



5...4...3...2...1...

SPACE LAUNCH SYSTEM

BUILDING THE FUTURE OF SPACE EXPLORATION

Robert Coker, PhD
NASA Marshall Space Flight Center
Sept. 2, 2016



I THOUGHT NASA WAS CANCELED?



History of US Human Spaceflight

◆ Sputnik / Explorer



History of US Human Spaceflight

- ◆ Sputnik / Explorer
- ◆ Mercury and Gemini



History of US Human Spaceflight

- ◆ Sputnik / Explorer
- ◆ Mercury and Gemini
- ◆ Apollo



History of US Human Spaceflight



- ◆ Sputnik / Explorer
- ◆ Mercury and Gemini
- ◆ Apollo
- ◆ Skylab

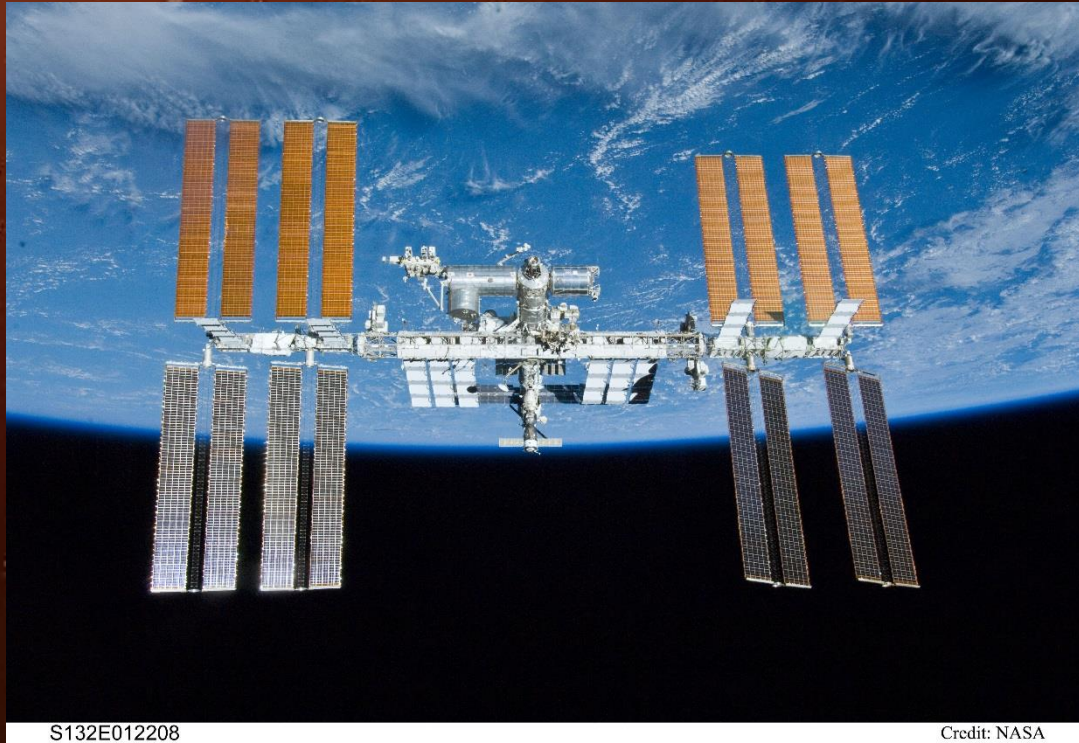
History of US Human Spaceflight



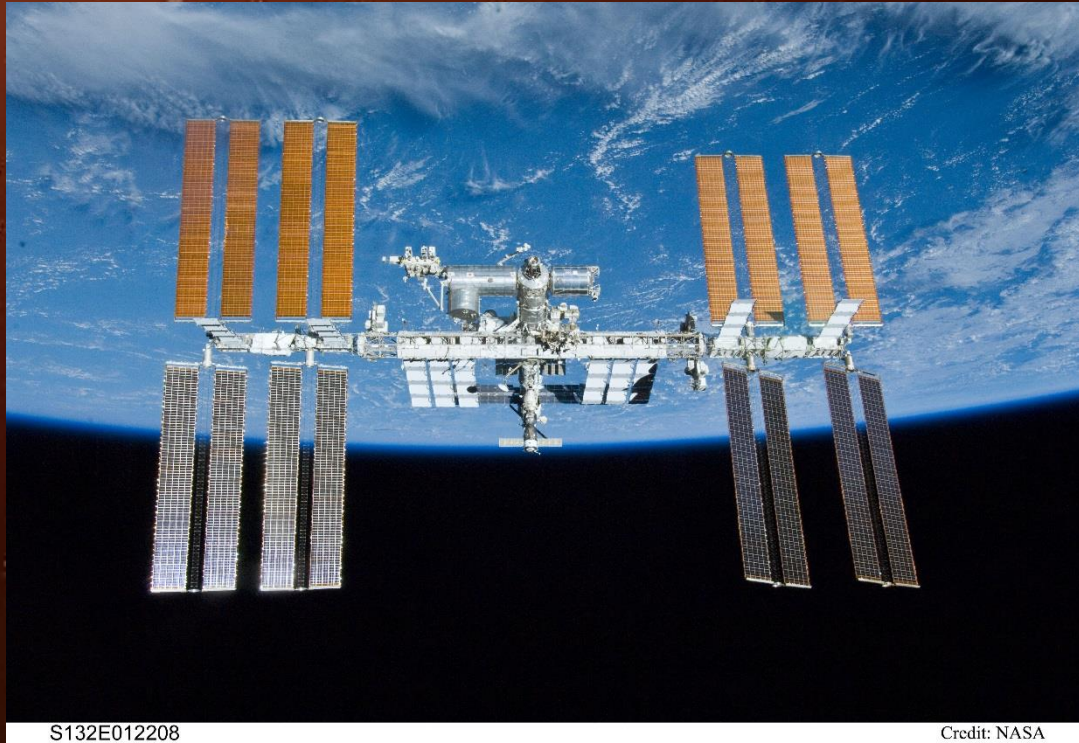
- ◆ Sputnik / Explorer
- ◆ Mercury and Gemini
- ◆ Apollo
- ◆ Skylab
- ◆ Space Shuttle

History of US Human Spaceflight

- ◆ Sputnik / Explorer
- ◆ Mercury and Gemini
- ◆ Apollo
- ◆ Skylab
- ◆ Space Shuttle
- ◆ International Space Station (through 2024)



History of US Human Spaceflight



S132E012208

Credit: NASA

- ◆ Sputnik / Explorer
- ◆ Mercury and Gemini
- ◆ Apollo
- ◆ Skylab
- ◆ Space Shuttle
- ◆ International Space Station (through 2024)

- ◆ What's next??

THE WORLD'S MOST POWERFUL ROCKET



Interim Cryogenic Propulsion Stage:

The second stage for the first SLS launch will push Orion beyond the moon.

Orion:

Carries explorers safely into space & back.

Stage Adapter:

Provides space for sending several small spacecraft to the moon and beyond.

Core Stage:

Larger than any other rocket stage, the SLS core stage holds fuel for launch.

