LESSON

10.2 Recent and Future Missions

Let's check your book answers:

Explain

1. What is a goal of future space exploration?

One goal is to extend human space travel in the solar system.

Differentiate

2. What is the purpose of each type of probe?

Solar	Lunar
help scientists understand the hazards of solar radiation	help scientists collect data to determine the best location for a future lunar outpost

Identify

3. What do scientists want to learn about the inner planets?

Scientists want to learn how they formed, what geologic forces are active on them, and whether any of them can support life.

LESSON

10.2 Recent and Future Missions

Describe

4. Why are missions to the outer planets difficult?

They are difficult because the outer planets are so far from Earth.

Connect

4. Highlight why it is important for scientists to investigate the conditions for life on Earth.

Conditions Needed for Life

Astrobiology *is the study of life in the universe, including life on Earth and the possibility of extraterrestrial life.* Investigating the conditions for life on Earth helps scientists predict where they might find life elsewhere in the solar system. Astrobiology also can help scientists locate environments in space where humans and other Earth life might be able to survive.

Relate

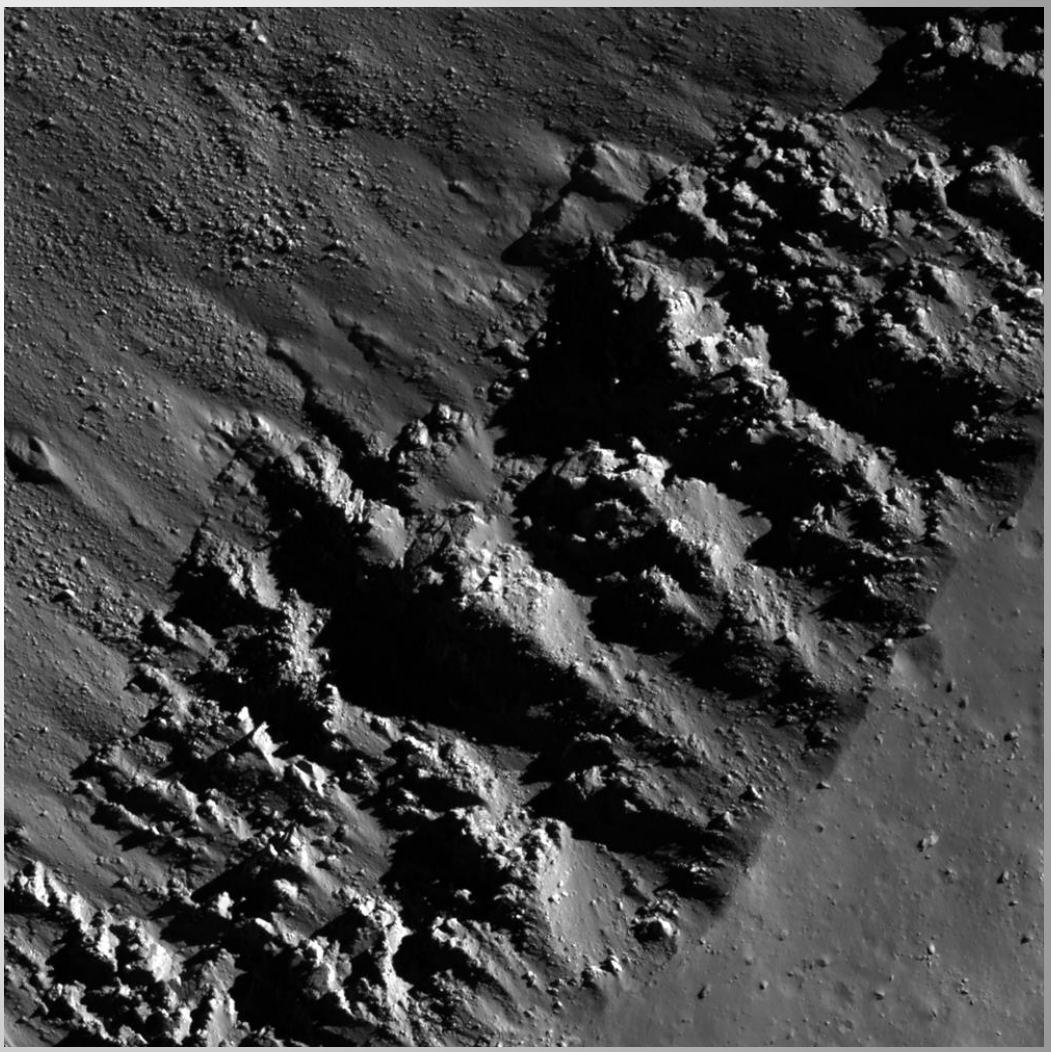
5. Underline how exploring space can help scientists learn about Earth.

Understanding Earth by Exploring Space

Space provides frontiers for the human spirit of exploration and discovery. The exploration of space also provides insight into planet Earth. Information gathered in space helps scientists understand how the Sun and other bodies in the solar system influence Earth, how Earth formed, and how Earth supports life. Looking for Earthlike planets outside the solar system helps scientists learn if Earth is unique in the universe.

