Aerospace Technology II

8488 36 weeks

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Acknowledgments

The components of this instructional framework were developed by the following curriculum development panelists:

Nasir Ayoub, Instructor, Colgan High School, Prince William County Public Schools and Associate Professor, Northern Virginia Community College, Alexandria/Annandale
Christopher Balthis, Instructor, Botetourt Technical Education Center, Botetourt County Public Schools
Mickey Dawson, Systems Engineer, Leidos, Medford, NY
Joseph J. Franco, Instructor, West Potomac High School, Fairfax County Public Schools
Diana Lewis, AAE, Director of Planning and Engineering, Roanoke Regional Airport Commission, Roanoke-Blacksburg Regional Airport, Roanoke
Daniel Parilla, Instructor, Mount Vernon High School, Fairfax County Public Schools
Veronica L. Spradlin, Instructor, Blacksburg High School, Montgomery County Public

Schools
Matthew J. Thys, Manager, Washington Airports District Office, Federal Aviation Administration, Herndon

Correlations to the Virginia Standards of Learning were reviewed and updated by:

Leslie R. Bowers, English Teacher (ret.), Newport News Public Schools
Vickie L. Inge, Mathematics Committee Member, Virginia Mathematics and Science Coalition
Anne F. Markwith, New Teacher Mentor (Science), Gloucester County Public Schools
Michael L. Nagy, Social Studies Department Chair, Rustburg High School, Campbell County Public Schools

The framework was edited and produced by the CTE Resource Center:

Heather A. Widener, Writer/Editor
Kevin P. Reilly, Administrative Coordinator

Virginia Department of Education Staff

Dr. Lynn Basham, Specialist, Technology Education and Related Clusters
Dr. Tricia S. Jacobs, CTE Coordinator of Curriculum and Instruction
Dr. David S. Eshelman, Director, Workforce Development and Initiatives
George R. Willcox, Director, Operations and Accountability

Office of Career, Technical, and Adult Education
Virginia Department of Education

Course Description

Suggested Grade Level: 11 or 12
Prerequisites: 8487

Aerospace Technology II provides an advanced exploration of flight, space travel, and supporting technologies through a practical approach centered around problem solving. Students explore concepts in aircraft operations; aircraft design, flight safety, and maintenance; airport infrastructure; and small unmanned aircraft systems (sUAS).

Task Essentials Table

For the indicated course(s):

- Tasks/competencies designated by plus icons (⊕) in the left-hand column(s) are essential
- Tasks/competencies designated by empty-circle icons (○) are optional
- Tasks/competencies designated by minus icons (⊖) are omitted
- Tasks marked with an asterisk (*) are sensitive.

Task Number	8488	Tasks/Competencies	
Understanding Aircraft Operations			
39	⊕	Identify the licenses required to become a pilot	
40	⊕	Complete a preflight checklist.	
41	⊕	Simulate flight operations and maneuvers.	
42	⊕	Plan a flight.	
43	⊕	Simulate the navigation of aircraft, using instrumentation.	
Designing Aircraft			
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45	⊕	Construct an airfoil.	
46	⊕	Test an airfoil.	
47	⊕	Analyze airfoil test results.	
48	⊕	Describe factors that affect aircraft design.	
49	⊕	Construct an aircraft.	
50	⊕	Identify emerging aircraft technologies.	
51	⊕	Explain the importance of following a periodic aircraft maintenance schedule.	
52	⊕	Identify aircraft maintenance and repair concerns.	

53	⊕	Identify flight-line safety protocols when performing aircraft maintenance.	
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Examining Aviation Flight Safety			
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56	⊕	Research an aviation accident.	
57	⊕	Identify flight safety equipment and safety protocols.	
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59	⊕	Describe the responsibilities of ATC.	
Working with Model Rockets			
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61	⊕	Describe extra-orbital space exploration systems.	
62	⊕	Design a device to solve a potential problem in space exploration.	
63	⊕	Research trends in the space industry.	
64	⊕	Design a multistage rocket.	
65	⊕	Construct a multistage rocket.	
66	⊕	Operate a multistage rocket.	
67	⊕	Discuss advanced space travel theories and concepts.	
Exploring sUAS Technology			
68	⊕	Identify types of sUAS.	
69	⊕	Research the evolution of UAS.	
70	⊕	Analyze the commercial operations of sUAS.	
71	⊕	Describe the recreational use of sUAS.	
72	⊕	Describe regulations and requirements for sUAS.	
73	⊕	Complete a flight simulation.	