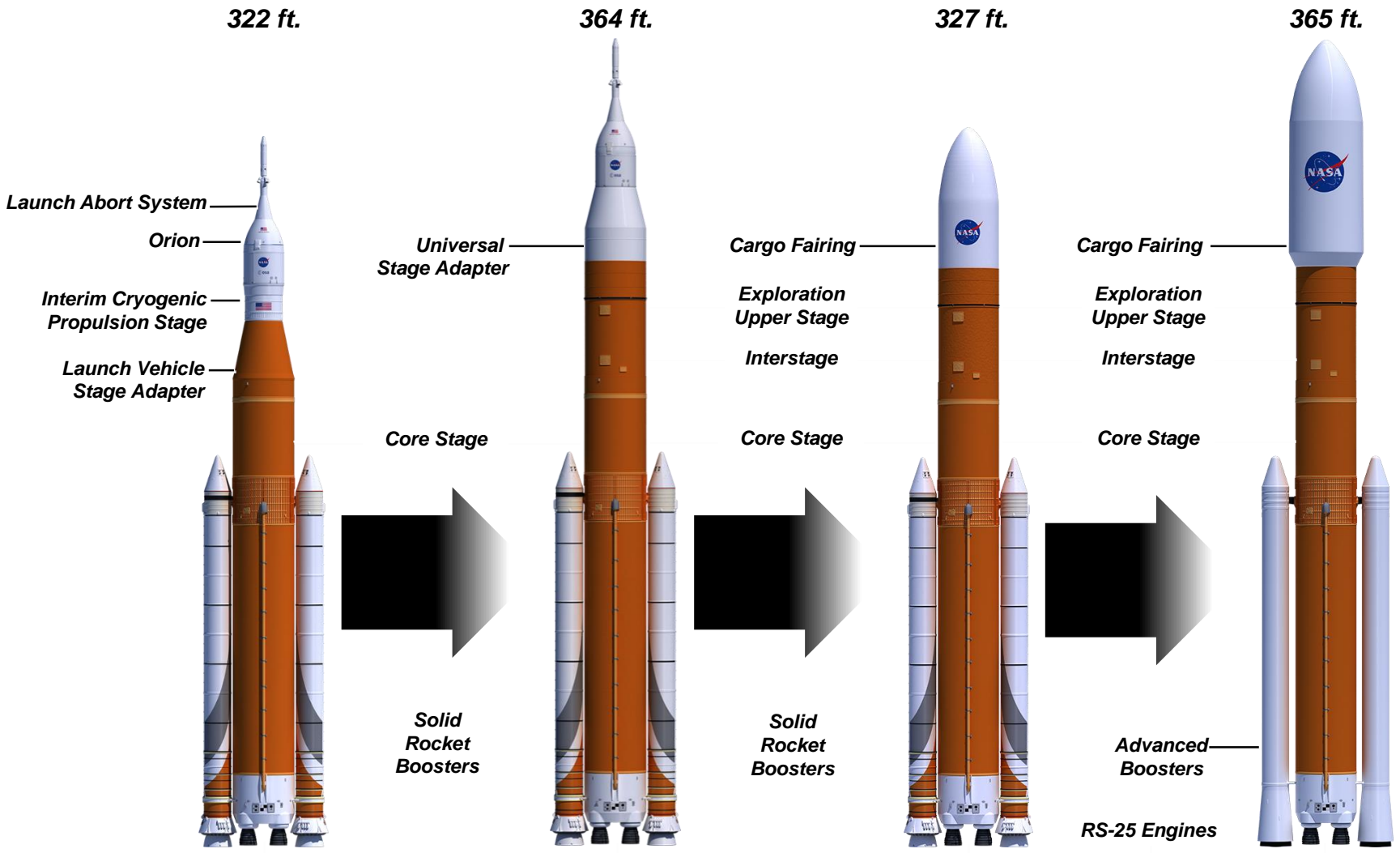
Solid Rocket Boosters:

The largest boosters to ever fly will provide most of the power for the first two minutes of flight.

