MOON MISSION: LUNAR LEGACY

OVERVIEW DOCUMENT

PROGRAM CONTACTS

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Mission-by-Mission Snapshot

Mission	Time	At a Glance
01 | Assemble the Crew	45 minutes	Explore careers, assemble complementary crew roles, interpret emergency priorities and patch symbolism, and prepare a crew-readiness briefing.
02 | Survive the Moon	45 minutes	Compare Earth and Moon conditions, investigate lunar hazards and protective systems, and recommend evidence-based survival strategies.
03 | Code a Message to the Moon	45 minutes	Encode messages, model relay communication, compare sound and electromagnetic waves, debug failures, and summarize a reliable communication approach.
04 | Launch the Lunar Rescue Mission	45 minutes	Examine rocket systems and forces, conduct launch and landing trials, interpret data through Newton's laws, and recommend a rescue configuration.
05 | Code the Lunar Rescue Rover	45 minutes	Analyze terrain, program ordered rover commands, apply loops, sensors, and conditionals, debug the code, and authorize a safe route.
06 | Power the Shackleton Rescue Base	45 minutes	Prioritize critical loads, test series and parallel circuits, trace energy transformations, and defend a constrained hybrid-power design.
07 | Personal Reflection and Peer Review	45 minutes	Organize mission experiences, draft a developed reflection, provide actionable peer feedback, revise, and approve a publication-ready statement.
08 | Mission Legacy	45 minutes	Confirm artifact identity, create an encoded message, apply archival principles, assemble the Mission Manifest, quality-check, and submit the legacy package.

MISSION 1

Assemble the Crew

LEARNING OBJECTIVE

Students will analyze the emergency at Shackleton Base to identify the expertise needed for a lunar rescue team, interpret the symbols and messages used in mission patches, and design a shared team identity that communicates their crew's roles, values, and rescue purpose.

DRIVING QUESTION

How might we, as space agency cadets, assemble a team capable of thriving and surviving on the lunar surface?

THE 5E LEARNING JOURNEY

45 MINUTES

ENGAGE - Many Paths Into Space

Survey space-career examples, connect personal interests to possible roles, and identify which specialists would be needed to respond to the Shackleton Base emergency.

EXPLORE -Build the Mission Ecosystem & Form Your Crew

Form a four-person crew, assign complementary roles, establish working agreements, match partner organizations to responsibilities, and sequence how the rescue team will collaborate.

EXPLAIN - Every Talent Has a Place in Space - STEM Career Exploration

Examine fourteen space-career profiles, compare three promising pathways, and match each career's skills and responsibilities to specific Moon Mission functions.

ELABORATE - Emergency at Shackleton Base & Decode the Mission Patch

Analyze the emergency transmission, rank rescue priorities with evidence, decode NASA patch symbols, and design an individual patch that communicates identity and mission purpose.

EXTEND - Mission Identity Briefing

Present the crew name, roles, call signs, agreements, patch choices, and readiness evidence in a concise mission briefing for review.

MISSION 2

Understanding the Lunar Environment

LEARNING OBJECTIVE

Students will investigate lunar radiation, extreme temperatures, dust, and other environmental hazards, test possible protections, analyze evidence, and recommend a system that can keep Crew 42 safe.

DRIVING QUESTION

How might we, as lunar scientists and engineers, protect Crew 42 from the hazards surrounding Shackleton Base?

THE 5E LEARNING JOURNEY

45 MINUTES

ENGAGE - Emergency Transmission

Review the incoming emergency transmission, identify reported lunar hazards, match each hazard to possible crew or habitat effects, and record missing information.

EXPLORE - Read the Lunar Surface

Compare Earth's and the Moon's atmosphere, gravity, regolith, water, temperature, seismic activity, illumination, and south-pole terrain using field evidence.

EXPLAIN - Build a Protection Model

Connect radiation, heat transfer, dust filtration, mixtures, pH, conductors, and insulators to the protective systems that could control each hazard.

