GLOSSARY:

Aviation: The art or science of flying aircraft, including the design, production, and maintenance associated.

Aerodynamics: The branch of mechanics that deals with the motion of air and other gases, and with the effects of such motion on bodies in the medium.

Aeronautics: The study or practice of all aspects of flight through the air (including orbital and suborbital flight).

Carbon fiber: An extremely strong, thin fiber, consisting of long, chain-like molecules of pure carbon that are made by charring synthetic fibers such as rayon in the absence of oxygen. Carbon fibers are used in high-strength composite materials in aircraft, automobiles, architectural structures, and in other applications where light materials capable of withstanding high stress are required.

Force: Any of various factors that cause something to change its speed, direction, or shape. Force is a vector quantity, having both magnitude and direction. Contributions of force from different sources can be summed to give the net force at any given point.

Lift: An upward force acting on an object. Lift can be produced by creating a low-pressure area above an object, such as an airplane wing or other airfoil that is moving through the air.

Propulsion: The driving of an aircraft by the powerful thrust developed when a jet of gas is forced out of a jet engine.

Titanium: A shiny, white metallic element that occurs in all kinds of rocks and soils. It is lightweight, strong, and highly resistant to corrosion. Titanium alloys are used especially to make parts for aircraft and ships. Atomic number 22; atomic weight 47.87.

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***Advanced* Teachers Guide**

SYNOPSIS:

Aeronautics is the science of flight as well at the theory and practice of aircraft navigation. Any vehicle that flies through the air or travels in space falls into the field of aeronautics. This includes helicopters, airplanes, space vehicles such as the SpaceX Dragon, and the retired NASA space shuttles.

Aerodynamics is an important branch of physical science dealing with the motion of air and how it interacts with objects in motion. By studying the way air flows around objects, engineers can define the shape of a plane. The wings, tail, and the main body – or fuselage - all affect the way air will move around the plane. Students may find it interesting that engineers consider air to behave as a fluid, like water. Other important aspects are aerodynamics, propulsion, materials and structure, as well as stability and control.

CURRICULUM UNITS:

- Chemistry
- Engineering
- Physical science
- Physics

CAREER OPPORTUNITIES:

- Aeronautical engineer
- Chemist
- Computer science
- Electrical engineer
- Mechanical engineer
- Physicist

PROGRAM OVERVIEW:

Strength and stability are important factors in airplane or space vehicle design. Engineers create vehicles that are strong enough to fly effectively and efficiently by using specific materials and structures that are lightweight and durable. Important decisions are made regarding the materials that are used to make the fuselage, wings, tail, and engine.

Many airplane materials are now made of composite materials that are lightweight, yet stronger than most metals. This issue shows how aircraft manufacturers are utilizing materials such as carbon fiber along with aluminum and titanium to engineer aircraft.

The boom in aeronautics and commercial aviation came when thousands of pilots were released from military service after World War II and the potential for using aircraft as an affordable and convenient method of transportation led to the creation of airline companies eager to capitalize on this emerging and untapped market.

The Boeing 707 was introduced in 1958 as the first widely used passenger jet and laid the foundation for Boeing's steady rise in the jet airliner market. More recent models, including the the 787 Dreamliner, have improved aerodynamics, advances in engine technology, better fuel consumption, and improved cabin features.

Since NASA no longer flies people and cargo to the International Space Station it is turning to private companies. Virgin Galactic's SpaceShipOne and SpaceShipTwo along with SpaceX's Dragon show how private companies are moving into commercial spaceflight with new advances in aeronautics.

ISSUES & CRITICAL THINKING:

1. Discuss the requirements of vehicles designed for sub-orbital spaceflight, orbital spaceflight, and long distance rockets that will go to the Moon and beyond.

2. Looking back at the history of flight – what are some of the major advances that have benefited air travel?

3. Discuss with students what economic and technological advances have made air travel more efficient.

4. Have students, in small groups, list how the ease of intercontinental flight has changed political situations, trade and commerce, sociology, and even the human gene pool.

5. Have students imagine they are an aeronautics engineer. Write an excerpt in their lab journal, complete with sketches, of a new discovery that they made, perhaps with their team members (whom they can name as their friends). Was the discovery of a new material that might improve an existing vehicle? Or was it of a design that will enable a flight to some remote planet, or moon of a planet? Students can envision the excitement of participating in science discoveries.