

ELECTRIC DUCTED FAN DUO MONOPLANE

by Christian Moes

The original Duo Monoplane was designed almost sixty years ago by the great Bill Dean, an aeromodeller extraordinaire who is remembered with great affection by Brit modellers of a certain age. His designs appeared regularly during the fifties and sixties in the popular comic, adventure, and action magazine for British boys - the "Eagle", which also gave hobbies and crafts a lot of coverage in those days. The original model was 15" span, all balsa, and powered by a Jetex "50".

The idea to build a "modern" version of the Duo Monoplane was the result of some recent correspondence with "Gray", whose feature - the "Sport Channel" appears monthly in the fine British magazine RC Model World.

www.rcmodelworld.com

Somehow, we ended up reminiscing on the topic of classic unorthodox designs - specifically the tandem wing layout - and he was kind enough to sent me a copy of the article and plans for this little gem. It was originally published in Aeromodeller - January 1952. Thanks Gray!

Clearly, it was an excellent candidate for an indoor micro, but somehow, I don't think the school board would appreciate us flying a fire breathing Jetex in their gym. Furthermore, Bill

Dean's comments: "We were pleased to find that if the model happened to be climbing vertically when the charge expired, the stall recovery was remarkably good" confirmed that the original powerplant might not be ideal for indoor operations!

For more info on Jetex - and a glimpse at the myriad of models designed for these amazing micro rocket engines see

www.jetex.org

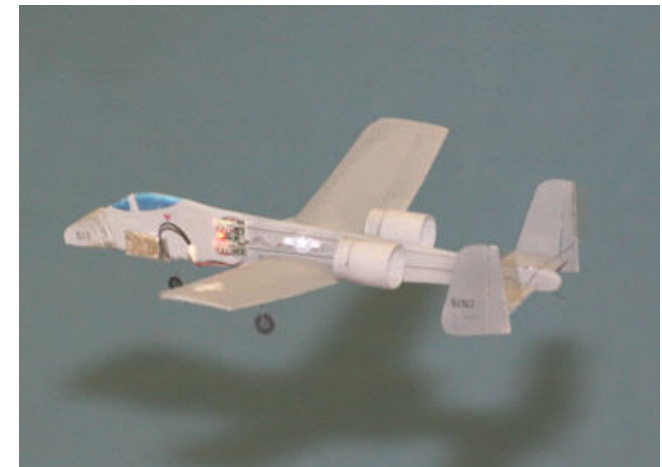
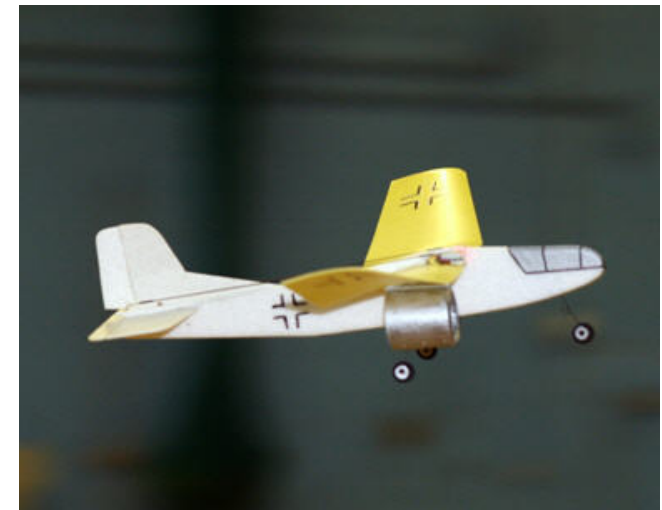
So what to use for power? Well, I just happened to have a pair of micro 30mm Electric Ducted Fans (EDF) units stashed away for the past year or so - these being salvaged from a wrecked cheapo "AirHog" model - the type that uses differential throttles for control. Similar models have been sold under different brand names - including "Silverlit" in the UK.

Enter John Stennard. John is a regular correspondent for RC Model World and Q&EFI magazines --

www.qefimagazine.com

-- and is a pioneer in the use of these small, low cost EDF units on simple indoor models. These fans don't produce much thrust, and care must be taken to keep the model light and provide plenty of wing area to develop sufficient lift without too much induced drag.

