Christen Diffusion F-22

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Mark Hinton describes fitting out this interesting yet simple model

The first model F22 I ever saw was at Pampa Jets in 1998. It was a ducted fan plane and I did buy a kit then, but did not get around to making it. Things progress and now several years later I saw a super F22, turbine ready and much of the installation work already done. The kit is from Christen Diffusion.


Nice cockpit detail

The Kit

I opted for the deluxe kit which includes a fully moulded fibreglass outer shell with all the panel lines already etched into the surface. All the woodwork is glued in place and is reinforced with glass cloth to the fibreglass of the fuselage and wings. The undercarriage area is re-enforced with a carbon Kevlar cloth.

The captive nuts are installed within bearers to take the undercarriage. There are intakes and bypass, giving a fully ducted engine running into a light, well fabricated bifurcated jet pipe.

The wings are also fully moulded with wing tubes installed to take supplied carbon rods. There are two beautifully moulded fins and tailerons. These are also all pre-drilled ready to take the cap screws to hold the pivot actuator rods. A cockpit deck is a moulded plastic part pre-cut to fit and the canopy is a very clear moulded unit. The undercarriage consists of a set of Springair 411 units. These are bored out to take nicely made oleo legs which are custom built for this aircraft. The wheels are aluminium units with very light high quality soft foam tyres.

The brake system is the 'O' ring type and these have to be fitted onto the oleos. All the valves are supplied for the air system and these are Jetronic valves. There are 2 separate valves, one for the retracts and one for the brake units. The air line is also supplied together with a filler valve and some T's.

The fuel system suggested is a plasma bag type but due to the restrictions at some jet meets on plasma bags I had already decided to go my own route and make some fibreglass tanks. I also added the customary UAT. I decided to use a JetCat P120 on the initial installation.

The Installation

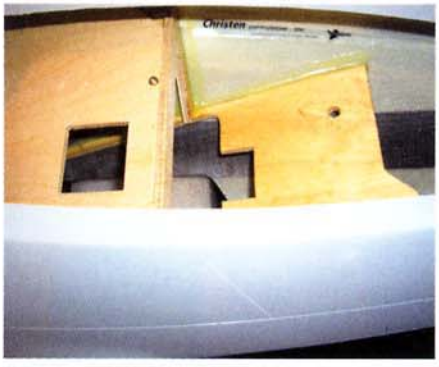
The first thing to do is to put it all together to see what it looks like in one piece. When I did this I found the first problem with the aircraft. Unfortunately the wing joining tubes that were supplied were just too small in diameter and when these were slid into the front tube in the wing I had over 1 mm of play, clearly the tube was the wrong size. However the carbon fibre rod supplied fitted very snugly both into the fuselage and the wing tube. These were used but not the forward rods.

I knew one of my first problems was to get hold of some new wing joining dowels. I went down to my local engineer and he turned me up some. These were a far better fit than the supplied unit. When the wings slid onto the dowels and wing tubes correctly I was able to check the incidence and it was spot on. I decided to fit locating pins to make doubly sure that the angle of incidence did not alter with high 'G' manoeuvres. The next thing to fit was the tailerons.

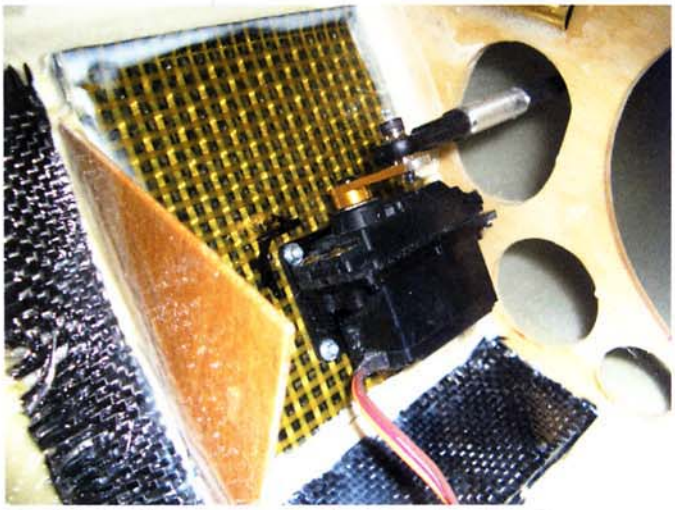
Four very nicely machined nylon bushes are supplied. These bushes slide into the holes that are already drilled into the rear part of the fuselage. They have to be located and glued in. Two aluminium rods bolt into the elevons. All the holes in the elevons are already drilled and tapped. After a small amount of work on the bushes and the rods everything was rotating very freely and I decided to glue them in and let it set overnight. I am a great believer in BVM Aeropoxy so that is what is used throughout the installation.