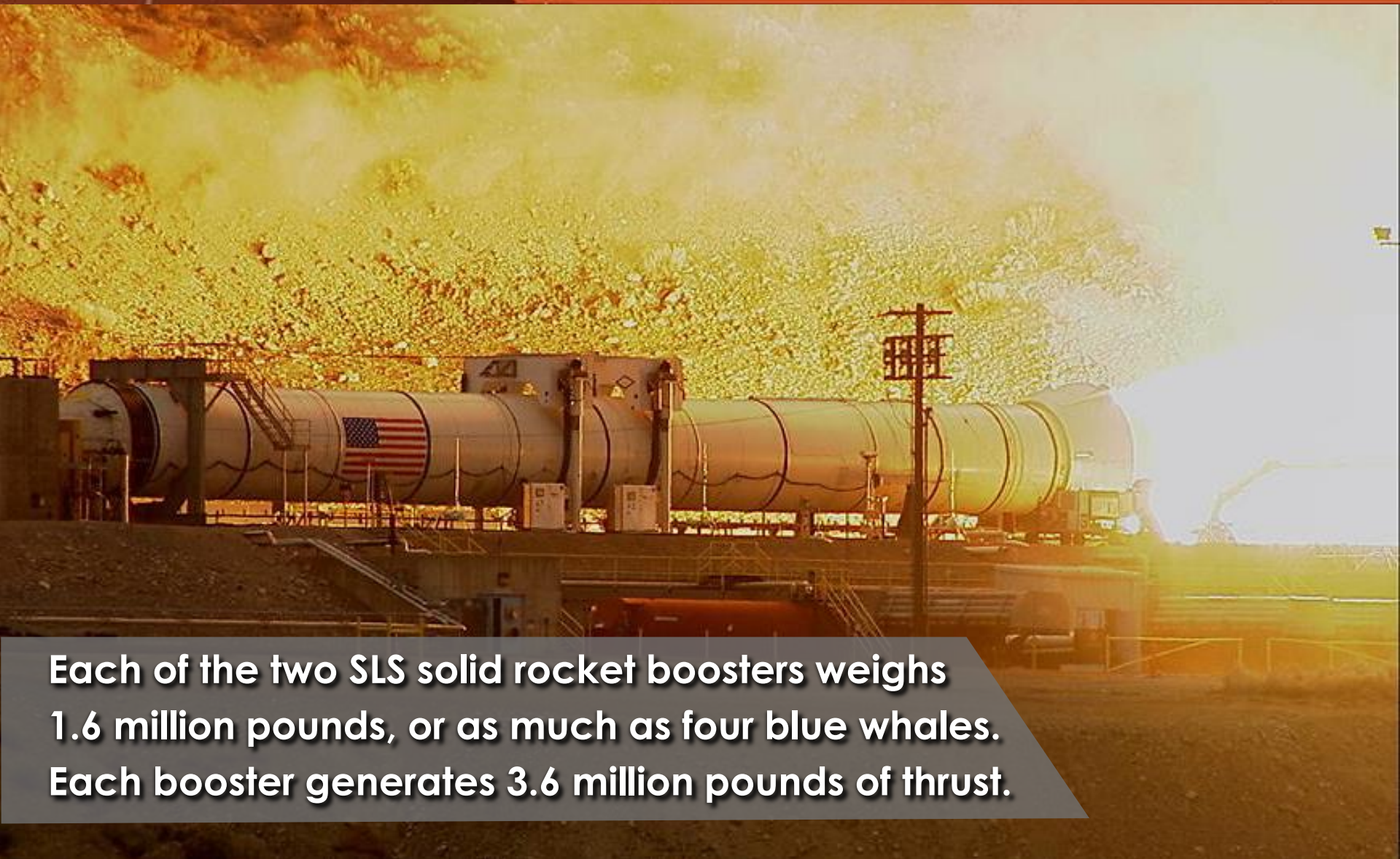
RS-25 Engines:

The most reliable engines of their kind; upgraded with new technology.

Block 1, Block 1B Crew, Block 1B Cargo, Block 2 Cargo



BUILDING A BETTER BOOSTER



Each of the two SLS solid rocket boosters weighs 1.6 million pounds, or as much as four blue whales. Each booster generates 3.6 million pounds of thrust.

