Flight 2014:

Celebrating 100 years of commercial aviation

St. Petersburg - Tampa Airboat Line, 1914
CELEBRATING 100 YEARS OF COMMERCIAL AVIATION

IN AN AVERAGE YEAR, THE AIRLINE INDUSTRY CARRIES 3 BILLION PEOPLE + 50 MILLION TONS OF CARGO, WHICH IS THE EQUIVALENT OF

- 80,416,438 TON MILES OF DISTANCE TRAVELLED
- 1 JAN 1914 to 1 JAN 2014
- 8,547,945 PASSENGERS
- 1 JAN 1914 to 1 JAN 2014
- 58.1 MILLION JOBS
- 21ST CENTURY ECONOMIC ACTIVITY

THE AIRLINE INDUSTRY SUPPORTS

44% of the World Population

In addition to supporting the world's economies, the airline industry is a major contributor to the global workforce, generating millions of jobs and stimulating economic growth. The airline industry has evolved significantly since its inception in 1914, and its impact on international trade and cultural exchange continues to grow.

Sai Bedry, Development Specialist
ordemie@tampabay.com

© Tampa Bay Times 2014
The world’s first airline

On Jan. 1, 1914, a small biplane piloted by aviation pioneer Tony Jannus lifted from the water in downtown St. Petersburg, Fla., with one paying passenger. Twenty-three minutes later, the plane landed in Tampa, Fla., launching the world’s first regularly scheduled commercial airline flight and flying into the annals of aviation history.

Just 10 years after the Wright brothers’ first flight, the St. Petersburg-Tampa Airboat Line operated two scheduled round-trips daily across Tampa Bay, with two bi-wing seaplanes called Benoist airboats. Regular one-way fare was $5. With average airspeeds of 60 miles per hour, flight time between the bay cities was a fraction of the time required for the trip by car, rail or boat.

Air Transport Action Group

The Air Transport Action Group (ATAG) is an organization that brings together companies from across the aviation industry. Representing airlines, airports, air traffic management companies and the makers of aircraft and engines, the ATAG team works on making sure that air transport can grow in terms of passengers and aircraft, but in a sustainable way with environmental concerns being addressed. ATAG and its members were able to develop the world’s first climate-change targets for any global sector.

Aviation provides a great number of benefits to the world economy and society. It is a tool for business and a way for people to connect with their families and friends and experience the world. ATAG works with the industry and governments to make sure that the industry can grow and continue to provide benefits to the world while also meeting its environmental obligations.

For more information, visit aviationbenefits.org or atag.org.

Flight 2014 Planning Board Inc.

The Flight 2014 Planning Board Inc. is an organization composed of representatives from the Florida Aviation Historical Society, the Tony Jannus Distinguished Aviation Society, the St. Petersburg Museum of History, and the cities of St. Petersburg and Tampa.

The board’s vision is “to share the story of the birth of the world’s first scheduled airline with the world and to make all aware that pioneer aviator Tony Jannus’ inaugural flight of the 1914 St. Petersburg-Tampa Airboat Line represents the birth of the global airline industry.”

More information about the Flight 2014 Planning Board can be found at airlinecentennial.org.

See page 16 for a listing of the Flight 2014 Planning Board.

Florida Aviation Historical Society

The Florida Aviation Historical Society (FAHS) is a nonprofit corporation dedicated to preserving Florida’s aviation heritage and to promoting Florida aviation, aerospace and airports. FAHS is Florida’s largest aviation historical society, with approximately 900 members in 26 states. More information about FAHS can be found at FloridaAHS.org.

Learning with the Times

Learning new words

When you study new things, you often come up against some tough vocabulary words, such as aviation, transportation and tourism. Most vocabulary words are learned from context clues or good old-fashioned dictionary work. While you read this publication, be sure to highlight or circle words you don’t know. Try to figure out the words’ meanings by looking for clues in the sentences around them. Write down your best guess, and then look the words up in a dictionary. As a group activity, make a list of the words your classmates identified and see which ones stumped the class. Next, use these words for a news scavenger hunt. See if you can find these words in the Tampa Bay Times. The group that finds the most words wins the game.

Tony Jannus and Percival Fansler in front of the Benoist airboat, 1914.
St. Petersburg Museum of History
In the early 1900s, travel between St. Petersburg and Tampa was slow and difficult. With no bridges across Tampa Bay, both trains and automobiles had to travel north and around the bay – a five-to-12 hour trip by train and an all-day trip by car. Even the more direct route across the bay by steamboat took two hours.

Percival E. Fansler, a Jacksonville electrical engineer, had the idea of starting an airline between the two cities. He enlisted the support of airplane manufacturer Thomas Benoist, who agreed to supply the airboats and pilots and to operate the airline on a break-even basis, and the St. Petersburg city government, which built a hangar for the airboat on the municipal pier. Fansler also recruited investors from the city’s business community to help subsidize the airline’s cost.

These early backers, some of the city’s most notable citizens, included men whose names remain part of today’s St. Petersburg, such as Noel Mitchell, C. Perry Snell and George Gandy.

The St. Petersburg-Tampa Airboat Line consisted of a fleet of two Benoist airboats, an early form of seaplane that could take off and land on water. This was a necessity, as St. Petersburg’s first airport would not be built until 1926. Airboat No. 43 could carry one passenger in addition to the pilot. Airboat No. 45 could accommodate two passengers.

At 10 a.m. on Jan. 1, 1914, history was made as pilot Tony Jannus and his first passenger, former St. Petersburg mayor Abram C. Pheil, who paid $400 in a charity auction for the privilege, lifted off from St. Petersburg and touched down on the Hillsborough River 23 minutes later. This short trip was the world’s first scheduled airline flight and marked the dawn of commercial aviation.

