BUYER'S GUIDE: 138 PLANS DESIGNS TO BUILD FROM SCRATCH

KITPLANES®

YOUR HOMEBUILT AIRCRAFT AUTHORITY

Bolt from the Blue!

Steen Skybolt:
Super Aerobatic Performance Plansbuilt Price

January 2012

CULTURE CLUB
Van's POV on Raising Flight Safety

AMPED UP
Alternair's Electric LSA Takes Shape

FIREWALL FORWARD
Wiring Ignitions, Sensors, Starters & More

The Lancair Evolution Gets a New Coat

$4.99US $5.99FOR
01>
0 74820 08883 8

CONTENTS

January 2012 | Volume 29, Number 1

KITPLANES
THE INDEPENDENT VOICE FOR HOMEBUILT AVIATION

On the cover: Kevin Wing photographed the Steen Skybolt in Palm Bay, Florida.

EDITOR'S LOG

The beauty of simplicity.

As this was written, it had been a scant three days since it was announced that one of the great visionaries of our time, Apple cofounder Steve Jobs, passed away. I was deeply saddened by the news, as I often am when I hear of someone who had so much more they could have done, but was cheated of that opportunity by an early death. Still, what an amazing legacy remains.

I have been a fan of Apple products for 27 years. Jobs attended the same junior high school that I did (though not at the same time) in Cupertino, so I felt a certain kinship with him and his innovations, and I bought one of the first Macintosh computers in 1984. I remember that purchase clearly, because it was an outrageous expenditure for me at the time. The whole setup, the printer, basic software and the Mac itself set me back $4500, and it took forever to pay off. Mind you, that was for an all-in-one box with a small black-and-white monitor, floppy disk storage, basic word processing and a dot matrix printer, hardly what we would consider state of the art today. Nonetheless, I had to have one, and I was thrilled to get it. Some friends thought it was foolish, but this tool was a game changer for me.

That first Macintosh was revolutionary in its simplicity. Part of its appeal was that it was "portable," and that aspect served me well. It got me through both my undergraduate years and grad school, without fail. I held on to that computer, out of sentimentality perhaps, until 2007, when in a fit of downsizing I donated it. I think I kept it for so long because I felt as though I owned a piece of history, and I just couldn't part with that. (In fact, I still have the carrying case for the computer, but now it holds office supplies.)

Apart from a brief foray into the PC world with a laptop computer in the 1990s, I have owned many Apple products since then. Every one of them was incredibly reliable, fun and straightforward to use, and elegant in the sophisticated simplicity of its design. The iMac I employ now is a far cry from that early model, but the same description applies, and it is in part the aesthetic beauty of the machine itself (and its accompanying operating system) that allows me to tolerate spending as many hours in front of it every workday as I do.

So I wanted to talk about the allure of simplicity as we present our annual Plans-built Buyer's Guide this month. If you are inclined to construct an airplane yourself, it doesn't get any more basic than scratch-building from plans. Although the process of rendering the plans has changed over the years, in some cases enhancing the quality of the product significantly, the basic premise remains the same. You acquire a set of drawings, start gathering together materials or materials kits, and off you go—if you're lucky, slowly but surely assembling an aircraft until you have something that is signed off as airworthy and ready to fly. I can imagine what a sense of accomplishment that must be, essentially having made something from almost nothing. I'm sure there is great satisfaction in it.

In certain cases, building from plans is the only way to acquire a particular design, because it simply does not exist as a kit. Plans also offer a way to tap into history via replica aircraft that may not be available in any other form. For some builders, constructing from plans provides the opportunity to tinker, improving on an existing design from the outset with a tweak here and a redraw there. Breezy builder Matt Hlavac, featured on the October 2009 cover of this magazine, comes to mind as someone who wanted the challenge that this type of building provides. He took a long-proven design (the R.L.U.-1 from Carl H. Unger) and amended it so that the finished product was precisely tailored for his particular mission: local low-and-slow flying. Simply for fun. And he's had a great time piloting his Breezy in the gentle clime of Southern California. For him, the building project was a thorough education and an extremely gratifying experience. If that's your inclination, there are likely more than enough listings here to whet your appetite without breaking the bank.

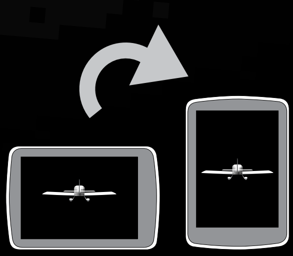
Jobs, at a Stanford University commencement speech in 2005, discussed the shortness of life and the need to seize the moment and follow your passion. That seems an apt characterization of so many participants in our small niche of general aviation, whether kit builders or plans builders. Passion and the desire to realize a dream are the prime motivators for pursuing almost any airplane building project, sometimes despite skepticism from family and friends. I'll reiterate what Jobs advised the students at Stanford that day: Stay hungry. Stay foolish. And I'm sure he meant that in the best sense of those terms. Words to live by. +

Mary Bernard

The product of two parents with Lockheed Aerospace careers, Mary grew up with aviation, prompting her to pursue pilot training as an adult. Her father, a talented tool-and-die maker and planner, instilled in her an abiding interest in how things are built. For more than a decade, she has been a contributing writer and Managing Editor for KITPLANES®.

The touchscreen makes it perfectly smooth. And 3-D terrain makes it totally awesome.

Introducing our new top-of-the-line Garmin aera® 796 portable GPS. Featuring a unique 3DVision™ perspective view of the topography beneath your aircraft, this new unit is Garmin's most visionary portable yet. With a choice of portrait or landscape orientation, the aera's "virtual reality" flight graphics can be framed with GPS-derived indications of ground track, altitude, groundspeed, vertical speed and turn indication – all updated 5 times per second. The big 7-inch hi-res touchscreen brings tap-and-go simplicity to page navigation. And geo-referenced FliteCharts®[1], IFR Enroute[1] charts, VFR Sectional charts[1], SafeTaxi®[1] diagrams, AOPA Airport Directory, and more, all come pre-loaded as well. A built-in digital document viewer expands the unit's utility as an electronic flight bag (EFB), letting you view an entire approach plate at a glance. You can also add airways, satellite weather with NEXRAD, and XM™ audio entertainment[2]. So, what more could you want in a portable? Garmin aera® 796. It's the future in your flight bag.



Follow the leader.

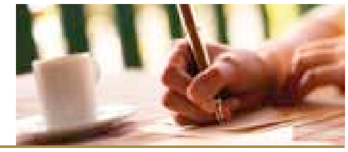
NASDAQ **GRMN**

[1] Includes initial FliteCharts®, Enroute and Sectional charts for the U.S., as well as detailed SafeTaxi® diagrams for nearly 1,000 U.S. airports
[2] XM subscription required (sold separately)

www.garmin.com

GARMIN®

LETTERS



EDITORIAL@KITPLANES.COM

Risky Business?

Marc Cook, you have it right ["Around the Patch," August 2011]. Engines must have qualified technology and sufficient development, with a long gestation to work out the kinks. Aircraft and auto engines. Everyone must agree that the auto industry spends considerable time, talent and money developing and operationally testing their engines under certainly the worst conditions. The late Fred Geschwender, who produced many auto conversions over the years, professed that modifying a production engine simply creates problems.

At Quiet Aviation, we have started processing our FAA Issue Paper that has the basis to install the GM LS3 430-horsepower Corvette engine in the C-172 for an STC. Here we take Fred's attitude even further by holding the engine operation below our driving habits, and we don't risk overhauls. We have accepted a weight penalty for this engine so that its operation is never in excess of 42% power. We take a catalog crate engine, specially built by the GM Performance Build Group, and install it in the aircraft with an Airflow Performance mechanical fuel-injection system, a gearbox that has proven its worth over more than 25 years of airboat use and a cooling system overdesigned with redundancy.

Give us a half year to introduce this conversion and let our General Aviation critics assess its merits. We have 400 hours of V-8 time with some 80 hours on the LS engine without incident. Keep it simple, don't try anything new, use it conventionally, and enjoy the security of an automotive engine.

ALAN ADEN

Back to School

An excellent option for arc welding training not mentioned by Ken Scott ["Learning to Weld," September to December 2011], is the Lincoln Electric Welding School in Cleveland. I discovered it when exploring options for creating a fuel tank for my project and found that none of the local colleges or high schools run courses anymore. Forget the negative economic trade-off of saving a bit by doing it yourself versus cost of tuition, travel expense, and getting excited and buying a welding rig and materials. And despite the fact that I became a passable TIG welder in a variety of materials excluding thin aluminum (the one material I'd hoped to master), I found the five-day course a quality experience well worth the expense. Besides its comprehensive offering of certificate programs for tradesmen, the school offers a variety of high-quality, one-week courses. The price represents a good value for an intensive learning experience. And when you're done, you can take advantage of discounts offered to students for their products, which can be hazardous to your $ health.

HOWARD LEDERMAN

A Real Gem

I just read Paul Dye's essay on clouds [September 2011]. Move over Ernie Gann and Richard Bach. There is a new honest-to-God aviation writer in town. Since the shuttle program is taking its place in history, maybe Paul can settle down to explore what is obviously his greatest God-given talent, inspiring aviators and ground-bound souls with artistic and inspiring prose. What a treasure.

STEVE ASHBY

EDITORIAL
Editor Mary Bernard, editorial@kitplanes.com
Associate Editor Abby Ventzke
Editor at Large Marc Cook
Senior Editor Ed Wischmeyer
Art Direction Rachel Bidelspacher • Tracy Stephens, Avidity Graphics
Contributing Editors Chuck Berthe, Roy Beisswenger, Stein Bruch, Paul Dye, Steve Ells, Ed Kolano, Amy Laboda, Rick Lindstrom, Dave Martin, Paul Nafziger, Dave Prizio, Dick Starks, Barnaby Wainfan, Jim Weir
Webmaster Omar Filipovic
Cartoonist Robrucha

ADVERTISING
Publisher/Ad Director Cindy Pedersen, cindy@kitplanes.com
Sr. Advertising Manager Chuck Preston, chuck@kitplanes.com

BUSINESS OFFICE
P.O. Box 1501, Solana Beach, CA 92075
Main Number: 760/487-8075

EDITORIAL OFFICE
P.O. Box 315, Ashland, OR 97520
619/677-6526

PRODUCTION & CLASSIFIED ADVERTISING
Production Manager Marsha Blessing, 717/731-1405 ads@kitplanes.com
Classified Advertising Allyson Patton, 717/982-0744 ads@kitplanes.com

CIRCULATION
Circulation Director Lisa Evans
Circulation Manager Laura McMann

SUBSCRIPTION DEPARTMENT
800/622-1065
www.kitplanes.com/cs
P.O. Box 8535, Big Sandy, TX 75755-8535
For Canada: Box 7820 STN Main, London, ON N5Y5W1

BACK ISSUES
P.O. Box 8535, Big Sandy, TX 75755-8535
800/622-1065
www.kitplanes.com/backissues

REPRINTS FOR PUBLICATION AND WEB POSTING AVAILABLE
Minimum Order: 500
Contact Jennifer Jimolka, 203/857-3144

CHANGE OF ADDRESS? MISSING ISSUE? SUBSCRIPTION QUESTION?

Visit www.kitplanes.com/cs. Or call 800/622-1065 **from the U.S. and Canada. Foreign *or fax 203/857-3100.***

Belvoir MEDIA GROUP LLC

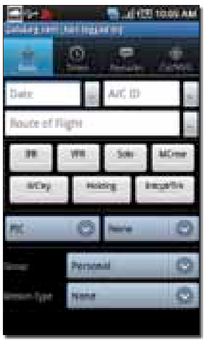
BACK ISSUES: Call 800/622-1065
WEB SITE INFORMATION: General homebuilt aircraft information, back issue availability, online directories ordering info, plus a KITPLANES® article index and selected articles can be found at www.kitplanes.com.
Unsolicited manuscripts: Are welcome on an exclusive basis, but none can be acknowledged or returned unless accompanied by a stamped, self-addressed envelope. No responsibility is assumed for loss or damage to unsolicited material.
KITPLANES® (ISSN 0891-1851) is published monthly by Aviation Publishing Group, LLC, an affiliate of Belvoir Publications, 800 Connecticut Avenue, Norwalk, CT 06854-1631, Robert Englander, Chairman and CEO; Timothy H. Cole, Exec. Vice Pres./Editorial Director; Philip L. Penny, COO; Greg King, Exec. Vice Pres./Marketing Dir.; Ron Goldberg, CFO; Tom Canfield, Vice Pres., Circulation.

Subscriptions: One year (12 issues) is $29.95 U.S. $41.95 in U.S. funds in Canada, includes GST. $41.95 in U.S. funds for Foreign Surface Mail or $57.95 in U.S. funds for Foreign Air Mail. Single copy price $4.99 U.S., $5.99 Canadian.
POSTMASTER: Please send address changes and subscription inquiries to: KITPLANES®, P.O. Box 8535, Big Sandy, TX 75755-8535, or call 800/622-1065. KITPLANES® is a registered trademark of Aviation Publishing Group, LLC.

WHAT'S NEW

Pilot Logbook for Android

ZuluLog, a web-based aviation record-keeping services and software provider, has released a new Android application for pilots. The app can be used as a stand-alone pilot logbook but is designed to work with customer accounts at ZuluLog.com. Users can enter, edit and view flights from anywhere, with or without a data connection, from any compatible Android device. Once online, pilots can sync up with their online logbooks on the web site.



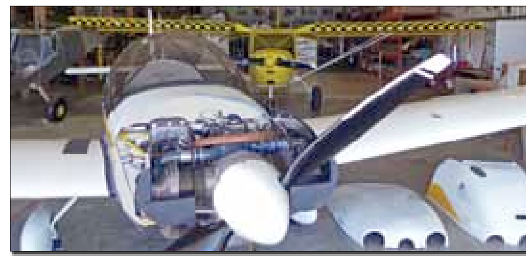
The Android app tracks PIC, instrument and NVG currency. A flight counter screen tracks takeoffs and landings, approaches and holds in real time, as well as total flight time, simulated instrument time and actual instrument time, the company says.

Pilots can also use dedicated screens to track notes, squawks, nav/com frequencies, transponder codes, and IFR clearances. The app also includes reference information and pilot tools. The app is currently free for all users, though future releases are expected to be made available only to active ZuluLog customers. The company also plans to release dedicated apps for the iPhone and iPad.

For more information, visit *www.zululog.com*. Find a direct link at *www.kitplanes.com*.

Zenith and UL Power Introduce Firewall-Forward Kit

Zenith Aircraft Company and UL Power North America, LLC have announced the availability of a complete firewall-forward kit for the CH 650 kit aircraft. The announcement followed the successful installation and testing of the UL350iS powerplant in the low-wing Zenith cruiser.



The firewall-forward engine package includes the direct-drive, air-cooled, lightweight and fuel-efficient UL350iS engine. The four-stroke, four-cylinder 130-horsepower powerplant ($23,450) is horizontally opposed, with FADEC (full authority digital engine control), multipoint electronic fuel injection, and automatic altitude and temperature compensation. The installation kit ($4950) includes engine mount, oil cooler, fuel pumps, propeller and spinner, and a fiberglass cowl. According to Zenith President Sebastien Heintz, the company plans to offer the same firewall-forward kit to its STOL CH 750 customers.

For more information, call 573/581-9000, or visit *www.zenithair.com*. Find a direct link at *www.kitplanes.com*.

PORTABLE AERA NAVIGATOR FROM GARMIN

Garmin has launched the aera 796—its new flagship portable aviation navigator. The aera 796 builds on the features of the GPSMAP 696 by adding a touchscreen user interface, selectable screen orientation, and 3D Vision. It also includes a digital document viewer, scratchpad and preloaded geo-referenced AeroNav IFR and VFR enroute charts, as well as a GXM 40 receiver.

The high-resolution, 7-inch touchscreen can be viewed in portrait or landscape mode. The 3D Vision gives pilots a virtual reality depiction of land and water features, including obstacles, runways and airport signposts—all shown in relative proximity to the aircraft.

The aera 796 also uses forward-looking terrain avoidance capability to predict potential hazards and has amber or red overlays to highlight those areas. The price is $2499.

For more information, visit *www.garmin.com*. Find a direct link at *www.kitplanes.com*. ✈

To submit a press release on a homebuilt-related product, email a detailed description and high-resolution photograph to editorial@kitplanes.com. Mailing address is KITPLANES®, New Products, P.O. Box 315, Ashland, OR 97520. Your submission may be used in print or online at *www.kitplanes.com*.

VIEWFINDER

Idle hands.

There are lots of reasons I miss N30KP. As some of you may know, I parted with my beloved Sportsman 2+2 homebuilt in 2011, the culmination of a series of difficult decisions that were, themselves, prompted by our persistently sluggish economy. Thankfully, the airplane was sold to a foreign buyer who will enjoy its incredible utility in another country. He decided to put it on conventional gear for use in the African bush.

Delivering the Sportsman to its birthplace at the Glasair Aviation facility in Arlington, Washington, where it would be fitted with conventional gear was one of my most difficult flights—and not because the Pacific Northwest decided to give me one last ice encounter just for fun.

Needless to say, I miss the airplane terribly, but probably not for all the reasons you'd guess. Some of those reasons should be obvious. I had more than a little blood and sweat in that airplane, and it was an excellent traveling companion. It was truly useful in my line of work: arrive at an airplane company off the beaten path with the camera ship in hand (saves scrabbling around for something that might or might not be suitable), provide a platform for testing new technologies and, no doubt, simply flying the flag. For the right mission, a light airplane makes tremendous sense; I saved days of travel using the Sportsman compared with riding the airlines.

The author goofing around during his Sportsman build in 2006. It's all fun until you deviate a septum with a #30 drill bit.

Since the sale, I've had to rent or borrow airplanes, which carries its own set of challenges. The less said about that the better.

Platform for Experimentation

By far the most surprising thing about my post-Sportsman life has been that glaring hole in my off-hours activities, and I don't mean the flying. You see, the Sportsman not only bore me through the sky but also tolerated an almost outlandish amount of tinkering and tweaking. Right from the start, the airplane fulfilled my need to build something. Although N30KP started as a Two Weeks to Taxi prototype, there was a massive amount of work to be done. What's more, because it was the first Sportsman to carry the Lycoming IO-390, we were prototyping the installation at the same time we were prototyping the program. Double your pleasure.

Sure, pleasure. I recognize there is a broad spectrum of builder types, from those who want to make every part on their own from scratch, to those who much prefer the Tab A/Slot B assembly method where little pure fabrication is done. I'm somewhere in the middle, better at visualizing the way parts go together and determining the best ways to do it than at raw fabrication.

That said, I was probably unduly proud of the third seat I fabricated for the Sportsman, which normally carried a bench seat at the back of the cabin just large enough for kids. That didn't work for my family of three (which includes a teenage daughter who's now bigger and stronger than her mom), nor was it useful when the Sportsman became the magazine's camera station for air-to-air photography. Without commercial alternatives, I built a composite structure from scratch,

Marc Cook

Former KITPLANES® Editor-in-Chief Marc Cook has been in aviation journalism for 22 years and in magazine work for more than 25. He is a 4200-hour instrument-rated, multi-engine pilot with experience in nearly 150 types. He's completed two kit aircraft, an Aero Designs Pulsar XP and a GlaStar Sportsman 2+2.

Ted Setzer offers tips on installing windows into the Sportsman doors. By recollection, these tasks weren't as odious as they seemed at the time.

using foam cores, raw E-glass and vinylester resin. I did more work in composites on that seat alone than there is in the whole of the quickbuild Sportsman kit, though it did pale compared to the years of laying up, sanding and scratching on my mid-1990s Pulsar.

This rear-facing seat structure was bonded into the belly of the airplane behind the metal safety cage and worked splendidly for many hours. I was confident that the bonding to the fuselage shell was more than sufficient for the loads, but with composites you never know—until I removed the seat for the sale. (I didn't want the liability.) Or I should say *tried* to remove the seat. It took most of a day to grind it out of the fuselage shell. I felt all warm and fuzzy (as well as sweaty and covered in fiberglass dust) that the seat was so secure; my research and practice with composites was validated. Ted Setzer, Glasair Aviation's veteran fabricator and fanatic about weight, would probably not share my enthusiasm. "Marc, if it's that strong, you built it too heavy!"

The seat was one of many sub-projects, as longtime readers of this magazine know. I've truly lost count of the different instrument-panel configurations that were in the airplane. With Stein Bruch's help, I learned a lot about wiring and troubleshooting. There were times when I thought I should just sit on my hands and enjoy using the Sportsman, but that would pass, and soon a new subproject would appear on the horizon. My own version of the Winchester House.

What Now?

In the time since the sale, I've closed up the hangar and moved a ridiculous number of tools to the shop behind my house. For awhile, I was happy to have weekends off. But then the itch: First my motorcycles received some much-needed maintenance, then the cars, then the house. I wander out on a Saturday morning looking for something to do. When I had the Sportsman, that was *never* the case. It was more like: Which of the many projects should I tackle first?

My point is this: Relish the building process. Enjoy it now. I appreciate that you want to get it done, move that project out of the garage or shop or hangar and assuage your family's perhaps unstated concerns that you've bitten off more than you can chew. But that's not your motivation, or it shouldn't be.

As you pound rivets or mix epoxy or string wire, you are learning. You are facing new challenges, staring them down and engaging your mind to find solutions. Building an airplane is far more than the make-work it seems sometimes to be, even when faced with repetitive tasks. Yes, there are unpleasant aspects—I once thought I was going to be trapped under the instrument panel of my Pulsar until I remembered that, well, somehow I got *in there* so there must be a way back out—and, yes, you will make mistakes. But it's all part of the experience. One day, you'll be done, and you may even have to make the difficult decision to part with your handiwork. From that perspective, there's nothing sweeter than a rivet perfectly driven. ✢

When you don't have a project of your own, borrow one. The author at the Zenith Aircraft build-a-tail day last year, trying to remember how a pneumatic drill works.

Photos: Marc Cook

FLIGHT REVIEW

Steen Skybolt

Just like a Pitts, except maybe better. *Really.*

BY ED WISCHMEYER

Our story starts with the late LaMar Steen flat on his back under a Pitts S-2 with a tape measure when the late Curtis Pitts walks up. "Aw, shucks, LaMar, I'll give you a set of plans," said Pitts, and the Skybolt was under way, a bigger S-2 for bigger pilots. And that's what it is, a delightful aerobatic mount worthy of being classed right along with its step-siblings, the Pitts biplanes.

How They Got There

Eventually Hale Wallace took over the business, and *Yellow Bird*, the plane we flew, was the third one he built. Then Paul Goetsch, an obviously brilliant engineer, and his partner Jere Larson came onto the scene, looking to buy a Skybolt to fly. They wound up purchasing Steen Aero Lab from Wallace, adding it to their portfolio.

Have you seen the "vegetable peeler" winglets on the Falcon 50? Goetsch and Larson also own Shapes Aerospace International, which makes those winglets; they give almost twice the fuel savings of conventional units. They also make parts for the Airbus A-320 and the military A-400 turboprop transport, so they play with the big boys.

If you go into the Steen Aero shop in Melbourne, Florida, just a few miles inland from the Atlantic Ocean, the first thing you see is the Pitts Model 14. It's a machine similar to the Model 12 with the same Russian engine, but the Model 14 has an unswept, three-piece upper wing. That change was to make the project easier to build, but it meant sacrificing some performance in snap rolls for a more docile plane. Hanging from the ceiling are several single-seat Pitts fuselages, welded in Argentina. Steen is the dealer for Bruntons flying wires as well.

The late Curtis Pitts used to come by the Steen shop, visiting for a week at a time to keep his hand in the airplane game, and Goetsch was a pall bearer at Pitts's funeral.

Unconventional Conventional Construction

The construction of the Skybolt is pretty conventional for a biplane: wood wing with built-up ribs, wood spars and compression struts, and wire bracing for anti-drag loads. The fuselage is welded steel, with aluminum panels at the front and fabric covering on the aft fuselage and all of the flying surfaces. Wallace made some improvements to the original design, such as increasing the number of stringers on the fuselage sides from three to five.

There is also a Firebolt derivative, and the company web site says the two designs often overlap. Steen also sells plans for Mac McKenzie's Firebolt development of the Steen Skybolt, including all-new, detailed drawings. The Firebolt has a longer fuselage, stretched 2 inches in the front cockpit, Marquart Charger-type landing gear, different ailerons (with three hinges instead of two), a different nosebowl, a rearward-sliding canopy and various other modifications. Many flying aircraft are in fact "hybrids" between the Skybolt and Firebolt, with individual builders incorporating selected features from the Firebolt design into their Skybolt project, most often the sliding canopy or the nosebowl design.

But the most interesting part of the Skybolt has to be the wing kit. Traditionally, each wingrib has a trusswork of

Photos: Kevin Wing

Entrepreneur Paul Goetsch went to buy an airplane, but he bought the company.

The canopy gets tilted out of the way for access to the cockpits.

quarter-inch spruce capstrips to give the rib its shape and strength, a nosebowl and gussets at each intersection of the trusswork. The ribs are built in a jig, and the gussets, small rectangles of thin plywood, are traditionally glued onto the capstrips and then nailed with tiny brads to hold them in place till the glue dries.

In the Steen model, the nosebowl and gussets all come CNC cut, along with a pegboard jig. Put dowels into all of the pegboard holes and *Voila!* A jig that will hold all of the components in place with no nails. To put pressure on the glue joints while they're curing, a matching clear plastic piece fits over all of those same dowels. Put weights on the plastic, and watch the glue dry.

If building one rib at a time is too slow, there's now a jig with double-height dowels. Put one rib into the jig, lay a piece of waxed paper on top of it to keep the glue from wandering around, and then put another rib atop that. Add weights on top of the whole thing and build two ribs at once. Goetsch tells the story that one builder's kids had so much fun building the first set of ribs that he ordered a second, unneeded set of ribs to give the kids something to do. If you're not so inclined, another grand will buy one-piece routed ribs.

You can buy wing leading edges ready to go, too. Those are made of two laminations of plywood, with each laminate three-ply, $\frac{1}{32}$ inch thick. The plywood is so flexible that you don't have to steam the leading edges to bend them.

Steen Aero has reinvented the traditional wood spar, fabricating it out of

Getting ready to go do some aerobatics in a delightful airplane. The author is in front, with demo pilot John Testerman in the back.

laminations of spruce instead of solid pieces. Surprisingly, the laminated spars are 30% to 40% stronger than the solid spars, and when they break, they will not fail catastrophically. Instead, the laminates fail individually, and the company's tests show that even a failed spar can still have enough strength to get the airplane home. Some spars with carbon fiber between the laminations were also tried, but the laminated versions are already stronger, so there's no need to spend the extra money.

The bottom line is that although this is a plansbuilt design, there are enough components available so that building a biplane doesn't have to be the massive fabrication of the old days. The total effort of building with a full set of Steen components would be comparable to building a pre-punched metal airplane, but Goetsch says that the added complexity of a biplane does take more passion to build.

Further, Goetsch said that no two Skybolts are really alike. Some are open cockpit, some are closed, and a variety of engines and propellers is available. One builder even put a Continental radial engine on the front of his that was from a WW-II tank.

Aerobatics R Us

Yellow Bird is not your average Skybolt. Up front is 350 horsepower of Lycoming engine, and the novel canopy gets completely out of the way as you

What's in the Box

Steen Aero Lab sells a variety of components, from weldments you can put on your own fuselage to ready-to-cover wings and fuselages; wing kits in various levels of completion; and numerous aircraft components, including fuel tanks, canopies and landing gear. The most complete set of components, still 51% compliant, would cost $39,000.

—E.W.

A four-blade prop on a biplane? Well, yes. You don't have to dive for speed in maneuvers.

STEEN SKYBOLT

Price	Plans $165; Materials Kit $39,000
Estimated completed price	$35,000 - $100,000
Estimated build time	3000 hours
Number flying (at press time)	530
Powerplant	Lycoming IO-540, 350 hp
Propeller	Four blade, constant speed
Powerplant options	180-360 hp Lycoming

AIRFRAME

Wingspan	24 ft
Wing loading	11.76 lb/sq. ft
Fuel capacity	29 gal; 38 optional
Maximum gross weight	1970 lb
Typical empty weight	980-1280 lb
Typical useful load	690-990 lb
Full-fuel payload	520-820 lb
Seating capacity	2 tandem
Cabin width	24 in
Baggage capacity	25 lb

PERFORMANCE

Cruise speed	160-180 mph (139-156 kt) TAS 7500 ft @ 75% of max-continuous, 19.7 gph
Maximum rate of climb	3500 fpm
Stall speed	68 mph (53 kt) IAS
Takeoff distance	300 ft
Landing distance	800 ft

Specifications are representative; expect considerable variation from airplane to airplane depending on weight, canopy or open cockpit, engine and prop.

Yellow Bird's rear instrument panel. The airplane is normally piloted from the back seat.

climb aboard. The front cockpit is not as compact as in some other homebuilt biplanes, but there's not room to stretch your legs out. Reaching all the belts and straps for the parachute and shoulder harness is best left to the young and limber or to an assistant such as master mechanic Butch Childres, who took care that all was well up front.

In an emergency, the back-seater would release the two canopy latches in the back cockpit. The aerodynamicists say that the down-flow off the top wing would lift the canopy into the slipstream without giving the front-seater a bonk on the noggin, but good manners would dictate a warning to duck. Once above the fuselage, the canopy would be out of the way, but the slipstream would undoubtedly rip it off.

In the back, demo pilot John Testerman did all of the normal pilot things until there was the sound of an electric fuel pump. "Clear prop," he said, and the very tall stick came back, along with the sound of a big engine starting up. Initially, it had an easy loping baritone like a big radial with that wonderful smell of engine-start burnt oil before accelerating to a faster, even idle.

Testerman cautiously S-turned us past the parked vehicles for the early-morning flight and past the parked Piper Tri-Pacer photo ship. Out from

Not many biplanes have 350 hp attached to the other end of the throttle quadrant.

Why can't all airplanes have engine access like this? All the better to check up on the Lycoming.

Dual exhausts for that big engine.

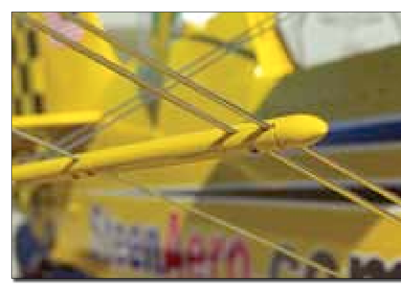
between the hangars, he called Melbourne ground and S-turned us out to Runway 27 Right.

Takeoff acceleration provided a good push back into the seat, and the front airspeed indicator showed 130 mph as we passed the departure end of the runway, a speed so high that I questioned its accuracy. Then again, maybe we were accelerating that much, because the Barrett Precision Engines IO-540 with Airflow Performance fuel injection and one Light Speed Engineering ignition was not your typical biplane powerplant. The four-blade MT propeller was also doing its bit to help convert dead dinosaurs to thrust.

Once we were out of the traffic pattern, it was my turn to take the controls. As one might expect for an aerobatic airplane, my initial impression was that the Skybolt was smooth, light and powerful, just exactly what you would want in this type of airplane.

Out over the Atlantic, a few clearing turns confirmed the first impression. Then it was time to exercise the aircraft in its design mission: aerobatics. First was an aileron roll, entered from level flight at 155 mph indicated. Nose up to 15° or so, lots of left aileron, and around we went. Maybe halfway around, it occurred to me that I might not have full aileron in, and sure enough there was more to exploit. Roll rate was quick, seemingly faster than an RV, but not obscenely fast like the airshow monoplanes that fly routines more appropriate for model airplanes.

Then came a windup turn, increasing to 4 G to recalibrate my internal G force sensor with callouts from the back cockpit, as there was no indicator up front. Then I did another one to get a feel for stick force pull as I built up G load. Those forces were light and increased proportionally to the G forces, with 4 G requiring roughly 12 to 15 pounds of pull on the long control stick. For aerobatics, those light pitch forces were perfect: You can fly a bunch of maneuvers without feeling like you're giving your arm a workout. For flying a long cross-country in turbulence, should you ever need to, those forces might be on the light side. Having done horizontal circles, it was time for a vertical circle, also known as a loop. I used a 4-G pull OK, but being rusty, I didn't relax enough pressure over the top, getting a little



Note the redundant flying wires, standard on aerobatic biplanes.

The front instrument panel is typically sparse, which may necessitate cooperative communication with the back-seater.

The canopy arrangement is unique, and the canopy can only be released from the back seat.

Aileron spades. They may not be necessary, but the ailerons had a great feel with them.

Extra credit if this looks just like the center section of a Pitts to you.

pre-stall buffet. Testerman demonstrated a loop and needed only a 3-G pull as the big engine gave us plenty of smash all the way around.

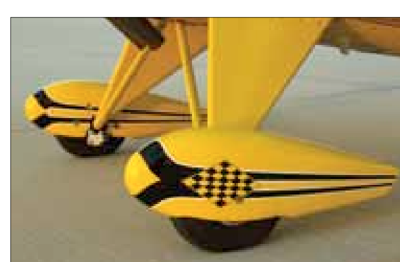
Next on the agenda was a super slow roll. This being my first time in the airplane, I wasn't watching the altitude at all, but it was easy to keep the Skybolt on heading all the way around, easily within a few degrees, while feeling the gravity vector rotate around the airplane. Inverted, I pushed too hard and got -1.8 G, but it was a smooth overcontrol and not jerky, another tribute to the design.

It had been years since my last snap roll, and Testerman recommended a 125-mph entry speed. I slowed to 120, brought the power back in and, as we passed 125, pulled the stick back and put in a bunch of left rudder. *Pow!* Around we went at blazing speed, and by the time I quit being amazed and got around to recovering, we were 80° past level. One interesting detail was that I could feel the stall buffet all the way around during the snap roll. And with that sparkling roll rate, I could have fun doing all those maneuvers that Jungmeister pilots used to do in the 1930s, like quarter snaps. (One of their more famous maneuvers was to touch down with a little extra speed, bounce the landing, snap roll it, and then complete the landing.) On a later solo flight for the camera plane, Testerman snapped it at 100 mph. At that speed and center of gravity, he reported that buffeting is absent.

Testerman did more clearing turns while I took notes, and then it was time for a stall. With power back, buffeting started with the front airspeed indicator showing 73 mph. (The company quotes a 68-mph stall speed.) The buffeting built up, and the nose and right wing dropped gently. Keeping the stick back, I picked up the right wing with left rudder and the plane then rolled to the left. Again I picked up the low left wing with right rudder, and the Skybolt did a quarter snap roll before I recovered.

This behavior is not unexpected in an aerobatic biplane. Many cruising airplanes will diverge in roll when you "deep stall" them, but the snap was different. However, consider that this is an aerobatic biplane with the top wing swept for snap rolls, and a NACA $63A_2015$ laminar flow airfoil with abrupt stall characteristics to give you a crisp entry. The airplane did what it was designed to do, and this is entirely in keeping with its character. The lesson is that the Skybolt will do what you tell it to do, not what you hope that some plain-vanilla trainer might do. (The airfoil on the lower wing is a symmetrical NACA 0012, an airfoil series commonly used on tail surfaces.

The Skybolt sits relatively flat on the ground and, from this angle, somehow is reminiscent of a WW-II fighter.



Spiffily painted wheelpants add to the airplane's appeal.

These are the same airfoils used on the later Pitts models.)

Testerman showed me his rudder power demonstration, as many new Skybolt pilots have not flown a plane with significant rudder authority. I then tried a rudder doublet (lots of rudder one way followed immediately by lots of rudder the other, then feet off the rudders). The Skybolt straightened itself out in just over one full cycle, showing excellent yaw stability.