LRO

Lunar Reconnaissance Orbiter



Launch Date: June 18, 2009

Destination: Earth's moon

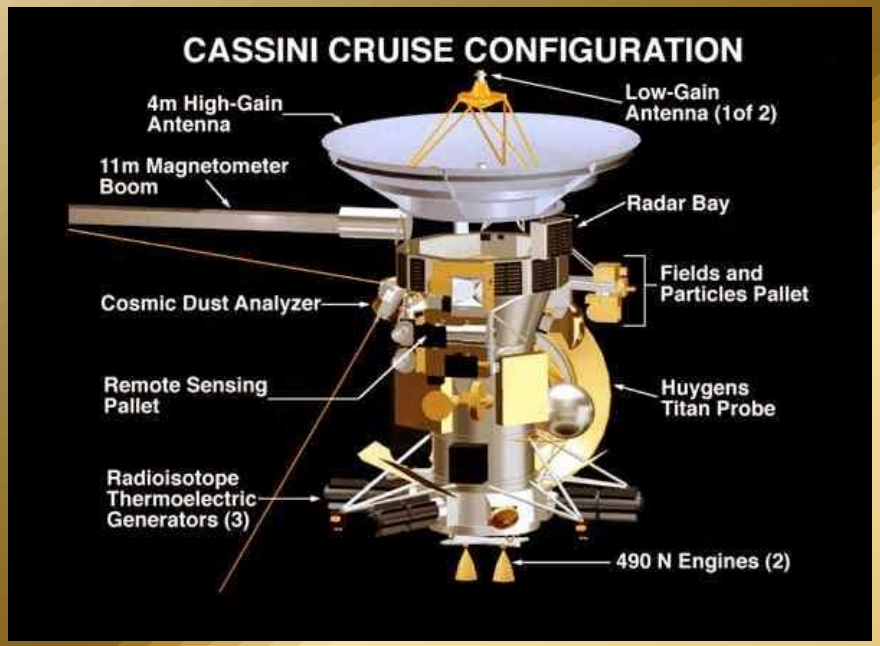
Reached Moon: June 23, 2009

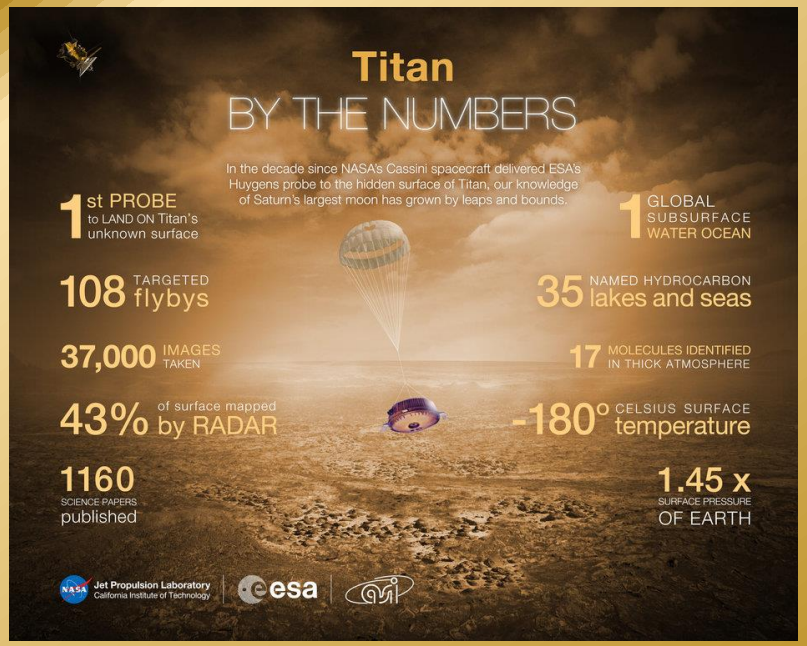
Type of craft: Orbiter

Intended purpose: to map the surface of the moon like never before

Click **HERE** for newest information.

Cassini-Huygens





Launch Date: October 15, 1997

Destination: Saturn and its system

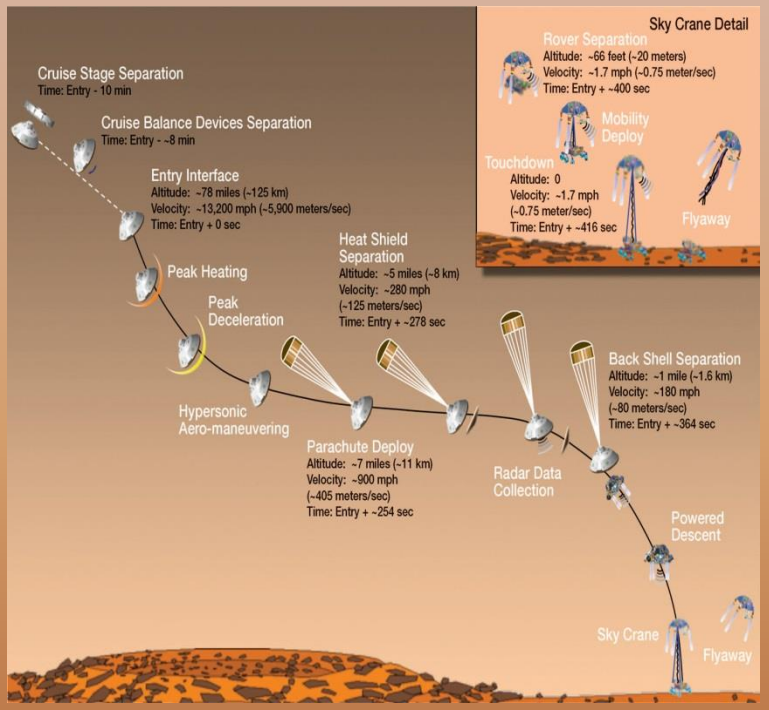
Reached Saturn: June 30, 2004

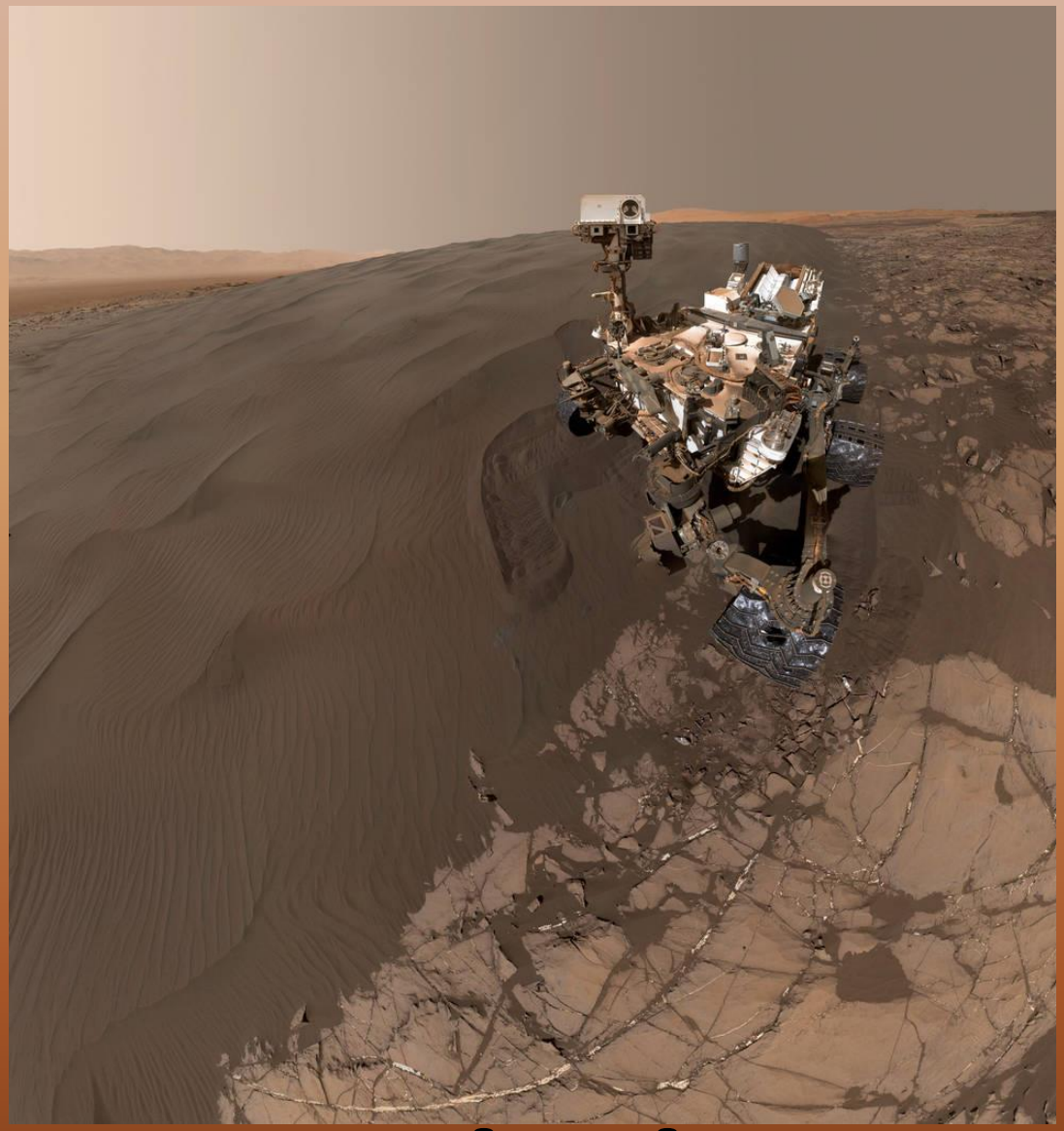
Type of craft:
Cassini = Orbiter
Huygens = Lander

