

MINECRAFT & SCIENCE

EXPLORING THE INTERNATIONAL SPACE STATION

VERSION 1.0

Lesson 9

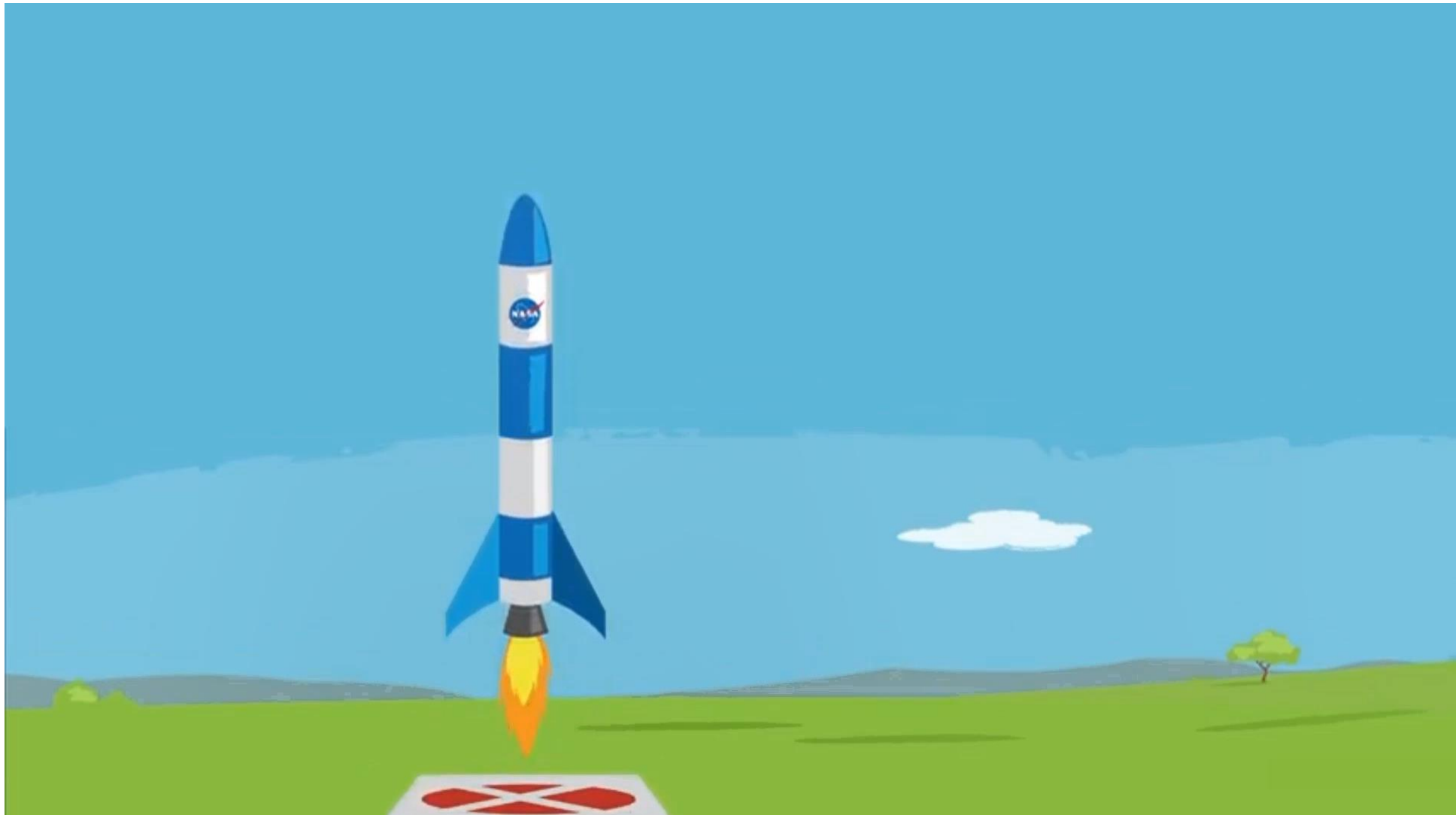
Rockets Away

ROCKETS AND THE ISS

- How do astronauts get to the ISS?
 - Rockets carrying astronauts in a space shuttle are launched into space.
 - Space shuttles are released from rockets to travel to the ISS.
- How do they get inside of the ISS?
 - Astronauts board the ISS through the hatch
- First Launch – October 31st, 2000