I wanted to finish with a spin, but Testerman had recently recovered from a sinus infection and didn't want to push his luck, so we passed on that. He reports that the Skybolt rotation rate will wind up in a spin.

As we flew back to the airport, I tried some rudder exercises. One was a slow Dutch roll, slowly rolling the plane back and forth while keeping it straight with the rudders. In most airplanes, the trick to doing this maneuver at all is to roll the airplane slowly. In the Skybolt, the handling was so good that there was no need to inch your way through the maneuver. *Impressive*. Fast Dutch rolls were a piece of cake, but they're also easy in the vast majority of airplanes out there.

After those delightful aerobatics and maneuvers, I must admit I was thinking about anything but cross-countries, or cross-country numbers. Depending on engine, prop, canopy, how many coats of paint are on the airplane and all of the variations that come with homebuilt aircraft, expect a payload of 690 to 990 pounds out of the gross weight of 1970 pounds. Fuel capacity is 29 gallons, optionally 38, which is fine for the smaller 180-hp engines, but the bigger engines can easily burn 13 gph at low cruise power. Advertised cruise speeds are 160 to 180 mph. And although open cockpits look really cool, they can slow the plane down by 15 to 18 mph. Only the front-seater gets buffeted with open cockpits.

Finally, it was time to give the airplane back to Testerman for the landing. Turning final over the beach, miles from the runway, the airspeed was 125 mph, slowing to 80 mph on short final. He did a wheel landing in the crosswind, and then added power to keep the tail up for better visibility on the way to the next taxiway.

For Those Who Do Aerobatics

While I am not the ace of the base for aerobatics, this Skybolt was a delight to fly. The advertised build prices are $35,000 to $100,000, and you get a lot of bang for the buck. The big engine meant that we never had to dive for speed of course, but the airplane also made me look good. The Skybolt literature quotes a number of pilots who compare it favorably with various Pitts models, often characterizing it as easier to land and easier to handle in some aerobatic maneuvers. I certainly found nothing lacking for the entry-level aerobatic pilot. The Skybolt's 24-foot wingspan, versus 20 feet for a two-seat Pitts, may be a factor there.

Goetsch says that he doesn't market the Skybolt against other planes because he doesn't need to; the airplane has a following. Testerman says that when used Skybolts come on the market, they sell quickly. Usually after landing from a pilot report, I contemplate the flight and work on putting it into context. This time, a big smile said it all. ✈

For more information, call 321/725-4160 or visit www.steenaero.com. Find a direct link at www.kitplanes.com.

The Ultimate Upgrade

Now comes the fun part of building Wendell and Martha Solesbee's Lancair Evolution: preparation for painting.

BY DAVE PRIZIO

Wendell and Martha Solesbee have been working for almost two years assembling their Lancair Evolution and are now nearing the end of that process. When we last checked in for the November issue, the Solesbees had hung the mighty Pratt & Whitney PT6A engine and were working through systems installation and integration. That's no small task, which is why the magazine deadlines caught up with and passed their efforts. (This series did not appear in the December issue, so you didn't miss anything.)

Of course, part of the delay was due to the nature of the next step: painting and its related preparation. Fortunately, the Solesbees are uniquely qualified to face the challenge of painting. Not only have they built two other award-winning airplanes—a Giles aerobatic plane and a Lancair IV-P—but they also own an automotive paint and body business that restores some 200 cars per month. They and their son, Terry, showed us what it takes to put a first-class paint job on their first-class project.

Since the days of the IV-P, Lancair has made great strides in the quality of its composite work. Where the older Lancair model used hand-laid molds, the Evolution molds are made with computer precision. As a result, there are no more waves and bumps in the fuselage and wings. Parts come out of the mold smooth and straight, and they fit together with much greater precision. It's probably fair to say that the previous idea of "lock together" parts was true only in the most general sense; most composite aircraft from the 1980s and '90s needed a lot of finish work to make them look like show winners. Every place where composite sections joined presented new opportunities to refine your smoothing and sanding skills.

The quality of the Evolution parts saves the builder time and effort when preparing for paint. Here's an example: The Evolution has a seam where the two halves come together and a recess where the pressure bulkhead bolts through the fuselage. These two areas must be filled and blended into the body. That's not a lot of work when you consider the size of this airplane.

Other areas that required significant work were the cowl sections, especially the ducts in the lower cowl that couldn't be incorporated into the mold and had to be hand-fitted. Solesbee says this was the hardest part of the plane to build. Carbon-fiber cloth and epoxy took care of the structural tasks, and a mixture of glass bubbles (often called micro) and resin are used for non-structural filler. Wherever a little extra strength was needed in the filler, flocked cotton fibers (flox) were added to the mix. Because the inlet duct is both large and prominent, the Solesbee's completed this part of the kit with great care.

Sand in Your Shoes

Once the cowl was built and fitted, and the seams in the fuselage were blended in, there remained many little things to do.

With any composite structure, pinholes in the skin must be filled. A good high-build primer, properly applied, does the job best. You might think that spraying would be the preferred technique, but actually it is hard to blow primer into a small hole. Small disposable paint rollers work much better, because the rollers press the paint into the holes. The Solesbees used WLS epoxy primer, a product popular with Lancair builders. The primer provided a good material for sanding and blocking, which they tackled next.

On the curved surfaces that make up most of the Evolution, sanding and blocking is primarily done with a long board using a cross pattern, first 45° to the axis of the curved surface and then 45° in the opposite direction to make a 90° cross pattern. This ensures that no flat spots or low spots will be introduced into the surface by the sanding process. It works well but requires patience for good results. The blocking process reveals low spots that need additional filling, as well as high spots, which must be dealt with carefully to avoid sanding completely through the gelcoat into the carbon-fiber cloth. This process begins with a fairly coarse grit sandpaper such as 80 or 120. The long-board paper comes on rolls with a sticky back, making it easy to use.

Often, when a particularly tough situation presents itself during the blocking process, a guide coat is applied to more clearly reveal the low spots. What's a guide coat? In this process the surface is sprayed with a thin coat of flat black lacquer and then cross-sanded with a long board. Sanding removes the black paint except in the low spots, clearly identifying areas that need to be filled. Solesbee said that the Evolution was in such good shape that he did not have to use this technique.

Pass the Primer

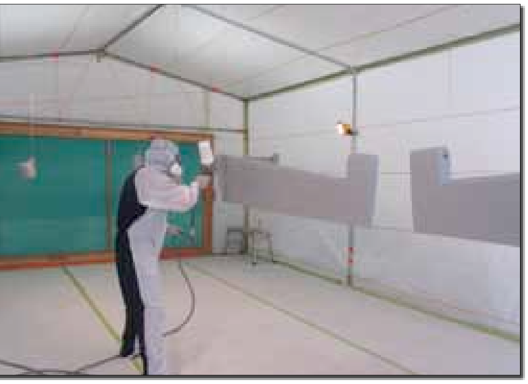
After blocking and filling until smooth, it is time to apply a second coat of primer. The Solesbees used gray primer, but in retrospect admit they should have used white. White primer would have provided a better base coat for the white paint to follow, making it possible to use fewer coats. If you're thinking, "Who cares if it takes two or three coats to cover the primed surface?" keep

Terry Solesbee block-sands and fills the fuselage after the first coat of primer to smooth the high spots left from the manufacturing and assembly processes. He is using a flexible long board to better conform to the continuous curves of the Evolution.

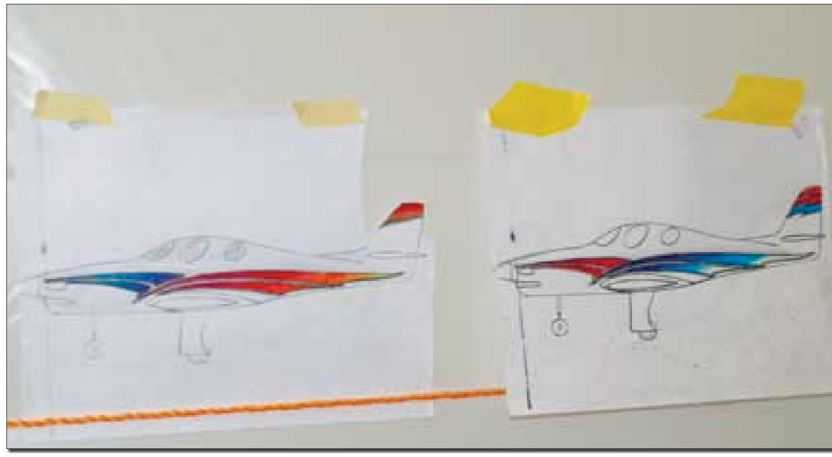
The Solesbees rented a portable booth to paint the Evolution. It fit well in their hangar at the Chino airport. The booth itself is made of plastic sheeting over a pipe framework. Note the large fan box on the end near the outside.

Wendell and Terry load the Evolution fuselage into the paint booth. Once the plane is inside, the fan box simply wheels back into place. The dolly that Wendell welded together makes moving the big Evo fuselage easy for two people.

Photos: Courtesy Wendell Solesbee, Dave Prizio, Marc Cook



Terry puts a second coat of primer on the elevators. Unlike the first coat, which is better applied with a roller, there is no reason not to spray the second coat. Good lighting and ventilation make the booth a pleasant place to work in.



Before the color scheme can be laid out on the airplane, it's worked out on paper. The Solesbees experimented with many variations before they landed on the final design. Even then, minor changes were made when the actual pattern was masked out.

in mind that on a plane the size of the Evolution, an extra coat of paint adds several pounds to the empty weight. As a builder, you're always looking for ways to save weight, unless doing so impacts safety. Primer and paint aren't even remotely structural.

It's the nature of composites that after the second coat of primer a few more tiny imperfections surface that must be fixed. If simple sanding won't cure them, then it might be necessary to fill them with glazing putty. This is only for the smallest imperfections, because it's essentially just very thick paint. After spotting here and there, these areas need to be primed again to ensure the surface is uniform in color and texture. This second coat of primer is sanded with a dual action (DA) sander or by hand using 400-grit sandpaper. Flat and convex surfaces can be sanded with an air-powered DA sander, but concave (inward curving) surfaces must be sanded by hand because the edges of the sander can cut into them. The 400-grit leaves a smooth surface that still has enough roughness to grip the finish paint.

Covers the World

It is important that the primer and the finish coat paints are compatible. Most finish paints work well with epoxy primers such as the one the Solesbees used, but never assume anything. Always check with the paint manufacturers to be sure all products will work together. A paint job can lift because the finish coat and the base coat don't like each other—it's an ugly phenomenon that you never want to see on your own

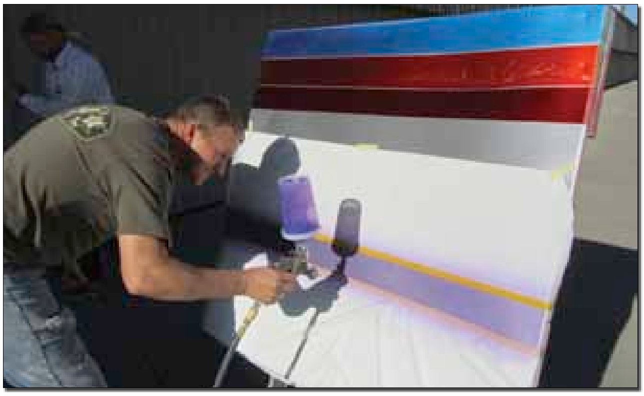
With the considerable size of the Evolution it was nice to use two paint guns simultaneously to apply the base white coats. To do this you need two good painters and an air compressor large enough to keep up with two guns.

What's a "Miss Diss?"

All airplane builders should be familiar with the material safety data sheets (MSDS) for the products they are using on their projects. These are government-mandated safety bulletins that all product manufacturers are required to provide their customers free of charge. They can usually be found on the Internet, but sometimes a paper copy must be obtained from the product vendor. In any case, they contain valuable information about how to safely handle a product and what to do in case of an emergency. Each MSDS will contain the following, but not always in the same order: the name of the product, a physical description, what is in it, how to safely handle, store and use it (including personal protection required), how susceptible it is to fire and explosion, and how to clean it up if you spill it.

There are two big reasons you need this information and should have a printed copy of it in your shop when you use these products. One, you want to know how to safely use the product to avoid harming yourself and others around you. Two, if something goes wrong and you need emergency help, the paramedics will not know how to treat you if they do not know what they are dealing with. Using a toxic product without reviewing the MSDS is like taking off on a flight without knowing where you are going or how to get there. Please be safe. We like having you around.

—D.P.



A lot of testing and mixing went into the color selection process before any paint went on the Evolution. Test strips were painted, allowed to dry, and then checked outside in natural light. Only then could the Solesbees be sure of the colors they would end up with.

Wendell and Terry are all dressed up in their "bunny suits." As soon as they finish mixing their paints and filling their guns, they will start covering the Evolution with its white base coat.

project. This is one place where an ounce of prevention is worth a pound of cure, and then some.

To ensure quality results from their painting project, the Solesbees rented a portable paint booth and set it up inside their hangar. The booth is simply plastic sheeting draped over and fastened to a pipe framework that can easily be set up, torn down and moved from place to place. A large exhaust fan with an even larger filter is installed at one end, and an equally large filter for intake air is built into the other end. The fan box is on wheels so that it can be moved out of the way to push the plane into the booth. This is a slick setup and easily accommodates the large Evolution fuselage without the wings, which must be painted separately.

Once the plane has been primed with a second coat and sanded, it is time to go over everything with a tack cloth to remove any traces of dust or lint. Tack cloths can be purchased at any good paint supply store. They are cloths impregnated with a sticky or tacky chemical that grabs all the loose dust without leaving any residue.

The White Stuff

Finally, it was time to start spraying those freshly primed and sanded airplane parts. With such a large surface to cover, the Solesbees pressed Terry into service to handle a second paint gun. He also has many years of painting and auto-body experience, and is especially

With masking tape and plastic in place to protect the white base coat, the fuselage is now ready for the first application of color. It will take several times through the masking process to apply all of the various colors.

The various colors go on one at a time with a smaller paint gun. These water-based paints are much less toxic and require less personal protection than the more hazardous urethane paints. Unfortunately, they also dry much more slowly.

With the masking removed, Wendell and Terry inspect their handiwork on the tail of the Evolution. Terry will follow up with striping and shadow details later.

Wendell removes the masking from a section of the fuselage. With the slow-drying water-based paints used for the colors, it is important to be patient while unmasking. It would be a shame to rush at this point and have to redo so much hard work.

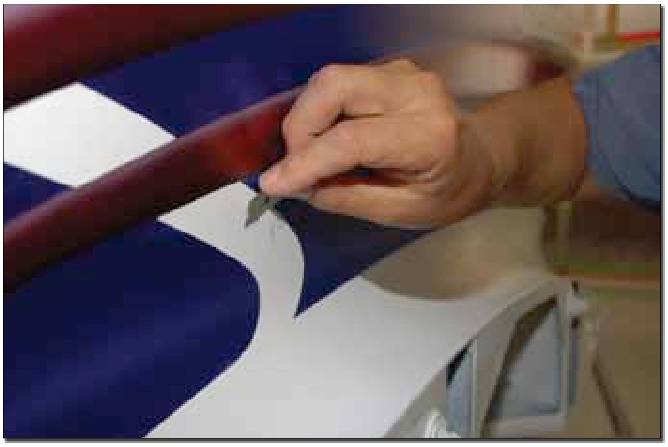
Terry is pleased with the results as he and Wendell remove the masking tape from the last color application. It is easy for something to go wrong when working with such a complex color scheme.

adept at striping and graphics. It's nice to have a spare expert in the family to make short work of a big project.

The Solesbees used Sherwin-Williams Genesis urethane paint for the base white coat. Two double-wet coats went on in quick succession, providing full coverage over the gray primer. "Two double wet coats" is terminology Solesbee uses to describe the application process in which a first coat is applied with a 50% overlap of the spray pattern, followed by a second similar coat applied immediately after the first while it is still wet. The urethane provides a tough and durable base for the color details to come, but it is nasty to work with. It requires special protection for the painter applying it to protect skin and lungs from potentially harmful effects. As with any toxic chemical, careful review of the paint's material safety data sheet (MSDS) is in order before using it. (See the sidebar, Page 18.)

Once dry, the white base coat is sanded with 800 grit in preparation for the color details to follow. This process began with a sketch of what the Solesbees wanted to do. Several schemes were drawn with colored pencils and considered before a final design came together. Next came mixing and spraying a number of colors on a metal sample board to see what they would really look like on the airplane. With all of this finally accomplished, the masking tape went on, tracing the design. The first step was to place green masking tape to the outside edges of the color details. Next, blue 3M Fine Line masking tape was laid up against the edges of the green tape. With the Fine Line tape in place, the green masking tape was then removed. Large areas that were to remain white were covered next until only the areas to be painted with the first color were left exposed. Then it was ready for color.

Sanding, sanding and more sanding. That is what painting is all about. Before the clear coats go on, the entire fuselage is lightly sanded to remove any small imperfections and ensure a good grip for the next layer of paint.



By razor trimming the edges of the color, the clear coat will go on flatter and not build up on the ridges of the accent stripes. This work takes a steady hand and is not recommended for the inexperienced painter.

Terry has applied shadows and accents with an air brush. These extra touches go almost unnoticed at first glance but upon closer scrutiny really add flair to an already impressive paint job.

Color with Universal Appeal

The Solesbees used Planet Color, another Sherwin-Williams product, for the color details. This water-based paint was much different from the urethane base coat—namely in its lengthy drying time. However, Sherwin-Williams highly recommended it for its ability to retain its vivid colors for years. The paint caused some frustration for the Solesbees, but they were pleased in the end. Because there are several colors on their Evolution, the Solesbees put in considerable time and patience to achieve the final results. All of the masking, painting, unmasking, re-masking and painting again is a tedious and painstaking process that is frankly not for the impatient or inexperienced. Terry added a few finishing touches of shadows and stripes to set off the striking design.

Before the clear coat was applied, the edges of the colored designs were razor trimmed, another task best done by an experienced and steady hand. Another pass with the tack cloth, and the clear coat went on in two double-wet coats. To really make the finished paint job perfect, the Solesbees took the extra step of carefully block-sanding the clear coat with 400 grit to remove every little wave and imperfection. After that, the clear was hit with 1000 grit and 2000 grit in successive steps. Finally, a good polishing brought a pearl luster to the finish.

You can do it yourself, as the Solesbees did, for a few thousand dollars in

The difference between a good paint job and a great one is a lot of extra work. Terry blocks out the clear coat to remove the remaining tiny ripples and imperfections. He will follow with additional sanding using 1000 and 2000 grit. It is critical that he removes only a portion of the clear coat and not disturb the paint below.

This detail shot of the wing shows the colors, striping and shadowing that artfully combine to present a truly amazing display of the Solesbees' painting skills.

materials and a lot of work, or you can pay someone $30,000 or so to do it for you. Most Evolution builders will just write a big check.

If you want to do it yourself, there are some things you will need, starting with a good spray booth. You can rent one or make your own with plastic sheeting. In any case, don't skimp on the ventilation or lighting. You will need more of both than you think. A good spray gun and compressor that can provide plenty of air comes next, and don't forget the water trap and inline water filters; water in paint is a disaster. Personal protective equipment, based on the MSDS recommendations, is a must. And lastly, a good paint job is impossible without good paint and preparation products. Expect to pay as much as $400 per gallon for high-quality paint, and more for some colors. It's expensive, but your airplane is worth it. It won't be easy to match what the Solesbees did, but with patience, some experienced help and a lot of hard work you can turn out a nice-looking airplane.

Next time the Solesbees will be reassembling their airplane, getting it inspected and taking it on its first flight. This is the real excitement of building your own airplane—two years of effort culminating in one moment of pure emotion. There is nothing quite like seeing your baby take off for the first time under its own power. You won't want to miss it! ✈

For more information, call 541/923-2244 or visit www.lancair.com. Find a direct link at www.kitplanes.com.

The finished fuselage shows off its new paint job in the Southern California sun. With limited space in the booth, the wings had to be painted separately and can now be reattached. You can see how many colors were used to make this Evolution one of a kind.

ALL ABOUT AVIONICS

We take a look at the all-important firewall-forward electrical elements.

BY STEIN BRUCH

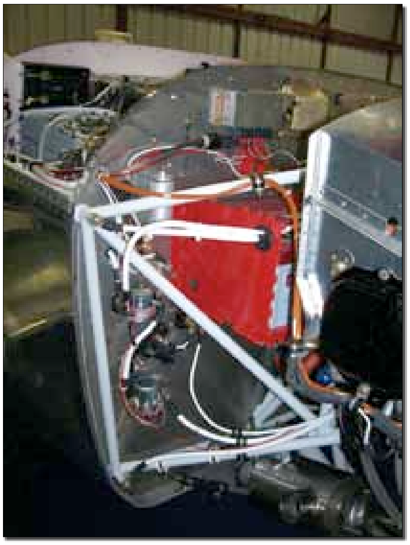
When we hear the term "aircraft electronics," it usually conjures up images of complex instrument panels or airframe wiring. What we often don't think of is what goes on forward of the firewall *electrically*. In our Light Sport-type aircraft the wiring and associated electronics forward of the firewall are every bit as important (and, in some cases, more so) than the rest of the airframe. The biggest reason is that outside of the firewall resides the largest single point of failure in our airplanes, the engine. In a single-engine airplane, it matters little what else you do if you don't pay close attention to the single engine driving the single prop.

Like the rest of the industry, components and engines forward of the firewall are becoming increasingly dependent on electrical power; items such as FADEC (full authority digital engine control), ignitions, fuel pumps and more are all core to the operation of the engine. Even modern twin-engine aircraft are becoming more electrically dependent, all the way up to the 100% electrically reliant modern airliners. Heck, it probably won't be long before more and more planes are buzzing around solely on electrical power.

Creating Electricity

Almost every airplane (I say almost, because a number of planes still happily fly around without any electrical systems) has a source of electrical power generation attached to the engine. Sure, some older aircraft used a wind generator, but it's neither common nor practical anymore. Most common is a simple alternator (or, historically, a generator),

Photos: Stein Bruch



Firewall forward view showing the battery box and relays as well as a ground strap on the engine mount.

Routing of spark plug harnesses secured through baffle materials.

Mounting these sensors directly to the firewall ensures good ground contact.

which in design varies little from its automotive brethren. They can be either internally or externally regulated, and I won't get into arguing which one is better; the fact is that both of them work, and both are acceptable. Some engines have gear-driven alternators, some are belt driven, and some even use an integral flywheel-mounted "generating or lighting coil" as seen in the well-proven Rotax engines. In the end, they all perform the same task: providing power for both the engine and other systems in the plane.

There are a couple of key factors when talking about the alternator and electrical systems. First is a secure ground. I'll repeat it because it's of utmost importance: *Make sure you have a good engine-to-airframe ground*. That may sound simple, but it's often overlooked and frequently the cause of problems for first-time builders. You see, the alternator is most likely attached to the engine, which frequently is isolated from the airframe via rubber bushings that do not conduct electricity. Therefore, it's common for an engine to have no ground path to the engine other than through various other wires such as an alternator field, P-lead shielding, etc. This can cause all sorts of electrical problems, and the solution is to install a ground strap or wire of sufficient size from the firewall to the engine to handle all probable electrical loads on the engine, which can include the alternator, starter, ignition and more. Make sure this strap or wire is of fairly good size and also goes directly from a reliable contact point on the airframe to a reliable point on the engine, typically the engine case itself. Installing a ground strap should be considered a mandatory item.

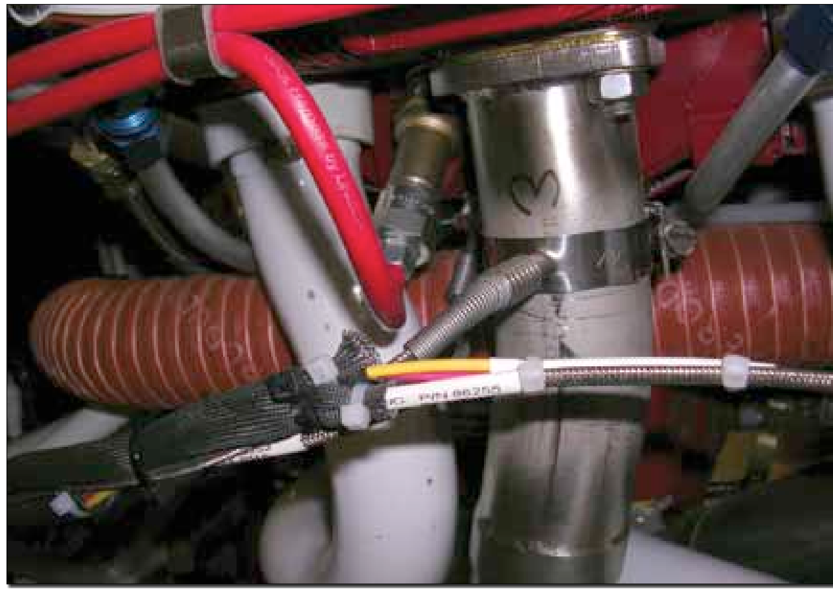
Ignition

Keeping the fire lit is something we rarely think about, but it is of great importance. While piston airplane engines rely on spark plugs (except for a few diesels), the method of producing that spark can vary a bit. Good

Standoffs may be used to better position some sensors and probes.

Protective boots over heavy wire terminals can be beneficial.

old-fashioned magnetos generate their own power. Even though it is old technology, the magneto is a stalwart of reliability. While they generate their own power, we still need a method to turn them on or off, which typically is an ignition switch hooked to a wire from the magneto called a P-lead. In case you're wondering why it's called a P-lead, it's because that wire typically ends up going through the magneto and is attached to the primary coil windings, hence the name. This wire is often shielded, so it frequently ends up being the wire that is the sole ground return to the engine when the main ground strap or wire is defective or missing. It's also an electronically noisy wire that we want to run separate from other wires through the firewall to the ignition switch.



Devices such as exhaust gas temperature (EGT) probes need to be adequately mounted, secured and protected.

Another important item that is often overlooked is the spark plug lead. Many times we have found that the automotive-type harnesses are just fine when constructed properly, but if they're not assembled perfectly, they can cause all kinds of weird problems with noise or instrument indications. Of course, keeping the plugs clean and gapped properly is always good practice. If you

Alternative mounting for probes and sensors on this composite firewall.

An overall view of a clean and tidy engine installation.

are using an electronic ignition, it's also important to keep your wire runs to those devices or to their computers and coils as neat and tidy as possible.

Starter

Most of us use electric starters on our planes that greatly ease the task of getting the fan turning. If everything is wired correctly with the starter and ignition (and fuel pump), things normally go as planned. However, if you forget to install the mandatory ground strap, you'll likely fry the P-leads, alternator leads or any other electrical connections between the airframe and engine, as they are the only ground returns.

The wire to the starter is typically a fairly large and fat wire. Make sure you support it properly, and also make sure you use a good crimper or "the terminal tool" to fasten the terminals to the fat wire. You may choose to solder those terminals, but make sure you have a hot enough iron or torch to do a good job. Note that with the starter solenoid, it's a good idea to install diodes across the posts on the relays to protect other devices from the resultant voltage spike. Diodes for the starter and master relays are available from a number of sources, but we find it most convenient to spend the few dollars and purchase them from Van's Aircraft.

When you run out of space on the firewall, you can sometimes use the engine mount tubes for probe mounting. Note the rubber boot on the master relay wire.

Sensors

In years past, we've used mechanical gauges driven by fluid lines in the cockpit. But now the majority of homebuilt aircraft will have electronic instrumentation. Modern instruments use senders that are mounted on or near the firewall, even sometimes on the engine itself. One very important aspect with most of these sensors and transducers is that they normally must have good grounds. Lack of a good ground has flummoxed many a technician trying to troubleshoot gremlins. Some sensors are provided with their own ground, but many of the popular ones rely on the case of the sensor to provide a ground

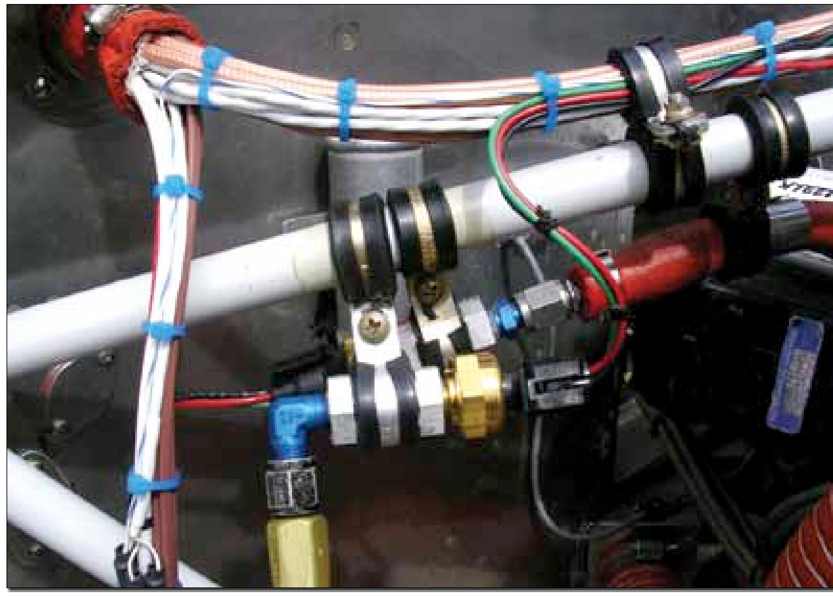
Antennas mounted forward of the firewall need to be adequately secured and grounded.

path. This means you need to ensure the case somehow has a ground connection, either through the mount or via a wire.

It's also important to mount sensors securely and per manufacturers' recommendations. More than one issue with broken sensors has been the result of improper mounting and connection. For example, if a sensor is mounted on the firewall and connected to the engine, then a flexible line is typically recommended.

Battery

Many airplanes will have a battery mounted on or near the firewall. There isn't much to go wrong with a battery, but there are some basics to be followed. First, ensure the battery is secure. Second, ensure the terminals are easily identified. A good tip is to physically mark + and – somewhere close to each post. It's not unheard of for a customer to install or purchase a new battery where the terminals are physically reversed on the battery from their old one. This can be true especially for those using recreational ATV or motorcycle batteries. When the owner installs it,



Note the usage of cushion clamps and high-temperature Tefzel ties in this installation.

the cables attach just fine and then when the master switch is turned on, there's a smoky surprise because the battery is hooked up backward.

Other beneficial items are boots to cover the terminals where the wires are attached. This will help keep the errant piece of safety wire from shorting the terminal to a firewall or engine mount. Lastly, it is handy to permanently install a lead for a trickle charger that allows you to plug it in without having to remove the cowl. We like to use the Battery Tender Jr. from *www.batterytender.com* (it includes a nice lead for the charger that you can install on the battery permanently). There are many others available that work just as well.

Mechanical Considerations

One last aspect to talk about when discussing wiring forward of the firewall are the physical considerations, meaning the actual mounting and securing of

More high-temp Tefzel ties and protective coverings used for wires near the exhaust.

This clean installation shows use of protective boots, cushion clamps and clean wire routing.

The coax cables secured to this engine mount tube are routed through cushion clamps and wire ties.

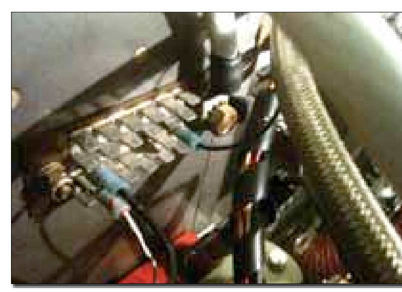
More secured coax cables bundled with other wires along an engine mount tube.

wires. Many times you'll see pictures of wires that are zip-tied to engine mounts with nothing for protection. This is bad for various reasons, first because the zip tie will eat into the engine mount, and second, because it can also eat into the wire. If you must use zip ties, then at least use some sort of physical tape or other insulation to protect both the wire and the engine mount. Chafe tape, silicone tape, rubber tape and other heat-resistant products usually suffice. Along that line, you need to make sure the zip ties you use are at a minimum the heat-resistant type, but the best are the turquoise-blue colored Tefzel ties that can withstand the highest temps.

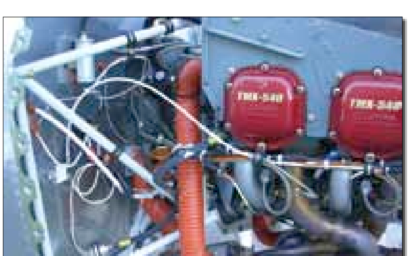
Even with simple installation, the firewall-forward area of your plane can become quite crowded, which makes routing of wires even more important for safety, reliability and future maintenance.

Other means of securing wires are the standard cushion type clamps (aka Adel clamps), spring clamps, lacing cord or other methods. Spark plug wires, as previously discussed, often will run through engine baffles, so it's likewise important that they are protected from rubbing on the baffling. Wires such as CHT and EGT thermocouple type wires should be secured as well.

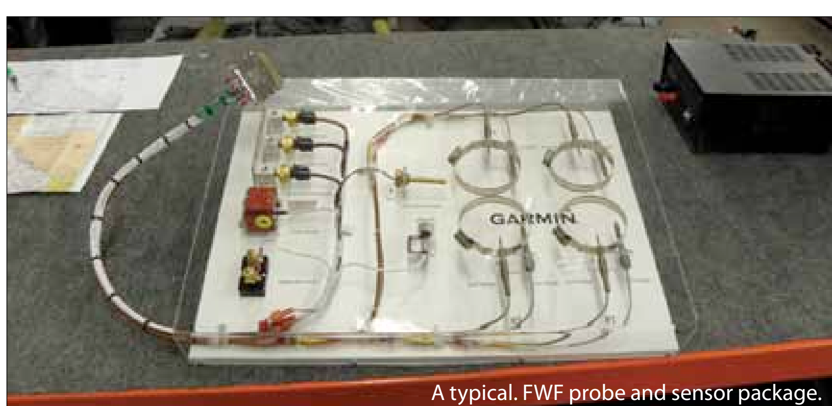
Overall, the wiring firewall forward is just as important as the instrument panel, except you also need to be wary of increased heat and vibration not present with wires inside the cockpit. For some airplanes there are even oil leaks to contend with. If you do a good job with the wire routing and securing, you're halfway there. The other half is to pay close attention to grounds. Firewall-forward grounds can cause a lot of problems with seemingly unrelated systems in the airplane and can eat up lots of hours troubleshooting. As with almost any endeavor, it's much easier to put in a few hours of extra time to make it right when first doing the job. ✢



The FWF ground tab/block.



You can see some of the many wires that will be on the firewall as well as running throughout the engine compartment.



A typical. FWF probe and sensor package.

Ask the DAR

Know your limitations: Who can do inspections?

BY MEL ASBERRY

Last time we talked about inspection requirements, when they're needed and how to sign them off. Now let's see who can do this all-important inspection.

(26) An Experimental aircraft builder certificated as a repairman for this aircraft under 65.104 or an appropriately rated FAA-certificated mechanic may perform the condition inspection required by these operating limitations.

If we have applied for and received the repairman certificate for this aircraft, we may perform and sign off the condition inspection. But what if we bought the aircraft and don't qualify for the repairman certificate? Well, then we must find an appropriately rated FAA-certificated mechanic. Note that nothing was said about an inspection authorization. The IA is not required at any time when inspecting an Experimental/Amateur-built aircraft; any A&P can do it. Reason being that one of the primary duties of the IA is to confirm that the aircraft meets its type certificate, and our aircraft does not have a type certificate.

One thing we haven't discussed, and it isn't even mentioned in our operating limitations, is the requirement to inspect and test the emergency locator beacon. Even though it's not part of the annual condition inspection, this must be done annually. Why not include it then? It's a convenient time, and the aircraft is already opened up.

