§130.417 Scientific Research and Design TEKS Overview
2022 Texas High School Aerospace Scholars Virtual Curriculum

Standard #	Standard	# of Activities Aligned
(c)(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:		
130.417.c2A	(2A) demonstrate safe practices during laboratory and field investigations; and	9
130.417.c2B	(2B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.	10
(c)(3) The student uses a systematic approach to answer scientific laboratory and field investigative questions. The student is expected to:		
130.417.c3A	(3A) know the definition of science and understand that it has limitations, as specified in subsection (b)(1)* of this section;	15
130.417.c3B	(3B) know that scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories;	14
130.417.c3C	(3C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-- established and highly--reliable explanations, but may be subject to change as new areas of science and new technologies are developed;	14
130.417.c3D	(3D) distinguish between scientific hypotheses and scientific theories;	13
130.417.c3E	(3E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness;	12
130.417.c3F	(3F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data--collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettes, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, and meter sticks;	12
130.417.c3G	(3G) analyze, evaluate, make inferences, and predict trends from data;	15
130.417.c3H	(3H) identify and quantify causes and effects of uncertainties in measured data;	11
130.417.c3I	(3I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs; and	11
130.417.c3J	(3J) communicate valid conclusions supported by the data through various methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.	12
(c)(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:		
130.417.c4A	(4A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;	11
130.417.c4B	(4B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;	13
130.417.c4C	(4C) draw inferences based on data related to promotional materials for products and services;	14
130.417.c4D	(4D) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society;	15

130.417.c4F	(4F) research and describe the connections between science and future careers; and	12
130.417.c4G	(4G) express and interpret relationships symbolically in accordance with accepted theories to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition.	12
(c)(5) The student formulates hypotheses to guide experimentation and data collection. The student is expected to:		
130.417.c5A	(5A) perform background research with respect to an investigative problem; and	14
130.417.c5B	(5B) examine hypotheses generated to guide a research process by evaluating the merits and feasibility of the hypotheses.	14
(c)(6) The student analyzes published research. The student is expected to:		
130.417.c6A	(6A) identify the scientific methodology used by a researcher;	14
130.417.c6B	(6B) examine a prescribed research design and identify dependent and independent variables;	15
130.417.c6C	(6C) evaluate a prescribed research design to determine the purpose for each of the procedures performed; and	16
130.417.c6D	(6D) compare the relationship of the hypothesis to the conclusion.	14
(c)(7) The student develops and implements investigative designs. The student is expected to:		
130.417.c7A	(7A) interact and collaborate with scientific researchers and/or other members of the scientific community to complete a research project;	15
130.417.c7B	(7B) identify and manipulate relevant variables within research situations;	11
130.417.c7C	(7C) use a control in an experimental process; and	13
130.417.c7D	(7D) design procedures to test hypotheses.	9
(c)(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:		
130.417.c8B	(8B) record observations and events as they occur within an investigation;	11
130.417.c8C	(8C) acquire, manipulate, and analyze data using equipment and technology;	14
130.417.c8F	(8F) construct data tables to organize information collected in an experiment; and	12
130.417.c8G	(8G) evaluate data using statistical methods to recognize patterns, trends, and proportional relationships.	14
(c)(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:		
130.417.c9A	(9A) synthesize conclusions supported by research data;	13
130.417.c9B	(9B) consider and communicate alternative explanations for observations and results; and	9
130.417.c9C	(9C) identify limitations within the research process and provide recommendations for additional research.	13
(c)(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:		
130.417.c10A	(10A) construct charts, tables, and graphs in facilitating data analysis and in communicating experimental results clearly and effectively using technology; and	9
130.417.c10B	(10B) suggest alternative explanations from observations or trends evident within the data or from prompts provided by a review panel.	9

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Texas Essential Knowledge and Skills Alignment 130.417 Scientific Research and Design