74	⊕	Plan a flight mission.	
75	⊕	Construct a UAS.	
76	⊕	Troubleshoot sUAS.	
77	⊕	Operate an sUAS.	
78	⊕	Research careers that use sUAS.	

Legend: ⊕Essential ○Non-essential ⊖Omitted

Curriculum Framework

Understanding Aircraft Operations

Task Number 39

Identify the licenses required to become a pilot

Definition

Identification should include

- private pilot
- commercial pilot
- instruments pilot
- multi-engine pilot
- flight instructor
- airline transport pilot (ATP).

Process/Skill Questions

- Which agency regulates pilot training?
- Why are the regulations for licensing aircraft pilots important?
- What are the security requirements for pilots?

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18. Transportation Technologies

Task Number 40

Complete a preflight checklist.

Definition

Completion should include

- selecting the appropriate checklist for the type of aircraft
- signing the completed list or co-signing the list with a co-pilot.

Completion may also include an illness, medication, stress, alcohol, fatigue, eating (IMSAFE) checklist.

Process/Skill Questions

- What items might be included on a preflight checklist?
- What is the function of a preflight checklist?
- What do all preflight checklists have in common, regardless of the type of aircraft?
- What drugs (over the counter or prescription) can affect a pilot's ability to fly?
- How long should a pilot wait to fly after scuba diving?

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18. Transportation Technologies

Task Number 41

Simulate flight operations and maneuvers.

Definition

Simulation should include the following operations or maneuvers:

- Taxi
- Takeoff
- Ascent
- Trimming of the aircraft

- Descent
- Pitch
- Roll
- Yaw
- Spin entry and recovery
- Stall and recovery
- Landing

Process/Skill Questions

- Why should every pilot be trained on how to recover from an aerodynamic stall?
- What is a likely consequence of failing to deploy the flaps when landing?
- How can a pilot compensate for the tendency of the aircraft to turn due to propeller motion?
- Why is an approach turn stall so dangerous?

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Task Number 42

Plan a flight.

Definition

Plan should be completed on a Federal Aviation Administration (FAA) Form 7233-1 for both a visual flight rules (VFR) and instrument flight rules (IFR) flight and should include

- the use of waypoints
- bearings
- the use of flight computer
- wind corrections
- time, distance, and fuel consumption
- navigation charts and plotters
- checkpoint determination
- check-in procedures
- special flight rules area (SFRA) departures
- SFRA arrivals
- VFR transitions
- Class B airspace operations.

Process/Skill Questions

- What are the main reasons for filing a flight plan?
- With whom should the pilot file the flight plan?
- What are the consequences of failing to file a flight plan?
- What is a stopover flight plan?
- What are the required fuel minima if an alternate is required (under IFR)?
- When is a flight plan required?

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18. Transportation Technologies

Task Number 43

Simulate the navigation of aircraft, using instrumentation.

Definition

Simulation should include weather data and using various navigation methods:

- Global positioning system (GPS)
- Pilotage and dead reckoning
- Radio/radar or long range (LORAN)
- Map interpretation/topography
- Ground-based navigational aids (e.g., Very High Frequency Omnidirectional Range [VOR], automatic direction finder [ADF])
- Magnetic variation

Navigation instrumentation should use or produce the following data or actions:

- Coordinates
- Vectors
- Airspeed
- Altitude
- Detection (air or ground)
- Inertia (through inertial navigation systems)
- Broadcasts for aircraft location (through beacons—Very High Frequency Omnidirectional Range/Tactical Aircraft Control [VORTAC])

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Designing Aircraft

Task Number 44

Apply the design process to aircraft design.

Definition

Application should include

- identifying the design problem or need
- defining the design problem
- generating multiple solutions (brainstorming)
- evaluating, analyzing, and selecting solution(s)
- implementing solution(s)
- reevaluating solution(s)
- refining as necessary.

Process/Skill Questions

- How does the conceptual design process compare to the scientific method?
- Why should all brainstorming ideas be recorded?
- What is the importance of reevaluating solutions?

ITEEA National Standards

11. Apply the Design Process

18. Transportation Technologies

Task Number 45

Construct an airfoil.

