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

Standard #	Standard	# of Activities
(c)(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:		
130.417.c2A	(2A) demonstrate safe practices during laboratory and field investigations; and	18
130.417.c2B	(2B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.	18
(c)(3) The student uses scientific methods and equipment during laboratory and field investigations. 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)(4)* of this section;	29
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;	29
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;	10
130.417.c3D	(3D) distinguish between scientific hypotheses and scientific theories;	10
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;	14
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	16
130.417.c3G	(3G) analyze, evaluate, make inferences, and predict trends from data;	13
130.417.c3H	(3H) identify and quantify causes and effects of uncertainties in measured data;	13
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.	15
(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;	33
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;	20
130.417.c4C	(4C) draw inferences based on data related to promotional materials for products and services;	32
130.417.c4D	(4D) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society;	45
130.417.c4F	(4F) research and describe the connections between science and future careers; and	22

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

Standard #	Standard	# of Activities
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.	19
(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	13
130.417.c5B	(5B) examine hypotheses generated to guide a research process by evaluating the merits and feasibility of the hypotheses.	10
(c)(6) The student analyzes published research. The student is expected to:		
130.417.c6A	(6A) identify the scientific methodology used by a researcher;	33
130.417.c6B	(6B) examine a prescribed research design and identify dependent and independent variables;	56
130.417.c6C	(6C) evaluate a prescribed research design to determine the purpose for each of the procedures performed; and	63
130.417.c6D	(6D) compare the relationship of the hypothesis to the conclusion.	43
(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;	3
130.417.c7B	(7B) identify and manipulate relevant variables within research situations;	10
130.417.c7C	(7C) use a control in an experimental process; and	4
130.417.c7D	(7D) design procedures to test hypotheses.	7
(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;	8
130.417.c8C	(8C) acquire, manipulate, and analyze data using equipment and technology;	37
130.417.c8F	(8F) construct data tables to organize information collected in an experiment; and	5
130.417.c8G	(8G) evaluate data using statistical methods to recognize patterns, trends, and proportional relationships.	36
(c)(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is		
130.417.c9A	(9A) synthesize conclusions supported by research data;	39
130.417.c9B	(9B) consider and communicate alternative explanations for observations and results; and	13
130.417.c9C	(9C) identify limitations within the research process and provide recommendations for additional research.	12
(c)(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is		
130.417.c10A	(10A) construct charts, tables, and graphs in facilitating data analysis and in communicating experimental results clearly and effectively using technology; and	5
130.417.c10B	(10B) suggest alternative explanations from observations or trends evident within the data or from prompts provided by a review panel.	12

2022 Texas High School Aerospace Scholars Online Curriculum

Texas Essential Knowledge and Skills Alignment 130.417 Scientific Research and Design

Module One --- Getting There

Science Focus Questions	Science Activity Objectives	TEKS:
How has venturing off our planet given us more understanding of our planet?	Satellite missions enable scientists to learn about Earth's natural processes, and the disruptions therein.	130.417 Scientific Research and Design (c)(3)(A,B,F) 130.417 Scientific Research and Design (c)(8)(B,D)
How will the future of aeronautics address noise, emissions and fuel consumption? Is NASA going green?	The goal of green aviation is to have aircraft with minimal impact on the environment.	130.417 Scientific Research and Design (c)(4)(A,D) 130.417 Scientific Research and Design (c)(6)(A,C) 130.417 Scientific Research and Design (c)(9)(A)
How can understanding the capillary flow of coffee cups improve future rocket engines?	Capillary flow experiments led to understanding fluid dynamics in a micro---gravity environment.	130.417 Scientific Research and Design (c)(3)(B) 130.417 Scientific Research and Design (c)(4)(D) 130.417 Scientific Research and Design (c)(6)(B,D)
How did NASA MAVEN project manager, Sandra Cauffman “Get To” Mars?	Sandra Cauffman's background in math, physics and electrical engineering led to a NASA career in aerospace robotics and mechanical systems, and earned her the title of MAVEN project manager.	130.417 Scientific Research and Design (c)(4)(F) 130.417 Scientific Research and Design (c)(9)(A)
How is the habitability of Earth linked to comets?	Consensus among the scientific community is that comets delivered organic elements through impacts with early Earth.	130.417 Scientific Research and Design (c)(6)(B,C,D) 130.417 Scientific Research and Design (c)(8)(C,G)

Science Assignment Problem(s) or Overarching Question(s)	Science Assignment Objectives	TEKS:
Option 1 -- Select a satellite for collecting data to answer a research question about Earth's changing climate. Option 2 - Select a space telescope for collecting data to answer a research question about the Universe.	Students will investigate a research question that could be answered using NASA satellite data or space telescope data. The research will include: Research question about either Earth's climate or the universe; Satellite or space telescope selection capable of providing data needed to answer your research question; Described data collected; Data or images from the satellite or space telescope with usage explanation; Other data sources determined that could be used to help interpret collected data or images; Who will benefit from the findings? Students will write a 250---500 word essay with no significant grammatical errors, correctly citing references using APA style.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3) (A,B,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D) 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)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(B)

2022 Texas High School Aerospace Scholars Online Curriculum

Texas Essential Knowledge and Skills Alignment 130.417 Scientific Research and Design

Module One --- Getting There

Technology Focus Questions	Technology Activity Objectives	TEKS:
How is NASA technology advancing the future on Earth and in space?	The pace of new technology development slowed down after the Apollo years due to the focus on safety with fewer risks taken, and the focus on successful missions.	130.417 Scientific Research and Design (c)(3)(H) 130.417 Scientific Research and Design (c)(4)(A,D)
How is NASA's game-changing development program transforming how NASA develops new technology?	NASA seeks to identify and rapidly mature innovative/high impact capabilities and technologies for infusion in a broad array of future missions. TRL's measure the maturity of evolving technologies. The range of TRLs is 1 (lowest) through 9 (fully developed).	130.417 Scientific Research and Design (c)(4)(C,F,G)
What are some of the technologies that NASA is developing to help make aircraft more efficient, safer, and quieter?	NASA's Environmentally Responsive Aircraft (ERA) team is using computer drawings, wind tunnels and scaled models. NASA is to focusing on aircraft drag, aircraft weight, fuel consumption, fuel emissions, and aircraft noise.	130.417 Scientific Research and Design (c)(4)(C,D)
What are some of the technologies used in the daily operation of the International Space Station?	Focused on green engineering, the space station uses multiple technologies in the daily operation including solar arrays to collect sunlight and convert it to energy; environmental control and life support system for air and water supplies; and thermal control system for heating and insulation.	130.417 Scientific Research and Design (c)(6)(A,B,C,D)
What are some of the technologies that NASA is using to improve entry, descent, and landing on Mars?	The Deployable Energy Absorber has an advantage over traditional air bags because it can better handle crush with sheer. Arc---jet testing evaluates the thermal protection systems (heat shields) for spacecraft entry, descent, and landing.	130.417 Scientific Research and Design (c)(5)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(A,B,C)
How is NASA "Getting to" our solar system and beyond?	Ion propulsion engines power deep space missions.	130.417 Scientific Research and Design (c)(6)(A,B,C,D)

