GLOSSARY:

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.

Carbon fiber: An extremely strong, thin fiber, consisting of long, chainlike 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 lightweight materials capable of withstanding high stress are required.

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 movement 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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Show Me Science Advanced

Aeronautics - 21st Century Flight

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***Advanced* Teachers Guide**

SYNOPSIS:

Aeronautics is the science of flight as well as the theory and practice of aircraft navigation. Any machine that flies through the air falls into the field of aeronautics. This includes helicopters, airplanes, as well as space vehicles such as the SpaceX Dragon, and the retired NASA space shuttles. Aerodynamics is a branch of physical science which deals with the motion of air and the way that it interacts with objects in motion.

By studying the way air flows, 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, but they should not confuse these two states of matter. They must take into account aerodynamics, propulsion, materials, structure, stability and control.

CURRICULUM UNITS:

- Chemistry
- Engineering
- Physical science
- Physics

CAREER OPPORTUNITIES:

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

PROGRAM OVERVIEW:

Engineers create vehicles that are strong enough to fly effectively and efficiently by using specific materials and structures. In an airplane, the choice of materials that are used to make the fuselage, wings, tail, and engine will affect strength and stability. Many airplane materials are now made out of composite materials that are lightweight, yet stronger than most metals.

There was a boom in aeronautics and commercial aviation after World War II as thousands of pilots were released from military service and many inexpensive war transport and training aircraft became available. 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.

Introduced in 1958, the Boeing 707 was the first widely used passenger jet and laid the foundation for Boeing's steady rise in the jet airliner market. This program shows how airlines are utilizing composite materials such as carbon fiber along with aluminum and titanium to engineer efficient aircraft.

Virgin Galactic's SpaceShipOne and SpaceShipTwo along with SpaceX's Dragon demonstrate 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 benefitted 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 envision themselves to be an aeronautics engineer. Write excerpts 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 an improvement to an existing vehicle? Or was it of a design that will enable a flight to some remote planet or moon of a planet? Perhaps the students wish to detail a new wing or engine design. Emphasize that this is an exercise in creativity, not research. Students can envision the excitement of participating in science discoveries.