Intended purpose:
Cassini orbits Saturn, studying the ringed planet and its moons in detail.
The **Huygens** probe landed on Saturn's largest moon, Titan, in January 2005 to study clouds, atmosphere, and surface.

In late 2016, the Cassini spacecraft began a daring set of orbits called the Grand Finale, which will be in some ways like a whole new mission

Click **HERE** for newest information.





Curiosity

Launch Date: November 6, 2011

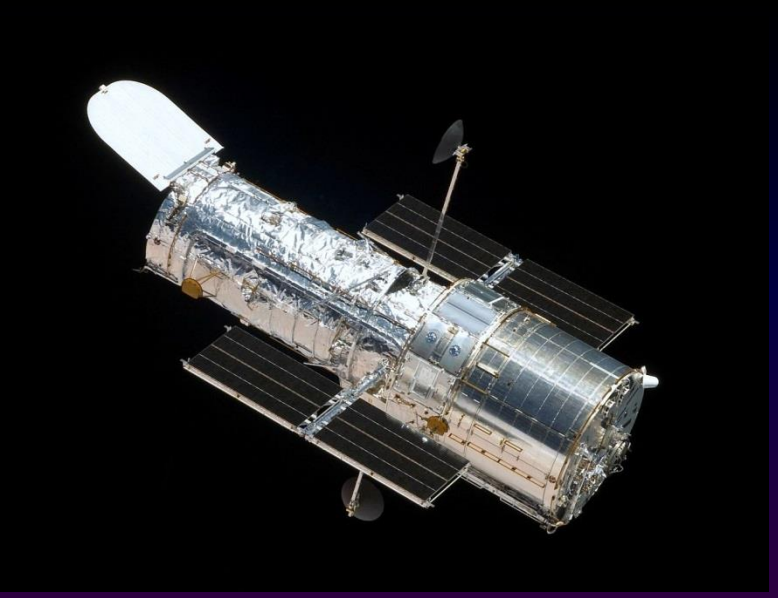
Destination: Mars

Landed on Mars: August 6, 2012

Type of craft: Lander / rover

Intended purpose: Determine if Mars was ever able to support microbial life.

Click **HERE** for newest information.



Hubble Space Telescope

Launch Date: April 24, 1990 by Space Shuttle Discovery

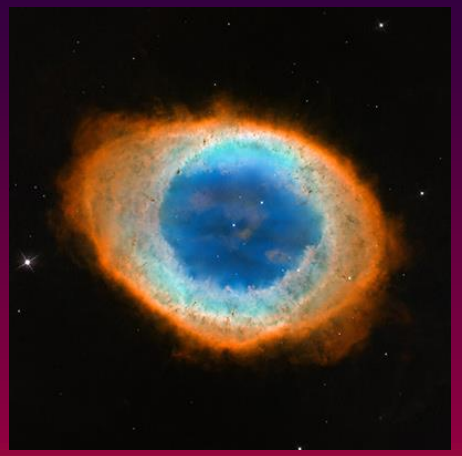
Destination: in orbit 353 miles above Earth

Type of craft: orbiting telescope

Intended purpose: Hubble has reshaped our perception of the cosmos with clear and deep views from above Earth's atmosphere.

Click HERE for newest information.