MISSION TO MOON TO PREPARE FOR MARS RESEARCH CHALLENGE	
Purpose: Research and develop the nine stages of a sustainable long term human presence on the Moon in preparation for a round trip human mission to Mars of (30 - 500 days) scientific community of astronauts. **Objective:** Create a cohesive, technically sound video presentation aligned with true industry requirements, facilitated by a team of NASA's Johnson Space Center industry professionals.	
Research and Prototype Focus Objectives	**TEKS**
Expeditions to Lunar Surface	
Research and design a prototype of either an autonomous Cargo Lunar Lander OR a lunar Polar Exploration Rover. Driving questions: What is our mission for an expedition to the lunar surface? What do we need before we travel to the Moon? How will we do it? Presentation Subtopics include: Overall science goals, Precision landing, Lunar cargo and payloads, In-situ resource utilization experiments (geology, fuel, water, mining ores, etc)	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)
Option 1. Cargo Lunar Lander prototype includes: Autonomous precision landing systems, Laser retro-reflector array, Navigation Doppler Lidar for precise velocity and range sensing, Video and camera systems, Payloads to test chemical response of lunar regolith during landing, Advanced photovoltaic energy transfer systems, Magnetometer, Near-infrared volatiles mass spectrometer. Option 2. Polar Exploration Rover prototype includes: Ability to rove across the lunar surface, Autonomous driving, Miniaturized sensors, Spectrometer to hunt for water ice, At least two moveable and threaded drilling devices (different types of drill heads), Casing or other material to allow for hole stabilization while drilling, Battery and/or solar power for operations, Extreme environmental resistance.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)

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Research and Prototype Focus Objectives	TEKS
Flying to Lunar Orbit	
Research and design a prototype of a human rated capsule capable of travelling to the Moon. Must have a cutaway section so inside can be viewed. Driving questions: How do we go? How do we go to lunar orbit safely? Where are we going on lunar surface? Presentation Subtopics include: Rationale and risk assessment; Interplanetary spacecraft design to lunar orbit (propulsion, timelines, and communication systems); Prototype in-space propulsion to reduce time for lunar mission; Entry, descent, and landing site for human lunar mission.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)
Human rated capsule prototype includes: Propulsion system and control (fuel and oxidizer); Electrical energy system (represented in blue); Water, waste, and oxygen recycling system (represented in red); Environmental Control system and CO_2 scrubbers system; Crew quarters; Radiation protection; Waste Management System; Photography/Earth Observation portal; Guidance, Navigation and Control system; Communication and radar system	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)

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Research and Prototype Focus Objectives	TEKS
Living in Lunar Orbit	
Research and design a prototype of a Habitation and Logistics Outpost (HALO) or a Power and Propulsion Element (PPE). Driving questions: How do we survive? What are the dangers? What are our physical and psychological needs? Presentation Subtopics include: Microgravity issues; Nutrition and exercise, and interpersonal relationships; Space weather and radiation hazards; Science goals during deep space transit to the Moon.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)
Option 1. HALO prototype includes: Autonomous docking ports, Power distribution system, Command and control systems, Design for initial autonomous operations, Safe haven for emergencies, Space suit storage, Crew quarters. Option 2. PPE prototype includes: Solar electric propulsion, Electrical power system, Autonomous navigation and trajectory systems, Navigate to different orbits, Fuel storage	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)

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Research and Prototype Focus Objectives	TEKS
Traveling to Lunar Surface	
Research and design a prototype of a Human Lunar Landing System capable of descending to and ascending from the lunar surface or a Lunar Terrain Vehicle. Driving questions: How do we go to and from lunar surface? Where are we going on the Moon? How do we communicate in transit to surface? Presentation Subtopics include: Spacecraft design for descent to surface and ascent from surface (propulsion and timelines); Entry, descent, and landing site on lunar surface; Communication in transit to and on surface; Analog mission to Lunar surface	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)
Option 1. Human Landing System (HLS) prototype includes: Compact life support system; Autonomous docking to lunar Gateway or human rated capsule; Staged from lunar Gateway orbit; Deployable; Compact operating and propulsion system; Electrical energy system; Radiation protection; Guidance, navigation and control system. Option 2. Lunar Terrain Vehicle (LTV) prototype includes: Unpressurized (unenclosed), Transport crew around site, Ability to explore and conduct experiments in lunar south pole, Staged on lunar surface prior to crew arrival, Electronic vehicle energy storage and management, Autonomous driving, Extreme environmental resistance	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)

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Research and Prototype Focus Objectives	TEKS
Living on Lunar Surface	
Research and design a prototype of a Lunar Foundation Surface Habitat (FSH). Driving questions: How do we build a surface habitat? What do we need? How do we mitigate lunar hazards? Presentation Subtopics include: Lunar surface hazards (Micrometeroid & radiation shielding, and dust mitigation); Launching pad; Pilot plants; Pressure and temperature mitigation	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)
The Lunar Foundation Surface Habitat (FSH) prototype includes: Biomedical station for testing and evaluation of human beings; Geological station for testing rock samples and evaluating rock specimens (Mass spectrometer, Chemical analysis of rocks, Atmospheric sensors for analyzing atmospheric content, Radiation Assessment Detector, Laser-Induced Remote Sensing that has the ability to capture high-resolution images); Engineering station set-up for maintenance and repairs of rovers, equipment, etc; Plant growing area with automatic watering and lighting system; Communications; Power; Airlock; Waste disposal	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)

