

Fei Bao Jets

May 2012

Mirage F1 Assembly Manual



Written by Dawid Visser

**Congratulations on your purchase of the Fei Bao Mirage F1 Jet.
May you enjoy this model jet aircraft and we wish you many happy landings.**

Disclaimer:

THIS IS NOT A TOY. This is a high performance miniature aircraft, capable of high speeds and capable to cause injury of even death or damage to property. The manufacturer and its distributors cannot control how you assemble, what equipment you use to fit it out, or how you operate and fly it and

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cannot assume any liability for any damages, injury or death that may occur when you operate or fly this aircraft. By assembling this model you agree to indemnify and hold blameless the manufacturer and his/ her agents from any and all sorts of liability associated with the use of this product. Please inspect all parts before beginning assembly. If any parts are missing or appear to be suspect, please contact your dealer or the manufacturer for repair or replacement **BEFORE** you begin. Once you have completed construction you are the pilot in command and are responsible for the operation of this aircraft including any damages or injury or death. R/C model jets require a high level of skill both in assembly and flying. If you do not feel confident in either of these aspects, PLEASE get assistance from an experienced modeller. It is HIGHLY RECOMMENDED to have a second experienced modeller thoroughly check your aircraft after assembly. A second pair of eyes may spot a problem that you have missed. If you have not flown a model like this before it is HIGHLY recommended that an experienced jet turbine pilot do your maiden flight for you. The first few seconds of the maiden flight can be critical until the aircraft is trimmed out. Having an experienced pilot at the controls can make the difference between a wrecked aircraft and hundreds of enjoyable flights. Fly from an adequate airfield with a long runway especially for the first few flights.

Introduction:

You have chosen a model that represents the pinnacle of ARF technology. While there is not a lot of building to do there is enough to keep you busy for a few evenings. We recommend that you follow the basic building sequence in order to save time and prevent any omissions that might have saved your aircraft. Read through the manual and decide on your building sequence. The main thing is to complete the fuel tank before joining the fuselage and the nose section!! The building sequence also optimises drying time of glue. You need to employ fine craftsmanship every step of the way as turbine jets are critical. Neatness counts and will also help to quickly spot something that might be loose or out of place. A chain is only as strong as its weakest link. Even the smallest component is important and can cause the loss of your aircraft. Take your time to do things right. Very important with high speed aircraft are the hinges and linkages that must be assembled accurately with no play or slop as it causes flutter of the flying surface that can easily cause structural failure and a crash. Keep this in mind with everything that you do, evaluate the result critically and ask yourself "is this potentially going to cause a crash of my aircraft?" If there is any doubt about the work you have just done, back up, have a tea and re-do it properly.

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FeiBao deliveries are done worldwide. Aircraft can be ordered in standard colour schemes. Custom colour schemes can also be done. Kits normally include the scale landing gear sets and "deluxe" kits are also available. More than 18 different aircraft are produced. See more on the website: www.fbjets.com

The Model:

Scale: 1:6
Length: 2.3m
Wingspan:1.37m
Weight:13.5kg

The Aircraft:

The Dassault Mirage F1 is a French built single seat air superiority fighter and attack aircraft designed and built by Dassault Aviation as a successor to the Mirage III family. Maiden flight was on 23 December 1966 and the aircraft entered service in the early 1970's. More than 700 were produced and many were also exported to 11 countries including South Africa where it flew for 21 years until 25 November 1997.

Technical details:

Length. 15.33m
Wingspan: 8.44m
Height: 4.49m
Max take off weight: 16200kg
Powerplant: 1x SnecmaAtar 9K-50 afterburning turbojet with 7166kg thrust.
Max speed: Mach 2.3
Combat range: 425km
Ferry range: 2 150 km
Service ceiling: 20 000m(66000')
Armament: 2x 30mm Defa cannons 150 rounds each
4x underwing hardpoints carrying Matra 68mm rocket pods or bomb racks for "dumb" or "smart" bombs.
Wingtip missile racks: Matra 550/V3A/V3B/AIM 9/AM39
Exocets/AS30L
Aux fuel tanks can be fitted on the centreline or under the wings.