Technology Assignment Problem(s) or Overarching Question(s)	Technology Assignment Objectives	TEKS:
Compare and contrast two biomimicry technologies, Gecko Gripper (https://www.jpl.nasa.gov/videos/crazy-engineering-gecko-gripper) and Spider Bot (https://www.jpl.nasa.gov/videos/spider-bot), then post comments to discussion board to justify best biomimicry technology.	Students will compare and contrast 2 biomimicry technologies then justify a sole selection by: Creating an original discussion board post that listed choice and justification for selection; Writing two well thought-out responses to other scholars' discussion board posts.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(B)

2022 Texas High School Aerospace Scholars Online Curriculum

Texas Essential Knowledge and Skills Alignment 130.417 Scientific Research and Design

Module One --- Getting There

Engineering Focus Questions	Engineering Activity Objectives	TEKS:
What are some of the engineering capabilities and jobs at NASA's Johnson Space Center?	Johnson Engineering Capabilities and jobs include: Avionics, Communication and Software Radiation Resistant Hardware Structure and Materials Development Integrated Power Thermal Management Mechanical Separation Integrated Spacecraft Propulsion Spacecraft Cockpit Rapid Prototyping Design	130.417 Scientific Research and Design (c)(4)(B,D,F)
What are some of the solutions that engineers developed to work around? What should have been mission ending failure for Landsat 5?	Creative Engineering 1: Landsat 5's primary solar array drive failed and the back-up drive failed. Solar array couldn't move, so engineers pitched the satellite to face the Sun. This movement gave the satellite just enough extra Sun exposure to keep the batteries charged and execute its imaging duties. Creative Engineering 2: After pathways for sending data to the ground had failed, an instrument on Landsat 5 was powered back on after seventeen years, and amazingly, it worked.	130.417 Scientific Research and Design (c)(4)(B) 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)(9)(C)
What are some of NASA's contributions to major milestones in aviation history?	Historic events in aerospace history include: Explorer 1 successfully orbited Earth; Gemini Missions; Apollo Missions; International Space Station was assembled and has had crews living there since 2000.	130.417 Scientific Research and Design (c)(4)(B,D,F)
It takes a village…to train an astronaut! Who are some of the people who help get astronauts to space?	Astronaut candidates (ASCANs) undergo two years of intensive astronaut candidate training which includes team building, survival skills, and technical space systems training. Technical training includes robotics instruction, how to perform spacewalks, operational training in T-38 Talon supersonic jet, language training, expeditionary crew skills, and specialized hardware and science instruction.	130.417 Scientific Research and Design (c)(4)(D,F) 130.417 Scientific Research and Design (c)(9)(A)
Why is entry, descent, and landing on Mars called "Seven Minutes of Terror?"	Entry into Mars atmosphere to Martian surface takes seven minutes. The EDL process had zero margin of error, and was completely autonomous because by the time Curiosity had reached the surface, seven minutes had already passed since it takes 14 min for a signal to reach Earth from Mars.	130.417 Scientific Research and Design (c)(4)(A,B,C) 130.417 Scientific Research and Design (c)(6)(A,B,C,D)
How did NASA engineers exchange two crucial telescope?	Micro Shutter Array is an instrument that will control whether light from an astronomical object in the telescopes field of view enters the NIRSpec. The NIRSpec on the James Webb telescope will be able to measure the spectrum of up to one hundred objects simultaneously and will be capable of observing large samples of galaxies and stars at unprecedented depths across large swaths of the universe and far back in time.	130.417 Scientific Research and Design 130.417 Scientific Research and Design 130.417 Scientific Research and Design 130.417 Scientific Research and Design (c)(8)(C,G)

Engineering Assignment Problem(s) or Overarching Question(s)	Engineering Assignment Objectives	TEKS:
Learn how to create 3D drawings using the tools of 3D design Create a 3D mock satellite.	Draw and label power, communication, instruments systems of a satellite. Write a paragraph to explain the relevance of in the aerospace industry. Include both space applications.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(8)(B,D) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(A,B)

2022 Texas High School Aerospace Scholars Online Curriculum

Texas Essential Knowledge and Skills Alignment 130.417 Scientific Research and Design

Module One --- Getting There

Mathematics Focus Questions	Mathematics Activity Objectives	TEKS:
How are reference systems used to describe the location of objects in the sky?	Reference systems for locating objects in the sky include declination and right ascension, azimuth and elevation, and the International Celestial Reference Frame.	130.417 Scientific Research and Design (c)(3)(C) 130.417 Scientific Research and Design (c)(4)(A,C,G) 130.417 Scientific Research and Design (c)(8)(G)
How does orbital mechanics impact Earth satellite mission planning?	There are three types of Earth orbits: high Earth orbit, medium Earth orbit, and low Earth orbit. Many weather and some communications satellites tend to have a high Earth orbit, farthest away from the surface. Satellites that orbit in a medium (mid) Earth orbit include navigation and specialty satellites, designed to monitor a particular region. Most scientific satellites, including NASA's Earth Observing System fleet, have a low Earth orbit. Height, eccentricity and inclination shape a satellite's orbit.	130.417 Scientific Research and Design (c)(7)(B,D) 130.417 Scientific Research and Design (c)(8)(C,G)
How do computer modeling and visualization speed up ground operations and aid flight safety?	Taxiway Navigation and Situation Awareness System (T-NASA) speeds up ground operations and aids flight safety. T-NASA blends GPS abilities with virtual reality technology to create displays that help pilots move around the airport quickly and safely.	130.417 Scientific Research and Design (c)(4)(D) 130.417 Scientific Research and Design (c)(6)(A,B,C,D)
When are the International Space Station and other satellites visible from your location?	Depending on your location, you may see the International Station several times a week to only a time or two a month. The space station makes a complete orbit of Earth every 90 minutes.	130.417 Scientific Research and Design (c)(4)(G) 130.417 Scientific Research and Design (c)(7)(B) 130.417 Scientific Research and Design (c)(8)(C,G) 130.417 Scientific Research and Design (c)(9)(A)
What parameters impact the timing for a mission to Mars?	Based on a 2.5 year human exploration mission, the maximum stay time on Mars is 1.49 years.	130.417 Scientific Research and Design (c)(3)(A) 130.417 Scientific Research and Design (c)(7)(B,D) 130.417 Scientific Research and Design (c)(8)(C,G) 130.417 Scientific Research and Design (c)(9)(A,C)
How will emerging technologies improve future spacecraft navigation?	Advantages of emerging technologies, as demonstrated by the SEXTANT investigation, include use of celestial clocks called pulsars for reliable and high---precision timing; autonomous navigation which does not rely on the Global Positioning System; accessibility for nearly every possible mission course.	130.417 Scientific Research and Design (c)(3)(B,C,D) 130.417 Scientific Research and Design (c)(6)(A,B)

