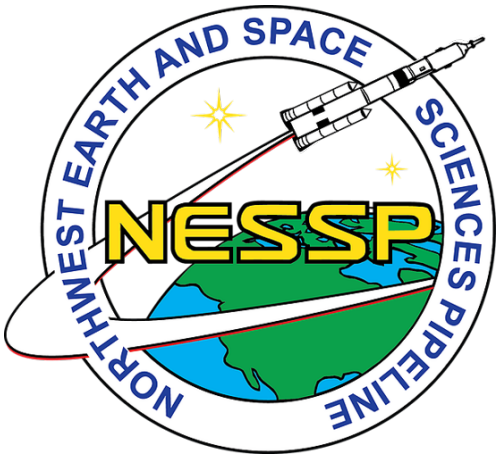
Idaho Manual

Welcome to the

Idaho Apollo 50th Regional Hub



About the Challenge

On June 20, 1969, NASA landed the first humans on the Moon. To mark the 50th anniversary of this achievement, the week of July 16-20, 2019, will see student teams across the U.S. simulate the Apollo 11 Moon landing.

In celebration of Neil Armstrong's "one small step" — and to prepare students for the next "giant leap for mankind" — NESSP is pleased to present the Apollo 50th Next Giant Leap Student Challenge (ANGLeS). This nationwide event for middle and high school levels invites students to celebrate the history of the Apollo program while giving them hands-on experience with current technology. ANGLeS provides students the opportunity to experience NASA-like engineering challenges and decision-making, opening the door to students' eventual participation in the development of new technologies to study Earth and beyond.

Student teams will build a replica of an Apollo Lunar Module that will be flown — using a drone, technically known as an Uncrewed Aerial Vehicle (UAV) — and landed on the Moon, represented by a high-resolution map of the actual Apollo 11 landing site. Once the module has landed, students will place a Lunar Rover at their landing site and apply on-the-spot programming changes to deliver their team-built payload and collect lunar samples. Student teams may design the robot to look like an astronaut or a rover and will assemble a creative and meaningful payload.

Students participating in ANGLeS will develop an understanding of remote sensing of Earth and places beyond. The program promotes cooperative learning, quantitative problem solving, and critical thinking in a science and engineering environment using hands-on problems.

Idaho Hub Logistics

Dates	July 15th-16th, 2019
Location	**Memorial Gym** at the University of Idaho (Moscow, Idaho, 83844)
Lodging	We will reserve rooms for each team to stay overnight for the night of July15th to 16th in our University of Idaho **Wallace Dormitory**.
Meals	We provide dinner on July 15th and breakfast and lunch on July 16th at the **Wallace Dining Facility**. Dietary requests will be accommodated based on your registration.

Idaho Hub Agenda

July 15th, 2019

9 AM - 5 PM	**CHECK-IN** at **Memorial Gym** all day from 9AM to 6PM. After teams check in, they will receive their room key and room location for the overnight stay in our dormitories. We will also have the Hub Challenge map set up and teams can test-run their equipment.
5 PM - 6 PM	**DINNER** provided at the **Wallace Dining Facility**
6 PM	Enjoy your evening. Check your equipment and make sure all batteries get charged for the next day. We'll provide you with a few options of what you can do in our town.

July 16th, 2019

8 AM - 9 AM	**BREAKFAST** provided at the **Wallace Dining Facility**
9 AM - 10AM	**SET-UP**: Each team gets a designated table to set up their equipment. Teams will be asked to check their programming, make sure their lander is set up, make sure the drone is good to go, and all batteries are fully charged. Teams will get a chance to review their rock types.
10AM - 12PM	**CHALLENGE** event starts at the **Memorial Gym**. We will randomly assign start times to the different teams.
12 PM - 1 PM	**LUNCH** provided at the **Wallace Dining Facility.**
1 PM - 3 PM	**CHALLENGE** continues at **Memorial Gym**.
3 PM – 4 PM	**AWARD CEREMONY**

