5 Airports and Airspace

Content Area: **Science**
Course(s): **Aerospace Engineering**
Time Period: **Semester 1**
Length: **1 Week**
Status: **Published**

Standards

9.3.ST	Science, technology, engineering & mathematics
9.3.ST.5	Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.
9.3.TD-OPS	Transportation Operations
9.3.12.TD-OPS.1	Develop and evaluate transportation plans to move people and/or goods to meet customer requirements.
9.3.12.TD-OPS.2	Analyze performance of transportation operations in order to improve quality and service levels and increase efficiency.
9.3.12.TD-OPS.3	Comply with policies, laws and regulations in order to maintain safety, security and health and mitigate the economic and environmental risk of transportation operations.
9.3.TD-SYS	Transportation Systems / Infrastructure Planning, Management & Regulation
9.3.12.TD-SYS.1	Develop plans to maintain and/or improve the transportation infrastructure.
9.3.12.TD-SYS.2	Assess, plan and manage the implementation of transportation services.
9.3.12.TD-SYS.3	Describe ways to improve the system utilization, flow, safety and environmental performance of transportation systems.

Enduring Understandings

1. Airport is a general term for any location where aircraft can take off and land, and there are a huge variety of airports, ranging from virtually empty grass fields to major international terminals.

2. The national airspace system classifies airspace based on the flight operations that occur in that space, and it establishes the rules for each classification that will ensure the safety of all aircraft (for example, to reduce collision hazard).

3. All flight operations can be classified as visual flight operations or instrument flight operations, and the rules pertaining to different airspace classifications account for these two different flight operations.

4. The facilities available for aircraft, their locations around the world, and whether flights will be visual or instrument, dictate the performance and systems requirements that engineer's must meet to create feasible designs.

Essential Questions

1. How can the airspace around us be organized to ensure the safe operation of the aircraft within it?

2. How can aircraft operate and remain separated in weather conditions the restrict visibility?

3. How do the airport, airspace, and safety constraints associated with the national airspace system affect the design parameters in which modern aircraft are designed?

Knowledge and Skills

Knowledge:

- An airport is a location that has been set aside for the operation of aircraft and has a place for aircraft to safely take off and land. Airports vary as widely as the aircraft that operate from them.
- All airports have some sort of runway, taxiway, ramp/apron, wind indicating device, and other services or facilities pertinent to the type of aircraft operating at that airport.
- Runways are always numbered based on their direction with respect to magnetic north. All runways have two runway numbers, one in each direction, that represent reciprocal magnetic directions.
- Airports may be towered (where traffic is managed by air traffic controllers in a control tower), or non-towered (where pilots adhere to rules and procedures to ensure traffic separation).
- All airspace can be classified as controlled airspace and uncontrolled airspace based on whether or not air traffic control controls that airspace. Controlled airspace can be further separated into different classes of airspace (class "A" airspace, class "B" airspace, etc.) based on the level of control required to ensure separation and reduce collision hazards.
- There are two sets of rules upon which the national airspace system operates: (1) visual flight rules, also known as "VFR" which facilitate the separation of aircraft in conditions where the operators can see and avoid other aircraft, and (2) instrument flight rules, also known as "IFR" which facilitate the separation of aircraft in conditions where pilots are operating in clouds, fog, or any weather that reduces visibility.
- Air traffic control uses two systems to monitor and ensure the separation of air traffic: (1) radar, which uses electromagnetic waves to locate aircraft in the vicinity of the radar dish, and (2) Global Positioning Satellites, or "GPS" to identify and locate aircraft as part of the next generation air traffic control system (known as Automatic, Dependent, Surveillance Broadcasts, or "ADS-B").
- Using these tools, aircraft operate on orderly "highways in the sky", known as either "Victor Air Routes" or "Jet Routes". These routes, and the procedures in the vicinity of airports, are akin to the movement of cars on the road from their point of origin, over local roads, to interstate highways, then back to local roads to their destination.
- The ADS-B system that allows air traffic controllers to follow and manage flights is the same system that feeds readily available aps that run on our devices (cell phones, tablets, computers, etc.) to tell the location of any airline or private flight.
- Modern aircraft of all kinds must be designed to operate from modern airports and within the national airspace system.

Skills:

- Students will have the ability to read aeronautical charts that depict the airports and airspace around them. The students will be able to make decisions about the types of operations and the procedures associated with these operations given the airspace and airports nearby. This is an essential skill for the operation of unmanned aerial systems ("drones"), model rockets, and model aircraft, in addition to full

size aircraft carry passengers.
- Students will be able interpret topographic maps that depict elevation, measure distances using a map's scale, and interpret direction with respect to true and magnetic north.
- Make use of readily available aviation tools to plan and check the status of flights, including commercial flights, in the national airspace system.

Transfer Goals

- Recognition that the design of any product must also take into account the environment in which it must perform.
- Understanding that the operation of a machine may be dictated by rules, procedures, and boundaries created to ensure the safety of those associated with its operation.
- Pilots of all unmanned aerial systems (UAS, or "drones") must know and operate within the rules of the national airspace system.

Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit?usp=sharing

Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit?usp=sharing