Mathematics Assignment Problem(s) or Overarching Question(s)	Mathematics Assignment Objectives	TEKS:
Review Spherical Coordinate Systems and use Google Earth to find the location of the coordinates: Find the position of the AFRC site with respect to the Earth's center in terms of i, j, and k; Write the Earth---centered vector, f_{ec} , in the form: $f_{ec} = xi + yj + zk$ Find the position of the space shuttle with respect to the AFRC in terms i, j, and k; Find the Earth---centered position vector of the space shuttle; Find the length of the space shuttle's Earth---centered position vector; Find the space shuttle's distance above Earth's surface.	Spherical Coordinates are curvilinear positions on a sphere. Spherical Google Earth. Transform spherical coordinates to Cartesian Represent 3D vectors in terms of i, j, and k; Perform vector addition operations.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design 130.417 Scientific Research and Design (c)(4)(D,G) 130.417 Scientific Research and Design (c)(8)(C,G)

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Texas Essential Knowledge and Skills Alignment 130.417 Scientific Research and Design

Module Two --- Discovering There

Science Focus	Science Activity	TEK
How is NASA gathering data "on the fly?"	Scientists want to introduce bacteria into Earth's stratosphere to predict what will happen when microorganisms get to Mars.	130.417 Scientific Research and Design (c)(3)(B) 130.417 Scientific Research and Design (c)(6)(A,B,C,D)
How do supersonic shockwaves lead to quieter aircraft?	Researchers utilize Schlieren imaging relevant to aeronautics to determine flow patterns for future aircraft that will allow quieter overland flight.	130.417 Scientific Research and Design (c)(3)(C) 130.417 Scientific Research and Design (c)(4)(A,D)
How will biological systems research lead to better astronaut health?	Biological research for better astronaut health gives scientists insight into the basic cellular and molecular mechanisms of the human body. Biological research of plants gives scientists insight on how plants can lead to air purification technology.	130.417 Scientific Research and Design (c)(4)(A,C,G)
How will dust storms on Mars really impact astronauts?	The development of global dust storms is a sequential process: radiative heat of sunlight reaches the surface of the planet; heat warms the air closest to the surface, leaving the upper air cooler; warm and cool air together becomes unstable; warm air rises up and takes dust with it.	130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(C,G) 130.417 Scientific Research and Design (c)(9)(A)
Why did OSIRIS-REx go to Bennu?	NASA's asteroid-sample-return mission is OSIRIS-Rex. Factors that influence the Yarkovsky effect are composition, energy transport through the surface, temperature, and topography.	130.417 Scientific Research and Design (c)(3)(A,B,C,D) 130.417 Scientific Research and Design (c)(4)(D) 130.417 Scientific Research and Design (c)(6)(C,D) 130.417 Scientific Research and Design (c)(8)(C,G) 130.417 Scientific Research and Design (c)(9)(A)

Science Assignment Problem(s) or Overarching Question(s)	Science Assignment Objectives	TEKS:
Compute the volume of the asteroid, assuming it was nearly spherical. Compute the density of the asteroid. What does the density tell you about the physical composition of the asteroid? Determine its primary composition. How much kinetic energy was released by the event? Give answer in Joules and kilotons. At what altitude did atmospheric entry occur? What layer of the atmosphere is this?	On Feb. 15, 2013, a small asteroid entered Earth's atmosphere over Russia. Asteroids have volume and density. Density of an asteroid reveals its physical composition. Asteroids have kinetic energy.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,C,D,F,G,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,D,G) 130.417 Scientific Research and Design (c)(6)(D) 130.417 Scientific Research and Design (c)(8)(C,G)

2022Texas High School Aerospace Scholars Online Curriculum

Texas Essential Knowledge and Skills Alignment 130.417 Scientific Research and Design

Module Two --- Discovering There

Technology Focus	Technology Activity	TEK
How does space technology benefit us on Earth?	NASA's space technology leads to innovations on Earth.	130.417 Scientific Research and Design (c)(4)(D,F)
How do remote sensing technologies help NASA monitor Earth systems?	High altitude and longer duration flights are a benefit to using Global Hawk technology for studying hurricanes.	130.417 Scientific Research and Design (c)(4)(A,C) 130.417 Scientific Research and Design (c)(6)(A,B,C,D)
How is NASA's research in new aviation technologies transforming the future of flight?	NASA's aviation technology research includes rapid prototyping reduced costs for design and testing phase; transitions from hover to wing-borne flight; and using electric engines with reduced noise.	130.417 Scientific Research and Design (c)(6)(A,B,C,D)
How does the International Space Station provide a unique opportunity for researchers to demonstrate new space technologies?	To demonstrate new space technologies researchers are using the space station by evaluating personal journals to understand psychological impacts; growing fresh produce to improve nutrition; analyzing blood, urine, and saliva to study the immune system.	130.417 Scientific Research and Design (c)(4)(A,D) 130.417 Scientific Research and Design (c)(6)(A,B,C,D)
What real NASA technologies have inspired the "The Martian?"	Technologies already in use on Mars or in space include Ion Propulsion, Radioisotope Thermoelectric Generators (RTG), and Oxygen Generation System.	130.417 Scientific Research and Design (c)(6)(B,C) 130.417 Scientific Research and Design (c)(9)(A,B)
What challenges did engineers overcome with Hubble Space Telescope technology?	The Hubble Space Telescope challenges have included a primary mirror with the slightly wrong shape causing images to be out of focus; the fragility of glass mirrors, cameras and spectrographs.	130.417 Scientific Research and Design (c)(4)(G) 130.417 Scientific Research and Design (c)(5)(A) 130.417 Scientific Research and Design (c)(6)(C)