Ring Nebula



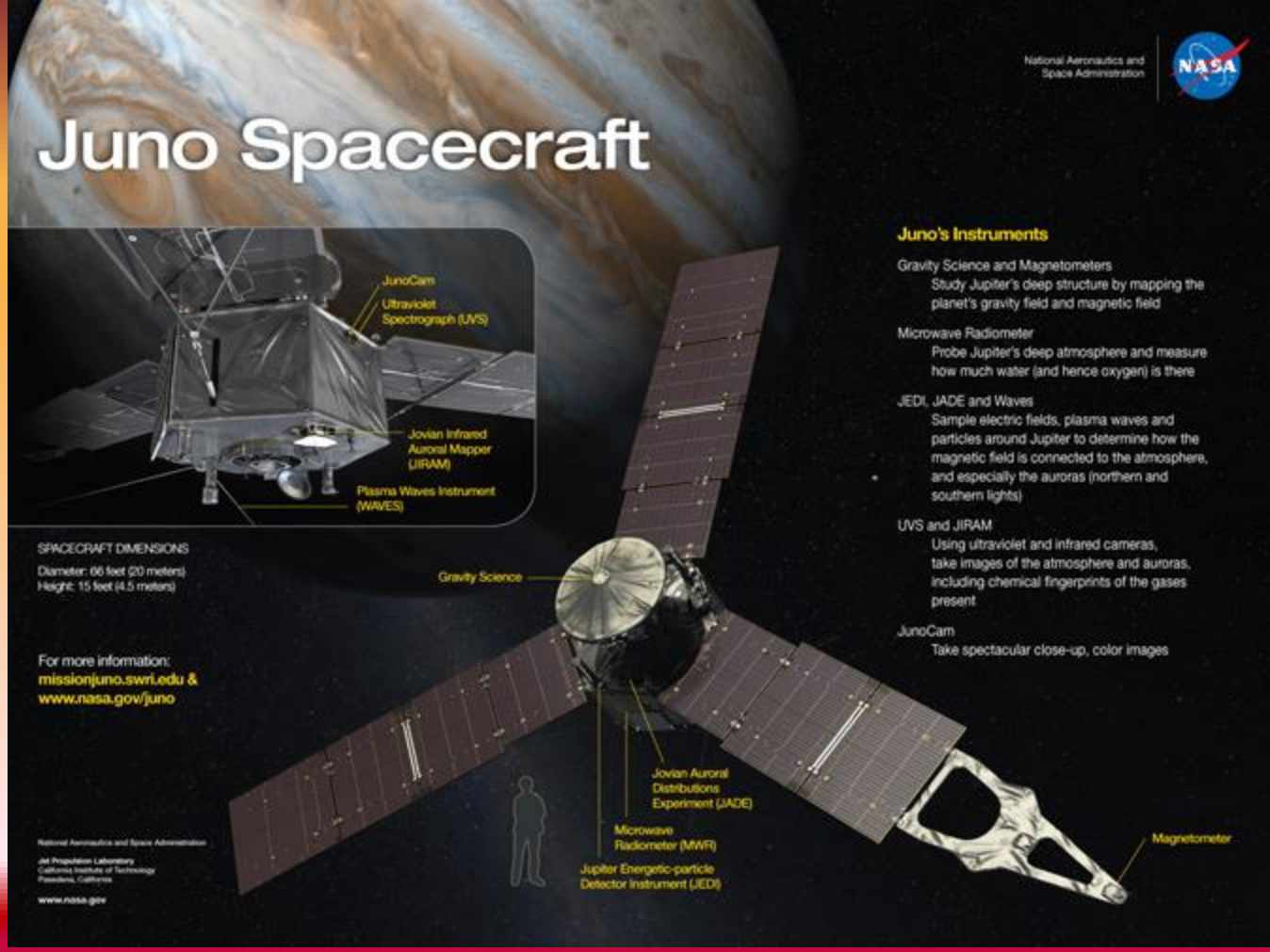
←Astronaut Steve Smith works on Hubble during the second servicing mission in 1997 with a ratchet. NASA specially designed the power tool to withstand the harsh environment of space, making it an essential item during three different Hubble missions. Hubble was specifically built to be serviced in orbit with replaceable parts and instruments. Astronauts performed four days of spacewalks during the second servicing mission to replace instruments and repair the telescope.

Juno

Launch Date: August 5, 2011

Destination: Jupiter

<u>On January 13, 2016</u>
NASA's Juno mission to Jupiter broke the record to become humanity's **most distant solar-powered probe.**



Arrived: July 4, 2016
Juno has now travelled 1.71 billion miles since launch, and has another 48 million miles to go before entering orbit around Jupiter (as of 2/16/16.)

Type of craft: Orbiter

Intended purpose: Understand origin and evolution of Jupiter, look for solid planetary core, map magnetic field, measure water and ammonia in deep atmosphere, observe auroras.

Click **<u>HERE</u>** for newest information.

Dawn

Intended purpose: Learn more about formation and makeup of early solar system.

First mission to orbit two targets.

Launch Date: September 27, 2007

Destination: Ceres and Vesta
Currently orbiting dwarf planet Ceres.

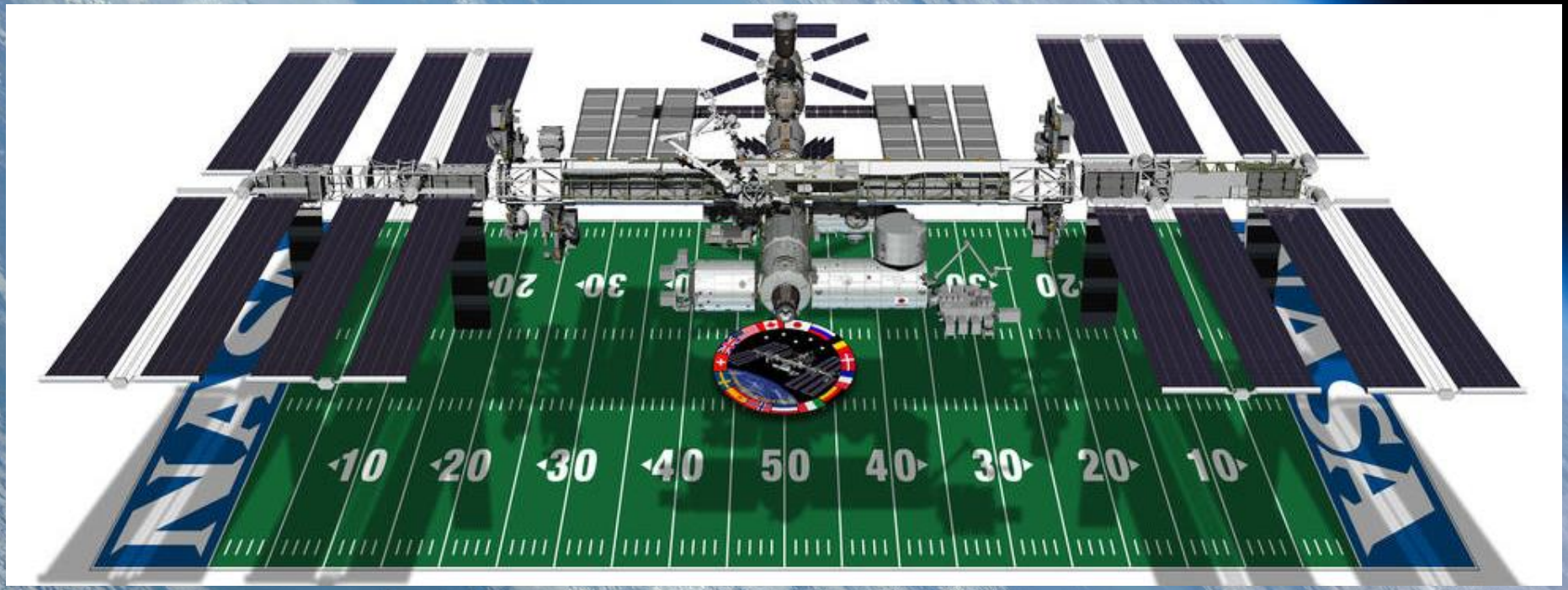
Reached Vesta: July 16, 2011
Reached Ceres: March 2015

Type of craft: Orbiter

Click **HERE** for newest information.

Ceres

ISS International Space Station



Construction began: November 20, 1998
Destination: in orbit between 205-255 miles above Earth where it orbits Earth once every 90-minutes

Type of craft: Orbiter

ISS has been continuously occupied since November 2000, where it has housed over 200 people from 15 countries. Crew members spend about 35 hours each week conducting research in many disciplines to advance scientific knowledge in Earth, space, physical, and biological sciences for the benefit of people living on our home planet.