Two of John's earliest successes using these tiny EDFs are the Arado look-a-like and A-10 Warthog. Both use the three channel Parkzone Vapor receiver (Rx) module and have aftermarket airfoil wings. Based on John's success with these designs, I was confident that the Duo



Monoplane and the AirHog EDFs would make a great matchup.

In the original write-up, Bill Dean suggested that the "all-up weight should not be more than one ounce", and this was our target for the RC version. It ended up only 1 gram more than this - at 29 grams total - which includes the 160 mAh LiPo cell.

The outlines are exactly the same as the original model, but the overall size was increased serendipitously from 15" to 16" span. Structural

weight reduction (to offset the weight of RC gear) was achieved by using thinner balsa for the fuselage (3/32" vs. 1/8") and 2mm Depron® for the flying surfaces, braced with carbon fibre rods (vs. 1/16" sheet balsa). (3)



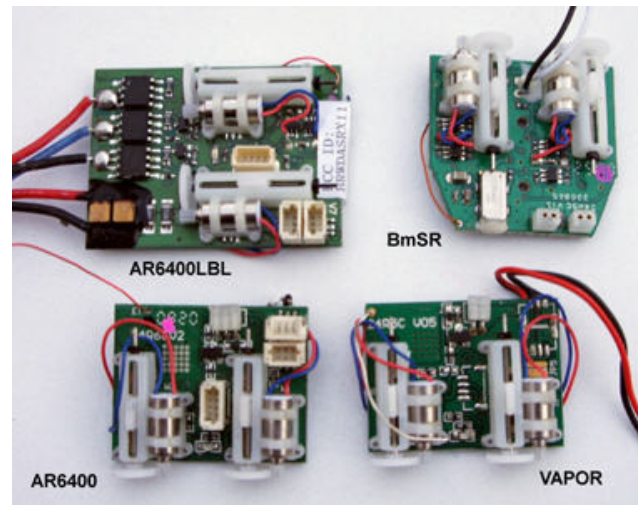
So how does it fly? Awesome! It is the smoothest flying micro in our gym (we fly everything from Vapors to T-28s). At least half a dozen pilots have tried it, with universal feedback that it is "so easy to fly!"

Despite the lack of rudder control, it handles quite well in our standard size basketball court gym - although it does take some flight planning - as "normal" turns are fairly wide. Tighter turns are possible, by banking over and giving it a shot of throttle and up elevator in the turn.

It has ZERO aerobatic capability (that we know of!) - so you'll just have to just cruise around at half throttle, listen to the strange sound, and smile! It also seems to have only one flying speed - about the same as a Hobbyzone Champ (see photos later). Give it throttle and it climbs, cut the throttle and it descends. Nope.... it's not a pylon racer either!

One other modification from the original design that I should mention is the mono-wheel landing gear... or should I say undercarriage? The wheel was "borrowed" from a Parkzone Sukhoi - although any small lightweight wheel would do.

Takeoffs and landings from the gym floor are a breeze with this setup - and steering is also possible by banking left or right thereby dragging one fin or the other. If you intend to fly outdoors only, don't bother with the monowheel.



RC Equipment Considerations:

This photo, courtesy of John Stennard, shows four of the current Spektrum ultra micro Rx modules. The unit shown on the bottom right is the Vapor/Ember 2 module - 3 channels with aileron and elevator servos on the board and a single (brush type) motor output. This is the same type of module that is presently installed in the Duo Monoplane, as shown in all other photos. The transmitter (Tx) mixing is set for "Elevons" - mixed elevators and ailerons. Using a Spektrum DX6i transmitter, the Rx module must be mounted

with the servo gears at the back (to get the surfaces to move the right way) - which is no problem, but you must be careful when installing the pushrods so that there is no interference.

The Night Vapor module (not shown) is similar, but with an additional output for the lighting circuit. Mmmm.... a Duo Mono with lights?

The unit shown in the upper right corner is the "5 in 1" micro heli receiver - 4 channels plus gyro with the equivalent of aileron and elevator servos on the board (same as Vapor) but with TWO throttle outputs - which can be controlled together (throttle) and differentially (rudder).



