Volume 37 Issue 3 March, 2020

Winds Aloft

EAA Chapter 790 Lake in the Hills, IL 790.eaachapter.org

Chapter Banquet

Our Annual Chapter Banquet was held at the Cary Country Club. Paul Sindberg gave an excellent presentation on the Boeing 777 Max.

Scholarship awards were presented to Megan Pranczke for the Air Academy and Mark Luchsinger for the $1,000 flight training. Certificates were awarded to Chapter Leaders. Paul Ranieri, president, and Matt Van Bergen made the presentations.

Mic Petrie Treasurer

In this Issue

Cover nose and mouth, wash hands

Megan and Mark, Scholarship Winners

Love those shoes Megan

Tom LeGates Website Manager

High Octane WW11 *By Jack Krohn*

It has always puzzled me as to why the German Luftwaffe kept on using 87 Octane Aviation Gasoline while the Americans and British used 100 Octane Gasoline in their Spitfire Fighters and Americans used 130 Octane in our P-51 and other fighters. This morning I discovered the reason! This is a declassified article by the British Society of Chemists (Declassified in 2014)

It seems that the German and British aircraft both used 87 Octane Gasoline in the first two years of the war. While that was fairly satisfactory in the German Daimler-Benz V-12 engine, It was marginal in the British Rolls-Royce Merlin XX engine in British aircraft. It fouled the spark-plugs, caused valves to stick, And made frequent engine repair problems.

Then came lend- lease and American aircraft began to enter British service in great numbers. If British engines hated 87 Octane gasoline, American, General Motors Built, Allison 1710 engines loathed and despised it. Something had to be done!

Along came an American named Tim Palucka, a chemist for Sun Oil in their South East Texas Refinery. Never heard of him? Small wonder, very few people have. He took a French formula for enhancing the octane of Gasoline, and invented the "Cracking Tower" and produced 100 octane aviation Gasoline. This discovery led to great joy among our English Cousins and great distress among the Germans.

A Spitfire fueled with 100 Octane gasoline was 34 miles per hour faster at 10,000 feet. The need to replace engines went from every 500 hours of operation to every 1,000 hours. Which reduced the cost of British aircraft by 300 Pounds Sterling. Even more, when used in 4 engine bombers.

The Germans couldn't believe it when Spitfires that couldn't catch them a year ago started shooting their ME-109 E and G models right out of the sky.

Of course, the matter had to be kept secret. If the Germans found out that it was a French Invention, They'd simply copy the original French patents. If any of you have ever wondered what they were doing in that 3 story white brick building in front of the Sun Oil Refinery on Old Highway 90, that was it. They were re-inventing gasoline.

The American Allison engines improved remarkably with 100 Octane gasoline, but did much better when 130 octane gasoline came along in 1944. The 130 Octane also improved the Radial Engine Bombers we produced.

The Germans and Japanese never snapped to the fact that we had re-invented gasoline. Neither did our "Friends" the Russians. 100,000 Americans died in the skies over Europe. Lord only knows what that number would have been without "Super-Gasoline". And it all was invented just a few miles west of Beaumont, and we never knew a thing about it.

Article submitted by Bud Herod

Aviation Fuel

Many parts of a successful aircraft are easily visible葉he control surfaces, engines, wings, fuselage, and structure for instance. But the fuel that powers the engines is equally important, though not nearly as visible. Aircraft engines, from powerful piston engines to jet turbines, have always required a more sophisticated form of fuel than most ground vehicles, and the technological development of this fuel to power the engines is just as significant as other technological advances.

For the first few decades of flight, aircraft engines simply used the same kind of gasoline that powered automobiles. But simple gasoline was not necessarily the best fuel for the large, powerful engines used by piston-driven airplanes that were developed in the 1930s and 1940s.

Before World War II, Major Jimmie Doolittle realized that if the United States got involved in the war in Europe, it would require large amounts of aviation fuel with high octane. Doolittle was already famous in the aviation community as a racing pilot and for his support of advanced research and development (and would later earn even wider fame as head of the 1942 B-25 bombing raid on Tokyo). In the 1930s, he headed the aviation fuels section of the Shell Oil Company.

Fuel is rated according to its level of octane. High amounts of octane allow a powerful piston engine to burn its fuel efficiently, a quality called "anti-knock" because the engine does not misfire, or "knock." At that time, high-octane aviation gas was only a small percentage of the overall petroleum refined in the United States. Most gas had no more than an 87 octane rating. Doolittle pushed hard for the development of 100-octane fuel (commonly called Aviation Gasoline or AvGas) and convinced Shell to begin manufacturing it, to stockpile the chemicals necessary to make more, and to modify its refineries to make mass production of high-octane fuel possible. As a result, when the United States entered the war in late 1941, it had plenty of high-quality fuel for its engines, and its aircraft engines performed better than similarly sized engines in the German Luftwaffe's airplanes. Engine designers were also encouraged by the existence of high-performance fuels to develop even higher-performance engines for aircraft.