For the next three months, the St. Petersburg-Tampa Airboat Line made at least two regularly scheduled round-trips between Tampa and St. Petersburg each day, carrying both passengers and cargo, including bundles of the St. Petersburg Daily Times. The cost to fly one passenger or 100 pounds of freight was $5 – more than $100 in today’s currency. By the end of March 1914, the airboat line had carried 1,205 passengers and thousands of pounds of freight over Tampa Bay.

Financially, the St. Petersburg-Tampa Airboat Line came close to breaking even. Its last flight was on May 5, 1914. Scheduled commercial passenger service would not resume in the United States until 1919.
In 2010, the American Institute of Aeronautics and Astronautics designated St. Petersburg’s Central Yacht Basin as a Historic Aerospace Site in recognition of its history as the site of the world’s first commercial airline flight.

Thomas Benoist (1874 - 1917)

Born in Irondale, Mo. in 1874, Thomas Benoist was an airplane pilot, flight instructor, designer, marketer and manufacturer. In 1908, Benoist founded America’s first aircraft parts distributorship. He soon expanded into designing, manufacturing and selling aircraft. He designed his first production-model airplane in 1911 and opened a flying school the same year. After the closing of the St. Petersburg-Tampa Airboat Line, Benoist moved his company from St. Louis to Chicago, and then, in 1916, to Sandusky, Ohio. Tom Benoist was inducted into the Florida Aviation Hall of Fame in 2012.

Tony Jannus (1889 – 1916)

Anthony “Tony” Habersack Jannus was born in 1889 in Washington, D.C. Jannus taught himself to fly at the age of 21, and quickly became a skilled aviator. In 1911, he moved to St. Louis to serve as the chief pilot for the Benoist Aircraft Co.

On March 1, 1912, Jannus was the pilot for parachutist Albert Berry’s world-first parachute jump from a moving airplane. Jannus’ other aviation accomplishments include setting a record for over-water flight by flying a Benoist airboat 1,900 miles from Omaha, Neb., to New Orleans over the Missouri and Mississippi rivers. Jannus was only 24 years old when he made his historic flight across Tampa Bay.

In 1916, Jannus was killed in an accident while training Russian pilots for the Curtiss Aeroplane Co. during World War I.

In 2003, Jannus was inducted into the Florida Aviation Hall of Fame, and in 2006, his portrait was added to the First Flight Shrine at the Wright Brothers National Memorial. In 2010, he was designated a Great Floridian by the State of Florida.


Benoist airboat reproduction

In commemoration of the centennial of the first flight, aircraft designer Kermit Weeks built an exact, full-scale reproduction of the Benoist XIV airboat flown by Tony Jannus.

The entire aircraft was handcrafted by Weeks and his team. The six-cylinder, two-stroke engine was reverse-engineered from one of only six original Roberts engines left in the world and was built from scratch. Weeks planned to fly his reproduction aircraft across Tampa Bay on New Year’s Day 2014, precisely 100 years after Tony Jannus’ historic flight, but the aircraft wasn’t ready.

Instead, Eddie Hoffman Jr. flew the flying boat Mullet Skiff across the bay to commemorate the occasion. The Mullet Skiff was built by Hoffman and his father Ed Hoffman Sr., who also built the Benoist airboat replica on display at the St. Petersburg Museum of History.

Sources: Fantasy of Flight, Tampa Bay Times

In 2010, the American Institute of Aeronautics and Astronautics designated St. Petersburg’s Central Yacht Basin as a Historic Aerospace Site in recognition of its history as the site of the world’s first commercial airline flight.

Benoist airboat reproduction

In commemoration of the centennial of the first flight, aircraft designer Kermit Weeks built an exact, full-scale reproduction of the Benoist XIV airboat flown by Tony Jannus.

The entire aircraft was handcrafted by Weeks and his team. The six-cylinder, two-stroke engine was reverse-engineered from one of only six original Roberts engines left in the world and was built from scratch. Weeks planned to fly his reproduction aircraft across Tampa Bay on New Year’s Day 2014, precisely 100 years after Tony Jannus’ historic flight, but the aircraft wasn’t ready.

Instead, Eddie Hoffman Jr. flew the flying boat Mullet Skiff across the bay to commemorate the occasion. The Mullet Skiff was built by Hoffman and his father Ed Hoffman Sr., who also built the Benoist airboat replica on display at the St. Petersburg Museum of History.

Sources: Fantasy of Flight, Tampa Bay Times

In 2010, the American Institute of Aeronautics and Astronautics designated St. Petersburg’s Central Yacht Basin as a Historic Aerospace Site in recognition of its history as the site of the world’s first commercial airline flight.

Benoist airboat reproduction

In commemoration of the centennial of the first flight, aircraft designer Kermit Weeks built an exact, full-scale reproduction of the Benoist XIV airboat flown by Tony Jannus.

The entire aircraft was handcrafted by Weeks and his team. The six-cylinder, two-stroke engine was reverse-engineered from one of only six original Roberts engines left in the world and was built from scratch. Weeks planned to fly his reproduction aircraft across Tampa Bay on New Year’s Day 2014, precisely 100 years after Tony Jannus’ historic flight, but the aircraft wasn’t ready.

Instead, Eddie Hoffman Jr. flew the flying boat Mullet Skiff across the bay to commemorate the occasion. The Mullet Skiff was built by Hoffman and his father Ed Hoffman Sr., who also built the Benoist airboat replica on display at the St. Petersburg Museum of History.

Sources: Fantasy of Flight, Tampa Bay Times

In the early 1900s, travel between St. Petersburg and Tampa was slow and difficult. But Percival E. Fansler, Thomas Benoist and Tony Jannus were about to change things in a big way. Put yourself in the role of a newspaper reporter who is going to break this story to the public. Research this time period and the information about these men. In a small group, create a mini newspaper for this big event. Use the Tampa Bay Times as your model. Be sure to include some advertisements that would appear in the newspaper during this time period. Also, be sure to include direct quotes from each inventor, and include some quotes from your classmates about their thoughts about flight travel and the new airline. Share your newspaper with your classmates.

