VULTEE BT-13
WORLD WAR II BASIC TRAINER

After Primary Training, Aviation Cadets Transitioned Into The Vultee "Vibrator"

By Norm Goyer

There is no doubt in my mind that the Army, Navy and Marine pilots of World War Two were the best-trained aviators in the history of aviation. This came about because of the determination of the youth of that time not to allow any other nation to attack our country, or to pose any threat to our way of life. Young men and women by the thousands flocked to the recruiting stations which had been set up in every city, eager to serve their country.

While still a senior in high school, I took the Navy's V-5 Program entrance test, and because of the knowledge of aviation I'd gained from building and flying model airplanes, I almost aced the exam. I received my high school diploma on a Thursday night at John M. Green Hall, on the campus of Smith College, in Northampton, Massachusetts, and the very next morning, I boarded the train for Dartmouth College, in Hanover, New Hampshire, to begin my studies as a Naval Aviation Cadet. My mother thought I would be studying to be an accountant; neither my father nor I dared tell her I was on my way to becoming a Navy pilot.

The flight training was extremely well structured, and the determined


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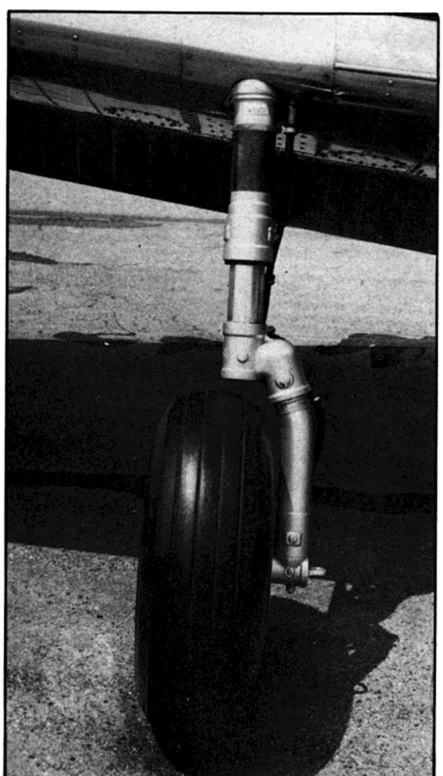
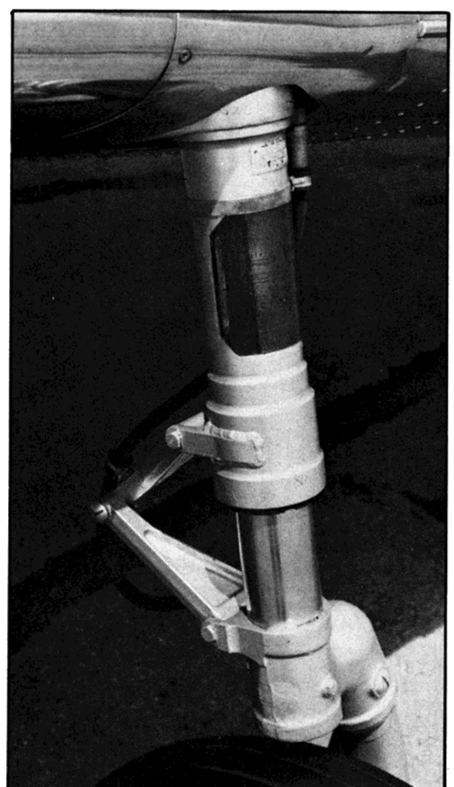
NO STEP

Stiff-legged BT-13 was made with a rugged landing gear to withstand the onslaught of the cadets' basic training.



Strut is perpendicular to the ground, with a large amount of dihedral. The BT-13 was, and still is a very stable aircraft.



Using these photos, there's no excuse for a modeler to have inaccurate landing gear on their aircraft.

cadets applied themselves well. In addition, the young pilots had the advantage of flying in super training craft.

When Pearl Harbor was attacked in 1941, the only available pilots were the few which were already in the armed services, and they were flying relatively obsolete aircraft. The only other pilots were those civilians who flew because they loved flying, and owned one or more small aircraft. From that pool, the military chose those men and women who were involved in air racing and aerobatics.

Because of his experience in designing and building his "Jeep," race pilot Art Chester was called in to design a cowling for the Mustang fighter.