A major problem with gasoline is that it has what is known as a low "flashpoint." This is the temperature at which it produces fumes that can be ignited by an open flame. Gasoline has a flashpoint of around 30 degrees Fahrenheit (-1 degree Celsius). This makes fires much more likely in the event of an accident. So engine designers sought to develop engines that used fuels with higher flashpoints.

The invention of jet engines created another challenge for engine designers. They did not require a fuel that vaporized (turned to a gaseous state) as easily as AvGas, but they did have other requirements. Instead of using gasoline, they chose kerosene or a kerosene-gasoline mix. The first jet fuel was known as JP-1 (for "Jet Propellant"), but the U.S. military soon sought fuels with better qualities. They wanted fuels that did not produce visible smoke and which were also less likely to produce contrails (the visible trail of condensed water vapor or ice crystals caused when water condenses in aircraft exhaust at certain altitudes). But a major requirement was for fuels that did not ignite at low temperatures in order to reduce the chance of fire.

Certain types of aircraft operations also demanded that specific types of fuel be available. For instance, the U.S. Navy had to carry large amounts of fuel for the planes and helicopters on its aircraft carriers. When most of the aircraft were piston-driven, they carried AvGas, which had a low flashpoint and was therefore dangerous to have on board because it could easily catch fire.

Continued on next page

Aviation Fuel (*continued)*

The advent of jets led the Navy to seek jet propellant that had a higher flashpoint than JP-1. Whereas most Air Force aircraft soon used a kerosene-gasoline mix called JP-4, which already had a higher flashpoint than standard AvGas, the Navy developed a fuel known as JP-5 with an even higher flashpoint than JP-4. It also sought to retire aircraft that used AvGas. Fortunately, the introduction of turbine engines on helicopters and for propeller-driven airplanes also reduced the Navy's need for AvGas. Navy leaders are extremely safety-conscious about fuels. When a Navy jet is refueled in flight by an Air Force tanker with Air Force fuel, safety rules prohibit the plane from being stored below deck on the ship when it lands.

Aircraft operators are constantly refining their fuels to deal with specific performance concerns. The U.S. Air Force during the 1990s switched from JP-4 to JP-8 because it had a higher flashpoint and was less carcinogenic, among other things. By the mid 1990s, the Air Force further modified JP-8 to include a chemical that reduced the buildup of contaminants in the engines that affected performance. JP-8 has a strong odor and is oily to the touch, which makes it more unpleasant to handle and less safe in some ways (military personnel who work with it complain that it is difficult to wash off and causes headaches and other physical problems). About 60 billion gallons (227 billion liters) were used worldwide by the late 1990s, with the U.S. Air Force, Army, and NATO using about 4.5 billion gallons (17 billion liters). It is also used to fuel heaters, stoves, tanks, and other military vehicles.

Commercial jet fuel, known as Jet-A, is pure kerosene and has a flashpoint of 120 degrees Fahrenheit (49 degrees Celsius). It is a high-quality fuel, however, and if it fails the purity and other quality tests for use on jet aircraft, it is sold to other ground-based users with less demanding requirements, like railroad engines. Commercial jet fuel as well as military jet fuel often includes anti-freeze to prevent ice buildup inside the fuel tanks.

The development of the A-12 OXCART spyplane in the late 1950s created another problem for aircraft and engine designers. The high speeds reached by the A-12 would cause the skin of the aircraft to get hot. Temperatures on the OXCART ranged from 462 to 1,050 degrees Fahrenheit (239 to 566 degrees C). The wings, where the fuel was stored, had external temperatures of more than 500 degrees Fahrenheit (260 degrees C). Even with the lower flashpoint, fuel stored in the wings could explode. As a result, the engine designers at Pratt & Whitney sought a fuel with an extremely high flashpoint. Working with the Ashland Shell and Monsanto companies, the engine designers added fluorocarbons to increase lubricity (or slipperiness), and other chemicals to raise the flashpoint. The resulting fuel was originally known as PF-1 but later renamed JP-7. It was used only by the A-12 OXCART (and its sister YF-12 interceptor) and later the SR-71 Blackbird. JP-7 has such a high flashpoint that a burning match dropped into a bucket of it will not cause it to ignite.