Challenges and Objectives

The challenge has several components:

1. Build a replica of the Apollo Lunar Module and use a UAV to land it at the Apollo 11 lunar landing site.
2. Design and build a robotics system to replicate an Apollo astronaut or rover to navigate the surface of the Moon and complete a series of challenges.
3. Develop a scientific or cultural payload that the robot delivers to the surface of the Moon.
4. Retrieve a LEGO sample from near the crater and transport it to the Lunar Module.
5. Identify a rock sample associated with the sample retrieved by the Lunar Rover.
6. Depart from the Moon by having the UAV recover the Lunar Module from the Moon and return it to the starting location (high school required, middle school optional).

Mission Objective 1: Lunar Landing

BACKGROUND: Most spacecraft landings are accomplished by pre-programmed systems. The Apollo Lunar Module, which carried the astronauts from lunar orbit to the surface of the Moon and back, used a combination of automated computer control for descent and direct manual control by the astronauts onboard for landing. In the case of Apollo 11, last minute adjustments had to be made as Astronauts Armstrong and Aldrin saw the guidance system was sending them toward a boulder field.

OBJECTIVE: Land the Lunar Module as close to the designated landing site as possible. The Lunar Module Pilot must control the drone from behind the control table. Teams may also use a camera mounted directly on the UAV, although it does not have to be in its original position. In addition, team members may give verbal and visual guidance to the Lunar Module Pilot. Once the landing has been made, the UAV needs to leave the Lunar Module in place and fly back to base. Points will be awarded both on distance of the Lunar Module to the marked landing site and on landing the module upright without dragging it.

TECHNICALLY: The Lunar Module location will be judged by the landing leg closest to landing site using concentric circles as shown on the map.

Mission Objective 2: Navigation

OBJECTIVE: Once the team has landed the Lunar Module, teams must place their rover on the challenge mat in one of the following starting positions: Lunar Rover will be placed within 1 inch of the Lunar Module. The Lunar Module will remain in place at this site. The Lunar Rover may be placed in any orientation at its starting position. Once the team has placed their Lunar Rover on the map, teams may not touch or modify their Lunar Rover until the challenge is complete. From the starting position, the rover must traverse the surface to the complete Mission Objective 3: Payload Delivery and Mission Objective 4: LEGO Sample Retrieval. The rover will be deducted points for crossing into or over any craters or going out of bounds. The rover will score points for up to 4 narrations and points for successfully navigating back to the landing target.

TECHNICALLY: Teams must place their rover on the challenge mat in one of the following starting positions: Lunar Rover will be placed within 1 inch of the Lunar Module. The Lunar Module will remain in place at this site. All functions of the rover must be done through programs and not via remote control of any form. Programs may be enabled by selecting them on the rover programming brick or with a computer or tablet via Bluetooth or WiFi. CHALLENGE MAIN EVENT COMPONENTS 16 OF 27 OFFICIAL MANUAL V 1.2 APOLLO NEXT GIANT LEAP STUDENT CHALLENGE #APOLLO50 #APOLLONEXTGIANTLEAP The rover will be deducted points for crossing into or over any craters or going out of bounds (off the Challenge Map). Crossing into a crater is defined as any part of the rover that normally touches the ground, such as a wheel or leg, or any part of the rover contained within that area crossing over a red boundary circle marking. Out of bounds will be judged in the same way, using the edge of the lunar surface image on the challenge map.

Mission Objective 3: Payload Delivery

BACKGROUND: The Apollo missions brought several important scientific instruments to place on the Moon. One example was a Laser Ranging Retroreflector which provided a means to determine the exact distance between the Earth and Moon. Astronauts also left some items of personal importance, from a falcon feather to a family photo to golf balls. The Apollo 11 astronauts left items in memory of astronauts and cosmonauts who had lost their lives. They left an Apollo 1 Mission Patch, and two medals awarded to Soviet Cosmonauts Yuri Gagarin and Vladimir Komarov.

