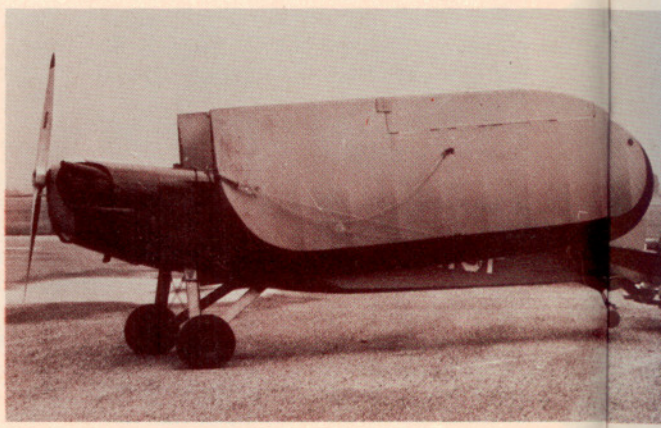
▲ Corben "Baby Ace" was factory design of 1930's, based on the Heath Parasol. Recently redesigned to use more modern components, including Piper Cub landing gear, it is one of the most popular designs available to home builders of aircraft

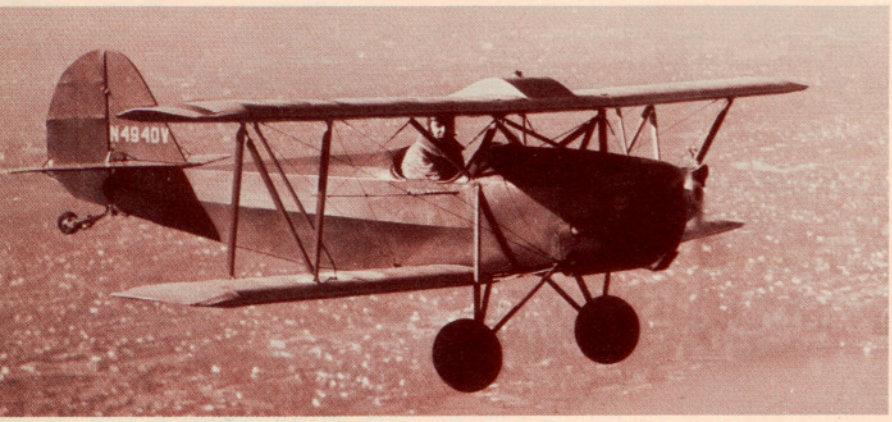
Author Bowers designed the all-wood "Fly Baby" which sacrifices top speed for improved low speed and "over-the-fence" characteristics ▲

*Photos by the author*

▲ The two-seat Pietenpol "Air Camper," powered with a converted Model A Ford automobile engine, was one of the most popular homebuilts of the 1930's. This one is a genuine antique but others are still being made from the 30-year-old plans



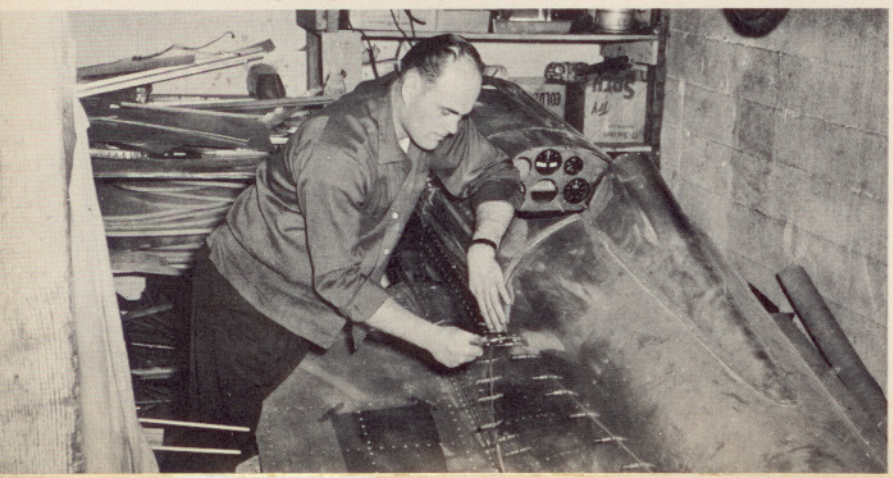
Developed for an EAA design contest, the "Fly Baby," shown here, demonstrates contest requirement for road transportability and folded dimensions that permit home storage in a standard-size garage ▲