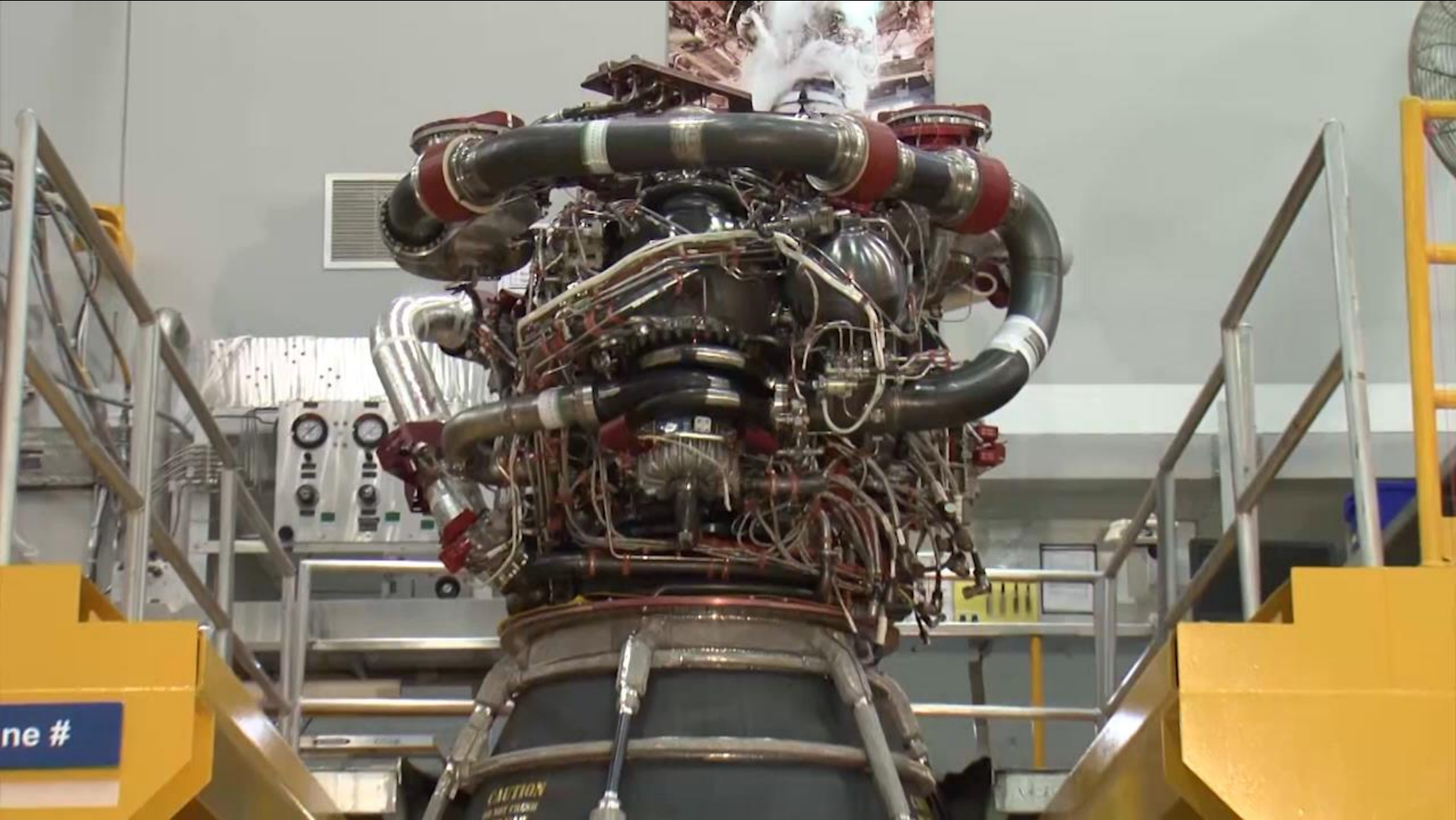




DESIGNED FOR PERFORMANCE




The four RS-25 engines in the Core Stage will generate as much power as 16 Hoover Dams.



ne #

CAUTION
HOT SURFACES

FUELING THE FLAMES



Using the world's largest welding tools, the 200-foot-tall Core Stage is in production today. It will carry 2 million pounds of propellant. Tanks are 27.6 feet across



