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Carried Through The Sky On Fine Threads



Boeing 787 Dreamliner

Boeing Aircraft Photo

by Tyler Beckman

The aerospace industry never ceases to be on the cutting edge of technology! If you want to know or see the future of technology in engineering and design, look no further than in the aerospace industry because it usually starts there. When we think of the word “aerospace,” we envision



Cirrus Vision SF50

Cirrus Aircraft Photo

NASA’s space shuttle launching from Cape Canaveral with all its aerodynamic curves and its powerful rocket boosters. Herein lies the challenge given to all engineers and aerospace companies that produce these amazing machines.

Early Aircraft Structures

Early scientists, inventors,

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and engineers were challenged with making the materials of their day take flight through the sky. The Wright Brothers and others during their time became successful with a combination of lightweight wood, fabric, and the internal combustion engine. Power generated by an internal combustion engine was definitely crucial at this time in history. As time went on, these early structures proved to fall behind as aircraft began flying higher, moving faster, and flying longer. To do these things, aircraft had to become lighter and stronger.

Wood and fabric took the airplane only so far, and engine technology became increasingly powerful. Fabric and wood just cannot withstand the forces produced by these higher power engines, nor can they provide a suitable pressure vessel for a pressurized cabin. So aluminum came on the scene. Lightweight, easily formable, and strong were all the characteristics needed to fly faster, higher, and carry a lot of weight in passengers, cargo and fuel.

Aluminum and its various alloys have their birthplace from World War I and II. Like the rest of the aerospace technology, many aircraft, rockets, and satellites have been designed and produced around this lightweight material. Aluminum came into the aerospace industry and has been the go-to material for many years, and I believe it will continue to be so.

Future Aircraft Structures

Today, we see aircraft made from a mixture of structures, which is a sign that aircraft companies are researching and designing lighter weight components. We all know about the new passenger aircraft rolling off the assembly lines with Advanced Composite materials, which make up greater than 50% of a structure. Examples, such as the Boeing 787 and the Airbus A350, Cirrus SR-22, Cirrus Vision SF50, the Learjet 85, all use composite materials. Even the engines of these aircraft are using advanced composites within the internal

components where titanium has been the primary material used for years in jet engines.

What are these composite materials? Aramid (Kevlar) fiber.

A scientist at DuPont by the name of Stephanie L. Kwolek developed Kevlar in 1965.

Kevlar is an interesting material. The applications of the material I think are the most interesting. Kevlar has been used to make cut resistant gloves; it has been woven to make bulletproof vests; and it has been used where flame resistance is a desired characteristic, such as for firefighting gear.

My experience working with Kevlar comes from a small unmanned aerial system (sUAS) we fly in our Certificate of Authorization (COA).

Northland Community & Technical College (NCTC) received the COA from the FAA in 2014 to fly sUAS in Roseau County, Minnesota for agricultural research purposes at NCTC. It is called the "Sentera Phoenix," sold by Sentera, which is a Minneapolis, Minnesota-based company. Most of the structure, wings and fuselage uses Kevlar. The internal bay is reinforced with carbon fiber to give it strong internal bracing where the battery and sensors mount.

Carbon Fiber

Carbon fiber is advancing by leaps and bounds in many industries. Carbon fiber is considered to have the greatest strength-to-weight ratios compared to Kevlar and glass.

An intriguing part on aircraft where carbon fibers are being used is the first stage fans on high bypass turbo fan engines. For example, the GENx engine has carbon fiber composite fan blades, which are laid up by hand and placed into an auto-clave for cure. Each blade is rigorously tested before being installed on a new engine. According to GE, they are seeing 15% better fuel consumption with these blades installed.

Ceramic Matrix Composites

Ceramic Matrix Composites (CMCs) are being researched and developed by General Electric, which would have excellent weight savings in the hot section of a jet engine. Metals have dominated this area of the engine over the years, but CMCs may prove to be a formidable competitor.

Ceramic is a brittle substance that can withstand extremely high temperatures. GE has figured out an advanced process to produce engine parts that can withstand the extreme requirements in a jet engine.

What This Means To Aerospace Education

An understanding is needed by technicians to know the material and the structures that these materials make. The following questions will need to be answered to repair aircraft structures:

What material is the fiber made out of?

What style of weave was the fiber used to construct?

What orientation is the weave fabricated?

What matrix system was used to encapsulate the fibers?

The list goes on with the technical knowledge in this field.

One of the most important questions technicians need to ask is, can I repair this part?

There is no need to be overwhelmed by these questions, and if you lack experience in these areas, please know there are several options out there to get you up to a faster airspeed.

At Northland Community & Technical College, we have been training FAA mechanics with ratings in Airframe and Powerplant for over 50 years. This program provides the skills of having a good aviation maintenance technician foundation. NCTC also offers a certificate in Unmanned Aerial Systems Maintenance, which provides additional training built upon the solid foundation of having an FAA mechanic certificate with Airframe and

Powerplant ratings. If you have been keeping up with aviation news, you may have noticed quite a few articles about the decline in the number of aircraft mechanics entering into the workforce. We need your help with this.

NCTC actively recruits for the

program, but even if we turn out the students we have, it will still not be enough for what the industry needs.

There is a strong future in the aerospace industry and you can be part of it.

EDITOR'S NOTE: Northland

Aerospace is a collaborative partnership between Northland Community and Technical College (NCTC) of Thief River Falls, Minnesota and the Northland Aerospace Foundation (NAF) of East Grand Forks, Minnesota. NCTC is the educator and NAF helps it operate "at the speed of business." □

REIGEL/KLOBUCHAR FROM PAGE 49

Reauthorization, please keep in mind the GA industry's need for a multi-year reauthorization that will sustain funding for multi-year projects. The FAA, and ultimately GA, need committed, long-term funding, rather than a string of continuing resolutions that only perpetuate uncertainty and insecurity within the entire aviation industry.

"Futhermore, Congress and the

FAA need to retain authority over Air Traffic Control (ATC) and the National Airspace System (NAS). Transferring control of these air transportation systems to a 'private entity' funded by user fees (which have been repeatedly rejected by Congress) would not result in efficiencies or benefit the public. Rather, such a transfer would add bureaucracy and cost which would unduly burden and stifle the GA industry."

Reigel concluded his letter by thanking Senator Klobuchar for being a member of the General Aviation Caucus and for supporting General Aviation, and offered to discuss these issues further at her convenience.

EDITOR'S NOTE: All pilots, airport managers and aviation business owners are urged to likewise contact their U.S. Senators and Representatives and encourage their support of the Pilot's Bill of Rights II (PBOR2). □

South Dakota Aviation Businesses Oppose Creation of Air Traffic Control Corporation

WASHINGTON, DC – In a September 8, 2015 letter to the Chairman of the Senate Commerce Committee, Senator John Thune (R-SD), South Dakota aviation businesses expressed opposition to using the upcoming FAA reauthorization legislation to create a user-fee funded

air traffic control corporation, stating, "It will undermine the National Air Transportation System by denying rural America access to cutting-edge technology and hinder South Dakota's economic development."

The letter concluded by stating, "The upcoming FAA reauthorization

presents many opportunities to improve operations at the FAA and make it easier for aviation businesses to interact with the agency. However, separating air traffic control from the agency's regulatory functions risks undermining aviation safety, jobs, and investment for all South Dakotans."

The letter to Senator Thune follows a briefing with South Dakota businesses by NATA President Tom Hendricks on the status of FAA reauthorization. □

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