

BILL KUBIAK "ON CANARDS"

In a previous column we promised more information about Bill Kubiak's Counsellor, a canard. The following article, describing canard design, originally appeared in Bill's club newsletter.

ON CANARDS
by Bill Kubiak MRCSS

"I've been interested in canard type aircraft for a long time. My first canard was a hand-launched glider I made when I was in high school in 1943, followed by some stick ROG types and finally in 1947 an O&R 23 powered free flight. It flew very well until the rubber band holding the canard to the fuselage failed in flight. It was then that I discovered the advantages of using several rubber bands rather than one large long rubber band. In general, canards are stable, easy to adjust, forgiving of heavy handed tweaking, and they fly well.

"Canard enthusiasts can usually quote several reasons why a canard is so desirable, especially in 1:1 scale. They are safe. The canard must stall first before the main wing in order to be stable. So the main wing never stalls, never spins, etc....

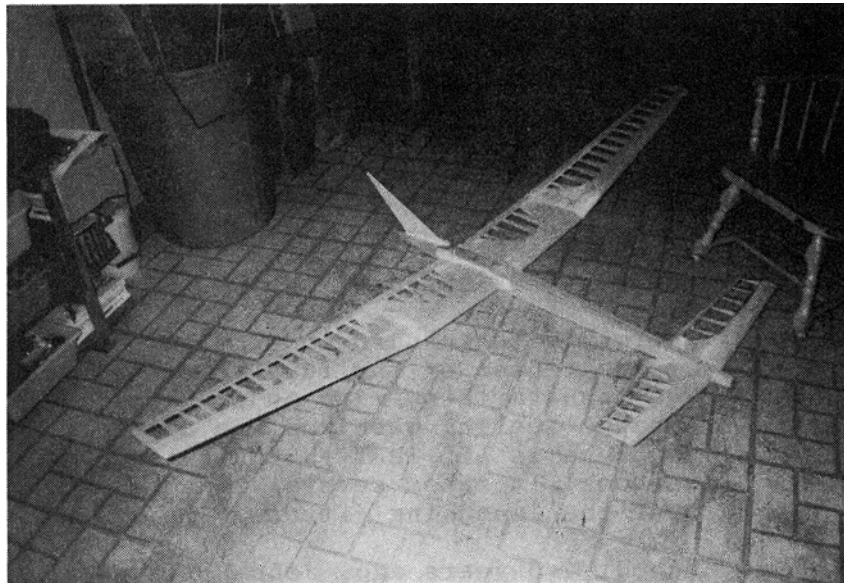
"They are also efficient. The tail downloading of conventional aircraft is replaced by an up load on the canard surface. This reduces the wing induced drag and so increases the overall efficiency of the aircraft.

"Canards are also very easy to lay out. In conventional 1:1 aircraft, especially in general aviation (small), the payload volume usually has to be located at the junction of the wing-fuselage load paths. Fuselage structure and wing carry-through design can usually be greatly simplified if you could just run a diagonal across the cockpit right through the pilot's chest. Cockpit design in a canard is a lot easier. The CG is ahead of the wing. The wing carry-through runs behind the cockpit. The canard loads run across the

fuselage ahead of the cockpit. The cockpit is located in the center of the fuselage, and the pilot feels good without that diagonal running through his chest.

"But I think the greatest appeal of the canard is that it's different.

"Canard design is pretty straight forward. I have varied the area of the canard surface from 10% to 60% of the wing area, and have found 25-33% to be about best. I lay out the decalage at three degrees and add in six to 10 degrees of dihedral to the canard. The Vertical Tail Volume Coefficient is usually 0.02, and the main wing has about six degrees of dihedral. The forward fuselage at the canard needs some side area like a cabin or pylon. If it doesn't have the side area or dihedral the nose tends to fall in a turn. The canard surface should be located above the wing. It helps to have the canard tip above the ground when the fuselage and a wing are touching the ground.





"Whenever I build a model I weigh and balance the wing, fuselage, and tail parts after they are covered. After several years and several dozen model designs, I can estimate weight and balance of a new airframe quite accurately. I also weigh and balance the innards and draw them in place in my layout drawing. Then it's easy to calculate the weight and balance point location before the design is finalized. On a canard I locate the CG at 0.21 ± 0.03 times the average chord ahead of the neutral point. I locate the towhook $1/2$ " ahead of the CG.

"Normally the canard model's towhook is about at the center of the fuselage. When you put the highstart tow-ring on the hook, it's a strange feeling when you are about to launch as there is ALL THAT FUSELAGE ahead of the towhook. It takes several launches to get over the launching jitters.

"About 4-5 years ago, John Borlaug started talking about building a canard model. I offered to design him one, but Craig Christenson had plans for a model called the "Weird One," published in Flying Models.

"John built that design and it flew very well. I continued with a canard design, which turned out to be model design #18, "Enalpria," in my long string of designs, but I didn't get a chance to build it then. John followed up his experience with the Weird One by doing a design of his own. It turned out to be very handsome design, but overweight. It's life was short for a variety of reasons, but it looked so darn good it would have been a shame to let it die. We took it over to my house, put a clean sheet of paper on the drawing board, and traced the profile of the fuselage and tail. Using that as the starting point, I designed a Standard Class that John called the Counsellor (or #22 in my books). It flew very well, including a 60 minute flight one lazy Saturday afternoon. Well, that got some enthusiasm going to build old #18, so last winter it was built and its been flying all this summer. Stability is good about all three axes, and it has good L/D. The only downfall is it is too light to penetrate well, so it can only be flown on days with winds below 15mph. It thermals well when someone like John is at the controls, but finding and riding thermals is not one of my skills.

"It has survived a launch with the receiver off, resulting in a spectacular pop-off and helicopter/frisbee return to earth. Ask Tom Rent for details as all I can remember is frantic blur.

"If you want to talk about flying canards, talk to John Borlaug. If you are interested in canard design, look me up."