



Spirit of Flight

Experimental Aircraft Association

Chapter 14: San Diego, CA

May 2020



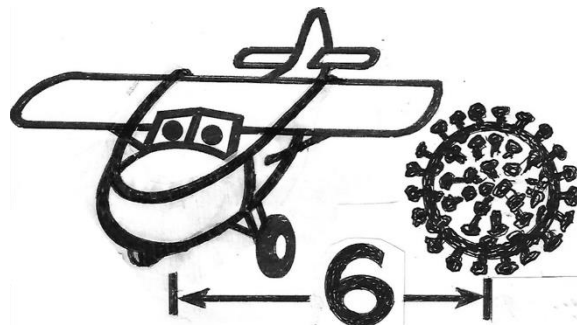
Jim MacKinnon got this photo of a Bell AH-1Z Viper in flight at SDM. It's also called a "Zulu Cobra" He said that it was searching for virus. Maybe he's right. 4/17



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No activities scheduled due to COVID-19 social distancing rules. Stay safe.



Chapter Briefing

EAA Chapter 14
Members



Chapter Activities: Information provided by Chapter members.

Week ending Apr 4: Beautiful weather – and some hardy souls showed up at the chapter to work on their projects. Gene Hubbard explored starter options, Ryan dealt with carburetor possibilities, and Craig Cornford was busy, as always, working on his Mustang – making good progress. Serendipity Club members were also busy.

Week ending Apr 11: April showers were the norm this week. But it didn't stop Gary List from continuing the paint job on the lower kitchen cabinets. Ron Shipley also put in some plug-in pest control devices in Hangar 1 and the Young Eagles area. He says they really work—let's hope they perform well here too. One is plugged in over by the oven in Hangar 1 – right next to the brand-new can opener which actually works! Jimmy Kennedy and his wife Lori stopped by to pick up parts/tools so Jimmy can keep working on his Nieuport project at home.

Week ending Apr 18: Beautiful weather again this week. Gleb Dorogokupets, Gene Hubbard, Gary List, Ryan, and Richard West all made appearances at the Chapter working on various projects. Gert Lundgren reported that he is still awaiting the shipment of the avionics for the RV-12 he is building. See Spirit of Flight newsletter January 2020 for more information on Gert's project. He said that he's had the wings and wheel pants painted and they look good. And we received some very good news: Tobias Burch and Jackie Steiner, builders of the Carbon Cub featured in the March Spirit of Flight went ahead and got married on April 12. Tobias texted: "It was a small ceremony, but we enjoyed it fully and looking forward to our future. We hope to celebrate later on with all our family and friends." As can be seen by the pictures, Pocahontas, the beautiful Carbon Cub, figured in the current ceremony and the cake topper featured a plane as well – our very best wishes to them.

Week ending Apr 25: Sunny/rainy, warm/cool – typical spring weather this week in San Diego. The advent of spring also sees the advent of more bunnies around the Chapter – nowhere near as many as last year, as many of the hiding spaces available to them last year are now gone. But they still manage to wriggle into Hangar 3 at times, so watch where you step if you are in there – and feel free to grab a broom and help keep it clean. Ryan continued to clean out some of the accumulated stuff in Hangar 3. Gary List replaced the weather stripping around the door to the trailer. Chuck Stiles wrote from Idaho. He and his wife Robin have been keeping busy with lots of work on their property. Best news for this week: we heard from our own chapter Vice-

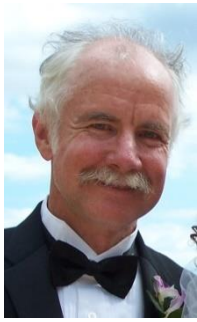
President "Doc" Gene Lenard. He recently had a pacemaker put in and so far everything is looking good. He had been feeling tired and occasionally light-headed, but had just not paid attention to the signals. He promised to write an article about what to look for soon so we can all recognize these symptoms and take timely action.