ELABORATE - Hazard Alert and Investigation

Define a testable question and variables, run one controlled hazard investigation, collect and interpret data, then compare results with evidence from other hazards.

EXTEND - Deliver the Mission Control Survival Briefing

Exchange hazard findings, classify useful materials as conductors or insulators, and combine the strongest evidence into a prioritized survival recommendation for Crew 42.

MISSION 3

Code a Message to the Moon

LEARNING OBJECTIVE

Students will investigate how sound and light waves carry information, encode and decode messages, and test a relay network to explain which communication path is most reliable.

DRIVING QUESTION

How might we as communications engineers use waves, coding, and relay systems to send a clear message between Earth and Shackleton Base?

THE 5E LEARNING JOURNEY

45 MINUTES

ENGAGE - Decode the Fragmented Signal

Restore missing words in a fragmented transmission, arrange block-code commands in the correct order, and test whether the reconstructed message makes sense.

EXPLORE - Build a Laser Communication Link

Encode a short binary message, position a transmitter, receiver, and relay nodes, and test multiple light paths around simulated lunar obstacles.

EXPLAIN - Test Sound and Light

Conduct controlled sound-and-light trials, compare how each wave travels, and connect the results to radio links and the Deep Space Network.

ELABORATE - Earth-to-Shackleton Coded Message

Decode binary information, route a signal around an obstacle, create a response, test the relay network, debug failures, and retransmit accurately.

EXTEND - Moon-to-Earth Communications Summary

Synthesize wave, coding, and relay evidence into a technical summary that recommends the most reliable communication path and explains remaining limitations.

MISSION 4

Launch the Lunar Rescue Mission

LEARNING OBJECTIVE

Students will investigate how thrust, gravity, mass, payload, and distance affect rocket motion; interpret launch and landing data; connect evidence to Newton's laws; and defend a reliable rescue recommendation.

DRIVING QUESTION

How might we as propulsion engineers use forces, motion, and test data to launch and land the Shackleton rescue spacecraft safely?

THE 5E LEARNING JOURNEY

45 MINUTES

ENGAGE - Launch Systems Check

Observe a rocket launch, label major vehicle systems, map thrust, gravity, drag, and mass, and predict the conditions needed for liftoff.

EXPLORE -Test Rocket Forces

Run three controlled launch trials, change payload mass while holding other variables steady, and record motion data for comparison.

EXPLAIN - How Do We Launch a Rocket from Earth?

Match observed launch behaviors to Newton's laws, graph mass against acceleration, and use the pattern to explain the trial results.

ELABORATE - Shackleton Base Landing Challenge

Test a landing model repeatedly, vary mass, descent speed, and engine power in controlled comparisons, and record which configurations land safely.

EXTEND - Launch Recommendation and Reflection

Recommend a rescue launch and landing configuration, cite quantitative trial evidence, explain the forces involved, and identify the next useful test.

MISSION 5

Code the Lunar Rescue Rover

LEARNING OBJECTIVE

Students will analyze lunar terrain, apply sequences, parameters, loops, sensors, and conditionals, debug rover code, compare trial data, and defend an evidence-based rescue route.

DRIVING QUESTION

How might we as planetary geologists use terrain evidence, coding logic, and repeated tests to guide a rescue rover safely to Crew 42?

THE 5E LEARNING JOURNEY

45 MINUTES

ENGAGE - Survey the Rover Route

Inspect elevation, slope, regolith, boulders, illumination, distance, and energy constraints, then select and justify a promising first rover route.

EXPLORE -Complete the Shackleton Rescue Route

Program two routes with ordered moves and turns, collect supplies in sequence, avoid hazards, reach Crew 42, and compare route performance.

EXPLAIN - Decode and Debug Mission Logic

Define sequences, parameters, loops, sensors, conditionals, and algorithms, then locate and repair logic errors in two rover programs.

