

HORIZONS

A publication of the Massachusetts Air and Space Museum

The Massachusetts Air and Space Museum inspires new generations to explore, experience, and pursue interests and opportunities in science and technology.

Vol. 2 Issue 2 Copyright © 2016 Massachusetts Air and Space Museum 200 Hanscom Drive Bedford, MA 01730 www.massairspace.org

General Electric

Aviation

American Innovator For the Jet Age

It would not be uncommon for many to believe that a company like General Electric focused primarily on the manufacture of household appliances and large-scale generating systems used in the production of electrical power. The company name in itself suggests just that. While such an assumption would be partially correct, it would not represent the complete scope of this very large and diverse modern corporation. Owing to its roots from the Edison General Electric Company, GE dates back to the



GE Aviation CF6-80C jet engine

era of the Spanish-American War. Then, the company seized upon the public's new-found fascination with all things electrical. It developed an elastic manufacturing model that is still in use today; one where innovation is the key element and driving force that allows the business to turn its eye toward the skies.

During the latter Nineteenth and early Twentieth Centuries, GE was intimately associated with major advances in the general field of

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transportation. From railroad locomotives to piston-driven airplane motors, the company was involved in both manufacturing and reconfiguring the motors that moved America and the world. One of its primary plants for accomplishing all this heavy lift capability was the River Works Plant in Lynn, Massachusetts. Seated at the mouth of the Saugus River, the plant is a spacious intermodal hub that is accessible by land, rail and sea. Skilled workers were attracted to the area because it offered plenty of comfortable housing in well-ordered communities just north of Boston. Having a wealth of skilled labor available and the acreage to expand and grow as technology changed was part of the chemistry that made, and continues to make, the GE River Works Plant such a success. Today that sprawling plant hosts a technological building that is dedicated to the production of the most efficient jet propulsion engines in the world.

How GE first came to be involved in jet engine production is entrenched in the technological advances in aviation that were forged in the crucible of World War II. Both the British and the Germans had engaged during the war in parallel development of jet propulsion, and both nations had independently produced jet-propelled fighter aircraft before war's end. But the United States military had committed itself to piston-driven engines until General Hap Arnold stepped in and helped arrange for GE to begin the development of an American jet engine to power the military aircraft of the future. He had



General Electric J31 Jet Engine

witnessed first-hand what the amazing Whittle engine could do, and he was convinced that the mighty Arsenal of Democracy needed them to stay ahead of the technological curve.

GE had extensive experience in propulsion development dating back to the 19th Century. Steam turbines for both power generation and transportation were part of the company's stock and trade. It was this in-depth knowledge of power generation that made the company the logical place for developing a new turbine power source for aviation. Although initially focused

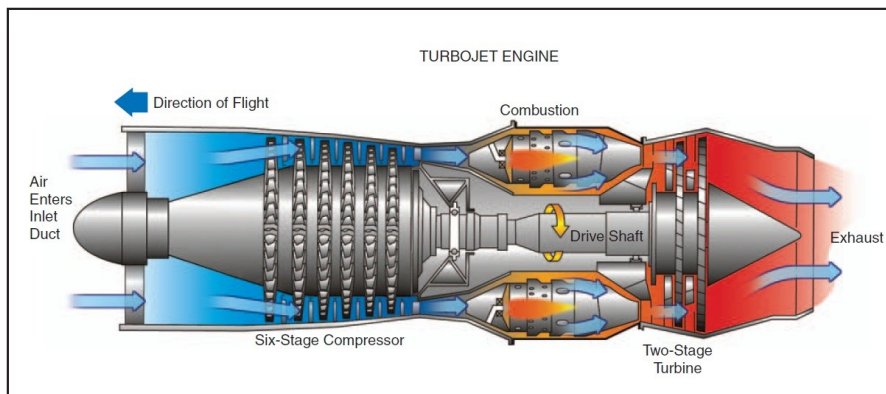
on improving the dynamics of aviation's piston engines, engineers and scientists turned their attention toward developing a turbine engine that could out-perform the biggest and best piston engines.