Tobias Burch, Jackie Steiner, and Pocahontas. 4/12



Wedding cake for a small ceremony. Cutting it with a Swiss Army Knife is highly appropriate! 4/12



President's Message

Gene Hubbard



I hope everyone is holding out OK, staying safe and staying active. COVID-19 is going to be with us for a while, and we can't risk anyone's health by prematurely restarting our organized activities, so regular programs and organized activities remain suspended until further notice.

There are plenty of ways to get your aviation fix during the shutdown, though. First, the airport remains open and Chapter members have access to their planes and projects. The Chapter Briefing (p. 2) describes some of the progress that members are making on their projects, both at their hangars and at home. All socially distanced, of course. Gary List and Ron Shipley have also contributed to Chapter maintenance by repainting the cabinets in Hangar 1 (this page) and instituting electronic warfare against our unwanted rodent population (p. 8). We will all appreciate this work when we can start to host groups of members and visitors again.

This is also a good time to start planning your next project, or to get over speed bumps in your current one. On page 6, Donna Ryan, our Chapter Librarian, as well as Chapter Secretary, begins her review of Tony Bengelis's book on engines. It's a must-read for anyone building or contemplating a homebuilt aircraft. If you've already read it cover-to-cover, maybe it's time to read it again, or one of Bengelis's other books on aircraft construction. There's almost always something new to find in them.

Finally, on page 4, George Haloulakos gives a different view on what it took to produce the B-24 Liberator bomber during World War II. Many of us are fairly familiar with the aircraft itself and even with the factory and production methods, but George describes the financial environment that made it possible to even build the bomber plants that produced 18,500 B-24s in five years. By the way, there's an interesting 1945 newsreel about the Ford plant that produced B-24s at Willow Run on YouTube at <https://www.youtube.com/watch?v=p2zukeYbGQ>.

I look forward to seeing everyone at the Chapter again as soon as we can do so safely.

Gene Hubbard

Ray Scholarship Update

Trinidad Lopez

Due to the coronavirus pandemic flight training for our Ray foundation aviation scholarship recipient Ryan Flores has been delayed.

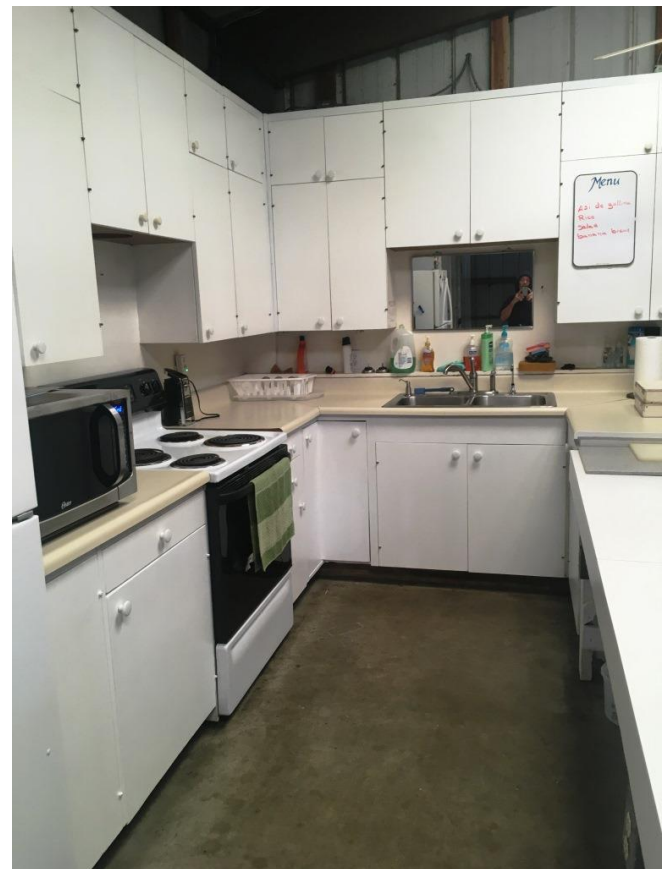
Instead his time and efforts have been dedicated to preparing for the Private pilot written exam.