Learning with the Times

Breaking news

In the early 1900s, travel between St. Petersburg and Tampa was slow and difficult. But Percival E. Fansler, Thomas Benoist and Tony Jannus were about to change things in a big way. Put yourself in the role of a newspaper reporter who is going to break this story to the public. Research this time period and the information about these men. In a small group, create a mini newspaper for this big event. Use the Tampa Bay Times as your model. Be sure to include some advertisements that would appear in the newspaper during this time period. Also, be sure to include direct quotes from each inventor, and include some quotes from your classmates about their thoughts about flight travel and the new airline. Share your newspaper with your classmates.
The earliest attempts at aviation

The hot air balloon was the first aircraft to successfully carry human beings. Two French brothers named Joseph and Jacques Montgolfier invented the first hot air balloon. The first balloon had a fabric bag attached to a basket and used fire to heat air, which rose to fill the balloon. The first manned flight took place on Nov. 21, 1783. Less than two weeks after that first flight, Jacques Alexandre César Charles and M.N. Robert made the first flight in a hydrogen balloon.

Sir George Cayley was a pioneer of aircraft design. He designed and built working models of many different gliders. He also designed airships, ornithopters and was the first to envision the powered fixed-wing aircraft.

German engineer Otto Lilienthal conducted extensive early research into aerodynamics and designed the first glider able to carry a person and fly long distances. In 1889, he published the book Bird Flight as the Basis of Aviation, which was used by the Wright brothers as the basis for their designs.

Astronomer Samuel P. Langley was the first to attempt to design a flying machine that was self-propelled, controlled in the air and able to carry a human. Langley used steam engines to power his “aerodromes.” He built six full-scale prototypes, several of which flew briefly but none of which achieved controlled flight.

Astronauts

The Wright brothers
Inspired by the work of Otto Lilienthal, Orville and Wilbur Wright began by designing and building gliders. While Lilienthal sought to control his aircraft solely through body movements, the Wright brothers designed a method of controlling the glider’s lift by twisting, or warping, the wings to present different angles to the wind. The pilot could cause the glider to climb, dive and bank to the right or left by “wing warping.”

The brothers tested their first man-carrying glider at Kitty Hawk, N.C., in 1900. Although its lifting capabilities proved disappointing, the control system performed as designed. Over the next two years, they tested more than 200 types of miniature wings in a six-foot wind tunnel. They compared monoplane, biplane, triplane and staggered-wing models and measured the lift produced by different angles, aspect ratios, wing curvatures and thicknesses. In 1902, the Wrights returned to

Airships

Unlike hot air balloons, airships, also known as dirigibles, are self-propelled and steerable.

While there are several different kinds of airships, they all include a balloon filled with a lighter-than-air gas such as hydrogen or helium; a car or gondola that is carried below the balloon; engines for propulsion; and rudders for steering.

In 1900, a German named Count von Zeppelin invented a type of aluminum-framed rigid airship that came to be known as zeppelins. Zeppelins were used to bomb Paris and London during World War I. After the war, airships were used for passenger service. In 1936, trans-Atlantic passenger service began with the zeppelin Hindenburg. Unfortunately, the hydrogen-filled Hindenburg crashed while landing in New Jersey in 1937. This, and other disasters, combined with the advances taking place in heavier-than-air aircraft technology led to the decline of commercial airships.

Source: Encyclopedia Britannica

1000 B.C.E. - Kite is invented in China.
1709 - Bartolomeu Larenço de Gusmao designs and builds hot air balloon models.
1783 - Jean François Pilâtre de Rozier and Marquis d’Arlandes make the first voyage in a Montgolfier hot air balloon.
1789 - Sir George Cayley designs gliders, helicopters, airships and fixed-wing aircraft.
1804 - Sir George Cayley builds and flies the world’s first successful model glider.
1849 - National Air and Space Museum, Smithsonian Institution
1852 - Henri Giffard’s steam-powered airship makes its first flight.
1895 - Otto Lilienthal builds and flies monoplane and biplane gliders.
1896 - Samuel P. Langley builds and flies steam-powered Aerodrome models.
1900 - Count Ferdinand von Zeppelin makes the first flight in his “rigid” airship.
1903 - Orville and Wilbur Wright make the first powered, sustained and controlled flight in a heavier-than-air flying machine.
1908 - Madame Therese Peltier is the first woman to fly solo in an airplane.
1912 - Capt. Albert Berry makes the first parachute jump from a powered airplane.
Kitty Hawk with a larger glider that included a tail with two vertical vanes for stability. This aircraft could glide more than 600 feet.

On Dec. 17, 1903, the Wright brothers made the world’s first powered, sustained and controlled flights in an airplane called the Flyer I. The Flyer I weighed about 600 pounds and had a 12-horsepower engine that generated about the same power as two modern lawn mowers. The first flight, by Orville Wright, covered more than 120 feet and lasted 12 seconds. The day’s longest flight, by Wilbur Wright, covered 852 feet and lasted 59 seconds. The brothers spent the next two years improving their design, and on Oct. 5, 1905, Wilbur flew the Flyer III for 39 minutes.

Aviation in World Wars I and II

At the beginning of World War I, lighter-than-air aircraft – hot air balloons, zeppelins and other airships – were used extensively for reconnaissance, artillery spotting, antisubmarine patrol and even for combat operations. The underpowered and unarmed heavier-than-air airplanes were used only for reconnaissance. The value of controlling the airspace soon became clear and led to the emergence of fighter planes with more powerful engines and better designs. At the war’s beginning, fighter pilots and observers carried pistols or rifles aboard to shoot at enemy planes, but by 1915, fighter planes armed with machine guns began to enter service for both the Germans and the Allies. New generations of combat aircraft continued to enter service throughout the war, including fighters, flying boats used for reconnaissance and the first ship-based aircraft.