LAUNCHING ROCKET INTO SPACE



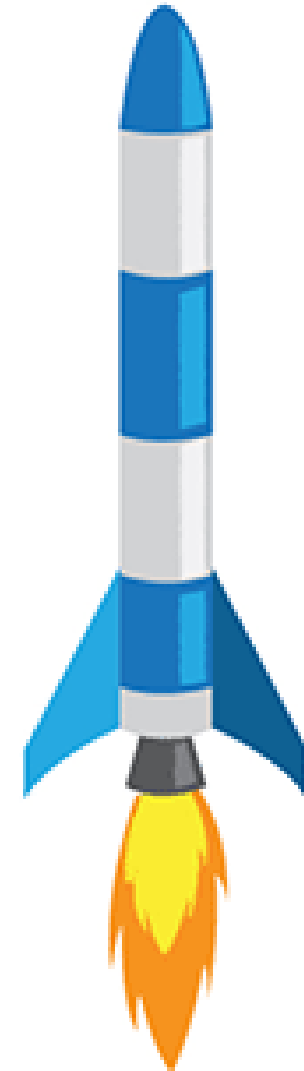
ROCKETS PROPELLANT

- Rockets are launched into space by putting them on rockets carry tons of propellants.
- Propellants give the rocket energy to boost away from Earth's surface and gravity.



ACTION & REACTION FORCE

- In 1686, Isaac Newton presented 3 basic laws of motion. Law #3 : **For every action, there is an equal and opposite reaction.**
- During rocket launches, the exhaust streaming out of the bottom of the rocket pushes out towards the ground.
 - **ACTION** force
- In response, the rocket begins moving in the opposite direction, lifting off the ground.
 - **REACTION** force



GRAVITY AND THRUST

- Earth's **gravity** creates a downward force.
- Burning propellants and pushes out exhaust, creates an **upward force called thrust**.
- To launch, **thrust** pushing up must be greater than the force of **gravity** pulling the rocket down.
- Rocket to be at least 17,800 miles per hour to fly above the Earth's atmosphere, in a curved path around Earth.

RELEASING SHUTTLE

- The rocket launches and travels at least 17,800 miles per hour.
- When the rocket gets to a specific distance from Earth, it will release the shuttle.



LANDING ON THE ISS

- The ISS orbits about 250 miles above the Earth.
- It travels at about 17,150 miles per hour.