Technology Assignment Problem(s) or Overarching Question(s)	Technology Assignment Objectives	TEKS:
Review the 2019 NASA Spinoff brochure and select a technology. Produce a video demonstrating knowledge of the technology. Provide justification for why this technology should earn 2019 NASA Spinoff Technology of the Year.	NASA technology creates spinoff technology. Provide an argument for why the selected spinoff technology should earn [2019] NASA Spinoff Technology of the Year. Storytelling of spinoff relayed through video presentation.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,E,F,G,H,I,J) 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)(9)(A,B) 130.417 Scientific Research and Design (c)(10)(B)

2022 Texas High School Aerospace Scholars Online Curriculum

Texas Essential Knowledge and Skills Alignment 130.417 Scientific Research and Design

Module Two -- Discovering There

Engineering Focus	Engineering Activity	TEK
When are robots a better design than rovers?	Robots are designed to go where wheels cannot. Future robots using developing limb technology will ultimately have autonomous capabilities for real-world applications on Earth, underwater and in space.	130.417 Scientific Research and Design (c)(4)(C,D,F) 130.417 Scientific Research and Design (c)(6)(A,B,C,D)
How is a 1969 airplane serving the world's scientific community?	NASA's DC-8 Airborne Science Lab supports the Earth science community including academia, government and investigators for missions such as sensor development, sensor verification, and geophysical research using in-situ instruments and remote sensing instruments.	130.417 Scientific Research and Design (c)(4)(D) 130.417 Scientific Research and Design (c)(6)(C) 130.417 Scientific Research and Design (c)(8)(C,G) 130.417 Scientific Research and Design (c)(9)(A)
How have spacesuits been engineered to meet the needs of EVAs?	The spacesuit, or Extravehicular Mobility Unit (EMU), replicates earthlike conditions for astronauts to be able to leave the controlled environment of their vehicle.	130.417 Scientific Research and Design (c)(4)(D) 130.417 Scientific Research and Design (c)(6)(B,D) 130.417 Scientific Research and Design (c)(8)(C,G)
How has Curiosity's discoveries changed our perception of Mars?	Missions will be driven by rigorous scientific questions that continually evolve from discoveries by prior missions.	130.417 Scientific Research and Design (c)(4)(A,C,D) 130.417 Scientific Research and Design (c)(6)(A,B,C,D)
What is so exceptionally sweet about Chandra?	In the Electromagnetic Spectrum the Chandra layer of Google Sky/Google Earth is X-Rays.	130.417 Scientific Research and Design (c)(5)(B,C) 130.417 Scientific Research and Design (c)(6)(B) 130.417 Scientific Research and Design (c)(7)(B,D) 130.417 Scientific Research and Design (c)(8)(C)

Engineering Assignment Problem(s) or Overarching Question(s)	Engineering Assignment Objectives	TEKS:
Design and draw a tool for space. This tool may be designed for any specific tasks related to living and working in transit (on a spaceship), or on the Moon, Mars, or an asteroid.	Design a handheld tool to be used in space. Submit the graphic as either hand drawn, or using 3D software. A one page overview will provide an overview of the design.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(8)(A,C,D) 130.417 Scientific Research and Design (c)(9)(A)

2022 Texas High School Aerospace Scholars Online Curriculum

Texas Essential Knowledge and Skills Alignment 130.417 Scientific Research and Design

Module Two --- Discovering There

Mathematics Focus	Mathematics Activity	TEK
How does NASA identify, observe, and measure objects without direct contact?	An active remote sensor example is Lidar which provides distance measurements by using a laser and receiver to transmit and detect a light pulse reflecting off a target.	130.417 Scientific Research and Design (c)(4)(A,B,C,D,G) 130.417 Scientific Research and Design (c)(9)(A)
How does NASA calculate the number of satellites needed to collect data for a region?	To calculate the number of [CYGNSS] storm chaser satellites the following criteria is considered: altitude of orbit and orbital inclination; location of 10 years' worth of tropical cyclones; average repeat time over specific region.	130.417 Scientific Research and Design (c)(3)(A,B,C,D) 130.417 Scientific Research and Design (c)(9)(A,C)
How is NASA using mathematics to improve safety of unmanned aircraft?	Research involving Detect and Avoid Alerting for Unmanned Systems, or DAIDALUS, seeks to demonstrate that the mathematical algorithm is capable of providing maneuver guidance to pilots for deciding a safe path; utilizing well defined vertical and horizontal clearances to avoid collisions; calculating solutions to allow both unmanned and traditional manned aircraft to fly in the same airspace.	130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(C,G) 130.417 Scientific Research and Design (c)(9)(A,H)
How do remote sensing tools on International Space Station improve our understanding of Earth ystems?	Remote sensing classifies images into categories including critical measurements that will tell us more about the global impact of pollution, smoke and dust on Earth's climate.	130.417 Scientific Research and Design (c)(4)(A,B,C) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(C,G)
How can Mars Trek tools help you explore surface features of the Red Planet?	Spectral data can provide useful information about variety and abundance of vegetation, types of minerals or rock structure, and images of surface features and land cover, all by using the wavelength and the intensity of light.	130.417 Scientific Research and Design (c)(6)(B,C,D) 130.417 Scientific Research and Design (c)(7)(B) 130.417 Scientific Research and Design (c)(8)(C,G)
How can mathematics help *you* become an asteroid hunter?	To calculate Tisserand's Parameter for mathematically describing the orbit of a small body, use the constants of: semi-major axis of the small body; semi-major axis of Jupiter; orbital inclination of the small body.	130.417 Scientific Research and Design (c)(3)(A,B,C,D) 130.417 Scientific Research and Design (c)(4)(D,F) 130.417 Scientific Research and Design (c)(6)(C,D)

