

# Sing, Solve, and Unite

Space exploration lessons from astronaut and flight controller perspectives.

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# Outline

Introduction

1st Lesson: Orion Songs

2nd lesson: Flight Foundations  
(Values) of your Classroom

3rd Lesson: Activity, solve an everyday problem  
in an extraordinary environment, space.

Wrap up and additional project options

Questions



Photo credits: NASA/Ben Smegelsky



Photo credits: Kirsi Kuutti

# Elise Campbell

Teaching since 1990

Grades K - 6

BA in Music, German,

Elementary Ed, MS in Education

Cellist Duluth-Superior Symphony, 27yrs

FIRST Robotics Mentor, Daredevils 2512

# Kirsi Kuutti

Flight Controller in Training  
Space Environmental Systems

EE CS CE UMD

STEAM outreach in classrooms

Captained a FIRST Robotics

Team & continues to volunteer at events



Photo credits: Kirsi Kuutti



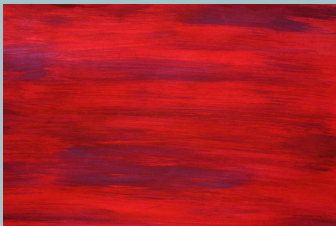


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# Maintaining Student Attention Virtual Edition

Go for flight?

Green, amber or red...

- Video background
- Putting responses in the chat
- Household objects

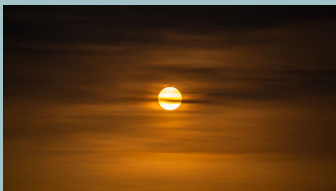


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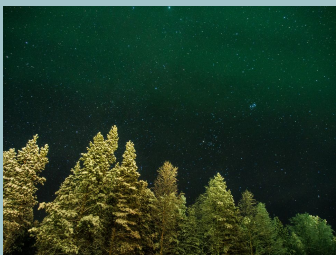


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Photo by Joan Tran on Unsplash