Our chapter has provided Ryan with all of the necessary study materials.

On the positive side he has plenty of time to study. We expect him to schedule and take his written test by the end of May.

With a little luck we hope Ryan will be able to start his flight training in June.

Trinidad Lopez



The kitchen hasn't looked this good in years. Thanks, Gary!



EAA Ramp in February 2019. Jonathan Robbins, Ron Shipley, and Ted Krohne get ready to fly Young Eagles. We'll get back to doing that as soon as we can.

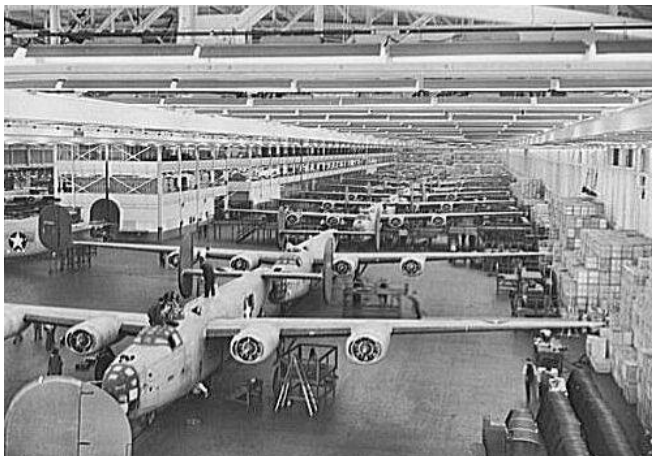
Building the Liberator

George Haloulakos, edited by Gene Hubbard

The B-24 Liberator has long been viewed as the poster child for America's Arsenal for Democracy during World War II. Its legacy as the most widely built combat aircraft in US history and used by all Allied and US air services that helped win World War II is the result of Mass Assembly Line Production made possible by the fusion of Finance, Accounting and Operations Research.

Much has been written about the Liberator's versatility and multiple roles that enabled it to be a game changing capital asset for the Allied forces. However, a peek behind the curtain reveals a story that when viewed through the disciplines of Finance, Accounting and Operations Research shows the B-24 helped set the template for Mass Assembly Line Production and Total Quality Management (TQM). The historic and objective nature of Accounting facilitated the Planning and Budgeting for a mass production capital project that demonstrated how the "Learning Curve" was a by-product of Absorption & Activity Based Accounting that made possible economical mass production. "Economy of scale" (a practical outcome from accumulated manufacturing experience) enabled the FORD company to produce one Liberator aircraft every hour as a prime-contractor for Consolidated – the designer of the B-24. FORD's Willow Run plant that made the B-24 was the result of maximizing efficiency of raw materials, labor and capital so that production lines could run at full speed with few if any glitches.

Facilities design achieved through classical application of Operations Research and mobilization of capital through proven Time Value of Money principles in Finance resulted in a project that remains a platinum standard for excellence in Total Quality Management (TQM). Internal production of critical parts gave rise to "Rosie the Riveter" and fully integrated operations that were successfully used to accomplish the same with other major capital projects during World War II, thus creating America's Arsenal of Democracy.



B-24Es under construction at the Willow Run plant between July 1942 and February 1943.



Two women install rivets on the center wing section of a B-24E at the Willow Run Bomber Plant sometime between July 1942 and February 1943.

All photos in this article were taken by employees of the U.S. Government as part of their official duties and are in the public domain.

The use of Control (i.e., the means of deconstructing the variance of planned versus actual financial outcomes) enabled the B-24 Liberator to be a solidly profitable project, thereby setting an example of a most effective Private-Public-Partnership (PPP), a concept that has continued to be replicated in the decades since. In sum, the B-24 Liberator, the result of successful application of immutable Accounting, Finance and Operations Research principles, helped honor the past and advance the future with its enormous contributions in the cause of Freedom versus Tyranny.