On returning to these the next day I found that things had tightened up a little bit and the


As supplied with servo cut outs in place and fully ducted installation


Servo trays under cockpit all pre-fixed


'D' shaped outlets for the bifurcated tail pipe



One of the 2 taileron servos mounted on strengthened panel

Rigid fuel tanks made to fit space

bushes were a little tight in the wood. A couple of hours work and everything rotated nice and freely again. On the inner end of the elevon actuating arms are two aluminium horns already drilled to take clevises or ball joints.

I opted for a very heavy-duty ball joint because I did not want slop in the elevons. The next thing to install were the two servos, I decided on using the JR 8511 servo with 15 kilos of torque. They could not be mounted in the position in the instructions because I was going to use solid tanks rather than plasma bags.

I decided to mount these onto the sidewall of the fuselage. The sidewall of the fuselage needed re-enforcing to take the torque, so I added some carbon fibre mat to the side of the fuselage to stiffen it up. Two JR side mounts were purchased from Motors & Rotors to fit the JR 8511 servos and these were glued in place. I used carbon fibre push rods to link the servos to the elevon horns. The only other servo left to install was the nose wheel servo in its cut out position. This really is the simplest of aircraft with the minimum of servos.

Checking C of G

I quickly laid all the equipment inside the aircraft just to see where it was going to balance. It was soon clear that I was going to have to put everything in the nose and I mean absolutely everything. The only position for fuel tanks was some 150 mm behind the C of G. Obviously this is not a good thing because as you run out of fuel the plane becomes heavier to fly as the C of G starts to move forward. I had however already seen one of these planes fly and it had no problem with the C of G moving during flight. The Jetronics valves were mounted up in the front and I made sure I left enough room between the ECU and the receiver. The next thing to make up and install were the fuel tanks.

I decided to mount the fuel tanks on a couple of pieces of light GRP resin impregnated board. The board is light and once the tanks had been stuck onto this with silicon I could remove a completed tank unit for any service work that I may want to carry out. I filled one of the fuel tanks up with water I found I could get over 3 litres in the tank. This would give me a flight time of between 8 and 10 minutes. However I decided to cut them down to an overall fuel load of 2.2 litres. The tanks fitted perfectly in place. I made up a couple of small bungs to take a clunk and used BVM flexible fuel line within the tank, these were then submerged in water and pumped up to about 20 psi to check for any leaks. With the fuel tanks mounted the next thing was to fit the engine and the bifurcated duct.

The Fins and Tailerons

I considered making the fins removable to facilitate easy transportation. As supplied, the fins slide onto two carbon rods, again the holes are in the fins for these and there are tubes already installed and bonded into the fuselage to take the other end of the carbon rod. Once these were on the tail cone was pinned in place and screwed with 4 small screws. The tailerons however were left with the original drilled and tapped holes so they can be removed for transportation. The model was then inverted in the building frame and the 3 retract units fitted easily into the pre-drilled holes which already had the captive nuts installed. I decided not to fit gear doors as the model was being built for one purpose, to revisit Pampa. Anybody who has flown off of grass with gear doors knows that they do not last long!

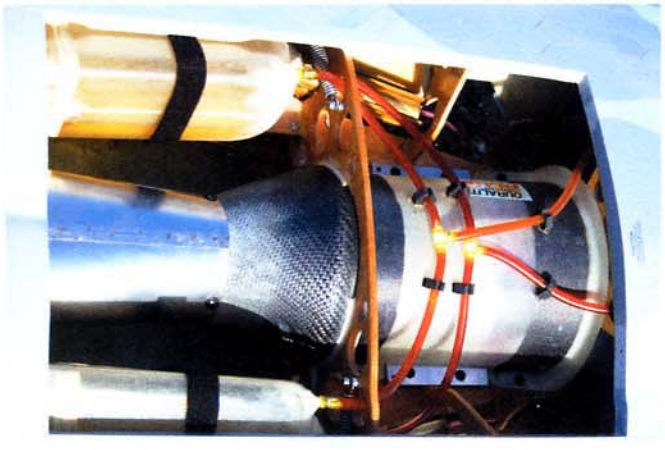
BVM hatch catches were used on both the canopy assembly and the main hatch. Very little work was needed here to get a very good fit. A small amount of cockpit detail was put within the very clearly moulded canopy.

Installation Complete

Another couple of evening's work and most of the installation was now done. All the wiring was in, the engine was bolted in place and all the airlines fitted and left under pressure for an evening to make sure I had no leaks. The undercarriage worked faultlessly from the start. A pull/pull system was used for steering of the front nose leg. After getting the model to this state of finish the C of G was again checked and I found that I was still a little light on the nose end.