Photo Credit: NASA

# 1st Lesson Artemis Songs

1. Artemis **GO** Chant
2. Fly, Fly, Fly Up High -  
To the tune of Row, Row, Your Boat



Photo Credit: NASA



Photo Credit: NASA

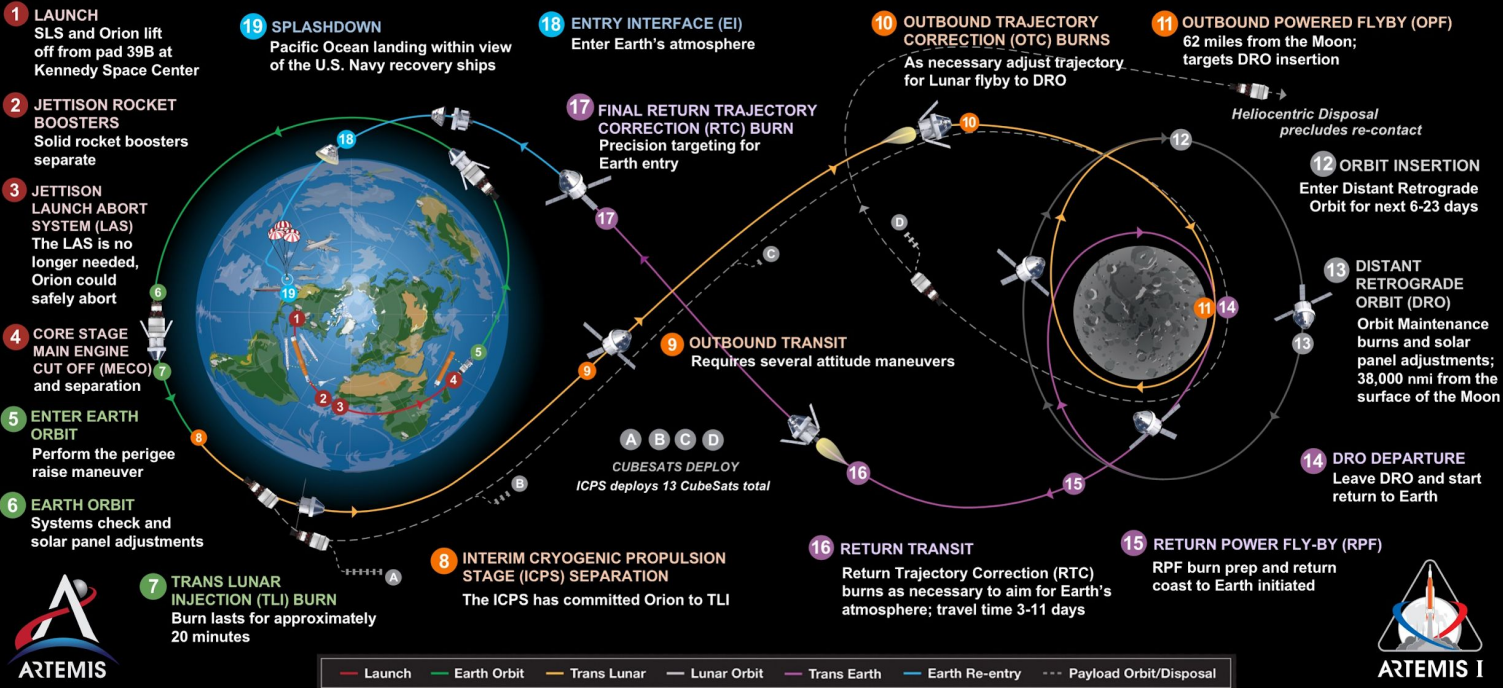


# ARTEMIS I

Rendering Credits: NASA

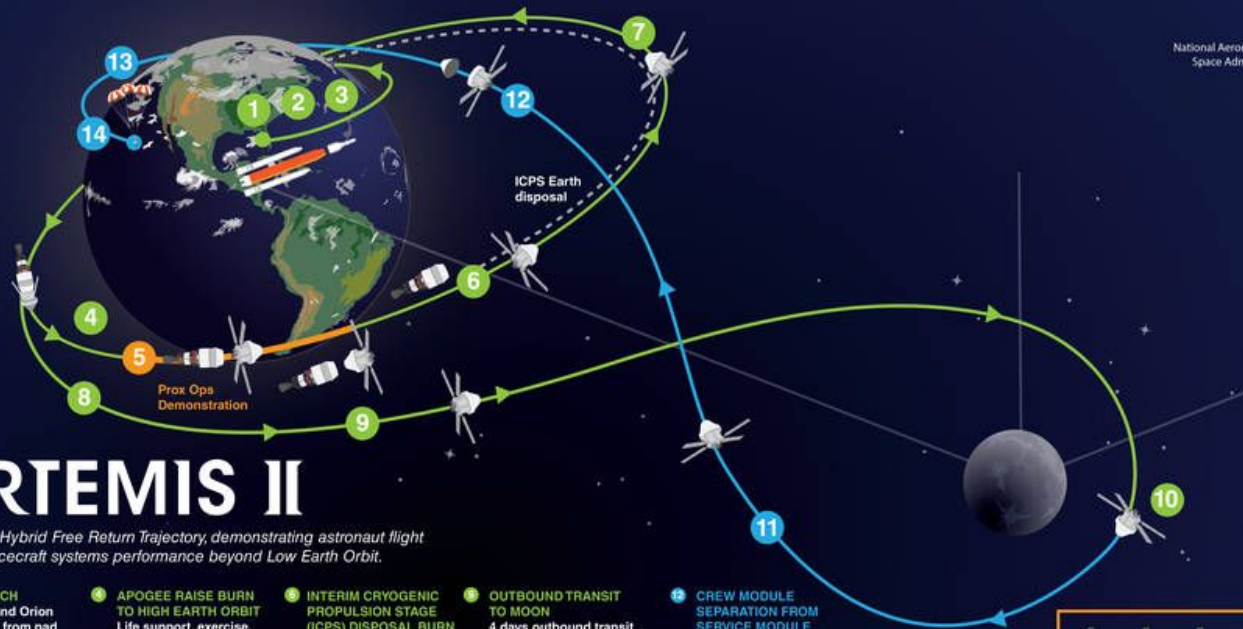


The first uncrewed, integrated flight test of NASA's Orion spacecraft and Space Launch System rocket, launching from a modernized Kennedy spaceport



Total distance traveled: 1.3 million miles – Mission duration: 26-42 days – Re-entry speed: 24,500 mph (Mach 32) – 13 CubeSats deployed





