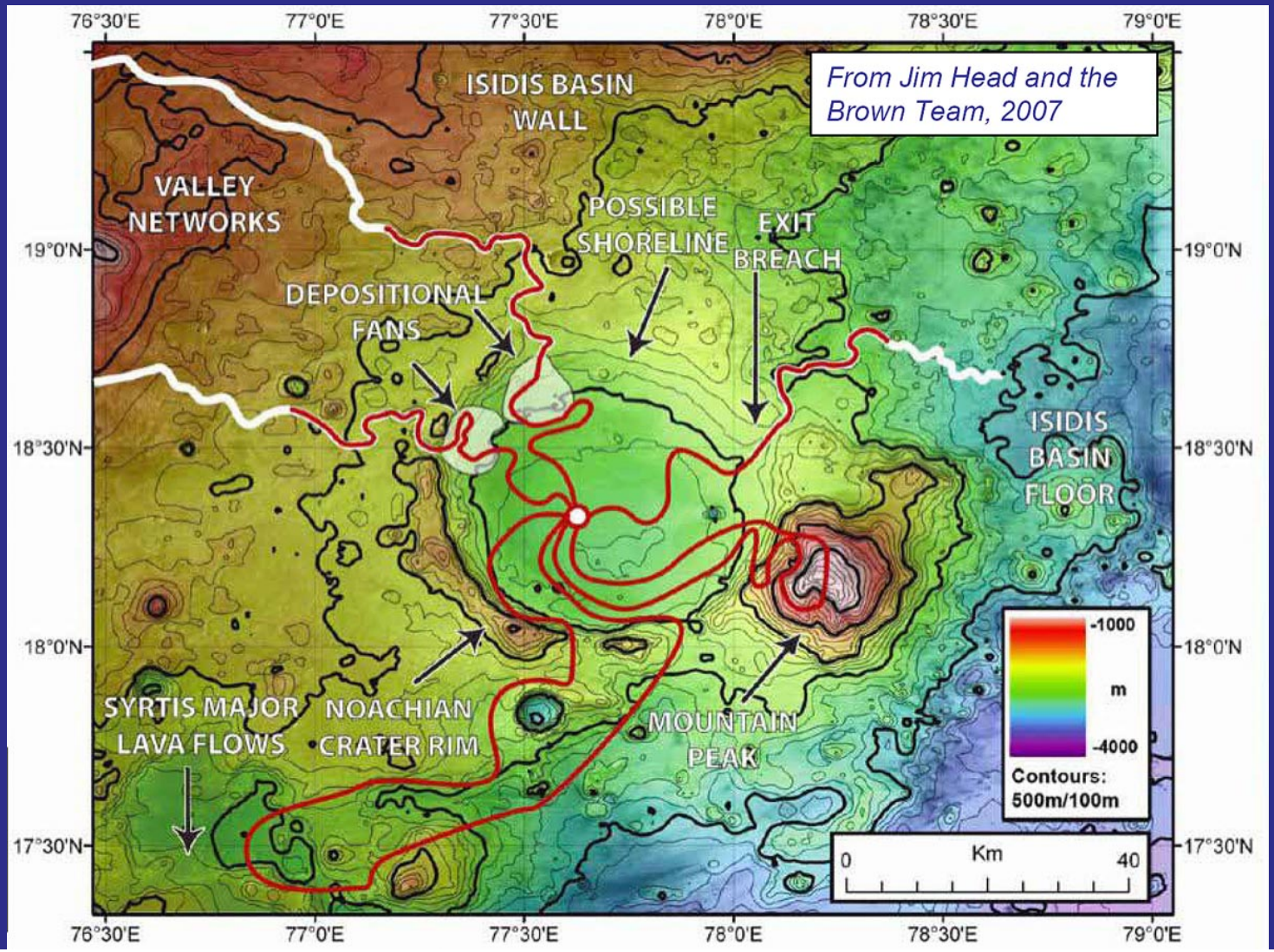


Mars Design Reference Architecture 5.0 Mission Profile
NTR Reference Shown

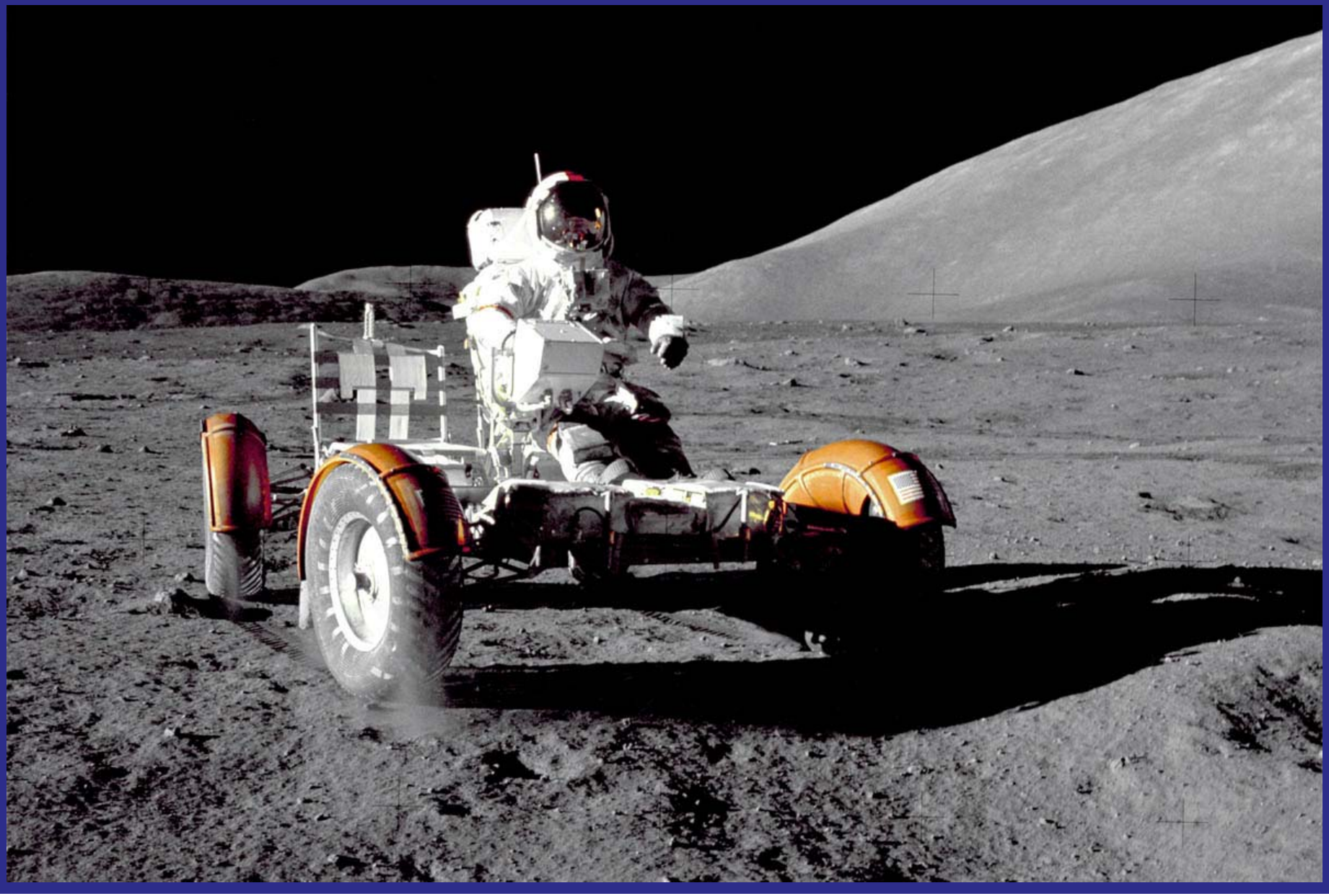


Planning the scientific exploration of Mars

A big study in recent years suggested long stays on Mars at three different sites, with rovers to allow long distance exploration from the base camp.