ISS017E015499

Current Crew of ISS

SS017E015499

EXPEDITION 50

Expedition 50 began October 30, 2016 and ends March 4, 2017. This expedition includes biotechnological research, human research and Earth and space science. Two spacewalks are tentatively planned during Expedition 50.

THE CREW:

Soyuz MS-02 Launch: October 19, 2016 • Landing: March 4, 2017

Robert Shane Kimbrough (NASA) – Commander

Born: Killeen, Texas
Interests: baseball, golf, weightlifting and running
Spaceflights: STS-126, Expedition 49
Bio: http://go.nasa.gov/2eoHfTG
Twitter: @astro_kimbrough
Instagram: @astro_kimbrough

Andrey Borisenko (Roscosmos) – Flight Engineer

Born: Leningrad, Russia
Interests: fishing, badminton and road trips
Spaceflights: Expeditions 27, 28, and 49
Bio: http://go.nasa.gov/2eoOoDC

Sergey Ryzhikov (Roscosmos) – Flight Engineer

Born: Bugulma, Tatarstan, Russian
Interests: sports, games and music
Spaceflights: Expedition 49
Bio: http://go.nasa.gov/2eoLUoC

Soyuz MS-03 Launch: November 17, 2016 • Landing: April 20, 2017

Peggy Whitson (NASA) – Flight Engineer

Born: Mount Ayr, Iowa
Interests: weightlifting, biking, basketball and water skiing
Spaceflights: STS-111, STS – 113, Expeditions 5 and 16
Bio: http://go.nasa.gov/2eoOV8r
Twitter: @AstroPeggy

Thomas Pesquet (ESA) – Flight Engineer

Born: Rouen, France
Interests: basketball, jogging, swimming, squash, mountain biking, kite surfing, skiing, sailing and mountaineering
Spaceflights: Expedition 50 marks his first space station mission
Bio: http://go.nasa.gov/YSS3JI
Twitter: @thom_astro
Instagram: @thom_astro

Oleg Novitskiy (Roscomos) – Flight Engineer

Born: Cherven, Minsk Region, Belorussia
Interests: football, tourism, hunting, fishing, table tennis and reading
Spaceflights: Expeditions 33 and 34
Bio: http://go.nasa.gov/2eoGOsu

THE SCIENCE:

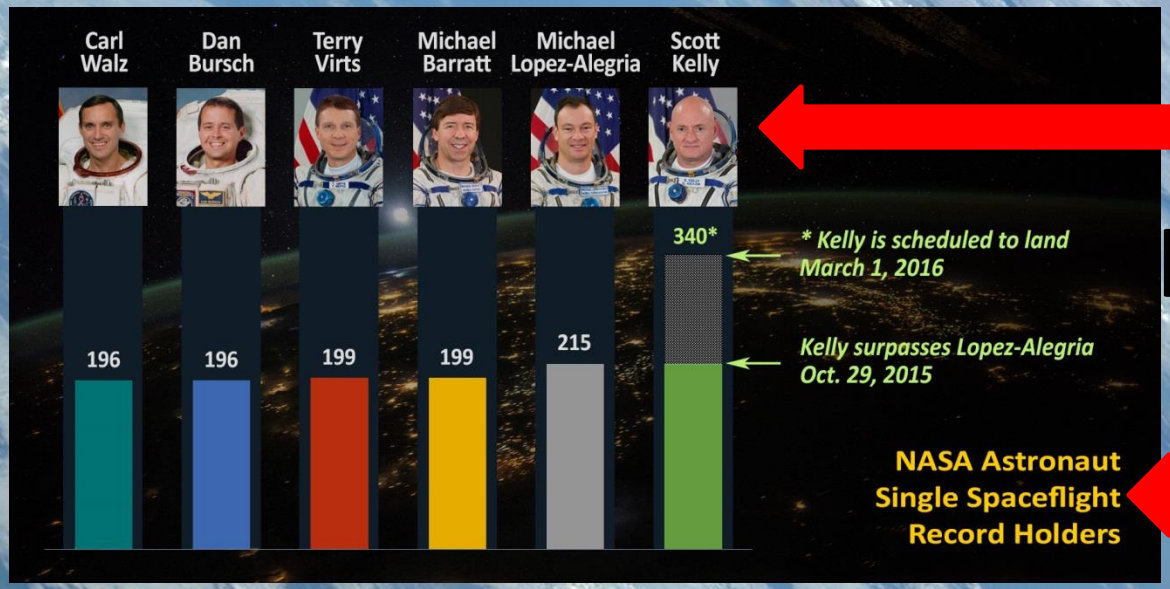
What are some of the investigations the crew is operating?

During Expedition 50, researchers will investigate how lighting can change the overall health and well-being of crew members, how microgravity can affect the genetic properties of space-grown plants, and how microgravity impacts tissue regeneration in humans.

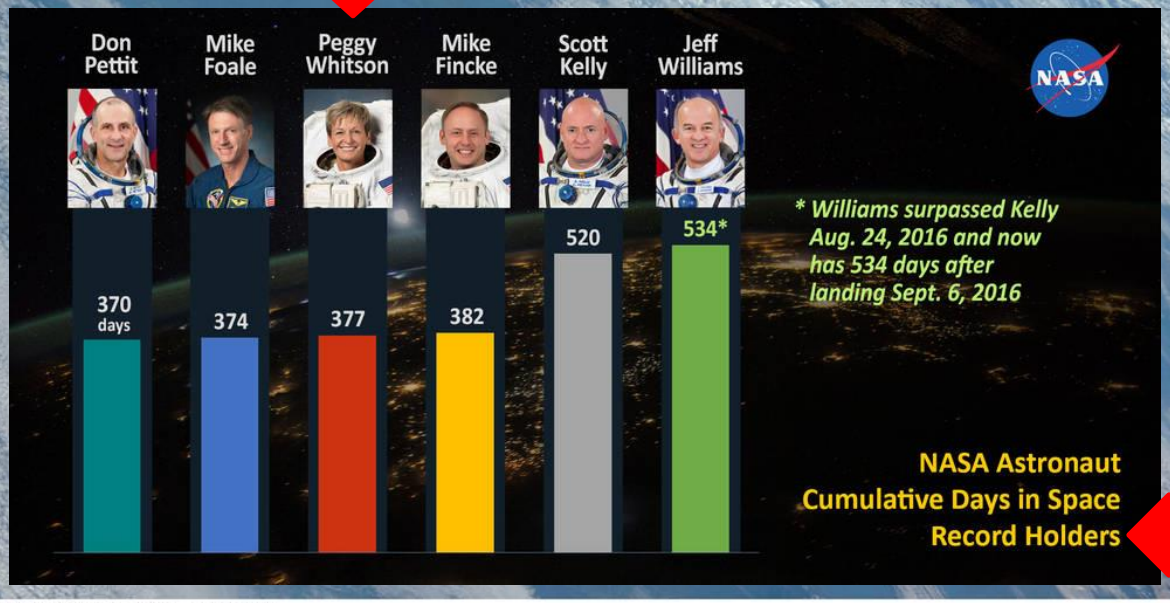
THE MISSION **PATCH:**

The Expedition 50 patch encompasses the spirit of human exploration from previous missions to the moon to current exploration on the International Space Station (ISS). The red border symbolizes future human exploration of Mars – the Red Planet. Our home planet Earth is prominent in the patch to remind us that everything done on the mission is to help people on Earth – "Off the Earth, For the Earth." The background colors of red, white, and blue represent the national colors of all six crew members – United States, Russia, and France. The six stars represent the families of all six crewmembers. Finally, the numeral 50 signifies the 50th Expedition to the ISS.