# ARTEMIS II

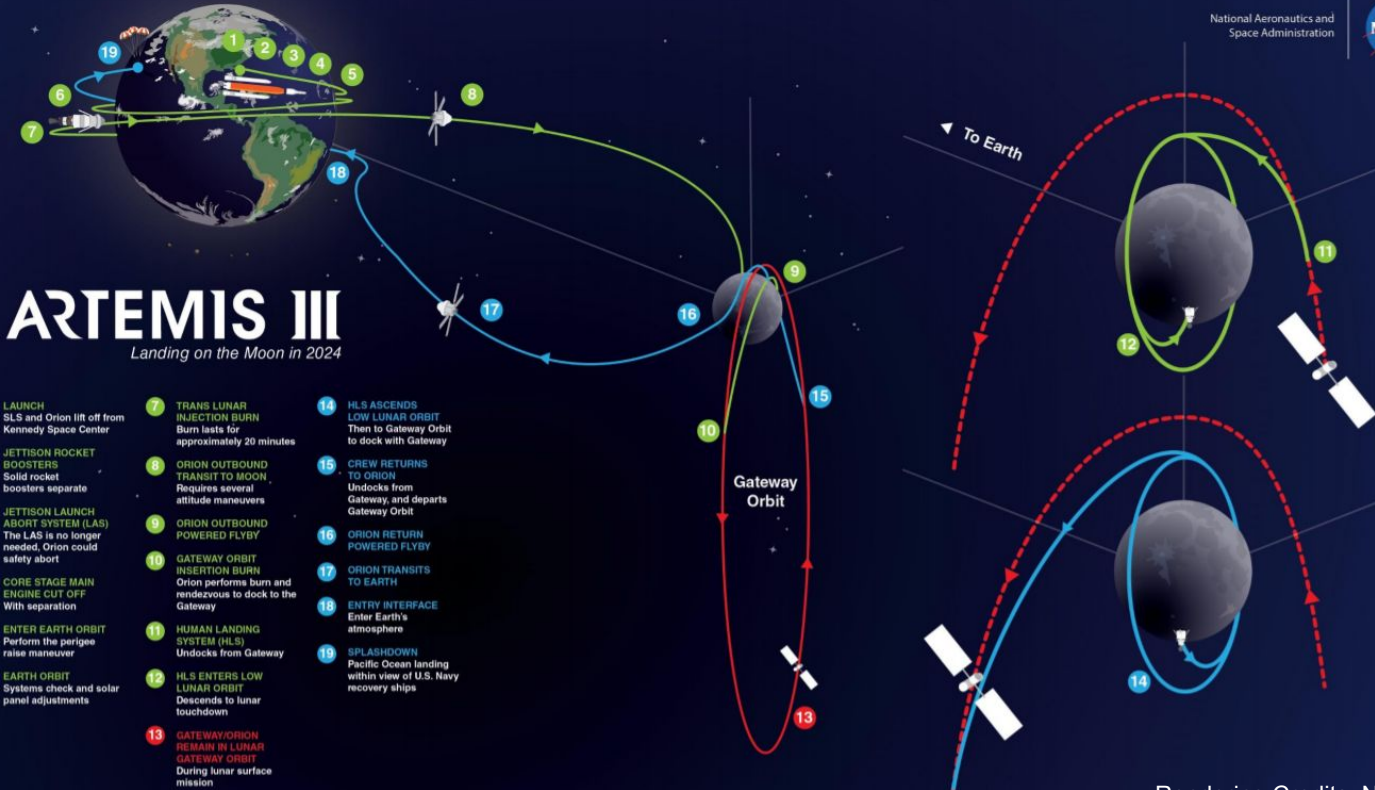
Crewed Hybrid Free Return Trajectory, demonstrating astronaut flight and spacecraft systems performance beyond Low Earth Orbit.

- LAUNCH**  
SLS and Orion lift off from pad 39B at Kennedy Space Center.
- JETTISON ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM**
- CORE STAGE MAIN ENGINE CUT OFF**  
With separation.
- APOGEE RAISE BURN TO HIGH EARTH ORBIT**  
Life support, exercise, and habitation equipment evaluations. 42 hour checkout of spacecraft.
- PROX OPS DEMONSTRATION**  
Orion proximity operations demonstration and manual handling qualities assessment for up to 2 hours.
- ORION PERIGEE RAISE BURN**
- TRANS-LUNAR INJECTION (TLI) BY ORION'S MAIN ENGINE**
- INTERIM CRYOGENIC PROPULSION STAGE (ICPS) DISPOSAL BURN**
- OUTBOUND TRANSIT TO MOON**  
4 days outbound transit along free return trajectory.
- LUNAR FLYBY**  
4,000 nmi (mean) lunar farside altitude.
- TRANS-EARTH RETURN**  
Return Trajectory Correction (RTC) burns as necessary to aim for Earth's atmosphere; travel time approximately 4 days.
- CREW MODULE SEPARATION FROM SERVICE MODULE**
- ENTRY INTERFACE (EI)**  
Enter Earth's atmosphere.
- SPLASHDOWN**  
Pacific Ocean landing within view of the U.S. Navy recovery ship.