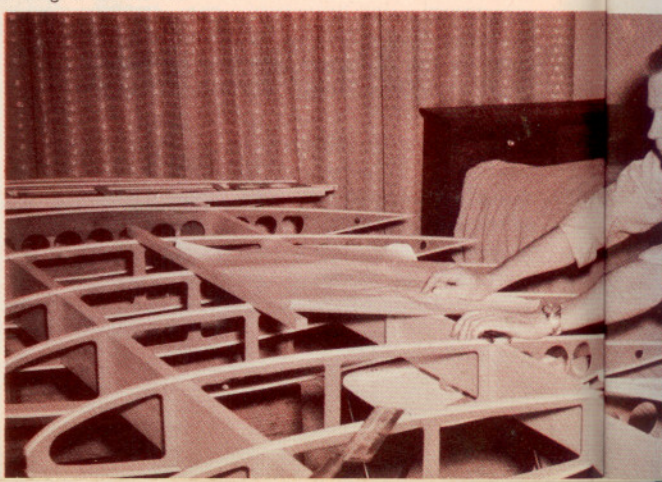
▲ One of oldest homebuilts flying is the 1930 "White," originally fitted with a 25 h.p. Henderson, rebuilt in 1932 as "Smith" with a 40 h.p. Salmson engine, then again rebuilt in 1954 as the "Sorrell" with a 37 h.p. Continental engine, which soon was replaced by a 65 h.p. power plant

First legalized homebuilts of the postwar years were the Goodyear racers introduced in 1947. The Wittman "Bonzo," shown in the photograph, is a sister ship of the 1947 winner, "Buster," itself converted from a higher-powered prewar design ▲

▼ A major requirement for home aircraft construction is adequate space, regardless of location. Here, an all-metal Landingham Special is being built in a basement



Only a bachelor could get away with this: Northwest Airlines pilot, Dave Gauthier, assembles a wooden wing in his bedroom ▼

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# Do-It-Yourself Aviation

*Air has been bumpy for 'homebuilts,' but FAA recognition and encouragement have given basement aircraft industry new lift and respectability. Almost 1,000 of these planes now flying; about 3,600 more are now being constructed*

*by PETER M. BOWERS • AOPA 54408*

There's a term that's being heard more and more around the airports these days—homebuilts. It refers, of course, to those little sport planes designed and built by the do-it-yourself flyers.

In past years, the word "homebuilt" was used somewhat derisively to describe more or less "outlaw" operations conducted by zealous and nonconformist amateurs, for there was no provision under the Federal aviation regulations for the licensing or operation of other than standard production aircraft. All of that has changed since World War II, however, and the homebuilders now occupy an honorable and clearly recognized place in the general aviation scene.

The way of the homebuilt airplane has not been easy. There were no problems at all until 1927, when Government licensing requirements were adopted. It was possible for a while after that to fly unlicensed aircraft, which included homebuilt and some World War I surplus types, but one by one the states adopted the Federal requirements and barred the unlicensed types. In the years immediately before World War II, Oregon was the only state where the homebuilts were legal and many die-hard zealots actually moved there so they could continue their activities. The few who managed to operate in other states were usually entirely illegal and out of sight in the boondocks or had their machines registered as exhibition types in the experimental category or for such other special purposes as racing.

The ice was finally broken by two events in the early postwar years. George Beaugardus, one of the prewar amateurs of Troutdale, Ore., flew a single-seat homebuilt from Portland to Washington, D. C. and back to petition the CAA and demonstrate that such machines could be dependable. This flight was a significant milestone that influenced Federal thinking and led to the present-day liberal regulations. The second was establishment of the midget racing class in 1947 for planes powered with engines under 200 cubic inches. This class was sponsored by the Goodyear Aircraft Company for its first three years, and the type has been known ever since as the "Goodyear Racer." The existence of this class greatly stimulated the homebuilders although it was not supported to the degree expected by the public, which had become conditioned to unrestricted horsepower and 400 m.p.h. speeds as the air racing standard. Goodyear class racing has died out almost completely, but the general designs carried on to become the nucleus of the new legalized homebuilt movement when the "amateur design" subdivision of the experimental category was established in 1949.

Under this classification, the homebuilder can build and fly anything that he wants to, subject to approval of the local FAA safety agent. This approval is not necessarily of the basic design, but considers construction practices, suitability of materials, and workmanship. Box structures must be approved before being closed, and the entire airframe must be inspected and approved prior to final covering. In most cases, the agent will want to observe the first test flight. Because of the "experimental" classification, initial testing must be confined to a designated test area away from population areas and high-density air traffic. Present regulations require a 50-hour test period in an area not to exceed a 25-mile radius from the test base for homebuilts powered with approved-type airplane engines and 75 hours for those with nonapproved engines.