ELABORATE - Test and Improve Rover Code

Build, test, and debug a rescue algorithm that uses a loop, sensor, and conditional, then compare before-and-after trial data.

EXTEND - Rover Mission Recommendation

Submit the program, selected route, trial record, graph, and key improvement as evidence for authorizing the rover rescue plan.

MISSION 6

Power the Shackleton Rescue Base

LEARNING OBJECTIVE

Students will explain energy transfers and transformations, compare series and parallel circuits, evaluate lunar power technologies, and use voltage and heat evidence to defend a hybrid power design.

DRIVING QUESTION

How might we as power systems engineers combine energy sources and reliable circuits to restore dependable power for Crew 42?

THE 5E LEARNING JOURNEY

45 MINUTES

ENGAGE - Emergency Power Triage

Review the emergency power transmission, identify dependencies among base systems, and prioritize the critical loads that must be restored first.

EXPLORE - Energy Moves Through Circuits

Build and test series and parallel rescue circuits, disconnect one load in each arrangement, and compare how the remaining devices respond.

EXPLAIN - Energy Forms and Transformations

Identify twelve energy forms and trace each transfer or transformation through a Rube Goldberg system that delivers rescue supplies.

ELABORATE -Design and Redesign Hybrid Rescue Power

Compare lunar power technologies, complete a 36-volt design, then redesign a 42-volt hybrid system under heat and no-solar constraints.

EXTEND - Power Restoration Recommendation

Defend the parallel habitat circuit and hybrid power plan using performance evidence, explain energy transfer and transformation, and propose the next test.

MISSION 7

Personal Reflection and Peer Review

LEARNING OBJECTIVE

Students will organize mission experiences, identify a central meaning, draft connected paragraphs, apply specific peer feedback, and revise a clear Personal Statement.

DRIVING QUESTION

How can specific experiences, emotions, and evidence explain how the Moon Mission changed my thinking and skills?

THE 5E LEARNING JOURNEY

45 MINUTES

ENGAGE - Map Your Moon Mission Story

Create an experience web linking mission events, emotions, challenges, discoveries, growth, and future goals, then select the details that matter most.

EXPLORE - Build the Reflection in Parts

Choose a central meaning, organize three mission moments in a logical order, and draft an introduction that previews the reflection's direction.

EXPLAIN - Practice Purposeful Peer Review

Evaluate sample feedback, rewrite a weak comment, review a peer's planning notes and introduction, and revise using specific, respectful suggestions.

ELABORATE -Develop the Full Reflection

Expand the revised introduction into three developed body paragraphs and a conclusion that explains what the Moon Mission experience means.

EXTEND - Review, Revise, and Approve the Final Personal Statement

Exchange complete drafts, attach three useful comments, revise for meaning and conventions, identify two improvements, then title and approve the statement.

MISSION 8

Mission Legacy

LEARNING OBJECTIVE

Students will finalize four connected mission artifacts, explain how archive systems preserve information, and submit a complete Mission Legacy Package.

DRIVING QUESTION

How can we preserve and share our Moon Mission identity, learning, and message so future crews can understand it?

THE 5E LEARNING JOURNEY

45 MINUTES

ENGAGE - Confirm Mission Identity

Review and refine the mission name, call sign, career role, and patch so the identity remains consistent across every final artifact.

EXPLORE - Code a Message to the Moon!

Build a simple data path, use a code name, and compose a future-facing message of no more than one hundred words.

EXPLAIN - How Lunar Archives Protect Information

Compare encoding, storage, instructions, metadata, redundancy, compatibility, integrity checks, and error checking across different proposed lunar archive systems.

ELABORATE - Finalize the Mission Manifest

Integrate mission identity, patch, encoded message, reflection, and selected images into a clear, accurate, and visually organized Mission Manifest.

EXTEND - Submit the Mission Legacy Package

Quality-check the four connected artifacts for completeness and consistency, accept the archive tag, submit the package, and receive mission certification.