This differential thrust arrangement has been used to great advantage with aerobats such as the "Goolie". This "standard" EPP version and new "micro" Depron version are also by John Stennard.

Flight trials were conducted with the Duo Monoplane using the 5in1 heli receiver with each fan connected to a separate throttle output for yaw control.

Although the fans are close together, they are separated by a "plate" (the profile fuselage itself) and the yaw effect is quite noticeable when you move the rudder stick. Indeed, the turns can be tightened somewhat - but to be honest, it wasn't much of an enhancement with this model.

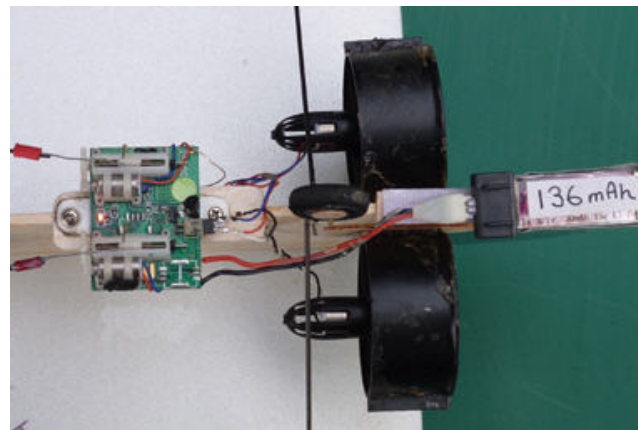
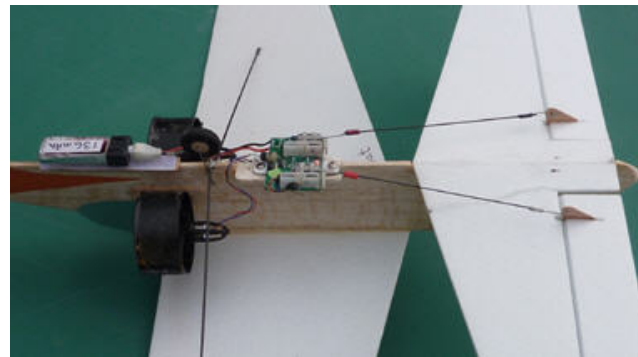
Furthermore, this module is equipped with a gyro - and there seemed to be some strange, momentary, and unauthorized motor speed changes, especially when coming out of a turn. Is it possible the gyro was trying to make a "correction"? Although it was not enough to affect the flight path, it sounded annoying - so I removed the heli Rx and went back to the regular 3 channel Vapor type. The heli Rx is also slightly heavier than the Vapor type.

The receiver shown lower left is the 6 channel AR 6400, which has the "rudder" and "elevator" servos on the board. It will work just fine with the Duo Monoplane, but you will need to mix "V-Tail" - combined rudder and elevator - instead of "Elevon". And... using the Spektrum DX6i Tx, the module must be mounted gears towards the rear.

John's photo also shows the latest AR6400 with brushless electronic speed control (ESC) on the board (upper left) - but this unit is too heavy and would not be suitable for the Duo Monoplane as presented here.

As with all three channel airplanes... When using the three channel (Vapor) receiver, also mix "rudder" to "aileron" +100% both ways at your transmitter. When using the AR6400, mix "aileron" to "rudder" +100% both ways. With this setup, the plane will turn with either stick. This is especially beneficial if you frequently move back and forth between three and four channel air-

planes. With an elevon or v-tail setup, it will also provide some extra throw when you push both sticks over.