Engine designers and fuel chemists created JP-7 with a high flashpoint that would not explode in the aircraft's tanks, but this also made the fuel hard to ignite within the engines themselves. Because JP-7 is so hard to ignite, particularly at the low pressures encountered at high altitudes, these planes used a special chemical called tri-ethyl borane (TEB), which burns at a high temperature when it is oxidized (combined with air). Another problem that the A-12 encountered was that the engine exhaust (particularly shock waves created in the exhaust when the engines were at full afterburner) was easily seen by radar. The engine designers added an expensive chemical known as A-50, which contained cesium, to the fuel for operational flights that reduced its ability to be detected by radar.

--Dwayne A. Day

For the **March Chapter Meeting** there will be two flight simulators set up for IFR landings. For those who either have not experienced IFR simulation's or those who like to refresh there pilot skills, this event should be fun.

Ray Aviation

Scholarship

Chapter 790 has been awarded the Ray Aviation Scholarship for 2020. Mark Luchsinger has been nominated for the award and is in the process of submitting his application to EAA. Upon approval Mark will begin his flight training within 60 days. CONGRATULATIONS Mark. On behalf of the chapter, thanks EAA for this tremendous opportunity to benefit Youth in Aviation.

Eddied Ranieri is in the process of completing his Ground School Studies and will be prepared to take the FAA written exam shortly, then back to the skies.

Calendar of Events

- March 24th Tues Chapter Meeting IFR Flight Simulations
- April 7th Tues Board Meeting LITH
- April 28th Tues Chapter Meeting
- May 4th , Sat Young Eagles LITH 8:30-noon
- May 16th, EAA Learn to Fly Day
- May 26th Chapter Meeting w/BBQ
- June 6th, Sat Young Eagles LITH 8:30-noon
- June 23rd, Chapter Meeting w/BBQ
- July TBD, Sat Young Eagles, LITH 8:30-noon
- July 20th-26th Air Venture Oshkosh
- July 28th Tues Chapter Meeting Oshkosh Tails w/BBQ
- August 1st Sat Young Eagles, LITH 8:30-noon
- August 26th Chapter Meeting w/BBQ
- Sept 5th,, Sat Young Eagles, LITH 8:30-noon
- Oct 3rd, Sat Young Eagles, LITH 8:30-noon
- Check the Chapter Website "http://www.790.eaachapter.org/"

  for any additional details and a list of local chapter events in the area

"Too often we enjoy the comfort of opinion without the discomfort of thought." *JFK*

Back to Electrics

Ground has been broken on Gigafactories in both Shanghai China, and Germany outside Berlin (the tree farm)

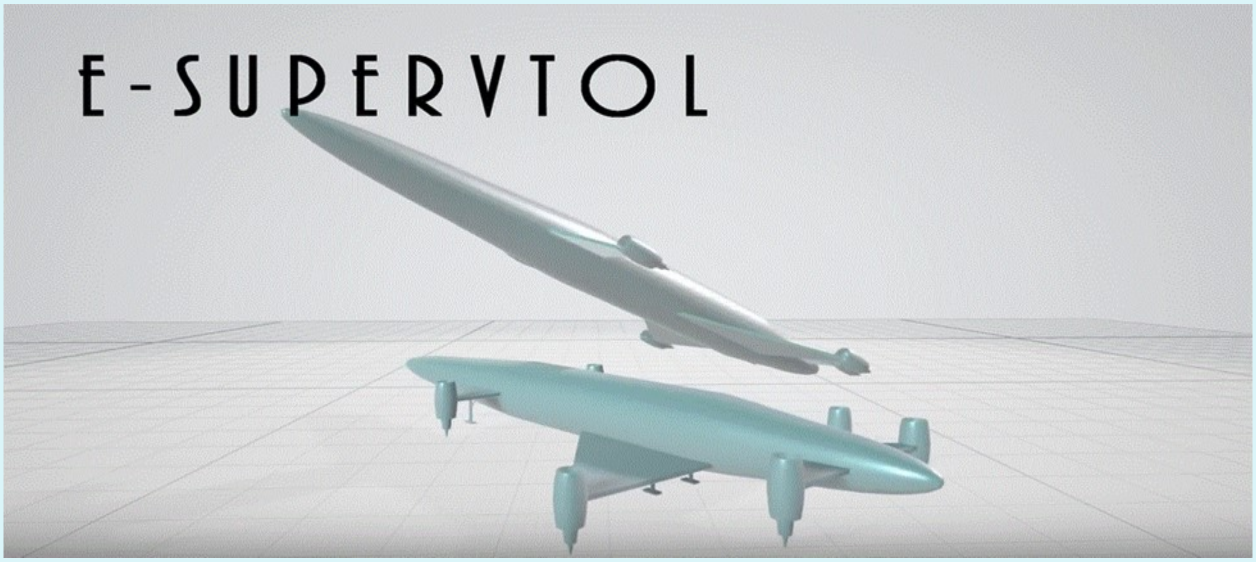
In China, Tesla may be going to the prismatic battery (flat pouch type) and use the Chinese firm CATL as their supplier. (Battery supplies are not keeping up with electric auto production.) These type batteries have shorter range but a 25% decrease in cost.