There has been some question about whether you, as the repairman for your aircraft, can do this inspection. The folks in Oklahoma City have assured me that the holder of the repairman certificate can perform the inspection and testing required by 91.207(d). If you find a problem with the ELT, you are not authorized to make repairs unless the problem is limited to the installation.

(27) Application must be made to the geographically responsible FSDO or MIDO for any revisions to the operating limitations.

This rule was written when DARs were not authorized to amend operating limitations. It was discussed that DARs can issue the operating limitations, so why can't they amend them? Eventually the rules did change, authorizing DARs who hold function code 33 to make these revisions. However, because you would normally first contact a FSDO or MIDO, the wording wasn't changed.

(28) The pilot in command of this aircraft must notify air traffic control of the Experimental nature of this aircraft when operating into or out of airports with an operational control tower. When filing IFR, the Experimental nature of this aircraft must be listed in the remarks section of the flight plan.

This rule is what causes us to say "Experimental N12345" when calling the tower. However, this tells the tower operator nothing about what kind of aircraft you are flying except that it is *not* a Cessna, Piper or other "certified" aircraft. Often the controller will ask what kind of Experimental, mostly looking for something that will tell him what speeds to expect. I recommend that pilots add something like "Experimental RV N12345." Now you have answered the unasked question.

This is only required when operating into or out of airports with an operational control tower. It is not required when transitioning airspace or operating at non-towered airports.

Listing the Experimental nature of the aircraft in the remarks section of the IFR flight plan is self-explanatory.

Well, this pretty much completes our operating limitations. What do you think? Thoroughly confused?

I get many questions about amateur-built and Light Sport Aircraft. You'd be surprised how many times the answer is, "Read your operating limitations." Just about everything is in there.

Photo: Mel Asberry

2012 PLANSBUILT BUYER'S GUIDE

COMPILED BY RICHARD VANDERMEULEN

Plansbuilders, the ultimate do-it-yourselfers. They're undaunted when presented with a set of prints and little more than the unlimited potential of an idea. Perhaps they have more time than money, or maybe they simply enjoy the challenge of creating something from scratch. This is where the original homebuilt movement started, long before there were prebuilt composite or metal components, quickbuild kits and builder-assistance programs. Whatever the appeal for would-be scratch-builders, there should be more than enough here to be tempting, with some 138 designs total.

The solely plansbuilt designs are dwarfed by the number of kits available to homebuilders about three to one, which reflects the trend in this industry. More and more builders are inclined to have at least some of the work done for them, with more than enough left to do to satisfy the FAA's 51% rule. Still, a certain segment will always want to build from plans.

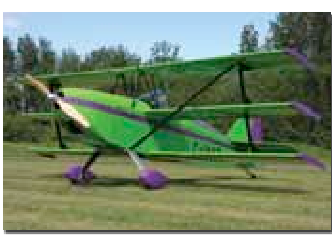
Although there haven't been tremendous changes to this year's edition of the Plansbuilt Buyer's Guide since the last time it appeared in this magazine, there have been some. Russell Alarie is now marketing the former Marv Reese Daisy Mae (find it under Alarie, Russell). Roger Mann/Ragwing Aircraft Designs has shortened its name to Roger Mann (you'll find it in the M section: Mann, Roger). And WAR Aircraft Replicas has added two new models to its lineup, the F8F Bearcat and the Hurricane. The Tiziano Danieli Piuma Twin is now known as the Piuma Twin Evolution.

So there you have it. Our hats are off to the scratch-builders out there. ✈

Key to Buyer's Guide Codes

All specifications are provided by the manufacturers.

Not applicable	n.a.
Information was not provided	n.p.
Retractable gear/fixed gear	R/F
Composite	C
Fabric	F
Metal	M
Tubing	T
Wood	W
Meets Light Sport Aircraft Rules	LSA Legal

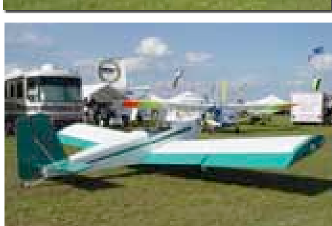


Acrolite Aircraft
Acrolite 1T

Cruise, mph	90	Fuel Capacity, gal.	9	Beginner Build Time, hrs.	2000
Stall, mph	44	Empty/Gross Weight, lb.	450/720	No. Completed & Flown	1
Range, s.m.	290	Length, ft.	15.5	Cost	$125
Rate of Climb, fpm	1100	Wingspan, ft.	18	Estimated Completed Cost	$8K-$20K
Takeoff/Landing Distance, ft.	500/500	Wing Area, sq. ft.	111		LSA Legal
Engine Used	Rotax 582	No. of Seats	1		
HP/HP Range	65/50-75	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.acrolite.org	
		Bldg. Materials	F, T, W	807/935-2587	

Acrolite Aircraft
Acrolite 2M

Cruise, mph	105	Fuel Capacity, gal.	14	Beginner Build Time, hrs.	2000
Stall, mph	43	Empty/Gross Weight, lb.	600/1200	No. Completed & Flown	1
Range, s.m.	400	Length, ft.	20.3	Cost	$160
Rate of Climb, fpm	1100	Wingspan, ft.	28.3	Estimated Completed Cost	$12K-$30K
Takeoff/Landing Distance, ft.	600/600	Wing Area, sq. ft.	141		LSA Legal
Engine Used	Rotax 912	No. of Seats	2T		
HP/HP Range	80/65-100	Cockpit Width, in.	30		
		Landing Gear	tailwheel	www.acrolite.org	
		Bldg. Materials	F, M, T	807/935-2587	

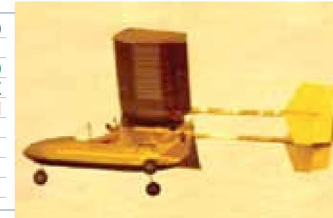


Adams Aeronautics Company, Inc.
CA-2

Cruise, mph	63	Fuel Capacity, gal.	n.p.	Beginner Build Time, hrs.	600
Stall, mph	26	Empty/Gross Weight, lb.	250/520	No. Completed & Flown	6
Range, s.m.	125	Length, ft.	16.6	Cost	$150
Rate of Climb, fpm	600	Wingspan, ft.	26	Estimated Completed Cost	$4K-$8K
Takeoff/Landing Distance, ft.	100/200	Wing Area, sq. ft.	117		LSA Legal
Engine Used	Rotax 288	No. of Seats	1		
HP/HP Range	28/28-40	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.adamsaero.com	
		Bldg. Materials	F, M, T	770/443-8792	

Adams Aeronautics Company, Inc.
T-100D Mariah

		Fuel Capacity, gal.	5	Beginner Build Time, hrs.	800
		Empty/Gross Weight, lb.	254/504	No. Completed & Flown	1
Cruise, mph	63	Length, ft.	19.1	Cost	$250
Stall, mph	27	Wingspan, ft.	34	Estimated Completed Cost	$4K-$8K
Range, s.m.	250	Wing Area, sq. ft.	146.5		LSA Legal
Rate of Climb, fpm	600	No. of Seats	1		
Takeoff/Landing Distance, ft.	350/300	Cockpit Width, in.	22		
Engine Used	Cuyuna 215R	Landing Gear	trigear	www.adamsaero.com	
HP/HP Range	20/20-35	Bldg. Materials	F, M, T, W	770/443-8792	



Aero-Systems
Cadet Model STF

		Fuel Capacity, gal.	25	Beginner Build Time, hrs.	2500
		Empty/Gross Weight, lb.	750/1350	No. Completed & Flown	1
Cruise, mph	130	Length, ft.	18.5	Cost	$430
Stall, mph	50	Wingspan, ft.	27	Estimated Completed Cost	$35K-$48K
Range, s.m.	500	Wing Area, sq. ft.	120		
Rate of Climb, fpm	1000	No. of Seats	2		
Takeoff/Landing Distance, ft.	800/875	Cockpit Width, in.	39.5		
Engine Used	Continental O-200	Landing Gear	tailwheel/R	www.ibeatyouthere.com/culver	
HP/HP Range	85/85-100	Bldg. Materials	F, T, W	619/460-2494	

Aircraft Spruce & Specialty
Acroduster Too SA-750

		Fuel Capacity, gal.	35	Beginner Build Time, hrs.	2000
		Empty/Gross Weight, lb.	1050/1950	No. Completed & Flown	152
Cruise, mph	155	Length, ft.	18.5	Cost	$95
Stall, mph	55	Wingspan, ft.	21.4	Estimated Completed Cost	n.p.
Range, s.m.	500	Wing Area, sq. ft.	130		
Rate of Climb, fpm	2300	No. of Seats	2T		
Takeoff/Landing Distance, ft.	800/1200	Cockpit Width, in.	23		
Engine Used	Lycoming IO-360	Landing Gear	tailwheel	www.aircraftspruce.com	
HP/HP Range	200/180-300	Bldg. Materials	F, T, W	877/477-7823	

Aircraft Spruce & Specialty
Acrolite 1B

		Fuel Capacity, gal.	8	Beginner Build Time, hrs.	2000
		Empty/Gross Weight, lb.	495/750	No. Completed & Flown	2
Cruise, mph	110	Length, ft.	17	Cost	$300
Stall, mph	43	Wingspan, ft.	20	Estimated Completed Cost	$7K
Range, s.m.	290	Wing Area, sq. ft.	133		LSA Legal
Rate of Climb, fpm	1000	No. of Seats	2		
Takeoff/Landing Distance, ft.	500/500	Cockpit Width, in.	31		
Engine Used	Rotax 912	Landing Gear	tailwheel	www.aircraftspruce.com	
HP/HP Range	80/55-112	Bldg. Materials	M, T, W	877/477-7823	

Aircraft Spruce & Specialty
Baby Great Lakes

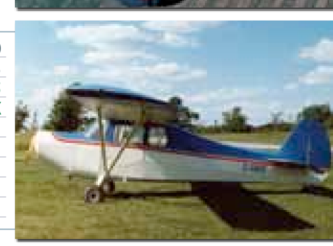
		Fuel Capacity, gal.	12	Beginner Build Time, hrs.	1000
		Empty/Gross Weight, lb.	480/850	No. Completed & Flown	252
Cruise, mph	118	Length, ft.	13.8	Cost	$279.95
Stall, mph	55	Wingspan, ft.	16.6	Estimated Completed Cost	$40K
Range, s.m.	290	Wing Area, sq. ft.	88		
Rate of Climb, fpm	2000	No. of Seats	1		
Takeoff/Landing Distance, ft.	300/400	Cockpit Width, in.	23		
Engine Used	Continental C-85	Landing Gear	tailwheel	www.aircraftspruce.com	
HP/HP Range	85/65-100	Bldg. Materials	F, M, T, W	877/477-7823	

Aircraft Spruce & Specialty
Buddy Baby Lakes

		Fuel Capacity, gal.	14	Beginner Build Time, hrs.	1400
		Empty/Gross Weight, lb.	550/1000	No. Completed & Flown	5
Cruise, mph	135	Length, ft.	14.7	Cost	$250
Stall, mph	55	Wingspan, ft.	18	Estimated Completed Cost	$40K
Range, s.m.	290	Wing Area, sq. ft.	98		
Rate of Climb, fpm	1600	No. of Seats	2T		
Takeoff/Landing Distance, ft.	400/400	Cockpit Width, in.	23		
Engine Used	Lycoming O-235	Landing Gear	tailwheel	www.aircraftspruce.com	
HP/HP Range	108/85-125	Bldg. Materials	F, T, W	877/477-7823	

Aircraft Spruce & Specialty
Christavia MK 1

		Fuel Capacity, gal.	19	Beginner Build Time, hrs.	2000
		Empty/Gross Weight, lb.	800/1500	No. Completed & Flown	363
Cruise, mph	105	Length, ft.	21	Cost	$298.95
Stall, mph	40	Wingspan, ft.	32.5	Estimated Completed Cost	$8K-$14K
Range, s.m.	360	Wing Area, sq. ft.	146.2		
Rate of Climb, fpm	900	No. of Seats	2T		
Takeoff/Landing Distance, ft.	300/600	Cockpit Width, in.	23		
Engine Used	Continental A-65	Landing Gear	tailwheel	www.aircraftspruce.com	
HP/HP Range	65/65-100	Bldg. Materials	F, T, W	877/477-7823	



Aircraft Spruce & Specialty
Cozy Mark IV

		Fuel Capacity, gal.	52	Beginner Build Time, hrs.	2500
		Empty/Gross Weight, lb.	1050/2050	No. Completed & Flown	353
Cruise, mph	190	Length, ft.	16.8	Cost	$500
Stall, mph	69	Wingspan, ft.	28.1	Estimated Completed Cost	n.p.
Range, s.m.	980	Wing Area, sq. ft.	88.2		
Rate of Climb, fpm	2000	No. of Seats	4		
Takeoff/Landing Distance, ft.	1500/1500	Cockpit Width, in.	40		
Engine Used	Lycoming O-360	Landing Gear	trigear/R	www.aircraftspruce.com	
HP/HP Range	180/160-200	Bldg. Materials	C	877/477-7823	

Aircraft Spruce & Specialty
One Design DR 107

Cruise, mph	160	Fuel Capacity, gal.	20	Beginner Build Time, hrs.	3000
Stall, mph	60	Empty/Gross Weight, lb.	740/1140	No. Completed & Flown	61
Range, s.m.	380	Length, ft.	17	Cost	$376.95
Rate of Climb, fpm	2000	Wingspan, ft.	19.3	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	600/n.p.	Wing Area, sq. ft.	75.5		
Engine Used	Lycoming IO-320	No. of Seats	1		
HP/HP Range	160/150-200	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.aircraftspruce.com	
		Bldg. Materials	C, F, M, T, W	877/477-7823	

Aircraft Spruce & Specialty
Starduster One SA-100

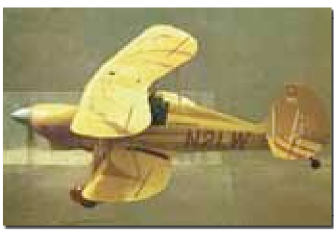
Cruise, mph	132	Fuel Capacity, gal.	24	Beginner Build Time, hrs.	3500
Stall, mph	50	Empty/Gross Weight, lb.	700/1080	No. Completed & Flown	102
Range, s.m.	400	Length, ft.	n.p.	Cost	$115
Rate of Climb, fpm	2000	Wingspan, ft.	19	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	200/n.p.	Wing Area, sq. ft.	110		LSA Legal
Engine Used	Lycoming 0-320	No. of Seats	1		
HP/HP Range	125/85-160	Cockpit Width, in.	22		
		Landing Gear	tailwheel	www.aircraftspruce.com	
		Bldg. Materials	F, M, T, W	877/477-7823	

Aircraft Spruce & Specialty
Starduster Too SA-300

Cruise, mph	130	Fuel Capacity, gal.	44	Beginner Build Time, hrs.	2000
Stall, mph	56	Empty/Gross Weight, lb.	1000/1985	No. Completed & Flown	703
Range, s.m.	560	Length, ft.	20.6	Cost	$250
Rate of Climb, fpm	1800	Wingspan, ft.	24	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	700/1000	Wing Area, sq. ft.	165		
Engine Used	Lycoming 0-360	No. of Seats	2T		
HP/HP Range	180/160-300	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.aircraftspruce.com	
		Bldg. Materials	F, T, W	877/477-7823	

Aircraft Spruce & Specialty
Starduster Starlet SA-500

Cruise, mph	105	Fuel Capacity, gal.	22	Beginner Build Time, hrs.	1400
Stall, mph	55	Empty/Gross Weight, lb.	500/1000	No. Completed & Flown	42
Range, s.m.	630	Length, ft.	17	Cost	$99.50
Rate of Climb, fpm	950	Wingspan, ft.	25	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	300/400	Wing Area, sq. ft.	83		
Engine Used	1500cc VW	No. of Seats	1		
HP/HP Range	65/65-125	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.aircraftspruce.com	
		Bldg. Materials	F, T, W	877/477-7823	

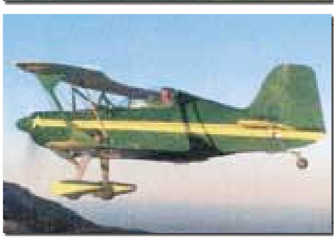


Aircraft Spruce & Specialty
Starduster V-Star SA-900

Cruise, mph	75	Fuel Capacity, gal.	22	Beginner Build Time, hrs.	1800
Stall, mph	35	Empty/Gross Weight, lb.	600/1000	No. Completed & Flown	70
Range, s.m.	320	Length, ft.	17.1	Cost	$195
Rate of Climb, fpm	600	Wingspan, ft.	23	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	400/600	Wing Area, sq. ft.	141		LSA Legal
Engine Used	Continental A-65	No. of Seats	1		
HP/HP Range	65/65-150	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.aircraftspruce.com	
		Bldg. Materials	F, T, W	877/477-7823	

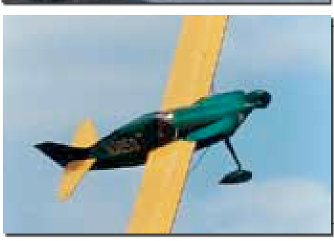
Aircraft Spruce & Specialty
Super Baby Great Lakes

Cruise, mph	135	Fuel Capacity, gal.	12	Beginner Build Time, hrs.	1000
Stall, mph	55	Empty/Gross Weight, lb.	500/850	No. Completed & Flown	52
Range, s.m.	290	Length, ft.	13.8	Cost	$295
Rate of Climb, fpm	3000	Wingspan, ft.	16.7	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	250/400	Wing Area, sq. ft.	88		
Engine Used	Lycoming 0-235	No. of Seats	1		
HP/HP Range	108/108-125	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.aircraftspruce.com	
		Bldg. Materials	F, M, T, W	877/477-7823	



Aircraft Spruce & Specialty
Super Starduster SA-101

Cruise, mph	170	Fuel Capacity, gal.	20	Beginner Build Time, hrs.	2000
Stall, mph	55	Empty/Gross Weight, lb.	840/1300	No. Completed & Flown	2
Range, s.m.	310	Length, ft.	16	Cost	$158.95
Rate of Climb, fpm	3000	Wingspan, ft.	19.5	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	200/1000	Wing Area, sq. ft.	105		
Engine Used	Lycoming IO-360	No. of Seats	1		
HP/HP Range	200/n.p.	Cockpit Width, in.	23		
		Landing Gear	tailwheel	www.aircraftspruce.com	
		Bldg. Materials	C, F, M, T	877/477-7823	



Aircraft Spruce & Specialty
Wittman V-Witt Racer

Cruise, mph	150	Fuel Capacity, gal.	10	Beginner Build Time, hrs.	1500
Stall, mph	48	Empty/Gross Weight, lb.	430/700	No. Completed & Flown	25
Range, s.m.	460	Length, ft.	18.1	Cost	$95
Rate of Climb, fpm	1000	Wingspan, ft.	17.5	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	800/n.p.	Wing Area, sq. ft.	77		
Engine Used	VW	No. of Seats	1		
HP/HP Range	50/n.p.	Cockpit Width, in.	22		
		Landing Gear	tailwheel	www.aircraftspruce.com	
		Bldg. Materials	F, T, W	877/477-7823	

Aircraft Spruce & Specialty
Wittman W10 Tailwind

Cruise, mph	180	Fuel Capacity, gal.	35	Beginner Build Time, hrs.	2500
Stall, mph	45	Empty/Gross Weight, lb.	876/1425	No. Completed & Flown	377
Range, s.m.	690	Length, ft.	19.6	Cost	$195
Rate of Climb, fpm	1200	Wingspan, ft.	24	Estimated Completed Cost	$12K-$40K
Takeoff/Landing Distance, ft.	750/650	Wing Area, sq. ft.	92		
Engine Used	Continental O-300	No. of Seats	2		
HP/HP Range	145/n.p.	Cockpit Width, in.	40		
		Landing Gear	tailwheel	www.aircraftspruce.com	
		Bldg. Materials	F, T, W	877/477-7823	

Alarie, Russell
Daisy Mae

Cruise, mph	80	Fuel Capacity, gal.	15	Beginner Build Time, hrs.	2500
Stall, mph	40	Empty/Gross Weight, lb.	780/1300	No. Completed & Flown	1
Range, s.m.	200	Length, ft.	18	Cost	$165
Rate of Climb, fpm	400	Wingspan, ft.	23	Estimated Completed Cost	$17K-$30K
Takeoff/Landing Distance, ft.	750/600	Wing Area, sq. ft.	173		LSA Legal
Engine Used	Continental O-200	No. of Seats	2		
HP/HP Range	100/85-115	Cockpit Width, in.	27		
		Landing Gear	tailwheel	www.daisymae-biplane.com	
		Bldg. Materials	F, M, T	417/858-8821	

Aviat Aircraft
Pitts S-1-11B (Super Stinker)

Cruise, mph	187	Fuel Capacity, gal.	29	Beginner Build Time, hrs.	2000
Stall, mph	54	Empty/Gross Weight, lb.	1028/1500	No. Completed & Flown	80
Range, s.m.	400	Length, ft.	18.2	Cost	$330
Rate of Climb, fpm	3300	Wingspan, ft.	18	Estimated Completed Cost	$100K-$300K
Takeoff/Landing Distance, ft.	1000/1400	Wing Area, sq. ft.	110.3		
Engine Used	Lycoming IO-540	No. of Seats	1		
HP/HP Range	250/n.p.	Cockpit Width, in.	30		
		Landing Gear	tailwheel	www.aviataircraft.com	
		Bldg. Materials	F, M, T, W	307/885-3151	

Blanton, D. L.
Sport Racer

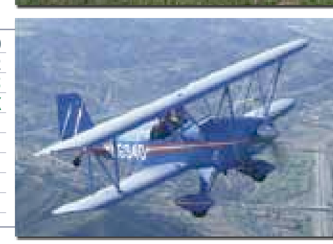
Cruise, mph	175	Fuel Capacity, gal.	30	Beginner Build Time, hrs.	1500
Stall, mph	62	Empty/Gross Weight, lb.	1175/1825	No. Completed & Flown	9
Range, s.m.	470	Length, ft.	21	Cost	$300
Rate of Climb, fpm	900	Wingspan, ft.	22	Estimated Completed Cost	$25K-$35K
Takeoff/Landing Distance, ft.	1600/1800	Wing Area, sq. ft.	81		
Engine Used	Ford 230 V-6	No. of Seats	2T		
HP/HP Range	200/150-260	Cockpit Width, in.	26		
		Landing Gear	tailwheel	email: daveblanton@cox.net	
		Bldg. Materials	F, T, W	316/755-0659	

Blanton, D. L.
V-6 STOL

Cruise, mph	120	Fuel Capacity, gal.	36	Beginner Build Time, hrs.	650
Stall, mph	48	Empty/Gross Weight, lb.	1250/2200	No. Completed & Flown	111
Range, s.m.	335	Length, ft.	22.3	Cost	$100
Rate of Climb, fpm	1700	Wingspan, ft.	32	Estimated Completed Cost	$25K-$35K
Takeoff/Landing Distance, ft.	500/500	Wing Area, sq. ft.	168		
Engine Used	Ford 3.8L V-6	No. of Seats	4		
HP/HP Range	230/230-300	Cockpit Width, in.	40		
		Landing Gear	tailwheel	email: daveblanton@cox.net	
		Bldg. Materials	F, M, T	316/755-0659	

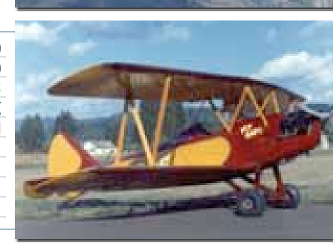
Blanton, D. L.
Wichawk

Cruise, mph	127	Fuel Capacity, gal.	40	Beginner Build Time, hrs.	2000
Stall, mph	56	Empty/Gross Weight, lb.	1280/2000	No. Completed & Flown	102
Range, s.m.	500	Length, ft.	19	Cost	$375
Rate of Climb, fpm	1700	Wingspan, ft.	24	Estimated Completed Cost	$20K-$40K
Takeoff/Landing Distance, ft.	600/400	Wing Area, sq. ft.	185		
Engine Used	Lycoming O-360	No. of Seats	2-3		
HP/HP Range	180/160-300	Cockpit Width, in.	36.5		
		Landing Gear	tailwheel	email: daveblanton@cox.net	
		Bldg. Materials	C, F, M, T, W	316/755-0659	



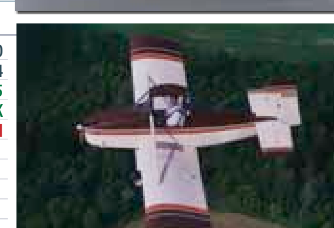
Bowers, David R.
Fly Baby

Cruise, mph	87	Fuel Capacity, gal.	16	Beginner Build Time, hrs.	1200
Stall, mph	45	Empty/Gross Weight, lb.	605/925	No. Completed & Flown	50
Range, s.m.	230	Length, ft.	18.9	Cost	$145
Rate of Climb, fpm	875	Wingspan, ft.	22	Estimated Completed Cost	$10K-$12K
Takeoff/Landing Distance, ft.	350/400	Wing Area, sq. ft.	150		LSA Legal
Engine Used	Continental C-85	No. of Seats	1		
HP/HP Range	85/65-100	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.bowersflybaby.com	
		Bldg. Materials	F, W	253/833-7283 (fax)	



C-N-C Aviation
Supercat

Cruise, mph	80	Fuel Capacity, gal.	11	Beginner Build Time, hrs.	550
Stall, mph	32	Empty/Gross Weight, lb.	325/650	No. Completed & Flown	254
Range, s.m.	170	Length, ft.	15.3	Cost	$125
Rate of Climb, fpm	1000	Wingspan, ft.	27.6	Estimated Completed Cost	$5K-$11K
Takeoff/Landing Distance, ft.	300/450	Wing Area, sq. ft.	110		LSA Legal
Engine Used	Rotax 503	No. of Seats	1		
HP/HP Range	46/28-50	Cockpit Width, in.	26		
		Landing Gear	tailwheel	email: SC94cat@aol.com	
		Bldg. Materials	W	301/472-4898	



Cassagneres, Ev
Ryan ST-R (Replica)

Cruise, mph	120	Fuel Capacity, gal.	24	Beginner Build Time, hrs.	5000
Stall, mph	45	Empty/Gross Weight, lb.	1175/1575	No. Completed & Flown	1
Range, s.m.	350	Length, ft.	21.5	Cost	$875+$75 postage
Rate of Climb, fpm	850	Wingspan, ft.	30	Estimated Completed Cost	$10K-$20K
Takeoff/Landing Distance, ft.	525/1000	Wing Area, sq. ft.	124		
Engine Used	Tigre G IV B MNA	No. of Seats	2T		
HP/HP Range	150	Cockpit Width, in.	30		
		Landing Gear	tailwheel		
		Bldg. Materials	F, M, T	203/272-2127	

Clutton, Eric
Fred

Cruise, mph	75	Fuel Capacity, gal.	10	Beginner Build Time, hrs.	1500
Stall, mph	40	Empty/Gross Weight, lb.	550/820	No. Completed & Flown	40
Range, s.m.	210	Length, ft.	16	Cost	$55
Rate of Climb, fpm	600	Wingspan, ft.	22.6	Estimated Completed Cost	$5K-$12K
Takeoff/Landing Distance, ft.	200/400	Wing Area, sq. ft.	110		LSA Legal
Engine Used	Continental A-65	No. of Seats	1		
HP/HP Range	65/50-80	Cockpit Width, in.	21		
		Landing Gear	tailwheel	email: doctordiesel@cafes.net	
		Bldg. Materials	W	931/455-2256	

CSN
Corby Starlet CJ-1

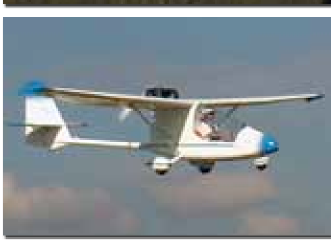
Cruise, mph	130	Fuel Capacity, gal.	11	Beginner Build Time, hrs.	1400
Stall, mph	35	Empty/Gross Weight, lb.	465/750	No. Completed & Flown	148
Range, s.m.	340	Length, ft.	14.9	Cost	$295
Rate of Climb, fpm	1200	Wingspan, ft.	18.6	Estimated Completed Cost	$15K-$27K
Takeoff/Landing Distance, ft.	450/750	Wing Area, sq. ft.	68.5		LSA Legal
Engine Used	VW	No. of Seats	1		
HP/HP Range	60/45-80	Cockpit Width, in.	21.8		
		Landing Gear	tailwheel	email: corbystarlet@juno.com	
		Bldg. Materials	W	863/644-8426	

Danieli, Tiziano
Piuma Evolution

Cruise, mph	62	Fuel Capacity, gal.	5	Beginner Build Time, hrs.	1000
Stall, mph	35	Empty/Gross Weight, lb.	330/530	No. Completed & Flown	8
Aspect Ratio	13:1	Length, ft.	19.7	Cost	$380
L/D	20:1	Wingspan, ft.	38.7	Estimated Completed Cost	$8K-$12K
Minimum Sink, fpm	165	Wing Area, sq. ft.	114		LSA Legal
Engine Used	Rotax 447	No. of Seats	1		
HP/HP Range	40/25-40	Cockpit Width, in.	24		
		Landing Gear	trigear	www.piumaproject.com	
		Bldg. Materials	F, W	(011) 39-445-527929	

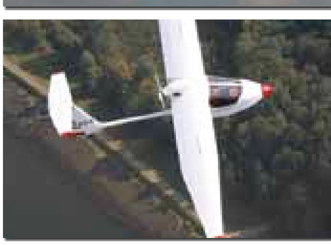
Danieli, Tiziano
Piuma Motorglider

Cruise, mph	50	Fuel Capacity, gal.	4	Beginner Build Time, hrs.	1000
Stall, mph	30	Empty/Gross Weight, lb.	320/530	No. Completed & Flown	7
Aspect Ratio	11:1	Length, ft.	19.4	Cost	$270
L/D	17:1	Wingspan, ft.	38	Estimated Completed Cost	$8K-$12K
Minimum Sink, fpm	200	Wing Area, sq. ft.	125		LSA Legal
Engine Used	Rotax 447	No. of Seats	1		
HP/HP Range	40/25-40	Cockpit Width, in.	23		
		Landing Gear	trigear	www.piumaproject.com	
		Bldg. Materials	F, W	(011) 39-445-527929	



Danieli, Tiziano
Piuma Tourer

Cruise, mph	84	Fuel Capacity, gal.	5	Beginner Build Time, hrs.	1000
Stall, mph	39	Empty/Gross Weight, lb.	350/550	No. Completed & Flown	1
Aspect Ratio	12:1	Length, ft.	19.7	Cost	$380
L/D	17:1	Wingspan, ft.	34.1	Estimated Completed Cost	$8K-$12K
Minimum Sink, fpm	235	Wing Area, sq. ft.	99		LSA Legal
Engine Used	Rotax 447	No. of Seats	1		
HP/HP Range	40/40-50	Cockpit Width, in.	23		
		Landing Gear	trigear	www.piumaproject.com	
		Bldg. Materials	F, W	(011) 39-445-527929	



Danieli, Tiziano
Piuma Twin Evolution

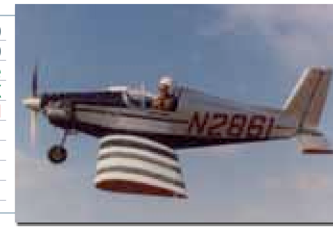
Cruise, mph	92	Fuel Capacity, gal.	11	Beginner Build Time, hrs.	1200
Stall, mph	44	Empty/Gross Weight, lb.	600/980	No. Completed & Flown	2
Aspect Ratio	13.5:1	Length, ft.	21.3	Cost	$590
L/D	20:1	Wingspan, ft.	42.7	Estimated Completed Cost	$10K-$14K
Minimum Sink, fpm	220	Wing Area, sq. ft.	132		LSA Legal
Engine Used	Rotax 503	No. of Seats	2		
HP/HP Range	45/45-65	Cockpit Width, in.	43		
		Landing Gear	trigear	www.piumaproject.com	
		Bldg. Materials	F, W	(011) 39-445-527929	

DCS, Inc.
Mini Coupe

Cruise, mph	100	Fuel Capacity, gal.	15	Beginner Build Time, hrs.	800
Stall, mph	48	Empty/Gross Weight, lb.	497/850	No. Completed & Flown	60
Range, s.m.	400	Length, ft.	17	Cost	$99+postage
Rate of Climb, fpm	750	Wingspan, ft.	22	Estimated Completed Cost	$8K-$20K
Takeoff/Landing Distance, ft.	400/500	Wing Area, sq. ft.	80		LSA Legal
Engine Used	VW	No. of Seats	1		
HP/HP Range	65/53-100	Cockpit Width, in.	24		
		Landing Gear	trigear	www.theminicoupe.com; www.teenietwo.com	
		Bldg. Materials	M	301/262-0446	

DCS, Inc.
Teenie Two

Cruise, mph	110	Fuel Capacity, gal.	9	Beginner Build Time, hrs.	800
Stall, mph	48	Empty/Gross Weight, lb.	310/590	No. Completed & Flown	300
Range, s.m.	400	Length, ft.	13	Cost	$99+postage
Rate of Climb, fpm	750	Wingspan, ft.	18	Estimated Completed Cost	$7K-$20K
Takeoff/Landing Distance, ft.	500/450	Wing Area, sq. ft.	60		LSA Legal
Engine Used	VW	No. of Seats	1		
HP/HP Range	65/53-65	Cockpit Width, in.	22		
		Landing Gear	trigear	www.theminicoupe.com; www.teenietwo.com	
		Bldg. Materials	M	301/262-0446	



DCS, Inc.
Tinni Three

Cruise, mph	160	Fuel Capacity, gal.	26	Beginner Build Time, hrs.	1500
Stall, mph	50	Empty/Gross Weight, lb.	600/1200	No. Completed & Flown	1
Range, s.m.	580	Length, ft.	18	Cost	$99+postage
Rate of Climb, fpm	800	Wingspan, ft.	21	Estimated Completed Cost	$15K-$35K
Takeoff/Landing Distance, ft.	500/550	Wing Area, sq. ft.	60		
Engine Used	Lycoming O-290	No. of Seats	2		
HP/HP Range	108/85-160	Cockpit Width, in.	38		
		Landing Gear	trigear	www.theminicoupe.com; www.teenietwo.com	
		Bldg. Materials	M	301/262-0446	

Design Resources
J. D. Special

Cruise, mph	140	Fuel Capacity, gal.	16	Beginner Build Time, hrs.	2000
Stall, mph	38	Empty/Gross Weight, lb.	659/939	No. Completed & Flown	1
Range, s.m.	450	Length, ft.	16	Cost	$235
Rate of Climb, fpm	1000	Wingspan, ft.	20.5	Estimated Completed Cost	$11K-$40K
Takeoff/Landing Distance, ft.	500/700	Wing Area, sq. ft.	83		
Engine Used	Continental C-90	No. of Seats	1		
HP/HP Range	90/65-110	Cockpit Width, in.	21		
		Landing Gear	tailwheel		
		Bldg. Materials	C, F, M, T, W	830/792-2133	

Dyke Aircraft
Dyke Delta JD II

Cruise, mph	180	Fuel Capacity, gal.	47	Beginner Build Time, hrs.	2500
Stall, mph	60	Empty/Gross Weight, lb.	1080/1950	No. Completed & Flown	59
Range, s.m.	860	Length, ft.	19	Cost	$350
Rate of Climb, fpm	1700	Wingspan, ft.	22.1	Estimated Completed Cost	$9K-$30K
Takeoff/Landing Distance, ft.	700/1000	Wing Area, sq. ft.	178		
Engine Used	Lycoming O-360	No. of Seats	4		
HP/HP Range	180/160-200	Cockpit Width, in.	47		
		Landing Gear	trigear/R	email: dykedelta1@aol.com	
		Bldg. Materials	C, F, T	937/430-8298	