Scott Kelly and His #YearInSpace



Currently on the ISS!



Cumulative = total

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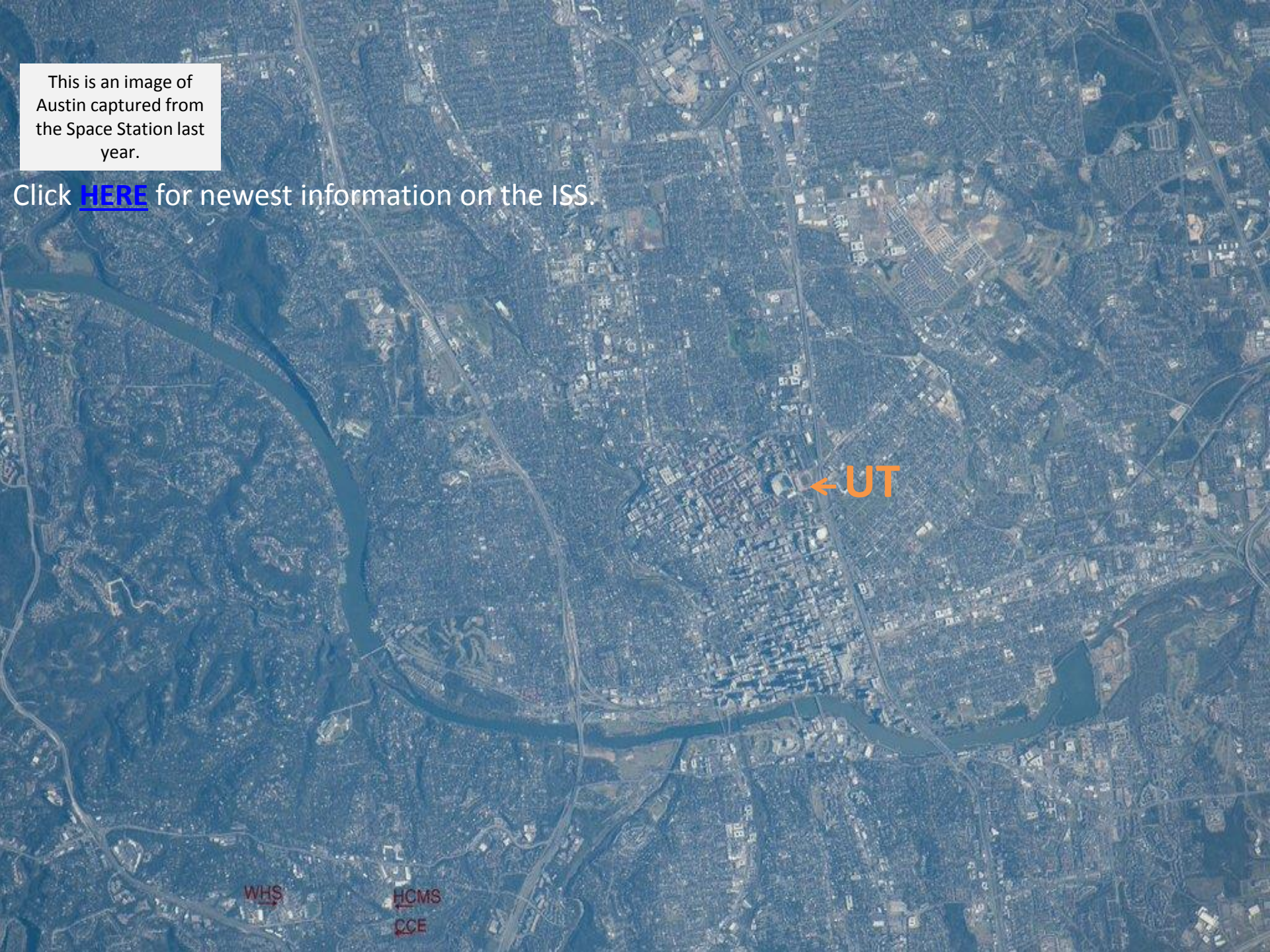

This is an image of Austin captured from the Space Station last year.
Click HERE for newest information on the ISS.
UT
WHS
HCMS
CCE

Orion Spacecraft

NASA's Orion spacecraft is built to take humans farther than they've ever gone before, like Mars.

Orion will:

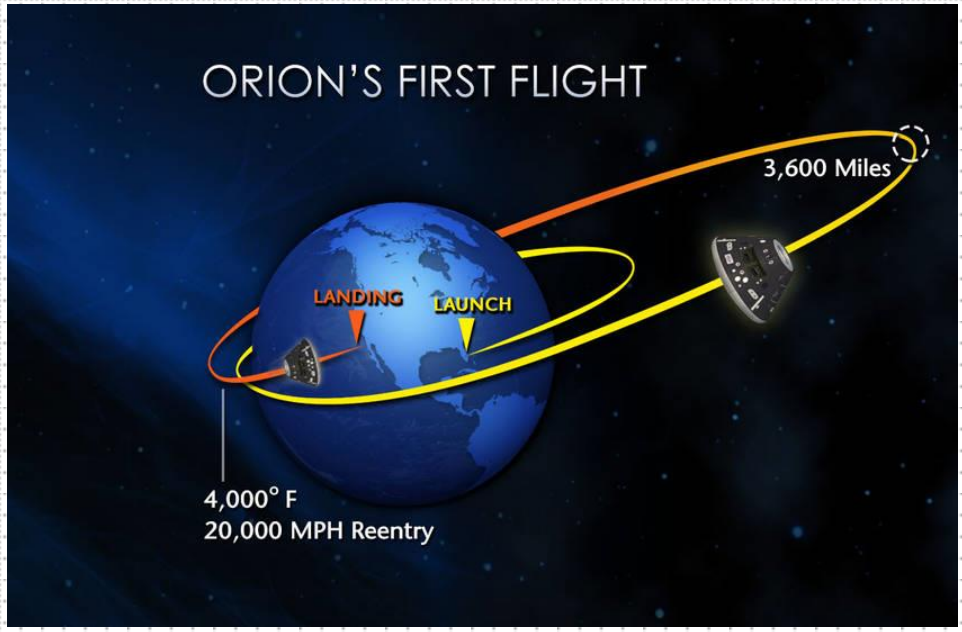
- serve as the exploration vehicle that will carry the crew to space,

- provide emergency abort capability,

- sustain the crew during the space travel, and

-provide safe re-entry from deep space return velocities.

