



TENNESSEE DEPARTMENT OF

**EDUCATION**

FIRST TO THE TOP

## Aviation I: Principles of Flight

<b>Primary Career Cluster:</b>	Transportation, Distribution & Logistics
<b>Consultant:</b>	<a href="mailto:Rachel.Allen@tn.gov">Rachel Allen, (615) 532-2835, Rachel.Allen@tn.gov</a> <a href="mailto:Casey.Haugner@tn.gov">Casey Haugner Wrenn, (615) 532-4879, Casey.Haugner@tn.gov</a>
<b>Course Code(s):</b>	6070
<b>Prerequisite(s):</b>	<i>Introduction to Aerospace</i> <a href="#">(6068)</a>
<b>Credit:</b>	1
<b>Grade Level:</b>	10-11
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Transportation courses.
<b>Programs of Study and Sequence:</b>	This is the second course in the <i>Aviation Flight</i> program of study.
<b>Necessary Equipment:</b>	<del>TBD</del> <a href="http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml">Equipment lists can be found at http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml</a>
<b>Aligned Student Organization(s):</b>	Skills USA: <a href="http://www.tnskillsusa.com">http://www.tnskillsusa.com</a> Brandon Hudson, (615) 532-2804, <a href="mailto:Brandon.Hudson@tn.gov">Brandon.Hudson@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	If a teacher has completed work-based learning training, <del>appropriate student placement can be offered</del> <a href="#">he or she can offer appropriate placement</a> . To learn more, visit <a href="http://www.tn.gov/education/cte/wb/">http://www.tn.gov/education/cte/wb/</a> .
<b>Available Student Industry Certifications:</b>	None
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
<b>Teacher Endorsement(s):</b>	594
<b>Required Teacher Certifications/Training:</b>	FAA Industry Certification
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml">http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml</a>

### Course Description

*Aviation I: Principles of Flight* builds on the fundamental knowledge and skills learned in *Introduction to Aerospace* while teaching students the essential competencies needed for flight under normal

conditions. Upon completion of this course, students will be able to apply knowledge, skills, and procedures in a variety of simulated flight environments. Moreover, students who complete this course will have the opportunity to move on to advanced study in *Aviation II: Advanced Flight*, where they will continue to ~~log hours in~~ preparation for the FAA Private Pilot written exam. Standards in this course are aligned with Tennessee Common Core State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee Common Core State Standards in Mathematics.\*

## Program of Study Application

This is the second course in the *Aviation Flight* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Transportation, Distribution & Logistics website at <http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml>.

## Course Standards

### Safety

- 1) Gather information from a variety of print and digital sources (such as textbooks, aviation magazines, publications, and industry websites) and write a report based on what the aviation industry is doing to enhance aviation safety. Discuss takeaways to incorporate into future decision making and thought processes that would help in preparation to be a safer pilot or mechanic. (TN CCSS Reading 7, 9; TN CCSS Writing 4, 8, 9)
- 2) Gather information from a variety of print and digital sources (such as textbooks and online industry publications) on the National Transportation Safety Board (NTSB), its purpose, and how the organization performs its duties. Explain how aviation safety is enhanced by NTSB investigations of aircraft accidents. Read and evaluate at least one aviation NTSB accident report and share with the class the NTSB findings, probable causes of the accident, and any NTSB recommendations based on their findings. Students should personalize what they learned from their research to devise strategies for being a safer pilot or mechanic based on what they learned. (TN CCSS Reading 7, 9; TN CCSS Writing 4, 8, 9)

### Careers

- 3) Research collegiate websites and affiliated publications to create a list of postsecondary educational opportunities that prepare students for careers in aviation. Evaluate personal career goals and desires, then determine which opportunity would provide the best preparation for the desired career. Develop a timeline detailing the postsecondary path that will lead to career goals. (TN CCSS Reading 9; TN CCSS Writing 4)

### Aerodynamics

- 4) Research industry manuals and course materials to explain the interrelationships among aerodynamics forces that affect an aircraft on the ground and in flight. Aerodynamic forces include, but are not limited to: ground effect, torque and P-factor, load factor, and aircraft stability. In addition, be able to explain the effects of frost, the significance of angle of attack as it relates to stalls and spins, and how load factors are affected by airplane turns. (TN CCSS Reading 2, 4, 9)



## Aircraft Systems

- 5) Describe the characteristics and functions of an airplane's aileron, elevator, and rudder functions, including the trim system if appropriate, citing technical manuals and industry guidelines. Detail the varying effects of changes in airspeed, density altitude, frost, snow, or ice on each of these functions. ~~Demonstrate-Illustrate~~ the operation of aircraft slats, spoilers, speed brakes, and thrust reversers. (TN CCSS Reading 2, 3, 4)
- 6) Compare and contrast the characteristics and operating principles of both a normally aspirated and turbocharged aircraft reciprocating engine, and relate the advantages and disadvantages of each. Explain how a turbine engine operates, including the different sections within the engine, and relate the advantages and disadvantages between ~~tending to important distinctions between~~ a turbo jet, turbo fan, and turbo prop engine. (TN CCSS Reading 3, 4)
- 7) Draw on technical manuals and manufacturers' guidelines to describe the characteristics and chief functions of the following aircraft systems or instrumentation systems: pitot-static system, vacuum system, flight gyros, navigation radios (such as VOR, ADF, and GPS), and aircraft communications radios. In the context of a specific aircraft, explain the advantages and disadvantages of a glass cockpit versus steam gauges. (TN CCSS Reading 3, 4)
- 8) ~~Perform in~~Deliver an oral presentation or a-guided explanation of the fuel system in a typical training aircraft, highlighting at minimum the following elements: fuel tanks, fuel selector valve, fuel drains, fuel pump(s), carburetor, and fuel injected systems. Distinguish between different types of aviation fuels by sight, color, and/or smell, and determine which type of fuel would be acceptable to use in an ~~an aircraft~~-reciprocating and/or turbine aircraft engine. (TN CCSS Reading 3, 4)
- 9) ~~Perform in~~Deliver an oral presentation or a-guided explanation of the electrical system in a typical training aircraft, highlighting at minimum the following elements: battery, alternator/generator, circuit breakers (CBs), and ~~a~~-12-volt system versus and 24-volt systems. (TN CCSS Reading 3, 4)
- 10) Describe how a retractable landing gear system operates in a typical training aircraft, citing aircraft handbooks and other manuals for illustration during normal operation procedures as well as emergency operation procedures. ~~Demonstrate-Describe or illustrate~~ the differences between pump versus hydraulic pump systems. (TN CCSS Reading 1, 2, 3)
- 11) Research studies on the effectiveness of anti-skid breake systems. Craft an original argument comparing the advantages and disadvantages of these systems, providing a precise explanation of how they operate and whether they conform to industry safety regulations. Share findings in a written or oral format. (TN CCSS Reading 7, 8, 9; TN CCSS Writing 1)

## Flight Environment



Note: The following standards can be used to meet TN CCSS Writing Standard 2 when specifically incorporating a writing assignment in which students write to inform or explain a technical process, concept, or procedure.

- 12) Gather information from a variety of print and digital sources (such as textbooks, aviation magazines, publications, and industry websites) to synthesize concepts related to the formation of weather, convective currents, fronts, and associated meteorological dangers. Discuss the explicit dangers, causes, and effects of thunderstorms; discuss airframe and carburetor icing; mountain waves; wind shear; and temperature/dew point. Describe the factors involved in the formation and dissipation of fog, temperature inversions, and clouds. Apply mathematics concepts to determine the stability or instability of an air mass. (TN CCSS Reading 2, 9; TN CCSS Math N-Q)
- 13) Outline the restrictions associated with each classification of airspace, ~~such as but limited to:~~ Class A, B, C, D, G, Airport Advisory Areas, prohibited or restricted airspace, alert areas, warning areas, and MOCAs. Articulate what relevant laws and regulations govern and apply to airspaces ~~by citing the texts of regulating agencies and agreements~~ as set forth by the Federal Aviation Regulations. (TN CCSS Reading 2, 9)
- 14) Describe the functions of and explain the differences between each of the following aspects of the flight environment: ATIS, AWOS, Clearance Delivery, Ground Controls, Towers, Approach/Departure Controls, Terminal Radar Programs, Air Traffic Centers (ATC), and Flight Service Stations (FSS). Demonstrate different ways to obtain a weather briefing while on the ground (phone call to FSS, internet, TV, etc.), and explain what a pilot should do to get an updated weather briefing while airborne (FSS, Flight Watch, ATC, XM Weather, etc.). (TN CCSS Reading 3, 4)
- 15) Analyze the following texts, synthesize the information contained therein ~~found~~, and demonstrate the ability to retrieve the correct report information in a timely fashion depending on the specific type of information needed to aid in aviation decision making: Aviation Routine Weather Report (METAR)s, Pilot Weather Reports (PIREP)s, Aviation Area Forecast, Terminal Aerodrome Forecast (TAF)s, Weather Depiction Charts, Radar Summary Charts and Radar Weather Reports, En route Flight Advisory Service (EFAS), Wind and Temperature Aloft Forecasts (FB), Significant Weather Prognostic Charts, AIRMETs and SIGMETs. Given a scenario designed by the instructor, make the appropriate go/no go decision based on the information retrieved. (TN CCSS Reading 1, 2, 3, 4, 5, 7, 8, 9)

### **Complex and Abnormal Procedures**

*Note: The following standards may require flight simulation equipment or training within another simulated environment in order to fully meet the range of activities outlined below.*

- 16) Demonstrate understanding of various complex and abnormal procedures and be able to accurately perform the correct procedures given a particular set of conditions, including but not limited to procedures relating to stalls and/or spins recovery, engine failures, engine fires, abnormal combustion, carburetor icing, loss of oil pressure, low oil pressure, high oil and/or CHT temperature(s), aircraft wake turbulence, deteriorating weather conditions, low fuel situations, and medical issues with pilot and/or passengers. (TN CCSS Reading 3)