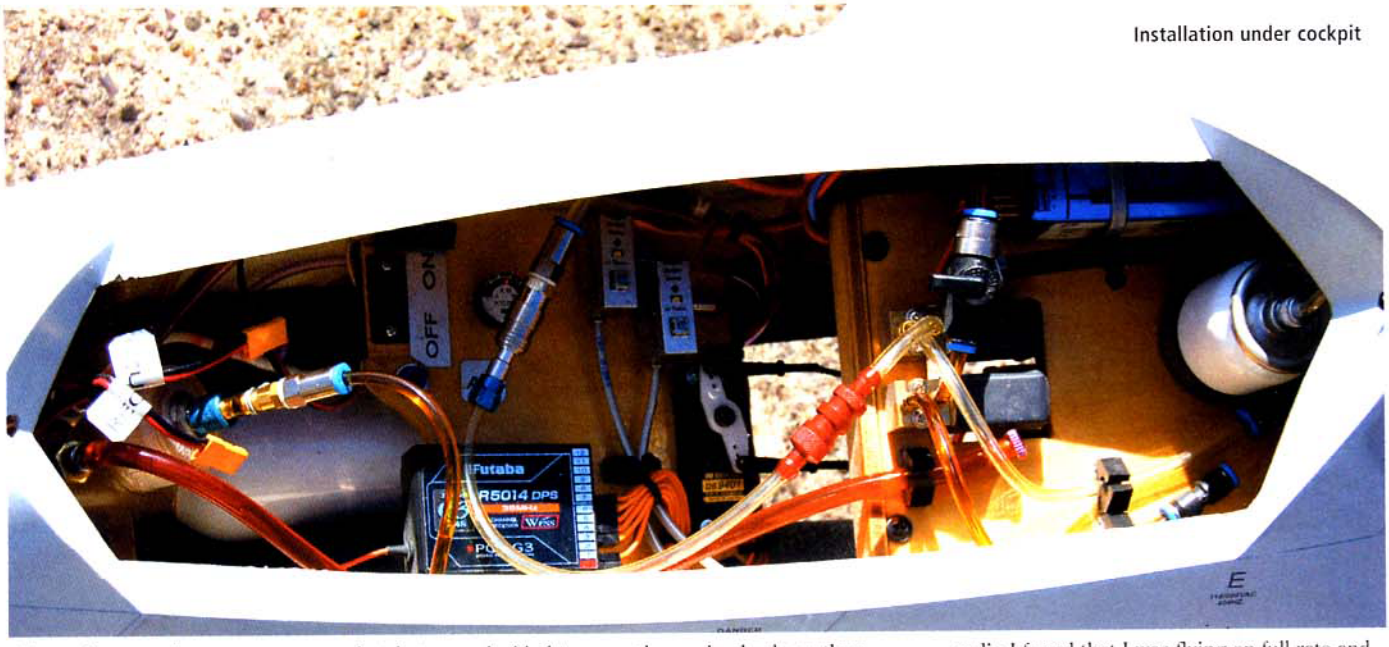
I filled the UAT up with fuel and placed it in the front end of the model so I could use this as helpful ballast. I had to keep the pump closely located to it so the drag on the pump was reduced as much as possible.

I used the Duralite Battery system because this gives me some security if a cell failed



Installation complete with engine in place

Method of securing tanks using straps



Installation under cockpit

without the necessity to run two complete battery systems. The receiver battery is a 4,000 mAh with redundancy and the ECU power pack is 4,000 mAh. With the Duralite system you have to run a voltage regulator, I decided on 5.1 v as I was using JR Radio throughout. FlightPower also can now supply the new safety switch for this system. With the ECU pack and receiver pack in the nose of the model and the full UAT I was getting somewhere close to the correct C of G position, but I still required 120 g of weight in the nose.

To complete the model I purchased two sheets of decals from Jerry Caudle of Promark, one of nomenclature and one of stars and bars all in low visibility grey. These were applied and the finishing touches were made to the model.

Test Run

A small amount of fuel was put in the model ready for a test run. All the pipework in the model was pre-primed with fuel using the test function in the JetCat ECU. The engine fired first time. I ran the engine for a few minutes, and I noticed things were getting warm. The engine was too far away from the front part of the bifurcated duct and the carbon fibre joining cone had just started to get hot and there was a smell of burning resin. This was duly cooled down very quickly with a CO_2 extinguisher. No real damage was done and it was decided to move the engine back another 20 mm.