First Flight – December 5, 2014
a two-orbit, four-hour flight that tested many of the systems most critical to safety like launch and high speed re-entry systems, attitude control, parachutes, and the heat shield. Results of the mission are a craft that is 500 pounds lighter with fewer parts.



Orion Spacecraft

What's next?

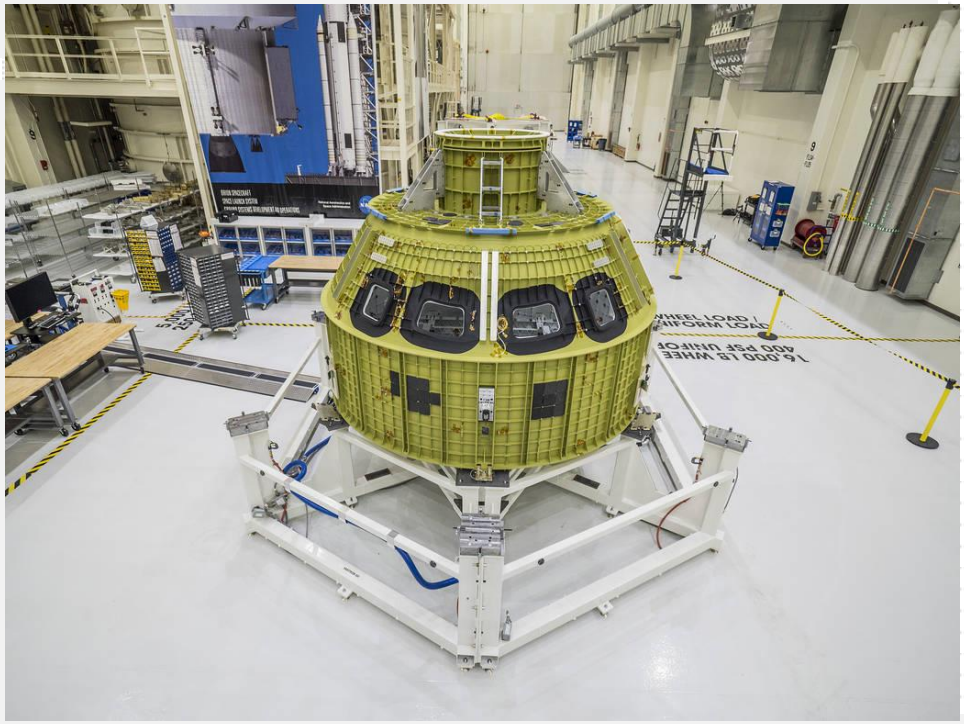
EM-1 (Exploration Mission-1) will test the **unmanned** vehicle in 2018 to prepare for a **manned** mission in 2023 – YOUR SENIOR YEAR!

Over the last 12 months and through the next 6 months, more than 100,000 components arrive at Kennedy Space Center. A team of engineers and technicians with NASA and Orion manufacturer, Lockheed Martin, will work together to build the craft.

The module will receive its:

- avionics (electronics systems)
- electrical power storage and distributions systems
- thermal controls
- cabin pressure control
- command and data handling
- communications and tracking
- guidance, navigation and control
- reaction control system propulsion
- flight software and computers

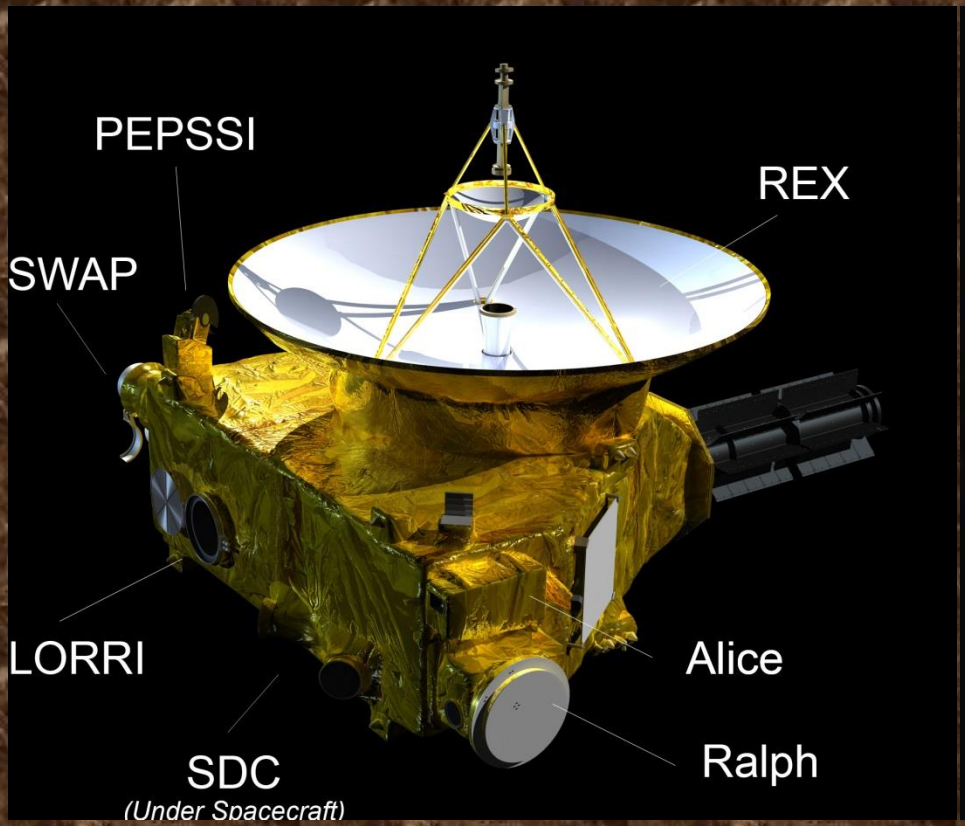
Click **HERE** for newest information.



Orion will launch on NASA's new heavy-lift rocket, the *Space Launch System*. More powerful than any rocket ever built, SLS will be capable of sending humans to deep space destinations such as an asteroid and eventually Mars.

Exploration Mission-1 will be the first mission to integrate Orion and the Space Launch System.

