Skymaster Plus F4 Phantom ARF

While all of us have a general love affair with aircraft, each one of us has that one airplane that we love above all others. It is the one that we dreamed about as children, built plastic models of as adolescents, and hoped to fly one day as we bought our first radio control trainer. For me, that plane is the F4 Phantom. I have been patiently waiting for a manufacturer to kit a large ARF model of the "Rhino", and Skymaster finally granted my wish right down to my favorite Jolly Roger paint scheme.

I must admit, as excited as I was to see this model on the market, sending a large wire transfer overseas without the usual protection of a credit card did give me pause. I shouldn't have worried, however, as the communications from Skymaster were excellent and the shipping was on the date promised. Total transit time from Guangzhou, China to Jacksonville, Florida was a very quick 5 days.

This had to be one of the best packed kits I have ever seen, including a double walled box, plywood sheets on all sides, heavy cardboard partitions and plenty of foam packing. Parts were individually wrapped in bubble material and taped to the sides of the container to prevent them from shifting during transit. Even if DHL had driven one of their trucks over the box, I doubt it would have done much damage.

Weight of all the component pieces was right at 24.5 pounds. Allowing 10.5 pounds for engine, electronics, UAT and batteries, I estimated the dry weight at 35 pounds, which would be surprisingly light for a 94-inch model. The Jet Central Rhino was chosen for propulsion, as I would expect about a one to one thrust to weight ratio. I have found this is the performance "sweet spot" for my style of flying.

Construction Notes

There is one caveat to the construction notes that follow. My kit was one of the first produced and as with all new products, there are opportunities for improvement. I have identified these in my comments on the build. You will likely find that some of the issues I have identified have been corrected by the time this article goes to press, as the kit will have matured considerably.

The manuals are long on pictures and short on text and I didn't feel that much time had been invested in their preparation. Having said this, the assembly process was generally straightforward due to the simplicity engineered into the design of the Phantom. Any modeler with minimal experience building jets should have no problem with this kit.

I began with the rudder. This is the only control surface on the model that requires hinging and some time is required for fitting and notching the pin hinges to get the proper clearances and recommended 25 millimeter throw. Parts fit was excellent, however, and the predrilled holes were accurately placed. I was also impressed with the engineering of the linkage system, which consists of two short control arms connected to a sturdy bellcrank. A very short but substantial metal rod is embedded in the bottom of the rudder that fits tightly into a notch on the top of the bellcrank. There is zero slop in this system. Pay attention to the orientation of the bellcrank slot as it slants from back to front. If you miss this, the fin will not sit flat on the fuse. Remember to grease the bearing sleeve and file a small flat spot on the bellcrank for the control horn setscrew. Use thread locker on the setscrew.

The vertical fin fit nicely without additional shaping

While testing the rudder actuation, I did find slight lateral movement of the vertical fin near the bellcrank. Lingering concerns also persisted as to the reliability of a single

attachment bolt as specified in the instructions, so I drilled and tapped an additional 8-32 attachment bolt just ahead of the rudder bearing sleeve. This solved both problems. As one more safely measure, I also installed a small 4-40 bolt through the carbon fiber vertical fin spar (see photo). I now have absolute confidence that the vertical fin will remain attached to the airframe.

Note the extra fin attach bolts, nice tight linkage

The stab installation was next. Bolting the factory pre-fabricated stab and its bearing plate into the tail took only a few minutes. Since the metal control horns were also pre-fitted, the primary work on the stab was servo installation. As with the rudder, the design of the stab mechanism resulted in a very secure installation with no free play.

Short linkages and factory mounted bearings and control horns made stab install easy, slop free

The F4 instructions show the JR matchbox for the twin stab servos mounted to the stab bearing plate, but JR recommends that the matchbox be not more that 12 inches from the receiver so three extensions will be required in total – rudder plus two for the elevator servos. Secure the leads to the upper side of the fuse well away from the pipe.

While the instructions don't address how to attach the tail cones, I decided to glue small wooden blocks and bolt them to the aft former. Spacers were ultimately required at the top block to achieve some down thrust. There were also no instructions for the arresting hook, so I simply epoxied two ply plates in the keel of the tail and bolted it in place. I installed a third bolt into the lower stab cover plate to give this hatch additional lateral stability.