While the typical combat aircraft of the first world war was an open-cockpit, fabric-covered biplane with fixed landing gear and top speeds of just over 100 miles per hour, World War II opened with all-metal, enclosed-cockpit monoplanes with retractable landing gear and top speeds of more than 350 miles per hour. Oxygen, voice radios, parachutes, gyroscopic flight instruments and electric cockpit lighting became standard equipment. World War II brought rapid technological innovation to fighters, bombers and reconnaissance and carrier aircraft. It also marked the coming-of-age of air transport and the dawn of the helicopter.

Sources: Encyclopedia Britannica

The jet age

In 1929, a British engineer named Frank Whittle invented the gas turbine, or jet, engine. The first jet-powered aircraft flew in 1939. Although several jet-powered fighters and bombers were developed before the end of World War II, they entered the war too late to make a significant difference.

The first generation of jet-powered airplanes was based on existing airframes, which were not engineered for turbojet propulsion. The late 1940s marked the development of the second generation of jet aircraft, which had aerodynamic refinements such as swept-back wings and thinner control surfaces. Some of these jets could exceed the speed of sound.

Sources: American Institute of Aeronautics and Astronautics, Encyclopedia Britannica

Doing the math

How much faster were the monoplanes flying during World War II than the biplanes flying in World War I?

soon led to the emergence of fighter planes with more powerful engines and better designs. At the war’s beginning, fighter pilots and observers carried pistols or rifles aboard to shoot at enemy planes, but by 1915, fighter planes armed with machine guns began to enter service for both the Germans and the Allies. New generations of combat aircraft continued to enter service throughout the war, including fighters, flying boats used for reconnaissance and the first ship-based aircraft.

While the typical combat aircraft of the first world war was an open-cockpit, fabric-covered biplane with fixed landing gear and top speeds of just over 100 miles per hour, World War II opened with all-metal, enclosed-cockpit monoplanes with retractable landing gear and top speeds of more than 350 miles per hour. Oxygen, voice radios, parachutes, gyroscopic flight instruments and electric cockpit lighting became standard equipment. World War II brought rapid technological innovation to fighters, bombers and reconnaissance and carrier aircraft. It also marked the coming-of-age of air transport and the dawn of the helicopter.

Sources: Encyclopedia Britannica

The jet age

In 1929, a British engineer named Frank Whittle invented the gas turbine, or jet, engine. The first jet-powered aircraft flew in 1939. Although several jet-powered fighters and bombers were developed before the end of World War II, they entered the war too late to make a significant difference.

The first generation of jet-powered airplanes was based on existing airframes, which were not engineered for turbojet propulsion. The late 1940s marked the development of the second generation of jet aircraft, which had aerodynamic refinements such as swept-back wings and thinner control surfaces. Some of these jets could exceed the speed of sound.

Sources: American Institute of Aeronautics and Astronautics, Encyclopedia Britannica

Learning with the Times

Learning to fly

When the Wright brothers first performed experiments, people thought they were crazy. People didn’t think it was possible for humans to fly. Look how far we have come from that fateful day in December 1903 to today. Throughout the centuries, there have been many myths and legends about flying. Myths and legends are fictional stories that attempt to explain a phenomena of nature, such as flight. Research myths and legends about flight, and turn one of the stories you find into a newspaper-style article. Use the newspaper articles in the Tampa Bay Times as models. Be sure to include the five Ws: who, what, when, where and why. Combine all of the class articles into a mini newspaper or magazine. Think about and discuss with your classmates what the myths or legends tell you about early ideas concerning flight.
Unmanned aerial vehicles

Unmanned aerial vehicles (UAVs) are aircraft that are guided remotely or autonomously. They are used for surveillance and reconnaissance and also can be used to designate targets and to drop munitions.

The first UAVs were remotely piloted vehicles (RPVs) used during World War II as training targets. In the 1950s, UAVs began to be used for photographic and electronic reconnaissance. In the 1980s, the development of new sensor technology, the implementation of the global positioning system and the miniaturization of avionics increased the capabilities of UAVs significantly. Today, UAVs are used by all four branches of the United States military for a variety of missions, and civilian versions are becoming increasingly common.

Source: Encyclopedia Britannica

Eyes in the sky

The U-2 high-altitude aircraft was developed during the Cold War to conduct reconnaissance from above the reach of Soviet anti-aircraft fire. It had a range of 3,000 miles and could carry up to 700 pounds of photoreconnaissance equipment to an unprecedented altitude of 70,000 feet.

In 1956, the U-2 entered service and was initially projected to have an operational life of two years. However,

Clockwise from top left: NASA Helios prototype flying wing, NASA Photo / Carla Thomas; USAF F-117A Nighthawk stealth fighter, Staff Sgt. Aaron Allmon II, USAF; The Falcon in flight, DARPA; SpaceShipTwo, Mark Greenberg, Virgin Galactic; Lockheed SR-71 Blackbird, NASA Photo / Tony Landis

Stealth technology

Since the development of radar in World War II, aircraft designers had been seeking ways to reduce the radar signature of aircraft. By the 1970s, new materials such as carbon-fiber composites and high-strength plastics had been developed that were light and strong enough for aviation use. These materials absorb radar energy rather than deflecting it, which makes them harder to detect. Avoiding radar detection also requires modifying the shape of an aircraft to avoid right angles, sharp curves and large surfaces.

In 1940, Northrop introduced the N-1M flying wing. This was the first aircraft that contained the pilot, engine and fuselage in a single airfoil structure. This radical design was the genesis of the design of the B-2 stealth bomber.

In 1983, the first stealth fighter became operational, and the first stealth bomber, the B-2, entered service in 1989.