Another star of the air racing circuit, Tony LeVier, was snatched up by the Lockheed Corporation to demonstrate correct flying techniques of their P-38s to military pilots in England. Tony proved so valuable to Lockheed that they retained him as chief test pilot for many years. Even since his mandatory retirement, today, at age 76, Tony still goes to work at Lockheed, now as an aviation safety consultant. He is dedicated to his project: S.A.F.E., based on Tony's belief that pilot training currently approved by the FAA is not adequate or acceptable, and this is the reason why so many avoidable general aviation accidents occur. Tony works hard trying to remedy that situation, and the FAA agrees with him, in theory, that something should be done, but so far nothing has been done.

Another of Tony's racing buddies, Tex Rankin, was responsible for revising some of the World War Two pilot training curriculum, to help prevent too many of our cadets from washing out of basic flight training. By initiating appropriate and correct flight training procedures, Tex succeeded in lowering the attrition rate of those much-needed pilots by as much as 15 percent. One of the flight schools which benefitted was the Basic Training Program for the Army Air Corps at Merced, California.

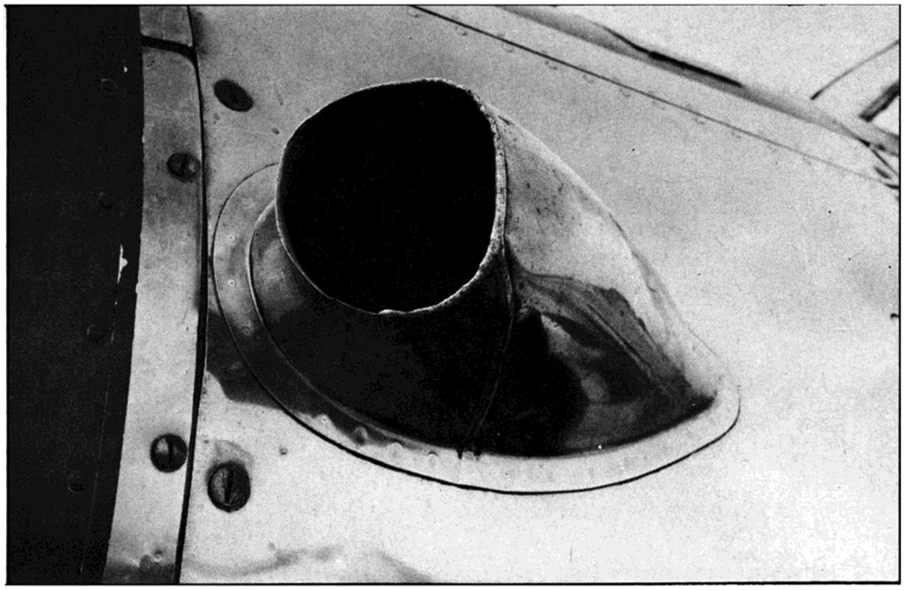
Scale R/C Modeler readers who have been following this series on training aircraft know that Army Air Corps cadets took their primary training in PT-17s, PT-22s, PT-19s, and some of the Corps' other available aircraft.

The Navy, however, wanted nothing to do with the easy-to-fly Fairchilds or the squirrelly PT-22s, so they stuck with their tried-and-true N2S Stearmans, and the Navy Aviation Factory N3Ns. Both of these first-trainer biplanes with their narrow landing gear, poor over-the-cowl visibility, and radial engines, were a much better transitional aircraft for the SNVs (BT-13s) and the SNJs (AT-6s) which were the next in line for the new pilots. If a Naval Aviation Cadet succeeded in becoming adept at flying those, even more difficult aircraft, and survived the training program, he was capable of flying any fighter plane produced by any nation.

Why was the program so successful? Most pilots who completed those courses later agreed that it was a combination of the knowledge gained in those two years of accelerated college courses which the Navy required all of its cadets to attend, and the quality of aeronautical theory taught in the Navy's Pre-Flight Schools.