- 17) Synthesize guidelines from piloting manuals to explain and demonstrate the operation of a constant speed propeller system, compass turning, correction of acceleration/deceleration errors, correction of altimeter errors, proper use of EGT for accurate leaning purposes, and navigation at different types of altitudes. (TN CCSS Reading 2, 3, 4)
- 18) Explain the terminology, outline basic procedures, and demonstrate the ability to perform procedures related to the following:
- Visual Approach Slope Indicators (VASI)
  - Runway markings
  - Taxiway and destination signs
  - Beacons and taxiway lights
  - ATC traffic advisories
  - ATC light signals
  - ELT's and VHF/DR steers
  - Land and Hold Short Operations (LAHSO)
  - Flying rectangular courses
  - Flying S-turns across a road
- (TN CCSS Reading 3, 4)

### Communications

- 19) ~~Role-play the protocol required for both air and ground communications. Role play the communications protocol required for aircraft to ground as well as aircraft to aircraft during a flight.~~ Communications include normal, abnormal, and emergency situations for the following: departing and arriving at non-controlled airports, departing and arriving at controlled airports, communicating with ATC, and requesting and receiving enroute weather from a Flight Service Station or Flight Watch. Explain each ATC light signal and the significance to the pilot. (TN CCSS Reading 3, 4)
- 20) Role-play use of the correct aviation terminology and radio phraseology required during all aspects of a flight, including but not limited to: receiving the current aircraft weather before starting the engine(s); calling ground control for a taxi clearance before taxiing, or advising traffic on the common traffic advisory frequency; and requesting a takeoff/landing clearance. (TN CCSS Reading 3, 4)

### Physiology, Aeronautical Decision Making (ADM), and Judgment Training

- 21) Demonstrate understanding of, recognize the symptoms of, and react properly to the following aeromedical factors affecting a pilot, including but not limited to: pressure effects, ear and sinus blockage, toothaches, stress, fatigue, noise, alcohol/drugs, hypoxia, hyperventilation, spatial disorientation, vision issues, and carbon monoxide poisoning. Perform a preflight self-inspection and determine airworthiness based on an appropriate rubric provided by the instructor. (TN CCSS Reading 3)
- 22) The goal of developing the skills required to make wise decisions is to increase safety. Develop a clear and systematic ADM system, or outline a plan to manage the human factors which may affect whether ~~or~~ a safe or unsafe outcome occurs in the course of flight. Consult ~~exemplar plans or other artifacts~~ recommendations and best practices endorsed from by industry to guide



the process. Students should develop a flow chart showing the proper steps and factors involved in making ~~an~~ effective and timely decisions, including at minimum protocols for assessing pilot-in-command responsibility, communication, workload management, resource use, and situational awareness. (TN CCSS Reading 9; TN CCSS Writing 4, 9)

- 23) Build upon principles previously learned and continue to refine one's thought process relating to judgment training. Based on experiences in this course, compose an essay demonstrating a pilot's good judgment(s) relating to a challenging in-flight situation. (TN CCSS Writing 4)

## Navigation

- 24) Accurately describe how to use the communication radios, navigation radios, ADF, DME, transponder, ELT, and autopilot (if aircraft so equipped), and be able to list any limitations as to their useful range. Explain the process around confirming that each radio or equipment is in working condition per the manufacture's operating manual or normal operation procedures. Student will also understand and explain the following transponder codes (1200, 7700, 7600, and 7500) and be able to list what each code communicates to ATC, as well as the function of Mode C and "Ident" button. (TN CCSS Reading 3, 4)
- 25) Accurately express how the basic GPS ~~satellite~~-system works in an aircraft, and cite specific principles of operation to determine the advantages and disadvantages of GPS navigation over the VOR and NDB systems. (TN CCSS Reading 9)
- 26) Clearly explain how to use ~~a sectional~~ and ~~/or~~ world aeronautical charts ~~as a tool~~ during a cross country flight to determine aircraft's position by use of pilotage and dead reckoning (DR). Given an appropriate scenario provided by the instructor, demonstrate proficiency in the use of lines of longitude and latitude to determine checkpoints or landmarks on a sectional and/or world aeronautical chart, and be able to input that information into a GPS for navigation purposes. Analyze the information retrieved to determine the necessary radio frequencies listed, the different types of airspace, and the altitudes of that airspace by using a sectional and/or world aeronautical chart. (TN CCSS Reading 3, 4, 7, 8; TN CCSS Math N-Q)
- 27) Gather information from a variety of publications such as FAA Advisory Circulars, Airport/Facility Directories, and Notices to Airmen Publications (NTAP) and be able to communicate that information to other crew members in order to successfully plan and fly to a desired cross-country destination safely. (TN CCSS Reading 9; TN CCSS Writing 4)
- 28) Understand and be able to clearly explain how to use a VOR for navigation purposes, determine an aircraft's position, and determine the radial distance from a VORTAC facility. Additionally, determine when an aircraft crosses over a VOR station. Apply this knowledge to use a VOT and/or a VOR in the process of determining whether the VOR is within the accuracy requirements in the FARs. (TN CCSS Reading 3, 4; TN CCSS Math N-Q)

## Predicting Aircraft Performance and Weight & Balance



- 29) Describe the effects of density altitude on aircraft performance, drawing on technical aids and course materials. Given a particular set of conditions, determine and accurately perform density altitude computations. (TN CCSS Reading 9; TN CCSS Math N-Q)
- 30) Consult aircraft manuals, tables, and charts to accurately determine aircraft cruise power settings. Explain in a mock communications scenario with a superior how different cruise power settings were determined, citing the advantages and disadvantages of each. (TN CCSS Reading 9; TN CCSS Math N-Q)
- 31) Consult aircraft manuals, tables, and charts to accurately determine the headwind/tailwind and crosswind components. Report on how each component was determined; based on the analysis, evaluate if the crosswind component is within the manufacturer's approved or demonstrated crosswind component. (TN CCSS Reading 9; TN CCSS Math N-Q)
- 32) Consult aircraft manuals, tables, and charts to accurately determine the required takeoff run distance based on projected aircraft weight, headwind/tailwind component, density altitude, and surface conditions; demonstrate to peers how the takeoff distance was determined. (TN CCSS Reading 9; TN CCSS Math N-Q)
- 33) Consult aircraft manuals, tables, and charts to accurately determine the required takeoff distance to clear a fifty-foot obstacle based on projected aircraft weight, headwind/tailwind component, density altitude, and surface conditions; demonstrate to peers how the takeoff distance was determined. (TN CCSS Reading 9; TN CCSS Math N-Q)
- 34) Consult aircraft manuals, tables, and charts to accurately determine the required landing roll distance based on projected aircraft weight, headwind/tailwind component, density altitude, and surface conditions; demonstrate to peers how the landing distance was determined. (TN CCSS Reading 9; TN CCSS Math N-Q)
- 35) Consult aircraft manuals, tables, and charts to accurately determine the required landing distance to clear a fifty-foot obstacle based on projected aircraft weight, headwind/tailwind component, density altitude, and surface conditions; demonstrate to peers how the **takeoff landing** distance was determined. (TN CCSS Reading 9; TN CCSS Math N-Q)
- 36) Consult aircraft manuals, tables, and charts to accurately confirm that the projected weight is within the manufacturer's approved maximum takeoff weight and that the center of gravity is within the manufacturer's approved takeoff CG envelope. Citing examples drawn from textbooks and manuals, explain weight and balance definitions and relate how to reduce the payload as needed to bring the aircraft within the manufacturer's approved maximum takeoff weight. Additionally, determine how to move passengers and/or cargo to bring the center of gravity within the manufacturer's approved takeoff CG envelope. (TN CCSS Reading 3, 4, 9; TN CCSS Math N-Q)
- 37) Consult aircraft manuals, tables, and charts to accurately confirm that the projected weight is within the manufacturer's approved maximum landing weight and that the center of gravity is within the manufacturer's approved landing CG envelope. Citing examples drawn from textbooks and manuals, demonstrate how to reduce the payload before takeoff as needed to bring the aircraft within the manufacturer's approved maximum landing weight. Additionally,



determine how to move passengers and/or cargo to bring the center of gravity within the manufacturer's approved landing CG envelope. (TN CCSS Reading 3, 4, 9; TN CCSS Math N-Q)

## Standards Alignment Notes

\*References to other standards include:

- TN CCSS Reading: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards ~~2, 6,~~ and 10 at the conclusion of the course.
- TN CCSS Writing: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3, 5, 7, and 10 at the conclusion of the course.
- TN CCSS Math: [Tennessee Common Core State Standards for Mathematics](#): Math Standards for High School: Number and Quantity (pages 58-83).
  - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate with mathematics educators to design project based activities or collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate quantitative reasoning as applied to specific technical concepts. In addition, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.





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## Aviation II: Advanced Flight

<b>Primary Career Cluster:</b>	Transportation, Distribution & Logistics
<b>Consultant:</b>	<a href="mailto:Rachel.Allen@tn.gov">Rachel Allen, (615) 532-2835, Rachel.Allen@tn.gov</a> <a href="mailto:Casey.Haugner@tn.gov">Casey Haugner Wrenn, (615) 532-4879, Casey.Haugner@tn.gov</a>
<b>Course Code(s):</b>	<del>TBD</del> <a href="#">6148</a>
<b>Prerequisite(s):</b>	<i>Introduction to Aerospace</i> <a href="#">(6068)</a> and <i>Aviation I: Principles of Flight</i> <a href="#">(6070)</a>
<b>Credit:</b>	1
<b>Grade Level:</b>	11-12
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Transportation courses.
<b>Programs of Study and Sequence:</b>	This is the third and final course in the <i>Aviation Flight</i> program of study.
<b>Necessary Equipment:</b>	Flight simulators are required in order to fully master many of the standards in this course. Instructors may use a range of equipment to meet this requirement, from simple computer software such as Microsoft Flight SimX to advanced freestanding simulators such as the Redbird FMX. This course also draws on preparation materials for the FAA Private Pilot Ground Test. Sample materials may be found on the FAA website or by order from Gleim Aviation at <a href="http://www.gleim.com/aviation/">http://www.gleim.com/aviation/</a> .
<b>Aligned Student Organization(s):</b>	SkillsUSA: <a href="http://www.tnskillsusa.com">http://www.tnskillsusa.com</a> Brandon Hudson, (615) 532-2804, <a href="mailto:Brandon.Hudson@tn.gov">Brandon.Hudson@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	If a teacher has completed work-based learning training, he or she can offer appropriate placement. For more information, please visit <a href="http://www.tn.gov/education/cte/wb/">http://www.tn.gov/education/cte/wb/</a> .
<b>Available Student Industry Certifications:</b>	Private Pilot Ground Test
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are currently dual enrollment opportunities with specific universities, including Middle Tennessee State University.
<b>Teacher Endorsement(s):</b>	594
<b>Required Teacher Certifications/Training:</b>	FAA Industry Certification
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml">http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml</a>

## Course Description

*Aviation II: Advanced Flight* is the capstone course in the *Aviation Flight* program of study intended to prepare students for careers in aviation. While continuing to build upon the knowledge, skills, and competencies acquired in *Introduction to Aerospace* and *Aviation I*, students in *Aviation II* will receive rigorous instruction in preparation to take the Federal Aviation Administration (FAA) Private Pilot written exam (~~Private Pilot Ground Test~~).