88-3

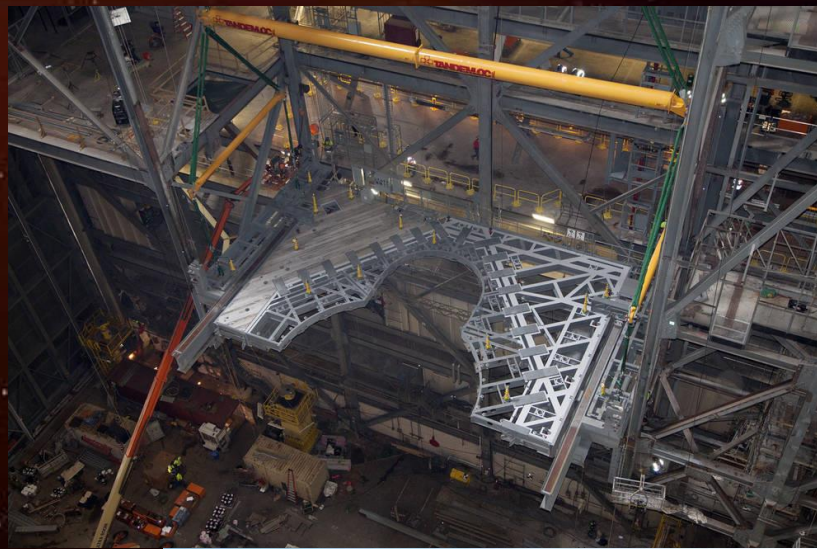
63
FT.