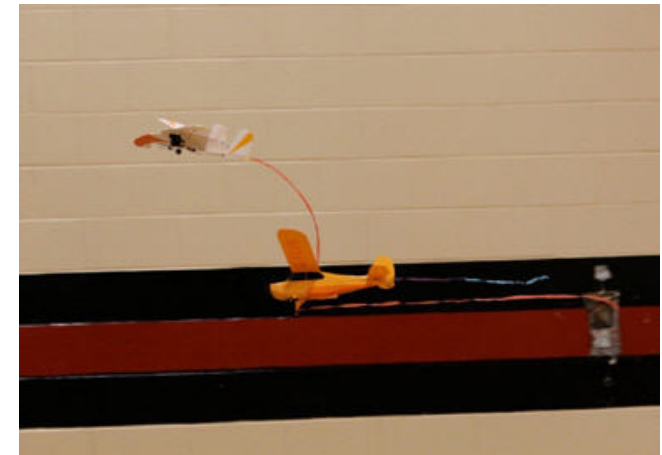
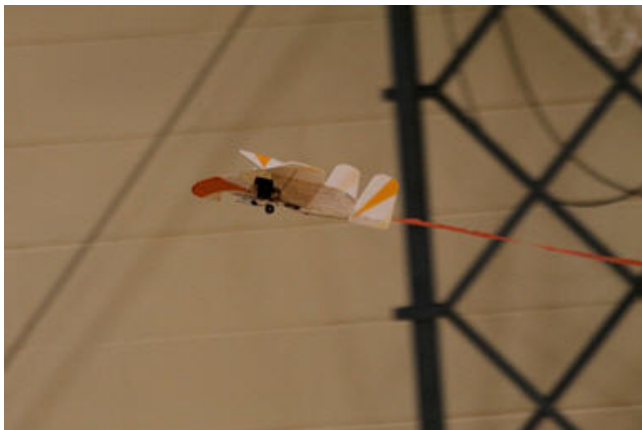
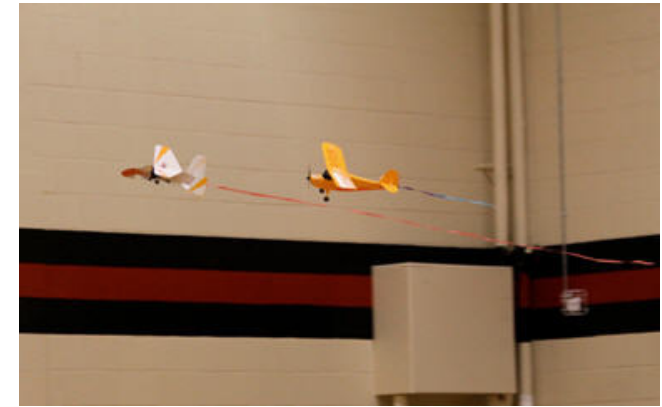


Construction:

Construction is straightforward, and all details are given on the plans. Use medium light balsa for the fuselage. The Depron® wing panels are bevelled at the dihedral joints and joined by holding one panel flat on the board and propping up the other panel to suit. The control surfaces are cut, bevelled, and hinged with Blendern. Carbon fibre bracing is standard practice - thin rods pointed at the outside ends and inserted into the wings and crossed over and glued into a small double wide notch at the fuselage.

The "Airhog" EDF units will need to be "cleaned up" a bit to get rid of excess glue. The 1/32" ply EDF mounting plates are slotted to fit over the plastic flanges, and glued in place so that the plates and flanges are at right angles. See section view on the plans. The fuselage itself is also slotted - and these assemblies are glued on either side - ensuring they are aligned and side-by-side. You may need to reduce the width of the plastic flange on the fan shrouds slightly to eliminate interference between the two fans when they are inserted into the fuselage slot. Double check the fan rotation before soldering the leads together.





Flying:

We discussed the docile flying characteristics earlier, and it's difficult to imagine any way of improving this classic design. Bill Dean would truly be proud to know that his Duo Monoplane has adapted so well to new technologies which were the stuff of dreams, some sixty years ago.