PROXIMITY  
OPERATIONS  
DEMONSTRATION  
SEQUENCE







# Artemis GO

Artemis Artemis Artemis **GO**

We cheer them on from down below



Orbit orbit orbit **AROUND**

On the trajectory, we're Moon bound

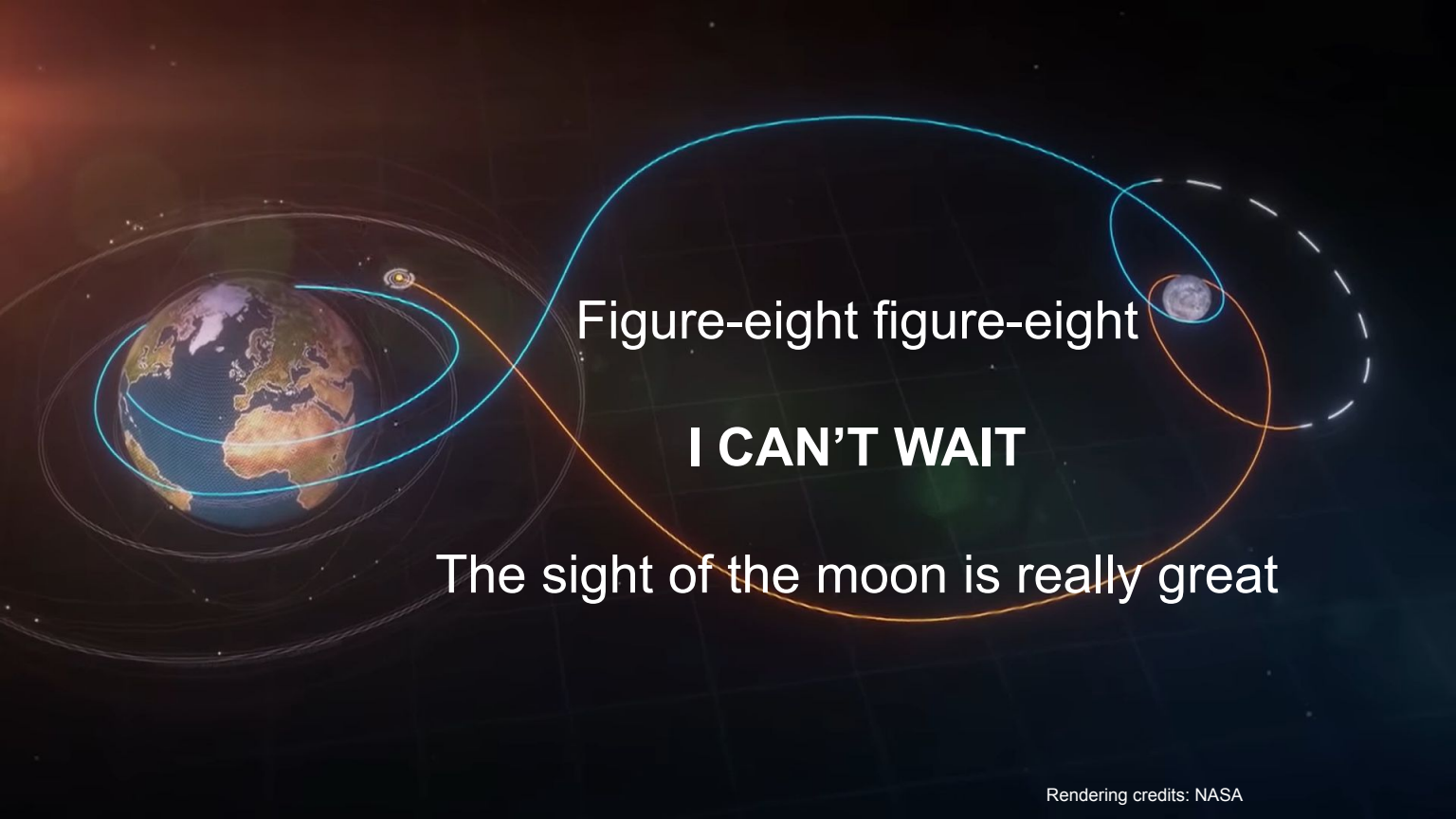


Figure-eight figure-eight

**I CAN'T WAIT**

The sight of the moon is really great



Crater here, crater there, got to go **HOME**

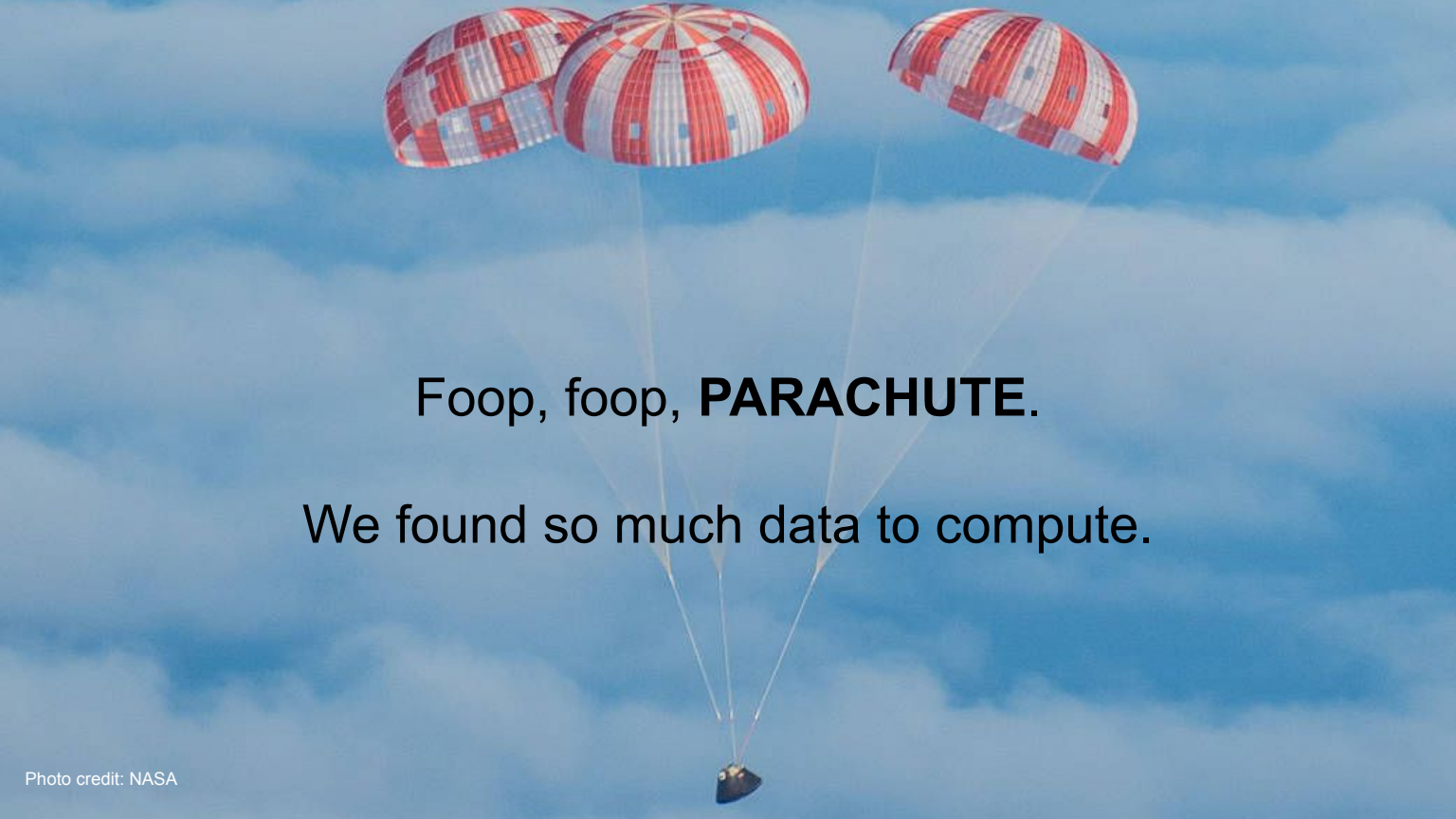
We'll be back, there's more space to roam



Blue, blue, blue, **GREEN.**

We can't believe how much we've seen.





Foop, foop, **PARACHUTE.**  
We found so much data to compute.



# Fly, Fly, Fly Up High

*To the tune of Row, Row, Your Boat*

*\*fists pumping to the sky\**

Fly, fly, fly up high  
way up to the moon,

*\*fingers walking on palm\**

Let's take a historical walk,  
See new moon craters.

Rendering Credits:  
NASA/MSEC



\*shading eyes with hand\*

Look, look where we land  
Our lander touches down.

\*reaching out\*

We pick up lots of rocks and dust  
We sample craters too.

\*hands make rainbow\*

Home, home -- our new home  
Gateway to the moon.



\*spin in a circle\*

We do science in this lab  
as it orbits around



# 2nd Lesson

## Foundations of Flight Operations - Values of your Classroom



Building rapport with your students.  
&  
Involving them in defining the  
classroom environment.

- NASA's Flight Foundations
- Current heroes of spaceflight
- Choose a class name
- Students create a class patch
- Choose flight foundations of classroom







# Foundations of Flight Operations

To instill within ourselves these qualities essential to professional excellence...

- DISCIPLINE
- COMPETENCE
- CONFIDENCE
- RESPONSIBILITY
- TOUGHNESS
- TEAMWORK
- VIGILANCE



Photo Credits: NASA



# Mission Patch Brainstorming

How to be a good friend...

Type Here

How to be a leader...

Type Here

How to be a good teammate...

Type Here

How to be responsible...