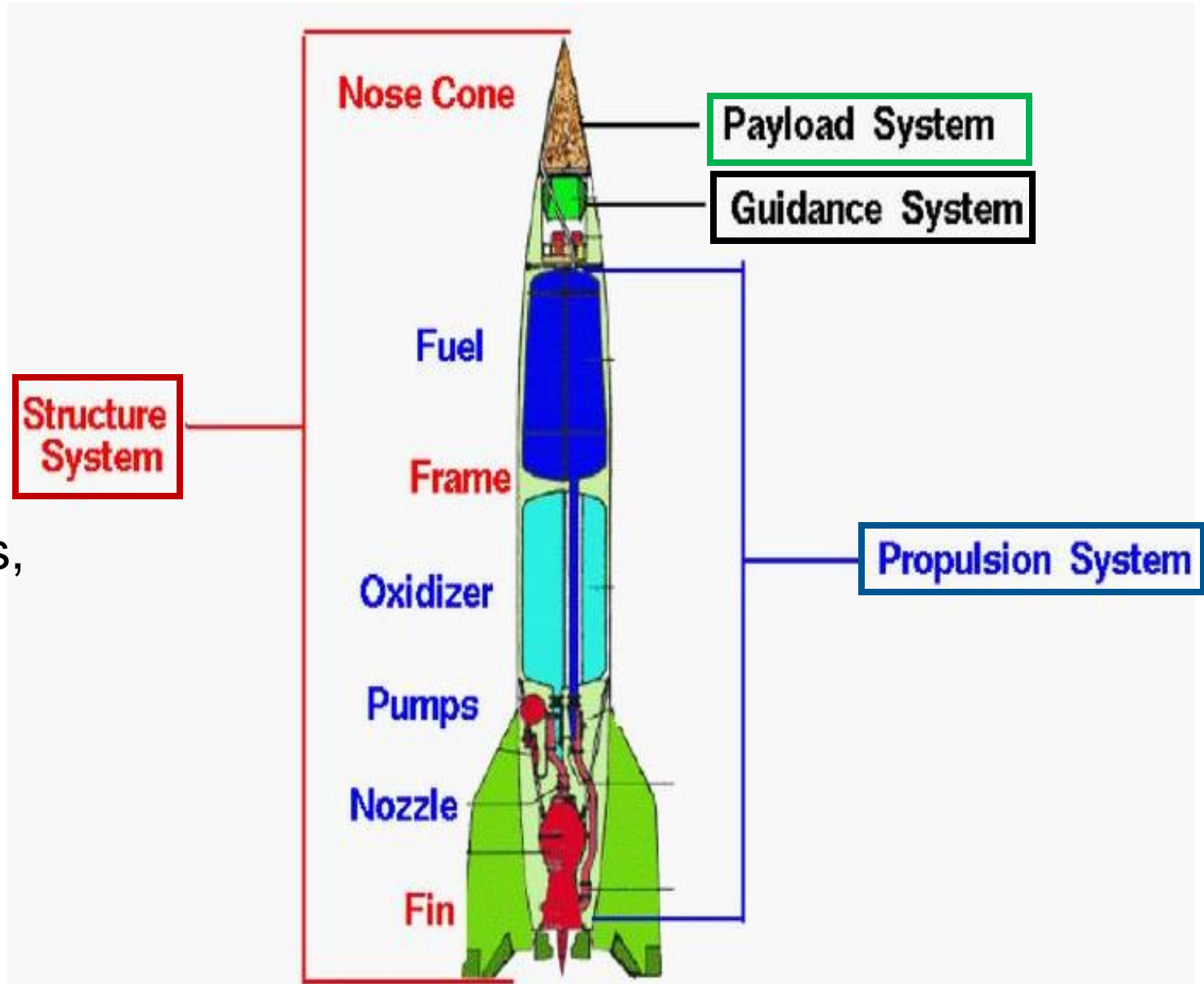


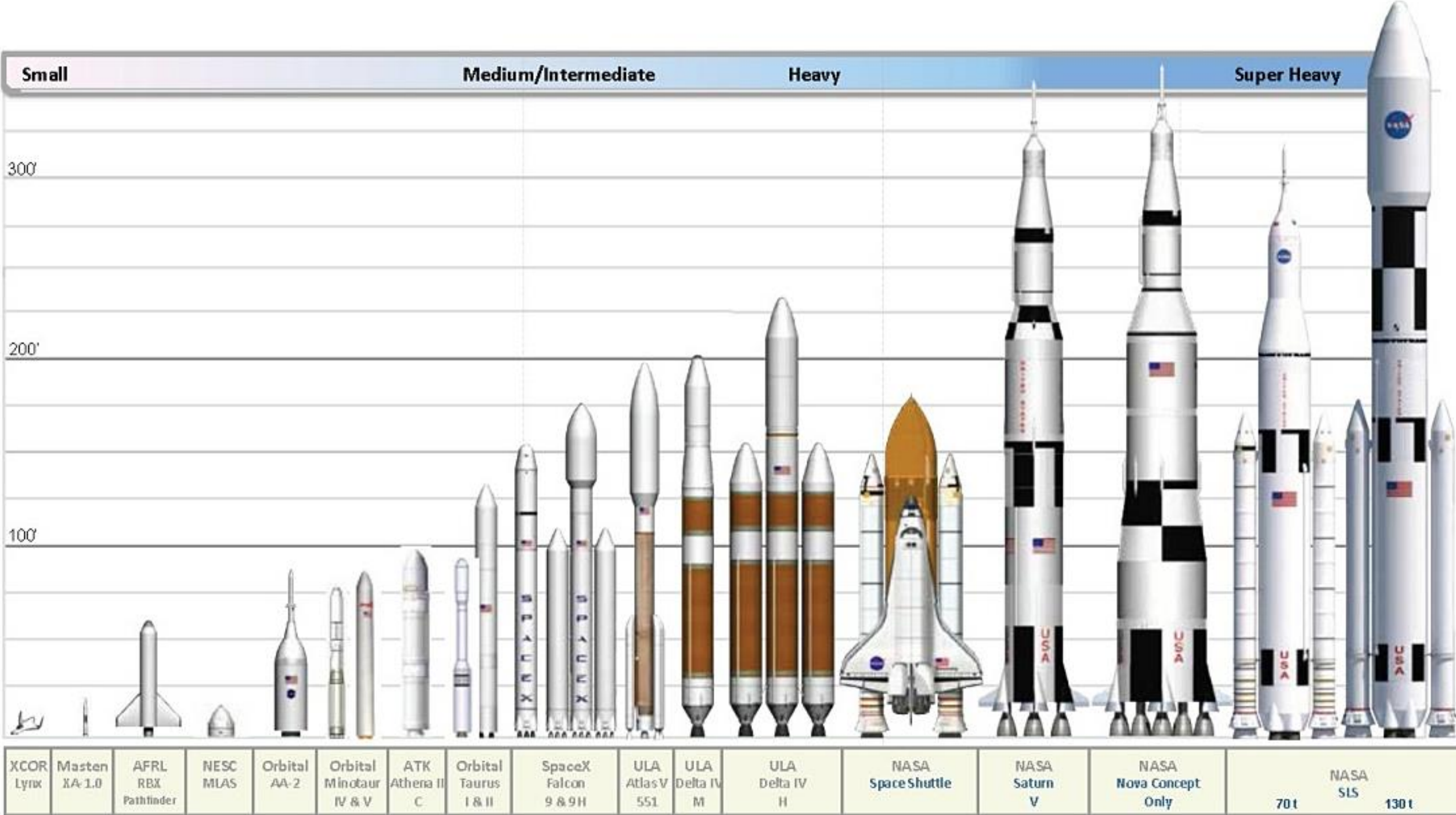
SPACE SHUTTLE DOCKING ON ISS



4 MAIN PARTS OF A ROCKET

- **Structure System** (frame)