Mathematics Assignment Problem(s) or Overarching Question(s)	Mathematics Assignment Objectives	TEKS:
Select a potential landing site for a human mission to Mars. Take the Mars Trek Tour to learn about the tools, layers, and other features available in the interactive Mars map. Explore Mars to select and describe the proposed "exploration zone." Use the line tools to measure distances and find elevations in your region. Create a discussion board post to share the chosen site.	Present a discussion board post to include the location, description and name of a proposed Mars exploration zone. Determine diameter of exploration zone (measured in km). Calculate the area of any craters in your exploration zone (measured in km2). Describe surface features within your exploration zone including elevations (highest/lowest). Describe any named region(s) within your exploration zone. Constructively critique other scholars' posts.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,E,F,G,J) 130.417 Scientific Research and Design (c)(4)(D,G) 130.417 Scientific Research and Design (c)(8)(C,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(B)

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Science Focus Questions	Science Activity Objectives	TEKS:
Are you adding to the hydrofluorocarbon impact of the ozone layer?	Based on the results of a NASA-derived atmospheric chemistry climate model, HFCs cause increased warming of the stratosphere, speed up the chemical reactions that destroy ozone molecules, and accelerate the upward movement of ozone-poor air.	130.417 Scientific Research and Design (c)(4)(A,D) 130.417 Scientific Research and Design (c)(6)(B,C)
Why don't pilots know what's in the clouds?	Current aircraft are equipped with radar capable of detecting larger precipitation in clouds such as rain and hail; however, smaller ice crystals also in clouds are undetected by radar.	130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(9)(A)
How does the brain adapt in space?	Sensory, motor, and cognitive assessments investigate neuroplastic and maladaptive brain changes in crewmembers following long---duration spaceflight. The neurocognitive and neural structural tests are determining the correlation between behavior and mental ability as mapped in the brain.	130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(B,C,G) 130.417 Scientific Research and Design (c)(9)(A)
What happened to Mars's atmosphere?	Loss of atmosphere to space given a combination of greater loss rates and increased solar storms in the past can cause changes to a planet's environment from one that could host microbes at the surface to one that does not.	130.417 Scientific Research and Design (c)(6)(B,C,D) 130.417 Scientific Research and Design (c)(8)(C,G) 130.417 Scientific Research and Design (c)(9)(A)
How are life signatures of atmospheric chemistry like students with pizza?	Methane and oxygen molecules together are a reliable sign of biological activity because methane doesn't last long in an atmosphere containing oxygen-bearing molecules. If both methane and oxygen are together in an atmosphere, the oxygen will react to consume the methane. (Correlation: If pizza and students are together in a room, the pizza must have recently arrived and won't last long.)	130.417 Scientific Research and Design (c)(3)(A,B) 130.417 Scientific Research and Design (c)(4)(A,C) 130.417 Scientific Research and Design (c)(6)(C)

Science Assignment Problem(s) or Overarching Question(s)	Science Assignment Objectives	TEKS:
Based on NASA's astronaut search, what do you think is most important in this selection of astronauts that would inspire you today? Why do you feel your choice is justified? How is this next group of American Artemis space explorers inspirational to you? Create a discussion board post on the required information above, plus write responses to at least two other scholars' posts.	NASA's astronaut search solicits candidates with multiple qualities and characteristics. Determine both pertinent and imperative astronaut criteria from provided resources. Present a discussion board post to include astronaut criteria and resources. Constructively critique other scholars' posts.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,E,F,G,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F) 130.417 Scientific Research and Design (c)(6)(B,C) 130.417 Scientific Research and Design (c)(9)(A) 130.417 Scientific Research and Design (c)(10)(B)

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Technology Focus Questions	Technology Activity Objectives	TEKS:
How can you help NASA SOLVE today's challenges?	Students can contribute their time and expertise to solving problems through crowdsourcing challenges through online platforms, citizen science projects, and education competitions.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(7)(A,B) 130.417 Scientific Research and Design (c)(8)(B,C,G)
How can images from space help protect some of Earth's most beautiful places?	Demonstrate the beauty of our planet using unique satellite images that show more than what is visible to the naked eye. Highlight how remotely-sensed data provides scientists and policymakers with the tools needed to identify and protect Earth's natural ecosystems. Provide citizens of Earth a global perspective from Earth-observing satellites analogous to the mental and spiritual shift experienced by astronauts called "The Overview Effect."	130.417 Scientific Research and Design (c)(4)(A,C,D) 130.417 Scientific Research and Design (c)(6)(C) 130.417 Scientific Research and Design (c)(8)(C)
How is NASA technology saving lives in air, sea, and land rescues?	NASA's role in the international satellite-based search and rescue system known as COSPAS-SARSAT includes improving the location accuracy of emergency beacon technology; developing and testing the proof-of-concept ground station for the medium-altitude satellite system; and providing better guidance for installing Emergency Locator Transmitters on aircraft.	130.417 Scientific Research and Design (c)(4)(C,D) 130.417 Scientific Research and Design (c)(6)(C) 130.417 Scientific Research and Design (c)(9)(A)
How is International Space Station instrumental in learning how to live off Earth and improving life on Earth?	Key aspects of the Environmental Control and Life Support System on the space station include reusing human urine and sweat to provide drinkable water; reducing cost by decreasing the need for resupply missions; and demonstrating more efficient and reliable systems for recycling air and water.	130.417 Scientific Research and Design (c)(4)(A,D) 130.417 Scientific Research and Design (c)(6)(A,B,C,D)
How is NASA using robotic technology on Mars to search for evidence of life and prepare for human exploration?	The suite of tools the Curiosity rover uses to study Mars' habitability include SAM: Sample Analysis at Mars to search for organics, ChemCam: Chemistry and Camera to vaporize rock surfaces for chemical analysis, and RAD: Radiation Assessment Detector to monitor radiation on the Martian surface.	130.417 Scientific Research and Design (c)(4)(C,D,F) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(C,G)
Could life exist on one of Jupiter's icy moons?	The objective of NASA's mission to Jupiter's moon Europa in the 2020s is a flyby at various altitudes to produce high---resolution images, investigate composition and structure of its interior and icy shell, and detect and analyze active water plumes.	130.417 Scientific Research and Design (c)(4)(C) 130.417 Scientific Research and Design (c)(6)(C) 130.417 Scientific Research and Design (c)(9)(A,B,C)