Type Here

How to be my best...

Type Here

How to have a good attitude...

Type Here



# Gene Kranz

- Former fighter pilot
- Lead flight director during NASA's Moon landing
- Lead flight director during Apollo 13, led problem solving to get astronauts back home safely
- Received the Presidential Medal of Freedom

Values: Leader, Responsible, Thinker



# Margaret Heafield Hamilton

- Director of the Software Engineering Division for MIT Instrumentation Laboratory
- Developed on-board flight software for NASA's Apollo program
- In charge of all Command Module software, which was all the software for navigation and lunar landing guidance
- Received the Presidential Medal of Freedom

Values: Leader, Thinker, Competent

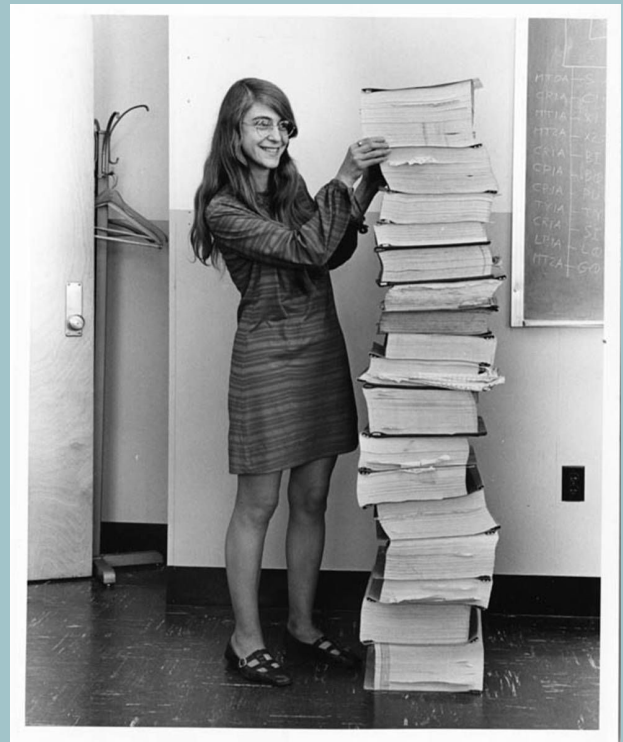


Photo Credits: NASA



Photo Credits: NASA

# Katherine Johnson

- Mathematician at NASA
- Calculated trajectories, launch windows, and emergency return paths
- Planned rendezvous paths for the Apollo Lunar Module and command module on flights to the Moon
- Received the Presidential Medal of Freedom

Values: Thinker, Teamwork, Positive Attitude, Confident

# Leland D. Melvin

- Professional football player
- Earned a Master of Science degree in Materials Science Engineering
- Co-designed and monitored construction of an optical nondestructive evaluation facility capable of producing in-line fiber optic sensors
- Mission specialist on two Space Shuttle missions



Photo Credits: NASA

Values: Teamwork, Responsible, Thinker



Photo Credits: NASA

## Ginger Kerrick

- Earned a master's degree in physics
- First non-astronaut Capsule Communicator (Capcom)
- First Russian-training-integration instructor
- NASA Flight Director 2005 - 2012 supporting Shuttle and International Space Station Missions

Values: Leader, Competent, Responsible, Confident



# Anne McClain

- Lieutenant colonel in the U.S. Army, engineer, and a NASA astronaut
- International Space Station Flight Engineer for Expedition 58/59
- Selected as one of NASA's Artemis astronauts
- Logged over 2,000 hours on various aircraft types