The B-24 Liberator was the most widely built combat aircraft in United States history, with 18,500 constructed between 1940 and 1945. They were used by every Allied air service in every theater of the war, mainly as heavy bombers, but with variants conducting maritime patrol (PB4Y), anti-submarine warfare, and transport missions (C-87). Compared to the Boeing B-17, the B-24 had more power, longer range, and carried a heavier bomb load. Probably the most famous B-24 operation took place on 1 August 1943 when B-24s flew 2,700 miles to attack the Ploiesti oil fields in Romania. They destroyed their targets, but 54 of the 177 aircraft that took part were lost.

Consolidated, Douglas, North American, and Ford all built B-24s during WWII, but nearly half (8600) were built by Ford at the Willow Run manufacturing complex between Ypsilanti and Bellville, Michigan between September 1942 and May 1945. At peak production in 1944, the Willow Run plant produced one aircraft per hour, compared to one aircraft per day at any other production facility. By fall 1944, Willow Run had the capacity to produce 650 aircraft per month in two nine-hour shifts, six days a week.

Ford's "economy of scale" technology transfer from automobile to aircraft manufacturing for the B-24 Liberator assembly process was reflected in lowering unit costs by



Riveting a center wing section for a B-24E bomber in the horizontal position at Ford's Willow Run plant, February 1943.

43% from \$379,000 to \$216,000. With Willow Run producing the largest share of B-24 aircraft, this efficiency gain enabled the entire B-24 program to achieve an 8% operating profit margin.

Vital statistics of the Willow Run plant include:

- 2,500,000 square feet of floor space: 3,200 feet long by 1,200 feet wide. At the time this was described as "the biggest room in the world."
- Mile-long assembly line
- Two nine-hour shifts per day and 42,000 workers
- 136 conveyors powered by 75 drive units
- Bridge conveyor carried fuselage section similar to "drop" technique for automobiles
- Machine shops, runways, hangars, power plant, hospital, and employee housing on site.

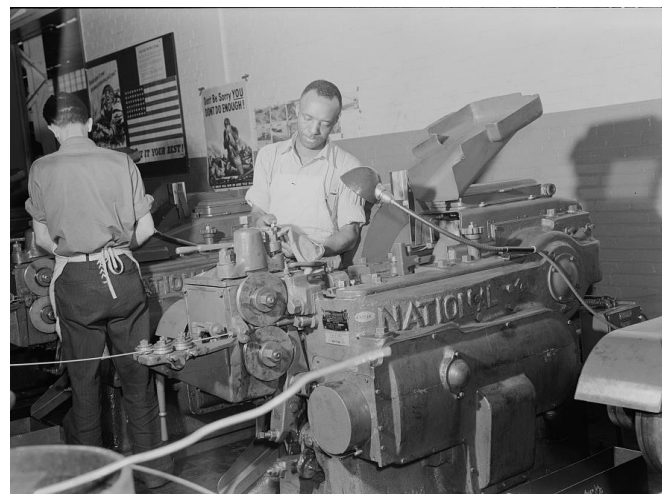
On the B-24, fitting the center wing section was key to production efficiency. Consolidated spent 1,500 man-hours and 13 days fitting the center wing assembly. By pre-manufacturing component structures that didn't need individual fitting, Ford reduced this assembly time to 6½ man-hours and only an hour of clock time. They also developed a fixture to help integrate the fuselage and wing center section with minimal movement of components and set up an internal forging department to produce seven million rivets a day in the 520 different sizes needed for the aircraft. By the end of 1944, Willow Run was producing B-24s so fast that the Army cut production to 200 per month because they had no place to store all the aircraft coming out of the plant.