This course goes beyond the mastery of procedures under normal conditions learned in *Aviation I: Principles of Flight* and introduces students to the troubleshooting and diagnostic techniques used by pilots and other aircraft personnel to assess and correct for malfunctions, make adjustments in hazardous weather conditions, and perform other crucial emergency procedures. Continued emphasis is placed on maintaining the safety of flight and developing sound judgment (“judgment training”) throughout these conditions.

In addition, students will develop a keen understanding of advanced aerodynamics and the physics of flight to aid in decision-making and technical adjustments while working under simulated abnormal procedures. Finally, upon ~~completion of this course graduation~~, proficient students ~~may qualify will be better prepared~~ to begin ~~solo flights in an aircraft flight training after graduation~~ in pursuit of a private pilot’s license should they choose. Standards in this course are aligned with Tennessee Common Core State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee Common Core State Standards in Mathematics.\*

## Program of Study Application

This is the capstone course in the *Aviation Flight* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Transportation, Distribution & Logistics website at <http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml>.

## Course Standards

### Aviation Safety

- 1) Apply the safety concepts learned in previous classes to develop several detailed plans to potential problems faced in flight. To guide the planning, students should ask and then answer the question, “What would I do if.....?” in response to problems such as, but not limited to:
  - a. Aircraft door pops open just after lift off
  - b. Engine fails at 100 feet AGL on takeoff
  - c. Engine fails at 500 feet AGL on takeoff
  - d. Oil on windshield on climb out
  - e. Fuel being siphoned out of fuel tank on climb out due to an unsecured fuel cap
  - f. Cabin fire
  - g. Engine fire
  - h. Minimum fuel situation
  - i. Deteriorating weather
  - j. Sick or unruly passenger

(TN CCSS Reading 1, 2, 3)



- 2) Demonstrate understanding of the five hazardous thoughts and associated antidotes to each of the following:

- a. Anti-authority
- b. Impulsivity
- c. Invulnerability
- d. Macho
- e. Resignation

Students will determine if they have one or more of these hazardous thoughts and explain what they do to realize when their decisions may be influenced by a hazardous thought. Students should also explain how they will counteract this thought in order to remain as safe as possible.  
(TN CCSS Reading 3)

### Careers in Aviation

- 3) Demonstrate understanding and be able to explain the privileges and FAA requirements for each of the following pilot certificates and ratings:

- a. Certificates
  - i. Sport
  - ii. Private
  - iii. Commercial
  - iv. Airline Transport Pilot (ATP)
- b. Ratings
  - i. Instrument
  - ii. Sea Plane
  - iii. Multi engine
  - iv. Glider
- c. License (Mechanic)
  - i. Airframe
  - ii. Power Plant

(TN CCSS Reading 1, 2, 3, 7, 9; TN CCSS Writing 4, 8, 9)

### Systems Problem Solving

- 4) Describe the functions and characteristics of an airplane's aileron, elevator, and rudder, including the trim system if appropriate. Troubleshoot system problems to safely land aircraft in a variety of situations, including but not limited to:

- a. Frozen or stuck ailerons
- b. Frozen or stuck elevators
- c. Frozen or stuck rudder
- d. Taking off with a control lock still in place
- e. Aileron, elevator, or rudder hooked up backwards

(TN CCSS Reading 3)



- 5) Describe the functions and characteristics of an airplane's power plant, and troubleshoot system problems to safely land aircraft in a variety of situations, including but not limited to:
  - a. Partial engine failure
  - b. Complete engine failure
  - c. Low oil pressure
  - d. High oil and/or cylinder head temperature(TN CCSS Reading 3)
  
- 6) Describe the functions and characteristics of an airplane's instrument systems, and troubleshoot system problems to safely land aircraft in a variety of situations, including but not limited to:
  - a. Blocked pitot system
  - b. Blocked static system
  - c. Failed vacuum pump
  - d. Failed flight gyros
  - e. Two-way communications failure(TN CCSS Reading 3)
  
- 7) Describe the functions and characteristics of an airplane's fuel systems, and troubleshoot system problems to safely land aircraft in a variety of situations, including but not limited to:
  - a. Low fuel
  - b. Vapor lock
  - c. Contaminated fuel(TN CCSS Reading 3)
  
- 8) Describe the functions and characteristics of an airplane's electrical systems, and troubleshoot system problems to safely land aircraft in a variety of situations, including, but not limited to:
  - a. Alternator/generator failure
  - b. Alternator/generator overcharging
  - c. Electrical fire
  - d. Popped circuit breaker(s)
  - e. Runaway electric trim
  - f. Electrical smoke(TN CCSS Reading 3)

### **Advanced Aerodynamics and Physics of Flight**

- 9) Research, understand, and be able to explain the aerodynamics force that affect an aircraft on the ground and in flight. Anticipate, prevent, and recommend actions to recover from unsafe flight conditions such as, but not limited to:
  - a. Becoming airborne at too slow an airspeed in ground effect
  - b. Aircraft stalling at an unsafe altitude
  - c. Aircraft spin



d. High density altitude airport operations  
(TN CCSS Writing 7, 8, 9)

- 10) Explain the effects of high-density altitudes on aircraft takeoff distances, aircraft rate of climb, aircraft angle of climb, Indicated Airspeed (IAS) versus True Airspeed (TAS), and landing distances. (TN CCSS Reading 9)

### Trends and Emerging Technologies

- 11) Drawing on industry magazines, scholarly research, and news media, explore in an informational essay the chief features, advantages, and disadvantages of emerging aviation technologies, such as unmanned aerial vehicles (UAVs) and mobile technologies gaining prominence in aviation fields. Discuss how these technologies work, how they have impacted (or are expected to impact) the aviation industry, and their impact on aircraft safety. (TN CCSS Reading 7, 9; TN CCSS Writing 2, 4, 8, 9)

### Emergency Procedures

*In order to demonstrate mastery of the following standards students must: (a) be able to determine that there is a problem or failure, (b) determine the problem or failure, (c) properly recall ~~any~~ the appropriate emergency procedure memory checklist, (d) refer to the appropriate written emergency checklist, (e) determine the best plan to deal safely with the problem or failure, (f) and how to safely land the aircraft. Moreover, students must be able to realize there may be multiple problems or failures that can occur at one time; they must be able to develop a plan of action that will deal with the failures while safely flying the aircraft.*

- 12) Demonstrate the ability to follow an emergency procedure for a low fuel situation. Read, recite, and complete the appropriate memory and non-memory checklists in front of peers or in a mock emergency situation while safely flying the aircraft. (TN CCSS Reading 3)
- 13) Demonstrate the ability to follow an emergency procedure for an aircraft fire situation. Read, recite, and complete the appropriate memory and non-memory checklists in front of peers or in a mock emergency situation while safely flying the aircraft. (TN CCSS Reading 3)
- 14) Demonstrate the ability to follow an emergency procedure for a medical emergency situation. Read, recite, and complete the appropriate memory and non-memory checklists in front of peers or in a mock emergency situation while safely flying the aircraft. (TN CCSS Reading 3)
- 15) Demonstrate the ability to follow an emergency procedure for a deteriorating weather situation. Read, recite, and complete the appropriate memory and non-memory checklists in front of peers or in a mock emergency situation while safely flying the aircraft. (TN CCSS Reading 3)
- 16) Demonstrate the ability to follow an emergency procedure for a two-way radio failure situation. Read, recite, and complete the appropriate memory and non-memory checklists in front of peers or in a mock emergency situation while safely flying the aircraft. (TN CCSS Reading 3)



- 17) Demonstrate the ability to follow an emergency procedure for a partial or complete engine failure situation. Read, recite, and complete the appropriate memory and non-memory checklists in front of peers or in a mock emergency situation while safely flying the aircraft. (TN CCSS Reading 3)

### Problems with Aircraft Performance and Weight & Balance

- 18) Consult the manufacturer's approved limits for an aircraft's center of gravity. Explain the associated problems when the aircraft's center of gravity is forward or aft of the approved limits. Given a designated degree of imbalance, determine and demonstrate in a mock setting how to move passengers and/or cargo to bring the center of gravity within the manufacturer's approved takeoff CG envelope. Correctly use a moment index to plot these changes on a loading graph to aid in the demonstration, attending to appropriate units, quantities, and terminology. (TN CCSS Reading 3, 4; TN CCSS Math N-Q, A-APR, A-REI, F-TF, G-GM)
- 19) Consult the manufacturer's approved maximum takeoff weight. Explain the associated problems when the aircraft's takeoff weight is greater than approved by the manufacturer. Calculate the proper reduction in weight for various combinations of passengers and cargo; be "able and willing" to reduce the payload as needed to bring the aircraft within the manufacturer's approved takeoff weight. (TN CCSS Reading 3, 4; TN CCSS Math N-Q, A-APR, A-REI, F-TF, G-GM)