Equipment:

Recommended additional parts:

Servos: Elevators: 2x Hitec 5955TG (25kg torque) or JR DS 8711
Ailerons: 2x Hitec HS 5245MG
Flaps: 2x Hitec HS 7985 MG
Rudder: JR DS 171 or Hitec 5125MG or a "wing servo".
Nosewheel steering: Diamond D 300

The following equipment were used for this aircraft:

Engine: Evojet. Booster. 130

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Radio: Futaba 10C with R6014HS receiver
Servos: 2x JR DS 8711 for elevators, 2x Hitec HS 5245 MG for ailerons, 2x Hitec HS 7985 MG for flaps, 1x Diamond D 300 for steering, JR DS 171 for rudder.
Electrics: Power Box evolution with 2x 7.4v 2100mah Lipo batteries.
Pneumatics: 2Jet TronicsJD valvesfor gear doors,Jet Tronics brake valve and Jet Tronics gear and door sequencer. Retracts via Jet Tronics HD gear valve.
Blue Loctite (non permanent thread locker fluid)
UAT fuel tank (hopper tank that removes air in fuel system)
Glues: Medium CA, 30 min epoxy, Aeropoxy or Hysol

Before we start, some info about adhesives:

The correct adhesive to use for most steps is either white Hysol 9462 made by Loctite or white Aeropoxy made by BVM or clear Vpoxxy by BVM for faster setting time. These are very strong epoxies which are thixotropic. This means that it will not run - it stays where it is applied. A good use is for hinges where regular epoxies can run away from the hinges without you even knowing. It takes a bit longer to dry and that is the reason for the construction sequence as you can get busy on something else while the glue dries overnight. It is also recommended that you use a proper dispensing gun and long type mixing nozzles especially for hinges. You can buy a complete kit with gun, nozzles and two cartridges of glue from your dealer for about \$ 80.

Construction:

1. General.
 - 1.1 Clean and inspect all parts. Inventory them against the parts list and notify your dealer of any missing or suspect parts BEFORE you begin assembly. If the paint scheme you have chosen is glossy it is recommended that you apply a coat of wax to painted parts to protect them from dirt, glue, stains and finger prints during construction. Vacuum or blow out the remnants of packing materials or dirt that remained in the fuselage.
 - 1.2 Assemble the aircraft to get a feel of it and to show it off to your friends. Check that the fittings and spars work nicely. Give affected areas a light sanding with 2000 sanding paper if necessary. This aircraft is all about the landing gear so be prepared to spend a lot of time and effort to get it to work correctly. I would highly recommend the use of high quality pneumatic valves.If you have all your equipment available place it in the approximate places so that you can get an idea if you will have CG problems later on.If the main landing gear is difficult to get out of the wheel has undo the

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screws at the retract units and check that the lower part twists at the shock strut (as per the real aircraft). If not it is probably dirty with paint inside and you will need to take it apart, clean it out and give it some light grease for lubrication. See 2.1. Carefully inspect and clean all parts.

2. Landing gear and doors. Before the space get invaded check each and every door actuator individually for leaks and free and correct operation. Fit colour coded air line to the up and down sides and route towards the position where you plan to install the valves with some tubing to spare.
- 2.1 Main gear. Check the fit of the main gears for its length and position with the wheels twisted upwards and that the door actuators do not interfere with its operation. Remove the unused round bits of the door hinges with a rotary tool (Dremel) to avoid it jamming with wheels or air lines. Next check the operation of the twisting rod. Check the secondary gear actuators and its fittings if you plan to use them. (Do the fuel tank and mark all air lines and servo extensions **before** joining the nose section to the fuselage!!) After the nose is connected to the fuselage you can continue with the following: Check the air bottles for leaks and fit them in the lower fuselage behind the main landing gear former. The bottle for the brakes goes in the nose. The Jet Tronics valves for doors and brakes are fitted on the plywood nose plate. Connect all the air lines. The filling fittings are on top of the plywood shelf just behind the air intake. Set up the door sequencer according to the manufacturer's instructions so that the doors operate correctly in sequence with the gear. The 2 small nose gear doors and the most rearward main gear doors stay open when the gear is down. Once satisfied with the alignment "permanently fix" the gear strut adding blue Loctite and then tighten the securing bolt as tight as possible.
- 2.2 Nose gear. I filed flat spots at the high stress areas to avoid slipping and took the opportunity to install a direct steering system using a small metal gear servo. Apply grease on the axles for the wheels as they do not have bearings to prevent the wheels from seizing. When installing the nose gear make sure nothing jams when the gear extends or retracts. Connect all the air lines and route the lines to the rear where you plan to install the fill valves and air tanks. Mark every line for identification before the nose section is joined with the main fuselage section. I also fitted airline restrictors in the nose gear air lines as the air demand of the nose gear is much less that what is required for the main gear retracts.