Once the service test period has been completed, the builder applies to FAA for removal of the initial restrictions and is then allowed to fly anywhere in the continental United States and to carry passengers. Other restrictions peculiar to the amateur-design category remain in force, however. Since the category was established strictly for recreational and educational purposes, the planes cannot be used for com-

*(Continued on page 48)*

(Continued from page 27)

mercial purposes. Passengers cannot be carried for hire and the planes cannot be rented out or used in connection with a business. As with all experimental planes, they are not to be flown over densely populated areas except as necessary to take off and land, and can be flown by student pilots only when signed off for specific models by an instructor qualified in that model and type. These are extremely minor restrictions, however, and are no handicap to the explosive growth of the movement. Reliable sources estimate about 950 U. S. homebuilts are now flying with 3,600 under construction.

The word "experimental," painted per regulation on the side of the airplanes has a deterrent effect on some people who tend to associate it with "unsafe" and the old sense of "homebuilt." In recognition of this, FAA is now considering a revision of the regulation that would put the homebuilt in a more pleasant-sounding "special" category. The good safety record built up by the type has had its effect on the life insurance companies, which a few years ago permitted no flying except on scheduled airliners. Many have modified or dropped their flight exclusion clauses to allow recreational use of homebuilts and standard lightplanes.

With the aircraft industry turning out more private planes than ever before, why should anyone want to build his own? There are, and always have been, two principal reasons. One is to obtain truly sporting airplanes of types not produced by industry and the other is to satisfy the urge to fly in a craft of one's own creation. A third reason, more valid in the years before World War II than now, is reduced cost. The materials alone for the average homebuilt cost between $1,000 and $2,000 today, considerably more than a good used lightplane. Adding 700 to 2,500 hours of labor, the cost of tools, and the heat bill for the shop puts the actual cost right up there with the factory products. Items of this type are intangibles, though, charged off to "hobby," and the average homebuilder seldom prices his ship at much more than the cost of the materials.

The cost picture was not always like this. Back in the 1920's, when there were no production lightplanes, the cost of recreational flying in standard rental types was almost prohibitive. In order to fly at all, one was forced to build his own, using what materials he could.

Since there were no low-powered airplane engines at reasonable prices either, the homebuilder of the 1927-1933 era used a wide variety of substitutes. Motorcycle engines, particularly the 25 h.p. four-cylinder air-cooled Henderson, were popular, but their power was marginal for even a small single seater and their reliability left much to be desired. The best-known design to use this engine was the Heath *Parasol*, designed in 1927 by the late Ed Heath, outstanding champion of the homebuilders, and refined through the years until it was produced as a type-certificated "factory" model in 1932. For bigger planes, notably the two-seat all-wood Pietenpol *Air Camper* of 1930, the 40 h.p. Model A Ford automobile engine was a satisfactory conversion. With its cast iron block and head, radiator, and associated plumbing, it was twice the weight of the 37-40 h.p. air-cooled Continental A-40 that appeared in the early 1930's. The cost advantage of the automobile conversion was still so great, however, that the Government encouraged the aircraft industry to develop designs around automotive engines to keep costs down. The best-known products of this campaign were the Arrow sport monoplane of 1937, with a Ford V-8 and the Funk B of 1938 with a Model B Ford conversion.

The power plant situation has changed since the war, and most home builders now design their planes around standard aircraft power plants and use factory-built propellers. A few, whose specialized interests still lie outside the area of conventional aircraft, seek the answer to their problem in surplus target drone engines, converted outboards, and in increasing numbers, in the Volkswagen and Porsche air-cooled automobile engines. These last two are immensely popular in Europe, where small airplane engines in the 40-100 h.p. range are not produced and the cost of importing them from the United States is prohibitive. They are still heavy for their power, and are used only for small single seaters. Americans have found that the cost of conversion brings them up to the cost of a good used 65 h.p. airplane engine.

The cost consideration is still in the picture, but is tied rather closely to other considerations. Used engines in the 65-85 h.p. range are readily available from $200 to $600 and are best suited to small single seaters. The homebuilders have finally found out, as industry did years ago, that small airplanes do not fly well on low horsepower. All of the successful low-powered production lightplanes have been "big" airplanes. The Aeronca C-3 of 1931 had a span of 36 feet to match its 36 h.p. and the Curtiss *Junior* spanned 42 feet with 45 h.p. Flight on low power is possible only when span loading and wing loading are kept low, which means large wings. If the homebuilder meets these requirements with a 65 h.p. engine, he ends up with something like a Piper J-3 *Cub*, which he can buy on the used market for less than the cost of building one.