CELL A
LH/LD
INTERTANK
VERTICAL STACK
TPS CLOSEOUT

UPGRADING THE GROUND SYSTEMS



Test Stands



Vertical Assembly Building



Crawler



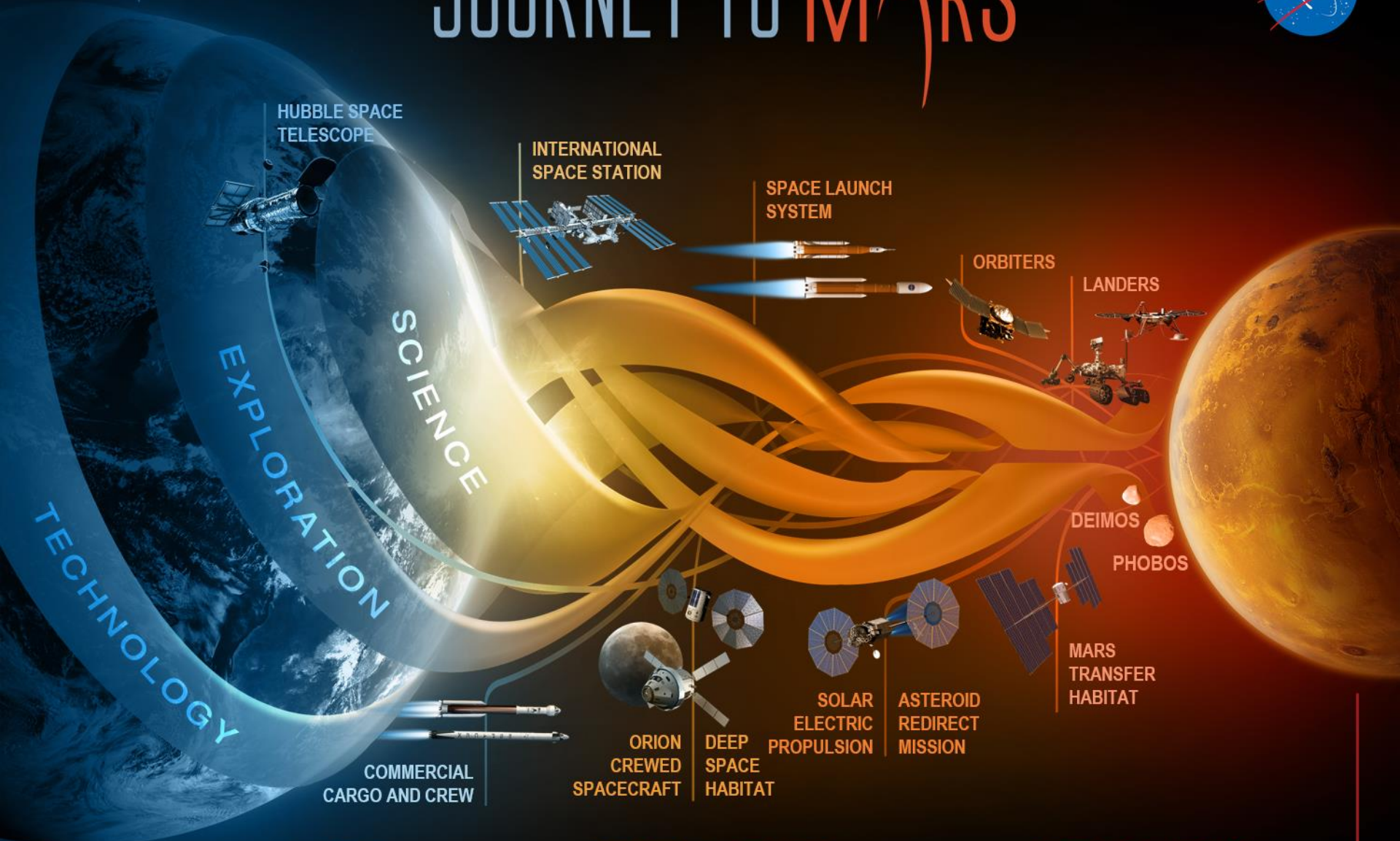
Pegasus barge

ADVANCING THE STATE OF THE ART

- 1) Additive manufacturing – Using 3D printing to create rocket engine components more quickly and affordably.
- 2) Composite materials – Testing materials to find ways to build rocket structures that are lighter or stronger
- 3) Structured Light Scanning – Provides a new tool for studying components without having to take them apart or destroy them

Investments in new technologies will keep SLS state-of-the-art as it upgrades to greater power, and will have benefits outside NASA.

JOURNEY TO MARS



HUBBLE SPACE TELESCOPE

INTERNATIONAL SPACE STATION

SPACE LAUNCH SYSTEM

ORBITERS

LANDERS

TECHNOLOGY
EXPLORATION
SCIENCE

DEIMOS

PHOBOS

MARS TRANSFER HABITAT

SOLAR ELECTRIC PROPULSION

ASTEROID REDIRECT MISSION

ORION CREWED SPACECRAFT

DEEP DEEP SPACE HABITAT

COMMERCIAL CARGO AND CREW

MISSIONS: 6-12 MONTHS

RETURN: HOURS

EARTH RELIANT

MISSIONS: 1-12 MONTHS

RETURN: DAYS

PROVING GROUND

MISSIONS: 2-3 YEARS

RETURN: MONTHS

EARTH INDEPENDENT

RETURNING TO DEEP SPACE

The first astronauts to fly on SLS will use Orion to travel beyond the moon, farther into space than any human being has ever ventured.

SMALL PAYLOADS, BIG SCIENCE!

Along with Orion, the first SLS launch will carry 13 6U smallsats, representing multiple disciplines and partners. The smallsats will be deployed from the Orion Stage Adapter.

MOON

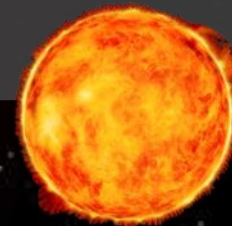
- Lunar Flashlight (NASA)
- Lunar IceCube (Morehead State University)
- LunaH-Map (Arizona State University)
- Omotenashi (JAXA)

ASTEROID

- NEA Scout (NASA)

SUN

- CuSP (Southwest Research Institute)



EARTH

- EQUULEUS (JAXA)
- Skyfire (Lockheed Martin)



AND BEYOND

- Biosentinel (NASA)
- ArgoMoon (ESA/ASI)
- Three Centennial Challenge Winners (TBD)



PROVING GROUND

MAKING THE IMPOSSIBLE POSSIBLE

Not only will SLS enable human exploration of deep space, it will make possible science missions and other payloads no other rocket can fly.

THE ADVENTURE BEGINS NOW.



www.nasa.gov/sls



@NASA_SLS



NASASLS



google.com/+nasa



youtube.com/nasa



@explorenasa

#JOURNEYTOMARS