Screws were passed through mounting blocks for tail cone installation

The fuel tanks are Kevlar and a step up from prior Skymaster tank offerings. I did struggle a bit with the tank hardware, however. The tank cap kit came with a Phillips head screw to clamp the metal plates around the stopper and I found it impossible to get it tight enough to prevent air leaks without stripping the head or applying significant pressure on the tank itself, risking a rupture. The brass tubes were also too soft. I ultimately replaced the cap kits with higher quality BVM parts.

The two saddle tanks fit nicely into pockets created by the formers and engine rails while the main tank slid neatly into place between the intakes. While the instructions called for the main tank to be glued in place, I elected to use a wooden brace bolted across the former just ahead of the tank so it would be easily removable for maintenance.

Saddle tanks fit nicely and are easily accessed

The manual calls for the front nose section to be mounted to the fuse at this point, but I elected to defer this step until later as my workshop is somewhat confined and the two sections are more easily worked apart.

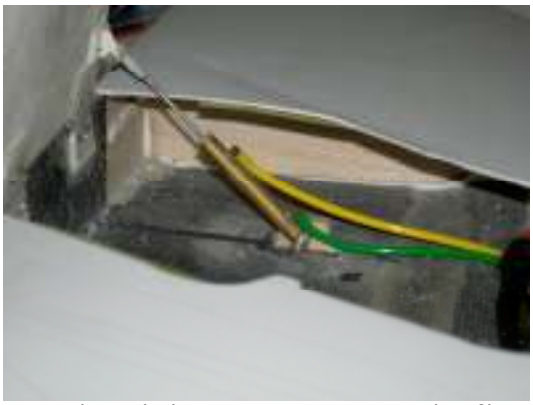
The Skymaster cockpit is nicely done, but will take some time to fit. It required a fair amount of trimming and a piece of the front tub must be cut away to allow clearance for the nose steering servo to move past it if you have the short nose kit. This is not an issue as this part of the tub is hidden behind the front instrument panel.

The nose gear doors are straightforward installations. I did use small panel screws to reinforce the hinge attachment. It is a good idea to turn the hinge pin around on the front hinge so the door can be removed at a later time. I found that the air ram supplied with the hardware kit didn't have enough throw to open the door, so it was replaced with a larger unit. The nose was now aligned on to the main fuse and all six bolts aligned perfectly.

Center tank shown with ply brace, air and brake valves attached

Wing work consists of mounting the retract units, installing the doors and then fitting the aileron and flap servos. The gear mounts required minor trimming for the retract units to fit. There was quite a bit of inward cant to the gear legs, so a bit of shimming was necessary. Finally, the front mounting tabs sit very close to the surface of the wing and I ended up countersinking the mounting lugs and using flat head bolts to allow for door clearance.

The inner gear doors are hinged to the wing root, which is constructed with a very thin layer of fiberglass. A reinforcement strip of glue had been run down the centerline of the root, but it didn't provide much stiffening. Since the pin hinges would be attached to this surface, and the air ram would put force against the root, I elected to reinforce it with carbon fiber cloth and epoxy resin. Some experimentation was also required to find the right mounting points for the supplied inner door rams to insure adequate travel (see photo).



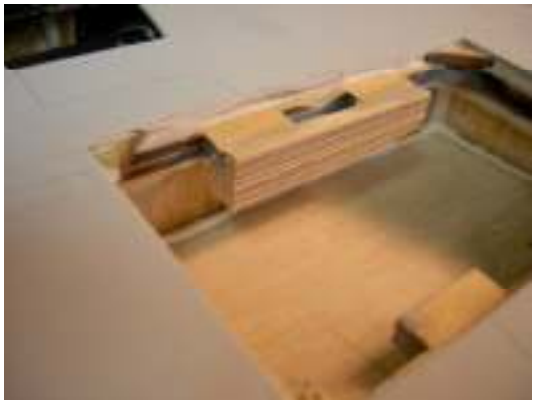
Inner door cylinder ram mounting. Note carbon fiber stiffening of wing root

The strut cover doors are mounted directly to the gear struts. This can be accomplished with a strap you will need to fabricate or by gluing the door directly to the strut using a hardwood spacer.