OBJECTIVE: Place a scientific instrument or item of cultural significance on the surface of the Moon. Teams are encouraged to design a payload that carries the ideals and ingenuity of the Apollo era but features the aspirations of their community and the hopes for the future. The item must be placed at Payload Drop Zone indicated by the green circles.

TECHNICALLY: Teams will be scored on how close their rover places the item to the center of the green circles on the map, the condition of the payload after delivery (upright and intact), and on the creativity of the payload.

Mission Objective 4: LEGO Sample Retrieval

BACKGROUND: While most people think of the Apollo astronauts as fighter pilots and military men, they had to be trained in every aspect of their missions to visit the Moon. For example, some astronauts were trained in geology so they could learn to recognize and gather significant and unique rock samples to bring back to Earth to be studied.

OBJECTIVE: Teams must retrieve a specified LEGO sample from the south side of West Crater and return it to the Lunar Module. The sample location is shown by the blue circle on the right side of the map. Teams will gain points for navigating to the correct LEGO sample, collecting the sample, and bringing the sample back to the landing site.

TECHNICALLY: In order to determine which of the designated rock samples to retrieve, the Lunar Rover must move the boulder to uncover a colored marker. The color of the marker will be randomized between rounds and will indicate which of the three samples to recover from the south side of the crater. The Lunar Rover must retrieve the rock sample and return it to the Lunar Module. This LEGO sample will be used in Mission Objective 5: Rock Sample Identification. The LEGO samples will be made of LEGO parts. An example will be provided. Teams will receive a penalty for returning the wrong sample to the Lunar Module.

Mission Objective 5: Rock Sample Identification

OBJECTIVE: The LEGO sample retrieved in Mission Objective 4: LEGO Sample Retrieval will be matched to one of the three types of rock most commonly found on the Moon. Teams must identify the rock sample.

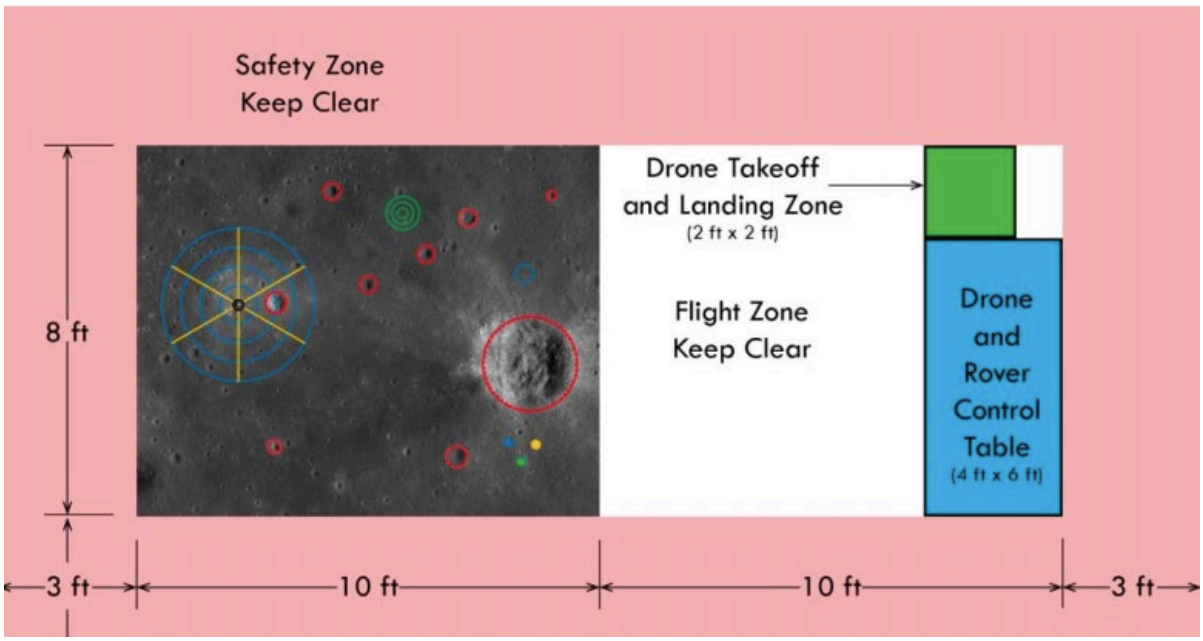
TECHNICALLY: Teams will earn points if the Science Officer can identify the rock sample associated with the LEGO sample retrieved by the Mission Objective 4: LEGO Sample Retrieval. The LEGO sample/rock sample association will be randomized for each round.