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3. Wings.
Epoxy(or use Hysol glue) the control horns into the control surfaces. Also do the hinges (Apply Vaseline to the pivot points to keep the epoxy or Hysol out). Trial fit them and check adequate amount of movement available and epoxy in place.
Fit the servos using the brackets and screws supplied for the flap servos. The aileron and rudder servos are epoxied to the hatches(This method has a disadvantage if servo maintenance is required later!!) Make sure the servos are centered and fit the servo horns. Check the length of the control rods and adjust as necessary. The clevises are at the servo horns and the ball fittings at the control surface horns.To avoid the rods from working loose "lock" one of the threaded ends by applying epoxy or metal epoxy to the thread. The other end can then still be adjusted if required.
4. Elevators.As this aircraft is equipped with all flying elevator a failure can easily cause a crash. That is why at least 25kg torque servos are required.I suggest to reinforce the former inside the aft fuselage where the elevators attach with epoxy and carbon fibre to eliminate any flexing in this area especially if you like to fly fast!! Make a baseplate from 5mm plywood sanded to the contour of the aft fuselage where you plan to glue the servo. Fit the ball fitting to the elevator horn and for additional security also add a nylock nut behind. Fix the servo to the baseplate using epoxy and hardwood blocks or metal fittings. Make sure the servo is centered and mark the approximate position of the horn on the side of the rear fuselage. Epoxy the whole unit in place. Attach the rod and clevis or ball fitting at the servo end. Apply threadlockerwhere applicable as a failure of the elevator servo will cause a crash. Make sure the movement is full and free. Use a spacer on the rod between the fuselage and the elevator if needed. Tighten with the 2 hex screws and don't forget the threadlocker! Use aluminium tape to protect the servo leads running forward towards the receiver.
5. Fin and rudder. Epoxy the control horn in place and the hinges as with the wings. It is difficult to get the rudder into position due to the sweep and I cut away a square at the base side of the fin to allow the rudder to go into position. Also use Vaseline on the leading edges of the rudder to avoid it getting stuck to the rear of the fin!! Trial fit before doing the real thing. Test the screw that fits into the forward fin attachment shaft.

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before attaching the fin to the rear fuselage. Secure the fin rear shaft in the fitting and tighten the hex screw. The forward attachment shaft also slides into its fitting and is then secured from the inside of the fuselage with the screw and washer that you tested. Route the servo lead with its extension attached (and locked) to the cockpit area and protect the lead in the tail pipe area with aluminium tape.

6. Fuel. Inspect the brass fuel lines and clear any burrs on the inner and outer ends. Check that the clunk reaches everywhere in the tank and does not get caught anywhere in the tank. Leak test the tank and check the fit in the fuselage. Use Velcro tape or your preferred method to keep the tank in place. I fitted the air trap tank on the fuselage floor between the retracted main wheels in a 45 degree attitude as recommended. The fill fitting is on top of the plywood shelf behind the intake. Use brass tube between the fuel tank and the UAT air trap tank to avoid fuel line kinking issues.
7. Engine. Check the glue joints of the engine bearers and reinforce if needed. The exhaust pipe position depends if you have a ducted or unducted installation. Mine is unducted and the exhaust pipe is 10mm from the rear of the engine exhaust cone. Cut off the excess pipe if needed. Make sure you center the inner and outer pipe again. Also make a support for the pipe at the bottom front. I used flattened brass tubing fitted with screws to the front lower part of the pipe and the closest former between the main landing gears. The ECU is fitted in the space behind the right hand engine air intake. The engine auxiliary equipment is fitted on brackets above the engine bearers to the front of the engine. The ECU battery goes in the nose as needed for the correct CG. The fuel pump is fitted on a plywood plate on the left hand side fuselage. Connect all wires and fuel lines. Tidy up all wire in the engine compartment area as loose wires might cause problems if they do get sucked into the engine!! If you use plastic cable ties do not pull them too tight. It might cut into the isolation and cause a short circuit between wires and a crash!! Use threadlocker on engine fitting screws.
8. Radio. Fit your receiver in the cockpit area to the right of the nose gear. The door sequencer is on the left side. The power box is on a plywood shelf made up for it behind the cockpit with the receiver batteries on either side of the nose gear bubble or as required for the CG. The valves for brakes and gear doors are fitted on the supplied plywood in front of the nose gear. My channel allocation is as follows:

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Channel 1: Ailerons via Power Box 1.
Channel 2: Left Elevator via Power Box 2.
Channel 3: Throttle via receiver to ECU.
Channel 4: Rudder and Nosewheel steering via rx. ch. 4.
Channel 5: Gear via receiver to sequencer.
Channel 6: Flaps via Power Box 5 (Use programmer to synchronise the flaps.
Channel 7: Right elevator via Power Box 6.
Channel 8: Brakes via Electronic valve.

Settings.

CG: 230mm to 240mm back from where the wing leading edge meets the fuselage.

Elevator: 60mm up and down. (Measured where the leading edge of the elevator meets the aft fuselage.)

Ailerons: 20mm down and 25mm up.