The outer doors actually overlap the strut cover door, so the only task once the door hinges were attached was to affix a small spring to keep the doors closed in flight. Finding a spring strong enough to keep the door shut while not putting undue force on the door while open has proven to be problematic. All in all, the main gear doors were the one construction sequence that did not flow smoothly.

Strut cover glued an wire tied to strut with wood block spacer. Note outer door spring

The instruction manual called for the servos to be mounted to a ply plate affixed to the top of the wing. I had been told that this had resulted in flexing of the skin when the servos were actuated on early prototypes. My production kit had added ribs for strength on either side of the servo compartment, and a set of ply tabs affixed to the bottom framework of the wing. None of this was in the instructions, but these tabs were positioned perfectly for servo installation so I intuited that this was their purpose. They turned out to be just slightly wider than the 8611a servo tabs so I fashioned ply extensions (see photo). I did elect to replace the clevises supplied in the hardware package with ball links to prevent binding, as the geometry of the linkage changes slightly as the control surfaces move.

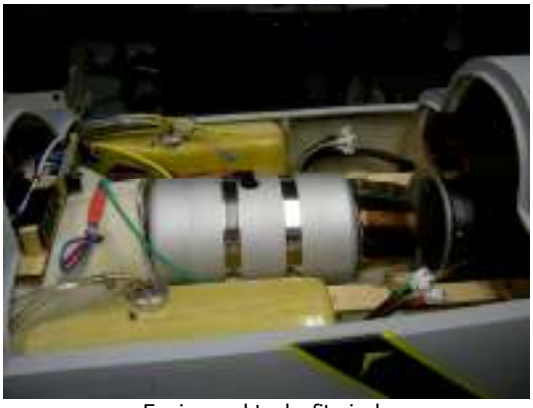


Modification to the forward ply mounting tabs for wing servos

Final servo installation

To finish off the wings, I routed a hole in the wing root just ahead of the main spar rib for the air lines. In the fuse this is an open space just behind the rear tank former. The wings were test mounted and as with all other major components, fit was excellent with no gaps at the root. The wings slid easily over the carbon fiber spar that runs through the fuse, and the attachment bolts at the rear spar and leading edge tab were perfectly aligned.

The last construction task was turbine installation. The Rhino fit exactly between the stock mounting rails. While I had ordered the fully enclosed bypass, it was set aside to facilitate cooling in the rear of the fuselage. I removed about 1 ½ inches from the intake to allow placement of the engine as far forward as possible. The Rhino was bolted in place with 6/32 cap screws and blind nuts. With the turbine secured, I glued two hardwood blocks to the top of the engine rails and bolted the forward pipe mounting tabs in place. Construction was now complete! Total build time was approximately 50 hours.



Engine and tanks fit nicely

UAT, ECU and valves mounted to plate in nose section

Setup

Three Lithium Ion packs were temporarily placed in the nose. Radio programming was quickly completed and I filled up the tanks with Jet A and double checked the fuel system for leaks. Finding none, the engine was primed and the Rhino roared to life. During this first test run, be sure to pay special attention to the stab section at full throttle. If the pipe incidence is correct, there should be no apparent buffeting of this control surface. Upon shutdown, immediately inspect the tail section for any signs of heat damage.

Once the Rhino cooled down and fuel was drained, an initial weight and balance computation followed. I utilize three baby scales and a CG spreadsheet to do this work on large airframes. More info on this can be found on the Jet Pilots Organization web site: www.jetpilots.org. The good news: the F4 tipped the scales at 34.1 pounds, slightly lighter than I had originally anticipated. The bad news: almost 18 ounces of lead would be required to achieve a CG 290 mm aft of the leading edge. I typically tape ballast weight to a long stick that is pushed as far forward into the nose as possible and then screwed to a forward bulkhead for easy removal and adjustment as necessary.

With lead packed into the nose section and the CG confirmed, I settled back to await an opportunity to test fly the Phantom.

Flying the F4

I wish I could say that the initial test flight was uneventful, but that would not be true. After 300 feet of ground run on the asphalt runway, the big Phantom lifted off nicely. I turned downwind, picking up a bit of altitude and speed. At this point, the ECU sensed a problem with voltage at the receiver, and while I noticed no loss of control, the ECU shut the engine down. Low and full of fuel, I immediately turned back and just made the runway. The landing was heavy, however, and one of the ply main gear plates delaminated and partially pulled free. This led me to retrace my steps and reinforce the plates with additional glue.