The nature of future exploration is now being debated



Current plans:

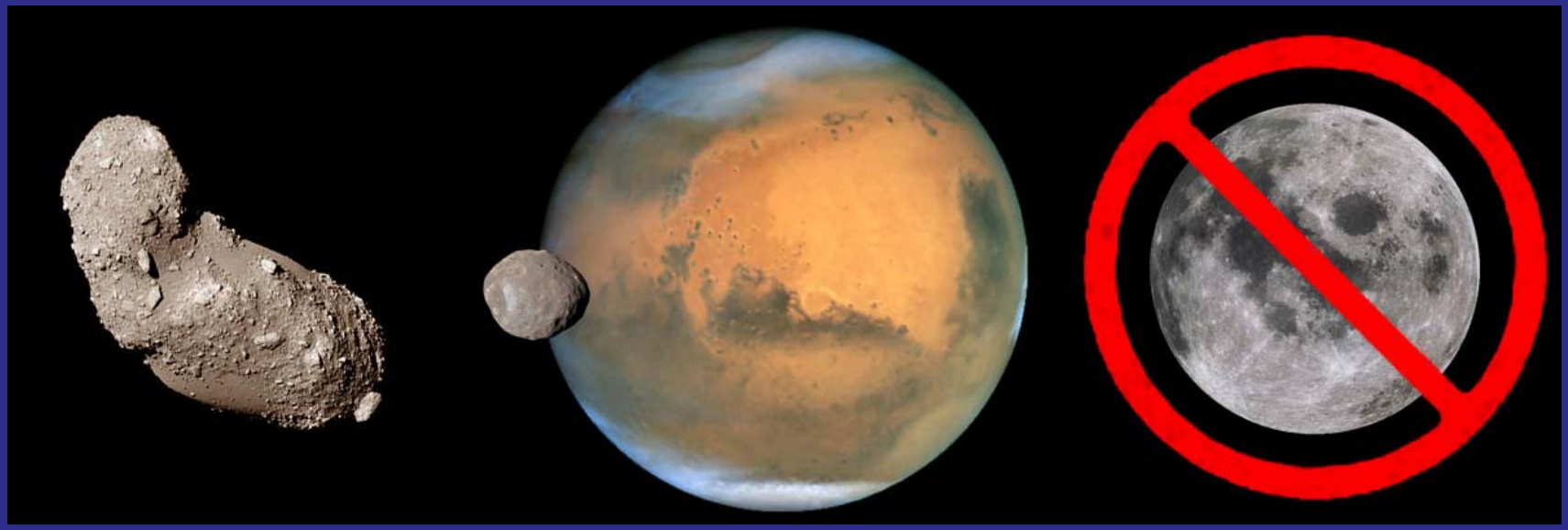
Soon – start building the large launcher needed for exploration

2020s – first human mission to an asteroid

mid-2030s – first human expedition to Mars orbit

Unspecified later date – human Mars landing

The Moon is not part of this plan.