Mass-assembly line production of the B-24 and other WWII war materiel owes its success to effective use of Absorption and Activity Based Costing plus Control. These techniques depend on Integrity, Independence and Objectivity, the same characteristics for a successful Accounting Information System that forms the basis for optimal Financial Decision Making

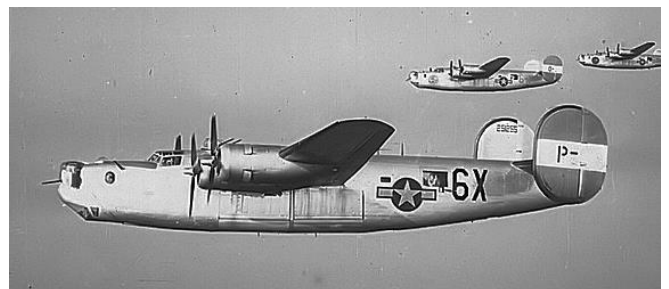
The Consolidated B-24 Liberator (a microcosm of the WWII Arsenal of Democracy) is a classical case study affirming the role of Accounting principles used to implement Mass-assembly Line Production. It is with profound gratitude and respect that this presentation is dedicated in blessed memory of all those connected with the B-24 Liberator.



A woman at the Willow Run plant welds parts of the cooling system on a supercharger. July 1942



A worker at the Willow Run plant operates a cold heading machine which makes hundreds of rivets a minute from aluminum alloy wire. The rivet-making shop at Willow Run could produce seven million rivets a day in over 500 sizes. July 1942.



Ford's Willow Run bomber plant produced approximately 8,600 B-24s during WWII. This photo shows a B-24H produced at Willow Run and assigned to the 854th Bomb Squadron in 1944.

Book Review: Tony Bingelis on Engines—Part 1

Donna Ryan, Chapter Librarian

Donna's review of this book is rather lengthy, so we will serialize it over several newsletters. This first installment covers the first five of the eleven sections in the book.

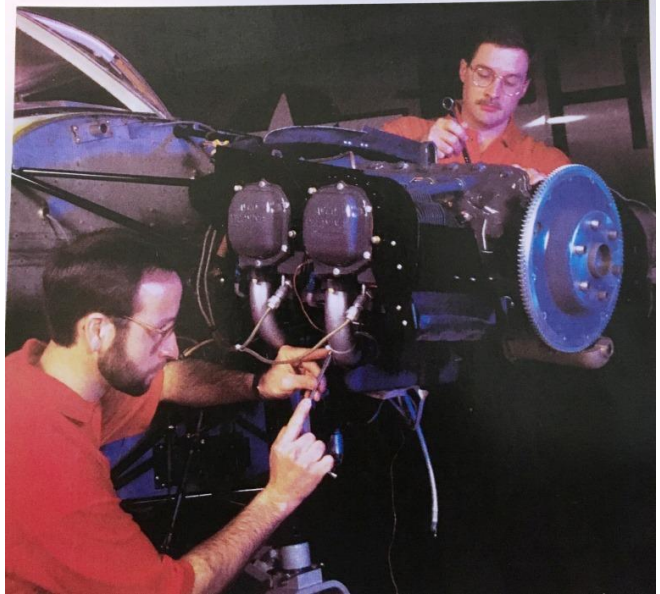
Many of you are familiar with the numerous books Tony Bingelis has written on various aspects of homebuilt aircraft construction, maintenance etc. Our EAA chapter library has three of those: Firewall Forward – Engine-Installation Methods, Sportplane Builder: The Aircraft Construction Methods, and Sportplane Construction Techniques.

Recently, a member donated another one of his excellent books: Tony Bingelis on Engines: Engine Compartment Installations for Sportplane Builders. This book, like many of the others, was published by EAA back in the 1990's and was based on much of the information printed in his Sport Aviation articles in the 1980s. While much of the information is still relevant today, there have been advances since that time as well, so be sure to research the most current information on a specific subject. The book has a number of actual engine or parts photographs, plus schematics. Following are just a few highlights from the book; the book itself is 233 pages long. Feel free to check out the book from your Chapter library – or you might want to buy this book and make it part of your permanent aviation library at home. You can order it off the internet.

The first section is on **Engine Selection**. Tony points out that the first consideration is to identify what kind of engine you have in mind – “an aircraft engine or an auto engine conversion.” Other items to consider are how powerful an engine do you want, and is your aircraft design approved for that much power. A final consideration is what kind of a shock mount do you prefer: dynafocal, conical, or an innovative engine mount to work with your auto engine conversion. He discusses the pros and cons of a converted auto engine, new versus overhauled, and where to find the engine of your dreams.