Technology Assignment Problem(s) or Overarching Question(s)	Technology Assignment Objectives	TEKS:
Using the NASA Facts Sheet and NASA @ Home and City: Determine examples of products that came from or were enhanced by Apollo technology that impact your life personally, and describe the personal, societal or community impact/influence of each product; Identify home products that have been created by NASA technology; Trace the diffusion of a NASA technologies into home, city and globally, and explain its affects and benefits; List and explain NASA influenced technologies that are used in your school; Explain how diffusion has led to globalization, and describe its applications in space and on Earth.	NASA technology has been adapted to meet the needs of the private sector, benefiting global competition and the economy; Diffusion is the spread of an idea or innovation from one place to another, and may occur on a local, regional or global scale.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,E,F,G,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,F) 130.417 Scientific Research and Design (c)(6)(B,C,D) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(B)

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Engineering Focus Questions	Engineering Activity Objectives	TEKS:
How do you measure the space environment at the boundaries of Earth's magnetic bubble?	Magnetic field surrounding Earth connects and disconnects from the magnetic field carried by the solar wind, which reconfigures the shape of Earth's magnetic environment, so MMS is gathering data to study this magnetic reconnection.	130.417 Scientific Research and Design (c)(4)(A,C) 130.417 Scientific Research and Design (c)(6)(B,C) 130.417 Scientific Research and Design (c)(9)(A)
Why would you purposefully put volcanic ash into an airplane engine core?	Upon simulating an airplane flying through volcanic ash, NASA scientists learned that the corrosive ash erodes the blades and accumulates in the engine as glass.	130.417 Scientific Research and Design (c)(4)(C,D) 130.417 Scientific Research and Design (c)(9)(A)
How are communication issues on the International Space Station being solved for deep space?	As communication delays decrease, both performance and morale of the space station crew increases.	130.417 Scientific Research and Design (c)(4)(D) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(C,G)
How has Orion's thermal protection system changed since EF-1?	The difference in the thermal protection from Orion's initial Exploration Flight Test-1 (EF-1) flight and the upcoming Exploration Mission-1 flight (EM-1) is it will have a metallic-based thermal control coating bonded to the crew module's thermal protection system back shell tile, and the heat shield will be made blocks.	130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(C,G) 130.417 Scientific Research and Design (c)(9)(A)
How is Kepler finding new worlds?	Transit photometry measures changes in a star's brightness caused by a mini-eclipse.	130.417 Scientific Research and Design (c)(4)(A,B,C) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(C,G)

Engineering Assignment Problem(s) or Overarching Question(s)	Engineering Assignment Objectives	TEKS:
Use the engineering design process to address the question, imagine a solution, plan a design, create the model, experiment/test the model, improve the original design; repeat three times; Make notes, and take a picture for each trial run; Write a conclusion analyzing the engineering design process as it directed the evolving model.	The engineering design process is a series of steps that engineers use to solve problems; All steps of the engineering design process are crucial to mission success at NASA	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(7)(C,D) 130.417 Scientific Research and Design (c)(8)(B,C,F) 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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Mathematics Focus Questions	Mathematics Activity Objectives	TEKS:
How many planets like Earth are out there?	Determining if there is life on other planets within the billions of galaxies is framed by our definition of what is essential to support life as we know it.	130.417 Scientific Research and Design (c)(9)(A,B,C)
What do statistics say about global climate change?	Evidence of climate change indicates carbon dioxide, global temperature and sea level have all been on the rise.	130.417 Scientific Research and Design (c)(4)(A,D,G) 130.417 Scientific Research and Design (c)(6)(B,C) 130.417 Scientific Research and Design (c)(8)(C,G)
How can an algorithm monitoring pilots' brain activity save lives?	Scientists researching functional near-infrared spectroscopy (fNIRS) have explored potential applications in analyzing brain function for dangerous levels of stress, fatigue, and distraction; real-time brain monitoring in motion-filled environments; and measuring neuronal activity by using light to detect blood flow in the brain.	130.417 Scientific Research and Design (c)(4)(A,C,F) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(C,G)
How is radiation exposure measured for people on Earth and in space?	Scientists are examining the use of shielding, nutrition, and medicines for protecting astronauts from the damaging effects of radiation. People living at higher elevations (mile high or greater) experience 2-4 times more radiation than people living at sea level.	130.417 Scientific Research and Design (c)(4)(C,D,G) 130.417 Scientific Research and Design (c)(6)(A,B,C,D)
Why is mathematics pivotal in the BioSuit™ design?	BioSuit™ design enhances astronaut mobility by using mathematical mapping of the lines of non-extension to build a soft exoskeleton; mechanical counter-pressure to replace the gas-filled bladder with a "second skin;" and a gas-pressured helmet to maximize field of vision.	130.417 Scientific Research and Design (c)(3)(A,B) 130.417 Scientific Research and Design (c)(4)(A,B,C,D,E,G) 130.417 Scientific Research and Design (c)(9)(A)
How is mathematics used to find new worlds?	Transit method of searching for shadows is used by Kepler to find potential habitable planets.	130.417 Scientific Research and Design (c)(4)(A,B,C) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(C,G)

Mathematics Assignment Problem(s) or Overarching Question(s)	Mathematics Assignment Objectives	TEKS:
What distances (in AU) would represent the inner and outer boundary of the "habitable zone" for the sun? If you could genetically engineer a new extremophile by merging the traits of two different kinds of extremophiles, which two traits would you select if your extremophile were to live on Jupiter's moon Europa? For each of the terms in the Drake Equation, provide a value and justification: N^* ; f_p ; n_e ; f_l ; f_i ; f_c ; f_L ; Solve the Drake Equation, and determine if your solution is more optimistic or conservative when it comes to thinking about extraterrestrial life with radio technology in the Milky Way galaxy; Explain if/how your solution would change if you were to consider additional galaxies. Could any of the terms in the Drake Equation be equal to zero? Select one of the arguments from the Fermi-Hart paradox and describe which term(s) it would affect in the Drake Equation.	The Drake Equation is from astronomer Dr. Frank Drake, who suggested an organized framework for thinking about life in the galaxy; Physicist Enrico Fermi questioned: If a multitude of advanced extraterrestrial civilizations exists in the Milky Way, why is there no evidence for them such as radio signals, spacecraft, colonies or probes? In 1975, Michael Hart wrote an article in which he detailed the many factors that could lead to such a cosmic silence, and this is sometimes called the Fermi-Hart Paradox; Bacteria and bacteria-like organisms living in places once considered extreme and uninhabitable are called extremophiles.	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,G) 130.417 Scientific Research and Design (c)(5)(A) 130.417 Scientific Research and Design (c)(8)(C,F,G) 130.417 Scientific Research and Design (c)(9)(A,B) 130.417 Scientific Research and Design (c)(10)(A,B)