 - Made of strong but light materials (ie titanium or aluminum)
- **Payload System**
 - Depends on the rocket's mission
- **Guidance System**
 - Includes sensors, computers, radar, communication equipment etc.
- **Propulsion System**
 - Liquid rocket engines
 - Solid rocket engines





Small

Medium/Intermediate

Heavy

Super Heavy

300'

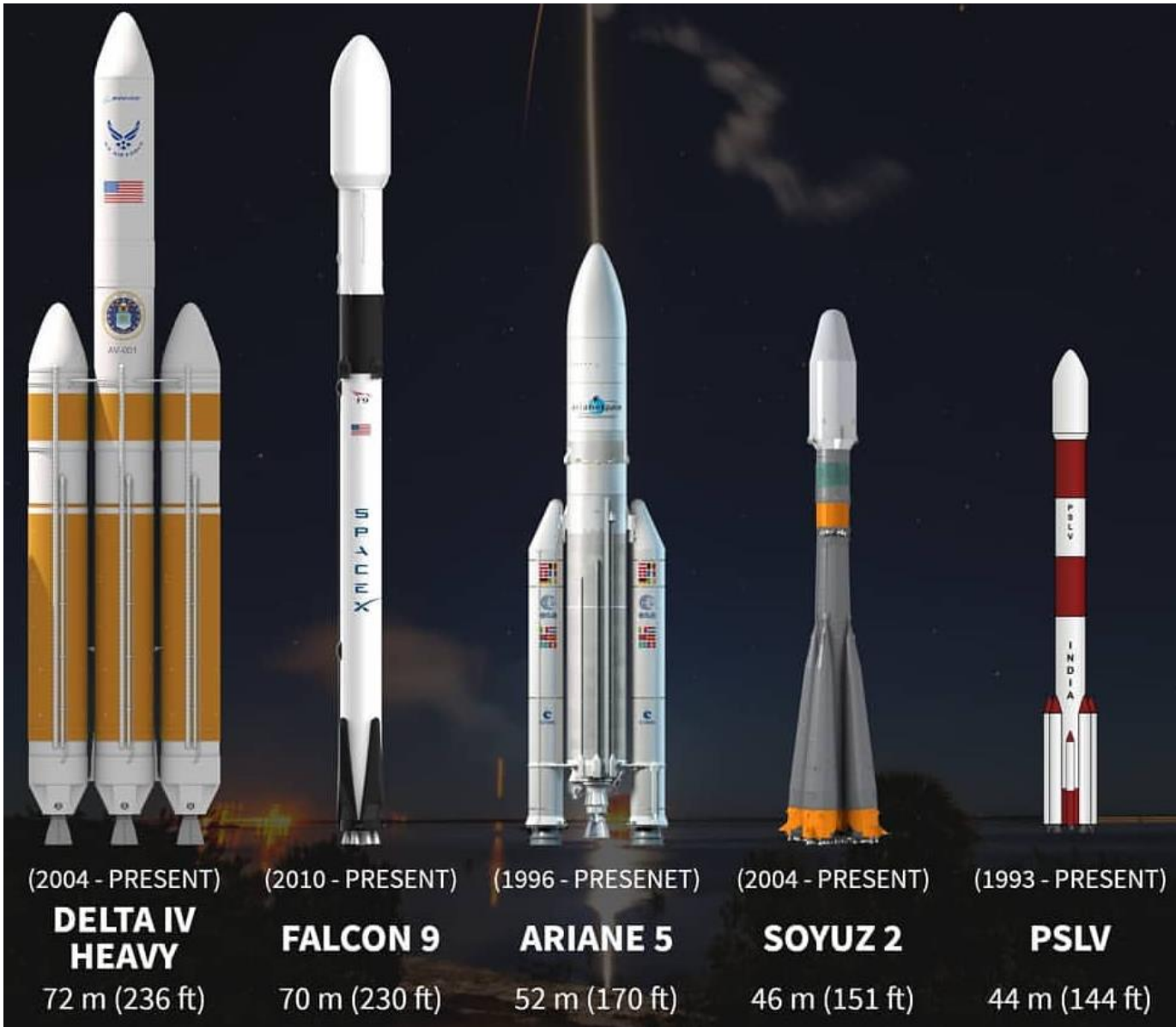
200'