Sources: Encyclopedia Britannica, Smithsonian Institution
Faster than a speeding bullet

The record for the fastest jet-powered aircraft was set in 2004 by NASA's experimental, unpowered X-43A scramjet (supersonic-combustion ramjet) project. The X-43A reached Mach 9.6, approximately 7,000 miles per hour and nearly 10 times the speed of sound.

The fastest air-breathing, manned aircraft is the Lockheed SR-71 Blackbird, which has achieved more than Mach 3. The SR-71 was developed during the Cold War as a reconnaissance aircraft that could not be shot down. It flew higher and faster than any aircraft before or since. The SR-71, in service for more than two decades, was retired in 1990. Lockheed Martin is currently developing a hypersonic successor to the SR-71 called the SR-72. This unmanned aircraft would fly at speeds up to Mach 6 and could be operational by 2030.

The rocket-powered X-15 was developed as part of a program researching piloted hypersonic flight. The X-15 flew for nearly 10 years and set unofficial speed and altitude records of 4,520 miles per hour (Mach 6.7) and 354,200 feet. The X-15 was air-launched from a B-52 aircraft at about 45,000 feet. The rocket engine provided thrust for only the first 80 to 120 seconds of flight. The remainder of the flight was without power. Most X-15 flights only lasted eight to 12 minutes.

The fastest passenger airplane is the Concorde, which can reach speeds of more than Mach 2. This supersonic passenger plane made its first flight in 1969 and entered service in 1973. From 1976 to 2003, both British Airways and Air France flew the Concorde on transatlantic routes, cutting travel time in half compared to regular commercial aircraft. Both airlines ceased their Concorde operations in 2003, when it became clear that the aircraft would never be financially profitable.

The United States Defense Advanced Research Projects Agency (DARPA) is currently developing the Falcon Hypersonic Technology Vehicle 2 (HTV-2). The rocket-launched HTV-2 is an unmanned, maneuverable hypersonic air vehicle that glides through the atmosphere at up to Mach 20 – approximately 13,000 miles per hour. At this speed, the exterior of the HTV-2 reaches 3,500 degrees Fahrenheit – hotter than a blast furnace capable of melting steel.

Suborbital flight

SpaceShipTwo is a prototype of a commercial manned spaceship under development by Virgin Galactic. In design, it is an air-launched, carbon-fiber composite glider with a hybrid rocket motor and thrusters for maneuvering in space. SpaceShipTwo can carry six passengers and two pilots. SpaceShipTwo is carried to an altitude of about 50,000 feet by a transport aircraft called WhiteKnightTwo. Once released, the “space plane” uses its rocket motor to reach space. SpaceShipTwo completed its first rocket-powered flight in 2013.

Sources: Scaled Composites LLC, Virgin Galactic

Learning with the Times

What do you think the economic impact of flight technology has been in the Tampa Bay area and Florida? This is a difficult question because you would have to consider employment, recreational travel, business travel, and the import and export businesses, as well as the military’s and NASA’s presence in our state. With a partner or in a small group, research some of the points discussed on these pages as well as on the other pages in this publication. Take notes while you are doing research. Review the “Decision making/Cost-Benefit Analysis” video located at econedlink.org/interactives/index.php?id=184&type=student. Create a graphic organizer — chart, web or outline — with the information you find. Based on what you have learned, write an argument essay for or against expansion of commercial and or government-sponsored air travel in Tampa Bay.

Sources: DARPA, How Stuff Works, NASA
Creating jobs

Air transport is a major global employer, generating a total of 58.1 million jobs annually. This includes jobs in the aviation industry itself—in airline and airport operations, aircraft maintenance, air traffic management, head offices and activities such as check-in and baggage handling—as well as jobs created by aerospace manufacturers.

- Aviation directly provides 8.7 million jobs at airlines, airports and aircraft manufacturers.
- Aviation generates 9.8 million indirect jobs through the purchases of goods and services from companies in its supply chain.
- Aviation industry employees support 4.6 million jobs through spending.
- Aviation-enabled tourism generates 35 million jobs.

In North America alone, air transport supports almost 10 million jobs. Jobs in air transport cover a wide range of activities and skills, and many require a highly trained and qualified workforce, driving innovation and STEM skills development and providing well-paid opportunities.

How has flight changed our lives?

The economic and social impact of aviation on our lives is immense. Air travel, as the only rapid worldwide transportation network, is essential for global business and tourism. By facilitating tourism and trade, aviation generates economic growth, provides jobs, improves living standards, alleviates poverty and increases revenues from taxes.

Globally, there are nearly 1,400 airlines, operating more than 25,000 aircraft and serving almost 4,000 airports. Every year, airlines transport over 3.1 billion passengers, and the annual global impact of aviation is estimated to be $2.4 trillion.

If aviation were a country, it would rank 21st in size economically. By 2032, it is estimated that the air transport industry will contribute more than 103.1 million jobs and $5.8 trillion to the world economy.

Connecting our world

Aviation promotes global economic growth and development by facilitating world trade, increasing access to international markets and allowing the globalization of production. World trade is expected to nearly double over the next decade, and air transport will help make it possible.
Air transport is a vital component of many industries’ global supply chain. Because it is more expensive than other transport options, it is used primarily for the rapid delivery of time-sensitive goods such as spare parts for machinery and equipment; sensitive electrical components; and perishable products such as vaccines, food and flowers.

The total value of goods transported by air represents 35 percent of all international trade. A leading economic forecaster estimates that the increase in global connectivity due to air transport over the last couple of decades is worth more than $200 billion to the global economy.

Connecting people

Tourism plays a significant role in the world economy, supporting more than 99 million jobs and contributing $1.8 trillion to the global economy. Tourism is particularly important to the economies of many developing countries. Aviation is critical to the global tourism industry, with more than 52 percent of international tourists now traveling by air. More than 35 million jobs in global tourism – jobs in industries such as hotels, restaurants, visitor attractions, local transport and car rental – are supported by foreign visitors arriving by air.