### Cross-Country Planning

- 20) Determine the different factors involved in mapping-planning the best route on each leg of a cross-country flight. For each factor, describe why it should be considered when determining the route, citing, by contrast, what could go wrong if the factor was not presentconsidered. Examples include the following:
- Shortest distance
  - Lowest terrain
  - Best emergency landing options
  - Smoothest air
- (TN CCSS Reading 3)
- 21) Determine the different factors involved in calculating the best altitude to fly on each leg of a cross-country flight. Factors may include the following:
- VFR – Easterly heading (odd thousand + 500') or Westerly heading (even thousand + 500')
  - IFR – Easterly heading (odd thousand) or Westerly heading (even thousand) (below FL 290)
  - Distance between departure airport and destination airport
  - Headwind/tailwind components at different altitudes
  - Terrain features
  - Emergency landing options
  - Smoothest air



- h. Pressurized versus non-pressurized aircraft  
Given a specific route, calculate optimum altitude for all stages of a cross-country flight, incorporating consideration of the factors identified above and relying on [topographic maps](#), [sectional and world aeronautical charts](#), aircraft specifications, and other resources to make proper determinations. (TN CCSS Reading 3; TN CCSS Math N-Q)
- 22) Given a specific flight route, determine the headwind/tailwind component on each leg of a cross-country flight. Specifically,
- Determine [actual forecast](#) winds aloft for each leg ~~as well as possible altitudes~~
  - Determine best altitude for each leg
  - Determine headwind/tailwind component ~~for best altitude~~ for each leg
- (TN CCSS Reading 3; TN CCSS Math N-Q, [A-APR](#), [A-REI](#), [F-TF](#), [G-GM](#))
- 23) Given a specific flight route, determine the estimated groundspeed on each leg of a cross-country flight. Specifically,
- Determine altitude
  - Determine true airspeed (TAS)
  - Determine headwind/tailwind component
  - Determine crosswind component
  - Determine estimated groundspeed ([GS](#))
- (TN CCSS Reading 3; TN CCSS Math N-Q, [A-APR](#), [A-REI](#), [F-TF](#), [G-GM](#))
- 24) Given a specific flight route, determine the estimated magnetic heading required for each leg of a cross-country flight. Specifically,
- Determine True Course (TC) / Magnetic Course (MC)
  - Determine crosswind component
  - Determine True Heading (TH)
  - Determine amount of variation; show how to add variation if it is a Westerly variation and subtract variation if it is an Easterly variation
  - Determine Magnetic Heading (MH)
- (TN CCSS Reading 3; TN CCSS Math N-Q, [A-APR](#), [A-REI](#), [F-TF](#), [G-GM](#))
- 25) Citing relevant examples and supporting texts, explain to both a lay audience and a technical audience the concept of estimated time enroute (ETE) and the effect of flying through different time zones. For a given scenario, determine and communicate departure and arrival times in local times and GMT. (TN CCSS Reading 2; TN CCSS Math N-Q)
- 26) Correctly [simulate how to](#) complete, file, activate, and close or cancel a VFR ~~or IFR~~ flight plan, following proper procedures and determining the information requested in each box of the flight plan. (TN CCSS Reading 3)
- 27) Research, role play, communicate, and write about the factors involved in correctly departing from and arriving at an airport. For each of the following, consult and cite [the Airman's Information Manual](#) and FAA guidelines when modeling the behaviors necessary for successful takeoff and landing, including communications with ground control, air traffic control, any passengers, and relevant superiors, peers, and authorities:



- a. Controlled airport – Departure
    - i. ATIS
    - ii. Clearance delivery (assigned headings, altitudes, transponder codes, departure frequencies)
    - iii. Ground control (taxi instructions)
    - iv. Tower (VFR flight plan activation)
    - v. Departure control
  
  - b. Controlled airport – Arrival
    - i. ATIS
    - ii. Approach control (tower)
    - iii. VFR flight plan closure
    - iv. Ground Control (taxi instructions)
  
  - c. Non-controlled airport – Departure
    - i. AWOS
    - ii. CTAF / Unicom (pre-taxi communication, pre-takeoff communication)
    - iii. Proceeding on course
    - iv. VFR Activation with FSS
  
  - d. Non-controlled airport – Arrival
    - i. AWOS
    - ii. CTAF / Unicom (airport advisory, pre-pattern communication, pattern communication, base communication, clearing runway communication)
    - iii. VFR flight plan closure with FSS via radio or telephone
- (TN CCSS Reading 2, 3, 4, 9; TN CCSS Writing 4, 9)

### **Federal Aviation Regulations (FARs)**

- 28) Demonstrate understanding and be able to explain important FARs that relate to Private Pilot operations included in the following, citing specific text and wording from the regulations:
- a. FAR Part 1
  - b. FAR Part 21
  - c. FAR Part 39
  - d. FAR Part 43
  - e. FAR Part 61
  - f. FAR Part 71
  - g. FAR Part 91
  - h. NTSB Part 830

Articulate why these regulations are necessary and analyze how the FAA has structured the FARs in order to quickly retrieve such information in the future. (TN CCSS Reading 1, 2, 4, 5)

### **Judgment Training**

- 29) Continue to explore and demonstrate understanding of proper techniques for improving pilot judgment and decision-making skills in every aspect of the pre-flight, in-flight, and post-flight stages.

### **FAA Private Pilot Written Exam Preparation**



*Note on the FAA Private Pilot Exam: Throughout all three courses in the Aviation Flight program of study, students will be exposed to the FAA Private Pilot written exam questions based on the material being covered. Upon completion of this course, students may qualify to sit for the exam at the discretion of the instructor, and based upon performance on a practice exam as indicated below.*

- 30) Students will demonstrate mastery of corresponding course content for the FAA Private Pilot written exam when achieving a score of 80% on a practice 60-question exam.

## Standards Alignment Notes

\*References to other standards include:

- TN CCSS Reading: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 6, 7, and 10 at the conclusion of the course.
- TN CCSS Writing: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 1, 3, 5, and 10 at the conclusion of the course.
- TN CCSS Math: [Tennessee Common Core State Standards for Mathematics](#): Math Standards for High School: Number and Quantity, [Algebra, Functions, Geometry](#) (pages 58-83).
  - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate with mathematics educators to design project based activities or collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate quantitative, [algebraic, functional, and geometric](#) reasoning as applied to specific technical concepts. In addition, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.





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## Distribution & Logistics I

<b>Primary Career Cluster:</b>	Transportation, Distribution & Logistics
<b>Consultant:</b>	<a href="mailto:Rachel.Allen@tn.gov">Rachel Allen, (615) 532-2835, Rachel.Allen@tn.gov</a> <a href="mailto:Casey.Haugner@tn.gov">Casey Haugner Wrenn, (615) 532-4879, Casey.Haugner@tn.gov</a>
<b>Course Code(s):</b>	6072
<b>Prerequisite(s):</b>	<i>Foundations of Distribution and Logistics</i> <a href="#">(6069)</a>
<b>Credit:</b>	1
<b>Grade Level:</b>	10-11
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Transportation courses.
<b>Programs of Study and Sequence:</b>	This is the second course in the <i>Distribution &amp; Logistics</i> program of study.
<b>Necessary Equipment:</b>	None
<b>Aligned Student Organization(s):</b>	Skills USA: <a href="http://www.tnskillsusa.com">http://www.tnskillsusa.com</a> Brandon Hudson, (615) 532-2804, <a href="mailto:Brandon.Hudson@tn.gov">Brandon.Hudson@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	If a teacher has completed work-based learning training, <b>appropriate student placement can be offered</b> he or she can offer <b>appropriate placement</b> . To learn more, visit <a href="http://www.tn.gov/education/cte/wb/">http://www.tn.gov/education/cte/wb/</a> .
<b>Available Student Industry Certifications:</b>	None
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
<b>Teacher Endorsement(s):</b>	503
<b>Required Teacher Certifications/Training:</b>	None
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml">http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml</a>

### Course Description

*Distribution & Logistics I* prepares students for entry into the warehouse and distribution career field. Course content emphasizes a deep understanding of the dynamics of distribution and logistics operations, the warehousing skills needed for the tracking and managing of inventory, and the problem-

solving skills used by logisticians in today's complex business environments. Safety, tools, equipment, operations, processes, customer fulfillment, product lifecycle, future trends, and regulatory issues are all covered in depth. Standards in this course are aligned with Tennessee Common Core State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee Common Core State Standards in Mathematics.\*

## Program of Study Application

This is the second course in the *Distribution & Logistics* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Transportation, Distribution & Logistics website at <http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml>.

## Course Standards

### Occupational Safety

- 1) Demonstrate the ability to comply with personal and environmental safety practices associated with the appropriate handling and storage methods of materials in accordance with local, state, and federal safety and environmental regulations.
  - a. Adhere to responsibilities, regulations, and Occupational Safety & Health Administration (OSHA) policies regarding reporting of accidents and observed hazards, and regarding emergency response procedures.
  - b. Interpret Material Safety Data Sheets (MSDS) to determine any hazards related to materials handled. Use appropriate signs and symbols to identify hazardous materials within warehouses and during transportation of the materials.
  - c. Maintain a portfolio record of written safety examinations and equipment examination for which the student has passed an operational checkout by the instructor.
  - d. Identify dangerous goods and be able to discuss how they influence warehouse and transportation decisions; and determine the appropriate corrective actions if faced with a hazardous situation, as outlined by the *Emergency Response Guidebook* published by the U.S. Department of Transportation.(TN CCSS Reading 3, 4; TN CCSS Writing 4)

### Logistics & Transportation

- 2) Research the four subdivisions of logistics in light of organizational management practices and prepare an explanatory paper or presentation that discusses the similarities and differences between the subdivisions:
  - a. Business logistics
  - b. Military logistics
  - c. Event logistics
  - d. Service logistics(TN CCSS Reading 1, 4; TN CCSS Writing 2, 4, 6, 7, 9)
- 3) While variations exist from organization to organization, the following functions are often included under the logistics umbrella. Synthesize information from textbook(s), print and online industry sources to describe each. Create a graphic illustrating how they interact with one



another and write an accompanying explanatory narrative that indicates how each affects product costs and profitability.