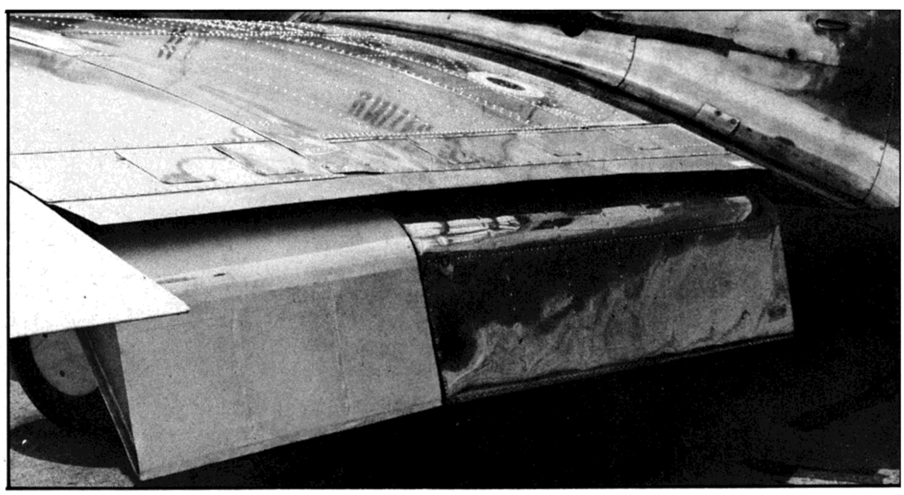
Because the Army Air Corps were pressed to provide pilots immediately, of necessity, they waived the college requirements for their cadets.

The Navy cadets considered their first military aircraft to be Vultee's BT-13, and the Navy version, the SNV. This airplane not only *looked* like a military plane; it *flew* like a military plane. It had a nice, round, engine up front: a 450 Horsepower Pratt & Whitney; and a Hamilton-Standard constant-speed propeller. It also had a fighter-type cockpit, including a long, rattling, canopy; the feature of the BT-13 which earned it the nickname, the "Vultee Vibrator," because, at a certain manifold and rpm setting, that canopy would come alive and vibrate like crazy. On the plus side, the Vultee had a wide-track, non-retractable landing gear, large dihedral angle and a very large vertical fin which kept the airplane in a true, straight, flight path.



Massive carb air intake on left side of fuselage. Note the aluminum welding bead.

Outer wing panel was borrowed from earlier Vultee aircraft which neccessitated the use of split flaps, so the angle was slightly off. Inner panel is aluminum; other flap is fabric.



Because of its good qualities, the BT-13/SNV, makes an ideal World War Two aircraft to model. You can go all out with cockpit details, a sliding canopy, operating flaps, and you won't have to worry about whether your retractable landing gear will operate properly or not . . . this one is fixed, and it can't mess up your wing tips or anything else.

In the past, in spite of all these advantages, this aircraft has somehow never been popular as a model. I can't remember seeing any kits made for R/C BT-13s, or even many rubber-powered kits for it either. Lately, though, there has been a reawakening of interest in this sturdy model, with the availability of Bob Holman's plans from England, other plans by Aero Plans 'N Parts, Olean, New York, and more recently, a great set of really scale plans by Pat Allen of Pampa, Texas.

Pat modeled his BT-13 after a full-scale one which was stationed at Merced, California, in 1944. The full-scale photos were taken at Merced in June of 1987.

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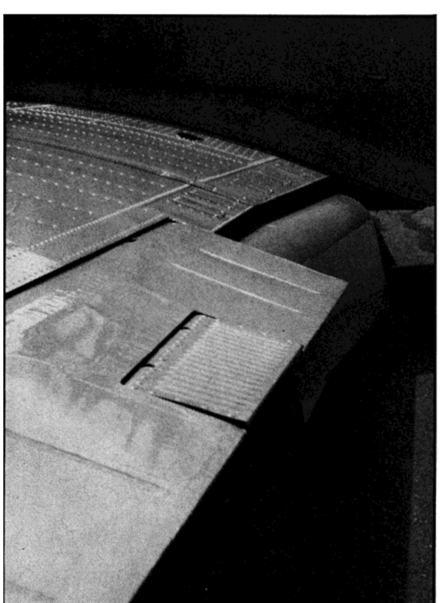
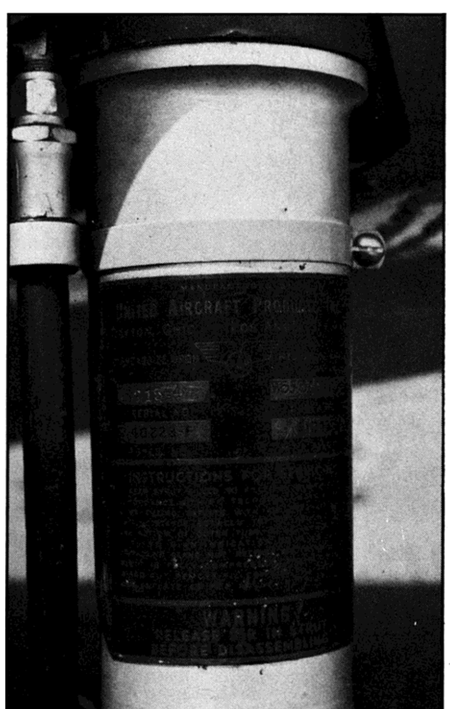
VULTEE BT-13A VALIANT