He also devotes an entire chapter to the topic “Bigger is Not always Better.” He cautions builders to not get carried away by installing a way more powerful engine than your plane design can handle. He points out, that besides being possibly dangerous, installing a bigger engine than the plane is designed for, may require more work for you as a homebuilder as you may need to make modifications to the cowlings or the exhaust system; it may also affect the weight and balance, the engine mount, and maybe even require a bigger propeller. He also reminded the reader, that while “a more powerful engine may give you a somewhat better rate of climb, and a higher fuel bill to show for it . . . don't expect much in the way of increased speed.” He starts out the chapter with another important caution: Are you sure you'll need an engine? He talks about the real possibility that you may not complete the aircraft project you are working on – maybe you don't like the design, or you just don't have the time or patience to finish the job. So spend

TONY BINGELIS ON ENGINES



A recent addition to the Chapter 14 library. Many of us have read, or even own, this book. But there's a lot of material in here and it always bears another look.

some time on constructing the tail surfaces, for example, first, before you begin your search for an engine. Take-away point: Read this section carefully before you make a decision on the engine.

The next section is on **Engine Installation**, composed of 4 sections: *Engine Hook-up Tips*, *Ready to Install that Engine?*, and *Installing the New Lycoming Engine (Parts 1 and 2)*.

In the *Engine Hook-up Tips* chapter, he covers “grounding the engine to the engine mount, and to the aircraft,” grounding straps, magneto wiring, engine cooling baffles, throttles, carefully routing your fuel lines, using cables large enough for the loads expected, and “bundling the wiring wherever practical.” He also recommends installing “the engine controls to the carburetor before access there becomes more difficult.” One top tip: “Discipline yourself to complete securing both ends of each assembly and each circuit before leaving it for some other task. It is so easy to overlook replacing that incorrect nut, or safetying that part sometime later. The ‘I'll get back to that later’ mentality is a bum habit to develop.”

In the *Ready to Install that Engine?* chapter, he begins by recommending that you “make up an inventory of the hardware and parts you will need” for the job to make sure everything runs smoothly when you start to install the engine. Some parts may require a two or three weeks time

period before you receive them – so do a checklist ahead of time. Obviously, you will want to have “all of the firewall mounted accessories . . . attached before the engine is bolted to the engine mount” as access later will be very difficult. The chapter includes a number of pictures showing properly prepared firewalls and trial fits of the engine mount. A template layout will be very useful. He also points out some possible decisions you’ll have to make such as who gets the cabin heat box – passenger or pilot, and where do you put the gascolator or solenoids. He also recommends installing bolt-on items while the engine is still on the engine hoist. Take away tip: “Any unit secured to the firewall, especially the voltage regulator and the battery and starter solenoids, should be installed with platenuts behind. Later, should you have to replace one of those units, you will be happy that you had the foresight to make its removal a simple one-person job.”

The next two chapters in the section deal with installing a new Lycoming engine. While the chapters are engine-specific, the information and pictures provided will help you with any engine installation.

The next section, **Firewall Preparation**, is short, as his book Firewall Forward covers this topic in detail. However, after the publication of that book, he received “countless queries asking for possible sources for firewall shields/grommets.” They can be difficult to find, so this section shows how to make your own firewall grommet shields. Step-by-step photos show the proper procedure.

Next Section: **Engine Baffles**. The first chapter deals with *Making Better Baffles*. Air-cooled engines all need them, but here isn’t a lot of information out there about what materials to use and how to make them. Some kit “plans may already contain the recommended baffle pattern,” but in other cases, you’ll just have to make your own from thin aluminum sheet. He discusses the material you’ll need (approximately 12 square feet of .025” or .032” thick aluminum), and then goes over the basic construction steps: making a template, cutting out the baffles, and making bends. He then provides tips on installing them, trimming the edges and attaching the sealing strips. Finally he recommends applying a bead of high temperature silicone sealant to every gap. The second chapter deals specifically with baffling for a 4 cylinder Lycoming engine. It is a long chapter and contains very detailed instructions and pictures. Although it is tailored to a new or rebuilt Lycoming engine, the information would be useful to anyone who plans on making baffles.