Supporting development

Air transport invests substantially in vital infrastructure, with the industry funding the vast majority of its own infrastructure costs. Infrastructure includes the basic equipment and structures needed for an organization to function properly: in this case, investment such as runways, airport terminals and air traffic control towers. In 2012, airports invested $19.3 billion in construction projects, creating jobs and providing new facilities to their communities.

Leading and innovating

Aviation is a technological industry with a focus on research and innovation. This not only leads to more efficient aircraft technology and operations, but also helps build research capacity at universities and high-tech skills across society. Every $100 million of research and development spending by the aerospace industry generates additional benefits of $70 million.

A vital lifeline

Air transport is a vital lifeline for communities that lack adequate road or rail networks. In many remote communities, reliable access to the rest of the world – and to essential services such as healthcare, education and government – is only possible by air. For example, there are more than 200 communities in Alaska, and more than 1,000 in Russia, that are inaccessible by road; while Indonesia consists of 17,508 separate islands. Air transport is relied upon for contact between communities and business links.

In Quebec, Canada, a remote northern region known as Nunavik is home to about 10,000 Inuit people who live in small family units and exist by hunting, fishing and gathering.

Emergency assistance

Air transport allows delivery of urgently needed assistance during humanitarian emergencies caused by natural disaster, famine or war. Aviation’s speed allows emergency and aid workers and supplies to reach even remote or inaccessible locations quickly, when time is of the essence. Both military and commercial aircraft play roles in providing support to humanitarian relief efforts by conducting search-and-rescue efforts, evacuating refugees, delivering cargo and providing staging points for rescuers and supplies.

The massive earthquake that devastated the island nation of Haiti in 2010 illustrates how air transport can make a life-or-death impact. Haiti is the poorest country in the Western Hemisphere and has experienced political instability for most of its history. In January 2010, a magnitude 7.0 earthquake struck just west of the capital, Port-au-Prince. More than 300,000 people were killed, and 1.5 million were left homeless. Haiti and its capital city were devastated.

Airlines transported emergency and relief workers and donated emergency supplies such as tents, blankets, medicine and food at no cost. Without these aircraft and people volunteering to fly them, very little emergency airborne-relief aid would have reached Haiti because the cost of chartering a single all-cargo relief flight can be as high as $250,000. International aid would have had to rely on much slower methods of transport, and more people would certainly have died of injury, disease and hunger.

Sources: Air Transport Action Group, The World Factbook

Going beyond the text

As you can see from the information you have read on these pages, air transportation plays a crucial role in the everyday lives of many people and businesses. Ask your teacher to separate your class into groups. Have your group choose one of the concepts discussed in this story to research. Research this information in your school media center or your local library. Find out as much information as you can. Write a report to share with your class. Be sure to document your sources. You can use print sources, such as newspapers, as well as electronic data bases and encyclopedias and atlases.

Learning with the Times

The importance of air transportation

Look for an article in the Tampa Bay Times that exemplifies the importance of air transportation in our society. Write an argument-style blog posting exploring why air transportation did or could have made a significant impact on the situation being described in this article. If air transportation was used, explain how it was used. If it was not used, explain why it should have been. Share your information and what you have learned with your class.
The forces of flight

Four forces act on an aircraft in flight: thrust, drag, gravity and lift. The motion of the aircraft through the air depends on the relative strength and direction of these forces.

**Thrust** is the mechanical force which moves an aircraft through the air. The amount of thrust is determined by the propulsion system.

**Drag** is the aerodynamic force that opposes an aircraft’s motion through the air. Drag is generated by every part of the external surface of an aircraft.

**Weight** is the force generated by the gravitational attraction of the earth on the aircraft and is always directed toward the center of the earth.

**Lift** is the mechanical aerodynamic force, produced by the motion of an aircraft through the air, which directly opposes the weight of an airplane and holds the aircraft in the air.

sources: Air Transport Action Group, NASA

Propulsion systems

NASA defines a propulsion system as “a machine that produces thrust to push an object forward.” Propellers act like a spinning wing, creating lift by moving through the air. The engine used to power the propeller is most commonly an internal combustion engine similar to that used in automobiles, but they also can be powered by jet or electric engines.

Propellers have been used on aircraft since the Wright brothers’ era and are still found on most general aviation airplanes. They are very efficient for low-speed flight, but they are not used on high-speed aircraft.

Gas turbine, or jet, engines burn fuel and air in a combustion chamber, creating hot exhaust that is passed through a turbine and out a nozzle to produce thrust. Jet engines can power aircraft for long distances and at high speeds. A turboprop engine is a gas turbine that powers a propeller.

Ramjets are a type of jet engine used for high-speed flight. However, unlike other jet engines, ramjets have no moving parts – only an inlet, a combustion chamber and a nozzle. Air is “rammed” into the combustor using the forward speed of the aircraft, burned with fuel, and ejected out of the nozzle to create thrust. Because of this, ramjets can produce thrust only when the aircraft is moving.

Rockets combine fuel and an onboard source of oxygen called an oxidizer. The oxygen and fuel ignite in a combustion chamber, exploding in hot exhaust that is passed through a nozzle to produce thrust. Because, unlike turbines, rockets carry their own oxygen and do not need air, they can fly in space. A rocket must accelerate to about five miles per second just to reach Earth orbit, about 25 times faster than the cruising speed of a passenger jet.

sources: Air Transport Action Group, HowStuffWorks, NASA, Smithsonian Institution

Roll, pitch and yaw

Unlike cars or boats, aircraft and spacecraft can move freely in three dimensions. A pilot must control the attitude, or orientation, of a vehicle in all three dimensions.