GE's vast experience with the development of the turbo-supercharged aircraft engine was a key element to the company's progression into the development of jet propulsion. In the early days, the terms *jet* and *rocket* often meant the same thing; propulsion with-

out propellers. Rockets carry their own oxygen source for combustion, while jets use what air is available to them to combust fuel. GE's experience in the development of turbo-charged engines in order

to make use of thinner air at higher altitudes proved to be essential in the development of jet engines. In essence, the jet engine is a turbocharger that produces thrust through the combustion of gases under pressure.

The first step toward developing a true jet engine was an intermediate design known as the *turboprop*



Fallriver Native is Awarded the Medal of Honor

Inspired in high school by an educator at Phillips Andover Academy, young **Thomas Hudner, Jr.** decided upon service in the United States military. Upon graduation from Phillips, he became a midshipman at the U.S. Naval Academy at Annapolis, graduating in 1946 alongside fellow classmates James B. Stockdale, Stanfield Turner and a Georgia farmboy by the name of Jimmy Carter. Stockdale would become a medal of honor recipient during the Vietnam War, Stanfield Turner would later run the Central Intelligence Agency, and Jimmy Carter would become the 39th President of the United States.

Hudner initially had no interest in aviation and served as a naval communications officer aboard ship. But, while stationed at Pearl Harbor, he developed an interest in flying and eventually applied for flight school. He was accepted and took his initial flight training in Pensacola, Florida, and advance training at Corpus Christie, Texas. He was certified a Navy pilot and assigned to fighter pilot duty with the Atlantic fleet. Hudner was assigned to fighter squadron VF-32 aboard the *USS Leyte*. He was piloting the F4U Corsair which he considered to be a very comfortable aircraft.

At the outbreak of the Korean conflict during the summer of 1950, the *USS Leyte* was pulled from duty in the Mediterranean and deployed to the waters off the coast of North Korea because command felt their pilots were better-trained than those on other carriers. Once there, VF-32 flew sorties inland to provide close air support to US Marine ground operations, and to take out strategic targets and any targets-of-



Tom Hudner in the cockpit of his Corsair F4U-4 fighter

opportunity that may have arisen.

Thomas Hubner's wingman was twenty-four-year-old Ensign Jesse L. Brown; the first African-American US naval carrier pilot. Prior to December 4, 1950, Brown flew twenty missions and had earned the Distinguished Flying Cross.



On December 4, 1950, Hudner and Brown flew through harsh winter weather some 100 miles to the area of the Chosin Reservoir in the

north-central region of North Korea. There, some 15,000 US troops were confronted with over 100,000 enemy soldiers. During the trip inland, Brown's aircraft was apparently hit by small-arms fire from the ground and another pilot informed him he was trailing something. The oil pressure dropped and Jesse was having trouble managing his airplane. After repeated efforts to solve the problem, he eventually ditched his aircraft on the remote side of a mountain seven to eight miles northwest of Chosin Reservoir.

In the crash the airplane disintegrated. Brown was badly injured and his leg was pinned under the wreckage. He signaled to the orbiting members of his squadron that he had survived the crash, and the covering pilots scoured the area for enemy troops. When it became clear that his wingman needed help,

Lieutenant Hudner found a patch of ground nearby and crash-landed his Corsair. He made his way to Brown's side and tried his best to free him from the battered fuselage, but was unsuccessful. Jesse Brown lay dying while his squadron-mates above radioed the ship at 14:40 hours for a helicopter to help rescue him. The helicopter arrived at 15:00 to find Brown pinned under a crashed and burning airplane, and Hudner furiously trying to extinguish the flames by throwing snow at them.

Despite efforts by the helicopter pilot, Hudner and Brown, Jesse's leg remained pinned under the wreckage. Jesse suggested that they amputate his leg in order to free him, but they didn't. The young pilot was in and out of consciousness, but manage to make one important request of his wingman before he passed out for the last time. Brown asked Thomas Hudner to, "Tell Daisy I love her." Daisy Pearl Nix was the girl he'd fallen in love with back in high school, and she later became his wife.

Unable to put out the fire, both Hudner and the helicopter pilot evacuated back to the ship via the chopper. Once aboard the *USS Leyte*, Thomas begged to be allowed to return to the crash site and bring Jesse back, but his requests were refused. Brown had succumbed to his injuries and the Navy eventually cauterized the crash site with napalm.