Definition

Construction should include

- following the design process
- adhering to specifications and constraints
- creating internal and external structures
- using multiple fabrication techniques where appropriate
- making adjustments.

Process/Skill Questions

- Why is it necessary to balance the airfoil?
- What effect would using different materials have on an airfoil?

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

13. Assess the Impact of Products and Systems

18. Transportation Technologies

Task Number 46

Test an airfoil.

Definition

Test should be conducted in a wind tunnel and should include documenting predicted and observed values for

- coefficient of lift
- coefficient of drag
- altering factors
- angle of attack.

Process/Skill Questions

- What role does the size and shape of the wind tunnel play in determining design specifications?
- What are methods for testing airfoils?
- How does air foil shape affect performance?
- How might changing the camber of a wing affect performance?

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

13. Assess the Impact of Products and Systems

18. Transportation Technologies

Task Number 47

Analyze airfoil test results.

Definition

Analysis should include

- changing parameters independently
- measuring lift and drag
- conducting a material analysis
- locating the center of gravity/determining balance.

Process/Skill Questions

- What is the correlation between lift and drag in the test results?
- Why is it necessary to balance the airfoil?
- What effect would using a different material have on the airfoil design?

ITEEA National Standards

13. Assess the Impact of Products and Systems

18. Transportation Technologies

Task Number 48

Describe factors that affect aircraft design.

Definition

Description should include

- the characteristics of materials (e.g., density, weight, tensile strength) used in the construction of aircraft, such as aluminum and composites as well as fasteners
- purpose
- payload
- travel distance and durability requirements
- propulsion
- cost (to build and to operate)
- serviceability and maintenance
- recycling, reconstruction, reuse factors.

Process/Skill Questions

- Why is it important to know the payload quantity and type before designing the aircraft?
- What types of reusable materials might be used in aircraft construction?
- How does knowing the purpose of the aircraft help determine the final design?
- Why would a glider wing be different than a high-speed, cross-country airplane wing?

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

18. Transportation Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 49

Construct an aircraft.

Definition

Construction should include

- determining and following a design plan, using the design process
- adhering to specifications and considering constraints
- using tools and software
- testing the aircraft.

Process/Skill Questions

- Which software programs are the best tools for aircraft design?
- What can be learned by testing an aircraft?

- Which components will require the most thought and planning when designing them? Why?
- How does aspect ratio influence the design of an aircraft?
- What is a spar?
- What is a longeron?

ITEEA National Standards

11. Apply the Design Process

12. Use and Maintain Technological Products and Systems

13. Assess the Impact of Products and Systems

18. Transportation Technologies

Task Number 50

Identify emerging aircraft technologies.

Definition

Identification should include

- new materials
- new designs (e.g., flying wing)
- stealth technology
- green power systems
- flight controls
- artificial intelligence
- unmanned aircraft systems (UAS) and small UAS (sUAS)
- unmanned aerial vehicles (UAV)
- remotely piloted vehicles
- propulsion systems
- advances in electric-powered aircraft.

Process/Skill Questions

- How does the weight of the aircraft affect energy consumption?
- What are methods for reducing aircraft weight? What are the considerations when doing so?
- What are the strengths and weaknesses of composites vs. metals?
- What are the ethical concerns of using UAV?

- What is the greatest challenge in terms of the development of electric-powered aircraft?

ITEEA National Standards

18. Transportation Technologies

4. The Cultural, Social, Economic, and Political Effects of Technology

7. The Influence of Technology on History

Task Number 51

Explain the importance of following a periodic aircraft maintenance schedule.

Definition

Explanation should include

- creating or using an existing maintenance checklist for inspection purposes
- distinguishing between airfield maintenance problems and those that require implementation in the hangar.

Process/Skill Questions

- What are the key benefits of following a preventive maintenance schedule?
- How do FAA maintenance requirements differ for commercial and private aircraft?
- What maintenance services are required to be performed by licensed aircraft technicians?
- What maintenance-related differences apply to experimental aircraft vs. certified aircraft?

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18. Transportation Technologies

Task Number 52

Identify aircraft maintenance and repair concerns.

Definition

Identification should include the following:

- Determining the troubleshooting process
- Creating or using a maintenance checklist for inspection purposes
- Following instructions in repair manuals
- Diagnosing issues related to the following:
    - Engine and general mechanics
    - Hydraulics (e.g., lubrication)
    - Electronics
    - Fuel.