To get the snappier performance demanded by sporting requirements and to reduce the size of the building job and the cost of materials, most of the homebuilts are single seaters. Sixty-five horsepower will give good performance to biplanes from 18- to 22-foot wingspan and to monoplanes between 20 and 25 feet. Speed falls off in larger sizes, and while the actual flying characteristics improve with size, the "sporting" characteristics diminish. The small ships do not have the same

floating characteristics of equivalent-powered types in the *Cub* class and handle like much heavier machines. This is emphasized greatly as size decreases. The 14½-foot Knight *Twister* biplane needs at least 85 h.p. for good performance and some use 100 or more. A few builders who like acrobatics go as high as 125 to 150 h.p. in their single seaters.

All considerations of low cost and do-it-yourself satisfaction aside, the real strong point of the average single-seat homebuilt is its flying characteristics. These can be described as "lively" without actually being "hot." The rates of roll and turn are terrific, thanks to the low inertias resulting from short dimensions and light weight. Move the controls or the throttle, and things happen fast. Light control forces and fast acceleration make it easy for the pilots of heavier equipment to over-control on their first flights in the small ships, but corrective action is also fast and effective. Because of the small wings, rate of descent is relatively fast. The light weight and quick acceleration are the principal factors on takeoff, however, and the pilot of the average "heavy" will find his homebuilt three feet in the air at just about the time he would normally expect the tail to start coming up.

While the single seaters get the most attention from the public because they are "cute little airplanes," there are plenty of two seaters. Most of them are side-by-side types of 20-foot span, the *Tailwind* designed by old-time racing pilot Steve Wittman, and the Nesmith *Cougar* which was derived from it. Their major advantage over production two-seaters is performance in that they can cruise 140 to 150 m.p.h. on 90 h.p. Landing speeds are considerably higher, too, but the strong point of these two-seaters is cross-country transportation rather than the sheer joy of being airborne that goes with the single seaters.

The materials and processes follow commercial aircraft practice closely. Construction runs from all wood to all sheet metal, with composite construction featuring welded steel tubing fuselage and tail with wood frame wings and fabric covering being the current favorite. Sheet metal is not too common because of the tooling investment and the time involved in making forming blocks. Wooden construction was at its height before World War II, but suffered in post-war years when decreasing production of aircraft grade plywood drove prices to impossible heights. The homebuilders have recently taken to importing aircraft birch plywood from Finland at ⅓ to ½ the price of the U. S. product. This, combined with new adhesives and preservatives and the fact that the FAA accepts top grade marine plywood for the homebuilts, has boomed the popularity of wood construction by winning many converts from steel tubing, which has been subject to many recent price rises. As in industry, some homebuilders are experimenting with fiber glass but it has not yet become an acceptable medium for primary structures. Cost and the strength/weight ratio are the major handicaps.

Not all of the homebuilts are 100 percenters. Such hardware as instruments, engine mounts, fuel tanks, and sometimes complete landing gear are standard components procured on the used market. In some cases, wings and tail surfaces are "cut down" from large ships. The manufacturers are against this, for it is their reputation that will suffer if their wing fails under circumstances over which they have no control. The use of "cut-down" major components was nearly outlawed several years ago, but is still tolerated within reasonable limits. The FAA is adamantly against indiscriminate modification of standard types, however, and a hopped-up clipped-wing *Cub* cannot be reclassified as a homebuilt.

A paradox exists here in a special category of the recreational airplane movement—the restoration and flying of antiques. If an amateur restores a standard 1928-type certificated plane to its original configuration he gets a standard airworthiness certificate for it. If he installs a more modern power plant, he can get a supplementary type certificate upon official engineering approval of his work. If he completes an absolutely pure restoration of a non-approved antique, such as a World War I type, it must be licensed in some other part of the experimental category, usually "exhibition" since nothing else fits. This brings about all sorts of operating restrictions. On the other hand, if the restoration is so extensive that the result is practically a new airplane, it can be licensed as a homebuilt replica that happens to use a few original parts! Other replicas are built from scratch and licensed as homebuilts by those who desire specific aircraft of a type that cannot otherwise be obtained, usually of World War I vintage or earlier.