- a. Transportation
- b. Warehouse and storage
- c. Intermodal freight transport
- d. Materials handling
- e. Inventory control
- f. Order fulfillment
- g. Inventory forecasting
- h. Production planning/scheduling
- i. Customer service
- j. Facility location
- k. Return goods handling
- l. Parts and service support
- m. Salvage and scrap disposal

(TN CCSS Reading 1, 4, 7; TN CCSS Writing 2, 4, 6, 7, 9)

- 4) Describe the tradeoffs that occur between transportation and inventory costs. Drawing on examples from real products and companies, explain when it is more profitable to use more expensive transportation and maintain smaller inventory, and when it is more advantageous to use cheaper transportation and maintain larger inventories. Discuss the application of key concepts such as Just-in-Time (JIT) strategy, lean dynamics, and Kanban systems. (TN CCSS Reading 1, 4, 7, 8; TN CCSS Writing 1, 4, 8)
- 5) Demonstrate the ability to calculate and explain to others the purchase cost, ordering cost, and holding cost for a given material or product within the supply chain. Determine total cost as a function of these costs and demonstrate the effects on profit for a specified price and quantity. (TN CCSS Reading 3, 4; TN CCSS Math N-Q, A-CED, F-IF, F-BF)
- 6) Perform inventory calculations to minimize costs as would a logistics manager for a given company. Using algebraic reasoning and appropriate units, determine the economic order quantity (EOQ) and reorder point (ROP) for a given product. Research forecasting models for the specified product and to understand how companies predict EOQ and ROP using logistics management. (TN CCSS Reading 3, 4, 9; TN CCSS Math N-Q, A-CED, F-IF, F-BF)

### Warehousing

- 7) Compare and contrast the warehousing requirements for a variety of different products including items such as perishable foods, hazardous chemicals, large items like furniture and appliances, school supplies, seasonal items, and subassemblies for the manufacture of a given product. (TN CCSS Reading 1; TN CCSS Writing 4, 7, 8)
- 8) Write an informative report describing different warehouse layouts and equipment used to move materials in each. Differentiate between bulk and rack storage, and indicate situations when each is employed. List the three categories of aisle spacing and describe the advantages and disadvantages of each. (TN CCSS Reading 1, 4; TN CCSS Writing 2, 4, 7)



- 9) Investigate various warehouse management system (WMS) software programs and create a comparison chart that could be used by a warehouse manager to select software to meet the specific needs of his/her operation. (TN CCSS Reading 1, 4, 7; TN CCSS Writing 2, 4, 8)
- 10) Demonstrate the ability to complete and interpret warehouse documents including, but not limited to, packing slips, bills of lading, advance shipment notices, distribution sheets, pick lists, invoices, special orders, and inventory forms. (TN CCSS Reading 3, 4, 5, 6)

### Regulations

- 11) Create a chart listing international, national, state, and local agencies and organizations that regulate some part of the supply chain and the role played by each. Indicate what areas each agency has jurisdiction over. Example agencies include:
  - a. U.S. Department of Transportation (DOT)
  - b. U. S. Customs and Border Protection (CBP)
  - c. Homeland Security (HS)
  - d. Environmental Protection Agency (EPA)
  - e. Occupational Safety and Health Administration (OSHA)
  - f. World Shipping Council
  - g. United Nations, including the International Maritime Organization (IMO)
  - h. International Organization for Standardization (ISO)
  - i. World Customs Organizations (WCO)
  - j. City and county laws and ordinances
  - k. State laws(TN CCSS Reading 1, 4; TN CCSS Writing 2, 4, 8)
- 12) Analyze the impact of international trade agreements on logistics decisions. (TN CCSS Reading 1, 2, 4; TN CCSS Writing 7, 8, 9)
- 13) Research International Commercial Terms, also known as INCOTERMS®, developed by the International Chamber of Commerce. Create a table or chart to indicate what each of the three letter standard terms means by delineating the respective obligations of the buyer and seller involved in the delivery of goods from the Seller to the Buyer. (TN CCSS Reading 4; TN CCSS Writing 4)

### Problem Solving

- 14) Solve given problems related to transportation of goods and warehousing by evaluating data and presenting solutions or recommending appropriate decisions. Use spreadsheets and/or other software in calculating “what if” scenarios as appropriate. Types of problems should include scenarios such as:
  - a. Selecting routes and modes of transportation between a distribution center and various markets
  - b. Calculating the carbon footprint of similar products shipped from different locations and by different modes of transportation
  - c. Optimizing warehouse usage
  - d. Planning for the moving and handling of hazardous goods
  - e. Analyzing the impact of natural disasters on supply chain



f. Developing strategies for ~~“going green”~~working toward the sustainable use of specific materials and modes of transportation  
(TN CCSS Reading 3, 4; TN CCSS Writing 4, 7, 8; TN CCSS Math N-Q, A-CED, F-IF, F-BF)

15) Given a selected case, plan for the storage, movement, and delivery of a specified good or service from one location to another. Using logistics data and applying concepts learned in the course, justify the tradeoff decisions (i.e., mode of transport, holding time, delivery constraints such as fuel cost) in the proposed plan, coherently explaining the logic behind each choice as if presenting to a senior manager. For example, outline the plan for fulfilling an order for a personal computer by a fixed date and transporting it through customs to a purchaser in a foreign country. (TN CCSS Reading 3; TN CCSS Writing 1, 4, 7, 8, 9; TN CCSS Math N-Q, A-CED, F-IF, F-BF)

### Trends

16) Analyze case studies of the logistics operations of various retail companies to see how they plan for and adjust their operations to remain competitive with companies such as Amazon, WalMart, and Kroger. (TN CCSS Reading 1, 4; TN CCSS Writing 4)

17) Using websites and journals from professional organizations related to transportation, distribution, and logistics, identify five trends that are impacting local, regional, national, and international supply chains. Trends could include such factors as rising fuel costs, movements toward fully automated warehouses, and greening the supply chain. Summarize research in an informative essay that includes:

- description of the trend and explanation of how it affects the supply chain,
- examples of how various businesses are responding to the trend, and
- an outline of the information that must be considered before a business implements any change, including a formal cost-benefit analysis.

(TN CCSS Reading 1, 4, 8; TN CCSS Writing 2, 4, 6, 7, 8)

### Project

18) Work with a local business to analyze its supply chain. Create a report and presentation with graphics and map(s) that depicts both the incoming supply chain and outgoing supply chain. Indicate what modes of transportation and types of warehousing operations it uses. Outline changes that it has made or plans to make in its supply chain and why it made/will make them.  
(TN CCSS Writing 2, 4, 6)

### Standards Alignment Notes

\*References to other standards include:

- TN CCSS Reading: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 5, 6, and 10 at the conclusion of the course.



- TN CCSS Writing: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3, 5, and 10 at the conclusion of the course.
- TN CCSS Math: [Tennessee Common Core State Standards for Mathematics](#): Math Standards for High School: Number and Quantity, Algebra, Functions (pages 58-83).
  - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate with mathematics educators to design project based activities or collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate quantitative, algebraic, and functional reasoning as applied to specific technical concepts. In addition, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.
- *Emergency Response Guidebook*:  
<http://phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/Hazmat/ERG2012.pdf>





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## Distribution & Logistics II: Management

<b>Primary Career Cluster:</b>	Transportation, Distribution & Logistics
<b>Consultant:</b>	<a href="mailto:Rachel.Allen@tn.gov">Rachel Allen, (615) 532-2835, Rachel.Allen@tn.gov</a> <a href="mailto:Casey.Haugner@tn.gov">Casey Haugner Wrenn, (615) 532-4879, Casey.Haugner@tn.gov</a>
<b>Course Code(s):</b>	6024
<b>Prerequisite(s):</b>	<a href="#">Foundations of Distribution and Logistics (6069)</a> , <a href="#">Distribution &amp; Logistics I (6072)</a>
<b>Credit:</b>	1
<b>Grade Level:</b>	11-12
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Transportation courses.
<b>Programs of Study and Sequence:</b>	This is the capstone course in the <i>Distribution &amp; Logistics</i> program of study.
<b>Necessary Equipment:</b>	None
<b>Aligned Student Organization(s):</b>	Skills USA: <a href="http://www.tnskillsusa.com">http://www.tnskillsusa.com</a> Brandon Hudson, (615) 532-2804, <a href="mailto:Brandon.Hudson@tn.gov">Brandon.Hudson@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	If a teacher has completed work-based learning training, <a href="#">appropriate student placement can be offered</a> <a href="#">he or she can offer appropriate placement</a> . To learn more, visit <a href="http://www.tn.gov/education/cte/wb/">http://www.tn.gov/education/cte/wb/</a> .
<b>Available Student Industry Certifications:</b>	None
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
<b>Teacher Endorsement(s):</b>	503
<b>Required Teacher Certifications/Training:</b>	None
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml">http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml</a>

### Course Description

*Distribution & Logistics II: Management* prepares students for a capstone learning experience in logistics, planning, and management systems. A range of business tasks will be undertaken to support the operation of supply chain processes including coordinating and controlling the order cycle and

associated information systems. This course is designed to prepare students for further education and careers in the distribution and logistics industry. Through exposure to crucial business activities such as project management, analyzing logistical problems, and producing new solutions, students will acquire advanced skills related to business professionalism, ethics, policies, and communication. While not required, optional standards outlining an internship experience can provide additional development and practice of technical skill. Standards in this course are aligned with Tennessee Common Core State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee Common Core State Standards in Mathematics.\*

### Program of Study Application

This is the third and final course in the *Distribution & Logistics* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Transportation, Distribution & Logistics website at

<http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml>.