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Science Focus Questions	Science Activity Objectives	TEKS:
How is the bottom of the food chain related to clouds?	Plankton populations give rise to small organic particles which leave the ocean as aerosol particles creating the nuclei on which cloud droplets form.	130.417 Scientific Research and Design (c)(3)(A,B,C,D) 130.417 Scientific Research and Design (c)(4)(A,D)
Why is bug chemistry studied by NASA Scientists?	Laminar aircraft wings are designed to be aerodynamically efficient; however, when a bug hits the wing it causes airflow to turn turbulent creating additional drag, and increasing fuel consumption.	130.417 Scientific Research and Design (c)(4)(D) 130.417 Scientific Research and Design (c)(6)(B,C,D) 130.417 Scientific Research and Design (c)(9)(A)
Why is space the most beneficial site for a National Laboratory?	Private commercial industry can use a National Laboratory, the International Space Station, in space to investigate in microgravity without the physiological constraints of Earth.	130.417 Scientific Research and Design (c)(4)(D,F) 130.417 Scientific Research and Design (c)(8)(C,G) 1130.417 Scientific Research and Design (c)(9)(A,C)
What happens to a mission when a delicate instrument leaks?	NASA managers suspend the launch due to an errant instrument in the science payload. The role of the impaired instrument, the Seismic Experiment for Interior Structure (SEIS), is to measure ground movements as small as the diameter of an atom.	130.417 Scientific Research and Design (c)(4)(A,B,C,D,F) 130.417 Scientific Research and Design (c)(6)(A,B,C,D)
How is the "Star Wars" universe similar to the Milky Way?	In "Star Wars," the fantasy planet “Alderaan” is blown to bits, which is similar to the real exoplanet extreme destruction of a white dwarf star caught in the act of devouring the last bits of a small planet in 2015.	130.417 Scientific Research and Design (c)(6)(B,C) 130.417 Scientific Research and Design (c)(8)(C,G)

Science Assignment Problem(s) or Overarching Question(s)	Science Assignment Objectives	TEKS:
Define the 5 different Martian terrains: spider, baby spider, swiss cheese terrain, channel network, and craters. Describe Martian “fans” and “blotches.” Screenshot examples of 5 or more fans and/or blotches using the fan tool and blotch tool from your own classification efforts. Explain the difference between CTX and HiRISE. How will NASA Scientists benefit from this project? Explain how citizen science projects work.	Identify and measure features on the surface of Mars. Fans and blotches are mainly formed by the thawing of carbon dioxide present in the polar ice cap during the Southern spring and early summer on Mars. Scientists believe that fans and blotches indicate wind direction and speed and form in the same spot each year and hope to learn how they change. By tracking how fans and blotches form, evolve, disappear, and reform over several Martian years, scientists hope to better understand Mars’ climate. Images of Mars come from NASA’s Mars Reconnaissance Orbiter (MRO) using the High Resolution Imaging Science Experiment (HiRISE) camera, the highest resolution camera ever sent to a planet. Citizen science is interested public, or non-experts, analyzing data of a given research project. It has been shown that the combined assessment of many non-experts can often equal and outperform those of experts and machine learning algorithms.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,E,F,G,H,I,J) 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,G) 130.417 Scientific Research and Design (c)(9)(A,B,C) 130.417 Scientific Research and Design (c)(10)(B)

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Technology Focus Questions	Technology Activity Objectives	TEKS:
What are the benefits of growing flowers and vegetables in space?	The advancements in technology or knowledge gained by growing fruits and vegetables in space include leaf sensors that can text message farmers when plants are "thirsty;" data on the feasibility of fruiting plants like tomatoes to be grown and eaten in space; and smart LEDs that sense the presence of plant tissue to vary light output to specific plant species at specific growth stages.	130.417 Scientific Research and Design (c)(4)(A,B,C,D) 130.417 Scientific Research and Design (c)(6)(B,C,D)
How is NASA working to improve drone technology for commercial applications on Earth and future missions to Mars?	NASA aeronautics engineers are developing technologies to improve drones for reasons including the development of technology so commercial drones may be used to carry cargo and even people one day; improving small drones for real-world uses, such as wildfire spotting, algae monitoring, search-and-rescue, weather monitoring, and scouting for Mars rovers; and advancing geo-fencing systems with a built safety approach to improve the airspace system in which drones fly.	130.417 Scientific Research and Design (c)(4)(A,B,C,D,F) 130.417 Scientific Research and Design (c)(6)(A,B,C,D)
How has 15 years of living and working on the International Space Station improved life on Earth?	Over the past 15 years more than 220 people from 17 countries have visited the space station and have contributed to the development of Eye Tracking Device equipment for corrective laser surgeries; pharmaceuticals to treat people with osteoporosis; and Image-Guided Autonomous Robot for precise movements during biopsies.	130.417 Scientific Research and Design (c)(4)(A,D,F) 130.417 Scientific Research and Design (c)(6)(B,C)
How have advances in technology improved robotic mobility?	The Mars Curiosity Rover inherited from the Mars Exploration Rovers: autonomous navigation software; mast mounted camera to image the surrounding area for potential hazards; and Rocker-bogie suspension system.	130.417 Scientific Research and Design (c)(6)(B,C) 130.417 Scientific Research and Design (c)(9)(A)
How is NASA's work with additive manufacturing or 3-D printing improving rocket technology?	Benefits of using additive manufacturing or 3-D printing for rocket engine parts include: a more affordable propulsion system for SLS; incorporate features that are not possible with traditional manufacturing; and build complex components faster and with fewer parts.	130.417 Scientific Research and Design (c)(4)(A,B,C,D,F) 130.417 Scientific Research and Design (c)(6)(B,C,D) 130.417 Scientific Research and Design (c)(9)(A)