100'

XCOR Lynx	Masten XA-1.0	AFRL RBX Pathfinder	NESC MLAS	Orbital AA-2	Orbital Minotaur IV & V	ATK Athena II C	Orbital Taurus I & II	SpaceX Falcon 9 & 9H	ULA Atlas V 551	ULA Delta IV M	ULA Delta IV H	NASA Space Shuttle	NASA Saturn V	NASA Nova Concept Only	70 t	NASA SLS	130 t
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FALCON 9 & FALCON HEAVY

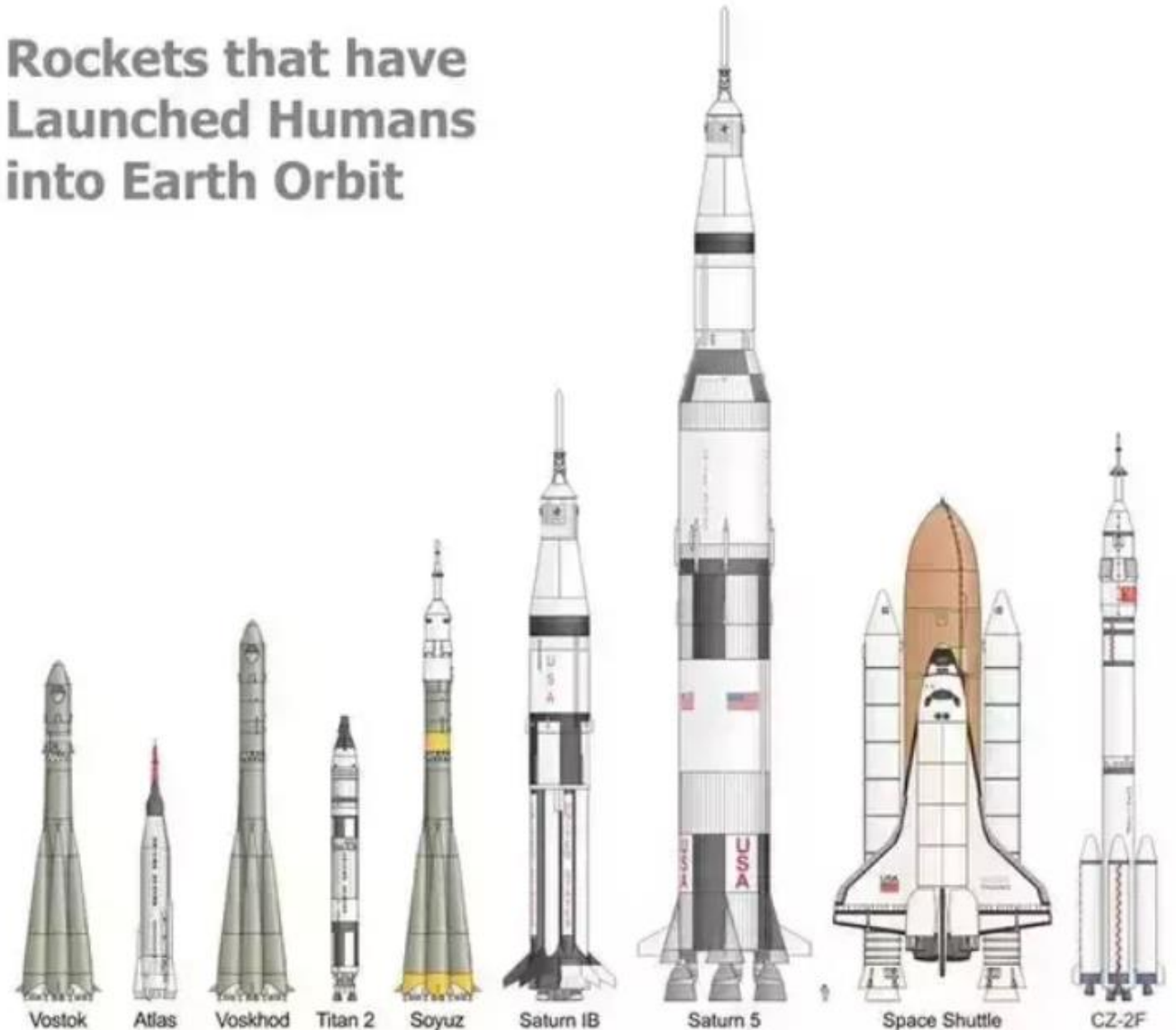
- A reusable rocket designed and manufactured by SpaceX
- Carried the ISS crew in 2020
- Launched with space shuttles:
 - Dragon
 - Endeavor
 - Resilience