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Research and Prototype Focus Objectives	TEKS
Exploring Lunar South Pole	
Research and design a prototype of a lunar spacesuit helmet AND glove that can sustain life support, but incorporates requirements for mobility, functionality, and comfort. Driving questions: How do we survive during Extravehicular Activities (EVAs), or spacewalks? What are the dangers? What science can we collect during a spacewalk? Presentation Subtopics include: Advanced space suit requirements; Lunar surface hazards; Lunar (1/6) gravity issues; Lunar atmosphere and surface hazards.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)
The Helmet Prototype includes: Encompass the entire head of the astronaut; Must have lights, hoses for oxygen and ventilation; Must provide water to the crew; Must have a clear visor, with an overlay to protect the astronaut's eyes; Need to have a connection point to the rest of the suit; Must have a communication system built in. The Glove Prototype includes: Must be able to be evaluated for comfort and mobility by multiple subjects; Must be able to easily grip a penny and hold on to it; Must represent temperature adjustment for inside the glove; Fingertips must be made out of a harder material and evaluated for accuracy; Outer material must be flexible, but be able to hold pressure; Fingers must have a full range of motion and be evaluated by multiple subjects.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)

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Research and Prototype Focus Objectives	TEKS
Exploring Lunar Surface	
Research and design a prototype of a Lunar Mobile Habitat. Must have a cutaway section so inside can be viewed. Driving questions: Why are we going? What are we hoping to discover? How are we going to track our lunar discoveries? Presentation Subtopics include: Long duration trips, Laboratories and tools, Demonstrate in-situ reutilization, Science goals & analog exploration of Moon	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)
The Lunar Mobile Habitat Prototype includes: Ability to rove across lunar surface; Support a crew for long duration trips of 10s of km; Mission duration on surface from 7 to 30-45 days from base camp; Space stowage area; Photography/observation portal; Rock hammer/crusher device, tool box containing necessary tools for operation; Communications; Battery or solar power for operations	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)

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Research and Prototype Focus Objectives	TEKS
Expanding Lunar Orbit	
Research and design a prototype of Expanded Gateway Habitat OR a Sample Return Vehicle Driving questions: How do we expand Gateway to prepare for Mars mission? How will we do a Mars mission? How will we communicate in transit to Mars? Presentation Subtopics include: Expanded gateway for Mars analog mission, How to live and communicate on voyage to Mars, Risk mitigation for two years flight to and from Mars, Maximum exploration with minimum Martian surface time.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)
Option 1. The Expanded Gateway Habitat prototype includes: International habitation module that can dock to initial Gateway; Additional systems to support human Mars mission preparation; Robotic arm; Additional logistics element; Additional support systems; Model must exhibit at least three additional systems that are of the team's original design. Option 2. Sample Return Vehicle prototype includes: Two sample collection devices (different types of devices); two return device capsules; Return Propulsion System; Return vehicle, capable of landing on a rough surface; Ability to rove across the Martian surface; Mass spectrometry device that detects chemicals for drilling areas; Battery or solar power for operations; Photography/observation portal; Core sample collectors; Launchpad for sample return mission to lift-off from.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)

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Research and Prototype Focus Objectives	TEKS
Expanding Lunar Surface	
Research and design a prototype of a Lunar Hopper OR a Lunar Crater Radio Telescope (LCRT). Driving questions: How do we expand lunar surface operations? What do we need for long duration Lunar missions? How do track our Lunar discoveries? Presentation Subtopics include: Advanced lunar surface power and long duration power for lunar surface mission; Mars gravity issues (38% of Earth's gravitational pull); Autonomous manufacturing, excavation, and construction; Science objectives of hopper and radio telescope	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)
Option 1. The Lunar Hopper prototype includes: Deliver science and technology payloads across lunar surface; Controlled by Artemis base camp; Ability to prospect for resources; Use locally resourced fuel; Propulsion systems; Aerial coverage and access to extreme terrain; Able to explore pits and caves; Hop over obstacles; Accelerometers. Option 2. The Lunar Crater Radio Telescope (LCRT) prototype includes: Remotely emplaced by Artemis base camp; Determine best location of farside lunar crater; Signal/noise reduction system; Lunar wall climbing robotics; Suitable depth-to-diameter ratio Reflector; Extreme environmental resistance.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)