In memory of his gallantry during his twenty missions, the *USS Jesse L. Brown* (FF-1089) was commissioned and named for him.

On April 13, 1951, President Harry S. Truman presented the United States Congressional Medal of Honor to Thomas Jerome Hudner, Jr. The citation that accompanied the medal reads as follows:

For conspicuous gallantry and intrepidity at the risk of his life above and beyond the call of duty as a pilot in Fighter Squadron 32, while attempting to rescue a squadron mate whose plane struck by anti-aircraft fire and trailing smoke, was forced down behind enemy lines. Quickly maneuvering to circle the downed pilot and protect him from enemy troops infesting the area, Lt. (J.G.) Hudner risked his life to save the injured flier who was trapped alive in the burning wreckage. Fully aware of the extreme danger in landing on the



rough mountainous terrain and the scant hope of escape or survival in subzero temperature, he put his plane down skillfully in a deliberate wheels-up landing in the presence of enemy troops. With his bare hands, he packed the fuselage with snow to keep the flames away from the pilot and struggled to pull him free. Unsuccessful in this, he returned to his crashed aircraft and radioed other airborne planes, requesting that a helicopter be dispatched with an ax and fire extinguisher. He then remained on the spot despite the continuing danger from

enemy action and, with the assistance of the rescue pilot, renewed a desperate but unavailing battle against time, cold, and flames. Lt. (J.G.) Hudner's exceptionally valiant action and selfless devotion to a shipmate sustain and enhance the highest traditions of the U.S. Naval Service.



On August 31st, Captain Thomas J. Hudner, Jr. (USN-Ret) celebrated his 92nd birthday with his family at his home in Concord, Massachusetts. It is fitting that the U.S. Navy is commissioning a ship in honor of Captain Hudner, and soon the Arleigh Burke-class guided missile destroyer *USS Thomas Hudner* (DDG-116) will be launched in Boston in 2018.



MASM Board of Directors and Steering Committee Meet



The Massachusetts Air and Space Museum Board of Directors and the steering committee recently met to finalize the donation of assets from the Massachusetts Aviation History Society to the MASM. This move is in conjunction with MAHS shutting down altogether. The board agreed to honor all MAHS memberships as members of MASM, and it was decided that the previous annual dues for MAHS of \$25.00 would become the standard for MASM as well. The board also voted to honor all the Pathfinder memberships that were previously part of MAHS.

Along with fixing annual membership dues at \$25.00, the MASM board also ordered the printing of MASM calendars which will be sent to all those who renew their memberships for the coming year. The calendars will be of high-quality and will be mailed out to all renewing members.

The Board of Directors discussed the possibility of a temporary facility available at Mansfield Airport. The space available is in a new-constructed building but would require some costly outfitting in order to be suitable for a museum.

Chairman Joe Dini also reported meeting with Minute-man Technical High School regarding possible space to be available for temporarily space, and for the development of a curriculum which he and Barbara Jagla will continue to track.

MASM setting up exhibits at the Air National Guard Museum at the former armory in Concord was put on hold pending the securing of funding to finance the project.

Upon motion without objection, all officers and directors were unanimously elected to continue in their present capacities.

Delivering Aviation Education and Inspiration



One idea being considered by the board and the steering committee is the development of traveling roadshow to inspire high school students all over the state. The concept has been proven in other locations throughout the country. All that is needed is a corporate sponsor to purchase and outfit a bus with the equipment and supplies necessary for an instructor to provide an established curriculum; and, of course, a qualified instructor.

MASM Hits the Road



The Massachusetts Air and Space Museum participated once again in the Aviation and Maritime STEM Education Expo at Logan Airport; STEM being the acronym for Science, Technology, Engineering and Mathematics. This annual event is sponsored by the Federal Aviation Administration in cooperation with MassPort. Now in its 22nd year, the Expo offers youth from around Massachusetts and southern New Hampshire the opportunity to be exposed to multiple career paths that are available in the aviation and maritime fields. This year's occurrence saw over 60 exhibits by various organizations including the FAA, MassPort, The US Coast Guard, GE Aviation, the Massachusetts Air & Space Museum, NOAA, the Massachusetts State

Police, the TSA, the Mass Maritime Academy, Cape Air, the Tuskegee Airman and numerous other groups.