### Course Standards

#### Occupational Safety

- 1) Create a safety procedures manual for new employees working in a warehouse facility. Outline in the manual the personal and environmental safety practices associated with the appropriate handling and storage methods of materials in accordance with local, state, and federal safety and environmental regulations.
  - a. Include employee responsibilities and protocols for adhering to regulations, and Occupational Safety & Health Administration (OSHA) policies regarding reporting of accidents and observed hazards, and regarding emergency response procedures.
  - b. Include information on how to interpret Material Safety Data Sheets (MSDS) to determine any hazards related to materials handled.
  - c. Include the appropriate signs and symbols that must be used to identify hazardous materials within warehouses and during transportation of the materials.(TN CCSS Reading 3, 4; TN CCSS Writing 4)
- 2) Prepare and deliver a safety demonstration on the use of a specific piece of safety equipment or personal protective equipment (PPE).

#### Communications and Professionalism

- 3) Practice effective verbal, nonverbal, written, and electronic communication skills for working with customers, employees, dispatchers, wholesalers, and retailers. Demonstrate the ability to listen attentively, speak courteously and respectfully, discuss client ideas/vision, resolve conflicts, and respond to customer objections or complaints to the customer's satisfaction. (TN CCSS Writing 4)
- 4) Collect Codes of Ethics from various transportation, distribution, and logistics-related professional organizations and/or companies, and examine areas of commonality. Analyze what these statements say about the work culture at a particular organization, and identify company values that resonate with one's own. Discuss how one would look for evidence of positive values



when conducting a job search. Synthesize principles from the codes investigated to create a personal code of ethics, to be included in a career portfolio compiled throughout the course. (TN CCSS Reading 1, 2, 4, 5, 6, 9; TN CCSS Writing 4, 8, 9)

- 5) Research job descriptions, career information, and online job boards to identify desirable employability skills and character traits for professionals working in the area of transportation, distribution, and logistics. Compile a class list of those skills and attributes. For each item on the class list, define the characteristic, state why it is important for people working in the field, and list at least two ways to build that skill. Possible skills include:
  - a. Collaboration
  - b. Honesty
  - c. Reliability
  - d. Communication
  - e. Responsibility
  - f. Problem-solving
  - g. Ability to work under pressure(TN CCSS Reading 1, 4; TN CCSS Writing 4, 8)

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### **Distribution and Logistics Technology**

- 6) Demonstrate proficiency with Microsoft Office programs by using them to complete class assignments including writing papers, making presentations, solving problems, keeping records, and managing data. (TN CCSS Writing 6)
- 7) Research the different applications of computers and programmable controllers in managing distribution and logistics operations. Find examples of the software and technology used for those applications. Create a catalog sorted by type of application that includes the following:
  - a. A generic description of the purpose of each type of software/technology included. Possible categories to include are electronic commerce (e-commerce); barcode software; enterprise resource planning (ERP); distribution resource planning (DRP); and electronic data interchange (EDI).
  - b. An entry for each specific software/technology that falls in the application category, including graphics, product description, key features, best uses, and a link to the product website.(TN CCSS Reading 2, 4, 7; TN CCSS Writing 2, 4, 6, 7)
- 8) Write an explanatory paper describing the benefits of having all of an organization's software programs integrated so that information is only entered once. Cite evidence from case studies, articles, and other sources. (TN CCSS Reading 1, 4, 7; TN CCSS Writing 2, 4, 7, 8)

### **Warehousing Management**

*Note: For the following standards, teachers are encouraged to leverage relationships with local businesses to bring in representatives for class discussions and/or supply examples of management processes and other relevant documents.*

- 9) Gather information from field visits, texts, and personal communications with business representatives to create layout plans for processing incoming and outgoing, cross-docking, and



storage of products. Provide a sketch of the shipping and receiving area and write out a standard operating procedure for each. (TN CCSS Reading 1, 4, 7)

- 10) Create a flow chart for the processing of incoming goods and materials using standardized industry protocols and procedures. Include processes for dealing with damaged, incorrect, and incomplete orders. (TN CCSS Reading 3, 7; TN CCSS Writing 4)
- 11) Simulate the work of a warehouse manager or logistician by planning for the shipment of a product. Given a set of constraints, such as a specified timetable, destination, quantity, or other factor, determine the number of pallets needed and assign dock doors to accommodate the appropriate number of loads. (TN CCSS Reading 3, 4; TN CCSS Math N-Q, A-CED)
- 12) Develop a written profile of how a local business coordinates and controls the order cycle and associated information systems of scheduling, cost analysis, documentation confirmation, packing lists, MSDS, product seals, packaging types, packaging labels, and routing issues. Include a description of the performance metrics used to monitor the quality, quantity, cost, and efficiency of the movement and storage of goods. (TN CCSS Writing 2, 4)
- 13) Apply skills learned in Distribution & Logistics courses to analyze a case study in which the supply chain for a particular product or company was disrupted. In a written paper or presentation, describe what went wrong and how management addressed the problem. Discuss whether or not the issue was resolved, and the impact it had on either the supply chain or the industry as a whole. For example, analyze the 2002 Long Beach Port Strike and demonstrate through graphic representations and narrative writing how the strike impacted a range of manufacturers, retailers, and consumers in multiple locations. (TN CCSS Reading 2, 9; TN CCSS Writing 2, 4, 7, 9)

#### Capstone Project

- 14) Plan a distribution center. In a written plan complete with accompanying graphic illustrations, charts, and/or tables, outline the following:
  - a. Select a location for the center and indicate on a map the service area for the distribution center.
  - b. Using online mapping applications, identify businesses within the area that could be potential customers.
  - c. Determine the type of distribution center to build based on potential customers—for example, a retail distribution center, a service parts distribution center, a catalog or e-commerce distribution center, or a 3PL (3rd party) distribution center.
  - d. Include a brief description of how each of the following operations will be handled at the distribution center: dock operations, receiving operations, storage operations, picking operations, packaging operations, shipping operations, processing returns.
  - e. Evaluate possible material handling and storage equipment for use in the distribution center.
  - f. Investigate the modes of transportation to be used to ship materials and develop guidelines for when each should be used. Consider truck, rail, air transport, maritime transport, intermodal, and outsourcing as methods of moving product.



- g. Develop clearly defined and measurable metrics to assess progress, and supply sample cost and revenue projections based on specified inventory, overhead, variable costs, and other inputs.

(TN CCSS Reading 1, 4, 7; TN CCSS Writing 1, 2, 4, 5, 6, 8, 9; TN CCSS Math N-Q, A-CED, F-IF, F-BF)

### **Career Portfolio**

- 15) Compile important artifacts that represent professional and personal skill attainment to create a career portfolio. Develop a plan to distribute the electronic portfolio as part of a career job search and/or admission to a postsecondary program. Portfolio items may include:

- Attainment of technical skill competencies, licensures or certifications, recognitions, awards, and scholarships
- Documentation of extended learning experiences, such as community service and professional organizations, or internship
- Abstract of technical competencies mastered during the practicum
- Resume
- Examples of best work
- Other artifacts compiled in previous courses

(TN CCSS Reading 1, 8; TN CCSS Writing 4, 9)

### **Internship Option\*\***

- 16) Participate in a work-based learning internship experience to develop, practice, and demonstrate skills outlined in the standards above and in previous courses in this program of study. An internship should follow current Tennessee work-based learning guidelines as appropriate.

- 17) Create and continually update a personal journal to document internship activities. Draw connections between the experience and course content, thoughtfully reflecting on:

- a. Acquired leadership skills
- b. Problem-solving techniques and decision-making skills
- c. Team member participation in a learning environment
- d. Personal career development

(TN CCSS Writing 2, 4)

- 18) Upon conclusion of the internship, write an informative essay summarizing the internship experience and next steps for personal and professional growth. Produce a technology-enhanced class presentation showcasing highlights, challenges, and lessons learned from the internship. (TN CCSS Writing 2, 4, 6)

\*\* Although a hands-on experience in work-based learning (WBL) is desired, it is recognized that not all students can be placed in a working establishment. Comparable placement in a school-based/district-based enterprise may be substituted if available.



## Standards Alignment Notes

\*References to other standards include:

- TN CCSS Reading: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN CCSS Writing: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3 and 10 at the conclusion of the course.
- TN CCSS Math: [Tennessee Common Core State Standards for Mathematics](#): Math Standards for High School: Number and Quantity, Algebra, Functions (pages 58-83).
  - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate with mathematics educators to design project based activities or collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate quantitative, algebraic, and functional reasoning as applied to specific technical concepts. In addition, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.





TENNESSEE DEPARTMENT OF

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## Foundations of Distribution & Logistics

<b>Primary Career Cluster:</b>	Transportation, Distribution & Logistics
<b>Consultant:</b>	<a href="mailto:Rachel.Allen@tn.gov">Rachel Allen, (615) 532-2835, Rachel.Allen@tn.gov</a> <del>Casey Haugner Wrenn, (615) 532-4879, Casey.Haugner@tn.gov</del>
<b>Course Code(s):</b>	6069
<b>Prerequisite(s):</b>	None
<b>Credit:</b>	1
<b>Grade Level:</b>	9-10
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Transportation courses.
<b>Programs of Study and Sequence:</b>	This is the first course in the <i>Distribution &amp; Logistics</i> program of study.
<b>Necessary Equipment:</b>	None
<b>Aligned Student Organization(s):</b>	Skills USA: <a href="http://www.tnskillsusa.com">http://www.tnskillsusa.com</a> Brandon Hudson, (615) 532-2804, <a href="mailto:Brandon.Hudson@tn.gov">Brandon.Hudson@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	If a teacher has completed work-based learning training, <del>appropriate student placement can be offered</del> <u>he or she can offer appropriate placement</u> . To learn more, visit <a href="http://www.tn.gov/education/cte/wb/">http://www.tn.gov/education/cte/wb/</a> .
<b>Available Student Industry Certifications:</b>	None
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
<b>Teacher Endorsement(s):</b>	503
<b>Required Teacher Certifications/Training:</b>	None
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml">http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml</a>

### Course Description

*Foundations of Distribution & Logistics* exposes students to careers and businesses involved in the planning, management, and movement of people, materials, and products by road, air, rail, and water. As an introduction to this important and globally evolving field, this course covers the basic principles of logistics, reviews the history and development of distribution networks, and examines how they

function within the dynamics of the supply chain. Students proficient in *Foundations of Distribution & Logistics* will explore career options; demonstrate an understanding of the historical, current, and future significance of the distribution and logistics industries; and plan for the effective and efficient flow of goods and services. Standards in this course are aligned with Tennessee Common Core State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee Common Core State Standards in Mathematics.\*

## Program of Study Application

This is the foundational course in the *Distribution & Logistics* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Transportation, Distribution & Logistics website at

<http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml>.