Early Bird Aircraft Co.
Jenny (2/3 scale)

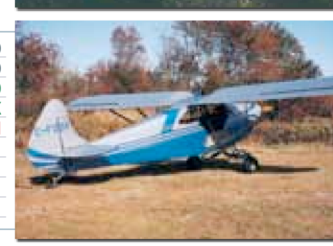
Cruise, mph	60	Fuel Capacity, gal.	10	Beginner Build Time, hrs.	600
Stall, mph	35	Empty/Gross Weight, lb.	450/800	No. Completed & Flown	81
Range, s.m.	210	Length, ft.	18.3	Cost	$125
Rate of Climb, fpm	800	Wingspan, ft.	27.5	Estimated Completed Cost	$8K-$13K
Takeoff/Landing Distance, ft.	100/250	Wing Area, sq. ft.	175		LSA Legal
Engine Used	Rotax 503 SC	No. of Seats	2		
HP/HP Range	46/46-65	Cockpit Width, in.	24		
		Landing Gear	tailwheel	email: dj_wiley@msn.com	
		Bldg. Materials	F, T	208/398-8569	

Eklund Engineering, Inc.
Thorp T-18

Cruise, mph	200	Fuel Capacity, gal.	29	Beginner Build Time, hrs.	2000
Stall, mph	59	Empty/Gross Weight, lb.	940/1600	No. Completed & Flown	407
Range, s.m.	580	Length, ft.	18.8	Cost	$400
Rate of Climb, fpm	1540	Wingspan, ft.	20.8	Estimated Completed Cost	$20K-$45K
Takeoff/Landing Distance, ft.	1000/1800	Wing Area, sq. ft.	86		
Engine Used	Lycoming O-360	No. of Seats	2		
HP/HP Range	180/125-180	Cockpit Width, in.	36		
		Landing Gear	tailwheel	www.thorpt18.com	
		Bldg. Materials	C, M	209/727-0318	

Falconar Avia Inc.
Cubmajor

Cruise, mph	100	Fuel Capacity, gal.	15	Beginner Build Time, hrs.	1400
Stall, mph	40	Empty/Gross Weight, lb.	800/1300	No. Completed & Flown	10
Range, s.m.	290	Length, ft.	26	Cost	$250
Rate of Climb, fpm	800	Wingspan, ft.	35	Estimated Completed Cost	$10K-$33K
Takeoff/Landing Distance, ft.	400/250	Wing Area, sq. ft.	163		LSA Legal
Engine Used	Continental C-85	No. of Seats	2T		
HP/HP Range	85/80-125	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.falconaravia.com	
		Bldg. Materials	F, W	780/465-2024	



Falconar Avia Inc.
Falconar F10A

Cruise, mph	120	Fuel Capacity, gal.	12	Beginner Build Time, hrs.	800
Stall, mph	35	Empty/Gross Weight, lb.	550/875	No. Completed & Flown	10
Range, s.m.	330	Length, ft.	19	Cost	$195
Rate of Climb, fpm	1200	Wingspan, ft.	23	Estimated Completed Cost	$9K-$30K
Takeoff/Landing Distance, ft.	200/250	Wing Area, sq. ft.	100		LSA Legal
Engine Used	Continental A-65	No. of Seats	1		
HP/HP Range	65/40-100	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.falconaravia.com	
		Bldg. Materials	F, W	780/465-2024	

Falconar Avia Inc.
Falconar F11E

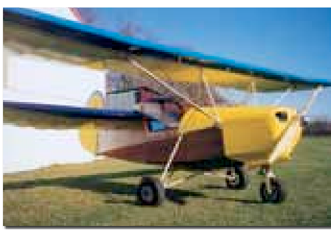
Cruise, mph	100	Fuel Capacity, gal.	17	Beginner Build Time, hrs.	1000
Stall, mph	42	Empty/Gross Weight, lb.	600/1050	No. Completed & Flown	1
Range, s.m.	600	Length, ft.	21	Cost	$225/$290 (one-piece/folding wing)
Rate of Climb, fpm	900	Wingspan, ft.	28	Estimated Completed Cost	$10K-$37K
Takeoff/Landing Distance, ft.	260/250	Wing Area, sq. ft.	140		LSA Legal
Engine Used	VW	No. of Seats	2		
HP/HP Range	50/50-100	Cockpit Width, in.	40		
		Landing Gear	tailwheel	www.falconaravia.com	
		Bldg. Materials	F, W	780/465-2024	

Falconar Avia Inc.
Fauvel AV36/361/AV362

Cruise, mph	60	Fuel Capacity, gal.	n.a.	Beginner Build Time, hrs.	1200
Stall, mph	30	Empty/Gross Weight, lb.	260/570	No. Completed & Flown	31
Aspect Ratio	11:1	Length, ft.	10	Cost	$300
L/D	26:1	Wingspan, ft.	42	Estimated Completed Cost	$9K-$20K
Minimum Sink, fpm	162	Wing Area, sq. ft.	157		LSA Legal
Engine Used	n.a.	No. of Seats	1		
HP/HP Range	n.a.	Cockpit Width, in.	24		
		Landing Gear	single wheel	www.falconaravia.com	
		Bldg. Materials	F, W	780/465-2024	

Falconar Avia Inc.
HM 290/293

Cruise, mph	90	Fuel Capacity, gal.	10	Beginner Build Time, hrs.	500
Stall, mph	28	Empty/Gross Weight, lb.	350/600	No. Completed & Flown	200
Range, s.m.	28	Length, ft.	13	Cost	$85
Rate of Climb, fpm	270	Wingspan, ft.	20	Estimated Completed Cost	$5K-$26K
Takeoff/Landing Distance, ft.	150/150	Wing Area, sq. ft.	113		LSA Legal
Engine Used	Continental A-65	No. of Seats	1		
HP/HP Range	60/40-70	Cockpit Width, in.	23		
		Landing Gear	tri or tail	www.falconaravia.com	
		Bldg. Materials	F, W	780/465-2024	

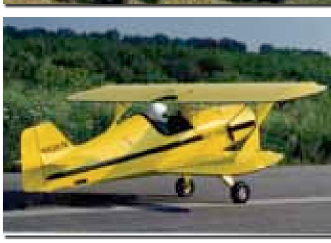


Falconar Avia Inc.
HM 360

Cruise, mph	95	Fuel Capacity, gal.	14	Beginner Build Time, hrs.	750
Stall, mph	28	Empty/Gross Weight, lb.	390/700	No. Completed & Flown	20
Range, s.m.	380	Length, ft.	13	Cost	$150
Rate of Climb, fpm	1000	Wingspan, ft.	21	Estimated Completed Cost	$7K-$34K
Takeoff/Landing Distance, ft.	130/130	Wing Area, sq. ft.	138		LSA Legal
Engine Used	Continental A-65	No. of Seats	1		
HP/HP Range	65/65-100	Cockpit Width, in.	40		
		Landing Gear	tri or tail	www.falconaravia.com	
		Bldg. Materials	F, W	780/465-2024	

Falconar Avia Inc.
HM 380

Cruise, mph	95	Fuel Capacity, gal.	23	Beginner Build Time, hrs.	1200
Stall, mph	28	Empty/Gross Weight, lb.	580/1100	No. Completed & Flown	20
Range, s.m.	600	Length, ft.	13	Cost	$250
Rate of Climb, fpm	700	Wingspan, ft.	21	Estimated Completed Cost	$7K-$34K
Takeoff/Landing Distance, ft.	130/130	Wing Area, sq. ft.	180		LSA Legal
Engine Used	Continental A-65	No. of Seats	2		
HP/HP Range	65/65-100	Cockpit Width, in.	40		
		Landing Gear	tri or tail	www.falconaravia.com	
		Bldg. Materials	F, W	780/465-2024	



Great Plains Aircraft Supply Co., Inc.
Easy Eagle I Bi-Plane

Cruise, mph	100	Fuel Capacity, gal.	12	Beginner Build Time, hrs.	400
Stall, mph	45	Empty/Gross Weight, lb.	450/725	No. Completed & Flown	3
Range, s.m.	400	Length, ft.	14.3	Cost	$65
Rate of Climb, fpm	900	Wingspan, ft.	18.4	Estimated Completed Cost	$8K-$12K
Takeoff/Landing Distance, ft.	400/400	Wing Area, sq. ft.	105		LSA Legal
Engine Used	VW	No. of Seats	1		
HP/HP Range	52/52-80	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.gpasc.com	
		Bldg. Materials	F, T, W	402/493-6507	

Great Plains Aircraft Supply Co., Inc.
Sonerai I

Cruise, mph	150	Fuel Capacity, gal.	11	Beginner Build Time, hrs.	1000
Stall, mph	45	Empty/Gross Weight, lb.	440/700	No. Completed & Flown	700
Range, s.m.	580	Length, ft.	16.8	Cost	$124.95
Rate of Climb, fpm	1000	Wingspan, ft.	16.7	Estimated Completed Cost	$10K-$20K
Takeoff/Landing Distance, ft.	600/900	Wing Area, sq. ft.	75		
Engine Used	VW	No. of Seats	1		
HP/HP Range	50/50-76	Cockpit Width, in.	19		
		Landing Gear	tailwheel	www.gpasc.com	
		Bldg. Materials	F, T	402/493-6507	

Great Plains Aircraft Supply Co., Inc.
Sonerai II Original, LT, L

Cruise, mph	140	Fuel Capacity, gal.	10	Beginner Build Time, hrs.	1000
Stall, mph	45	Empty/Gross Weight, lb.	520/950	No. Completed & Flown	800
Range, s.m.	410	Length, ft.	18.8	Cost	$124.95
Rate of Climb, fpm	500	Wingspan, ft.	18.7	Estimated Completed Cost	$10K-$20K
Takeoff/Landing Distance, ft.	900/900	Wing Area, sq. ft.	84		LSA Legal
Engine Used	VW	No. of Seats	2		
HP/HP Range	60/60-70	Cockpit Width, in.	19		
		Landing Gear	tri or tail	www.gpasc.com	
		Bldg. Materials	F, T	402/493-6507	

Great Plains Aircraft Supply Co., Inc.
Sonerai II Stretch

Cruise, mph	140	Fuel Capacity, gal.	10	Beginner Build Time, hrs.	1000
Stall, mph	50	Empty/Gross Weight, lb.	540/1150	No. Completed & Flown	500
Range, s.m.	350	Length, ft.	20.3	Cost	$124.95
Rate of Climb, fpm	700	Wingspan, ft.	18.9	Estimated Completed Cost	$10K-$20K
Takeoff/Landing Distance, ft.	900/900	Wing Area, sq. ft.	84		
Engine Used	VW	No. of Seats	2		
HP/HP Range	76/76-80	Cockpit Width, in.	22		
		Landing Gear	tri or tail	www.gpasc.com	
		Bldg. Materials	F, T	402/493-6507	

Green Sky Adventures, Inc.
Zippy Sport

Cruise, mph	110	Fuel Capacity, gal.	11	Beginner Build Time, hrs.	650
Stall, mph	45	Empty/Gross Weight, lb.	474/680	No. Completed & Flown	8
Range, s.m.	350	Length, ft.	17.8	Cost	$135
Rate of Climb, fpm	700	Wingspan, ft.	26.4	Estimated Completed Cost	$10K-$25K
Takeoff/Landing Distance, ft.	400/800	Wing Area, sq. ft.	100		LSA Legal
Engine Used	HKS 700E	No. of Seats	1		
HP/HP Range	60/40-65	Cockpit Width, in.	22		
		Landing Gear	tailwheel	www.greenskyadventures.com	
		Bldg. Materials	F, M, W	888/887-5625	

Hatz Biplane Association
Hatz CB-1

Cruise, mph	90	Fuel Capacity, gal.	21	Beginner Build Time, hrs.	3000
Stall, mph	38	Empty/Gross Weight, lb.	850/1400	No. Completed & Flown	200
Range, s.m.	290	Length, ft.	19.2	Cost	$150
Rate of Climb, fpm	700	Wingspan, ft.	26.3	Estimated Completed Cost	$12K-$80K
Takeoff/Landing Distance, ft.	400/600	Wing Area, sq. ft.	178		
Engine Used	Continental O-200	No. of Seats	2T		
HP/HP Range	100/85-180	Cockpit Width, in.	26		
		Landing Gear	tailwheel	www.hatzbiplane.com	
		Bldg. Materials	F, T, W	715/536-1069	

Hatz Biplane Association
Kelly-D

Cruise, mph	90	Fuel Capacity, gal.	24	Beginner Build Time, hrs.	3500
Stall, mph	40	Empty/Gross Weight, lb.	950/1500	No. Completed & Flown	25
Range, s.m.	310	Length, ft.	16.1	Cost	$150
Rate of Climb, fpm	800	Wingspan, ft.	26.3	Estimated Completed Cost	$12K-$80K
Takeoff/Landing Distance, ft.	400/600	Wing Area, sq. ft.	230		
Engine Used	Lycoming O-235	No. of Seats	2T		
HP/HP Range	115/100-125	Cockpit Width, in.	26		
		Landing Gear	tailwheel	www.hatzbiplane.com	
		Bldg. Materials	F, T, W	715/536-1069	

Hevle Aviation
Hevle Classic

Cruise, mph	105	Fuel Capacity, gal.	16	Beginner Build Time, hrs.	1200
Stall, mph	45	Empty/Gross Weight, lb.	800/1320	No. Completed & Flown	5
Range, s.m.	290	Length, ft.	22	Cost	$130
Rate of Climb, fpm	1000	Wingspan, ft.	28	Estimated Completed Cost	$19K-$40K
Takeoff/Landing Distance, ft.	400/500	Wing Area, sq. ft.	120		LSA Legal
Engine Used	Rotec R2800	No. of Seats	2T		
HP/HP Range	110/85-150	Cockpit Width, in.	27		
		Landing Gear	tailwheel	www.hevleaviation.com	
		Bldg. Materials	F, T, W	661/858-4515	

Littner, S.
C.P. 60 Super Diamant

Cruise, mph	155	Fuel Capacity, gal.	42	Beginner Build Time, hrs.	3500
Stall, mph	55	Empty/Gross Weight, lb.	1120/1875	No. Completed & Flown	110
Range, s.m.	770	Length, ft.	21.8	Cost	$350
Rate of Climb, fpm	1000	Wingspan, ft.	30.5	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	600/800	Wing Area, sq. ft.	143		
Engine Used	Lycoming O-320	No. of Seats	2+2		
HP/HP Range	150/100-180	Cockpit Width, in.	41		
		Landing Gear	trigear/R or tail	email: slittner@videotron.ca	
		Bldg. Materials	F, W	450/974-7001	

Littner, S.
C.P. 80 Zephyr

Cruise, mph	175	Fuel Capacity, gal.	10	Beginner Build Time, hrs.	1500
Stall, mph	50	Empty/Gross Weight, lb.	573/840	No. Completed & Flown	45
Range, s.m.	300	Length, ft.	17.3	Cost	$225
Rate of Climb, fpm	2300	Wingspan, ft.	19.6	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	650/650	Wing Area, sq. ft.	66.7		
Engine Used	Continental O-200	No. of Seats	1		
HP/HP Range	100/65-100	Cockpit Width, in.	n.p.		
		Landing Gear	tailwheel	email: slittner@videotron.ca	
		Bldg. Materials	F, W	450/974-7001	

Littner, S.
C.P. 90 Pinocchio

Cruise, mph	140	Fuel Capacity, gal.	15	Beginner Build Time, hrs.	2000
Stall, mph	45	Empty/Gross Weight, lb.	695/1015	No. Completed & Flown	75
Range, s.m.	570	Length, ft.	19.6	Cost	$250
Rate of Climb, fpm	1140	Wingspan, ft.	23.6	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	580/525	Wing Area, sq. ft.	104		
Engine Used	Continental	No. of Seats	1		
HP/HP Range	65/65-115	Cockpit Width, in.	30		
		Landing Gear	tailwheel	email: slittner@videotron.ca	
		Bldg. Materials	F, W	450/974-7001	

Littner, S.
C.P. 150 Onyx

Cruise, mph	50	Fuel Capacity, gal.	7.4	Beginner Build Time, hrs.	500
Stall, mph	22	Empty/Gross Weight, lb.	265/475	No. Completed & Flown	80
Range, s.m.	400	Length, ft.	11.6	Cost	$100
Rate of Climb, fpm	300	Wingspan, ft.	24	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	200/100	Wing Area, sq. ft.	137.7		LSA Legal
Engine Used	Solo	No. of Seats	1		
HP/HP Range	15/15-20	Cockpit Width, in.	n.p.		
		Landing Gear	trigear	email: slittner@videotron.ca	
		Bldg. Materials	F, W	450/974-7001	

Littner, S.
C.P. 328 Super Emeraude

Cruise, mph	142	Fuel Capacity, gal.	32	Beginner Build Time, hrs.	2500
Stall, mph	56	Empty/Gross Weight, lb.	850/1545	No. Completed & Flown	400
Range, s.m.	800	Length, ft.	21	Cost	$325
Rate of Climb, fpm	900	Wingspan, ft.	26.5	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	450/600	Wing Area, sq. ft.	117		
Engine Used	Lycoming	No. of Seats	2		
HP/HP Range	100/100-160	Cockpit Width, in.	41		
		Landing Gear	tailwheel	email: slittner@videotron.ca	
		Bldg. Materials	F, W	450/974-7001	

Littner, S.
C.P. 750 Beryl

Cruise, mph	160	Fuel Capacity, gal.	36	Beginner Build Time, hrs.	2500
Stall, mph	56	Empty/Gross Weight, lb.	1060/1850	No. Completed & Flown	75
Range, s.m.	680	Length, ft.	22.6	Cost	$275
Rate of Climb, fpm	1200	Wingspan, ft.	26.5	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	620/900	Wing Area, sq. ft.	117		
Engine Used	Lycoming O-320	No. of Seats	2		
HP/HP Range	150/115-160	Cockpit Width, in.	27		
		Landing Gear	trigear	email: slittner@videotron.ca	
		Bldg. Materials	F, T, W	450/974-7001	

Littner, S.
C.P. 1320 Saphire

Cruise, mph	167	Fuel Capacity, gal.	42	Beginner Build Time, hrs.	3000
Stall, mph	53	Empty/Gross Weight, lb.	1190/2075	No. Completed & Flown	65
Range, s.m.	830	Length, ft.	22	Cost	$275
Rate of Climb, fpm	1900	Wingspan, ft.	26	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	650/980	Wing Area, sq. ft.	119		
Engine Used	Lycoming O-320	No. of Seats	2+2		
HP/HP Range	150/100-160	Cockpit Width, in.	41		
		Landing Gear	tailwheel/R	email: slittner@videotron.ca	
		Bldg. Materials	F, W	450/974-7001	

Littner, S.
Champion V

Cruise, mph	143	Fuel Capacity, gal.	13	Beginner Build Time, hr.	1000
Stall, mph	47	Empty/Gross Weight, lb.	663/992	No. Completed & Flown	200
Range, s.m.	420	Length, ft.	20	Cost	$900
Rate of Climb, fpm	787	Wingspan, ft.	26.3	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	426/330	Wing Area, sq. ft.	120.5		
Engine Used	Limbach-Sauer VW	No. of Seats	2		
HP/HP Range	80/80-115	Cockpit Width, in.	41.3		
		Landing Gear	trigear/R	email: slittner@videotron.ca	
		Bldg. Materials	F, W	450/974-7001	

Littner, S.
Jewel

Cruise, mph	177	Fuel Capacity, gal.	21	Beginner Build Time, hrs.	1500
Stall, mph	40	Empty/Gross Weight, lb.	640/992	No. Completed & Flown	30
Range, s.m.	430	Length, ft.	23	Cost	$900
Rate of Climb, fpm	984	Wingspan, ft.	26.5	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	492/492	Wing Area, sq. ft.	103		
Engine Used	Limbach VW	No. of Seats	2		
HP/HP Range	80/75-100	Cockpit Width, in.	26		
		Landing Gear	trigear/R	email: slittner@videotron.ca	
		Bldg. Materials	F, W	450/974-7001	

Littner, S.
Junior VI

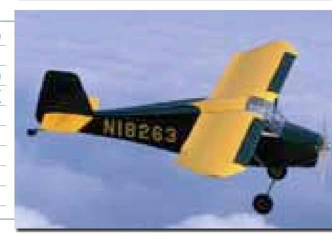
Cruise, mph	100	Fuel Capacity, gal.	15	Beginner Build Time, hrs.	1200
Stall, mph	38	Empty/Gross Weight, lb.	530/950	No. Completed & Flown	40
Range, s.m.	431	Length, ft.	20	Cost	$700
Rate of Climb, fpm	600	Wingspan, ft.	28.6	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	350/400	Wing Area, sq. ft.	123.7		LSA Legal
Engine Used	Limbach VW	No. of Seats	2		
HP/HP Range	62/50-65	Cockpit Width, in.	40		
		Landing Gear	trigear	email: slittner@videotron.ca	
		Bldg. Materials	F, W	450/974-7001	

Littner, S.
Whisky IV

Cruise, mph	130	Fuel Capacity, gal.	13	Beginner Build Time, hrs.	1500
Stall, mph	37	Empty/Gross Weight, lb.	622/1060	No. Completed & Flown	75
Range, s.m.	400	Length, ft.	21	Cost	$900
Rate of Climb, fpm	785	Wingspan, ft.	26.3	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	330/490	Wing Area, sq. ft.	120.5		
Engine Used	Limbach VW	No. of Seats	2T		
HP/HP Range	80/75-100	Cockpit Width, in.	28.3		
		Landing Gear	tailwheel/R	email: slittner@videotron.ca	
		Bldg. Materials	F, W	450/974-7001	

Luceair
Wittman Buttercup

Cruise, mph	130	Fuel Capacity, gal.	29	Beginner Build Time, hrs.	2000
Stall, mph	45	Empty/Gross Weight, lb.	790/1300	No. Completed & Flown	1
Range, s.m.	450	Length, ft.	19.5	Cost	$300
Rate of Climb, fpm	1200	Wingspan, ft.	29.3	Estimated Completed Cost	$13K-$23K
Takeoff/Landing Distance, ft.	300/200	Wing Area, sq. ft.	130		LSA Legal
Engine Used	Continental 0-200	No. of Seats	2		
HP/HP Range	100/65-125	Cockpit Width, in.	40		
		Landing Gear	tailwheel	www.luceair.com	
		Bldg. Materials	F, T, W	585/637-5768	

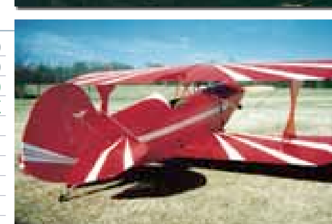


Mann, Roger
RW1 Ultra-Piet "Pete"

Cruise, mph	55	Fuel Capacity, gal.	5	Beginner Build Time, hrs.	750
Stall, mph	28	Empty/Gross Weight, lb.	254/550	No. Completed & Flown	25
Range, s.m.	460	Length, ft.	15	Cost	$50
Rate of Climb, fpm	650	Wingspan, ft.	25.5	Estimated Completed Cost	$5K-$10K
Takeoff/Landing Distance, ft.	150/150	Wing Area, sq. ft.	117		LSA Legal
Engine Used	Kawasaki 440	No. of Seats	1		
HP/HP Range	35/24-48	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.rogermann.org	
		Bldg. Materials	F, W	864/787-5980	

Mann, Roger
RW2 Special I

Cruise, mph	70	Fuel Capacity, gal.	5	Beginner Build Time, hrs.	750
Stall, mph	30	Empty/Gross Weight, lb.	278/550	No. Completed & Flown	20
Range, s.m.	90	Length, ft.	14.6	Cost	$100
Rate of Climb, fpm	750	Wingspan, ft.	18	Estimated Completed Cost	$8K-$18K
Takeoff/Landing Distance, ft.	100/200	Wing Area, sq. ft.	120		LSA Legal
Engine Used	Kawasaki 440A	No. of Seats	1		
HP/HP Range	38/35-65	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.rogermann.org	
		Bldg. Materials	F, W	864/787-5980	



Mann, Roger
RW4 Midwing Sport

Cruise, mph	70	Fuel Capacity, gal.	5	Beginner Build Time, hrs.	750
Stall, mph	28	Empty/Gross Weight, lb.	235/550	No. Completed & Flown	2
Range, s.m.	180	Length, ft.	16	Cost	$50
Rate of Climb, fpm	750	Wingspan, ft.	26.6	Estimated Completed Cost	$5K-$10K
Takeoff/Landing Distance, ft.	125/150	Wing Area, sq. ft.	117		LSA Legal
Engine Used	Rotax 277	No. of Seats	1		
HP/HP Range	28/20-48	Cockpit Width, in.	22		
		Landing Gear	tailwheel	www.rogermann.org	
		Bldg. Materials	F, W	864/787-5980	

Mann, Roger
RW5 Heath Replica

		Fuel Capacity, gal.	5	Beginner Build Time, hrs.	750
		Empty/Gross Weight, lb.	238/550	No. Completed & Flown	10
Cruise, mph	60	Length, ft.	16	Cost	$50
Stall, mph	28	Wingspan, ft.	25.6	Estimated Completed Cost	$5K/$10K
Range, s.m.	90	Wing Area, sq. ft.	117		LSA Legal
Rate of Climb, fpm	600	No. of Seats	1		
Takeoff/Landing Distance, ft.	150/200	Cockpit Width, in.	22		
Engine Used	Rotax 277	Landing Gear	tailwheel	www.rogermann.org	
HP/HP Range	28/20-48	Bldg. Materials	F, W	864/787-5980	

Mann, Roger
RW6 RagWing Parasol

		Fuel Capacity, gal.	5	Beginner Build Time, hrs.	750
		Empty/Gross Weight, lb.	242/550	No. Completed & Flown	6
Cruise, mph	66	Length, ft.	16.5	Cost	$50
Stall, mph	28	Wingspan, ft.	25.5	Estimated Completed Cost	$5K-$10K
Range, s.m.	130	Wing Area, sq. ft.	117		LSA Legal
Rate of Climb, fpm	800	No. of Seats	1		
Takeoff/Landing Distance, ft.	100/150	Cockpit Width, in.	24		
Engine Used	Rotax 447	Landing Gear	tailwheel	www.rogermann.org	
HP/HP Range	38/20-52	Bldg. Materials	F, W	864/787-5980	

Mann, Roger
RW7 Duster

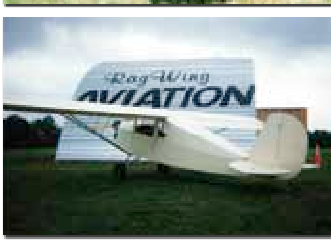
		Fuel Capacity, gal.	5	Beginner Build Time, hrs.	1000
		Empty/Gross Weight, lb.	275/660	No. Completed & Flown	1
Cruise, mph	65	Length, ft.	17	Cost	$50
Stall, mph	28	Wingspan, ft.	28	Estimated Completed Cost	$5K-$10K
Range, s.m.	130	Wing Area, sq. ft.	130		LSA Legal
Rate of Climb, fpm	1000	No. of Seats	1		
Takeoff/Landing Distance, ft.	70/150	Cockpit Width, in.	24		
Engine Used	Rotax 503 DC	Landing Gear	tailwheel	www.rogermann.org	
HP/HP Range	52/28-52	Bldg. Materials	F, W	864/787-5980	

Mann, Roger
RW8 RagWing Pt2S

		Fuel Capacity, gal.	10	Beginner Build Time, hrs.	1000
		Empty/Gross Weight, lb.	460/900	No. Completed & Flown	4
Cruise, mph	75	Length, ft.	17	Cost	$50
Stall, mph	36	Wingspan, ft.	30	Estimated Completed Cost	$10K-$25K
Range, s.m.	130	Wing Area, sq. ft.	135		LSA Legal
Rate of Climb, fpm	650	No. of Seats	2		
Takeoff/Landing Distance, ft.	300/400	Cockpit Width, in.	40		
Engine Used	Rotax 503 DC	Landing Gear	tailwheel	www.rogermann.org	
HP/HP Range	52/52-75	Bldg. Materials	F, W	864/787-5980	

Mann, Roger
RW9 Motor Bipe

		Fuel Capacity, gal.	5	Beginner Build Time, hrs.	750
		Empty/Gross Weight, lb.	225/525	No. Completed & Flown	2
Cruise, mph	60	Length, ft.	16	Cost	$50
Stall, mph	36	Wingspan, ft.	18	Estimated Completed Cost	$5K-$10K
Range, s.m.	130	Wing Area, sq. ft.	120		LSA Legal
Rate of Climb, fpm	750	No. of Seats	1		
Takeoff/Landing Distance, ft.	125/150	Cockpit Width, in.	12		
Engine Used	Kawasaki 440A	Landing Gear	tailwheel	www.rogermann.org	
HP/HP Range	22/22-52	Bldg. Materials	F, T, W	864/787-5980	



Mann, Roger
RW11 Rag-A-Bond

		Fuel Capacity, gal.	12	Beginner Build Time, hrs.	1000
		Empty/Gross Weight, lb.	420/850	No. Completed & Flown	1
Cruise, mph	78	Length, ft.	18	Cost	$50
Stall, mph	38	Wingspan, ft.	28	Estimated Completed Cost	$8K-$25K
Range, s.m.	200	Wing Area, sq. ft.	123.8		LSA Legal
Rate of Climb, fpm	525	No. of Seats	2		
Takeoff/Landing Distance, ft.	310/475	Cockpit Width, in.	40		
Engine Used	Rotax 503	Landing Gear	tailwheel	www.rogermann.org	
HP/HP Range	52/52-100	Bldg. Materials	F, W	864/787-5980	

Mann, Roger
RW16 Aerial

		Fuel Capacity, gal.	5	Beginner Build Time, hrs.	750
		Empty/Gross Weight, lb.	250/580	No. Completed & Flown	2
Cruise, mph	60	Length, ft.	16	Cost	$50
Stall, mph	28	Wingspan, ft.	26	Estimated Completed Cost	$5K-$10K
Range, s.m.	200	Wing Area, sq. ft.	117		LSA Legal
Rate of Climb, fpm	500	No. of Seats	1		
Takeoff/Landing Distance, ft.	150/200	Cockpit Width, in.	12		
Engine Used	Kawasaki 440	Landing Gear	tailwheel	www.rogermann.org	
HP/HP Range	25/22-48	Bldg. Materials	F, W	864/787-5980	

Mann, Roger
RW19 Stork

		Fuel Capacity, gal.	12	Beginner Build Time, hrs.	1200
		Empty/Gross Weight, lb.	497/1000	No. Completed & Flown	1
Cruise, mph	75	Length, ft.	22	Cost	$100
Stall, mph	22	Wingspan, ft.	32	Estimated Completed Cost	$15K-$30K
Range, s.m.	260	Wing Area, sq. ft.	180		LSA Legal
Rate of Climb, fpm	1000	No. of Seats	2		
Takeoff/Landing Distance, ft.	50/150	Cockpit Width, in.	30		
Engine Used	Rotax 912	Landing Gear	tailwheel	www.rogermann.org	
HP/HP Range	70/70-80	Bldg. Materials	F, T, W	864/787-5980	

Mann, Roger
RW20 Stork Side-By-Side

Cruise, mph	75	Fuel Capacity, gal.	20	Beginner Build Time, hrs.	1200
Stall, mph	22	Empty/Gross Weight, lb.	600/1000	No. Completed & Flown	6
Range, s.m.	130	Length, ft.	22	Cost	$100
Rate of Climb, fpm	1000	Wingspan, ft.	32	Estimated Completed Cost	$10K-$25K
Takeoff/Landing Distance, ft.	50/150	Wing Area, sq. ft.	180		LSA Legal
Engine Used	Rotax 912	No. of Seats	2		
HP/HP Range	70/70-80	Cockpit Width, in.	40		
		Landing Gear	tailwheel	www.rogermann.org	
		Bldg. Materials	F, T, W	864/787-5980	

Mann, Roger
RW22 Tiger Moth

Cruise, mph	80	Fuel Capacity, gal.	17	Beginner Build Time, hrs.	600
Stall, mph	35	Empty/Gross Weight, lb.	490/1050	No. Completed & Flown	3
Range, s.m.	280	Length, ft.	20	Cost	$100
Rate of Climb, fpm	750	Wingspan, ft.	24	Estimated Completed Cost	$10K-$25K
Takeoff/Landing Distance, ft.	300/400	Wing Area, sq. ft.	161		LSA Legal
Engine Used	Rotax 912	No. of Seats	2T		
HP/HP Range	70/70-80	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.rogermann.org	
		Bldg. Materials	F, W	864/787-5980	

Mann, Roger
RW26 Special II

Cruise, mph	85	Fuel Capacity, gal.	14	Beginner Build Time, hrs.	1000
Stall, mph	38	Empty/Gross Weight, lb.	450/950	No. Completed & Flown	1
Range, s.m.	90	Length, ft.	18	Cost	$100
Rate of Climb, fpm	800	Wingspan, ft.	18	Estimated Completed Cost	$10K-$20K
Takeoff/Landing Distance, ft.	350/450	Wing Area, sq. ft.	120		LSA Legal
Engine Used	Rotax 503	No. of Seats	2T		
HP/HP Range	52/52-100	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.rogermann.org	
		Bldg. Materials	F, W	864/787-5980	

Meyer Aircraft
Meyer's Little Toot

Cruise, mph	125	Fuel Capacity, gal.	19	Beginner Build Time, hrs.	3000
Stall, mph	51	Empty/Gross Weight, lb.	925/1320	No. Completed & Flown	50
Range, s.m.	200	Length, ft.	16	Cost	$305
Rate of Climb, fpm	1500	Wingspan, ft.	19	Estimated Completed Cost	$20K-$45K
Takeoff/Landing Distance, ft.	700/1200	Wing Area, sq. ft.	135		LSA Legal
Engine Used	Lycoming O-320	No. of Seats	1		
HP/HP Range	125/125-300	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.littletootbiplane.com	
		Bldg. Materials	C, F, M, T, W	817/269-9292	

Mirage Aircraft, Inc.
Celerity

Cruise, mph	205	Fuel Capacity, gal.	40	Beginner Build Time, hrs.	2500
Stall, mph	60	Empty/Gross Weight, lb.	1169/1825	No. Completed & Flown	4
Range, s.m.	760	Length, ft.	21.5	Cost	$295
Rate of Climb, fpm	1800	Wingspan, ft.	25	Estimated Completed Cost	$27K-$59K
Takeoff/Landing Distance, ft.	800/600	Wing Area, sq. ft.	100		
Engine Used	Lycoming O-320	No. of Seats	2		
HP/HP Range	160/150-180	Cockpit Width, in.	40		
		Landing Gear	tailwheel/R	www.mirage-aircraft.net	
		Bldg. Materials	C, W	520/665-9341	