As many as 20 airplanes and helicopters were on hand for the more than 1600 students to see, touch and in some cases actually sit at the controls. Other vehicles on-hand were the Boston bus tours, airport operations vehicles, fire apparatus and a rescue boat. Also, the Stellwagen Bank National Marine Sanctuary (NOAA) brought an inflatable life-size humpback whale and its calf. STEM is an acronym for Science, Technology, Engineering and Mathematics with a pri-

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mary focus to get children excited about those specific areas. A total of 45 schools brought children to the annual event to gain a clearer understanding of what paths are available under the STEM umbrella.

Past years have taught that this can be a very cold event. This year was no different. The temperature was hovering around 27° on drive into Logan Airport but we were dressed as if spending the day outdoors skiing. Although the large Delta hangar door remains open, a heater/blower works overtime to try to create some heat for the participants. The museum's table was manned by Joe Dini and Al Mundo with Barbara Jagla stepping in to give the two a break. Many pamphlets outlining the mission and goals of the future museum were handed out and teachers were informed about what the hopes are for a STEM program.

This event typically occurs on the first Wednesday of April. Speaking with Julie Seltsam-Wilps, the Aviation Education Program Manager for the FAA's New England Region and member of the MASM team, she stated that the time frame is based primarily on the school year's

testing regimen. Although a later date would be desired, the basic concern is that it would interfere with standardized testing such MCAS or PARCC. The other factor is that the event has to be late enough in the

season so that the aircraft have the potential for a good day to fly weatherwise. She also shared that 15 FAA employees, 50 MassPort employees and 20 volunteers made the affair work. Planning begins in September for the spring Expo.

I would recommend that anyone who would like the experience of being at Logan and helping to grow the museum, mark their calendar for next year's Expo. It may even be possible to fly in if you own a plane or are interested in renting. MassPort waives the landing fee and it is a rare opportunity to experience landing and departing at a major hub in small aircraft (although one can feel a little like a guppy in a sea of leviathans such as the aforementioned humpback.) The event continues to grow and expand. Coffee, water, snacks and lunch is provided to all organization participants and it is certainly a way to "give back" to the aviation community while also having an uncommon experience. I hope to see your name on the list of participants for 2017.➔



engine. Just prior to U.S. involvement in World War II, GE began the development of the first turboprop engine for aircraft use. Because the mindset at the time revolved around propeller-driven engines, the power plant existed to spin the prop in order to generate thrust from the propeller blades. However, the turboprop also produced thrust in the form of exhaust. This process was actually the basis for an actual jet engine – thrust derived alone from combustion and hot gases under pressure. The development of an engine for aviation that produced thrust without a propeller was the next logical step in the process. By eliminating the propeller, the *turboprop* evolved into the *turbojet*.

The first American jet aircraft ever constructed was the Bell XP-59-A, affectionately dubbed the *Airacomet*. This twin-engine aircraft, powered by GE's turbine engines, proved the concept of jet power at high altitudes. Operational tests of this airplane were conducted at Edwards Dry Lake, California; later known as Edwards Air Force Base. Due to the shroud of secrecy surrounding the project, in order to move the craft from one place to another at the test facility, a fake cowl and propeller covered the nose of the airplane. During initial tests, the test pilot decided to mask his own appearance by wearing a gorilla mask and a derby top hat. He also held a big cigar in his mouth as he came up on fellow test pilots in prop planes. These pilots reported that they had seen an airplane that had no propeller flying next to them with this gorilla wearing a top hat and smoking a cigar. Those on the ground accredited the pilot reports to



Bell XP-59-A Airacomet

severe stress, obscured vision due to anoxia, or that the pilots were just plain nuts.

Although the United States didn't develop an operation jet aircraft for the military use during World War II, jet-powered fighter and pursuit aircraft had become commonplace during the Korean War. Not only were jets flying from bases in South Korea, the Navy was able to launch and recover jets aboard aircraft carriers operating offshore from their inland targets. One young soldier stationed

at Fort Devens, Massachusetts was determined to fly, and eventually Joe McConnell became the first five-time ace in his F-86 Saber Jet by knocking out sixteen enemy MiG-15 aircraft in jet-to-jet aerial combat. Captain Joe McConnell's record still stands.