## Course Standards

### Occupational Safety

- 1) Demonstrate the ability to comply with personal and environmental safety practices associated with the appropriate handling and storage methods of materials in accordance with local, state, and federal safety and environmental regulations.
  - a. Inspect, maintain, and employ safe operating procedures with tools and equipment used in the warehouse and transportation area. Identify, demonstrate, and specify situations in which safety equipment such as harnesses, personal protective equipment (PPE), and eye wash stations are to be used.
  - b. Adhere to responsibilities, regulations, and Occupational Safety & Health Administration (OSHA) policies regarding reporting of accidents and observed hazards, and regarding emergency response procedures. Differentiate between a recordable and non-recordable incident and describe the impact that each can have on a facility.
  - c. Maintain a portfolio record of passed written safety examinations and equipment examinations.

(TN CCSS Reading 3, 4; TN CCSS Writing 4)

### Career Investigation

- 2) Identify and analyze career pathways within the Distribution & Logistics field. Cite supporting evidence from multiple career information sources, such as O\*NET OnLine, to summarize the essential knowledge and skills required for these careers. Complete one or more career aptitude surveys, analyze the results, and compose an essay describing the relationships between personal career aptitudes and careers in Distribution & Logistics. (TN CCSS Reading 1, 2, 9; TN CCSS Writing 2, 4, 8, 9)
- 3) Compile and analyze real-time and projected labor market data from public sources such as the U.S. Bureau of Labor Statistics to investigate local and regional occupational opportunities and trends in the field of distribution and logistics. Synthesize collected data to develop an illustration comparing occupations by education requirements, job availability, salaries, and benefits. (TN CCSS Reading 2, 7; TN CCSS Writing 4, 8, 9)



## History and Development of Distribution and Logistics

- 4) Synthesize research from informational texts to create an annotated timeline on the history of distribution and logistics. Using descriptive text, identify cultural, social, economic, and technological factors that have influenced the development of distribution and logistics. (TN CCSS Reading 2, 9; TN CCSS Writing 2, 4, 7, 9)
- 5) Analyze the importance of distribution and logistics in a global society. Investigate the influences of customer demands, ordering and managing inventory, forecasting, controlling inbound and outbound shipments, reducing costs, and saving time in product and service flow. (TN CCSS Reading 9; TN CCSS Writing 2, 4, 7)
- 6) Describe the ways that companies can gain a competitive advantage using logistics to distribute their products and services. Research media profiles of businesses that made their operations more sophisticated through the use of logistics management, and explain the factors that contributed to their success. (TN CCSS Reading 1, 2)

## Components of Logistics, Transportation & Distribution

- 7) Research the components of logistics planning. Create a diagram depicting a network for a hypothetical product, labeling all of the nodes (fixed spatial points where goods stop for storage or processing) and links (the transportation network that connects the nodes) in the network. Prepare an accompanying paper or presentation that explains the diagram and describes what is happening at each node. (TN CCSS Reading 4, 7; TN CCSS Writing 4, 7)
- 8) Explore the five modes of transportation (truck, train, plane, ship, pipeline) used to move materials by land, air, or sea. For each mode of transportation, analyze the costs, benefits, and problems associated with that mode of transportation, including environmental impact. List items that are most often transported by each type of transportation. (TN CCSS Reading 1, 4; TN CCSS Writing 2, 4)
- 9) Examine the various types of distribution centers and describe how materials feed into and flow from each type in an illustrated paper. Include the following categories, as well as hybrid facilities where these categories overlap:
  - a. Package handling center
  - b. Warehouse or fulfillment center
  - c. Cross-dock facility
  - d. Bulk break center(TN CCSS Reading 1, 4, 7; TN CCSS Writing 2, 4)

## Supply Chain Functions

- 10) Define the term supply chain and determine how the distribution and logistics domains fit within the larger supply chain. Develop a graphic illustration of a selected industry and map the movement of primary inputs and outputs on a global or local scale.



- 11) Research and describe the four major flows—product flow, information flow, financial flow, and demand flow—that occur in a supply chain. Analyze the impact that each has on the supply chain as a whole and the interactions that must occur between the flows. (TN CCSS Reading 1, 4, 7; TN CCSS Writing 2, 4, 7)
- 12) Differentiate between the internal supply chain and external supply chain of an organization, including internal and external customers. Write an informative paper and accompanying graphic that describes how the two chains are interrelated. (TN CCSS Reading 1, 4, 7; TN CCSS Writing 2, 4, 7)
- 13) Research the following terms as related to supply chains: lean, green, and sustainable. Define and describe each term and give examples of ways they are implemented in a supply chain. (TN CCSS Reading 1, 4; TN CCSS Writing 4)
- 14) Create a glossary of terms related to supply chains and their management. Include acronyms. Add new terms to the glossary as they are encountered. (TN CCSS Reading 4; TN CCSS Writing 4)
- 15) Gather and analyze information from multiple authoritative sources (i.e., industry magazines, academic journals) to explain how the following functions work together to support the distribution of products and services:
  - a. Transportation
  - b. Warehousing
  - c. Inventory control
  - d. Material handling
  - e. Information and communication systems(TN CCSS Reading 1, 4, 7; TN CCSS Writing 2, 4, 8)

### **Problem Solving**

- 16) Create a list of the decisions that must be made, and the problems that could potentially arise, in a complex supply chain. Research individual and group problem-solving and decision-making strategies and prepare a presentation indicating which strategies would be best for each of the decisions or problems on the list. (TN CCSS Reading 1, 2, 4; TN CCSS Writing 4, 6)
- 17) Apply problem-solving and decision-making strategies to recommend and defend solutions to supply chain issues such as:
  - a. Identifying efficient delivery routes having 3 or 4 stops
  - b. Minimizing costs of parts and delivery charges from different sources using different modes of transportation(TN CCSS Reading 3, 4, 5, 7; TN CSS Writing 1, 2, 7; TN CCSS Math N-Q, F-BF, F-LE)

### **Management and Information Technology**

- 18) Investigate the tools and processes used by companies to manage the flow of inputs and outputs within a supply chain. Determine how barcodes, radio frequency identification (RFID), unique identification (UID), and tagging methods (active and passive) are employed in the tracking and distribution of product flow. (TN CCSS Reading 5, 6)



- 19) Determine the ways that computers and other information technologies are used in a supply chain. Create a table or chart listing technologies/software that are used, and describe how they improve supply chain function. For example, discuss the impact of automated warehouses on distribution and logistics functions within a company. (TN CCSS Writing 2, 4, 8)

### Case Study

- 20) Synthesize information from industry, scholarly, and popular media sources outlining how a top 20 retailer has used supply chain management to become one of the largest retailers in the world. Create a model and presentation describing how the retailer handles the following areas of its global supply chain network:
- Customer service
  - Distribution costing
  - Distribution planning
  - Information technology
  - Materials and purchasing management
  - Order processing systems
  - Transport and inventory management
- (TN CCSS Reading 1, 4, 7, 8; TN CCSS Writing 2, 4, 7, 8)

### Standards Alignment Notes

\*References to other standards include:

- TN CCSS Reading: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 9-10 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 8 and 10 at the conclusion of the course.
- TN CCSS Writing: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 9-10 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3, 5 and 10 at the conclusion of the course.
- TN CCSS Math: [Tennessee Common Core State Standards for Mathematics](#): Math Standards for High School: Number and Quantity, Functions (pages 58-83).
  - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate with mathematics educators to design project based activities or collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate quantitative and functional reasoning as applied to specific technical concepts. In addition, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)



- Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.





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## Introduction to Aerospace

<b>Primary Career Cluster:</b>	Transportation, Distribution & Logistics
<b>Consultant:</b>	<a href="mailto:Rachel.Allen@tn.gov">Rachel Allen, (615) 532-2835, Rachel.Allen@tn.gov</a> <a href="mailto:Casey.Haugner@tn.gov">Casey Haugner Wrenn, (615) 532-4879, Casey.Haugner@tn.gov</a>
<b>Course Code(s):</b>	6068
<b>Prerequisite(s):</b>	None
<b>Credit:</b>	1
<b>Grade Level:</b>	9-10
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Transportation courses.
<b>Programs of Study and Sequence:</b>	This is the first course in the <i>Aviation Flight</i> and <i>Aviation Maintenance</i> programs of study.
<b>Necessary Equipment:</b>	<del>TBD</del> <a href="http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml">Equipment lists can be found at http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml</a>
<b>Aligned Student Organization(s):</b>	Skills USA: <a href="http://www.tnskillsusa.com">http://www.tnskillsusa.com</a> Brandon Hudson, (615) 532-2804, <a href="mailto:Brandon.Hudson@tn.gov">Brandon.Hudson@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	If a teacher has completed work-based learning training, <del>appropriate student placement can be offered</del> <a href="http://www.tn.gov/education/cte/wb/">he or she can offer appropriate placement</a> . To learn more, visit <a href="http://www.tn.gov/education/cte/wb/">http://www.tn.gov/education/cte/wb/</a> .
<b>Available Student Industry Certifications:</b>	None
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
<b>Teacher Endorsement(s):</b>	594
<b>Required Teacher Certifications/Training:</b>	FAA Industry Certification
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml">http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml</a>

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### Course Description

*Introduction to Aerospace* is a comprehensive foundations course for students interested in pursuing careers in aviation. This course covers the basic principles governing flight and the regulation of flight

that every aviation professional must know regardless of his or her occupation—as a pilot or an engineer, a salesperson or a specialist, a mechanic or a statistician. In addition to acquiring foundational knowledge of safety procedures and industry regulations, students will also gain essential understanding of aircraft structures, the flight environment, basic procedures, and navigation in preparation for further study in advanced *Aviation Flight and/or Aviation Maintenance* courses. Standards in this course are aligned with Tennessee Common Core State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee Common Core State Standards in Mathematics.\*

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## Program of Study Application

This is the foundational course in the *Aviation Flight and Aviation Maintenance* programs of study. For more information on the benefits and requirements of implementing this program in full, please visit the Transportation, Distribution & Logistics website at <http://www.tn.gov/education/cte/TransportationDistributionLogistics.shtml>.