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PRESENTATIONS AND TOURS TO SUPPORT MISSION TO MARS RESEARCH CHALLENGE		
Presentations and Topic	**Focus Objective**	**TEKS**
Mission Parameters Set-up for Mission to Moon and then Mars Research Challenge	Variables affecting a human mission to Moon in preparation for Mars are the year the launch happens, duration on Mars, duration in space travel, crew count, and cost.	130.417 Scientific Research and Design (c)(3)(A,B,C,E,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,D) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B) 130.417 Scientific Research and Design (c)(8)(B,C,F,G) 130.417 Scientific Research and Design (c)(9)(C)
Independent GooseChase: Artemis Program, NASA's Plan for Sustained Lunar Exploration and Development.	NASA is committed to landing American astronauts, including the first woman and first person of color, on the Moon through the Artemis program. Through the agency's Artemis lunar exploration program, we will use innovative new technologies and systems to explore more of the Moon than ever before. We will collaborate with our commercial and international partners to establish sustainable missions. And then we will use what we learn on and around the Moon to take the next giant leap – sending astronauts to Mars. Overview of how the mission architecture of the Artemis program and why it is important to develop a sustainable presence on the Moon.	130.417 Scientific Research and Design (c)(2)(B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,D,F) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,C) 130.417 Scientific Research and Design (c)(8)(B,C,G) 130.417 Scientific Research and Design (c)(9)(A,C)

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Texas Essential Knowledge and Skills Alignment 130.417 Scientific Research and Design

Presentations and Topic	Focus Objective	TEKS
Independent GooseChase: Commercial Crew Program and Ride to Station Simulation.	Overview of NASA's Commercial Crew Program is working with the American aerospace industry as companies develop and operate a new generation of spacecraft and launch systems capable of carrying crews to low-Earth orbit and the International Space Station. Commercial transportation to and from the station will provide expanded utility, additional research time and broader opportunities of discovery on the orbiting laboratory. The station is critical for NASA to understand and overcome the challenges of long-duration spaceflight necessary for the journey to Mars. By encouraging industry to provide human transportation services to and from low-Earth orbit, NASA can expand its focus on building spacecraft and rockets for deep space missions.	130.417 Scientific Research and Design (c)(3)(A,B,C,D,G) 130.417 Scientific Research and Design (c)(4)(B,C,D,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,B) 130.417 Scientific Research and Design (c)(8)(C,G) 130.417 Scientific Research and Design (c)(9)(A)

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Presentations and Topic	Focus Objective	TEKS
Independent GooseChase & NASA Live Sessions: Students to learn of NASA STEM & Non-STEM careers, including NASA Internships & Pathways	Careers at NASA are both STEM and non-STEM based, and the projects/work happening is diversified as the career path that led employees to NASA.	130.417 Scientific Research and Design (c)(3)(A,E,F,G,J) 130.417 Scientific Research and Design (c)(4)(C,D,F) 130.417 Scientific Research and Design (c)(6)(B,C) 130.417 Scientific Research and Design (c)(7)(A,C)
NASA Internships Live Session. Education Opportunities and Internships/OSSI	Scholarships and internships are available to students who are interested in STEM education and NASA careers.	130.417 Scientific Research and Design (c)(4)(C,F) 130.417 Scientific Research and Design (c)(6)(B,C)
Current Research on the International Space Station	Operating as a unique microgravity national laboratory for scientific research, the space station facilitates the development of U.S. commercial cargo and commercial crew space transportation capabilities. The space station enables research and technology developments that will benefit human and robotic exploration of destinations beyond low-Earth orbit, including asteroids and Mars.	130.417 Scientific Research and Design (c)(3)(A,B,C,D,G) 130.417 Scientific Research and Design (c)(4)(B,C,D,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,C) 130.417 Scientific Research and Design (c)(8)(C,F,G) 130.417 Scientific Research and Design (c)(9)(A,C)

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Independent GooseChase: Mars 2020 Perseverance & Ingenuity, and NASA's James Webb Space Telescope Overview	The Mars 2020 Perseverance Rover searches for signs of ancient microbial life, which will advance NASA's quest to explore the past habitability of Mars. Perseverance also tests technologies to help pave the way for future human exploration of Mars. Research of Ingenuity flight test and factors necessary for a successful flight, including development of a hypothesis and theory. The Webb telescope will be the premier observatory of the next decade, serving thousands of astronomers worldwide. It will study every phase in the history of our Universe, ranging from the first luminous glows after the Big Bang, to the formation of solar systems capable of supporting life on planets like Earth, to the evolution of our own Solar System. Describe reasons relating to the importance of the Webb Space Telescope mission objective	130.417 Scientific Research and Design (c)(3)(A,B,C,D,G) 130.417 Scientific Research and Design (c)(4)(B,C,D,G) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(7)(A,C) 130.417 Scientific Research and Design (c)(8)(C,F,G) 130.417 Scientific Research and Design (c)(9)(A,C)