Mirage Aircraft, Inc.
Marathon

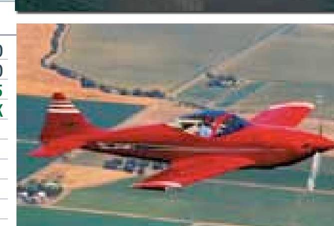
Cruise, mph	185	Fuel Capacity, gal.	40	Beginner Build Time, hrs.	2250
Stall, mph	60	Empty/Gross Weight, lb.	1119/1825	No. Completed & Flown	2
Range, s.m.	740	Length, ft.	21.5	Cost	$295
Rate of Climb, fpm	1500	Wingspan, ft.	25	Estimated Completed Cost	$23K-$42K
Takeoff/Landing Distance, ft.	800/600	Wing Area, sq. ft.	100		
Engine Used	Lycoming O-320	No. of Seats	2		
HP/HP Range	150/150-180	Cockpit Width, in.	40		
		Landing Gear	trigear	www.mirage-aircraft.net	
		Bldg. Materials	C, W	520/665-9341	

nVAero, LLC
KR-1

Cruise, mph	180	Fuel Capacity, gal.	10	Beginner Build Time, hrs.	1000
Stall, mph	52	Empty/Gross Weight, lb.	375/750	No. Completed & Flown	750
Range, s.m.	400	Length, ft.	12.75	Cost	$114.95
Rate of Climb, fpm	1200	Wingspan, ft.	17	Estimated Completed Cost	$9K-$15K
Takeoff/Landing Distance, ft.	350/900	Wing Area, sq. ft.	62		
Engine Used	VW	No. of Seats	1		
HP/HP Range	80/60-80	Cockpit Width, in.	20		
		Landing Gear	tailwheel	www.nvaero.com	
		Bldg. Materials	C, W	800/515-4811	

Osprey Aircraft
GP-4

Cruise, mph	240	Fuel Capacity, gal.	54	Beginner Build Time, hrs.	3000
Stall, mph	65	Empty/Gross Weight, lb.	1260/2100	No. Completed & Flown	40
Range, s.m.	1200	Length, ft.	21	Cost	$385
Rate of Climb, fpm	2500	Wingspan, ft.	24.6	Estimated Completed Cost	$50K-$68K
Takeoff/Landing Distance, ft.	300/1200	Wing Area, sq. ft.	104		
Engine Used	Lycoming IO-360	No. of Seats	2		
HP/HP Range	200	Cockpit Width, in.	42		
		Landing Gear	trigear/R	www.ospreyaircraft.com	
		Bldg. Materials	W	916/483-3004	



Osprey Aircraft
Osprey 2

Cruise, mph	130	Fuel Capacity, gal.	38	Beginner Build Time, hrs.	2500
Stall, mph	58	Empty/Gross Weight, lb.	960/1570	No. Completed & Flown	620
Range, s.m.	580	Length, ft.	21	Cost	$250
Rate of Climb, fpm	1300	Wingspan, ft.	26	Estimated Completed Cost	$25K-$35K
Takeoff/Landing Distance, ft.	400/600	Wing Area, sq. ft.	130		
Engine Used	Lycoming O-320	No. of Seats	2		
HP/HP Range	150/150-160	Cockpit Width, in.	44		
		Landing Gear	trigear/R	www.ospreyaircraft.com	
		Bldg. Materials	C, W	916/483-3004	

Pazmany Aircraft Corp.
Pazmany PL-1

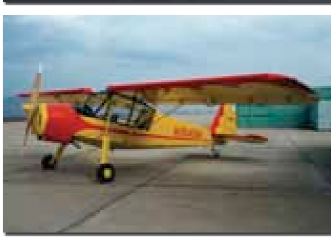
Cruise, mph	115	Fuel Capacity, gal.	25	Beginner Build Time, hrs.	3500
Stall, mph	54	Empty/Gross Weight, lb.	800/1320	No. Completed & Flown	250
Range, s.m.	576	Length, ft.	19	Cost	$425
Rate of Climb, fpm	1000	Wingspan, ft.	28	Estimated Completed Cost	$28K-$40K
Takeoff/Landing Distance, ft.	784/560	Wing Area, sq. ft.	116		
Engine Used	Continental C-90	No. of Seats	2		
HP/HP Range	95/95-140	Cockpit Width, in.	42		
		Landing Gear	trigear	www.pazmany.com	
		Bldg. Materials	M	619/224-7330	

Pazmany Aircraft Corp.
Pazmany PL-2

Cruise, mph	119	Fuel Capacity, gal.	25	Beginner Build Time, hrs.	4000
Stall, mph	52	Empty/Gross Weight, lb.	875/1416	No. Completed & Flown	300
Range, s.m.	492	Length, ft.	19.3	Cost	$425
Rate of Climb, fpm	1280	Wingspan, ft.	27.8	Estimated Completed Cost	$29K-$45K
Takeoff/Landing Distance, ft.	700/600	Wing Area, sq. ft.	116		
Engine Used	Lycoming O-235	No. of Seats	2		
HP/HP Range	108/100-150	Cockpit Width, in.	42		
		Landing Gear	trigear	www.pazmany.com	
		Bldg. Materials	M	619/224-7330	

Pazmany Aircraft Corp.
Pazmany PL-4A

Cruise, mph	97	Fuel Capacity, gal.	12	Beginner Build Time, hrs.	2000
Stall, mph	39	Empty/Gross Weight, lb.	578/850	No. Completed & Flown	395
Range, s.m.	280	Length, ft.	16.5	Cost	$375
Rate of Climb, fpm	650	Wingspan, ft.	26.7	Estimated Completed Cost	$18K-$25K
Takeoff/Landing Distance, ft.	560/440	Wing Area, sq. ft.	89		LSA Legal
Engine Used	VW	No. of Seats	1		
HP/HP Range	50/50-90	Cockpit Width, in.	42		
		Landing Gear	tailwheel	www.pazmany.com	
		Bldg. Materials	M	619/224-7330	



Pazmany Aircraft Corp.
Pazmany PL-9 Stork

Cruise, mph	104	Fuel Capacity, gal.	30	Beginner Build Time, hrs.	4000
Stall, mph	33	Empty/Gross Weight, lb.	1132/1673	No. Completed & Flown	2
Range, s.m.	350	Length, ft.	24.3	Cost	$550
Rate of Climb, fpm	1400	Wingspan, ft.	36	Estimated Completed Cost	$28K-$45K
Takeoff/Landing Distance, ft.	250/90	Wing Area, sq. ft.	166		
Engine Used	Lycoming O-320	No. of Seats	2T		
HP/HP Range	160/160-180	Cockpit Width, in.	42		
		Landing Gear	tailwheel	www.pazmany.com	
		Bldg. Materials	F, M, T	619/224-7330	

Pietenpol, Don and Andrew
Pietenpol

Cruise, mph	80	Fuel Capacity, gal.	18	Beginner Build Time, hrs.	1000
Stall, mph	40	Empty/Gross Weight, lb.	520/1040	No. Completed & Flown	620
Range, s.m.	300	Length, ft.	17.8	Cost	$100
Rate of Climb, fpm	500	Wingspan, ft.	29	Estimated Completed Cost	$4K-$16K
Takeoff/Landing Distance, ft.	400/400	Wing Area, sq. ft.	145		LSA Legal
Engine Used	Corvair	No. of Seats	2T		
HP/HP Range	60/40-100	Cockpit Width, in.	23		
		Landing Gear	tailwheel	www.pressenter.com/~apietenp/	
		Bldg. Materials	F, W	507/289-2436	

Pietenpol, Don and Andrew
Sky Scout

Cruise, mph	55	Fuel Capacity, gal.	10	Beginner Build Time, hrs.	1000
Stall, mph	35	Empty/Gross Weight, lb.	520/1020	No. Completed & Flown	25
Range, s.m.	300	Length, ft.	16.1	Cost	$100
Rate of Climb, fpm	200	Wingspan, ft.	27.3	Estimated Completed Cost	$4K-$16K
Takeoff/Landing Distance, ft.	150/250	Wing Area, sq. ft.	135		LSA Legal
Engine Used	Ford Model T	No. of Seats	1		
HP/HP Range	20/20-85	Cockpit Width, in.	20		
		Landing Gear	tailwheel	www.pressenter.com/~apietenp/	
		Bldg. Materials	F, W	507/289-2436	

Pro-Composites, Inc.
Vision Ex

Cruise, mph	157	Fuel Capacity, gal.	22	Beginner Build Time, hrs.	2500
Stall, mph	54	Empty/Gross Weight, lb.	850/1600	No. Completed & Flown	3
Range, s.m.	400	Length, ft.	19	Cost	$427
Rate of Climb, fpm	1400	Wingspan, ft.	21.7	Estimated Completed Cost	$30K-$40K
Takeoff/Landing Distance, ft.	800/900	Wing Area, sq. ft.	85		
Engine Used	Subaru	No. of Seats	2		
HP/HP Range	100	Cockpit Width, in.	44		
		Landing Gear	tri or tail	www.pro-composites.com	
		Bldg. Materials	C	847/271-4795	

Redfern Plans
Redfern Fokker DR1

Cruise, mph	100	Fuel Capacity, gal.	30	Beginner Build Time, hrs.	2500
Stall, mph	40	Empty/Gross Weight, lb.	1112/1455	No. Completed & Flown	38
Range, s.m.	390	Length, ft.	19	Cost	$100
Rate of Climb, fpm	2000	Wingspan, ft.	23.6	Estimated Completed Cost	$70K-$100K
Takeoff/Landing Distance, ft.	100/250	Wing Area, sq. ft.	202		
Engine Used	Warner	No. of Seats	1		
HP/HP Range	145/145-220	Cockpit Width, in.	36		
		Landing Gear	tailwheel	email: redfernplans@earthlink.net	
		Bldg. Materials	F, T, W	575/532-9700	

Redfern Plans
Redfern Nieuport 17 or 24

Cruise, mph	100	Fuel Capacity, gal.	25	Beginner Build Time, hrs.	2500
Stall, mph	45	Empty/Gross Weight, lb.	1004/1279	No. Completed & Flown	27
Range, s.m.	300	Length, ft.	18.8	Cost	$150
Rate of Climb, fpm	1500	Wingspan, ft.	26.9	Estimated Completed Cost	$70K-$100K
Takeoff/Landing Distance, ft.	100/300	Wing Area, sq. ft.	161.4		LSA Legal
Engine Used	Warner	No. of Seats	1		
HP/HP Range	145/145-180	Cockpit Width, in.	36		
		Landing Gear	tailwheel	email: redfernplans@earthlink.net	
		Bldg. Materials	F, T, W	505/532-9700	

Sky Classic Aircraft
Smith Miniplane 2000

Cruise, mph	125	Fuel Capacity, gal.	15	Beginner Build Time, hrs.	2000
Stall, mph	60	Empty/Gross Weight, lb.	650/1000	No. Completed & Flown	1
Range, s.m.	400	Length, ft.	15.5	Cost	$140
Rate of Climb, fpm	1000	Wingspan, ft.	17	Estimated Completed Cost	$7K-$25K
Takeoff/Landing Distance, ft.	400/400	Wing Area, sq. ft.	100		
Engine Used	Lycoming O-235	No. of Seats	1		
HP/HP Range	115/90-120	Cockpit Width, in.	23		
		Landing Gear	tailwheel	www.skyclassic.net	
		Bldg. Materials	F, T, W	515/243-0094	

Spencer Aircar
Spencer Air Car

Cruise, mph	140	Fuel Capacity, gal.	94	Beginner Build Time, hrs.	2000
Stall, mph	53	Empty/Gross Weight, lb.	2000/3250	No. Completed & Flown	47
Range, s.m.	810	Length, ft.	26.5	Cost	$300+$25 postage
Rate of Climb, fpm	860	Wingspan, ft.	37.3	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	700/500	Wing Area, sq. ft.	184		
Engine Used	Continental IO-520	No. of Seats	4		
HP/HP Range	300/220-310	Cockpit Width, in.	47		
		Landing Gear	trigear/R	email: robertkerans@earthlink.net	
		Bldg. Materials	C, F, T, W	847/882-5678	

Steen Aero Lab, Inc.
Firebolt

Cruise, mph	170	Fuel Capacity, gal.	39	Beginner Build Time, hrs.	3000
Stall, mph	61	Empty/Gross Weight, lb.	1354/2000	No. Completed & Flown	10
Range, s.m.	630	Length, ft.	21	Cost	$275
Rate of Climb, fpm	3500	Wingspan, ft.	24	Estimated Completed Cost	$40K-$105K
Takeoff/Landing Distance, ft.	400/850	Wing Area, sq. ft.	150		
Engine Used	Lycoming IO-540	No. of Seats	2		
HP/HP Range	180/180-340	Cockpit Width, in.	n.p.		
		Landing Gear	tailwheel	www.steenaero.com	
		Bldg. Materials	F, T, W	321/725-4160	

Steen Aero Lab, Inc.
Great Lakes Sport Trainer

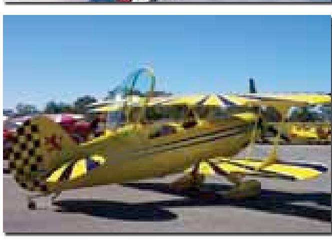
Cruise, mph	125	Fuel Capacity, gal.	26	Beginner Build Time, hrs.	1600
Stall, mph	40	Empty/Gross Weight, lb.	1025/1618	No. Completed & Flown	251
Range, s.m.	390	Length, ft.	20.3	Cost	$350
Rate of Climb, fpm	1200	Wingspan, ft.	26.7	Estimated Completed Cost	$50K-$120K
Takeoff/Landing Distance, ft.	300/400	Wing Area, sq. ft.	187.5		
Engine Used	Lycoming O-360	No. of Seats	2		
HP/HP Range	180/125-200	Cockpit Width, in.	n.p.		
		Landing Gear	tailwheel	www.steenaero.com	
		Bldg. Materials	F, T, W	321/725-4160	

Steen Aero Lab, Inc.
Knight Twister

Cruise, mph	145	Fuel Capacity, gal.	20	Beginner Build Time, hrs.	2500
Stall, mph	56	Empty/Gross Weight, lb.	517/865	No. Completed & Flown	100
Range, s.m.	700	Length, ft.	13.5	Cost	$250
Rate of Climb, fpm	1500	Wingspan, ft.	18.5	Estimated Completed Cost	$25K-$90K
Takeoff/Landing Distance, ft.	400/800	Wing Area, sq. ft.	55		
Engine Used	Lycoming O-320	No. of Seats	2		
HP/HP Range	108/85-180	Cockpit Width, in.	n.p.		
		Landing Gear	tailwheel	www.steenaero.com	
		Bldg. Materials	F, M, T, W	321/725-4160	

Steen Aero Lab, Inc.
Pitts S1-C

Cruise, mph	154	Fuel Capacity, gal.	20	Beginner Build Time, hrs.	2000
Stall, mph	64	Empty/Gross Weight, lb.	720/1150	No. Completed & Flown	520
Range, s.m.	290	Length, ft.	15.5	Cost	$250
Rate of Climb, fpm	800	Wingspan, ft.	17.3	Estimated Completed Cost	$25K-$75K
Takeoff/Landing Distance, ft.	300/600	Wing Area, sq. ft.	98		
Engine Used	Lycoming IO-360	No. of Seats	1		
HP/HP Range	180/125-200	Cockpit Width, in.	n.p.		
		Landing Gear	tailwheel	www.steenaero.com	
		Bldg. Materials	F, M, T, W	321/725-4160	



Steen Aero Lab, Inc.
Skybolt

Cruise, mph	170	Fuel Capacity, gal.	38	Beginner Build Time, hrs.	3000
Stall, mph	68	Empty/Gross Weight, lb.	1250/1970	No. Completed & Flown	530
Range, s.m.	520	Length, ft.	21	Cost	$165
Rate of Climb, fpm	3500	Wingspan, ft.	24	Estimated Completed Cost	$35K-$100K
Takeoff/Landing Distance, ft.	300/800	Wing Area, sq. ft.	152.7		
Engine Used	Lycoming IO-540	No. of Seats	2		
HP/HP Range	280/160-360	Cockpit Width, in.	n.p.		
		Landing Gear	tailwheel	www.steenaero.com	
		Bldg. Materials	F, T, W	321/725-4160	

Steeves, Richard
Coot Amphibian

Cruise, mph	100	Fuel Capacity, gal.	40	Beginner Build Time, hrs.	3000
Stall, mph	50	Empty/Gross Weight, lb.	1450/1950	No. Completed & Flown	70
Range, s.m.	460	Length, ft.	22	Cost	$250
Rate of Climb, fpm	800	Wingspan, ft.	36	Estimated Completed Cost	$25K-$50K
Takeoff/Landing Distance, ft.	1200/1000	Wing Area, sq. ft.	180		
Engine Used	Franklin	No. of Seats	2		
HP/HP Range	180/180-220	Cockpit Width, in.	44		
		Landing Gear	trigear/R	www.coot-builders.com	
		Bldg. Materials	C, F, M, W	608/833-5586	

Stewart Aircraft Co.
FooFighter

Cruise, mph	115	Fuel Capacity, gal.	19	Beginner Build Time, hrs.	n.p.
Stall, mph	48	Empty/Gross Weight, lb.	720/1100	No. Completed & Flown	3
Range, s.m.	390	Length, ft.	18.9	Cost	$90
Rate of Climb, fpm	1200	Wingspan, ft.	20.8	Estimated Completed Cost	n.p.
Takeoff/Landing Distance, ft.	450/450	Wing Area, sq. ft.	129		LSA Legal
Engine Used	Franklin Sport F	No. of Seats	1		
HP/HP Range	135/n.p.	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.stewartaircraft.com	
		Bldg. Materials	F, W	906/438-2277	

Stewart Aircraft Co.
Headwind B

Cruise, mph	85	Fuel Capacity, gal.	7	Beginner Build Time, hrs.	1200
Stall, mph	40	Empty/Gross Weight, lb.	435/750	No. Completed & Flown	101
Range, s.m.	200	Length, ft.	17	Cost	$65
Rate of Climb, fpm	650	Wingspan, ft.	28.3	Estimated Completed Cost	$10K-$35K
Takeoff/Landing Distance, ft.	300/400	Wing Area, sq. ft.	111		LSA Legal
Engine Used	VW	No. of Seats	1		
HP/HP Range	53/n.p.	Cockpit Width, in.	23		
		Landing Gear	tailwheel	www.stewartaircraft.com	
		Bldg. Materials	F, T, W	906/438-2277	

Taylor, T.
Taylor Monoplane

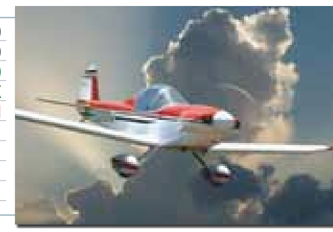
		Fuel Capacity, gal.	7.5	Beginner Build Time, hrs.	2200
		Empty/Gross Weight, lb.	450/700	No. Completed & Flown	152
Cruise, mph	100	Length, ft.	15	Cost	$148 (£95)
Stall, mph	40	Wingspan, ft.	21	Estimated Completed Cost	$9K-$11K
Range, s.m.	330	Wing Area, sq. ft.	76		LSA Legal
Rate of Climb, fpm	950	No. of Seats	1		
Takeoff/Landing Distance, ft.	350/750	Cockpit Width, in.	18		
Engine Used	VW	Landing Gear	tailwheel	www.taylortitch.co.uk	
HP/HP Range	40/40-60	Bldg. Materials	F, W	(011) 0702 521484	

Taylor, T.
Taylor Titch

		Fuel Capacity, gal.	10	Beginner Build Time, hrs.	2000
		Empty/Gross Weight, lb.	505/760	No. Completed & Flown	52
Cruise, mph	160	Length, ft.	16.6	Cost	$164 (£105)
Stall, mph	52	Wingspan, ft.	18.9	Estimated Completed Cost	$11K-$15K
Range, s.m.	350	Wing Area, sq. ft.	68		
Rate of Climb, fpm	1600	No. of Seats	1		
Takeoff/Landing Distance, ft.	350/900	Cockpit Width, in.	20		
Engine Used	Continental O-200	Landing Gear	tailwheel	www.taylortitch.co.uk	
HP/HP Range	85/60-100	Bldg. Materials	F, W	(011) 0702 521484	

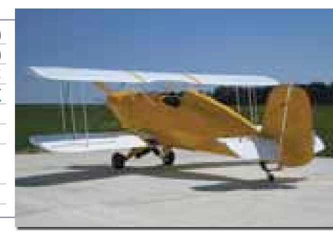
Thatcher Aircraft Inc.
Thatcher CX4

		Fuel Capacity, gal.	10.5	Beginner Build Time, hrs.	850
		Empty/Gross Weight, lb.	540/850	No. Completed & Flown	20
Cruise, mph	125	Length, ft.	18.3	Cost	$360
Stall, mph	40	Wingspan, ft.	24	Estimated Completed Cost	$12K-$18K
Range, s.m.	360	Wing Area, sq. ft.	84		LSA Legal
Rate of Climb, fpm	825	No. of Seats	1		
Takeoff/Landing Distance, ft.	700/800	Cockpit Width, in.	23.5		
Engine Used	VW	Landing Gear	tailwheel	www.thatchercx4.com	
HP/HP Range	55/55-80	Bldg. Materials	M	850/712-4539	



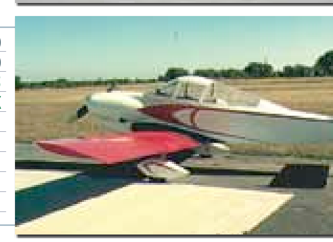
Townsley, Mike
Jungster 1 Biplane

		Fuel Capacity, gal.	16	Beginner Build Time, hrs.	1800
		Empty/Gross Weight, lb.	606/1000	No. Completed & Flown	60
Cruise, mph	110	Length, ft.	16	Cost	$225
Stall, mph	55	Wingspan, ft.	16.7	Estimated Completed Cost	$12K-$25K
Range, s.m.	200	Wing Area, sq. ft.	80		
Rate of Climb, fpm	1000	No. of Seats	1		
Takeoff/Landing Distance, ft.	800/800	Cockpit Width, in.	18	www.groups.yahoo.com/group/	
Engine Used	Continental O-200	Landing Gear	tailwheel	jungsterairplane/	
HP/HP Range	100/85-150	Bldg. Materials	F, M, T, W	319/551-3874	



Turner Aircraft, Inc.
T-40

		Fuel Capacity, gal.	19	Beginner Build Time, hrs.	2000
		Empty/Gross Weight, lb.	750/1060	No. Completed & Flown	50
Cruise, mph	145	Length, ft.	19.8	Cost	$175
Stall, mph	45	Wingspan, ft.	22.3	Estimated Completed Cost	$8K-$20K
Range, s.m.	600	Wing Area, sq. ft.	78		
Rate of Climb, fpm	1100	No. of Seats	1		
Takeoff/Landing Distance, ft.	600/500	Cockpit Width, in.	24		
Engine Used	Continental C-85	Landing Gear	tri or tail	www.turnert-40airplanes.com	
HP/HP Range	85/65-125	Bldg. Materials	C, W	760/373-8628	



Turner Aircraft, Inc.
T-40A

		Fuel Capacity, gal.	22	Beginner Build Time, hrs.	2000
		Empty/Gross Weight, lb.	1050/1600	No. Completed & Flown	36
Cruise, mph	147	Length, ft.	20	Cost	$225
Stall, mph	56	Wingspan, ft.	25.4	Estimated Completed Cost	$12K-$30K
Range, s.m.	550	Wing Area, sq. ft.	96		
Rate of Climb, fpm	850	No. of Seats	2		
Takeoff/Landing Distance, ft.	900/1000	Cockpit Width, in.	40		
Engine Used	Lycoming O-235	Landing Gear	tri or tail	www.turnert-40airplanes.com	
HP/HP Range	125/100-125	Bldg. Materials	C, W	760/373-8628	

Turner Aircraft, Inc.
T-40A Super

		Fuel Capacity, gal.	30	Beginner Build Time, hrs.	2000
		Empty/Gross Weight, lb.	1050/1650	No. Completed & Flown	127
Cruise, mph	155	Length, ft.	20.8	Cost	$225
Stall, mph	62	Wingspan, ft.	26.6	Estimated Completed Cost	$20K-$35K
Range, s.m.	600	Wing Area, sq. ft.	106		
Rate of Climb, fpm	1200	No. of Seats	2		
Takeoff/Landing Distance, ft.	1100/900	Cockpit Width, in.	40		
Engine Used	Lycoming O-320	Landing Gear	tri or tail	www.turnert-40airplanes.com	
HP/HP Range	150/100-150	Bldg. Materials	C, W	760/373-8628	

Unger, Carl H.
Breezy R.L.U.-1

		Fuel Capacity, gal.	18	Beginner Build Time, hrs.	1500
		Empty/Gross Weight, lb.	698/1200	No. Completed & Flown	410
Cruise, mph	80	Length, ft.	22.5	Cost	$130
Stall, mph	28	Wingspan, ft.	33	Estimated Completed Cost	$8K-$12K
Range, s.m.	280	Wing Area, sq. ft.	165		
Rate of Climb, fpm	600	No. of Seats	3		
Takeoff/Landing Distance, ft.	450/300	Cockpit Width, in.	40	8751 S. Kilbourn	
Engine Used	Continental C-90	Landing Gear	trigear	Oak Lawn, IL 60456-1021	
HP/HP Range	90/90-150	Bldg. Materials	F, M, T	708/636-5774	

Viking Aircraft LLC
Cygnet

Cruise, mph	100	Fuel Capacity, gal.	15	Beginner Build Time, hrs.	1700
Stall, mph	48	Empty/Gross Weight, lb.	585/1100	No. Completed & Flown	100
Range, s.m.	450	Length, ft.	19	Cost	$200/$225 overseas
Rate of Climb, fpm	580	Wingspan, ft.	30	Estimated Completed Cost	$14K-$16K
Takeoff/Landing Distance, ft.	700/700	Wing Area, sq. ft.	125		LSA Legal
Engine Used	VW	No. of Seats	2		
HP/HP Range	60/60-82	Cockpit Width, in.	39		
		Landing Gear	tailwheel	email: viking02@charter.net	
		Bldg. Materials	F, M, W	262/949-3247	

Vintage Ultra and Lightplane Assn.
Betabird

Cruise, mph	80	Fuel Capacity, gal.	7.5	Beginner Build Time, hrs.	500
Stall, mph	45	Empty/Gross Weight, lb.	405/650	No. Completed & Flown	5
Range, s.m.	280	Length, ft.	16.5	Cost	$65
Rate of Climb, fpm	750	Wingspan, ft.	26	Estimated Completed Cost	$2K-$5K
Takeoff/Landing Distance, ft.	250/150	Wing Area, sq. ft.	110		LSA Legal
Engine Used	VW	No. of Seats	1		
HP/HP Range	50/50-85	Cockpit Width, in.	24		
		Landing Gear	tailwheel	http://vula2.org	
		Bldg. Materials	F, T, W	678/290-0507	

Vintage Ultra and Lightplane Assn.
Gypsy

Cruise, mph	45	Fuel Capacity, gal.	5	Beginner Build Time, hrs.	300
Stall, mph	22	Empty/Gross Weight, lb.	225/475	No. Completed & Flown	19
Range, s.m.	80	Length, ft.	16	Cost	65
Rate of Climb, fpm	450	Wingspan, ft.	32	Estimated Completed Cost	$2K-$5K
Takeoff/Landing Distance, ft.	150/75	Wing Area, sq. ft.	144		LSA Legal
Engine Used	Zenoah	No. of Seats	1		
HP/HP Range	22/15-32	Cockpit Width, in.	24		
		Landing Gear	tailwheel	http://vula2.org	
		Bldg. Materials	F, T	678/290-0507	

Vintage Ultra and Lightplane Assn.
J3-JR

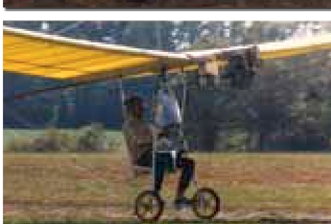
Cruise, mph	45	Fuel Capacity, gal.	5	Beginner Build Time, hrs.	500
Stall, mph	25	Empty/Gross Weight, lb.	254/550	No. Completed & Flown	12
Range, s.m.	320	Length, ft.	16.5	Cost	$45
Rate of Climb, fpm	650	Wingspan, ft.	32	Estimated Completed Cost	$2K-$4K
Takeoff/Landing Distance, ft.	150/75	Wing Area, sq. ft.	120		LSA Legal
Engine Used	2si	No. of Seats	1		
HP/HP Range	30/30-55	Cockpit Width, in.	24		
		Landing Gear	tailwheel	http://vula2.org	
		Bldg. Materials	F, T	678/290-0507	

Vintage Ultra and Lightplane Assn.
MW-7

Cruise, mph	55	Fuel Capacity, gal.	5	Beginner Build Time, hrs.	600
Stall, mph	35	Empty/Gross Weight, lb.	320/600	No. Completed & Flown	15
Range, s.m.	300	Length, ft.	15	Cost	$75
Rate of Climb, fpm	900	Wingspan, ft.	22	Estimated Completed Cost	$2K-$5K
Takeoff/Landing Distance, ft.	150/125	Wing Area, sq. ft.	88		LSA Legal
Engine Used	Rotax 503	No. of Seats	1		
HP/HP Range	52/52-65	Cockpit Width, in.	24		
		Landing Gear	tailwheel	http://vula2.org	
		Bldg. Materials	F, T	678/290-0507	

Vintage Ultra and Lightplane Assn.
Whing Ding

Cruise, mph	35	Fuel Capacity, gal.	3	Beginner Build Time, hrs.	400
Stall, mph	24	Empty/Gross Weight, lb.	123/310	No. Completed & Flown	15
Range, s.m.	75	Length, ft.	13	Cost	$40
Rate of Climb, fpm	200	Wingspan, ft.	17	Estimated Completed Cost	$2K-$5K
Takeoff/Landing Distance, ft.	250/100	Wing Area, sq. ft.	98		LSA Legal
Engine Used	McCulloch	No. of Seats	1		
HP/HP Range	12/12-20	Cockpit Width, in.	24		
		Landing Gear	tailwheel	http://vula2.org	
		Bldg. Materials	F, T, W	678/290-0507	



Vintage Ultra and Lightplane Assn.
Woodhopper

Cruise, mph	30	Fuel Capacity, gal.	3	Beginner Build Time, hrs.	200
Stall, mph	18	Empty/Gross Weight, lb.	145/345	No. Completed & Flown	10
Range, s.m.	40	Length, ft.	17.5	Cost	$40
Rate of Climb, fpm	250	Wingspan, ft.	32	Estimated Completed Cost	$2K-$5K
Takeoff/Landing Distance, ft.	75/50	Wing Area, sq. ft.	157		LSA Legal
Engine Used	Zenoah	No. of Seats	1		
HP/HP Range	22/12-22	Cockpit Width, in.	26		
		Landing Gear	tailwheel	http://vula2.org	
		Bldg. Materials	F, W	678/290-0507	

VSR
SR-1 Snoshoo

Cruise, mph	200	Fuel Capacity, gal.	6	Beginner Build Time, hrs.	2000
Stall, mph	65	Empty/Gross Weight, lb.	530/760	No. Completed & Flown	3
Range, s.m.	460	Length, ft.	18.3	Cost	$200
Rate of Climb, fpm	2000	Wingspan, ft.	20	Estimated Completed Cost	$15K-$30K
Takeoff/Landing Distance, ft.	900/1200	Wing Area, sq. ft.	66		
Engine Used	Continental O-200	No. of Seats	1		
HP/HP Range	100/85-130	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.snoshoo.com	
		Bldg. Materials	C, F, M, T, W	316/684-2032	

WAR Aircraft Replicas
A6M2-Zero

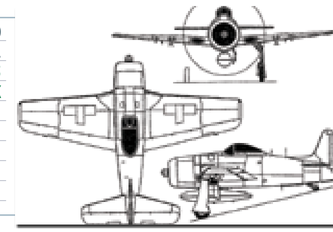
Cruise, mph	135	Fuel Capacity, gal.	14	Beginner Build Time, hrs.	1500
Stall, mph	55	Empty/Gross Weight, lb.	600/900	No. Completed & Flown	1
Range, s.m.	400	Length, ft.	17	Cost	$320
Rate of Climb, fpm	700	Wingspan, ft.	20	Estimated Completed Cost	$18K-$24K
Takeoff/Landing Distance, ft.	900/1400	Wing Area, sq. ft.	121		
Engine Used	Honda	No. of Seats	1		
HP/HP Range	100/90-125	Cockpit Width, in.	24	www.waraircraftreplicas.com	
		Landing Gear	tailwheel/R	813/620-0631	
		Bldg. Materials	C, M, W		

WAR Aircraft Replicas
F-4U Corsair

Cruise, mph	135	Fuel Capacity, gal.	14	Beginner Build Time, hrs.	1500
Stall, mph	55	Empty/Gross Weight, lb.	600/900	No. Completed & Flown	112
Range, s.m.	340	Length, ft.	14	Cost	$305
Rate of Climb, fpm	700	Wingspan, ft.	20	Estimated Completed Cost	$18K-$28K
Takeoff/Landing Distance, ft.	900/1500	Wing Area, sq. ft.	121		
Engine Used	Continental O-200	No. of Seats	1		
HP/HP Range	100/90-125	Cockpit Width, in.	24	www.waraircraftreplicas.com	
		Landing Gear	tailwheel/R	813/620-0631	
		Bldg. Materials	C, M, W		

WAR Aircraft Replicas
F8F Bearcat

Cruise, mph	135	Fuel Capacity, gal.	14	Beginner Build Time, hrs.	1500
Stall, mph	55	Empty/Gross Weight, lb.	600/900	No. Completed & Flown	n.p.
Range, s.m.	340	Length, ft.	17	Cost	$295
Rate of Climb, fpm	700	Wingspan, ft.	20	Estimated Completed Cost	$17K-$26K
Takeoff/Landing Distance, ft.	900/1400	Wing Area, sq. ft.	121		
Engine Used	Continental O-235	No. of Seats	1		
HP/HP Range	100/100-125	Cockpit Width, in.	24	www.waraircraftreplicas.com	
		Landing Gear	tailwheel	813/620-0631	
		Bldg. Materials	C, M, W		



WAR Aircraft Replicas
Focke Wolf 190

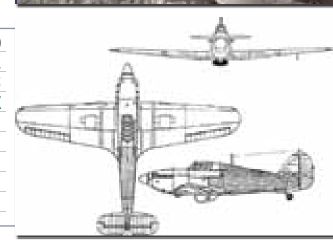
Cruise, mph	135	Fuel Capacity, gal.	14	Beginner Build Time, hrs.	1500
Stall, mph	55	Empty/Gross Weight, lb.	600/900	No. Completed & Flown	110
Range, s.m.	340	Length, ft.	14	Cost	$275
Rate of Climb, fpm	700	Wingspan, ft.	20	Estimated Completed Cost	$16K-$26K
Takeoff/Landing Distance, ft.	900/1500	Wing Area, sq. ft.	121		
Engine Used	Continental O-200	No. of Seats	1		
HP/HP Range	100/90-125	Cockpit Width, in.	24	www.waraircraftreplicas.com	
		Landing Gear	tailwheel/R	813/620-0631	
		Bldg. Materials	C, M, W		

WAR Aircraft Replicas
Hawker Sea Fury

Cruise, mph	135	Fuel Capacity, gal.	14	Beginner Build Time, hrs.	1500
Stall, mph	55	Empty/Gross Weight, lb.	600/900	No. Completed & Flown	8
Range, s.m.	340	Length, ft.	14	Cost	$265
Rate of Climb, fpm	700	Wingspan, ft.	20	Estimated Completed Cost	$16K-$26K
Takeoff/Landing Distance, ft.	900/1500	Wing Area, sq. ft.	121		
Engine Used	Continental O-200	No. of Seats	1		
HP/HP Range	100/90-125	Cockpit Width, in.	24	www.waraircraftreplicas.com	
		Landing Gear	tailwheel/R	813/620-0631	
		Bldg. Materials	C, M, W		