Robart quick disconnects and Ashlok servo connectors make for quick set up at the field

While admittedly it was a very short flight, my immediate impression was that the recommended CG and throws were very good. I had programmed about 15mm of up elevator from dead level neutral (see photos) and this proved to be very close to final trim for level flight. Total elevator travel was as recommended at around 105mm, though I had to enlarge the elevator opening just a bit to achieve this amount of movement. The roll was just a bit slow at 30mm of throw.

While the cause of the voltage anomaly was never identified, JetCentral offered a replacement ECU quickly and subsequent flights have been trouble free. The Rhino has proven to be a good match for the Phantom. Flight characteristics are scale in nature. Speeds and vertical performance are acceptable, though decidedly not on a par with the popular sport jets. Slow flight characteristics where surprisingly tame for an F4, and I was a bit surprised to find that the plane actually floats a bit in ground effect making for very smooth landings. Flight conditions in Florida at this time of year feature extreme heat and humidity, but

the airplane still manages to perform admirably.

I originally had mixed feelings about the amount of downthrust inherent in the design. On the positive side, it keeps the stabilizer out of the exhaust buffet. I was concerned, however, that it might produce significant pitch change at various throttle settings or hamper the transition to inverted flight. None of these tendencies were apparent. I was also pleased that the airplane pulled straight up into verticals with no rolling moment. As you can see from the photos, slow camera passes are what this plane excels at.

The big Phantom takes to the air on a test flight

The saddle tanks carry approximately 60 ounces of fuel each, while the center tank holds another 90. With total usable fuel in the 200-ounce range, I was not surprised to land with most of the main tank remaining with the timer set at 6 minutes. Most of this flying time was spent within three or four clicks of full throttle. I have worked the timer up to 8 minutes, which leaves a comfortable reserve for a go-around if necessary.

A few items requiring adjustment have arisen in the first months of flying. Even set to proportional mode, the JetTronic brake valve is very sensitive and requires a deft touch to avoid a brake lock-up. Aluminum parts replaced the composite elevator bearings and I retrofit these free upgrades when they arrived from Skymaster. Check to make sure there is no side to side movement in the elevator and shim the bearings if necessary. While not called for in the instructions, I noticed several other builders had reinforced the rear elevator bearing plate with metal L brackets secured to the aft former and made this change as well. As I suspected, flight photos confirmed that the outer gear doors were popping open in high-speed flight and I am still experimenting with various spring sizes, lengths and tensions. The main doors are gapping slightly and the door cylinders will eventually be replaced to increase throw to from 25mm to at least 30mm. Lastly, the battle to keep the flat finish clean continues. Be extra careful not to leave spilled kerosene on the paint, as it will cause rapid yellowing. I have found that carburetor cleaner misted lightly onto a clean cloth works best, but be very careful, as the solvents will remove the paint if applied heavily.

You will also need to keep an eye on tire pressures. The tires are tubeless inflatable in design, making them easy and cheap to replace. I found a pressure of about 40 pounds works well. Be careful not to over inflate.

The F4 touching down

<u>In summary</u>

There is much to like about this kit. Major parts fit was excellent and the general engineering results in reliable and precise linkages on all the primary flight surfaces. Assembly of most components proceeds quickly. The landing gear, retract units and brakes are all of excellent quality. The model sets up quickly at the flying field and is easy to transport. Lastly, the airplane looks great in the air and is not difficult to fly, countering the reputation that most F4's have. Its impressive size also helps with visibility issue that normally accompanies short span, small tail aircraft.

On the other hand, the hardware kit is incomplete and some parts were not up to my quality standards. The cylinders included with the air support option were inadequate. I would recommend passing on both and shopping for higher quality components. The instruction manual is better than some, but is not as comprehensive as I would have liked. The plywood used on the gear mounting plates

is a weak spot and should be reinforced and inspected frequently. The engineering of the gear doors requires some retrofitting and experimentation but can be made to work.

The F4 looks absolutely genuine on a low pass

These issues are not fatal, however, and with a bit of additional effort, you will be rewarded with one of the truly unique airframes available on the ARF market today. My Skymaster F4 certainly draws more attention and enthusiastic remarks than anything else I take to the flying field, and those low, slow flyby's do look so good!