Mission Objective 6: Ascent & Return

(For Extra Points)

OBJECTIVE: Fly the UAV back to the Lunar Module, pick it up, and fly it back to the starting area. Teams will gain points for capturing the Lunar Module and for transporting it back to the landing zone.

TECHNICALLY: While the Lunar Rover is attempting Mission Objectives 2-4, the Flight Crew may modify the UAV for retrieving the Lunar Module. When the Lunar Rover has completed Mission Objectives 2-4, or the Flight Crew stops the rover and indicates they are done with the Lunar Rover portions of the challenge, the Flight Crew must fly the UAV back to the Lunar Module and use the UAV to lift the Lunar Module off the challenge mat and transport it back to the takeoff and landing zone.



Apollo Hub Map Aerial Image. Please see NESSP ANGels official Manual for targets measurements.

Team Information

Registration

Make sure that teams are registered at https://nwessp.org/apollo50/registration

On the website, teams will find ANGels official manual, map designs, and more information regarding the challenges.

Team Members

Each team needs to have 5 members in total.

1. COMMANDER - a Challenge Event may require that the UAV is tethered for safety. If a tether is required, the Commander is responsible for managing it during the challenge to keep the UAV in a safe operating range.
2. LUNAR MODULE PILOT - the Lunar Module Pilot is responsible for piloting the UAV.
3. EVA OFFICER - the Extravehicular Activity Officer or EVA Officer is the primary team member responsible for operating, adapting, and executing the Lunar Rover programs.
4. SCIENCE OFFICER - the Science Officer is responsible for identifying the rock samples retrieved by the Lunar Rover.
5. CAPCOM - the Spacecraft Communicator, or CAPCOM, may give verbal or visual signals as guidance to the Lunar Module Pilot during Mission Objective 1: Lunar Landing.

Each team is going to have a Flight Director.

Flight Director - each team requires one adult Flight Director to act as the team coach and primary point of contact between the team, NESSP, and the Regional Challenge Hub. The Flight Director is also responsible for the organization and safety of the team. A person may serve as Flight Director for multiple teams. The Flight Director must be 18 years or older and maybe a teacher, educator, team parent or guardian, or other community members

Equipment

The Idaho Hub will provide a Lego EV3 robot to each team. We will also issue a stipend to each team upon accepted registration. Each team is required to use a UAV Force 1 U49W Blue Heron drone to be able to participate in the Apollo Challenge. You may purchase the drone at Force1rc.com and use promo code “UWAPOLLO”.

Equipment Use

Lunar Rovers must be built using LEGO Mindstorms. The lunar rover must fit within a 1 ft x 1 ft x 1 ft box. All equipment must be made of LEGO brand building parts in original factory condition, with the following **exceptions**: • String may be used. • Wire ties, string, stickers, or other items may be used for cable management. • Stickers or paper may be used for decoration or identification. • Other material may be used for decoration.

NESSP recommends programming the rovers using the LEGO Mindstorms Education Edition software, however teams may use any programming language or suite they wish. All NESSP professional development will use LEGO Mindstorms EV3 Education Edition hardware and software. Teams must be use autonomous programming to control the Lunar Rover. Programs may be selected and run by a flight crew member when the Lunar Rover is placed on the map. Teams may also run and adapt programs from a laptop or tablet during the challenge using wireless connection (Bluetooth or WiFi). However, the Lunar Rover may not be controlled using any form of direct or remote control. Once the team has placed their Lunar Rover on the map, teams may not touch or modify their Lunar Rover until the challenge is complete. All interaction with the Lunar Rover must be done through wireless programming. Points will be awarded for creativity of the design of the Lunar Rover.