WAR Aircraft Replicas
Hurricane

Cruise, mph	135	Fuel Capacity, gal.	14	Beginner Build Time, hrs.	1500
Stall, mph	55	Empty/Gross Weight, lb.	600/900	No. Completed & Flown	n.p.
Range, s.m.	340	Length, ft.	17	Cost	$295
Rate of Climb, fpm	700	Wingspan, ft.	20	Estimated Completed Cost	$17K-$26K
Takeoff/Landing Distance, ft.	900/1400	Wing Area, sq. ft.	121		
Engine Used	Mazda Prelude	No. of Seats	1		
HP/HP Range	100/100-125	Cockpit Width, in.	24	www.waraircraftreplicas.com	
		Landing Gear	tailwheel	813/620-0631	
		Bldg. Materials	C, M, W		

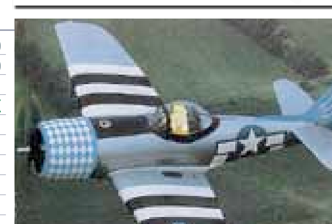


WAR Aircraft Replicas
Messerschmidt BF-109

Cruise, mph	135	Fuel Capacity, gal.	14	Beginner Build Time, hrs.	1500
Stall, mph	55	Empty/Gross Weight, lb.	600/900	No. Completed & Flown	1
Range, s.m.	400	Length, ft.	17	Cost	$320
Rate of Climb, fpm	700	Wingspan, ft.	20	Estimated Completed Cost	$18K-$24K
Takeoff/Landing Distance, ft.	900/1400	Wing Area, sq. ft.	121		
Engine Used	Honda	No. of Seats	1		
HP/HP Range	100/90-125	Cockpit Width, in.	24	www.waraircraftreplicas.com	
		Landing Gear	tailwheel/R	813/620-0631	
		Bldg. Materials	C, M, W		

WAR Aircraft Replicas
P-47 Thunderbolt

Cruise, mph	135	Fuel Capacity, gal.	14	Beginner Build Time, hrs.	1500
Stall, mph	55	Empty/Gross Weight, lb.	600/900	No. Completed & Flown	100
Range, s.m.	340	Length, ft.	14	Cost	$265
Rate of Climb, fpm	700	Wingspan, ft.	20	Estimated Completed Cost	$14K-$26K
Takeoff/Landing Distance, ft.	900/1500	Wing Area, sq. ft.	121		
Engine Used	Continental O-200	No. of Seats	1		
HP/HP Range	100/90-125	Cockpit Width, in.	24	www.waraircraftreplicas.com	
		Landing Gear	tailwheel/R	813/620-0631	
		Bldg. Materials	C, M, W		

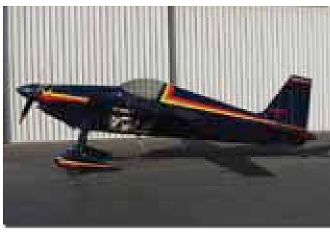


WAR Aircraft Replicas
P-51 Mustang

Cruise, mph	135	Fuel Capacity, gal.	14	Beginner Build Time, hrs.	1500
Stall, mph	55	Empty/Gross Weight, lb.	600/900	No. Completed & Flown	6
Range, s.m.	340	Length, ft.	17	Cost	$295
Rate of Climb, fpm	700	Wingspan, ft.	20	Estimated Completed Cost	$17K-$26K
Takeoff/Landing Distance, ft.	900/1400	Wing Area, sq. ft.	121		
Engine Used	Honda	No. of Seats	1		
HP/HP Range	100/100-125	Cockpit Width, in.	24		
		Landing Gear	tailwheel/R	www.waraircraftreplicas.com	
		Bldg. Materials	C, M, W	813/620-0631	

Williams, Lynn
Flitzer Z-21

Cruise, mph	93	Fuel Capacity, gal.	10.3	Beginner Build Time, hrs.	1000
Stall, mph	42	Empty/Gross Weight, lb.	480/800	No. Completed & Flown	8
Range, s.m.	250	Length, ft.	14.8	Cost	$300
Rate of Climb, fpm	750	Wingspan, ft.	18	Estimated Completed Cost	$10K-$25K
Takeoff/Landing Distance, ft.	400/400	Wing Area, sq. ft.	97		LSA Legal
Engine Used	VW	No. of Seats	1		
HP/HP Range	60/50-100	Cockpit Width, in.	22		
		Landing Gear	tailwheel	www.flitzerbiplane.com	
		Bldg. Materials	W	(011) 44 1685 814319	



York Enterprises
Laser Z-200

Cruise, mph	165	Fuel Capacity, gal.	20	Beginner Build Time, hrs.	3500
Stall, mph	64	Empty/Gross Weight, lb.	950/1400	No. Completed & Flown	20
Range, s.m.	330	Length, ft.	19.1	Cost	$275
Rate of Climb, fpm	2500	Wingspan, ft.	24.4	Estimated Completed Cost	$30K-$50K
Takeoff/Landing Distance, ft.	1000/1500	Wing Area, sq. ft.	98		
Engine Used	Lycoming O-360	No. of Seats	1		
HP/HP Range	180/150-200	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.yorkaircraft.com	
		Bldg. Materials	F, M, T, W	519/797-2930	

York Enterprises
Laser Z-2300

Cruise, mph	195	Fuel Capacity, gal.	30	Beginner Build Time, hrs.	3500
Stall, mph	60	Empty/Gross Weight, lb.	1250/2050	No. Completed & Flown	3
Range, s.m.	450	Length, ft.	21	Cost	$300
Rate of Climb, fpm	2800	Wingspan, ft.	26	Estimated Completed Cost	$30K-$50K
Takeoff/Landing Distance, ft.	1000/2000	Wing Area, sq. ft.	98		
Engine Used	Continental IO-470	No. of Seats	2T		
HP/HP Range	225/225-300	Cockpit Width, in.	24		
		Landing Gear	tailwheel	www.yorkaircraft.com	
		Bldg. Materials	F, T, W	519/797-2930	

Zenith Aircraft Company
STOL CH 701 Amphib

Cruise, mph	74	Fuel Capacity, gal.	20	Beginner Build Time, hrs.	500
Stall, mph	32	Empty/Gross Weight, lb.	760/1250	No. Completed & Flown	500+
Range, s.m.	280	Length, ft.	20.9	Cost	$425
Rate of Climb, fpm	950	Wingspan, ft.	27	Estimated Completed Cost	$18K-$60K
Takeoff/Landing Distance, ft.	155/225	Wing Area, sq. ft.	122		LSA Legal
Engine Used	Rotax 912S	No. of Seats	2		
HP/HP Range	100	Cockpit Width, in.	41		
		Landing Gear	trigear/R	www.zenithair.com	
		Bldg. Materials	M	573/581-9000	

Zenith Aircraft Company
Zodiac CH 601 HD

Cruise, mph	115	Fuel Capacity, gal.	16	Beginner Build Time, hrs.	500
Stall, mph	44	Empty/Gross Weight, lb.	590/1200	No. Completed & Flown	800+
Range, s.m.	480	Length, ft.	19	Cost	$315
Rate of Climb, fpm	1200	Wingspan, ft.	27	Estimated Completed Cost	$8K-$46K
Takeoff/Landing Distance, ft.	430/550	Wing Area, sq. ft.	130		LSA Legal
Engine Used	Rotax 912	No. of Seats	2		
HP/HP Range	80/65-120	Cockpit Width, in.	44		
		Landing Gear	tri or tail	www.zenithair.com	
		Bldg. Materials	M	573/581-9000	

Zenith Aircraft Company
Zodiac CH 601 UL

Cruise, mph	115	Fuel Capacity, gal.	16	Beginner Build Time, hrs.	500
Stall, mph	44	Empty/Gross Weight, lb.	550/1058	No. Completed & Flown	250
Range, s.m.	480	Length, ft.	19	Cost	$315
Rate of Climb, fpm	1200	Wingspan, ft.	27	Estimated Completed Cost	$8K-$45K
Takeoff/Landing Distance, ft.	430/550	Wing Area, sq. ft.	130		LSA Legal
Engine Used	Rotax 912	No. of Seats	2		
HP/HP Range	80/65-100	Cockpit Width, in.	44		
		Landing Gear	tri or tail	www.zenithair.com	
		Bldg. Materials	M	573/581-9000	

Did you know that the KITPLANES® Plansbuilt Aircraft Buyer's Guide is the only place where you can find comprehensive specifications and photos for nearly 140 scratch-built designs? Look for our Rotorcraft Buyer's Guide in February and our traditional Engine Buyer's Guide in April. Also, let us know if you see any errors or omissions by emailing editorial@kitplanes.com.

Setting up shop.

You've sent off the check. Before long you will receive a big box containing parts for your airplane. It would be a vast simplification to say, "All that's left is the assembly," because there will be 1001 details to work out between the day the kit arrives and the day the completed airplane first flies. But isn't that the fun of it all?

Let's talk about getting ready for the arrival of the big box and about organization. Most people have already developed their personal slant on organization, so I'll focus primarily on the aircraft workspace and tools.

Maintenance and Shop Basics

The ideal shop space is divided into four or five separate areas: an area for receiving and inventorying incoming parts, an area commonly called a "dirty room" where engines and other mechanical parts are disassembled and cleaned, an inspection area where the clean parts are inspected, and a general working or assembly room. If you're doing a lot of work with composites, it's best to set aside a separate area for those tasks. However, most of us don't have enough square footage to break out five separate areas, so we make do with what we have. Those hours or days spent planning and setting up a workspace organization system suitable for the room available always pay off big in efficiency, builder satisfaction and in the end, the airworthiness of the finished airplane.

Receiving and Inventory

Establish an inspection and inventory routine. Every parts order must be inventoried when it arrives. Few things are more frustrating than the "Oh, no!" feeling that dawns when you realize that you don't have everything you need for a productive workday—especially if you've rounded up helpers.

A common scenario occurs when you remember ordering the part but didn't inventory the order when it arrived. Pulling out the paperwork, you see a check in the "back-ordered" box. The order arrived last week. If you had inventoried it on arrival, you would have had plenty of time to reorder the missing part from another vendor before the workday.

Inventorying not only catches parts shortages before crunch time, it also lets you see what the parts actually look like, so you can begin to visualize how they go together.

The Dirty Room

While there's not much need for a dirty room area during the airframe period of construction, you'll use it regularly both during engine build-up and after the airplane is flying. The farther the dirty room is located from the rest of the work area, the better. The dirty room should have a solvent washer (and a pair of oil- and solvent-resistant gloves) for initial cleaning of parts, compressed air to blow parts dry, and a bench with a strong vise to hold oil filters so the cans can be cut open and the filtering media removed and inspected. This is where oily and greasy parts such as wheel bearings are cleaned before inspection. A dirty room should be stocked with face shields or eye protection, the aforementioned oilproof gloves and respirators to minimize contact with oil, gas and solvents.

OK, so it's less than elegant and multitasking, but it gets the job done. Boxing small engine parts makes them readily available in one spot when needed.

Steve Ells *is what you call a gen-u-ine mechanic, a bonafide A&P with an Inspection Authorization. Former West Coast editor for AOPA Pilot and tech guy for the Cessna Pilots Association, Ells has flown and wrenched on a wide range of aircraft. He owns and wrenches (a lot!) on a classic Piper Comanche. But don't hold that against him.*

Photos: Steve Ells

Keeping your tools well organized will save time over the course of the build.

Versatile 30-60 wrenches such as these will come in handy.

A bolt bin. You don't want to have to stop the project to order spare hardware.

The Inspection Room

After cleaning, parts are inspected. Many shops find that a table-mounted magnifying glass/lamp combination on a flex arm is helpful. The FAA often calls out the use of a 10x magnifying glass for mandated visual inspections, so get a good one. Good lighting is essential. This room or section of the shop must be clean and well-lit.

General Working or Assembly Room

This area is where most of the action takes place. When it comes to setup, there are two schools of thought and operation. The linear thinkers give the project good consideration before each step. They create calendars and define each construction goal with a well-defined, colored time block. Linear builders are most comfortable with steady day-by-day progress. They operate and are comfortable with goals and checklists; these are their tools.

Then there are the non-linear or visual builders. These builders operate from and are guided by their individual internal clocks, and by their systems of checks-and-balances. Visual builders are inspired to work long hours on a project; they are energized by a problem or process and make great progress only to stop work on the airplane, or at least that section of the airplane for a few days.

If the actions of a hard-working visual builder were charted, his or her actions would resemble the meandering path often seen in the "Family Circus" comic to illustrate the track of one of the children from point X to home.

If a linear builder walks into the workshop of a visual builder, the reaction will be a shake of the head and perhaps even an offer to help straighten things out. Conversely, the visual builder won't be able to resist telling a linear builder friend that he noted not one but two dull pencils when he last visited.

Organization—It's What Works for You

The point of sketching out personality differences is to illustrate that the organization of one's individual work area must fit one's working style.

If you're linear, there had better be cork boards on the walls to post those detailed and all-important flow charts. If you're visual, cork boards also have a place, because visual builders want *everything* out where it can be seen.

Let's spell out basic needs for everyone. First, the work area must be well-lit. This is especially true for seasoned citizens. Bad lighting causes eye strain, headaches and other physical ills. It also contributes to frustration and sloppy work. If normal fluorescent lighting is troublesome, pay a little more for a set of full-spectrum fluorescents. If you can't go full tilt on banks of lighting, buy a couple of full-spectrum standing lights that can be moved around your work area. Ott Lites are one brand that I've used. Ideally, the shop is well-lit by natural light streaming in from north-facing windows.

You're going to need a vise. Nothing will take the place of a heavy-duty solidly mounted vise. Get a bigger one—with at least 5-inch jaws—than you think you'll need, and bolt it down. If you can afford one with a rotating base, that will certainly increase the utility of this important tool. One night you'll need a helping hand; the vise is always ready to help, won't complain and never asks for a day off.

Shelves and storage areas go without saying. If you don't have built-in units, the wide variety and sizes of plastic storage bins available at any home-supply store provide a lot of storage with a small footprint, since they are made to be stacked. These bins can be used to store everything from special tools to parts to hardware to shop supplies. Go ahead and devise a color-coded storage system; buy bins in different colors or use spray paint on the end panels to build your system. I use this system and have bins for tools, Piper-specific parts, generic parts, paint tools and supplies, and a bin for everything else.

Buy some Sharpie permanent markers. These are available in different colors to help you set up that color-coded system. Bins holding firewall-forward parts might be red or at least labeled with a red Sharpie, while empennage parts might be white or green. Bins holding landing gear and brake parts would be another color.

A vise, preferably one that rotates, is a good investment.

One builder I know organizes his shop with a cluster of inexpensive wheeled metal carts that he buys at a home-supply store. He labels them and has one for sheet-metal tools, one for engine tools and trays, one for electrical work and so on. He's a visually oriented builder and his organized-down-to-categories technique works for him.

I buy and use segmented organizer boxes to store common size nuts, washers, screws and other assorted hardware. I don't like to stop working just to place an order for common hardware items.

Power Tools

There are a number of outlets for aviation tools. A few of the better-known suppliers are Aircraft Tool Supply, Avery Tools, Brown Tool Supply, Plane Tools and U.S. Tool. But often it pays to look at non-aircraft tool vendors, too. One is Harbor Freight. Many of my mechanic-builder friends have small 110 VDC solvent washers or air compressors from Harbor Freight. Another is Summit Racing, where moderately priced sheet-metal bending brakes, hand tools and even bench vises are available and reasonably priced.

Most professional light aircraft maintenance shops have a hefty air compressor feeding quick-disconnect outlets around the shop area. Shops use air-powered tools (drills, grinders, small air ratchets, etc.) to reduce the chance of igniting explosive vapors from solvents and gasoline during maintenance. However, if gasoline or solvents aren't present during the airframe construction phase of building, it's possible to work without buying a compressor or a selection of air-powered tools. Electrical plug-in and battery-powered tools are readily available and will help builders get started without laying out a big chunk of cash for an air tool setup.

Hand Tools

Professional light airplane mechanics performing general maintenance get by well with a comprehensive quarter-inch socket set. By comprehensive, I mean at least one high-quality ratchet, a set of normal depth and deep sockets, extensions up to 12 inches long and a set of universal-joint sockets. I have found that there's no reason to get 6-point sockets when 12 point are more versatile and are plenty strong enough to handle the torque required in 90% of applications. I have a few 8-point sockets in my quarter-inch set to take out pipe plugs. You'll also need a screwdriver or two—preferably the ones with interchangeable tips—a good pair of diagonal cutting pliers and a set of what I call 30-60 open-ended wrenches; 30-60 wrenches have the jaws on one end of the wrench handle, offset from the handle centerline by 30°, and the other set of jaws on the other end offset in the opposite direction by 60°. These are sometimes called obstruction wrenches. They're invaluable; I use them all the time.

I purchased a nice set of Snap-On combination wrenches (open-ended on one end of the handle and box-ended on the other) years ago but find I don't need the box-end wrenches as often as I thought I would. Box-end wrenches are the best when dealing with high torque—they won't slip, and the jaws can't spread under heavy loads—but few of the fasteners used on light airplanes are large enough or are turned hard enough to require the use of a box-end wrench; the 30-60 wrenches are used most often.

Label any storage containers in a way that makes sense to you.

Tool Kits

Aircraft Spruce & Specialty, Plane Tools and other tool stores stock a wide variety of aircraft tool kits that range from a starter-type aircraft builder tool kit on up to a master builder tool kit. Kits are also available for composite work and electrical work.

Also, builders who make good use of the informational and builders' forums on the Internet will be one step ahead. Take advantage of the knowledge of those who have gone before you. There's no better source of information for builders.

Clean out your workspace, and decide how you're going to set it up and what organizational tools will work best for you so you'll be ready to inventory the parts when that first big box arrives. ✈

RESOURCES

Aircraft Spruce & Specialty
www.aircraftspruce.com

Avery Tools
www.averytools.com

Aviation Tool Supply
www.aircraft-tool.com

Brown Aviation Tools
www.browntool.com

Harbor Freight
www.harborfreight.com

Plane Tools
www.planetools.com

Snap-On Tools
www.snapon.com

Summit Racing
www.summitracing.com

U.S. Tool
www.ustool.com

Safety is a culture.

At this point in my life, I can look back across more than 40 years spent deeply involved in amateur-built aircraft and the kit-aircraft business. There's been a lot of satisfaction and pleasure, but there's also been too much misery. Too many people I've known have been injured or killed in this part of aviation—far more than the small proportion of the aviation spectrum we occupy would suggest. The Federal Aviation Administration has not missed this fact, and people there have been tasked with improving the situation—one way or another.

I've thought a lot about the subject, and would like to share some of those ruminations. I'm not here to preach. We are already constantly bombarded with safety warnings and education opportunities by the FAA, EAA and AOPA. Is it really enough? Given the safety record, I'd say that it isn't.

I don't think safety can be imposed. Harsher rules, constant harping and even threats might improve the safety picture for a little while, but eventually they fade into the background. They address the symptom. I think we need to address the root.

A Safety Culture

Recently, I ran across a quote by KITPLANES® writer and vastly experienced pilot Doug Rozendaal. "Culture must change," he said, referring to ways of improving amateur-built safety. My first reaction was "Why?" Overall, we have a great culture. We have common interests in flying and building, we help each other in many aspects of building, and we enjoy socializing with each other. We mingle with our flying friends at the airport, at our EAA chapters and at Saturday morning brunches. These social contacts are probably our most powerful peer pressure influence. This less formal social side of aviation is the most enjoyable, and probably the most influential. This is our aviation "culture."

But as I thought about it a bit longer, I realized there *are* aspects of our flying culture, perhaps holdovers from bygone years, maybe the result of paranoia over our minority status in GA, that are counterproductive to safety. Whether we want to admit it or

VanGrunsven poses with his personal RV-12. His approach to flying and safety reflects a philosophy developed over many years.

Richard VanGrunsven

"Van" learned to fly in 1956 at the age of 16. An engineer and aircraft designer, he founded and developed Van's Aircraft, Inc. into the acknowledged leader in kit aircraft. He often speaks and writes about flying skills and safety. A life in aviation, including thousands of hours piloting both powered aircraft and sailplanes, has given him plenty of time to consider what makes pilots unsafe…or safe. He prefers the latter.

Photo: Courtesy Van's Aircraft

not, we as social beings are affected by our surroundings and our peers. While we may be self-proclaimed "rugged individualists," chances are that we are also creatures of our culture to a high degree. Awareness of this can help us understand our own flying behavior and that of our fellow pilots, and the positive or negative role that flying culture can play.

We need to develop a *safety* culture—a culture where the social interaction and peer pressure don't result in reinforcing paranoia and bad habits, but rather result in safer and more courteous flying.

We Don't Need More Regulations

This sounds like the typical comment that you might hear during any pilot's bull session. However, I heard it from Mel Cintron, head of the FAA GA Division during a phone conversation several months ago.

He called me regarding one of the safety columns that I regularly post on the Van's Aircraft Facebook page. We had a pleasant conversation about amateur-built aircraft safety and shared some thoughts on how safety might be improved and accidents avoided. The heavy hand of the FAA was completely absent from his tone—Cintron feels that much more can be accomplished through a collaborative effort than through more burdensome regulations.

This is refreshing, and helps explain the reason for establishing the Amateur Built Aircraft Safety Coalition consisting of FAA, EAA, AOPA and industry members. While involving players from alphabet groups across the GA spectrum is important, in the end it is much more important to involve the real players on this field: all of you.

Accident Reduction

I believe that we, EAA and the amateur-built community, should set a goal of cutting our accident rate in half. (The goal stated by the FAA was much less, something on the order of a 1% per year improvement.) I feel that this is achievable because a review of individual accidents shows that almost all of them are preventable. If accidents are not an act of God, such as physical incapacitation in flight, being hit from behind or being struck by lightning, I feel that they are preventable with these steps.

- To prevent loss-of-control accidents, we need to hone our flying skills.
- To prevent cowboy accidents, we simply must quit doing show-off stunts.
- To minimize mechanical problems, we need to become better builders and mechanics.
- As pilots, we must know our airplanes' systems better.

OK, this is easier said than done. What should be our time frame for this goal? One year or five years? One year is probably unrealistically soon and not achievable, so why try? Five years seems so distant that there's no need to rush. It allows us to put off action until later. My suggestion is to act *now*. When an opportunity presents itself, act. By thinking "safety," you'll be surprised how often a need, hopefully an opportunity, to act will arise.

How Do We Accomplish This?

First, we should constantly assess and upgrade ourselves. Regularly practice air work maneuvers. Practice landings of different types rather than just "arriving." Make it a point to do something educational on every flight. Make Biennial Flight Reviews (BFR) meaningful. Seek out instructors who will challenge and instruct us, not just sign our logbooks.

We need to bring safety into conversations with fellow pilots. Promote an atmosphere of professionalism within our flying peer group, be it EAA chapter meetings or just the klatch at the airport café.

We must encourage builders who are about to make first flights to get transition training, or at least to upgrade their proficiency.

If it is evident that some pilots you know are deficient in flying skills or judgment, network with fellow pilots to find diplomatic means to make them aware of their limitations and the need for more training and practice.

If you see flying behavior that is unsafe, inconsiderate or just plain dumb—act. Recently, I learned that a member of our glider club had been banned from using the club's private airfield because of his flying behavior. He owned a fast homebuilt and would fly in to use the club gliders. He often demonstrated his own stylized arrival procedure. I witnessed one of these industrial-strength buzz jobs, and agreed that corrective attention was in order. I mention this as an instance where peer pressure was applied effectively. The club's culture simply wouldn't accept reckless flying.

If you know of someone about to buy a "previously owned" homebuilt, do what you can to make that person aware of the availability and benefits of transition training. Van's has a transition training program available, and other kit manufacturers probably have similar programs.

The EAA web site includes a section under the heading of PROGRAMS, GOVERNMENT ADVOCACY that I encourage you to visit from time to time. The FAA/Industry Aviation Safety Coalition is still in its organizational stage and held a meeting in Oshkosh during this summer's AirVenture event. I plan to report on it, probably on the Van's Facebook page.

The list should be endless. Give it some thought and see what is appropriate for your aviation environment, your EAA chapter or your peer group. Different circumstances will present different opportunities and needs. I'd like to hear from anyone who has specific experience and ideas of what he or she feels is needed or what has worked.

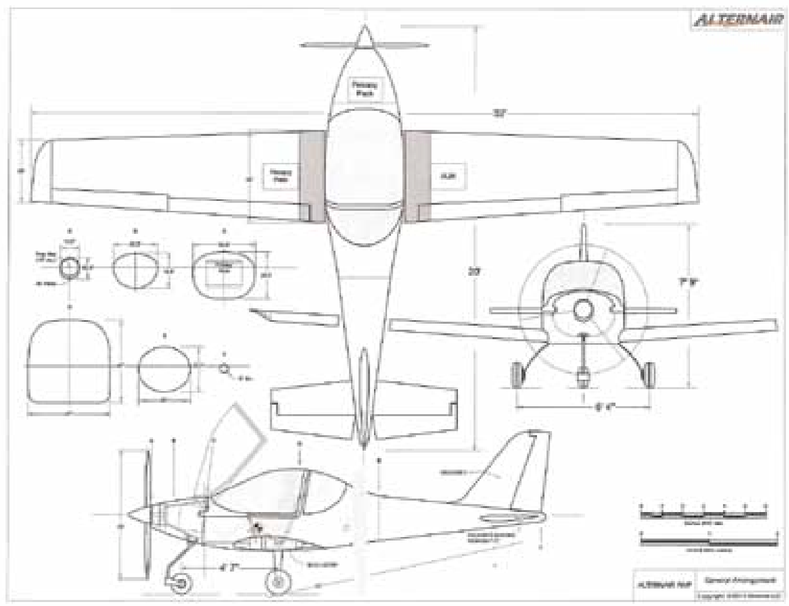
The FAA's job is that of safety, period. If its employees do their job well and safety improves, they will have the satisfaction of a job well done and maybe a good job performance review. But for those of us who actually fly amateur-built aircraft, enhanced safety means that more of us will live longer.

So who has the most to gain?

Light Sport electrified.

Light Sport Aircraft (LSAs) are a challenge to designers, restricting weight while usually requiring the ability to carry one or two passengers at a reasonable cruising speed on a minimum of fuel. Europe has a thriving LSA industry, while America, so far, has many legacy LSAs such as Piper Cubs, Aeroncas (and their replicas) and some homebuilts that qualify, but only a few new homegrown products, mainly the RV-12 from Van's Aircraft and the Sonex lineup from Monnett. Cessna's Skycatcher is built in China, powered by a Continental "light" O-200, while most foreign and domestic craft are powered by a Rotax four-cylinder, four-stroke engine.

An electric LSA is even more of a design issue, with heavy batteries eating into the possible payload, often requiring a larger, heavier, more motorglider-like airframe, and reducing performance and range.



This three-view gives dimensions and highlights features of the Amp LSA.

An Alternative Aircraft

Stephan Boutenko, founder of Alternair, Inc., thinks that a battery-powered LSA will promote the growth of an electric aircraft industry, possibly leading to an even more electrified infrastructure. A methodical person, Boutenko has built a careful business plan, developed a design for his projected aircraft (working from a Prescott, Arizona, location in association with Embry-Riddle Aeronautical University), and started a new headquarters in Ashland, Oregon, to realize his dream.

A three-quarter rear view of the Amp's smooth lines.

The market for such an airplane is promising, with its minimal medical requirements providing an incentive to many. Boutenko says, "It is our estimate that as many as 20% of today's pilots fly in the Light Sport Aircraft category. Currently there are 140 LSA manufacturers in the world, and the number is growing due to the less-stringent certification regulations and the affordability of the aircraft operations. There were 248 new LSAs manufactured last year (2010 to 2011), and 150 the year before that (2009 to 2010). The LSA market is growing faster than Part 23 certified aircraft."

In a narrower range, the Alternair Amp LSA would be a competitor to PC-Aero's

Dean Sigler

A technical writer for 30 years, Dean has a liberal arts background and a Master's degree in education. He writes the CAFE Foundation blog and has spoken at the last two Electric Aircraft Symposia and at two Experimental Soaring Association workshops. Part of the Perlan Project, he is a private pilot, and hopes to get a sailplane rating soon.

Photos: Courtesy of Alternair, Inc.

The front view highlights the Amp's wide stance and aerolastic propeller.

Elektra Two, a similar two-seater from Germany's Calin Gologan and to China's Yuneec E-430, which does not achieve LSA performance. Randall Fishman's ElectraFlyer X, also more motorglider than LSA, would compete nicely with the Yuneec e430 in size and performance. It would be smaller and lighter than George Bye's Cessna 172 electric conversion, a four-seater that gives up a back seat to make room for batteries and effectively becomes a large two-seater—but definitely not an LSA. Sonex has the electric Waiex, which has made three reported test hops to date.

Appearance

The Amp looks like a typical LSA with its low wing, tricycle landing gear and clear Plexiglas canopy. The 34 kilowatt hours of batteries replace the normal gasoline tanks in the 32-foot wings and behind the pilot's compartment, 8.5 kWh in each wingroot between the two spars and 17 kWh forward of the firewall. This weight distribution enables installation of future, lighter energy sources without affecting the balance of the aircraft.

Despite the competition for this niche market, Boutenko remains confident in the approach he is taking. His estimate of what the aircraft can achieve illustrates his hopes for his creation. His confidence in the aircraft's systems is great enough to allow him to offer a five-year limited warranty with free annual inspections during that period. Owners of fossil-fuel burning aircraft will appreciate that added economy of ownership.

• Preliminary design suggests that the Amp will be able to cruise for 2.5 hours at a nominal cruise setting of 11 kW and maintain a 90-knot (103 mph) true airspeed.

• The U.S. manufactured carbon-composite airframe will be light, yet durable and weigh just a little more than 300 pounds (not including the batteries). Total structural weight with motor will be around 330 pounds, and batteries add 550 pounds. Pilot and passenger can add another 440 pounds while the entire package remains within LSA limits.

• The aircraft will utilize state-of-the-art modern avionics with Aircraft Health Management (AHS) systems monitoring capability for safety and a higher standard of maintenance.

• The aircraft will initially feature lighter weight, higher energy density lithium-polymer energy storage, but may change to LiFePO4 battery packs, a little heavier but incapable of bursting into inextinguishable flame.

From the front, the Amp's roomy cockpit is apparent.

• The aircraft will be compatible with multiple types of U.S. electrical sources, including household 120/240 VAC, and electric vehicle (EV) quick charge station 480 VAC voltages. Further international voltage adaptor developments will be considered at a later time.

Is There a Market?

Customers would include Sport Pilots, with the airplane able to be charged for weekend flights and providing sufficient range to enable trips to neighboring airports and back to home base without recharging. Flight schools could use the "drastically reduced operating costs" to entice more student pilots into the sport, and to make them future customers for the airplane. Government clients might find the airplane a platform for patrolling national parks and borders, or performing law-enforcement or military applications. It can be plugged into a variety of electric systems, including normal house outlets, so it can operate from a wide range of sites. Its less than 65 dB operation would not disturb animals, criminals or border interlopers as it flies overhead, giving it a stealth aspect.

This approach represents more than merely creating a light airplane for the masses. It includes electrifying the entire airport infrastructure, and providing "green" energy that would reduce the costs and emissions of the aircraft and its support elements. Boutenko estimates that operating costs could be as low as 20% of those for a conventional Light Sport Aircraft.

Amp's lithium-polymer batteries would be monitored through the AHM application. Such systems allow "e-enabling" or monitoring and prognostication of aircraft and systems' needs. Mechanics could access history and trends for everything on the plane, and could plan maintenance and infrequent replacements based on that data. There is even some capability for rerouting signals though a neural-like network to "repair," at least temporarily, a non-functioning system.

Incorporating Current Technology

Boutenko initially conceived of using an iPad to act as a glass panel, and recent apps costing from $1.99 to $5.99 might make that even more of a probability. Even though sellers note their programs are for "educational purposes" only, one wonders how long it will be before FAA-approved aviator avatars will be helping guide and monitor in-flight activities. If this were to include connections to motor, controller and battery monitoring as well as attitude, altitude and heading references, a true revolution could follow in low-cost aircraft instrumentation.

As currently configured, the panel can hold an iPhone or iTouch to display an electronic checklist. The display function (DF) can also display and accept entries on the aircraft and maintenance logbooks.

These records are stored in the Aircraft Health Management Function (AHMF) and can be uploaded to the maintenance laptop for review. A flight display panel will be installed, and customers can select their own VHF radio, Mode S transponder or GPS receiver.

All this electronic wizardry will be transparent to the pilot, who will see a carbon-fiber aircraft with a gross weight of 1320 pounds, and performance that emulates the LSA ideal. Able to lift off in 450 feet and land in 500, the Amp is designed for at least a 600 feet per minute climb (with refinements, 800 fpm), a 43 knot (49.5 mph) clean stall speed, and 39 knot (45 mph) stall with flaps, making the craft easily managed by the average pilot.

Power Supply

Surprisingly, the aircraft will achieve this LSA performance with a mere 20-pound, 30 kW (40.2 horsepower) LaunchPoint pancake-like motor. Boutenko says the torque it generates is terrific, though, and will easily spin the aerolastic three-blade propeller, which automatically flexes to accommodate the power being applied and the flight conditions in which it finds itself.

Recently, Boutenko teamed with Karl Young, founder and CEO of eXtreme Capacitors, Inc. Young reports that his creation of high power/high energy ultracapacitors has demonstrated "around 0.9 mega Joules (250 watt-hours per kilogram) in the lab," with a goal of "5 mega Joules (1400 Wh/kg) for sport aviation." (Current lithium-polymer batteries average 130 to 200 Wh/kg.) "We've already found ways to improve our existing design," Young said, and he predicts success in reaching his energy storage goals. Young also predicts his ultracapacitors will sell for one-half to one-fifth of current prices for the best available batteries. The lower weight would allow increased payloads in electric aircraft; smaller, lighter airframes would bring costs down further.

The Bigger Picture

Beyond that, he and Boutenko are planning an electric vehicle (EV) charging infrastructure for airports with paved runways (more than 5000) using the X-Caps. It'd be for electric airplanes, utility vehicles, energy trucks (fuel trucks) and EVs in the parking lot.

Young sees a larger role for his technology. "It'll

The planform for the Alternair Amp.

The side view shows clean lines, simple landing gear and generous visibility.

help to minimize stress to the grid, and become part of the smart grid in distributed energy storage for national security." This would be similar to his vision for using X-Caps in that, "Electric vehicle charging stations would help utilities to level loads and shave the power demand peaks that would come with widespread EV adoption. With enough power density in a super capacitor, a driver could go 200 to 300 miles, and recharge in less than 5 minutes by tapping into a large super capacitor in a parking garage."

If such a system used wind or solar energy for power, it could be "grid-free" and could possibly even supply excess energy to the common grid.

When questioned about the possible use of Young's super capacitors in the Amp, Boutenko replied, "Supercaps may be possible, but which one comes first, the electric airplane or the batteries? I don't know if anyone can truly answer that! Karl has been helping us as one of the Alternair team members. He might be what we need to get new investors, as well as to make progress in both the electrical and the mechanical areas."

Almost all electric aircraft under development can be connected to a J17772 charging outlet, an industry standard for EVs. The Amp will be sold with its own CHAdemMO compatible portable charger, allowing it to be charged at any standard 120-, 220- or 480-volt outlet or J17772 charging station with its standard plug-in receptacle.

(According to the association's web site, "CHAdeMO" is an abbreviation of "CHArge de MOve," equivalent to "charge for moving," and is a pun for "O cha demo ikaga desuka" in Japanese, meaning "Let's have a tea while charging" in English. CHAdeMO is prevalent in Japan and parts of Europe now, with charging stations being installed on the U. S. West Coast.)

The planned price for the basic aircraft is $129,000, right in the LSA ballpark. With the five-year limited warranty and low operating costs, this might make enough economic sense to lure customers. If that doesn't suffice, the intention to provide an Experimental kit for the airplane might. Boutenko is now accepting reservations for the Amp.