But is this the only way to the Moon?

Google Lunar X Prize

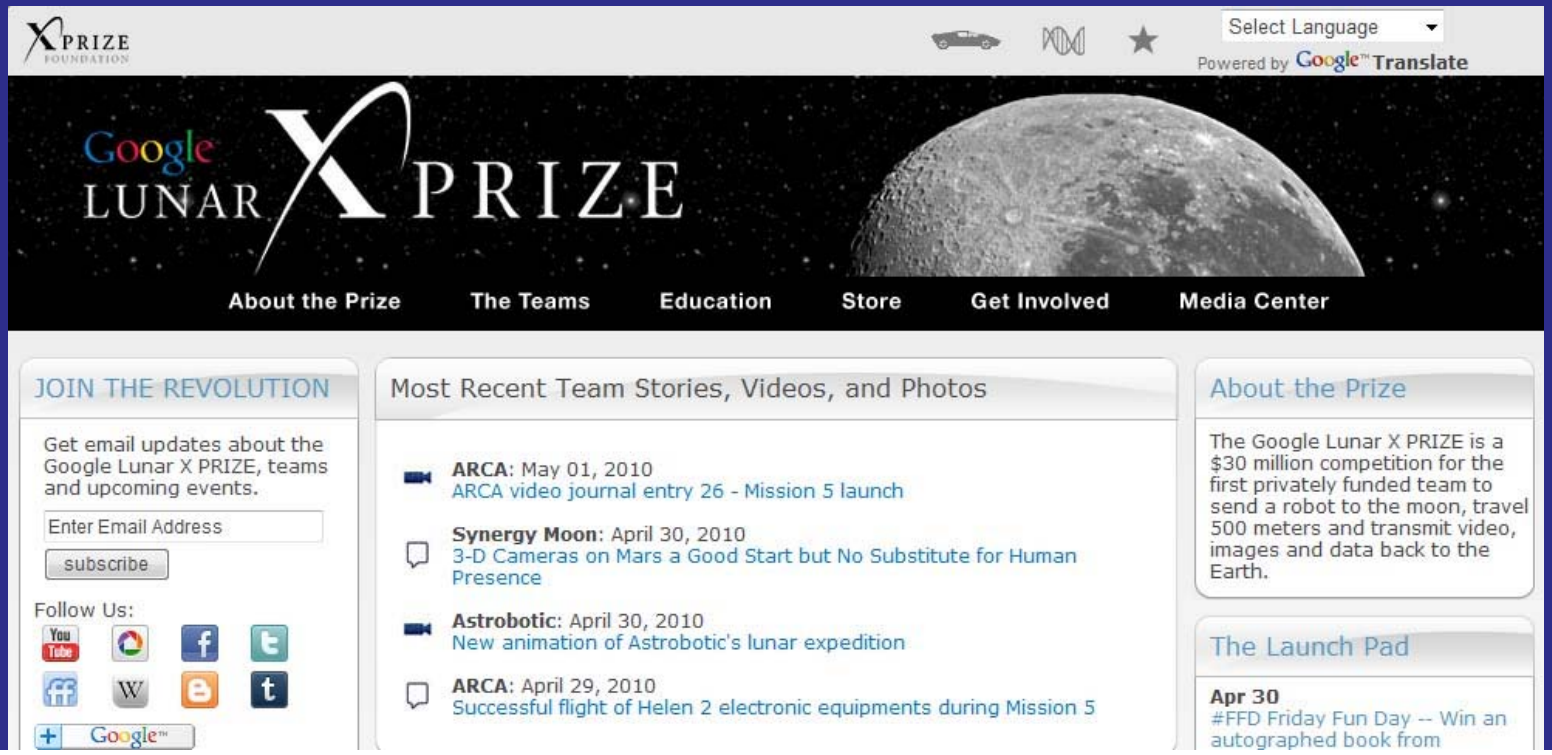
2004: X Prize Foundation - $10 million for first private suborbital flight.

2007: GLXP announced - $30 million for first lunar lander and rover.

2013: expected date of first attempt on the prize.

1990s: several other plans for private lunar missions.

Raising money has always been the biggest problem.



The Future of Space Exploration

Not just one program to one destination

NASA: developing technology, but no clear goals yet. They can only come from the President and Congress.

Other nations and agencies: Space becomes truly international.

Private sector: an increasing role, and not just as contractors.

Robotic exploration continues, but will people follow? Not yet clear.

End

Thanks for your interest in space.

Philip Stooke