The next section covers **Engine Cooling** and concentrates on identifying temperature limits and solving some cooling problems. He starts out by saying “during that first exciting test flight of a new aircraft or the initial flight for a freshly overhauled engine, it is not at all uncommon to experience a high oil temperature indication, an excessively high cylinder head reading, or both.” He admits this is scary, but points out the “if your oil temperature is extremely high but you don’t smell anything unusual and your oil pressure is ‘in the green’ (that is within limits), the threat of an immediate

engine seizure, due to oil starvation, is most unlikely.” After providing the steps to bring the engine temperature under control so you can get back to the airport, he then discusses cylinder head temperature, oil temperature, and oil temperature limits using a small 4-cylinder air-cooled aircraft engine as an example.

Next, he lists some conditions that may have caused that the high oil temperature you experienced, e.g. “oil supply insufficient, low grade of oil, malfunctioning oil temperature gauge, clogged oil lines or strainers” etc. The list is lengthy. He then notes some basic areas to check in order to identify the trouble source: oil level, engine gauges, cowling, baffles. He provides details on what to look for in each area, e.g. the formula for determining the size of cowling air inlets.



Serendipity Cherokee with its cowling off for some exhaust work. 4/6



Ryan works on a VW engine.. 4/6

Marketplace

ZENITH CH750 STOL • \$67,500 OBO • LIGHT-SPORT AIRCRAFT FOR SALE! • Built by legendary award winning builder Marv Vanderpool in 2013. Incredible build quality like no other. TT: 72hrs. Mattituck brand new Continental IO-240 125hp. Whirlwind Ground Adjustable Prop. Better Ergonomic Dual Stick Option. Upgraded Nosegear Fork. EarthX Lithium Battery(New2020). GTX-320A Transponder. ICOM A210 Comm. Unpainted beautiful exterior. Beautiful custom interior. Michelin 8.00x6 Tires. Vortex Generators. Fresh Annual by A&P Nov 2019. Amazing slow speed handling. Light Sport Compliant. • Contact Gleb Doro, Friend of Owner - located San Diego, CA United States • Telephone: 347-575-3102 (5/20)



Highlander - JUST Aircraft • \$65,000 OBO • LIGHT-SPORT AIRCRAFT FOR SALE! • TT:~700hrs. Rotax 912ULS. 3 Blade - Ground Adjustable - KIEV Prop. Dynon Avionics Skyview. Grand Rapids EIS. Vortex Generators. Good payload capacity. Light Sport Compliant. Not in annual. Log books are lost unfortunately. • Contact Gleb Doro, Friend of Owner - located San Diego, CA United States • Telephone: 347-575-3102 (5/20)



Engine for sale: Continental 0-470-7B (E-185-3). OSMOH. Rebuilt 1982. Documentation. Located in Ramona. \$9,000/offer. Text or call Dave at (619) 987-6398 (4/20)



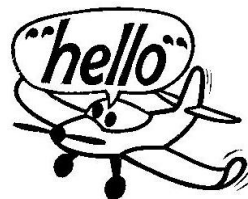
Pest Control

Ron Shipley installed several of these ultrasonic pest control devices in Hangar 1 and the Eagles' Nest. Ron says that he has had good luck with these units in his own house, and we certainly have rodents in the hangars. Thanks, Ron.

New Member

Donna Ryan

Welcome to **Dawn Yoon** who joined in April. **Dawn** is a student pilot with a passion for learning about aviation. She is interested in rock climbing and is knowledgeable in crew resource management. We look forward to meeting her once our general meetings resume – and hopefully one of our pilots can offer her a flight as well. Thanks, Dawn, for joining our Chapter.