Process/Skill Questions

- What key steps should every troubleshooting process include?
- Which aircraft system(s) provide(s) flight control?
- What diagnostic test helps technicians understand the mechanical condition of an engine? Why are maintenance manuals important to flight safety?

ITEEA National Standards

13. Assess the Impact of Products and Systems

18. Transportation Technologies

Task Number 53

Identify flight-line safety protocols when performing aircraft maintenance.

Definition

Identification should include

- technical orders (researching and using FAA or military specification [MIL-SPEC])
- foreign object debris (FOD)
- fueling and combustible fluids (e.g., liquid oxygen [LOX])
- electrical safety
- maneuvering around aircraft (e.g., walking; driving ground vehicles; adhering to safety guidelines near an intake, exhaust, rotor, and wings; towing; maintaining safety pin protocol)
- tool safety and accountability
- on-board oxygen generating system (OBOGS).

Process/Skill Questions

- What is the purpose of an FOD walk?
- What are some hazards that might result from not following tech orders?
- What is LOX, and why does it present a safety concern?
- What are OBOGS?

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18. Transportation Technologies

Task Number 54

Identify flight-line safety equipment.

Definition

Identification should include the following personal protective equipment (PPE):

- Ear (hearing) safety and headsets
- Eye (vision) safety (i.e., safety glasses, goggles)
- Safety shoes
- Gloves

Process/Skill Questions

- At what decibel level and exposure time does hearing loss occur?
- Why are safety shoes required, and how are they constructed?
- Why does ground crew wear reflective clothing?

ITEEA National Standards

18. Transportation Technologies

Examining Aviation Flight Safety

Task Number 55

Identify flight crew safety protocols.

Definition

Identification should include

- the requirements for checklist compliance
- mentality (attitude, alcohol and drug use)
- protective gear and survival equipment
- the use of traffic collision avoidance system (TCAS).

Process/Skill Questions

- What are hazardous attitudes? How can a hazardous attitude be neutralized?
- Why should flight crew avoid drugs and alcohol?
- Why are fire-resistant materials required apparel for military pilots and professional racecar drivers?
- Why are most pilots mandated to comply with TCAS alert instructions?

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18. Transportation Technologies

Task Number 56

Research an aviation accident.

Definition

Research should include

- identifying/summarizing an accident
- determining the causes
- determining corrective actions resulting from a flight disaster.

Process/Skill Questions

- What are some common causes of flight disasters?
- Why are accidents studied?
- What is the National Transportation Safety Board (NTSB), and what is its function?

- What percentage of aviation accidents are caused by pilot error?
- What is meant by the term *contributing factor* in reference to accident investigations?

ITEEA National Standards

18. Transportation Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 57

Identify flight safety equipment and safety protocols.

Definition

Identification should include

- pressurized cabins
- on-board oxygen
- pressure suits/space suits
- posted evacuation procedures
- ejection seats
- personal parachutes
- airframe parachutes
- aircraft instrumentation
- traffic-avoidance technology
- in-flight weather systems.

Process/Skill Questions

- At what minimum altitude level should crews in unpressurized cabins begin to use oxygen?
- What should a pilot do if his/her aircraft experiences rapid depressurization?
- When flying in fog, what informs the pilot that his/her aircraft is in a spin?
- How might a pilot judge his/her readiness to fly?
- What is Automatic Dependent Surveillance—Broadcast (ADS-B)? How has the data transmitted to ADS-B in equipped aircraft improved flight safety?

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18. Transportation Technologies

Task Number 58

Describe the air traffic control (ATC) system.

Definition

Description should include

- surveillance technology
- communication technology
- flight plan processing, and coordination of flight data from one ATC facility to the next
- the concept of dividing airspace into chunks and initiating/accepting handoffs for each aircraft
- the use of a national flow-control facility
- the use of airport capacity rates and how they can change due to wind and weather
- the use of weather reroutes to avoid areas of severe high-altitude weather (e.g., thunderstorms).

Process/Skill Questions

- How effective is ADS-B compared to ground-based radar?
- What are some advantages to ADS-B over radar?
- What are some reasons a flight can be placed into an airborne hold?
- How can high wind affect airport capacity?
- How can en route aircraft capacity be reduced due to weather?
- Why is it important that controllers approve flights prior to their entering the receiving controllers' airspace? How is this process automated?