In the US, Tesla will continue to use the cylindrical cells (which have greater range, better heat dissipation)

On the Electric Aviation Front

Tesla states for short range commercial aircraft they would need at least 400 W-h/kg of energy density. His vision is using an, electric Jet or EDF's

An independent Analysts Idea of Future Electric Jets based on the assumptions noted below: **from the "Limiting Factor" by Jordan Geesade**



Energy to Motion Comparison

Jet Fuel gets 12000 W-h/kg

1000 W-h/kg batteries get 1000 W-h/kg

Jet engines are 50% efficient

Electric Jet engines are 75%+ efficient

Existing Jet drag is 3750 verse 750 estimated prototype electric

Thus in total the jet fueled jet is 5X more efficient than an electric jet with 6 engines and

Back to Electrics *(continued)*

A potential Electric Jet prototype using Tesla's ideas;

No flight controls (drag, cost), uses gimbal engine directivity

No high maintenance or heavy landing gear, instead uses feet

No need for long runways. Can use smaller airports

No windows, passenger screens to be used instead. Windows create pressure point issues

Use stainless steel for fuselage. Tesla is noted for their expertise in pressure testing with stainless steel. Note their last test at Space X in late February exploded. Test, fail, reconfigure, and test again …. His expectations and history at Space X.

Autonomous cockpit. (*No pilot, don't like that idea at all. The Boeing 777 Max experience proves that things can go wrong and their needs to be a pilot and aircraft capable to take over when things do go wrong, and things* ***will*** *go wrong)*

Uses new sonic boom technology, now in testing at NASA and Boom

Higher altitudes and high Mach speed. Existing jets fly at .85 M 550 MPH or 890 Km/h *(getting used to referring to Km/h)*

With sonic boom technology from NASA and the company producing the Boom Jet. An electric jet could go Mach 1.6 or 880 mph or 1700 Km/h.

Electrics can fly higher (don't need oxygen) Existing jets fly at 42K feet verse electrics at 60k ft. plus.

Electric motors have fewer moving parts, costs less to maintain. Electric motors need cooling

Electric Jet Scenarios:

Generation 1 - Short haul commercial flights, 750 miles or less Battery density of **500** W-h/kg

Generation 2 - Medium hauls of 2500 miles Battery density of **1000** W-h/kg.

Generation 3- Long hauls of 6000 miles Battery density of **2000** W-h/kg. At 1.6 Mach in 6 hours verse 12 hours

Jordan thinks Tesla could start prototype production in the mid 2020's and final certification in the 2030's when batteries get to the 1000 W-h/kg

Notes:

New Zealand is using the Pipistrel electric and is 1/3 the cost per hour than other trainer aircraft

Innolith a Swiss Company, with research in Germany, claims to have a 1000 W-h/kg battery which is nonflammable.

Numerous other companies are in the prototype phase of aircraft electric propulsion as noted in previous newsletters.

This writer will continue to be monitoring the progress of the many battery companies, and research institutes to improve energy density, safety, cost and execution of new patent ideas.

As one person stated *it's not the idea that counts but the execution of that idea.*

Write up by Tom Solar

EAA Chapter 790 2020 Membership Form - Please Print

First Name: ____

Last Name: ____

Spouse: ____

EAA Membership Number: ____________________ (Must be an EAA member)

Street Address: ____________________________________

City: __________________________ State: _______ Zip: _____________

Home Phone: _____/______-_________ Cell Phone: ______/_______-____________

Email Address: ____________________________________

Own Aircraft: yes or no Model or Type: ____________________________________

Aircraft Project: yes or no Model or Type: ____

For Young Eagles

If you have completed Youth Protection training, what was the date ______________
If you have completed the background check, what was the date ______________

Dues

$25.00 Family/Individual Renewing Membership _____
$10.00 Family/Individual First-Time Membership ______
$10.00 Out of State Membership _____
$10.00 Student Membership _____

Please make checks payable to “EAA Chapter 790” and bring with this form to a member meeting or mail to: EAA Chapter 790, PO Box 685, Crystal Lake, IL 60039-0685

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