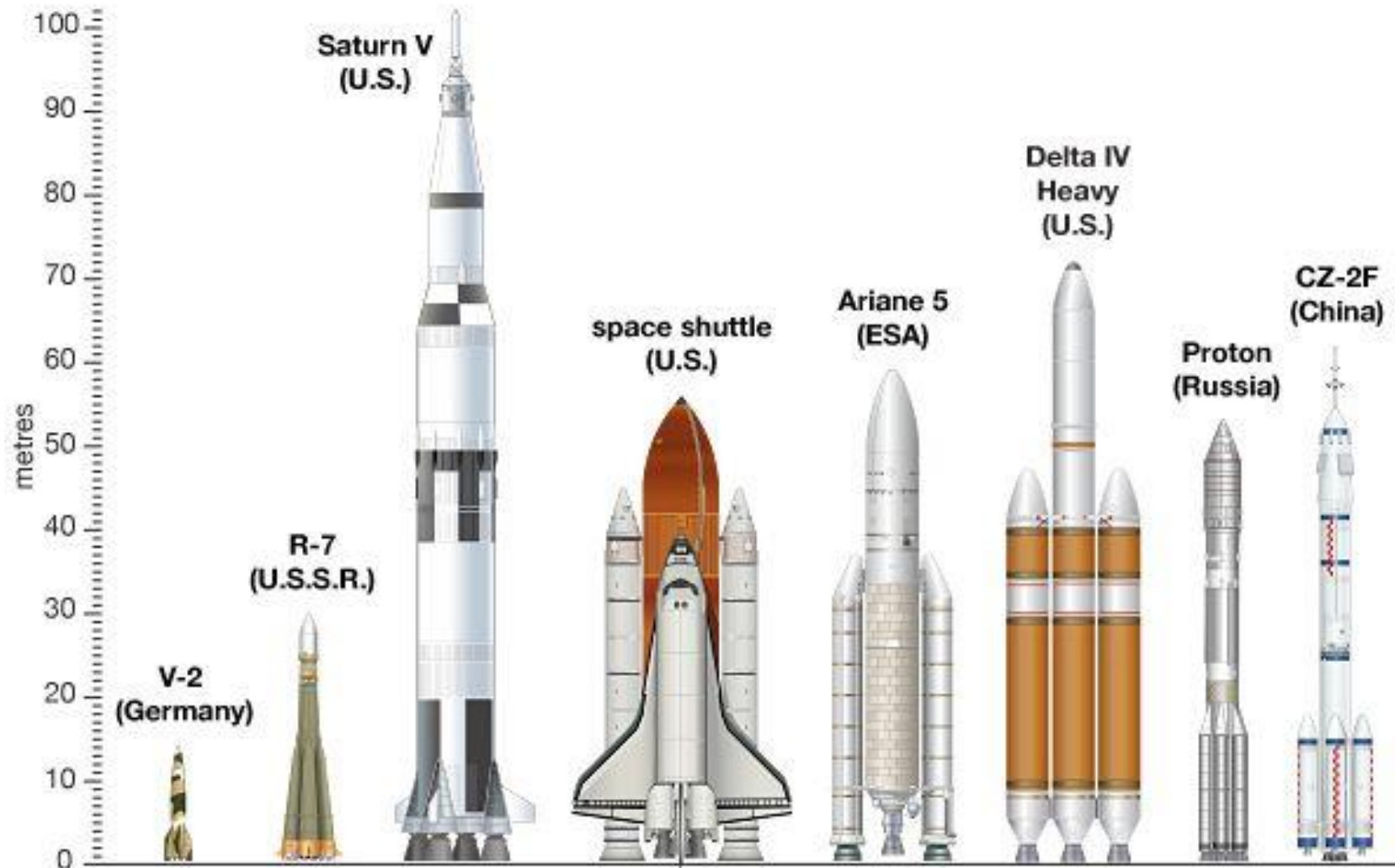
SOYUZ

- Russian rockets that carried the ISS crew from 2000 to 2020
- Launched space shuttles:
 - Endeavor
 - Discovery
 - Atlantis

Rockets that have Launched Humans into Earth Orbit



ROCKET SIZES



ROCKETS OF THE WORLD

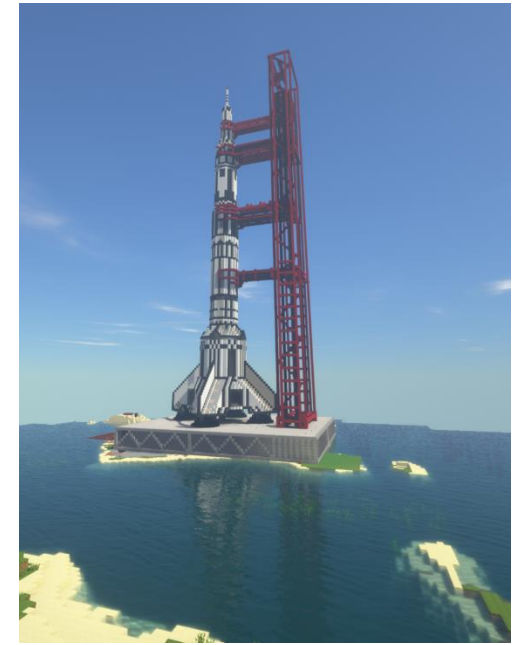
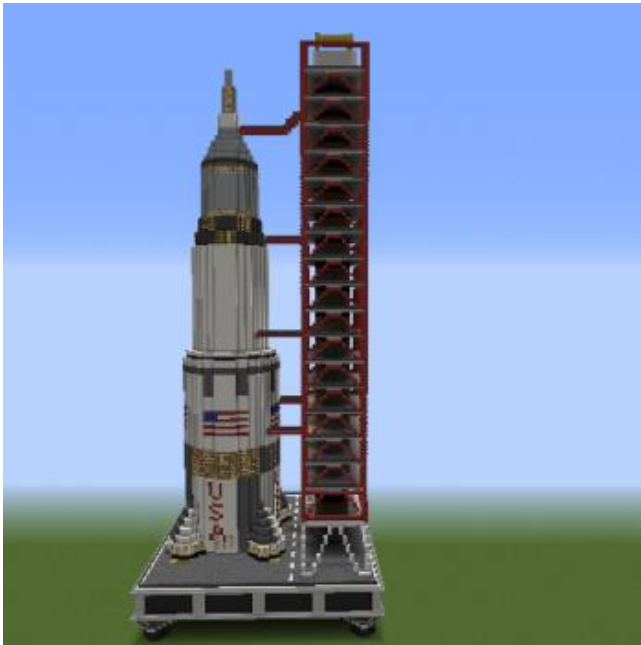
SKRABEK





STUDENT ACTIVITY

- Build and design your own rockets to take astronauts to your space station.
- These rockets should be built as if they are ready to launch.



END OF LESSON 9