ITEEA National Standards

18. Transportation Technologies

Task Number 59

Describe the responsibilities of ATC.

Definition

Description should include

- managing controlled airspace (e.g., communicating with aircraft and pilots; providing clearance to land, take off, or divert)
- responding to emergencies
- implementing new technologies
- managing aircraft movements on airfields
- solving problems.

Process/Skill Questions

- What training is required to become an air traffic controller? How often are air traffic controllers reevaluated?
- Who makes the final decision as to whether a plane should land or take off at a controlled airfield?
- How does an airfield without an ATC tower operate?
- Who directs an aircraft in a flight around the world?
- How does ATC control an aircraft throughout a flight?
- What are the evolutions of ATC systems?
- What is a transponder?
- What ATC services are available to VFR aircraft?

ITEEA National Standards

18. Transportation Technologies

Working with Model Rockets

Task Number 60

Model an extraterrestrial surface exploration vehicle.

Definition

Modeling should include determining

- a power source
- a structure
- appendages control
- a power train

- the purpose of the vehicle.

Process/Skill Questions

- What do extraterrestrial vehicles explore?
- How are extraterrestrial vehicles powered?
- How are vehicles controlled on the surface of other planets, moons, or asteroids?
- How do surface exploration vehicles send data back to earth?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

11. Apply the Design Process

12. Use and Maintain Technological Products and Systems

13. Assess the Impact of Products and Systems

9. Engineering Design

Task Number 61

Describe extra-orbital space exploration systems.

Definition

Description should include the features of the Hubble Telescope, Explorer, Voyager, other remote sensing systems, and the methods they use to gather and communicate data and discoveries.

Process/Skill Questions

- What is remote sensing?
- Why are exploration systems sent into space?
- What is being explored? What are the benefits of space exploration?
- What information do space probes provide?

ITEEA National Standards

18. Transportation Technologies

7. The Influence of Technology on History

Task Number 62

Design a device to solve a potential problem in space exploration.

Definition

Design should focus on devices that may alleviate or solve problems relating to

- communications
- physiology of personnel
- instrumentation failure
- shelter
- telemetries
- energy and fuel issues.

Process/Skill Questions

- What are some of the biggest obstacles facing manned space travel today?
- What is astrophysics, and how does it ultimately influence space travel and exploration?
- What makes Mars an attractive planet to explore?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

18. Transportation Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 63

Research trends in the space industry.

Definition

Research should include commercial and military applications for

- communications, media
- space tourism
- surveillance
- intelligence
- mapping
- mining
- climate evaluation.

Process/Skill Questions

- What is the future for commercial space travel?
- How do you learn about current trends in the industry?
- What is space mining?
- How does a satellite dish receive its signal?

ITEEA National Standards

18. Transportation Technologies

Task Number 64

Design a multistage rocket.

Definition

Design should follow the design process, identify safety concerns, and include the following components:

- Engine/propulsion system
- Materials
- Airframe system
- Guidance system
- Control system
- Recovery system

Additional considerations might include

- payload
- aerodynamics
- flight stability
- design tools used, such as software design applications.

Process/Skill Questions

- What are the steps in the design process?
- Why are multistage rockets necessary for space exploration?
- What are the drawbacks to using multistage rockets?
- What alternatives are there to multistage rockets?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

11. Apply the Design Process

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18. Transportation Technologies

9. Engineering Design

Task Number 65

Construct a multistage rocket.

Definition

Construction should include

- following manufacturer (for kits) and instructor guidelines
- following National Association of Rocketry (NAR) safety procedures
- determining components and materials
- determining tools and their uses
- completing all steps of the construction process.

Process/Skill Questions

- What is the NAR, and how is it important to rocketry?
- How can the reuse of multistage rockets be ensured?
- How does the altitude and distance at which the rocket needs to travel influence choices for materials used in its construction?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

11. Apply the Design Process

12. Use and Maintain Technological Products and Systems

13. Assess the Impact of Products and Systems

18. Transportation Technologies

9. Engineering Design

Task Number 66

Operate a multistage rocket.

Definition

Operation should include

- performing the launch at a secured test bed area or other approved location
- following NAR safety procedures
- graphing burnout, trajectory, and duration data to increase future flight efficiency.

Process/Skill Questions

- Why is it important to analyze flight data?
- Why are launches canceled due to weather concerns, even when it appears to be a good, clear day to launch?
- What safety precautions must be observed in every rocket launch?