Boutenko has an ambitious development plan for his aircraft, with test flights expected in 2012. He and Young have even grander plans for the expanded use of that technology, plans that could free aviation from its reliance on outside sources of energy and possibly give back to the greater community. With the quiet passage overhead of electric aircraft and the contribution of "free" electricity back to the grid, who could complain about that airport next door? ✈

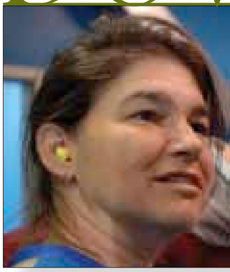
RESOURCES

Alternair, Inc.
http://alternair.com

CHAdeMO charging systems
http://chademo.com

eXtreme Capacitors, Inc.
www.extremecapacitor.com

LaunchPoint Motors
www.launchpnt.com/portfolio/aerospace/uav-electric-propulsion



Relief efforts: Homebuilts can help.

Wow. I recently received a sobering email from the wife of a friend, advising that her husband would be out of pocket for yet another week, helping his 96-year-old mother clean up after Hurricane Irene. A 6-foot storm surge had washed in the front door and out through the back, taking with it furniture, appliances and even the doors. He was on the Outer Banks of North Carolina, cut off from everything. Boats were bringing supplies in. "There, but for the grace of God, go I," I thought to myself, finding comfort that his mom, who evacuated ahead the storm, was safe.

In Irene's Wake

If you live on the western shore of the Atlantic Ocean, Irene seemed to punctuate the summer of 2011. Thankfully, for us in Florida it was just a scare. But the day after it blew through our neighbors in the Bahamas, it became a call to action for general aviation.

Bahamas Habitat, a 501 C (3) nonprofit, non-governmental organization that grew out of a Methodist ministry, was looking for pilots and airplanes to fly relief aid to the stricken out-islands of the Bahamas, where help from the government has historically been late in coming.

The aviation community, ourselves included, moved into action. Banyan Air Services at Ft. Lauderdale Executive Airport (KFXE), known for its generosity during the initial earthquake crisis in Haiti, provided a staging area for the Bahamas Habitat coordinator, Cameron King, and her staff. Cathy Ahles of Premier Aircraft Services contributed donated supplies, which were stuffed into 5-gallon buckets—also good for bailing, cleaning and carrying water). Twenty aircraft and pilots then proceeded to move 25,225 pounds of tarps, meals-ready-to-eat, water and other much-needed supplies directly to the most affected areas after the storm. All of it was delivered a week before the first supply-laden DC-3 arrived from the Red Cross.

My husband flew 20 hours of those missions in the Bahamas Habitat Aztec—but not because the RV-10 was not qualified for the mission. The organization needed a twin-rated pilot, and he has thousands of Aztec hours from his freight-dog days. In fact, RV-10s and Experimental aircraft are welcomed and encouraged to participate in disaster relief efforts, both in this country and in many others around the world.

Regulation 14 CFR Part 91 does not prohibit Experimental aircraft from

The Van's RV-10 might not strike you as a good relief mission aircraft, until you've seen one with the back seats removed. This workhorse can be filled through its big gull-wing doors and luggage door with needed supplies, then quickly move them right to the front line of the disaster.

The Christavia MK-1 (and its big sister, the MK-4) are plansbuilt aircraft designed by Ron Mason specifically for missionary flights. Design requirements were for short takeoff and landing, low fuel consumption, low stall speed, good rate of climb, a large cabin area, low maintenance and a high safety factor. It converts from wheels to floats or skis.

Amy Laboda *has taught students how to fly in California, Texas, New York and Florida. She's towed gliders, flown ultralights, wrestled with aerobatics and even dabbled in skydiving. She holds an Airline Transport Pilot rating, multiengine and single-engine flight instructor ratings, as well as glider and rotorcraft (gyroplane) ratings. She's helped with the build up of her Kitfox IV and RV-10.*

Photos: Amy Laboda, Robert St-Pierre

A full-Lexan door means that this Kitfox 7 is an excellent observation aircraft. The fact that it can safely fly at speeds as slow as 30 knots helps qualify it, too .

taking part in nonprofit relief flying. So, with that in mind, what makes an aircraft good for relief airlifts? You'd be surprised.

Do You Have What It Takes?

Even my Kitfox IV can be useful—though not for heavy hauling. The Kitfox excels at search-and-rescue (SAR) and scouting in damaged areas. It sips fuel and can burn auto gas; it's an excellent low-and-slow performer, has wonderful visibility from full Lexan doors on either side, and if we must touch down in an unimproved area, the taildragger configuration, rugged Grove main landing gear and STOL capabilities rise to the occasion—as long as the pilot has kept up her skills! The Zenith CH 601/701, Christavia MK-1, any of the trikes or gyroplanes, and even powered parachutes can all play important scouting and SAR roles in disaster relief.

There are, however, better candidates among kitbuilt aircraft for load-hauling. The Murphy Moose and CompAirs immediately come to mind, but even the Christavia MK-4 is purpose-designed for the task. The RV-10's wheelpants preclude rough-field operations, but they could be removed if necessary.

In general, what does a good relief aircraft require? Usable load capacity should be at least 1000 pounds, not including fuel. The center of gravity envelope should be wide, allowing for creative loading. A cabin that can be loaded easily is a plus; think cargo door.

Efficiency is also key. If your aircraft can carry a lot of fuel and burn it slowly, you'll be able to fly to the disaster site, deliver supplies and fly back without refueling. Why is this key? If there's no electricity where you are going, odds are there will be no way to pump fuel.

Beyond the basics, it is always a good idea for the aircraft and pilot to be IFR capable, rated and current. Weather is often the cause of the disaster, and relief aircraft can be first on the scene, even while the system's last bands of rain and low clouds are still dragging by. Especially in the tropics, in the summer. Just because a hurricane has passed, it does not mean the rain has stopped. Thunderstorms and low clouds are a daily occurrence during hurricane season. Instrument-rated pilots and aircraft have one more advantage: They tend to be

The Zenair CH 701C has been the quick-building, economical choice of African relief workers. The aircraft, particularly when equipped with amphibious floats, can fly far and wide to deliver medical supplies and air-evac patients who would not survive without modern hospital treatment. Medicine on the Move, based in Ghana, West Africa, depends on its Zenair.

The Grove landing gear on the Kitfox line of aircraft is made from sprung aluminum. It's light, but it can take the beating of off-field landings.

more experienced in working within the system. If you are part of a disaster relief effort, you will definitely be part of a coordinated system that will require the filing of flight plans, use of E-APIS for customs and immigration, and flight reporting. The more you've used the National Airspace System both here and abroad, the better off you'll be.

How to Get Started

If you are participating in an international effort, take the time to contact the EAA and get your letter of Standardization Validation, or you can find it here: *http://lancair.net/lists/lml/Message/53222-09-B/bahamas%20experimental%20validation.pdf.* You'll need this, along with the usual cadre of General Declaration Forms, Customs and Immigration documents and an Inward Cruising Permit if you are continuing on to other islands (downloadable from *www.bahamas.com*). Other Caribbean islands have similar constraints, as do our Central American neighbors. The Canadians make it slightly easier by eliminating most of the paperwork with the CanPass program.

Can you afford it? Well, that depends on whether you are doing relief flying for a 501 C (3) certified nonprofit. Ask them and they'll tell you. If they have this certification, the U.S. government will allow you to use the true cost of your aircraft on a per-hour basis as a tax deductible donation on your tax return. Include hangar rent, insurance, maintenance and fuel/oil in your calculations. (No, you may not include a fee for your services. That would be commercial compensation.) The result is that you'll get about a 30% discount on your flying, plus the satisfaction of helping people in need. It's a pretty good deal all the way around. ✈

The CompAir 7 (along with other CompAir designs) makes the list of possible relief aircraft because it is built to carry heavy loads from short fields. The piston-powered CompAir 7 is affordable and has great potential for an observation aircraft.

For more information on charity and relief flying, contact Bahamas Habitat at www.bahamashabitat.org. The EAA, NBAA and AOPA all have information regarding networks of relief and mission-based agencies that rely on general aviation aircraft to help move people and supplies during emergencies. Check in with them, too, or look on www.flyingforgood.com for a list of charities that can use help from pilots. Find direct links at www.kitplanes.com.

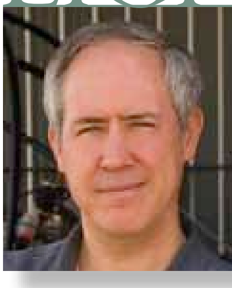
SPORTPLANES™
MARKETPLACE

This section is dedicated to aircraft and accessories for the new Sport Pilot and Light-Sport Aircraft category.

For details on this new rule, go to: http://www.kitplanes.com/sportplanes

Aircraft manufacturers state that these designs meet the required light-sport aircraft specifications and can be operated within the performance limitations of the rule:

E-LSA and S-LSA manufacturers state that they meet the ASTM consensus standards. Aircraft may be available to register as Experimental/Amateur-Built, Experimental Light-Sport (E-LSA) or Special (ready to fly) Light Sport (S-LSA)



Ultralight kits.

Your decision to enter the world of ultralight flying is only the beginning of your adventure. What kind of ultralight are you interested in? Do you want an airplane? How about a powered parachute? Foot-launched or wheeled? Yes, even helicopters and multi-engine models are possible because ultralight regulations won't limit you. But in this month's column, I'd like to focus on a kit-built versus a fully assembled ultralight.

How It Started

When the ultralight movement first began to take flight, pilots spent a lot of time building or modifying hang gliders to fly under power. Before too long, some of these pilots decided to release plans, build kits or focus on specific components such as engines or "redrives" for ultralights. As the sport grew, some people wanted to get into the sky more quickly, rather than spend time on a lengthy build, and so a few manufacturers began building complete aircraft to meet the demand, though many continued to sell kits.

A Manufacturer's Point of View

By definition, a successful company is one that's profitable. Ultralight manufacturers have to build and sell what their customers will buy along with delivering the products to their customers' ramps in a timely manner.

So in an instant-gratification society, why would a manufacturer still offer kits instead of ready-to-fly aircraft? It's tempting to answer the question with one word: cost. After all, producing finished aircraft is more expensive than shipping out boxes of parts and an assembly manual. The better answer to the question, though, is value. As prices go up, the pool of potential buyers diminishes. Pilots on a limited budget are priced out of buying aircraft. Therefore, the existence of ultralight kits is really market driven.

The pilot brings the landing gear for this aircraft. The rest normally comes fully assembled from the factory.

Ultralight trikes are natural choices for former hang-glider pilots.

Fortunately, a lot of pilots enjoy the opportunity to construct their own flying machines. Kit buyers sometimes put more time into building the aircraft than kit manufacturers do in assembling them. That's because a lot of the individual parts can be mass-produced and packaged. Plus, finish work is labor intensive. If you took every hour you spent on your aircraft and multiplied it by $25, you'd get a rough idea of how much money you're saving on labor. That estimate takes into account both the professional's hourly

Roy Beisswenger *is the technical editor for Powered Sport Flying magazine (www.psfmagazine.com) and host of the Powered Sport Flying Radio Show (www.psfradio.com). He is also a Light Sport repairman and gold seal flight instructor for Light Sport Aircraft as well as the United States delegate to CIMA, the committee of the Fédération Aéronautique Internationale (FAI) pertaining to microlight activity around the world.*

Photos: Courtesy Roy Beisswenger

The Bird was one of the first ultralights offered as a kit.

pay rate and the fact that the professional will have the tooling and expertise to do the work a little faster than an amateur builder would be able to.

But that isn't all that a manufacturer saves on. Facility costs for producing complete aircraft can be pretty high. As an airplane is assembled, it begins to take up a lot of space. When you include room for painting and the fact that, ideally, a manufacturer is building more than one aircraft at a time, you can see that factory space requirements add up quickly. If the final assembly area is your garage or hangar, that is space the manufacturer doesn't have to buy or rent.

Another factor is liability. It's impossible to completely avoid liability risks in our litigious society, but when the pilot does the final assembly, liability is shared.

Shipping a fully built aircraft requires special care and is expensive. Yes, many have wings that fold back. Some, like trikes and powered parachutes, have wings that can be shipped in tubes or bags. However, even those designs have fuselages that are relatively large, fragile, and mostly (by volume at least), air. By producing kits instead of fully built aircraft, long-distance shipping costs are minimized—a direct savings for the customer.

Why Aren't All Ultralights Delivered as Kits?

With all of the advantages of kits, why would a manufacturer bother to build a complete aircraft for a customer? Again, market demand. There are many people who want to fly low and slow, but just don't have the ability, or the shop space, or the time or maybe even the desire to build an ultralight. Luckily, all of those hurdles can be overcome with money. Ask almost any ultralight kit manufacturing company, and it will provide you with a completely built aircraft. And, if not, the company can usually refer you to a dealer or hobby builder who will happily take on the project.

But there are some ultralights that don't come as kits at all, and there are also reasons for that. Some ultralights are just too simple to provide as kits. Almost all powered paragliders fall into that category. The frame, motor and prop guard are easily assembled at the factory, and some models are actually meant to be able to be broken down even smaller for storage. No matter how many pieces they are delivered in, it is hard to consider them a "kit" in the classic sense.

Powered parachutes have changed dramatically due to Light Sport Aircraft rules. Ten years ago or so, the bulk of powered parachutes were shipped from the factory as kits to be assembled by the pilot or the dealer selling the kit. That was the policy for both single- and two-place aircraft because the two-place machines were considered ultralight trainers with the same lack of requirements for aircraft certification as their single-seat siblings. The advent of Sport Pilot rules changed how powered parachute manufacturers were allowed to build their two-place products. Now most of the machines are built at the factory despite the regulatory option for manufacturers to supply Experimental Light Sport Aircraft (ELSA) kits for homebuilding. This, in turn, has led to a different way of doing business because it is now actually easier for powered parachute factories to turn out completely built machines than it is to produce kits.

When producing kits, manufacturers must produce solid documentation on how to assemble that kit. If the documentation is poor (or even if it's good), manufacturers end up fielding questions from inexperienced owner/builders trying to assemble the product. And the entire airframe is now generally powder-coated and finished, so shipping a powered parachute kit has become a challenge. Structural parts must be individually wrapped to protect the finish during shipping. Each piece of hardware must be checked and double-checked before it leaves the factory. Because multiple versions of single-seat ultralight aircraft are rare compared to two-seat versions, it doesn't warrant the effort to supply kits.

Ultimately, when choosing an ultralight, the best approach is first to decide what kind of aircraft you want to fly, and then to explore the different models out there. If kits are available, they can certainly lower the purchase price. But if a kit is not your thing, there are plenty of people who would enjoy the opportunity to build your ultralight aircraft.

The Kolb Firefly is a kit ultralight with plenty of parts.

Test-flying airplanes: the reality.

Most pilots who are true aviation enthusiasts probably harbor at least a little bit of Walter Mitty inside of them. We all know the image of Experimental test pilots: steely-eyed fighter pilots who have defeated their human enemies and moved on to fighting the foes of technology and aerodynamics. Laughing in the face of danger, they thread the needle through the razor-thin limits of what is possible, finding and pushing the edges of the envelope where structure and control meet airflow and thermal limits. They know how to pull the airplane back from that precarious point just beyond the edge, and report back with critical insight on how to improve performance and take the next step in speed or altitude. They are, in a word, cool! Experimental test-flying has to be the ultimate when it comes to daring in the sky, and we all like to think, as we slip into our newly built planes for the very first time, that we know something of what it is like to be a part of that world.

The Great Not-So-Unknown

The truth, however, is a bit more grounded. Unless you are flying a brand-new design, something one-off and radically different from what has flown before, you probably have a good idea of what you are going to experience when you first leave the ground. Plansbuilt aircraft with many copies already finished, replicas of certified airplanes that have been flying for decades, and kit aircraft whose numbers can be counted in the thousands—nowadays these make up the majority of Experimental/Amateur-Built airplanes being flown for the first time. With earlier versions flying off of fields around the globe, the biggest question, "Will it fly?" has already been answered. Yes, it will, as long as it was built to good standards, and without radical changes to the design. The next question, "Can the pilot fly it?" has yet to be answered with certainty. But in general, with conscientious preparation, the answer is usually yes.

Early test-flying was for lone pilots, but as it developed into a science, it became more collaborative. Here, Neil Armstrong talks with the team after an X-15 flight.

So what is Phase I test-flying really like? Unfortunately, for many people Phase I consists of boring holes in the sky while watching the hours build on the recording tachometer. A minimum of 25 or 40 hours must pass before pilots can fly their new planes out of the test area with a passenger, though there are also those who, shall we say, bend those rules a bit. Phase I for these folks is passing time, consulting someone else's manual for speeds and operating limitations, while claiming to have tested the airplane throughout its envelope—even testifying to such with their signature in the logbook. This is not only against the letter of the law, but the spirit as well. And although I disagree with this approach on ethical and professional grounds, part of me understands the urge because Phase I, like many other types of flight-testing, can be just plain boring. Dull, repetitive and mind-numbingly boring.

A Day in the Life

Take, for example, the following exciting tale of Experimental test-flying. I do a lot of software testing for avionics and instrumentation companies, and this involves taking data to try and improve software gains and constants for autopilot control. As much as the code-slingers would like to believe that they can write a good set of control laws while sipping Diet Coke at their computers, the truth is that you simply have to go out and fly the stuff across a broad range of data points to see how it actually responds.

Paul Dye *is an aeronautical engineer, commercial pilot and avid homebuilder with 30 years of leadership experience in aerospace operations and flight testing. He is also an EAA tech counselor and flight advisor who currently flies an RV-8, which he built, and is working on an RV-3.*

Photos: Paul Dye, Courtesy NASA

Phase I flight testing of a kit aircraft is more about setting software gains and limits than it is about exploring the edge of the envelope.

So here I am, flying along in my RV-8 with a new software load in my No. 1 EFIS (I never update both at the same time), trying out the autopilot control functions. Our goal is to find a set of pitch gains that provide good, positive control of the airplane without getting twitchy and causing the plane to porpoise. Finding the magic numbers for the solo flight condition is not terribly hard (though a bit elusive), but with a passenger in the back seat, the resultant shift in center of gravity (and subsequent relaxed pitch stability) makes the plane decidedly unpleasant when I try to change altitude. Divergent porpoising and altitude overshoots make my palms sweat at the thought of using these laws in the clouds.

I climb to the test area, level off at an even 1000, and set power. Now I dial in a 500-foot altitude change to the preselect window—enough for the climb to steady up before the level-off. Engage. Watch it climb. I note on the kneeboard if there were any oscillations, and how it did in capturing the new altitude. "Pitch Limit Gain (PLG) = 2.5, no oscillations, 80-foot overshoot"—big whoop. I go in to the setup page and increase the PLG to 2.6. Dial in the next 500-foot altitude gain. Repeat. "Pitch Limit gain = 2.6, no oscillations, 70-foot overshoot." And so on, and so on.

Every once in awhile I descend a couple thousand feet and see how it does in a descent as opposed to a climb (and to keep the testing in a reasonably constant density altitude regime). I do this for an hour or so, and then head home and check the kneeboard to see if I can come to a reasonable conclusion about which gain setting is best. Oh, yes, did I mention that there are *dozens* of parameters that could affect the stability and control of the autopilot function? That's a lot of boring (pun intended) holes in the sky, lots of avgas to burn, and not a lot of excitement.

Writing up the test report is mandatory if I want to help the process improve, only to get a note back that reads, "Oh, thank you very much. We just figured out that we were applying the gain in a less than optimum spot in the equations. Here's a new load. Could you go back out and repeat the testing to see how it does?"

It's the Little Things

I have been a part of many test programs in my aviation career, and I can tell you that boring is the norm almost all of the time. Good science and good test engineering mean making small changes, recording your results, and then taking the data back to the desk to see if it makes any sense. Finding the edges of a kit airplane's envelope can be done pretty quickly, and wise builders who know how many of their airplane's type have already flown (and been tested to the edges by the kit's designer), generally stay within the bounds of reasonableness. There is little need to test out beyond the edges, and risk your investment, if not your life.

New, clean sheet designs are different, and that steely gaze might be a bit more appropriate. But ignoring the flight test regime or giving it short shrift because there were thousands flying before you is not the answer. Testing still needs to be done to establish a baseline of data for *your* airplane, and *your* avionics suite. Simple airplanes are easy; there is little to play with. But the trend toward complex avionics, instrumentation and autopilots means slow and steady envelope expansion—not in the aerodynamic sense, but in how well the electronics and software play together. That (as any good software engineer with a few million lines of code can tell you) can be tedious at best.

Ahhh…the exciting life of the test pilot. Few of us will experience that pure adrenaline rush of great speed or have the chance to challenge that magic point where the atmosphere thins to nothingness, and we hang in the balance between the terrestrial orb and the vastness of space. But test-fly we must, even when it is dull. Finding out that you have an unstable point in your speed range on a dark and stormy night while sliding down the ILS in the clouds is not much fun. It's better to poke at those edges during Phase I, or anytime a change to the hardware or software is involved in your aviation pursuits.

Within the ranks of test pilots, the exciting moments are few and far between (some would say thankfully). With the right kind of jacket and a kneeboard full of scrawled flight data, you can still pass at the local watering hole as one of those guys who tests new airplanes. And you don't really have to let on that the toughest part of the flight was staying awake.

Good data collection skills and attention to detail mark the good "production" test pilot.

List of Advertisers

Please tell them you saw their ad in KITPLANES Magazine.

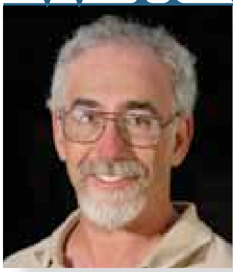
KITPLANES® *interactive makes it quick and easy for you to receive instant information about products or services directly from our advertisers' web site.*

➥ Go to: *www.kitplanes.com/links* for a virtual shopping tour via links to their web sites.

➥ Call the phone numbers listed below and be sure to tell them you saw their ad in KITPLANES Magazine.

Advertiser	page #	telephone
Advanced Flight Systems, Inc.	62	503-263-0037
AeroFlash Signal	57	800-322-2052
Aircraft Spruce & Specialty	21	877-4SPRUCE
Aircraft Spruce & Specialty	CV4	877-4SPRUCE
Aircraft Tool Supply Co.	25	800-248-0638
Dynon Avionics	CV2	425-402-0433
Garmin International	3	913-397-8200
Grand Rapids Technology	11	616-245-7700
Grand Rapids Technology	61	616-245-7700
Ivo Prop	61	800-FOR PROP
Jabiru Pacific	62	See Advertisement
Kitplanes Bookstore	58	800-780-4115
Lancair International	11	541-923-2244
MGL Avionics	61	1-877-8FLYING
Progressive Aerodyne	62	325-253-0108
Sonex Aircraft, LLC	57	920-231-8297
Stewart Systems	21	888-EKO-POLY

Advertiser	page #	telephone
Van's Aircraft	37	503-678-6545
Zenith Aircraft Co.	CV3	407-322-94888
BUILDERS' MARKETPLACE		
Airflow Performance	68	See Advertisement
Datatoys Digital Video Systems	69	800-210-8017
Eric B. Robinson, LTD	69	705-340-2408
Flight Grip	68	800-204-7625
Grove Aircraft	68	888-GEARLEG
INFINITY Aerospace	69	See Advertisement
Innovator Technologies Inc.	69	403-669-3101
Microair Avionics PTY Ltd	69	See Advertisement
Mountain High Equipment	68	800-468-8185
Mustang Aeronautics	69	248-649-6818
Sportsman's Market	68	800-SPORTYS
TCW Technologies	69	610-390-7195
Tormach LLC	69	608-84-8381
Whirlwind Propellers	68	619-562-3725
Ztron Labs, Inc	69	888-740-0917



The STOL equation.

Creating an airplane that can take off or land almost anywhere has intrigued designers since the very early days of flight. True STOL (short takeoff and landing) capability can make an airplane nearly independent of airports. A STOL airplane must be able to both take off and land in a very short distance, as it's not particularly useful to be able to take off from a runway you can't land on in the first place. Even worse is an airplane that can land short, but lacks the takeoff performance to safely depart the same field.

Short Takeoff

A takeoff consists of two segments: the ground roll and the initial climb over an obstacle.

Ground roll: During the ground roll, the airplane must accelerate from a complete stop to liftoff speed. The length of the roll depends on two factors: liftoff speed and the acceleration the airplane can achieve. To minimize the length of the takeoff roll we must maximize acceleration and minimize liftoff speed.

Acceleration: The distance required to get to liftoff speed is inversely proportional to the acceleration the airplane can achieve. Double the acceleration, and you halve the takeoff roll. Acceleration is determined by the mass of the airplane and the excess thrust available, which is the amount of thrust available over and above that required to overcome aerodynamic drag and rolling friction. Lots of power helps. A high power-to-weight ratio is one key to short takeoff.

The prop is the other piece of the equation. The prop converts the shaft horsepower of the engine to thrust. For a given horsepower, a large-diameter, low-pitch prop will generate more thrust at low airspeed than a smaller diameter prop with higher pitch. A good example of the high-diameter, low-pitch approach is the combination of prop speed reduction units and props used on modern ultralights. Ultralights also show us why it's not so simple for airplanes that have to go anywhere after takeoff. Having a fixed-pitch prop optimized for low-speed acceleration is like being stuck in first gear. The initial acceleration is great, but the prop will severely limit top speed. In cruise, the airplane needs a prop with more pitch to absorb the power of the engine at the higher airspeed without over-revving.

If the cruise performance of a pure takeoff-optimized fixed-pitch prop is unacceptable, the designer has two choices. The first is to use a compromise fixed-pitch prop that has more pitch than is optimum for takeoff and try to get an acceptable balance between takeoff acceleration and cruise. The second option is to make the inevitable "money for performance" trade and use a variable-pitch or constant-speed propeller.

Liftoff speed: The takeoff roll is proportional to liftoff speed squared. Double the liftoff speed, and you quadruple takeoff roll. Cut liftoff speed in half, and you cut one quarter of the distance. To get an idea of how powerful this squared function is, consider an airplane that lifts off at 60 knots, and has a 1000-foot takeoff roll. Reducing liftoff speed to 50 knots reduces the takeoff roll to 695 feet. If liftoff speed were 40 knots, the roll would be 444 feet, or less than half of that required to get to 60.

This speed-squared effect is the reason that ultralights, and similar very low wing loading planes can take off in such short distances. Even though the acceleration generated by their propulsion system may be unremarkable, they don't have to get going very fast to take off.

To fly away safely, the plane must have a reasonable margin above stall speed at liftoff. Minimum liftoff speed is determined by stall speed, which is a function of the wing loading of the airplane and the maximum lift coefficient of the wing.

Low wing loading is the simple way to minimize stall and liftoff speed. Early airplanes were all STOL. They had to be because there were no airports. Airfields were small grassy fields with no defined runways. The fighter designers of the time tended to prize maneuverability over speed. Early airliners followed essentially the same design philosophy. The British Handley Page H.P.42 Hannibal and the American Curtiss Condor biplane airliners both were capable of very short takeoff and landing, but were so slow that it was almost faster to take a train. Modern ultralights are another example of the "lots of wing" approach to STOL.

Low wing loading keeps stall speeds down but also keeps cruise performance low and hurts ride quality in turbulence. To increase wing loading to improve up-and-away performance, we must increase the maximum lift coefficient of the wing. This is the job of the high lift system. Using effective flaps and, if necessary, leading-edge slats or other devices,

Barnaby Wainfan *is a principal aerodynamics engineer for Northrop Grumman's Advanced Design organization. A private pilot with single engine and glider ratings, Barnaby has been involved in the design of unconventional airplanes including canards, joined wings, flying wings and some too strange to fall into any known category.*

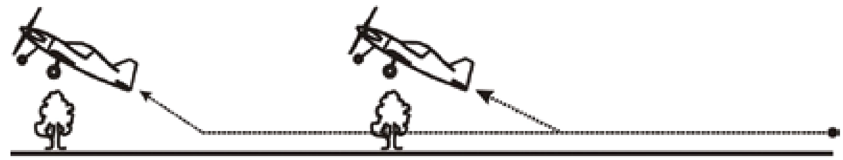
the designer can greatly increase the maximum lift available from each square foot of wing. This reduces stall speed or allows the wing loading to increase at constant stall speed. The higher the wing loading, the more sophisticated a high lift system will be required.

Climb: The critical distance for a takeoff is the total distance from the starting point required to lift off and clear an obstacle. For a STOL airplane, a safely positive rate of climb is not enough. Small landing sites are often surrounded by large trees. The need to clear obstacles means that climb angle is more important than climb rate for the first 50 to 100 feet of climb. The goal is not to gain altitude in minimum time, but in minimum distance traveled over the ground.

The majority of a plane's drag at liftoff speeds is induced drag. Induced drag is inversely proportional to airspeed squared, so slowing an airplane dramatically increases drag. A 10% reduction in airspeed increases induced drag 20%. This is even more important for STOL airplanes. If an effective high lift system allows a low-speed liftoff, the airplane will be on the back side of the power curve when it breaks ground. The induced drag will be high, and the airplane will need a lot of power to climb away successfully.

The climb power problem is acute if the airplane has a relatively small wing and is depending on powerful flaps and possibly leading-edge devices to get high lift. Powerful flaps are effective at increasing maximum lift, but they also generate parasite drag. The smaller wing means that the airplane will have a higher span loading, which increases induced drag. Increasing aspect ratio to keep the span loading down with a smaller wing area can help alleviate this problem, but at the cost of increased wing weight.

Once again, the designer faces a compromise. A low wing loading and large wingspan configuration can get the desired steep, slow climb but hurt cruise performance. Increasing wing loading and adding a high lift system makes more power and possibly a constant-speed prop necessary for enough power to climb. In the process, cruise performance is significantly improved.



The length of the takeoff roll is proportional to the liftoff speed squared. A relatively small reduction in liftoff speed can significantly reduce ground roll.

Short Landing

Like the takeoff, the landing maneuver has two segments: the final approach over the obstacle and the ground roll after touchdown. The keys to achieving the short landing part of STOL are slow approach speed and the ability to fly a steep approach. While a big engine and lots of thrust can haul an airplane out of a short field, landing is almost completely dependent on the performance of the wing and high lift system.

Approach: During final approach the plane must clear an obstacle and then descend to the ground. For a STOL mission, the final approach should be both slow and steep. The steep approach is needed because small landing spots are most often surrounded by large obstacles such as trees. As with takeoff, the goal is to minimize the total distance from the obstacle to the point where the airplane comes to rest on the ground. It does little good to be able to stop short after touchdown if you need a long clear area for your approach, and flying through the trees is not recommended.

To approach steeply the plane must have a lot of drag in its final approach configuration. This is needed for two reasons. First, the slope of the final approach is controlled by the lift-to-drag ratio of the airplane. If L/D is high, the approach will be shallow, so a low L/D is needed. Lift must equal weight, so the only way to reduce L/D is to add drag. High drag is also desirable in the flare to keep the airplane from floating. As the airplane enters ground effect the induced drag drops, and the airplane will tend to float. A low-drag airplane can cover a lot of ground sitting in ground effect a few feet above the ground during the flare. Some extra drag to slow the airplane when the nose is raised to flare is desirable.

The primary source of extra drag to steepen the approach slope is the flaps. Most of the stall speed reduction from flaps comes from the first 20° to 30° of deflection. Greater deflections are used primarily to add drag to get a steeper approach. High-drag flaps are good for landing approach, but can be a problem in a go-around. During a missed approach, the engine must have enough power to arrest the descent, and then establish a positive rate of climb starting with the airplane in the approach configuration at approach airspeed. For lower-powered airplanes this can be a problem, as the engine must overcome the extra drag of the flaps and accelerate the plane to an efficient climb speed.

Another good source of drag for steep approaches is a set of spoilers, which has two advantages. First, spoilers can be retracted quickly to clean up the airplane for a go-around. Second, they can be deployed fully on the ground to dump lift after touch-down to aid braking.

Ground roll: After the airplane touches down, it must stop. For short landings, a slow touchdown speed is a must because the amount of braking force available to stop the airplane after touchdown is limited. Also, the same speed-squared effect is present on braking as it is during the takeoff acceleration. The distance required to stop varies as the square of the touchdown speed.

The braking force available is directly proportional to the amount of weight on the wheels. After touchdown, it is desirable to transfer load from the wings to the wheels quickly. Landings with little or no flare help to accomplish this. Rapid retraction of the flaps after touchdown also helps. ✈

Illustration: Barnaby Wainfan

The ultimate passive GPS antenna.

My July 2011 column ("Gee, a PS antenna.") generated several questions from readers. All of them revolved around why the antenna increased the signal strength of some satellites and decreased it on others.

The more I thought about it, the more I came to the conclusion that because satellites were slowly changing their orientation (how their antennas were pointed), the linear polarization of our little spike ground plane wasn't capable of doing justice to the circular polarization of the GPS satellite constellation.

Without going deeply into J. C. Maxwell's (1831-1879) equations for radio wave propagation, let's just say that a single-element antenna like the spike ground plane can be oriented with the spike vertical (vertical polarization) or the spike horizontal (horizontal polarization).

To receive circular polarization, in which the vertical and horizontal components are rotating at the frequency of the transmitter signal, we need something more than simple linear polarization. Therefore, the GPS signal transmitted from the satellite at 1575.42 MHz spins more than 1575 million times a second.

We've known for a few dozen years that a "turnstile" antenna (so named because it looks similar to a stadium or subway turnstile) could easily be made to receive or transmit circularly polarized radio waves. A fellow by the name of M. W. Maxwell showed us how to make a turnstile relatively simply ("Reflections—Transmission Lines and Antennas," M. Walter Maxwell, ARRL Publishers, January 1994).

Then Zack Lau showed us a tricky way of making an elegant match to the turnstile down at 30 MHz in the article "A Simple 10-Meter Satellite Turnstile Antenna (RF)" in *QEX Magazine*, November/December 2001. Finally, Mark Kesauer adapted Zack's techniques to a GPS antenna for APRS work ("An Inexpensive External GPS Antenna," *QST Magazine*, October 2002).

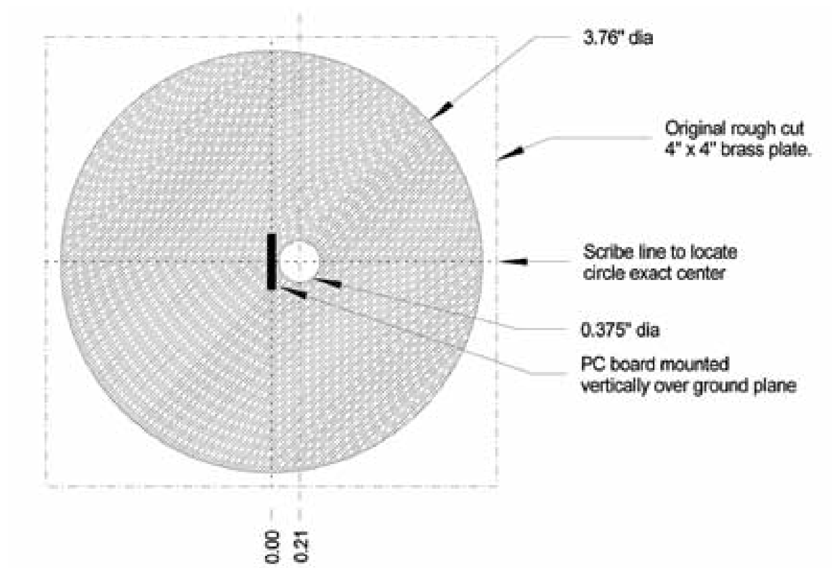


Figure 1. The material used is 4x4-inch brass or copper plate; thickness is not a factor. The prototype uses a 5-mil brass shim for ease of cutting and weight reduction. No finish is required.