Although military contracts with GE were cancelled by the end of World War II, engineers within the company pressed on toward the development of better jet engines in anticipation of future needs. The company eventually created the J47 engine, which saw heavy production through the middle-1950s, and the J79, which powered advanced airframes to Mach 2+ and won the coveted Collier Trophy for outstanding technical advancement of aviation. Although their chief competitor, Pratt Whitney, was powering many of the latest civilian aircraft in service at the time, G. E. also became a contender in the commercial aviation market powering both passenger and heavy-

\$25

That's all it costs to renew and maintain your membership with the Massachusetts Air and Space Museum for 2017. With your paid renewal you'll receive one of the museum's 2017 calendars which includes rare photos of noteworthy aircraft that are part of the Bay State's aviation heritage. In addition, you'll continue to receive all the 2017 editions of "Horizons," MASM's premier newsletter that will be filled with stories and links to the wide world of aviation.

Don't miss out on your chance to capture Massachusetts aviation history. Send your check today to:

**Massachusetts Air and Space Museum
200 Hanscon Drive
Bedford, MA 01730**

You can also renew via credit card online by clicking:

<http://www.massairspace.org/join/>

Renew Today!

MASM to Host 2nd Annual General Aviation Forum

Massport Terminal, Worcester Airport

Following the great success of the General Aviation Forum held this past spring at the Massport Terminal at Worcester Airport, participants from all over Massachusetts are anxious once again to come together to talk aviation. Keith Young of the MASM Steering Committee is again coordinating this extraordinary effort to bring together the leaders in general aviation from across the state. A date for the forum been announced and will be held on March 25, 2017 from 8:00 Am to 2:00 PM. Keep watching "Horizons" for updates, or check in to our website at:

<http://www.massairspace.org/>



This is a great chance to learn about the future of general aviation firsthand from industry leaders. Plan on attending!

lift cargo aircraft.

By the 1960s, a giant sign stood outside the entrance to the River Works plant in Lynn, Mass. that read: "Turbotown, Birthplace of the American Jet Engine, Small Aircraft Engine Department · Lynn, Mass." In the 1990s the plant had become the official home of GE Aviation. Jet engines for military and commercial use were rolling out of the River Works plant. General Electric eventually was counted among the top three producers of jet propulsion along with Pratt Whitney and Rolls Royce. Because of the weight-to-thrust ratio of the GE90 engine, Boeing uses that engine in the 747-8, the 777, and the 787 aircraft. The latter two airplanes also employ the new GEnX.

On the horizon for aviation is utilization of the latest in jet technology, the GEnX engine. In addition to proven technologies,

GE is using composite materials in the construction of the intake fan. Inside this light-weight engine casing is the most efficient core ever created. There is a ten-stage compact compressor that generates pressure

that is a 23:1 ratio;

tops in the industry. This translates into efficient development of thrust that is both economical to purchase, cheap, safe and reliable to operate, and green.

GE is now producing the first truly new jet propulsion system of the 21st Century. With it's rich history and innovative business model, this diverse company will continue to be the leader in aviation propulsion into the next century, and far beyond. ➔

GE's GENX Fan Blade by CFAN



Boeing 747-8



Boeing 777

Part 2

Part 3

Part 4

Part 5



Boeing 787 Dreamliner

Editor's note: If you are reading Horizons in hardcopy only, you are missing more than half the content of this publication. You can view all the hidden content by going to www.massairspace.org and clicking on "News and Events." Pick the issue of Horizons that you wish to review and have fun exploring all the content behind every photograph. It's like an Easter egg hunt for adults, only more informative!

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Video Page

A Humid Thunderbird

Always remember the secret to every edition of Horizons when you read it electronically; there is something hidden behind every photograph. Be sure to click each one to discover your passport to other places and additional interesting information about aviation.



THE PEARL HARBOR P-40 BOYS



Cargo Airships
Available in 2018



 **BOEING** *MicroLattice Technology*



2016 Singapore Airshow Static Displays



OSH KOSH 2016—WARBIRDS



22 & 30 HP HOMEBUILTS



The Story of Pan Am