ITEEA National Standards

18. Transportation Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 67

Discuss advanced space travel theories and concepts.

Definition

Discussion should include the following:

- Worm holes
- Twin Paradox
- Time dilation
- Interstellar propulsion systems

Process/Skill Questions

- What are interstellar propulsion systems?
- How was the presence of black holes validated?

ITEEA National Standards

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Exploring sUAS Technology

Task Number 68

Identify types of sUAS.

Definition

Identification should include a description and purpose for each type.

Process/Skill Questions

- What are some features that would be benefit a sUAS operator for a TV news station?
- What are flight rules for various sUAS?

ITEEA National Standards

18. Transportation Technologies

Task Number 69

Research the evolution of UAS.

Definition

Research should include

- first uses of UAS
- military implications
- commercial applications
- recreational applications.

Process/Skill Questions

- When were UAS first invented?
- What were the early uses of UAS?

ITEEA National Standards

18. Transportation Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 70

Analyze the commercial operations of sUAS.

Definition

Analysis should include the knowledge topics that are required for a Remote Pilot Certificate and the following:

- Part 107 regulations
- Airspace classification, requirements, and restrictions

- Weather and its effects on sUAS performance
- Aircraft loading
- Emergency procedures
- Crew resource management
- Radio communications
- Performance
- Physiological factors
- Aeronautical decision making
- Airport operations
- Maintenance and inspection procedures

Process/Skill Questions

- What are the parameters of sUAS operations?
- Why are anti-collision lights required?
- Where must a registration number be displayed on a sUAS?

ITEEA National Standards

18. Transportation Technologies

4. The Cultural, Social, Economic, and Political Effects of Technology

6. The Role of Society in the Development and Use of Technology

7. The Influence of Technology on History

Task Number 71

Describe the recreational use of sUAS.

Definition

Description should include the regulations for recreational use of sUAS, including quadcopters that weigh more than .55 pounds (lbs). Description also includes accessing reference sources, such as the Academy of Model Aeronautics (AMA) for recreational safety guidelines and FAA Reauthorization.

Process/Skill Questions

- What regulations apply to an sUAS that is used only for recreational purposes?
- Where can an sUAS be flown for recreational purposes?
- What resources are available to help identify safe areas to operate an sUAS?

ITEEA National Standards

18. Transportation Technologies

Task Number 72

Describe regulations and requirements for sUAS.

Definition

Description should include the regulatory differences in recreational and commercial sUAS operations and

- FAA sUAS classifications
- vehicle registration
- emergency waivers
- flight altitude (based on sectional chart data)
- right of way
- airport operations
- radio communications procedures.

Process/Skill Questions

- Which government agency issues remote pilot certification for people who wish to operate sUAS commercially?
- What is the difference between a regulation and a guideline?
- Who is required to register their sUAS?
- What FAA classification covers professional photographers using sUAS?

ITEEA National Standards

18. Transportation Technologies

4. The Cultural, Social, Economic, and Political Effects of Technology

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Task Number 73

Complete a flight simulation.

Definition

Simulation should include the following:

- Radio-controlled (RC) test operations
- Variable weather conditions

Process/Skill Questions

- What affect does increased wind speed have on the operation of a sUAS?
- How can simulation help establish a line of sight for a planned mission?
- What are the differences between first-person view (FPV) controls and RC?

ITEEA National Standards

18. Transportation Technologies

Task Number 74

Plan a flight mission.

Definition

Plan should include the following:

- Number of remote pilots in command, visual observers, and crowd observers
- Designated safety official
- Airport locations and notifications
- Altitude limitations
- Line of sight
- Drone Notices to Airmen (DROTAM) notification
- Communication methods
- Weather briefings

Process/Skill Questions

- When might it be wise to choose a designated safety official?
- Where can one find up-to-date local weather briefings?
- What are the consequences of flying above the maximum allowed altitude?

ITEEA National Standards

18. Transportation Technologies

Task Number 75

Construct a UAS.

Definition

Construction should include

- following manufacturer (for kits) and instructor guidelines
- determining components and materials
- determining tools and their uses
- completing all steps of the construction process.

Process/Skill Questions

- When do UASs need to be registered?
- What are implications for not following build guidelines?
- What are the primary components of a sUAS?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

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18. Transportation Technologies

9. Engineering Design

Task Number 76

Troubleshoot sUAS.