The Micro View

This article will build on those works with some improvements in construction and ease of assembly, and with help from a computer article that calculates "microstrip" construction.

Just like coaxial cable, microstrip is a form of transmission line. We say the RG-58 is "50 ohm cable." This impedance is a function of the ratio of the outer sheath to the center conductor diameter. Similarly, microstrip impedance is a function of the width of the strip and the thickness of the insulator between the microstrip and its ground plane. (See Figure 1.) The actual microstrip matching section is 0.11 wide and is separated from the ground plane by a sheet of 0.062 fiberglass. This is a small piece of standard double-sided, printed, circuit board material.

Jim Weir

began acquiring Aero'Lectrics expertise in 1959, fixing Narco Superhomers in exchange for flight hours. A commercial pilot, CFI and A&P/IA, he has owned and restored four single-engine Cessnas. He is chief avioniker at RST Engineering and teaches electronics at Sierra College. He'll answer questions at www.pilotsofamerica.com - maintenance. Check out www.rst-engr.com/kitplanes for previous articles and supplements. Gail Allinson is technical advisor.

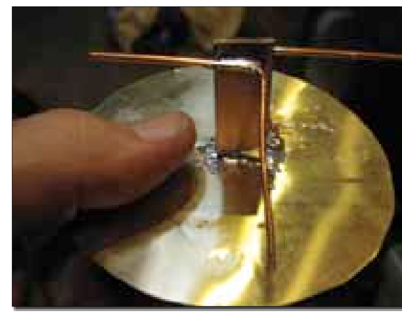
Marking the exact center of the brass ground plane.

Carefully cutting the ground plane with kitchen shears.

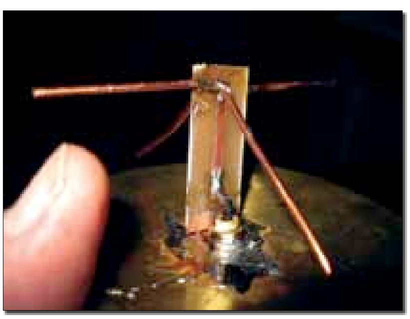
Using a compass to mark a perfect circle.

A perfectly circular ground plane.

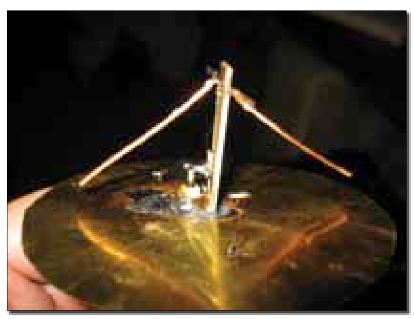
Scribing the pc board on the microstrip side of the board.



The antenna on the ground side of the microstrip.



The second antenna wire on the microstrip side.



The antenna element is bent at a 45° starting point.

Horizontal dipoles on both sides of the antenna mount.

These widths make a microstrip with a characteristic impedance of 50 ohms and the length of 1.03 inches is a quarter wave on pc board material. A quarter wave is 90 electrical degrees, so we have a 50 ohm microstrip feeding two antenna elements 90° out of phase. Maxwell says that this configuration will give us circular polarization.

Building It

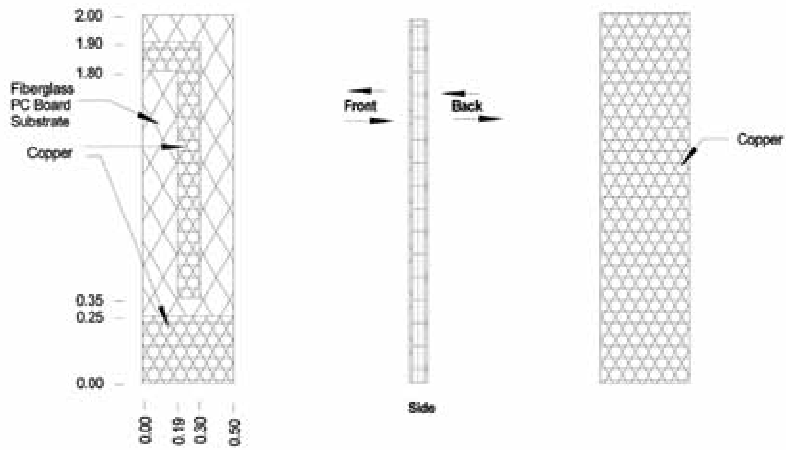
Enough theory, let's get to the construction. I used 5-mil brass for the circular ground plane for several reasons. First, it's very light, and can be cut with kitchen scissors. A 0.375-inch diameter hole is punched slightly off-center to allow a standard BNC chassis mount connector to be soldered directly to the ground plane.

One side of the pc board is laid out with a hobby knife, cutting the copper foil down to the fiberglass substrate. This allows just the unwanted copper to be removed while leaving the copper that will form the microstrip intact. Note that the little dogleg on the top of the copper microstrip line has no electrical function. It is strictly there for mechanical fastening of the dipole wire.

The unwanted copper foil on the microstrip side of the pc board can be removed by applying a soldering iron to one corner of the copper and then slowly peeling it away from the fiberglass pc board material. (The adhesive holding

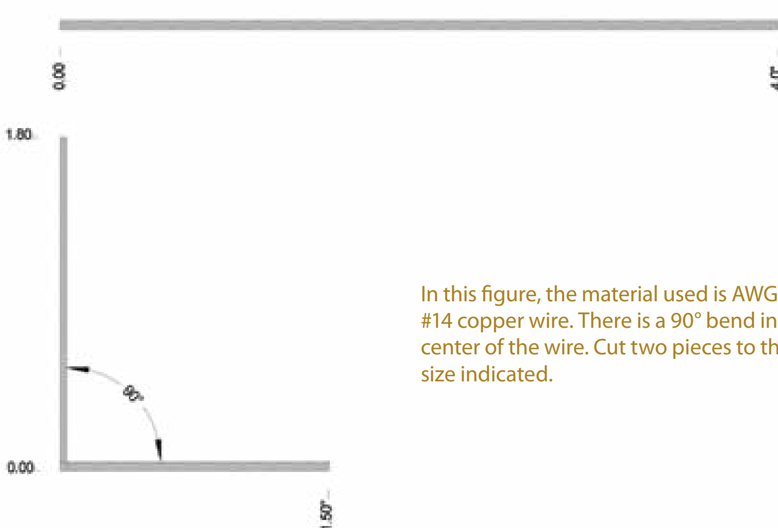
GPS Satellite #	Bars on Garmin	Bars on Turnstile	Difference (T-G)
5	0	1	1
7	2.5	4	1.5
8	5	5	0
11	2	2	0
15	4	5	1
17	4.5	5	0.5
19	0	1	1
24	0	2	2
26	5	5	0
28	5	5	0
48	4	4	0
51	5	5	0
Total			+7

Photos: Jim Weir



This figure calls for 0.062-inch thick FR-4 pc board stock (1 ounce [1.3mm] copper on both sides).

The antenna pattern range at Sierra College. The rock on the ground plane provides extra stability.



In this figure, the material used is AWG #14 copper wire. There is a 90° bend in the center of the wire. Cut two pieces to the size indicated.

The author's Sierra College class tests the GPS experiment. With 24 "saltwater sacks" standing around watching, the GPS may not have been receiving as good a signal as it could.

the copper to the fiberglass is heat *resistant*, not heat *proof*.) A soldering iron will melt the adhesive enough to allow a hobby knife to pry up the corner. Long-nose pliers can then be used to pull the copper from the board.

The antenna elements themselves are AWG #14 copper wire, available from the Romex Airplane Wire Store. Cut them roughly 4 inches long and then trim them to the dimensions in the drawing. The shorter of the wire lengths (1.5 inches) become the horizontal elements and the longer (1.8 inches) become the bent-down elements. Start with the bent-down elements 45° from the vertical, then tweak them until you achieve the best reception of all the satellites in range.

Does It Work?

It works very well indeed. Comparing it to the little "rubber duckie" that comes with the Garmin 295, all satellites were well above the signal strength using the turnstile, and three satellites that weren't even received were half-scale using the turnstile.

Is it pretty? Nope. Most prototypes are not pretty. They are constructed to demonstrate proof of concept, and are then made pretty. But it works.

What if you want to use this as a home outdoor antenna and need a radome? This configuration will fit perfectly into a plastic cream cheese or cottage cheese container.

So where do we go from here? In future issues we are going to learn about the FAA database site, recent developments in LED technology, and take a foray into free programs that will let you document your homebuilt project. Until then, stay tuned. ✈

Aircraft Design

ENGINEERING Services, aircraft modification and repair design, aircraft design, structural analysis, drawings, manuals, etc. Certified or experimental aircraft. Contact: **613-795-7959, info@othmanaviation.com**

Aircraft for Sale: Kits

BEARHAWK AIRCRAFT KITS

4-place & 2-place STOL
Easy ground handling • Big guys fit fine
QB kits and subcomponents available.

BEARHAWK AIRCRAFT
Toll Free: 877-528-4776
www.bearhawkaircraft.com

SOUTH LAKELAND SPORT AVIATION **SPORT PILOT TRAINING CENTER** home of the **RV-9 ELSA**, located at X49, 4 1/2 miles SW of Sun 'n Fun. Sport Pilot training in **RANS S6ES** and **S12XL**. Taking deposits for RANS **S-19 ELSA** kits. Builder assist and **DAR** available (airplane, trike and powered parachutes). Jay Kurtz, Lakeland, FL **863-701-0000, www.liteplane.com liteplane@bigfoot.com**

TANGO 2: AFFORDABLE EFFICIENCY

210 mph cruise, 63 stall. Up to 2,100 s.m. range.
160/210 hp. 800 lbs load. Grass strip capable.
Complete composite, fast-build kit. $29,750!

TEAM TANGO
1990 SW 19th Ave, Williston, FL 32696
Ph: 352-528-0982 • www.teamtango.com

AIRCRAFT DIRECTORY ONLINE — the most up-to-date, comprehensive database of over 700 designs including: kits, plans, rotorcraft, 'chutes, and trikes. Instant information in an easy to use searchable format with photos, design specs and e-mail and web links. **www.kitplanes.com/aircraftdirectory**. For a printed edition, call **800-622-1065** and order the most recent Dec., Jan. & Feb. back issues.

MURPHY REBEL kits, only $24,739 CAD. See this rugged, roomy, aluminum STOL at Brampton, ON. A great LSA with a R-912. **Bob Patterson, 9-9, 7 days 905-457-5238.**

BD-MICRO TECHNOLOGIES, INC. The BD-5 People. FLIGHTLINE Series, enhanced BD-5 kits - complete & predrilled for quick assembly. BD-5J Microjet, BD-5T Turboprop, BD-5B. 68-page info/catalog: $20 US, $25 Intn'l. **www.bd-micro.com; 541-444-1343.**

Aircraft for Sale: Projects

MIDGET MUSTANG. All metal Lycoming engine. New gas tank, fuel pump, carburetor. Has log book, 75% restored. $10,000 OBO. **707-263-3562.**

Aircraft Parts/Services

DISC BRAKES, WHEELS, TIRES. Chromoly Axles for Challenger, Pulsar, Sonex! **Tracy O'Brien Aircraft Specialties, Ph: 360-748-4089. www.tracyobrien.com Email: tracy@localaccess.com**

SPARS, STREAMLINE STRUTS, RIBS

6061T6 - EXTRUDED - CERTIFIED ANALYSIS
SPARS - *6 sections - 3" to 6 5/8"*
STRUTS - *Large, Small, Heavy Duty, Jury*
RIBS - *Stc'd, Experimental, Custom*
Write/Call for free info:
CARLSON AIRCRAFT INC.
330-426-3934 • carlsonaircraft@att.net
www.carlsonaircraft.com

WINDSHIELDS — WINDOWS — CANOPIES for experimental and certified aircraft. Custom jobs welcome. Half-price replacement warranty covers damage during installation for six months after purchase. **AIRPLANE PLASTICS, 9785 Julie Ct., Tipp City, OH 45371. 937-669-2677.** Fax: **937-669-2777.**

AFFORDABLE LED LIGHT SYSTEMS

TWO Strobe with LED Position Light System, complete $388. Meets FAA Requirements. LED Landing Light, Current draw 1.3A at 14 volts $234. And much more!

KUNTZLEMAN ELECTRONICS, Inc.
Phone: 610-326-9068 or www.KEstrobes.com

BELLCRANK BEARINGS MS20218-1 & 2, BCP4W10, BC4W10, & BC5W11 NEW and TRACEABLE. **E-mail: romamach@aol.com; www.romamachine.com.** Aircraft bearings in stock. Call for quote **815-325-8894**. Mention KP1 in all correspondence.

WIRING Solutions LLC. Integrated wiring and avionics systems for aircraft. Extensive experience on experimentals. Professional personal services available. **WiringSolutionsLLC.com 541-633-5778.**

Throw Out Your Phillips Head Screws Replace Them with Torx ® equivalent 100 degree flat head machine screws 4-40x1/2, 6-32x1/2, 8-32x5/8, 10-32x3/4. Also many sizes of hex socket cap screws, stainless and alloy. Order online at **www.microfasteners.com**. Call **1-800-892-6917** or email **info@microfasteners.com** for free catalog.

TODD'S CANOPIES — Supplier of canopies and windows for kit and plans built aircraft. Custom jobs welcome. **954-579-0874**. Website: **www.toddscanopies.com**

Aircraft Plans

"OSPREY 2" AMPHIBIAN!

2-Place, all wood, 12 sec. water take-off, full builder support, Oshkosh award winner. Info Pak $14 ($17 overseas), Plans $250 ($290 overseas).

OSPREY AIRCRAFT

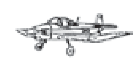
3741 El Ricon Way, Sacramento, CA 95864
Email: gp-4@juno.com

BEARHAWK Patrol Plans. 2-place tandem high wing, tail wheel type, 115-200 hp STOL. Kits available. Plans $280 PP. **R&B Aircraft, 2079 Breckinridge Mill Rd. Fincastle, VA 24090. 540-473-3661**.

11 WOODEN designs, single & 2-seaters, s.b.s. & tandem, fixed & retract. gear. Color catalog $25 USD. **Sylvia Littner, 432 Hamel, St. Eustache, Quebec, J7P-4M3 Canada.** Ph: **450-974-7001** Email: **slittner@videotron.ca**

SONERAI SERIES of Sport Aircraft. Sonerai I, midwing, single place, Sonerai II Original tandem midwing or low wing, Sonerai II Stretch tandem low wing. 4130 steel fuselage, fabric covering, all aluminum foldable or removable wings. Rugged aluminum landing gear. Powered by dependable, inexpensive VW based power plant. Plans built with many pre-fab parts available. Video/DVD and Info Pack $14.95. Plans $124.95 plus freight. **Great Plains Aircraft, 7011 N 160 Ave., Bennington, NE 68007. www.sonerai.com 402-493-6507**.

PLANS - KITS - PARTS



F11 Sporty

Flying Flea

and 10 other all wood designs

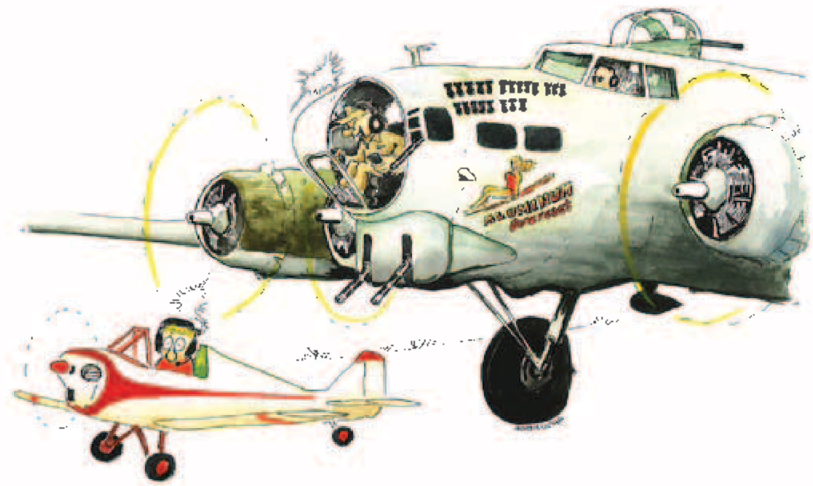
Info Packs $10/ea + $3 Postage
HIPEC Covering System - no ribstitching, no taping.
Lo cost — Lo labor — proven

www.falconaravia.com

Email: sales@falconaravia.com
FALCONAR AVIA INC. Ph: 780-465-2024

AIRCRAFT DIRECTORY ONLINE — the most up-to-date, comprehensive database of over 700 designs including: kits, plans, rotorcraft, 'chutes, and trikes. Instant information in an easy to use searchable format with photos, design specs and e-mail and web links. **www.kitplanes.com/aircraftdirectory**. For a printed edition, call **800-622-1065** and order the most recent Dec., Jan. & Feb. back issues.

EASY Eagle 1 LSA optional Bi-Plane. An affordable single place VW powered fun aircraft. Plans built for $10,000 or less. Many pre-fab parts available. Plans $65.00 plus shipping, includes wing construction DVD. www.easyeagle1.com. Info pack $4.00. **Great Plains Aircraft, 7011 N 160 Avenue, Bennington, NE 68007. 402-493-6507.**



"LINCOLN GROUND, THIS IS 'OVERCAST,' REQUEST PERMISSION TO TEST GUNS!"

Aircraft Wanted

PROJECTS/PARTS needed by Cornerstone Ministry (501c3 non-profit Christian foundation), teaching the Bible and serving since 1968. We pick up and p rovide all documentation. Your donation is deeply appreciated. **800-633-4369. planekit@aol.com http://www.donateyourplane.com**

Avionics, Instruments

T-30 ELECTRONIC TACHOMETER

T-30
$169

• Monitors Both Left and Right Ignition Systems
• Works with Magnetos and Electronic Ignition
• Engine Hour Meter Saves "Tach Time" or Actual Time
• Automatic Flight Timer

FLIGHT DATA SYSTEMS
Ph: 831-325-3131 • www.fdatasystems.com

Books and Manuals

NEW! Practical Stress Analysis for Design Engineers — Deluxe hardbound edition, 474 illustrations and drawings, 685 pages. Solutions based on "real" aircraft structure. A simplified, easy-to-understand reference book — contains no complex mathematics. Aircraft designers and experimenters can master the principles and fundamentals of stress analysis. Price $98. Satisfaction Guaranteed. **Lake City Publishing Company, Tel: 208-772-7721, www.psa1.com**

LIGHT AIRPLANE CONSTRUCTION FOR THE AMATEUR BUILDER. Molds, tools, jigs, 311 illustrations, 92 pgs., $60. **LIGHT AIRPLANE DESIGN.** Statistics, weights, simple calculations, 61 illustrations, 80 pgs., $65. **LANDING GEAR DESIGN FOR LIGHT AIRCRAFT.** 245 pgs., 463 illustrations, $85. **PL-4A CONSTRUCTION MANUAL $60; PL-4A EXPLODED VIEWS $50**. Books: mail/ins. USA $7, foreign $24. Pazmany PL-9 Video: $30, mail: US $5, foreign $18. **PAZMANY AIRCRAFT CORPORATION, PO Box 60577, San Diego, CA 92166. www.pazmany.com** Email: **info@pazmany.com** Phone: **619-224-7330 Fax: 619-224-7358.**

How to Cool Your Wankel by Paul Lamar. Help with your Mazda rotary installation. Color, 90 pages, 8.5 by 11. **rotaryeng@earthlink.net**

NEW - COMPOSITE TECHNIQUES

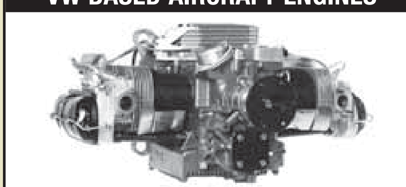
Two new books for the homebuilder by Zeke Smith: One, is a new edition for the beginner; the second book applies the technology to real structures.

FOR THE DETAILED STORY ON BOTH, SEE
www.aeronautpress.com

Engines, Parts, Services

REVMASTER ENGINES FOR SPORT AIRCRAFT. Proven reliability since 1968. Complete units 75-120 HP, Die cast Rev-Flow injector carb 30-42mm. Engine parts available. **REVMASTER AVIATION 760-244-3074, www.revmasteraviation.com**

VW BASED AIRCRAFT ENGINES



VW Type 1 Based Engines from 1600cc to 2276cc. 50 to 103 hp. Direct, Reduction, and Flywheel Drive. Assembled engines, kits, and engine parts.

GREAT PLAINS AIRCRAFT
7011 N 160 Avenue, Bennington, NE 68007
402-493-6507 • www.GPASC.com

GEO/SUZUKI Reduction Drives/Engines, 60-115 HP. **Manual** 3 Cyl $49.95, 4 Cyl $99.95 + $8 s/h. **Raven ReDrives Inc., 1025 Rosewood St., #100, Boulder, CO 80304**. Ph: **303-440-6234. www.raven-rotor.com**

LIGHT Sport Aircraft Engines by WWW.VIKINGAIRCRAFTENGINES.COM 110 hp-Honda Based Engines for **RV-12 - Sonex - Zenith - JustAircraft and Others.** Info@Vikingaircraftengines.com 386-566-2616.

KAWASAKI PACKAGE—SAVE 50% on engine, re-drive, carb, & exhaust. 0-time-64 lbs-40 hp J-Bird, **262-626-2611**.

HIRTH AIRCRAFT ENGINES

15 thru 110 hp. 1000 hour rated TBO. One year warranty. Sales, service, and parts. Highest power to weight ratio in the industry. BlueMax 2-cycle aviation oil. Contact:

RECREATIONAL POWER ENGINEERING
5479 East County Rd. 38, Tiffin, Ohio 44883
Tel: 800-583-3306 • Fax: 419-585-6004.
Visit us on the web at www.recpower.com

ENGINES STARTING AT $200-GUARANTEED. Kawasaki, Rotax, Hirth, and most other brands. BEST reduction drives, carburetors, and exhausts. Top-notch service from our friendly staff. **J-Bird, 210 Main St., Kewaskum, WI 53040, 262-626-2611.**

4-STROKE HEXADYNE 60 H.P.

Only 94lbs! Fuel Injected, Electronic Ignition, Purpose Built for Aircraft, 68HP Max, .8 Liter Displ., 1200 Hr. TBO, Made in U.S.A., Immediate Shipment, $8,800.00.

HEXADYNE AVIATION DIVISION
1998 N. Redwood Road, Salt Lake City, UT 84116
Ph. 801-363-8010 • Fax 801-363-8030
sales@hexatronengineering.com

Homebuilders Supplies

AIRCRAFT DIRECTORY ONLINE — the most up-to-date, comprehensive database of over 700 designs including: kits, plans, rotorcraft, 'chutes, and trikes. Instant information in an easy to use searchable format with photos, design specs and e-mail and web links. **www.kitplanes.com/aircraftdirectory**. For a printed edition, call **800-622-1065** and order the most recent Dec., Jan. & Feb. back issues.

AIRFOILS plotted to your size. Homebuilders. Model builders. Chord lengths to seven feet. Inquiries: **www.airfoils2size.com, tepcad@frontier.com**

TERMINALTOWN–Wiring supplies: mil-spec terminals, tefzel wire, crimpers, heat shrink, fuse blocks & cable ties. Terminal, connector and fuse block kits. Online catalog–secure ordering. **www.terminaltown.com**

Light Sport Aircraft

CHALLENGER LIGHT SPORT AIRCRAFT. See our website at **www.quadcitychallenger.com** or call the Challenger factory at **309-764-3515** for DVD, info, prices, options, and order forms.

Light Sport Aircraft Engines by WWW.VIKINGAIRCRAFTENGINES.COM 110 hp-Honda Based Engines for **RV-12 - Sonex - Zenith - JustAircraft and Others.**

Info@Vikingaircraftengines.com 386-566-2616.

Miscellaneous

ZENAIR FLOATS - EIGHT SIZES!

Kits or factory assembled.
750 to 2500 lbs MTOM, straight or amphibious, starting at $2,450.00. Aluminum, light, tough, excellent performances.

WWW.ZENAIRFLOATS.COM
or 705-526-2871

NO FAA REGULATIONS!

Build a **boat** using proven plans, full-size patterns & kits. Send $9.95 for Catalog of 300 boats for power, sail & row, includes **FREE** dinghy plans.

GLEN-L
9152 Rosecrans Ave/KB, Bellflower, CA 90706
Toll Free: 888-700-5007 • www.PlansForBoat.com

HELP WITH YOUR HOMEBUILT

Nothing beats watching over someone's shoulder to learn! How-to DVDs: Electrical Wiring, Metalworking, Glass Panels, Scratch Building. Video catelog available for sample previews. Order online!

HomebuiltHELP.com
9186 County K, Brussels, WI 54204
email: help@HomebuiltHELP.com
www.HomebuiltHELP.com

OWN YOUR OWN HANGAR

Hangars—All sizes available!
Direct from the Manufacturer—Save Thousands!
Starting as low as $7,467.

WORLDWIDE STEEL BUILDING
800-825-0316
www.wsbhanger.com • wbott@hrtmfg.com

Propellers, Services

SENSENICH PROPELLERS

Aluminum, Composite and Wood Propellers for Continental, Lycoming, Rotax 912+, Jabiru, VW & most others. Competitive prices. 65+ years of quality and experience.

SENSENICH PROPELLER
2008 Wood Court, Plant City, FL 33563
Ph: 813-752-3711 • www.sensenich.com

SABER MANUFACTURING - World's largest manufacturer of the highest quality **Prop Extensions**, crush plates, solid spacers, and stainless steel replacement lugs. Your source for extended thread prop bolts. Worldwide distribution, 27 years proven success, NO failures! Web site: **www.sabermfg.com** Email: **sabermfg@sabermfg.com** Phone: **817-326-6293.**

IVOPROP. Inflight or ground-adjustable. Carbon/graphite fiber composite blades with stainless steel leading edges. Number 2, 3- or 6-blade. No.1 selling prop in the world. Constant speed electronic governor. Readily reassembles from 3-blade into 2-blade configuration and one spare blade. Beautiful high-gloss finish. Unique pitch adjustment, no protractor needed. Low drag hub. 30-day money back guarantee. **Ivoprop Corp., PMB #330, 15903 Lakewood Blvd., #103, Bellflower, CA 90706.** Call: **800-FOR-PROP** or **562-602-1451**. Fax: **562-602-1374.** Website: **Ivoprop.com** E-mail: Ivo**prop@pacbell.net**

Aymar-DeMuth Propellers—Computer generated designs since 1968. Best climb and best fuel economy possible. Maple or composite props with steel edge protection. Very smooth and quiet. Discount extensions and crush plates. Call or write: **803-321-0569 or 410-790-1583, PO Box 1193, Newberry, SC, 29108.**

GSC SYSTEMS - Propelling the world since 1984. Best quality Eastern Maple Hardwood, available in fixed pitch, ground adjustable 2- and 3-blade, 2-blade mechanical in-flight adjustable and now available props for PPG market. Diameters range from 36"-72" with option for leading edge protection on all models. Outstanding customer service. **#8 2440 B 14th Avenue, Vernon, BC V1T-8C1. 250-549-3772 ph, 250-275-8441 fax. www.ultralightprops.com; email: info@ultralightprops.com**

PERFORMANCE Propellers USA LLC. The name says it all! Since 1988. Two and Three Blade Multi-Laminate, Quasi-Constant Speed, Wood Propellers for applications up through 300HP. **PerformancePropellersUSA.com 713-417-2519 Frank@PerformancePropellersUSA.com**

PRINCE P-TIP Propellers, Carbon Fiber and Wood, Anti-Vortex Design, Automatic pitch control, Increased efficiency and noise reduction. Avid, BD-4, BD-5, Cozy, **Cubs**, Defiant , Glasair, Glastar, Kitfox, Lancair, Long/Vari-Eze, **Murphy, RV's, Sonex, UAV/RPV**, Velocity, Zenith. Continental, Jabiru, Lycoming, Rotax, Subaru, Volkswagon. 2-Blade, Multi-Blade, Scale, Wind Tunnel, Custom. Computer designed for all configurations. Repair and Overhaul. Worldwide Exporting. **Prince Aircraft Company, P.O. Box 2669, 6774 Providence Street, Whitehouse, Ohio 43571. Telephone: 419-877-5557; Fax: 419-877-5564; Email: info@princeaircraft.com; Website: http://www.princeaircraft.com; All major credit cards accepted.**

Ultralight Aircraft

INTRODUCING the LEGAL EAGLE XL

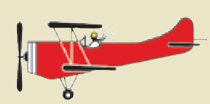
A NEW ultralight with a larger cockpit area. Empty 246 lbs, wing area 120 sq. ft. Gross wt of 575 lbs. STOL. Powered by Better Half VW aero engine. Wood wings, steel fuselage, and aluminum tank construction. Airplane plans $80. Engine plans $20. 4 helpful DVDs, $25 each.

Contact L.E. Milholland for plans, DVDs, and wing and fuselage parts, Work: 281-375-5453, Cell: 281-785-3777

Contact John Bolding for materials package and welded fuselages. 281-383-0113

Video Tapes & DVDs

THE most thrilling adventure documentary about a flight around the world in a RV7. ORDER X-mas DVD NOW. **www.DL-Pictures.com**



KITPLANES®

To place your online ad, log on to www.kitplanes.com

Advertising Deadlines

ISSUE:			
ISSUE: Mar '12	AD CLOSE:	Dec 7, 2011
	ON SALE:	Feb 7, 2012
ISSUE: Apr '12	AD CLOSE:	Jan 11, 2012
	ON SALE:	Mar 6, 2012
ISSUE: May '12	AD CLOSE:	Feb 8, 2012
	ON SALE:	Apr 3, 2012

To place your ad in Kitplanes magazine, phone: **717-982-0744** or email: **ads@kitplanes.com** Fax: **717-427-1525**

Classified Line Ad

Rate/word:	1 time	6 times	12 times
	$1.25	$1.15	$1.00

20 word minimum per ad.

Classified Box Ad

4 word heading, 25 words of copy, plus your company name, address, and up to 3 contact numbers.
1 time $94 • 3 times @ $89 ea.
6 times @ $84 ea.
12 times @ $73 ea.

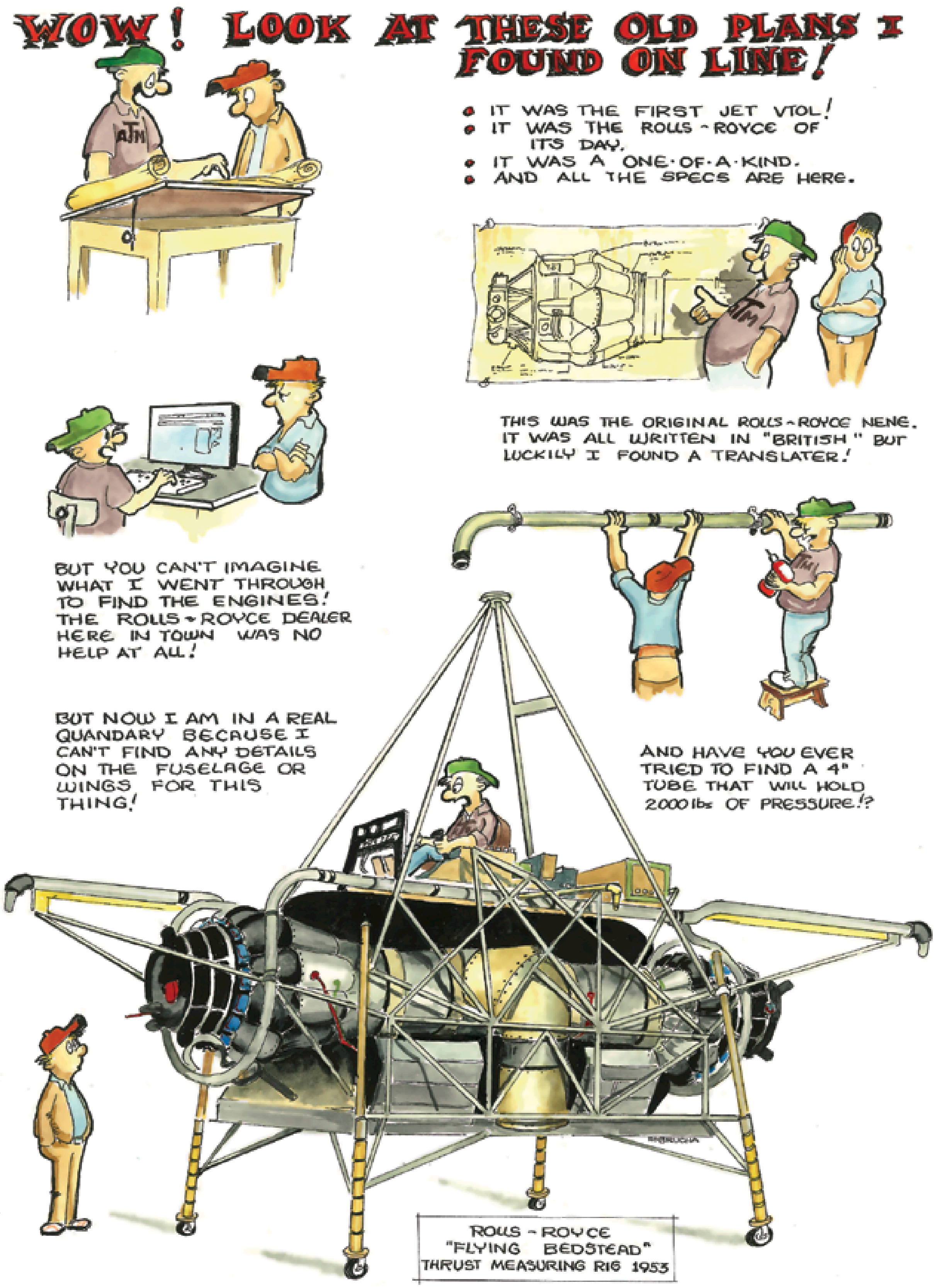
Classified Photo Box Ad Includes

4 word heading, 1" x 2⅛" B/W photo, 25 words of copy, plus your company name, address, and up to 3 contact numbers.

1 time $188 • 3 times @ $177 ea.
6 times @ $167 ea.
12 times @ $146 ea.

Digital Photo Specifications: 1200 dpi resolution for B/W, Tiff and EPS formats accepted.

Subscriptions:
Ph: 800-622-1065 (US and Canada) www.kitplanes.com (International) Fax 203-857-3103


WOW! LOOK AT THESE OLD PLANS I FOUND ON LINE!
• IT WAS THE FIRST JET VTOL!
• IT WAS THE ROLLS-ROYCE OF ITS DAY.
• IT WAS A ONE-OF-A-KIND.
• AND ALL THE SPECS ARE HERE.
THIS WAS THE ORIGINAL ROLLS-ROYCE NENE. IT WAS ALL WRITTEN IN "BRITISH" BUT LUCKILY I FOUND A TRANSLATER!
BUT YOU CAN'T IMAGINE WHAT I WENT THROUGH TO FIND THE ENGINES! THE ROLLS-ROYCE DEALER HERE IN TOWN WAS NO HELP AT ALL!
AND HAVE YOU EVER TRIED TO FIND A 4" TUBE THAT WILL HOLD 2000 lbs OF PRESSURE!?
BUT NOW I AM IN A REAL QUANDARY BECAUSE I CAN'T FIND ANY DETAILS ON THE FUSELAGE OR WINGS FOR THIS THING!
ROLLS-ROYCE "FLYING BEDSTEAD" THRUST MEASURING RIG 1953