Technology Assignment Problem(s) or Overarching Question(s)	Technology Assignment Objectives	TEKS:
Learn the language of programming using block-based coding and demonstrate your understanding by successfully completing The Hour of Code: Artist, ten increasingly more challenging geometric puzzles. In the final puzzle, you design your own code and create your own geometric design. Then you will create a discussion board post to share the URL for your design.	Learn the language of programming using block-based coding. Design code to create a geometric design. Present a discussion board post to include required criteria. Constructively critique other scholars' posts.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,E,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,G) 130.417 Scientific Research and Design (c)(10)(B)

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Engineering Focus Questions	Engineering Activity Objectives	TEKS:
Why is GOES-R the future of forecasting?	Geostationary Operational Environmental Series satellite-R (GOES-R) will collect three times more data and provide four times better resolution and more than five times faster coverage than current satellites.	130.417 Scientific Research and Design (c)(4)(G) 130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(C,G) 130.417 Scientific Research and Design (c)(9)(A)
How is virtual reality fused with real time for pilots?	Fused reality combines real-world images from a video camera with virtual images generated by a computer in a head mounted display. Fused reality provides a more realistic experience because the aircraft is real and only some external elements are virtual.	130.417 Scientific Research and Design (c)(4)(D,F) 130.417 Scientific Research and Design (c)(6)(B,C,D)
How will NASA power-up in space?	Graphene-based super capacitors could offer the fast charging of a capacitor, while having the slow power discharge of power like a battery.	130.417 Scientific Research and Design (c)(4)(G) 130.417 Scientific Research and Design (c)(6)(B,C)
How is a rocket for missions to Mars making life better on Earth?	Due to its complexity the RS-25 was designed to be highly efficient. To optimize a rocket engine increase thrust, increase weight to thrust ratio, and increase overall propellant efficiency.	130.417 Scientific Research and Design (c)(4)(C,G) 130.417 Scientific Research and Design (c)(9)(A)
How will hydrogen be excavated from the Moon?	Utilizing resources found naturally in extraterrestrial soil will foster more affordable and sustainable human exploration. The lunar mission, Resource Prospector, will extract samples of the lunar regolith. A neutron spectrometer will provide data to determine the type and quantity of elements and compounds.	130.417 Scientific Research and Design (c)(6)(A,B,C,D) 130.417 Scientific Research and Design (c)(8)(C) 130.417 Scientific Research and Design (c)(9)(A)

Engineering Assignment Problem(s) or Overarching Question(s)	Engineering Assignment Objectives	TEKS:
Investigate the augmented reality (AR) of JPL's Spacecraft AR app. Download the app. Choose a robotic spacecraft that you want to investigate, then research the mission of that craft. You will write a discussion post in "tweet" format using no more than 140 characters (about two sentences) to outline your app journey.	Investigate robotic spacecraft with JPL's Spacecraft AR app including NASA's Curiosity Mars rover; Juno, Cassini, and Voyager spacecraft; and the giant, 70-meter NASA Deep Space Network dish. Research the mission of the chosen spacecraft. Present a discussion board post to include required criteria. Constructively critique other scholars' posts.	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(4)(A,B,C,D) 130.417 Scientific Research and Design (c)(5)(A) 130.417 Scientific Research and Design (c)(6)(B) 130.417 Scientific Research and Design (c)(7)(B,D) 130.417 Scientific Research and Design (c)(8)(C,G) 130.417 Scientific Research and Design (c)(10)(B)

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Mathematics Focus Questions	Mathematics Activity Objectives	TEKS:
How is NASA studying lightning using Earth Science data on Earth and from space?	NASA's lightning detection systems on orbit and ground-based instruments provide Earth science data for researchers to investigate how turbulence in storms can improve our expectation of where lightning will start, where it will go, and how energetic it will be; the rate and amount of radiant energy for a greater range of the nearly 4 million lightning strikes across the globe every day; processes that trigger lightning within thunderstorms and what kind of lightning produces terrestrial gamma-ray flashes.	130.417 Scientific Research and Design (c)(4)(A,C,D,G) 130.417 Scientific Research and Design (c)(6)(B,C)
How does wing geometry effect the amount of lift produced on an aircraft?	Straight wing shapes would improve stability at low speeds for a small, lightweight aircraft.	130.417 Scientific Research and Design (c)(4)(D,G) 130.417 Scientific Research and Design (c)(6)(B,C)
What is the role of an Electrical Power Systems analyst for the International Space Station?	The role of the Electrical Power Systems team for the space station includes using mathematical models to predict the amount of power the space station will have for research, experiments, life support, etc.; design and development of new Lithium-ion batteries to replace the nickel-hydrogen battery Orbital Replacement Units; Integration of components that provide power generation, power distribution, and energy storage for the space station.	130.417 Scientific Research and Design (c)(4)(A,B,C,D,F,G) 130.417 Scientific Research and Design (c)(6)(A,B,C,D)
How have students contributed to the design concept of a Mars plane?	Students tested a variety of foundational design concepts for a possible Mars aircraft including boomerang-shaped, a delta-wing with a twist, and flat winglets.	130.417 Scientific Research and Design (c)(4)(G) 130.417 Scientific Research and Design (c)(6)(A,B,C,D)
What is the benefit to using hexagonal mirror segments on the James Webb Space Telescope?	Benefits to using hexagonal mirror segments on the James Webb Space Telescope include segments come close to forming a circle; bigger mirror, better vision; folds inside the rocket for launch.	130.417 Scientific Research and Design (c)(6)(B,C) 130.417 Scientific Research and Design (c)(9)(A)

Mathematics Assignment Problem(s) or Overarching Question(s)	Mathematics Assignment Objectives	TEKS:
Using the airplane design templates (on 8.5" x 11" paper), use a ruler to measure each wing length and chord line in centimeters. Use the measurements to answer each question. Given two wing shapes, rectangle and right triangle or a combination thereof, solve equations for surface area, length of the mean chord, and the wing's aspect ratio. Label with the appropriate units. Show all work.	All aircraft wing designs including rectangular, elliptical, swept and delta, have limitations or restrictions making them suitable only for certain tasks. An aircraft wing's number of lifting surfaces, shape, size and materials used all contribute to an aircraft's performance	130.417 Scientific Research and Design (c)(2)(A,B) 130.417 Scientific Research and Design (c)(3)(A,B,E,F,G,H,I,J) 130.417 Scientific Research and Design (c)(5)(A,B) 130.417 Scientific Research and Design (c)(7)(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)