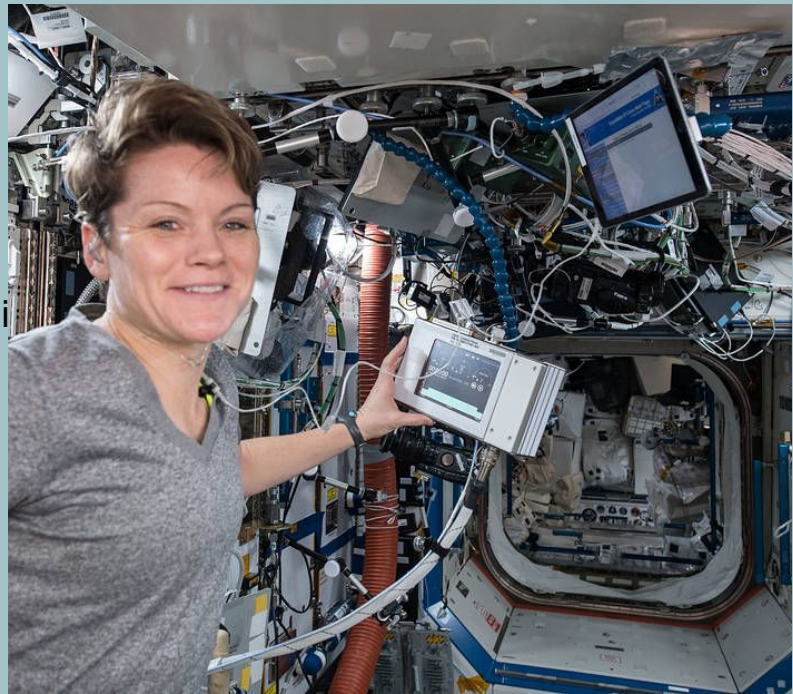


Photo Credits: NASA

Values: Teamwork, Toughness, Responsible

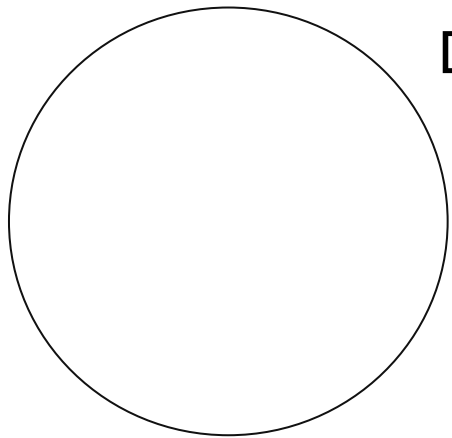


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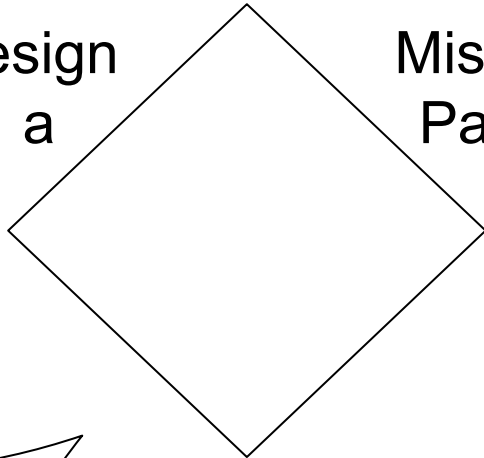
## Chris Cassidy

- Navy Seal
- Astronaut during the Shuttle and International Space Station
- Completed 10 spacewalks to perform repairs and upgrades
- Chief of NASA's astronaut office

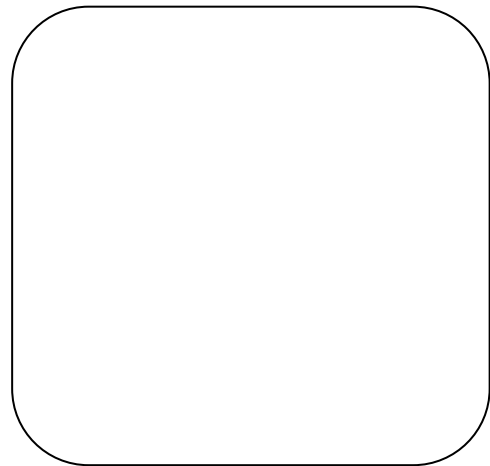
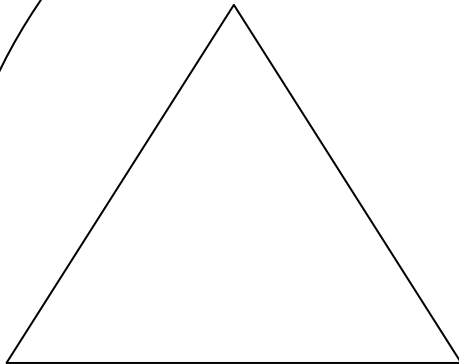
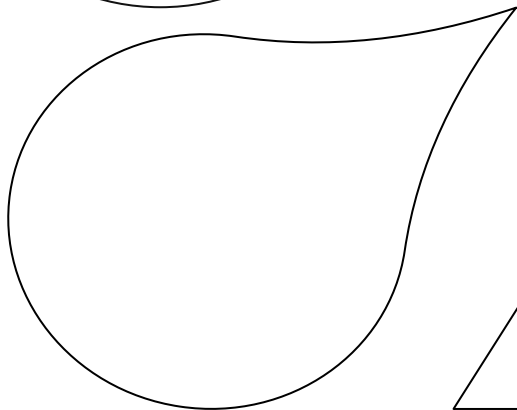
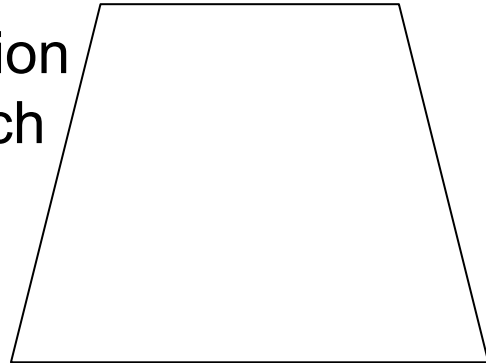
Values: Leader, Competent, Responsible, Confident