The official UAV of the ANGLeS Challenge is the Force1 U49W Blue Heron WIFI FPV Drone.

Other small UAVs may be used as long as they conform to the following rules: • Must weigh less than 0.55 lb (250 g) including battery and any other necessary flight hardware included from the factory. Anything added by the team to the UAV, including the Lunar Module and any decoration, **does not count toward this weight**. • May have an altitude hold system and an auto-land function. • May have WiFi, camera, and FPV capability. • Must not receive or use GPS. • Must not have any object avoidance systems.

All control of the UAV must be through direct inputs to the controller by the Lunar Module Pilot, without any autopilot, flight, or navigational aids, with the exception of auto takeoff and landing functions. Teams using a UAV that does not conform to these rules will not be permitted to use it at a Challenge Event. Depending on availability, the team may be permitted to borrow a UAV for the event. The UAV may be modified to land the Lunar Module (LM). The LM should be constructed separately and hang from a cable or string (see Mars Science Library Sky Crane). Points will be awarded for the creativity, structural integrity, and width-to-mass ratio of the lunar module.

Teams will need to create a replica of the **Apollo Lunar Module**. The Lunar Module must be at least 2 in by 2 in by 2 in and fit within a 1 ft by 1 ft by 1 ft box. The module should be light enough for the UAV to carry as a payload. The Hub will be able to support each team on creating their Lunar Module. The Hub has capabilities to a 3-D print design of team Lunar Module. After building Lunar Module, each team will need to bring their model during the competition.

Training

Each Regional Challenge Hub will provide training focused on the basics of UAV flight and LEGO Mindstorms programming. This training will provide the fundamentals needed for anyone who will be a Flight Director.

Mission Patch

Every NASA mission has a mission patch that illustrates the goal and spirit of the project, where the project originates from, and which institutions are participating.

“The American eagle, symbolic of the United States, was about to land on the Moon. In its talons, an olive branch indicated the crew “came in peace for all mankind.” The Earth, the place from which the crew came and would return safely in order to fulfill President John F. Kennedy’s challenge to the nation, rested on a field of black, representing the vast unknown of space.”

NASA Mission patch examples

Each team is encouraged to create and submit a Mission Patch. We encourage teams to get creative and design a mission patch that represents themselves, their community, and their mission in the Apollo Next Giant Leap Student Challenge.

Social Media Posts #ApolloNextGiantLeap #Apollo50

To ensure that students’ efforts are recognized and appreciated nationwide, as was the Apollo program itself, we encourage teams to post their efforts on social media with the hashtags #Apollo50 and #ApolloNextGiantLeap. The posts should be fun and appropriate. Suggested content includes your practice sessions, developmental stages of your Lunar Module or robot, your local challenge event — but teams should explore their own creativity and style in their posts!

Important Idaho Dates

April 15, 2019	Idaho Priority Registration closes for organizations* (one team per organization must be identified by May 31)
April 19, 2019	Mission Patch due
May 3, 2019	Social media posts due
May 31, 2019	**Organizations* nominate one team for a Regional Challenge Hub Event**
June 17, 2019	Regional Hub Challenge Event invitations go out to teams by
June 28, 2019	Teams confirm Regional Hub Challenge Event attendance and submit travel support requests
July 15-16, 2019	**Challenge Event**: Celebrating 50th Anniversary of the Apollo 11 Mission: Regional Challenge Event at University of Idaho
August 5-7, 2019	**Winning team backstage tour at NASA's Johnson Space Center, Houston, Texas**

*Organizations include schools, libraries, after-school programs, clubs, or similar entities