- **Roll** is movement of the wings of the aircraft up and down.
- **Yaw** is movement of the nose of the aircraft from side to side.
- **Pitch** is movement of the nose of the aircraft up or down.

sources: NASA, Smithsonian Institution

Controlling the air

Pilots control the attitude of their aircraft using control surfaces that produce aerodynamic forces and cause the aircraft to roll, pitch or yaw. Varying the type and amount of aerodynamic force allows the pilot to maneuver the aircraft.

- **Ailerons** are small hinged sections on the outboard portion of a wing. They can be used to generate a rolling motion.
- **The rudder** is a hinged section at the rear of the vertical stabilizer. It can be used to produce a yawing motion.
- **The elevators** are hinged sections at the rear of the horizontal stabilizers. They can be used to produce a pitching motion.
- **Slats** are moving parts on the leading edge of an aircraft’s wings that can be extended forward to increase the wing area, which generates more lift at slow speeds.
- **Flaps** are moving parts on the trailing edge of an aircraft’s wings that can be extended aft (toward the tail) to increase the wing area, which generates more lift at slow speeds.
- **Spoilers** are small, hinged plates on the top portion of an aircraft’s wings that can be used to slow an aircraft or to make an aircraft descend. Spoilers also can be used to generate a rolling motion if only one is deployed.

sources: Air Transport Action Group, HowStuffWorks, NASA, Smithsonian Institution

Controlling attitude in space

Because there is no air in space, the control surfaces that an airplane uses do not work there. To change orientation in space, a spacecraft uses torque, a twisting force that causes rotation. Typically, spacecraft use small thruster rockets to control their attitude. Some satellites use a system of spinning reaction wheels similar to gyroscopes.

source: Smithsonian Institution
Sustainable aviation biofuels

Unlike fossil fuels such as coal, oil or natural gas, biofuels are fuels that are produced from renewable biological resources such as plant or animal materials. Sustainably produced biofuels result in reduced greenhouse gas emissions compared to traditional fossil fuels. One of the most common biofuels is the petroleum substitute ethanol, which is produced by fermenting crops such as sugar cane or corn. Ethanol is a first-generation biofuel. First-generation biofuels are generally not suitable for use in aircraft and often come from non sustainable crops. Second-generation biofuels, which come from non food crop sources such as oil plants or municipal waste, can be processed into high-quality jet and diesel fuels. Developing sustainable biofuels for aviation will provide the industry with an alternative to petroleum-based fuels and enable it to reduce its greenhouse gas emissions.

Sustainable development

In 2008, the aviation industry committed to the world’s first sector-specific climate-change targets. Goals include improving fleet fuel efficiency by 1.5 percent per year until 2020, capping net carbon emissions beginning in 2020 and reducing net carbon emissions to 50 percent below 2005 levels by 2050. Airlines are using multiple strategies to meet these ambitious targets: new technology, efficient operations, improved infrastructure and market-based measures.

For more information about the aviation industry’s commitment to sustainability, visit aviationbenefitsbeyondborders.org.

Learning with the Times

Planning for the future

Reducing greenhouse gas emissions and other types of air pollution are important for the future of our environment. We need to think about reducing our carbon footprint today for it to affect the environment tomorrow. That is why it is important for the aviation industry to develop sustainable biofuels that will provide the industry with an alternative to petroleum-based fuels and enable it to reduce its greenhouse gas emissions. Working together with other students in your class, come up with a plan to get your school and family to reduce their carbon footprints. Next, look at the ads in the Tampa Bay Times. Think about the dynamics of the ads. Think about ways to draw people’s attention to an ad and its message. Now, design an ad for the print and digital editions of the Times that encourages people of all ages to reduce their carbon footprints. Share your ideas with your classmates.

Efficiency in action: winglets

Adding tilted-up “winglets” to the tips of aircraft wings significantly reduces drag on the aircraft, resulting in fuel usage reductions of between 3 and 5 percent. Since their introduction, winglets have saved more than 4 billion gallons of jet fuel. They are being retrofitted to more than 5,000 aircraft.

For more information about the aviation industry's commitment to sustainability, visit aviationbenefitsbeyondborders.org.
Aerospace engineer

Aerospace engineers design aircraft, spacecraft, satellites and missiles. They typically specialize in one of two types of engineering – aeronautical or astronautical – and can specialize in different types of aerospace products, such as aircraft, remotely piloted aircraft, spacecraft, or missiles and rockets. Aerospace engineers must have a four-year degree in aerospace engineering or another field of engineering or science related to aerospace systems, and may require security clearances.

Air traffic controller

Air traffic controllers coordinate the safe and efficient movement of air traffic by managing the flow of aircraft into and out of airport airspace, guiding pilots during takeoff and landing, monitoring aircraft as they travel through the skies and directing the movement of vehicles on airport runways and taxiways. To become an air traffic controller, a person must be a U.S. citizen, pass medical and background checks, achieve a qualifying score on the Federal Aviation Administration (FAA) pre-employment test, and complete a training course at the FAA Academy. Most air traffic controllers have a four-year degree.

Aircraft mechanic

Aircraft and avionics equipment mechanics repair, maintain and perform inspections on aircraft. Many mechanics are generalists who work on many different types of aircraft. Others specialize in a particular type of aircraft – such as jets, piston-driven airplanes or helicopters – or in a particular section or system, such as the engine, hydraulics or electrical system. Although some aircraft mechanics enter the field with a high school education or equivalent and are trained on the job or receive training in the military, most learn their trade at an FAA-approved aviation maintenance technician school and are certified by the FAA.

Astronaut

The duties of professional NASA astronauts depend on their crew assignment as commander, pilot or mission specialist. The commander is responsible for the vehicle, crew, mission success and safety of the flight. The pilot assists the commander in controlling and operating the vehicle. Mission specialists coordinate systems, crew activity planning, consumables usage and experiment/payload operations. Astronauts need a minimum of a four-year degree from an accredited institution in engineering, biological science, physical science or mathematics,
Although an advanced degree is desirable. Astronauts also must pass a NASA space physical and be citizens of the United States. In addition, commanders and pilots must have at least 1,000 hours of pilot-in-command time in jet aircraft.