Aircraft at the Udvar-Hazy Center of the National Air and Space Museum. The Nelson BB-1 "Dragonfly" in front became the first motor glider produced in the United States in 1946. It was underpowered and overweight and only seven were built. The Stanley "Nomad" behind was the world's first sailplane with a v-tail in 1938. Robert Stanley originally built the sailplane with a conventional tail, but when he landed in a remote field during the National Soaring Contest in Elmira, NY, someone stole the elevator control surfaces. Nelson took the opportunity to replace the entire tail assembly, finding that it was smaller, lighter, introduced less drag, and was less prone to damage in an off-airport landing. 2/3

Around Udvar-Hazy



Gemini Paraglider Research Vehicle 1-A. At one point, NASA thought they wanted to land the Gemini spacecraft on a runway rather than in the ocean. Gus Grissom and Neil Armstrong were among those who made hundreds of practice landings with this test vehicle from 1962-1964.



This single-seat Aeronca C-2 is the production prototype which first flew on October 20th 1929.



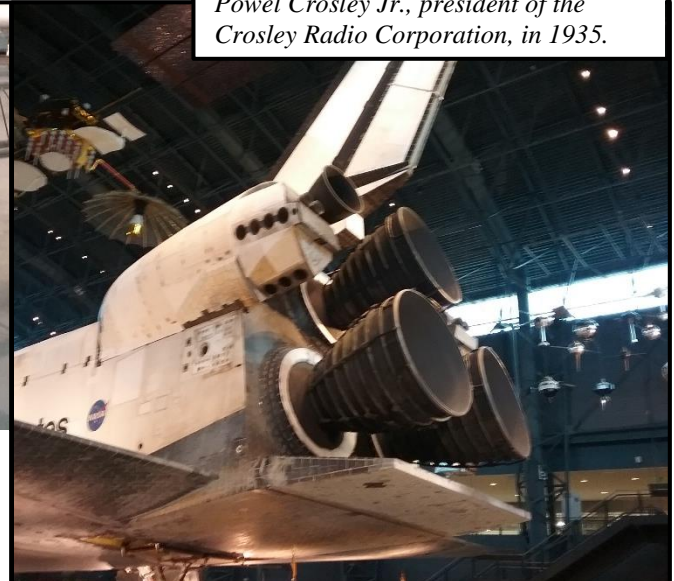
In 1911, Glenn Curtiss commented to Waldo Waterman about how nice it would be to drive his aircraft away from the landing field. This comment inspired Waterman in a decades-long quest to develop a roadable aircraft. This Aerobile #6 was begun in the late 1940s and finally registered as an experimental aircraft in 1957, and as a motorcycle in California.



Henri Mignet designed the HM.14 Pou du Ciel (Flying Flea) in 1933, envisioning a safe, stall-proof aircraft that anyone could learn to fly. This aircraft, the first Pou du Ciel built in the United States, was constructed for Powel Crosley Jr., president of the Crosley Radio Corporation, in 1935.



As part of her 95th birthday celebration in February, my mother, Cecilia Hubbard, wanted to see the Udvar-Hazy Center of the National Air and Space Museum. Who was I to say no? Of course, we took some pictures. Here we are with the Curtiss F9C-2 Sparrowhawk, designed to be based on a dirigible.



Business end of the Space Shuttle Discovery.

May 2020

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<http://www.facebook.com/pages/EAA-Chapter-14-San-Diego-CA/134162329986593>

Chapter Website

<http://www.eaa14.org>

EAA Chapter 14 Memberships

Applications are available at our Brown Field hangars and on our website.

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Chapter Events

Open House at the Brown Field hangars:
every Saturday from 9:00 am to 2:00 p. Lunch at 11:30

Young Eagles Flights:
9:00-1:00 am, second Saturday of the month

Pancake Breakfast:
7:30-9:30 am, third Saturday of each month

General Meeting: 10:00 am, third Saturday of each month

Directors Meeting: after lunch in the library. 3rd Saturday

Hangar Phone:

619-661-6520

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