When choosing a subject for modeling, you always pick one that is in

Graceful lines on the tail of this Vultee is only one of the appealing aspects of modeling the BT-13.



Break in the angle of the wing is shown here, along with the aileron trim tab. Aileron is fabric; tab is formed aluminum.



Closeup of manufacturer's plate on right gear strut. Line to the left is brake line.

some way attractive to you personally. There are some that may have "character" and beauty to me that might not appeal to you at all.

While the BT-13A may not be a beauty, there is something about it that "throws my switch."

Afer World War Two, I had the good fortune to fly a BT-13 occasionally.

The idea of modeling one came about in 1965 when I designed and built a small version ($1\frac{5}{8}'' = 1$ foot) which I still have.

In the Fall of 1983, I decided to build a larger version. A scale of 1/4 was too large (126-inch span), so I settled on 1/5 scale (100.8-inch span).

The original was completed and weighed 27 pounds. This, coupled with the fact that a BT-13 was not overly endowed with wing area, 9.47 square feet in this case, gave a wing loading of 47 ounces per square foot.

This airplane was lost in an "accident" in the Fall of 1985. It will be rebuilt with a different engine. Originally, it was powered with a Quadra Q50S, but will be powered with a 3.7 Sachs-Dolmar.

At sea level (the 1985 IMAA Festival at Mobile, Alabama), the power was adequate.

At our home altitude of 3,600 feet above sea level, the power is marginal.

As this airplane approaches stall speed, it snaps with no warning, so you keep all maneuvers wide and fast. On approaches with flaps down, it's a "pussy cat." However, there is no substitute for brute force, hence the "Sexy-Dolmar."

This is not a beginner's airplane, either in building or flying.

Still interested? Okay, let's commence.

Wing

I always build wings first, if possible, because I hate to build wings. If I get them out of the way, I don't lose interest.

Nearly everything I build is built on a jig. This one is no exception. It was built upside down on the jig by first laying down the upper wing skins and adding everything to this including the lower covering. When the wing comes off the jig, it is complete, in one piece, with flaps and ailerons hinged. It needs only the tip covering. This ensures a true wing with $2\frac{1}{2}°$ washout built in.

However, since you may not be "into jigs," I have added the building tabs on the ribs. Just be certain that you have the necessary $2\frac{1}{2}°$ washout or you will have an air-

BT-13s were used to transition students from primary trainers to the low-wing fighter types. Simple instrument panel was sufficient for the job to be accomplished. Note airspeed red-line of 230 MPH, and flap-down of 120 MPH; also tumbled whiskey compass.

plane nearly impossible to fly.

Let's start with the four 1/4-inch by 1/2-inch spruce spar strips. These should be about 51 inches long. Cut out the D-1 1/16: plywood doublers which go from Rib 1 to Rib 6.

Next cut out the 1/2-inch balsa filler for use between the spar strips and plywood doublers.

Assemble the lower 1/4-inch by 1/2-inch strip with the balsa filler and plywood doublers for both wing halves, leaving out the top strip. I use Franklin's Tite Bond for this.

Cut the ribs from the material shown, mostly 3/32 sheet, except Rib 1.

You will notice that it is necessary to cut Ribs 1 through 5 to fit on each side of the doublers.

Now mount the lower spar strip on the drawing, noting that it will be necessary to shim the strip up slightly on most of the ribs. Start gluing in the ribs in their appropriate locations.

At this point, you should make the plywood landing gear mounts complete with 6-32 blind nuts and add the plywood doublers to the front sections of Ribs 4 and 5.

By the way, at this point I bent the upper pieces of 1/4-inch music wire for the landing gear as it is wire than the other way around.

Install the gear mounts and provision for the landing lights cutout. My airplane had RAM landing lights actuated by the retract switch.