The homebuilt movement is about evenly divided into designs that are entirely original with the builder and those that are built from plans provided by other designers. The planes are usually named after their designers and carry such qualifying designations as "Smith Model One," "Jones Special," or "Bacigalupe Sport." A change of ownership that is followed by extensive modification frequently results in an entirely new designation bestowed by the new owner, so the three preceding names could all apply to the same airplane at different times. Plans and instructions for about two dozen designs ranging from small single-seat helicopters through gliders to acrobatic biplanes and four-place cabin monoplanes are available at prices between $20 and $135. These are advertised to some extent in the general aviation magazines, including The AOPA PILOT, but mostly in the following specialized magazines published by the organizations devoted to the activity:

SPORT AVIATION
Experimental Aircraft Association (EAA)
9711 W. Forest Drive
Hales Corners, Wis.

ANTIQUE AIRPLANE NEWS
Antique Airplane Association (AAA)
P. O. Box 14,
Fremont, Ia.

SOARING
Soaring Society of America (SSA)
P. O. Box 66071
Los Angeles, Calif.

AMERICAN AIRMAN
(Antiques, Homebuilts, History)
9929 W. Silver Spring
Milwaukee 18, Wis.

These organizations encourage and coordinate the various phases of the activity through the publication of pertinent information, news of the different builders, and new designs, but primarily through group activity in the form of local chapters and regional and national fly-ins. The oldest organization, the Soaring Society of America, organized in 1932, draws as many as 50 sailplanes to its annual national contests while the newer Experimental Aircraft Association (1954) with 11,000 members, had 87 ships, mostly homebuilt with a sprinkling of antiques, at its 1960 national fly-in. Attendance by distant members is encouraged by distance awards and competition consists of short takeoff, spot landing, design originality, and workmanship in various categories.

Do-it-yourself aviation appeals to all age groups from the teens to the sixties, and several ships have been built by high school shop classes as class projects. Vocationally, the builders range from the aforementioned students to laborers, office workers, skilled craftsmen in many fields other than aviation, and some of the top professionals in the aircraft industry, airlines, and the armed services. While a licensed mechanic must sign off the finished work, it is not necessary for the builder to be a mechanic himself. Because of the increasing growth of the activity at the local level, the nonprofessionals have little trouble in finding qualified help when they need it.

Look around. If you haven't seen much of your neighbor lately, he may be spending his time in the basement building an airplane!

## THE AUTHOR

*Peter M. Bowers, author of "Do-It-Yourself Aviation," is a frequent contributor to The PILOT. His "Yesterday's Wings" articles—the latest of which appeared in the July PILOT—have made a hit with thousands of PILOT readers. Pete is a three-threat man—homebuilts, antique planes and gliders—and is a recognized expert in all three fields. He is an engineer at Boeing Airplane Company, Seattle, Wash., and is active in private pilot circles, including the Seattle Unit of AOPA.*

# Amphibious Homebuilt

Volmer Jensen (AOPA 177087), 104 East Providencia Avenue, Burbank, Calif., designer and builder of the unique two-place amphibian shown below, says it all started with skindiving.

"I stopped flying land planes 12 years ago," he mused, "because I merely flew from airport to airport with nothing to do. Since I've been skindiving for the past 10 years, I decided to build the amphibian. Now we head for the water whenever we take off. I go four times farther on a gallon of gas than I used to with my 30 h.p. outboard boat."

Construction of the Volmer VJ22 *Sportsman* began in September of 1957 and the plane was completed, test flown and certificated by December 1958. Jensen, who designed many sailplanes as a prelude to the amphibian, says his flights to Ensenada, Mexico, Lake Mead, Nev., the Salton Sea and Catalina Island—landing in anything from dead calm water to five-foot swells—have shown the plane to be both airworthy and seaworthy, with takeoff from water accomplished in a mere 20 seconds. The *Sportsman* has now been in the air for over 100 hours with no hitches.

The plane, powered by a Continental C-85 pusher-type engine, consumes 4.5 gallons of fuel per hour, has a cruising speed of 85 m.p.h. and maximum range (with 20 gallons fuel) of 350 miles. Empty weight is 925 pounds and gross, 1,450 pounds.

With its simple wood and fiber glass construction and manually retractable landing gear, Jensen contends the *Sportsman* would be a cheap plane to manufacture, estimating a retail price of not over $7,500, "which is one-third the price of the only other amphibian being sold now," Jensen adds.

END

Sportsman takes to water like duck soup, completing a sea level takeoff in 20 seconds