## Course Standards

### Aviation Safety

- 1) The number one priority as a pilot is to maintain the safety of flight. Citing course materials such as textbooks and published guidelines including the Federal Aviation Regulations (FARs), identify the basic safety issues a pilot must be aware of before, during, and after each flight, including but not limited to: pilot's mental and physical condition, collision avoidance, weather conditions, maintaining minimum safe altitudes, visual scanning, right-of-way rules, flight over hazardous terrain, positive exchange of flight controls, and operating within the Federal Aviation Regulations (FARs). (TN CCSS Reading 1, 2)
- 2) Citing appropriate textual evidence, identify the basic safety issues relating to the aircraft, including but not limited to: aircraft airworthiness, taxiing in wind, operating within the aircraft's approved weight and balance, and airspeed limitations. (TN CCSS Reading 1, 2)

### Careers in Aviation

- 3) Citing labor and workforce data from public sources such as the United States Bureau of Labor Statistics, research the wide range of career pathways available in aviation today. Create a graphic illustration of major occupations within each pathway, including but not limited to: pilots, airframe and powerplant mechanics (A&P), aeromechanical engineers, aircraft salespersons, airport operators, airline statisticians, air traffic controllers (ATC), and flight service specialists (FSS). (TN CCSS Reading 1, 2, 3, 7, 9; TN CCSS Writing 2, 4, 8, 9)
- 4) Citing supporting evidence from textbooks, industry magazines, and professional journals, summarize the essential knowledge and skills required for careers in aviation, and describe important aptitudes for success in these careers, such as mechanical, verbal, scientific, manipulative, numerical, administrative, social, and artistic. Complete one or more career aptitude surveys, analyze the results, and discuss how they might inform career decisions in various aviation pathways. (TN CCSS Reading 1, 2, 3, 7, 9; TN CCSS Writing 2, 4, 8, 9)



- 5) Investigate regulatory agencies, governing bodies, and professional organizations related to the aviation industry, such as the Federal Aviation Administration (FAA), National Transportation Safety Board (NTSB), and National Aeronautics and Space Administration (NASA). Gather information from their websites and available publications to produce a coherent explanation of their functions, jurisdictions, and importance within the industry. [\(TN CCSS Reading 2, 9\)](#)

#### History of Aviation

- 6) Synthesize course readings to create an illustrated timeline of historical milestones in the development of flight. Describe the major obstacles that were overcome to achieve controlled, sustained, and powered heavier-than-air flight. [\(TN CCSS Reading 2, 9\)](#)
- 7) Research major contributors to the field of aviation, including scientists, inventors, pilots, and other historical figures, and determine what each person contributed. Discuss their impact on both the development of flight as well as the industry as a whole. [\(TN CCSS Reading 2\)](#)

#### Aircraft Structures

- 8) Explain the specific functions of various aircraft structures. For example, be able to understand and communicate the purpose for the aircraft's wings, tail, cabin, and other structures. Incorporate relevant design and mathematics concepts as appropriate when explaining how specific aircraft structures function. ~~For example, relate how the design of an aircraft's wings leverage the principles of aerodynamics.~~ [\(TN CCSS Reading 4; TN CCSS Math N-Q\)](#)

#### Aircraft Overview

- 9) ~~Draw on aviation handbooks and other course materials to~~ [Describe](#) ~~outline~~ the specific functions of each aircraft's flight control. ~~Articulate the relationships between~~ [Describe the purpose of](#) the aircraft's ailerons, elevators, rudder, and flaps, and explain the effect that each of these controls has on the aircraft's controllability. [\(TN CCSS Reading 1, 4\)](#)
- 10) ~~Draw on aviation handbooks and other course materials to d~~ Describe in a verbal or written format how a typical reciprocating engine is used on a general aviation aircraft. Compare and contrast the advantages and disadvantages of a reciprocating engine versus a turbine engine on a training aircraft. [\(TN CCSS Reading 1, 9; TN CCSS Writing 2\)](#)
- 11) In a graphic illustration such as an annotated diagram or electronic presentation, explain the typical application and operation of the basic electrical system, including but not limited to:
  - a. Battery
  - b. Alternator / Generator
  - c. Circuit Breakers
  - d. Master Switch(es)[\(TN CCSS Reading 1; TN CCSS Writing 2\)](#)

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12) Explain how fuel systems operate on a typical aircraft, and cite specific dangers and associated precautions that aircraft personnel should take when inspecting, filling, and draining fuel systems. Given a scenario or diagram assigned by the instructor, demonstrate the ability to identify and describe the characteristics of the fuel system, including but not limited to:

- a. Fuel tanks
- b. Fuel selector valves
- c. Fuel filters and drains

[\(TN CCSS Reading 1, 3; TN CCSS Writing 2\)](#)

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13) Explain the typical application and operation of the basic ignition system, including but not limited to:

- a. Magnetos
- b. Spark plug wires
- c. Spark plugs

[\(TN CCSS Reading 1, 3\)](#)

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14) Explain the typical application and operation of the basic flight instruments, including but not limited to:

- a. Airspeed Indicator
- b. Attitude Indicator
- c. Altimeter
- d. Turn Coordinator
- e. Directional Indicator
- f. Vertical Speed Indicator

[\(TN CCSS Reading 1, 3\)](#)

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15) Explain the typical application and operation of the basic engine instruments, including but not limited to:

- a. Oil Pressure Gauge
- b. Oil Temperature Gauge
- c. Cylinder Head Gauge

[\(TN CCSS Reading 1, 3\)](#)

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16) Explain the typical application and operation of the basic communication and navigation radios and instrumentation, including but not limited to:

- a. Comm # 1
- b. Comm # 2
- c. Nav # 1
- d. Nav # 2

[\(TN CCSS Reading 1, 3\)](#)

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## Flight Environment

- 17) Research and develop illustrative models that compare and contrast characteristics of the two basic types of airspace:
- Controlled
  - Uncontrolled

[\(TN CCSS Reading 1\)](#)

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- 18) Consult FAA guidelines to synthesize understanding of air traffic control (ATC) procedures related to visual flight rules (VFR) and instrument flight rules (IFR) operations. Explain the circumstances and conditions of operation regarding:

- Airport operations
- Local area procedures

[\(TN CCSS Reading 1, 2\)](#)

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- 19) Cite textual evidence from course materials and industry guidelines to explain the importance of meteorological knowledge among aviation professionals. Outline key concepts and terminology for the following:

- Basic weather theory
- VFR Minimums
- IFR Minimums

[\(TN CCSS Reading 1, 4\)](#)

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## Basic Procedures

- 20) Under normal conditions, determine adequate benchmarks surrounding the basic aspects of pre-flight, such as:

- Pilot's mental and physical health
- Airworthiness of aircraft
- Weather
- Weight and balance
- Fuel requirements
- Departure and destination airport conditions

Accurately assess basic situations and conditions in order to make a go/no go decision. [\(TN CCSS Reading 3\)](#)

- 21) Explain and demonstrate in a mock situation or drill (including but not necessarily involving a digital flight simulator) the following basic procedures:

- Pre-flight inspection
- Starting the engine
- Taxiing technique(s)
- Takeoffs
- Fundamentals of flight
- Airport traffic patterns
- Wake turbulence
- Collision avoidance techniques



i. Landings

[\(TN CCSS Reading 3\)](#)

22) Under normal conditions, determine adequate benchmarks surrounding the basic aspects of in-flight actions, such as:

- a. Changes in pilot's mental and physical health
- b. Actual wind and weather conditions
- c. Fuel reserve
- d. Destination and alternate airport conditions

Accurately assess current conditions in order to evaluate a decision to return to departure airport, land at an enroute airport, or continue to destination. [\(TN CCSS Reading 3\)](#)

23) Under normal conditions, determine adequate benchmarks surrounding the basic aspects of post-flight actions, such as:

- a. Post flight aircraft inspection to determine airworthiness of aircraft
- b. Evaluation of forecast versus actual weather encountered
- c. Comparison of estimated fuel requirements versus actual fuel consumption

Accurately assess basic situations and conditions experienced in order to make better future go/no go decisions. [\(TN CCSS Reading 3\)](#)

#### Basic Navigation

24) Explain how basic Pilotage and Dead Reckoning (DR) techniques work, and recognize when they are appropriate. Describe how pilots use such techniques in order to fly from one point or location to another. [drawing on textbooks and other course materials to provide accurate analyses of different flight situations. \(TN CCSS Reading 1, 2, 4\)](#)

#### Judgment Training

25) Explore techniques for improving pilot judgment and decision-making skills. Develop an original mock scenario in which a pilot must react to an in-flight complication or malfunction. Outline a strategy or how-to guide for remaining calm under pressure, maintaining lines of communication, and making sound decisions. [\(TN CCSS Reading 3, TN CCSS Writing 2, 4\)](#)

#### Standards Alignment Notes

\*References to other standards include:

- TN CCSS Reading: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 9-10 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3, 5, 6, 9 and 10 at the conclusion of the course.
- TN CCSS Writing: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 9-10 Students (pages 64-66).

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- Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3, 9 and 10 at the conclusion of the course.
- TN CCSS Math: [Tennessee Common Core State Standards for Mathematics](#): Math Standards for High School: Number and Quantity, ~~Algebra, Functions~~ (pages 58-83).
  - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate with mathematics educators to design project based activities or collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate quantitative, ~~algebraic, and functional~~ reasoning as applied to specific technical concepts. In addition, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.