Add the lower and upper 3/16-inch square spruce rear spar srips (and upper 1/4-inch by 1/2-inch strip). Install the basswood pieces for the wing attachment. Install flap and aileron linkage. Lots of modelers favor separate servos on flap linkage. I prefer to have both tied to one servo with a "Y" linkage. In this case, I show a World Engines S-16 Servo which will either put the flaps down or break them.

A word of caution. *Do not* use any clevises except 4-40 heavy duty and be sure to safety them.

Laminate the tip bows and install. Install the front 1/8-inch leading edge strip.

The 1/16 balsa webs from Ribs 6 to 15 are added. The 3/32 balsa top covering can now be glued in place. Note that an opening for servos is left between Ribs 1 and 2 and from the front to rear spar.

The other lower spar strip can now be attached to the drawing with the completed half projecting upward and this wing panel built as the first one.

The ailerons and flaps can be built upside down flat on the building board. This will not be exact, but should be close enough.

The hinge parts on the original were milled from aluminum. If you do not have machine facilities for doing this, use whatever method works for you.

A word of caution here. You will note that the hinge line on the flaps is not straight and that the short outer segment is pinned to the long segment by a 1/8-inch pin through plywod ribs.

The geometry of the hinges is very critical. I made three sets of flap hinges before getting a set that worked right.

Mount the forward parts of the flap hinges to 1/8 plywood pieces with 2-56 screws and nuts. The plywood is cut to fit between the ribs and the upper and lower spar strips.

The 1/16 by 1/4 aluminum parts are bolted to the plywood flap and aileron ribs with 2-56 screws.

Complete the hinging and all control installation before covering the lower side of the wing. When installing the lower 3/32 sheet balsa, be sure to keep the 2½° washout.

Add the 3/16 sheet covering to the tips and sand the whole wing.

Tail Surfaces

The stabilizer and rudder were also built on jigs but again, whatever works for you.

Except for the hinges, these should not present any particular problem. The hinges should be accurately mounted to ensure free movement. Also, nylon bushings should be used to prevent any possible electrical noise. The stabilizer and fin should be covered with 1/16 sheet balsa.

Fuselage

The original fuselage was built using Lite Ply for the basic structure, but has been changed to 3/16 square spruce and 1/32 plywood. This is not only stronger, but is lighter.

After the assembly of the box, you can begin adding 3/16-inch balsa formers.

Laminate the 3/8-inch plywood firewall from three layers of 1/8-inch 5-ply. At this time, make provisions for the fuel tank. The original had a 20 ounce metal tank with a screw-in metal cap. 10-32 blind nuts are used to hold the engine.

Install all the push rods and throttle linkage before covering or planking the fuselage with 1/8-inch balsa. I used two retainers on the push rods between the servos and control horns to prevent vibration.

Fit the tail surfaces and glue in place. Fit the wing and drill and install 10-32 hold down screws.

Make and install the tail wheel mounting plate.

Install the 3/16 by 3/8 basswood strips. Using a long sanding block, sand the formers and basswood strips to alignment. The 1/8 covering or planking can now be glued in place.

The shape of the wing and tail fillets can best be determined by photographs. This also applies to panel lines and rivets.

Bob Banka of Model Research in California has a set of two and probably other documentation firms have them.

I also have a set for $12.00.

Finish off the fuselage features such as the tail cone and balsa ring and cowl mount on the front. The cowl was made of two laminations of 1/32 plywood with a turned basswood front.

Make and install the canopy track. The canopy was heat formed from .060 plexiglass, but .040 would be heavy enough. The frames were made from SIG .030 ABS plastic strips glued on with Ambroid. It is best to mask off the clear areas to prevent getting glue on the wrong place.

The landing gear is machined mostly from steel. It could be made from 1/4-inch music wire with features simulated with plastic or wood.