Definition

Troubleshooting should include checking the components of the system for flaws.

Process/Skill Questions

- Why is the ability to troubleshoot sUAS important?
- How would the troubleshooting process differ on a sUAS with load from one without load?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

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Task Number 77

Operate an sUAS.

Definition

Operation should include the following:

- Perform a pre-flight inspection.
- Ensure the area is safe for flight.
- Hover over a predefined area.
- Fly a square pattern.
- Orbit a point.
- Practice precision landings on a predefined point.
- Execute safe shutdown procedures for the sUAS.

Process/Skill Questions

- Which sUAS maneuvers are commonly used to capture images and video?
- Why would it be important to log flight time when operating an sUAS?
- What are the requirements for flying sUAS?
- When is a radio license needed to operate an sUAS?
- What are the components of a checklist?
- What are the safety protocols of the AMA?
- Why is it important to follow manufacturer's guidelines when charging batteries?
- What is the maximum altitude allowed for sUAS?
- How does the position of the load affect the maneuverability of an sUAS?
- How does the weight of a payload affect the battery life of an sUAS?

ITEEA National Standards

18. Transportation Technologies

Task Number 78

Research careers that use sUAS.

Definition

Research includes job opportunities available for sUAS operators and

- salary information
- flight time requirements
- certification requirements.

Process/Skill Questions

- What is the salary for a sUAS operator?
- What are some common commercial uses of sUAS?

ITEEA National Standards

18. Transportation Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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SOL Correlation by Task

39	Identify the licenses required to become a pilot	English: 11.5, 12.5
40	Complete a preflight checklist.	English: 11.5, 12.5
41	Simulate flight operations and maneuvers.	
42	Plan a flight.	English: 11.1, 11.5, 12.1, 12.5
43	Simulate the navigation of aircraft, using instrumentation.	History and Social Science: VUS.14, WHII.14 Mathematics: T.9, MA.7
44	Apply the design process to aircraft design.	English: 11.3, 11.5, 12.3, 12.5
45	Construct an airfoil.	
46	Test an airfoil.	English: 11.5, 11.6, 12.5, 12.6

		Mathematics: G.8, AII.3, AII.7, MA.7
47	Analyze airfoil test results.	English: 11.5, 12.5 Mathematics: G.8, AII.3, AII.7, MA.7
48	Describe factors that affect aircraft design.	English: 11.5, 12.5
49	Construct an aircraft.	English: 11.5, 12.5
50	Identify emerging aircraft technologies.	English: 11.5, 12.5 History and Social Science: VUS.14, WHII.14
51	Explain the importance of following a periodic aircraft maintenance schedule.	English: 11.5, 11.6, 12.5, 12.6
52	Identify aircraft maintenance and repair concerns.	English: 11.5, 12.5
53	Identify flight-line safety protocols when performing aircraft maintenance.	English: 11.5, 12.5
54	Identify flight-line safety equipment.	English: 11.5, 12.5
55	Identify flight crew safety protocols.	English: 11.5, 12.5
56	Research an aviation accident.	English: 11.5, 11.8, 12.5, 12.8
57	Identify flight safety equipment and safety protocols.	English: 11.5, 12.5
58	Describe the air traffic control (ATC) system.	English: 11.5, 12.5 History and Social Science: VUS.14, WHII.14
59	Describe the responsibilities of ATC.	English: 11.5, 12.5
60	Model an extraterrestrial surface exploration vehicle.	English: 11.5, 12.5
61	Describe extra-orbital space exploration systems.	English: 11.5, 12.5 History and Social Science: VUS.14, WHII.14 Science: ES.3
62	Design a device to solve a potential problem in space exploration.	English: 11.1, 12.1 History and Social Science: VUS.14, WHII.14
63	Research trends in the space industry.	English: 11.8, 12.8 History and Social Science: VUS.14, WHII.14 Science: ES.1