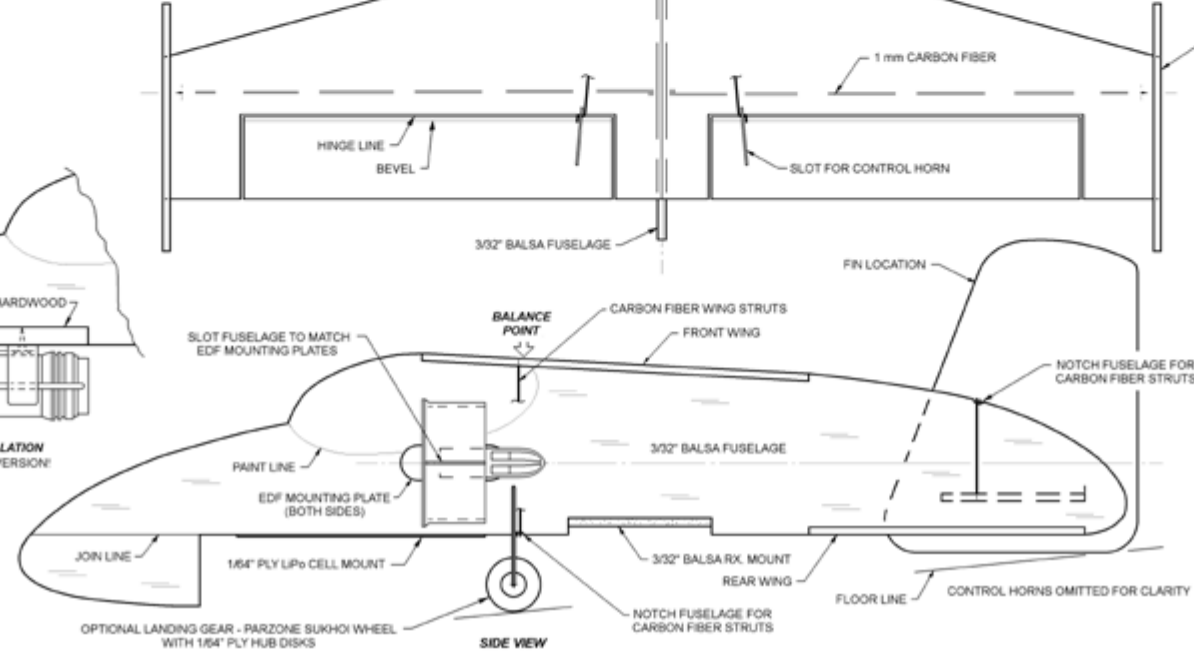
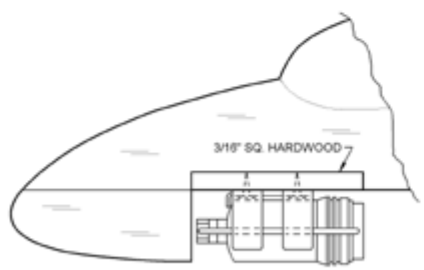
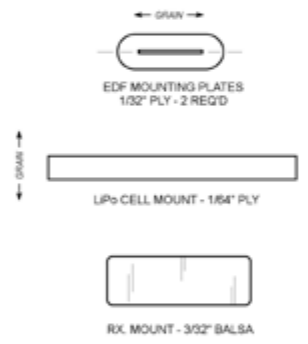
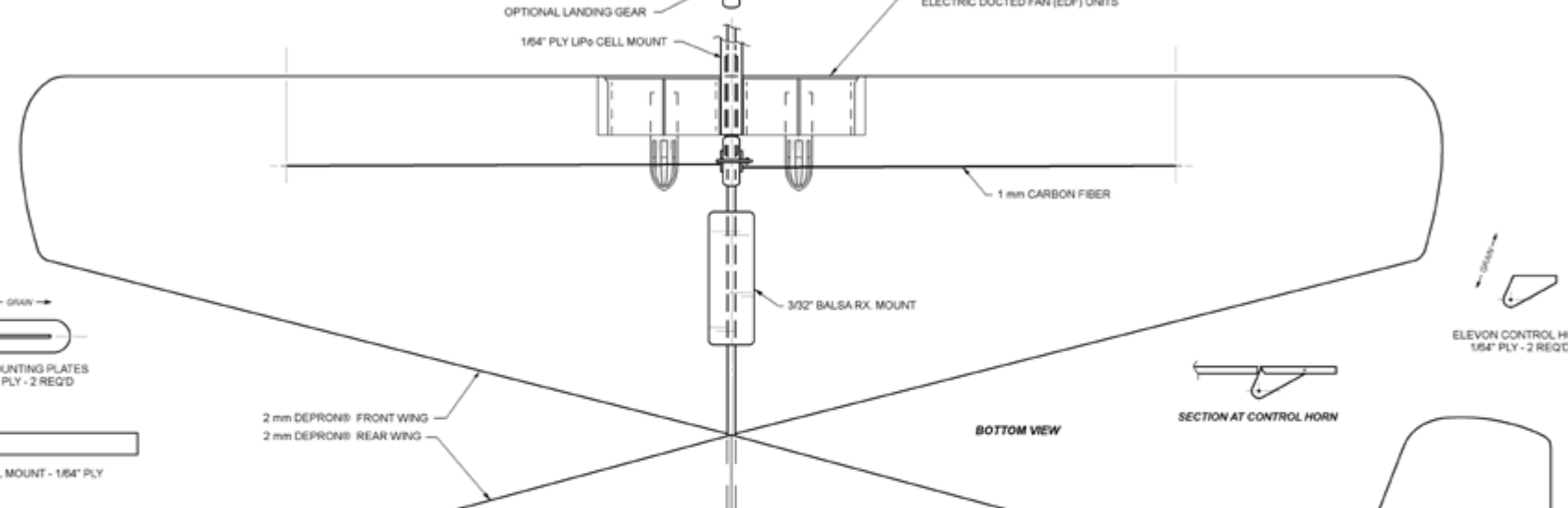
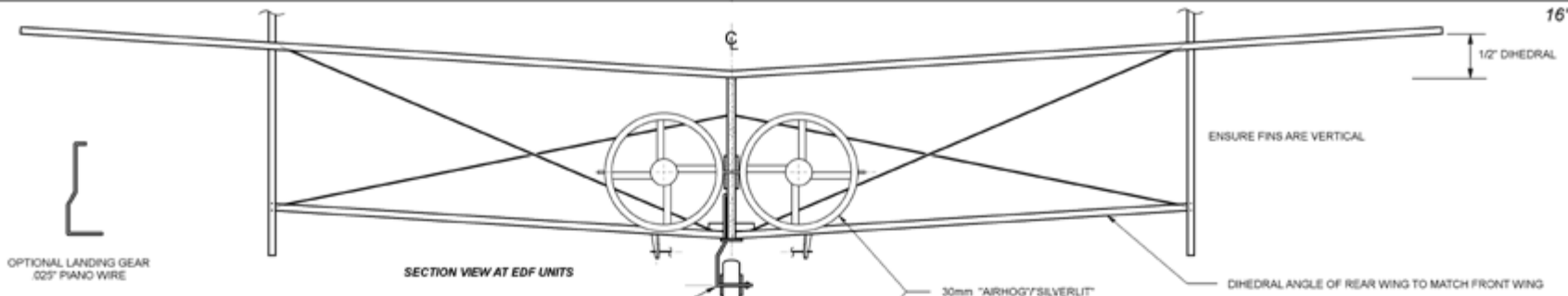
In these amazing flying photos taken by Peter Smith at our regular indoor flying venue in Sault Ste. Marie, Ontario, the EDF Duo Monoplane shows off its futuristic lines and streamer towing capability - standard practice in our gym!

In these last three photos, also snapped by Peter, the Duo Mono flies peacefully alongside a Hobbyzone Champ, until that dastardly Airknocker decided to take a bite of streamer! Where's Dan Dare when you need him? ...all in good fun of course, and no harm done.

Please contact me at

cattail@soonet.ca

if you have any questions - and of course, we'd love to see photos and hear of your adventures with the Duo Monoplane. If you'd like a copy of Bill Dean's original construction article and plans presented in Aeromodeller, just ask - and I'll send a .pdf file.



Note: The original all-balsa Duo Monoplane was designed by Bill Dean for Jetex "50" power and was published in Aeromodeller - January 1952

Bill Dean's DUO MONOPLANE
 Updated for Micro RC & Twin Electric Ducted Fans

Wing Span: 16"	Flying Weight: 29 grams (1.0 oz.)
For 3 Channel Micro RC	Updated by: Ctr. Moes Jan-11

0 1 2 3 4 INCHES