The First Flight

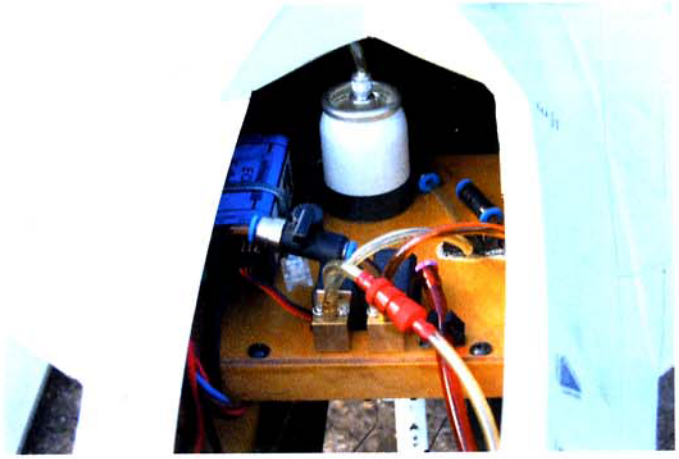
At Abingdon the next morning I proudly got my new plane out. I had one of my buddies check the model over, as I wanted a second pair of eyes to make sure I had not missed any detail. The C of G was once again checked with a full UAT. On giving the engine a full power run up it was found that one of the tanks was drawing a small amount of air in through the seal round the lid of the tank. I could see that this would give me no problem once in the air other than one tank emptying quicker than the other.

I had estimated a flight duration of around 8 minutes, but decided that I would fly for just 4 minutes for the first test flight. I taxied out to the flight line, turned the model into wind, opened the throttle and she quickly started to pick up speed down the runway. After about 30 m the nose started to lift on its own, I watched carefully as the plane became airborne, retracted the undercarriage and we were away. The plane was climbing very slightly but there was no trim needed in roll or pitch for this first flight. I proceeded to do the flight, came back round into wind and slowed up a little. On the first circuit full throttle was not required, it is quite a slippery aeroplane.

Although I had put rates onto the MX22 radio I found that I was flying on full rate and it was very smooth. I climbed to gain a little height and then throttled right back. I just keep increasing up elevator until the plane just nodded to let me know that the stall was imminent. Over the top of the stall, it started to gather a little bit of speed, I put the power on and we were back into a good flight envelope again.

With the amount of wash out already built into the wings I had not expected anything else. I proceeded to do a couple of rolls to the right and a couple to the left, all these went very well and a very small amount of down was required in the inverted position, it meant the C of G must have been somewhere close.

On the next circuit I pulled into a big loop which was executed very cleanly and the plane did not screw either to the right or to the left. Suddenly I was reminded that we were at 3 ½ minutes, I was thoroughly enjoying the F22. The next circuit was a gear pass, all the gear was down and locked. I came round and lined up for the landing. The plane actually came in a lot quicker than I expected and was not bleeding off the speed at all. I put straight down the runway, I just held the nose up until the speed was fully bled off, it was a very long landing but she was down, no scrapes, bashes, or scratches. A small touch of the brakes was used at the end of the landing. The model was turned around and taxied back. The hatches and canopy were



Much of installation pushed right to front

ECU connections for JetCat

On the flight line!

then removed and the engine put into the shut down sequence. The engine cut, the tail cone did not get hot, perfect, however on looking at the fuel tanks my suspicions were right, the right hand fuel tank had emptied a lot quicker than the left hand fuel tank.

Post Flight Inspection

The post flight inspection revealed that the bifurcated spot welds had become detached which meant some of the rear scale tail cone detail had been burnt. Also a couple of blisters had appeared in the underneath of the fuselage. It was decided to go no further on this first day. In the workshop it was found that one fuel tank still had 200 cc of fuel in it and the other side had 700 cc left in it. Once the fuel tanks were taken out I was then able to draw the bifurcated duct down to the back of the model. It was found that the spot welds had probably come off some 150 mm up the pipe. This had meant that hot gases had managed to burn some of the scale detail on the rear cone, also a couple of blisters appeared on the fuselage surface underneath.

It only burned the underneath of the fuselage because the top is already supplied with the ceramic wall stuck in. The leak in the fuel tank turned out to be an 'O' ring that had pushed out as I was filling the tank, this was replaced with a new one and sealed with a small amount of sealant. With the amount of fuel consumed I decided on the next test flight to push the time up to about 6 1/2 minutes.

Conclusion

In conclusion, I thoroughly enjoyed putting the F22 together, the shape and the overall finish of most of the parts and components were excellent. A couple of small problems were found in the kit, the main one was the aluminium wing spar. The second was the bifurcated duct coming apart during the first test flight. The plane is however a delight to fly.