Flight attendant
Flight attendants ensure the safety and comfort of airline passengers by ensuring that everyone follows security regulations. Flight attendants, who must have at least a high school diploma, receive initial training from their employer and are certified by the FAA.

Pilot
Airline and commercial pilots fly and navigate airplanes, helicopters and other aircraft. Airline pilots fly for airlines that transport people and cargo on a fixed schedule, while commercial pilots fly aircraft for other reasons, including charter flights, rescue operations, firefighting, aerial photography and agricultural crop dusting. Most airline pilots begin their careers as commercial pilots. Commercial pilots typically need a high school diploma, while airline pilots typically need a four-year degree. All pilots who are paid to fly must have at least a commercial pilot’s license from the FAA, and airline pilots also must have an Airline Transport Pilot (ATP) certification. Most pilots begin their flight training with independent instructors or through flight schools. You can search for a flight school near you at av-info.faa.gov/PilotSchool.asp.

Sources: Federal Aviation Administration, NASA, U.S. Bureau of Labor Statistics

Military careers in aviation and aerospace
The U.S. armed forces offer many occupational specialties related to aviation and aerospace for both officers and enlisted men and women. Many do not require previous education or experience; training, which may also qualify for college credit, is provided by the military immediately following basic training. Of course, the Air Force offers many occupations directly involved with aviation and aerospace. However, the Army, Coast Guard, Marine Corps and Navy also have many jobs in these fields, including air traffic controller, air transportation specialist, aircrew member, flight engineer, aircraft launch and recovery specialist and crewchief.


Learning with the Times
Aviation careers
So are you interested in exploring career paths in aviation and aerospace? There are hundreds of options. Some career options are listed on these pages, but there are many more choices. What other types of jobs do you think there are in this field? Check out the websites listed on these pages. Write down all of the different types of jobs you can find. Choose five of these jobs and write a few sentences about how you feel these people make a difference in their community. Next, find an article in the Tampa Bay Times that depicts someone making a difference in the community. Write down the main points of the article. Share what you have learned with your class.
Tony Jannus Distinguished Aviation Society

Founded in 1964, the Tony Jannus Distinguished Aviation Society is a 501(c)(3) nonprofit organization that recognizes extraordinary accomplishments in the field of commercial aviation. Each year, the society honors a historic aviation achievement by recognizing a distinguished individual for outstanding contributions to scheduled air transportation with the Tony Jannus Award. The society also looks to the future by offering the annual Tony Jannus Student Essay Contest and the Tony Jannus Scholars Awards.

More information on the Tony Jannus Distinguished Aviation Society can be found at tonyjannus.org.

Tony Jannus student essay contest

The Tony Jannus Distinguished Aviation Society is proud to partner with the Florida Council on Economic Education to offer the annual Tony Jannus student essay contest. The goal of the essay contest is to encourage the interest of high school students in scheduled commercial aviation and in Tony Jannus' history-making role. Students enrolled in grades 9 – 12 in a Florida school are eligible to enter. The Grand Prize winner is awarded a trip to Tampa for the award presentation in November, three round-trip airline tickets and a $600 spending allowance.

The deadline to enter the 2014 essay contest is Sept. 29, 2014. For more information about the Tony Jannus student essay contest, visit TonyJannus.org.

Tony Jannus Scholars Award

The Tony Jannus Distinguished Aviation Society provides financial support to students enrolled in college-level courses leading to a degree in fields related to potential careers in scheduled commercial aviation. Each year, the society honors six aspiring aviation leaders with awards totaling $15,000.

The deadline to apply for a 2014 Scholars Award is Sept. 29, 2014. For more information about the Tony Jannus Scholars Award, including how to apply, visit TonyJannus.org.

Florida Aviation Hall of Fame

Membership in the Florida Aviation Hall of Fame is awarded annually by a selection committee of aviation historians chosen by the Florida Aviation Historical Society. Honorees are inducted into the Hall of Fame at an installation ceremony at the Florida Air Museum at Lakeland Linder Airport in Lakeland, Fla.

Honorees

• Thomas W. Benoist, pioneer aircraft builder (2008)
• Jacqueline Cochran, pioneer aviatrix (2004)
• Glenn Curtiss, pioneer pilot, inventor and founder of three Florida cities (2006)
• Jimmy Doolittle, pioneer pilot and war hero (2007)
• Amelia Earhart, pioneer aviatrix (2010)
• Chalmers H. Goodlin, WWII fighter pilot and test pilot (2005)
• George Haldeman, test pilot and holder of numerous aviation records (2006)
• Ed Hoffman Sr., pioneer pilot (2008)
• Howard Hughes, pioneer pilot and movie producer (2007)
• Jack Hunt, Navy blimp pilot, Distinguished Flying Cross recipient and founding president of Embry-Riddle Aeronautical University (2011)
• Antony H. Jannus, pilot of the first airplane (2003)
• Colin Kelly, WWII B-17 pilot and “first hero of WWII” (2011)

Flight 2014 Planning Board

• Will Michaels, Ph.D., President
• Capt. David McIay, Vice President
• John N. Bowman, CPA, Treasurer
• H. Britt Bocchiardy
• Warren Brown, M.D.
• Robert J. Carter
• Joan Karins
• Al Michejda, AIA
• Frank Robertson
• Chris Steinocher

Florida Aviation Hall of Fame

The St. Petersburg Museum of History was founded in 1920 as the St. Petersburg Memorial Historical Society. The mission of the St. Petersburg Museum of History is to collect, preserve and communicate the history and heritage of Florida with emphasis on St. Petersburg and the Pinellas Peninsula. The museum maintains a collection of more than 32,000 artifacts and an archive of more than 8,000 historic photos and 5,000 documents. More information about the museum can be found at spmoh.com.