New Horizons



Launch Date: January 19, 2006
Gravity assist at Jupiter: February 2007
Reached Pluto: July 14, 2015

Destination: Pluto and farther into the Kuiper Belt

Type of craft: Flyby

Intended purpose: Answer questions about Pluto, its moons, and Kuiper Belt objects

Click **HERE** for newest information.

Rosetta-Philae

Intended Purpose:
Rosetta's main objective was to meet up with, and enter orbit around, a comet named Churyumov-Gerasimenko ("*Cheery-im-off Gu-ris-i-menko*")

It was to perform observations of the comet's nucleus and coma. The timing was perfect so that Rosetta was able to measure the comet at the peak of its activities while it was closest to the sun. On November 12, 2014, a lander named Philae was deployed and made the first soft landing on a comet. (*Read that again: We built something that landed on a comet!)*

Once it landed, the solar panels on Philae did not open to face the sun as expected, so we did not learn as much as we had hoped to.

Launch Date: March 2, 2004

Reached Comet: August 6, 2014

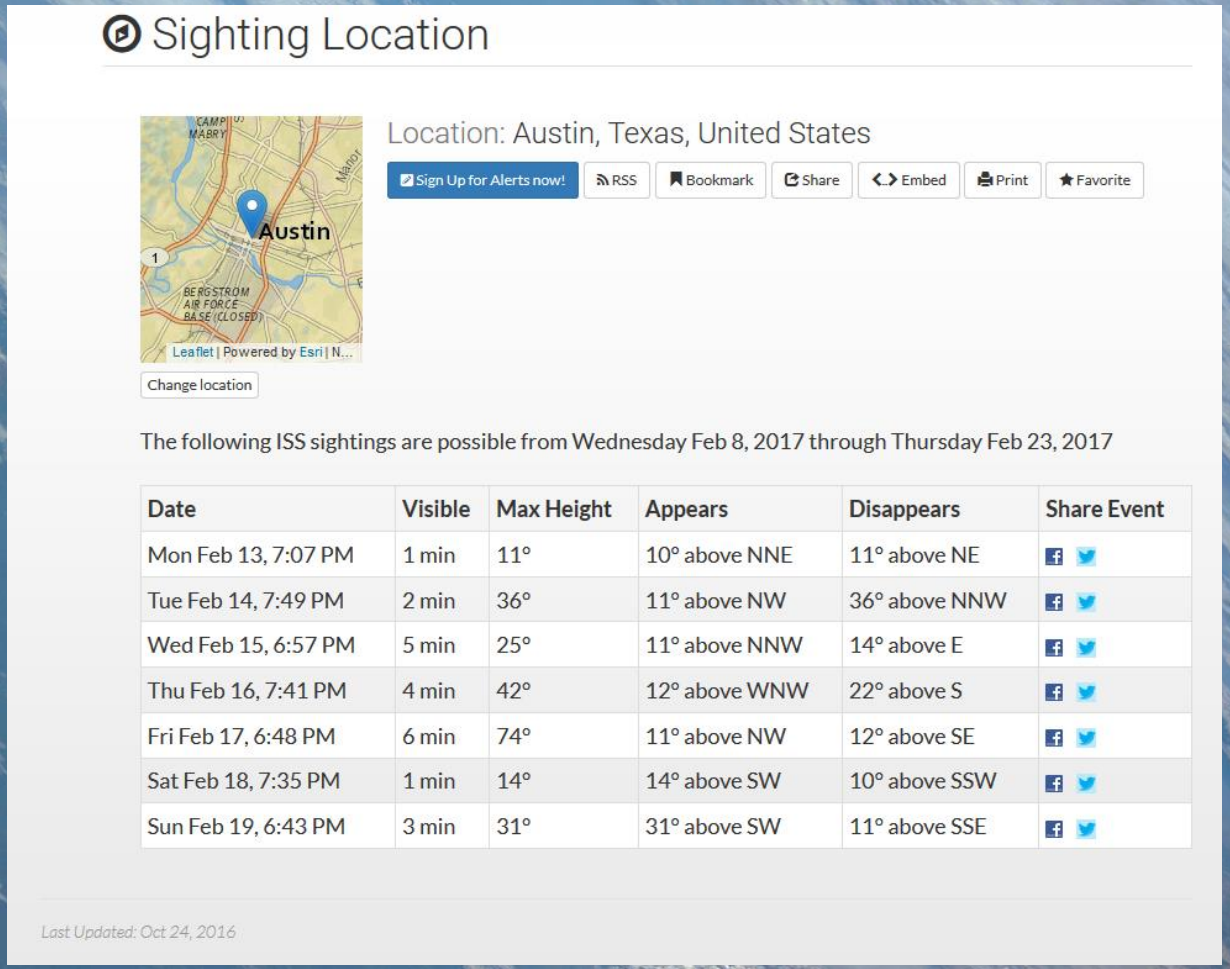
Mission was scheduled to end: September 2016

Rosetta: Orbiter **Philae:** Lander

Click HERE for newest information.

If you finish the chart on page 1 of your handout AND completed the notes for the newest information, you may scroll through the next two pages on this presentation and explore those links provided.

You can see the Space Station fly overhead at night; go to this site to see the times you can see it. You can also sign up for text alerts, and you will receive a text of when to look for it. Click on the image below for the schedule during any free time you have.



Sighting Location

Change location

Location: Austin, Texas, United States

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The following ISS sightings are possible from Wednesday Feb 8, 2017 through Thursday Feb 23, 2017

Date	Visible	Max Height	Appears	Disappears	Share Event
Mon Feb 13, 7:07 PM	1 min	11°	10° above NNE	11° above NE	
Tue Feb 14, 7:49 PM	2 min	36°	11° above NW	36° above NNW	
Wed Feb 15, 6:57 PM	5 min	25°	11° above NNW	14° above E	
Thu Feb 16, 7:41 PM	4 min	42°	12° above WNW	22° above S	
Fri Feb 17, 6:48 PM	6 min	74°	11° above NW	12° above SE	
Sat Feb 18, 7:35 PM	1 min	14°	14° above SW	10° above SSW	
Sun Feb 19, 6:43 PM	3 min	31°	31° above SW	11° above SSE	

Last Updated: Oct 24, 2016

Scott Kelly and His #YearInSpace

This time last year, we were eagerly awaiting Scott Kelly's return to Earth after being at the ISS for a year. He and his twin brother, Mark who is also an astronaut, are involved in medical studies to see how being in space for a prolonged period of time affects the body.

As time allows go here to read new results of this study: https://www.nasa.gov/twins-study

Time Magazine produced a documentary program on this mission. You can find it here and watch at home or with permission from teachers in free-time.

http://time.com/space-nasa-scott-kelly-mission/