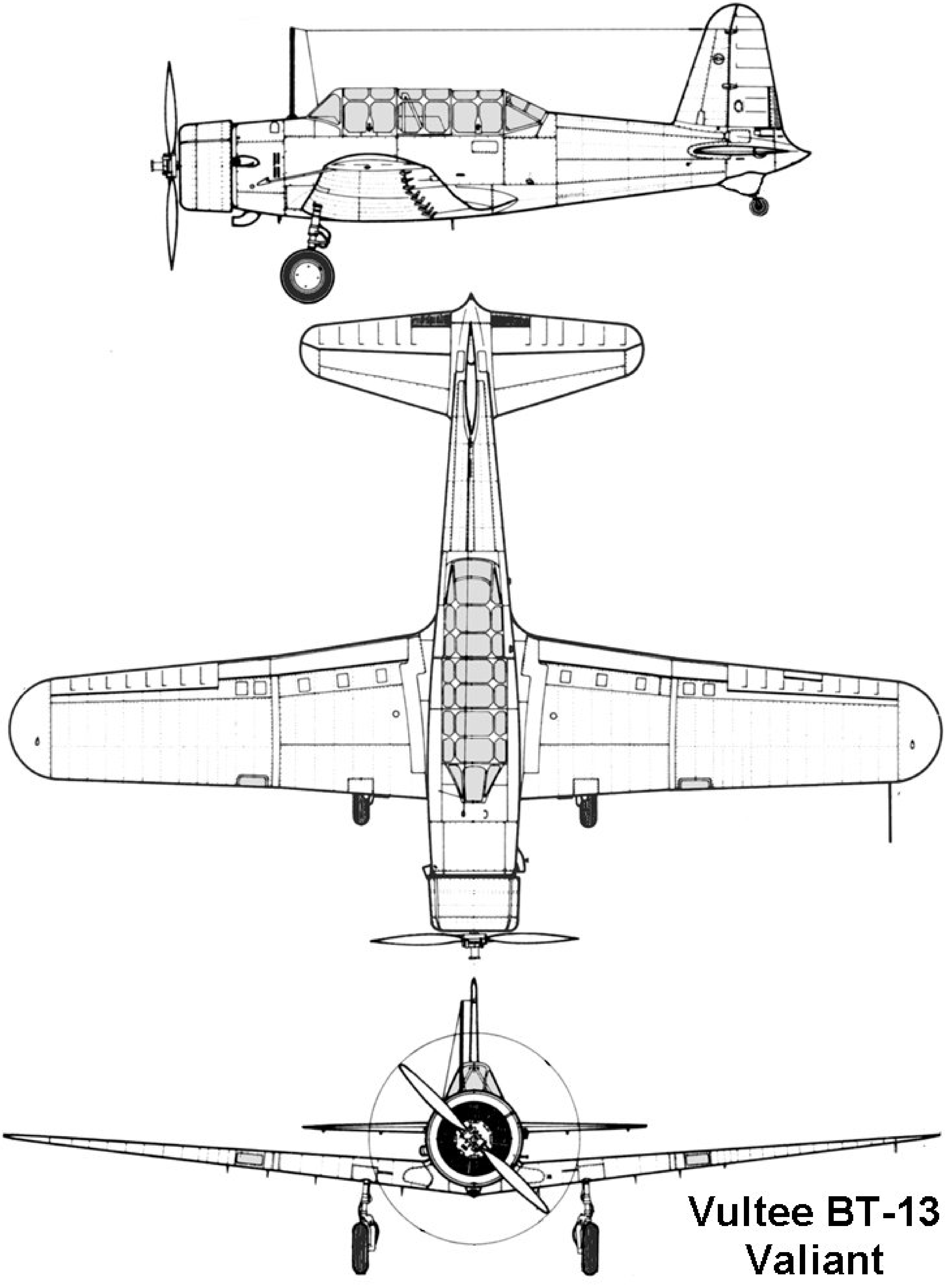
With the exception of the elevators, rudder ailerons and flaps which were covered with SIG Koverall, the airframe was covered with Dan Parsons .6 oz. fiberglass cloth applied with K&B resin. The finish was K&B Epoxy Paint. The blue is made by mixing one can of blue with a can of white. The Trainer Yellow is made by adding about a teaspoon of red to an 8 oz. can of yellow.

Due to the complexity of this airplane, I think the detailing could go on forever. It just depends on how far you want to go. It does make up into a beautiful model.

Balance the model at the point shown, with the wide landing gear, it tracks very well. The takeoff is aided by about 10° of flaps. When the flaps are lowered to 45°, after throttling back, there is a slight bump and the glide angle steepens. A final word of caution. *Don't* do anything abrupt or you will get a high speed stall.

If you have any questions, contact me at this address:

Pat Massey
1125 Charles Street
Pampa, TX 79065



Vultee BT-13 Valiant