**Design  
a**



**Mission  
Patch**



# Mission Names

## Astronaut Class Names

- 1959 Group 1 – "The Mercury Seven"
- 1965 Group 4 – "The Scientists"
- 2017 Group 22 – "The Turtles"

## Robotics Team Names

- First Robotics Competition Team #1816 -  
Green Machine, Edina Robotics
- First Lego League Team #31211 - Fire Balls
- First Robotics Competition Team #2177 -  
Robettes



Photo Credits: NASA



Logo Credits: Edina Robotics



# 3rd Lesson

Solving everyday problems in an extraordinary environment, space.



Photo Credits: NASA



Photo Credits: NASA

ISS026E012169

# #NASAMoonKit

What would you bring with you on...

- Orion
- a Moonwalk
- Gateway



## Scenarios

Oops, I spilled food.

My storage container broke.

My clothes are dirty.

I want to take a walk outside.

My food is burning!



# Wrap Up

Maintaining attention from students

1st Lesson: Orion Songs

2nd lesson: Flight Foundations (Values) of your Classroom

3rd Lesson: Activity, solve an everyday problem in an extraordinary environment, space.



Photo Credits: NASA



# Questions?

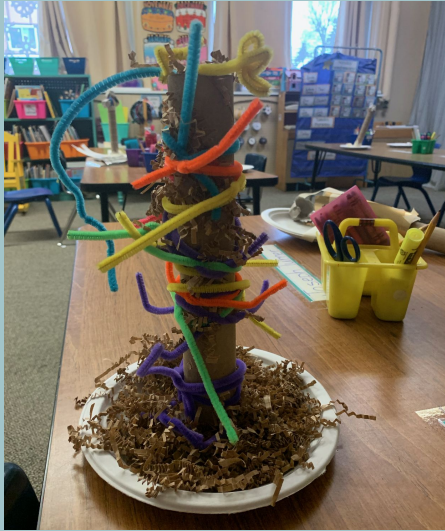
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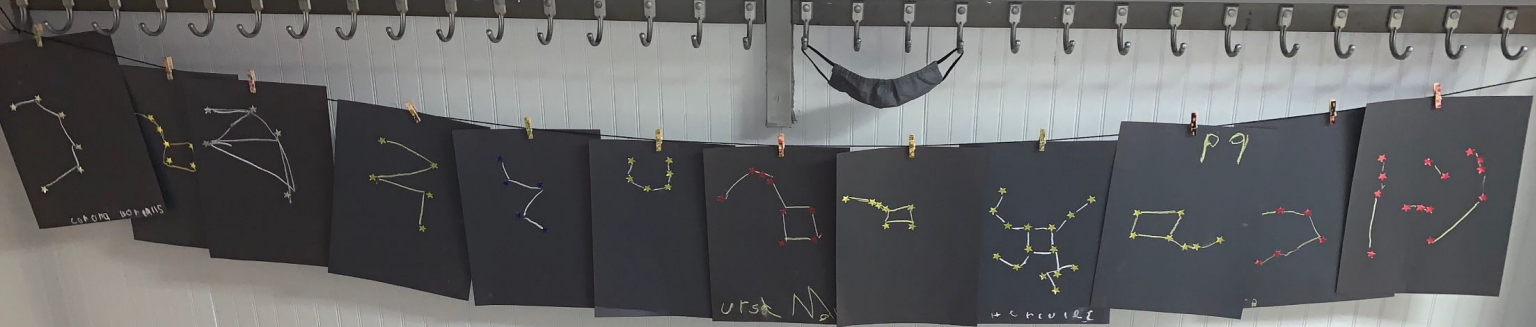
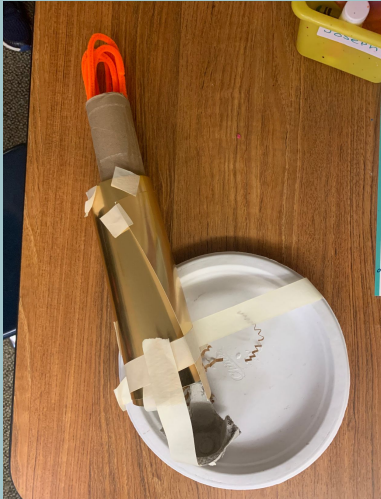
# Backup Slides



# Class Projects



# Class Projects





# Class Projects