64	Design a multistage rocket.	English: 11.1, 11.5, 12.1, 12.5 History and Social Science: VUS.14, WHII.14
65	Construct a multistage rocket.	English: 11.5, 12.5
66	Operate a multistage rocket.	English: 11.5, 12.5 Mathematics: A.7, A.8, A.9, AFDA.1, AII.7, AII.9, PS.4*
67	Discuss advanced space travel theories and concepts.	English: 11.1, 12.1 History and Social Science: VUS.14, WHII.14
68	Identify types of sUAS.	English: 11.5, 12.5
69	Research the evolution of UAS.	English: 11.8, 12.8
70	Analyze the commercial operations of sUAS.	English: 11.5, 12.5
71	Describe the recreational use of sUAS.	English: 11.5, 12.5
72	Describe regulations and requirements for sUAS.	English: 11.5, 12.5 History and Social Science: VUS.14, WHII.14
73	Complete a flight simulation.	
74	Plan a flight mission.	English: 11.1, 12.1
75	Construct a UAS.	English: 11.5, 12.5
76	Troubleshoot sUAS.	
77	Operate an sUAS.	
78	Research careers that use sUAS.	English: 11.8, 12.8

Teacher Resources

Instructional Resources for Aerospace Technology

- **Federal Aviation Administration**
  The FAA site contains information helpful to students. Visit the Aviation and Space Education section (http://www.faa.gov/education/) for additional resources for classroom use.
- **Mars One**
  Mars One is a non-profit organization that intends to establish a human settlement on Mars. The site summarizes the aerospace technology that the mission will require and outlines its feasibility and risks.
- **NASA**
  The site offers the latest news on NASA projects and missions, as well as resources for both educators and students.

U.S. Department of Transportation: K-12 Education and Training

The Center for Transportation Workforce Development supports efforts to build awareness and interest in future careers in transportation among K-12 students. Programs and products help provide the skills necessary to succeed as members of tomorrow's transportation workforce. Learn more.

Design Brief: Flight Planning

Context
General aviation flying is an alternative to driving on the interstates and highways for personal transportation. Before you can get in a plane and fly to your destination, you will need to determine a detailed flight plan in order to keep you safe.

Challenge
You and a friend would like to fly to a football game. Plan a flight from your local airport to Virginia Tech Montgomery Executive Airport (KBCB). You will be using dead reckoning navigation.

Objectives
Upon completion of this design brief, students will be able to determine the following:

1. Total distance
2. Waypoints every 15 nautical miles
3. True heading
4. Magnetic heading
5. Wind correction angle based on current weather conditions
6. Total flight time
7. Total fuel burn

Materials

- VFR Sectional Chart
- Navigation plotter
- Flight computer
- Internet access for obtaining weather information

References

- Aviation Weather Center. http://www.aviationweather.gov/
- Federal Aviation Administration. *Pilot's Handbook of Aeronautical Knowledge*. https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak/

Evaluation
When students have completed their flight plans, discuss the following questions:

- How did you determine the total distance?
- Did you mark your route with waypoints minimally spaced 15 nautical miles apart?
- How did you calculate true and magnetic headings?
- How did you determine the wind correction angle?
- Did you determine how long the trip would take and how much fuel you would use? How did you do so?

Acknowledgement
Christopher Balthis, Wise County Public Schools, Powell Valley Middle School

Entrepreneurship Infusion Units

Entrepreneurship Infusion Units may be used to help students achieve additional, focused competencies and enhance the validated tasks/competencies related to identifying and starting a new business venture. Because the unit is a complement to certain designated courses and is not mandatory, all tasks/competencies are marked “optional.”

Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- College and Work Readiness Assessment (CWRA+)
- National Career Readiness Certificate Assessment
- Workplace Readiness Skills for the Commonwealth Examination

Concentration sequences: *A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.*

- Aerospace Technology I (8487/36 weeks)

Career Cluster: Science, Technology, Engineering and Mathematics	
Pathway	**Occupations**
Engineering and Technology	**Aeronautical Drafter** **Aerospace Engineer** **Aerospace Engineering Technician** **Electro-Mechanical Technician** **Electronics Engineering Technician** **Engineer** **Engineering Technician** **Human Factors Engineer** **Power Systems Engineer** **Quality Engineer**
Science and Mathematics	**Atmospheric Scientist** **Materials Scientist**

Career Cluster: Transportation, Distribution and Logistics	
Pathway	**Occupations**
Facility and Mobile Equipment Maintenance	**Aircraft Mechanic and Service Technician** **Aircraft Structure, Surfaces, Rigging, and Systems Assembler**
Transportation Operations	**Air Traffic Controller** **Flight Engineer** **Pilot** **Transportation Manager**
Transportation Systems/Infrastructure Planning, Management and Regulation	**Traffic Engineer** **Traffic Technician** **Transportation Manager**