Rudder: 30mm left and right.

Flaps: Take off -20mm Landing - 40mm

Scale cockpit installation.

I soon realised that I will not be able to fit the cockpit tub as one piece so I cut it off with a Dremel to separate it just behind the instrument panel. I fitted a balsa "ledge" below the front edge of the windscreen and the bottom part of the instrument panel is fixed to the equipment bay with Velcro (hook and loop). The seat area is cut out once again to leave space for the nose gear steering servo and the "tub" is fixed with screws to the cockpit shoulders.

Ground tests.

Check and double check the operation of the landing gear. Make sure of the nosewheel steering and program in a good deal of exponential to avoid overactive nosewheel steering. Check CG in limits and weigh your aircraft for reference. Check all the flight controls and do not exceed the recommended settings. Check your turbine for operation and do not forget the all important range check. Go over the entire aircraft and make sure every screw and fitting is tight and threadlocked where needed (vibration or high stress areas). Check all control linkages and fittings tight and slop free to avoid flutter. If the brakes are too tight with the 2 o-rings per wheel blank off one hole with metal epoxy so that only one o-ring works as brakes.

Flying.

Despite the small wings the Mirage F1 handles quite well at low speed. For take off make sure you have enough speed and gently feed in increasing elevator to let her fly off when she wants to. The ailerons are quite powerful despite their small size so take care not to be too active on them. For landing do not come in too fast and get the speed down for a nice nose up attitude for landing. Use flaps as you want and enjoy the landing. Good luck with your landing gear operation and we hope that you will enjoy flying your Mirage F1.

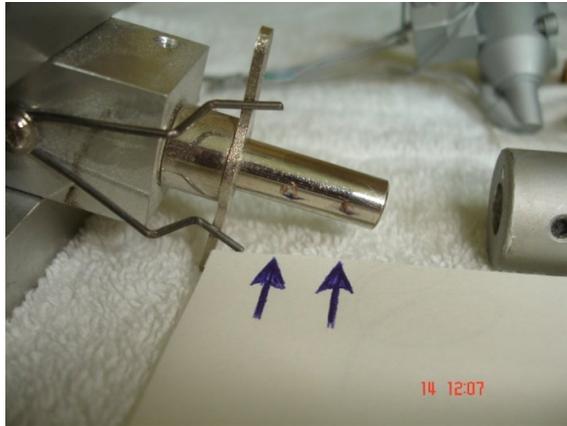
Photos of construction.



1. Big box safely at home.



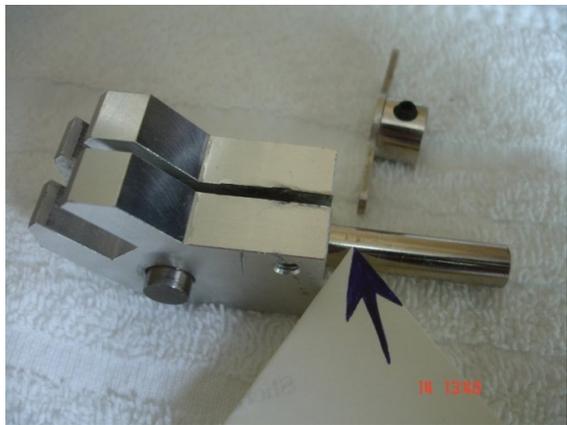
2. Nosewheel disassembled.



3. Nosewheel steering arm where I filed flat spots.



4. Point for another flat spot at the scissor link at bottom of nose gear.



5. Flat spot position for nosewheel steering arm.



6. Nosewheel retract disassembled.



7. Left main gear leg.



8. Right main gear leg.



9. Both main gear legs.



10. Left main gear pivot mechanism.



11. Right main gear pivot mechanism.



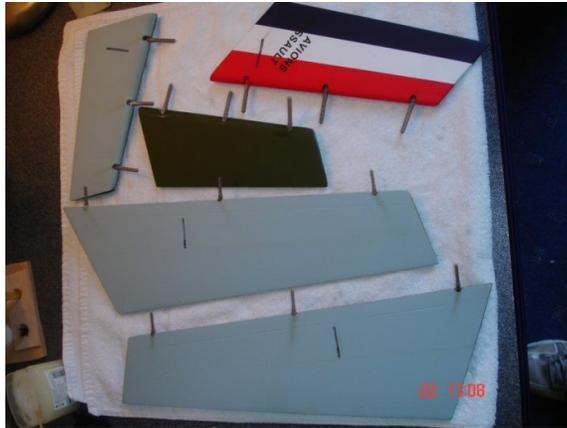
12. Main gear retract unit disassembled.



13. Main wheel brake detail.



14. Main gear pivot system.



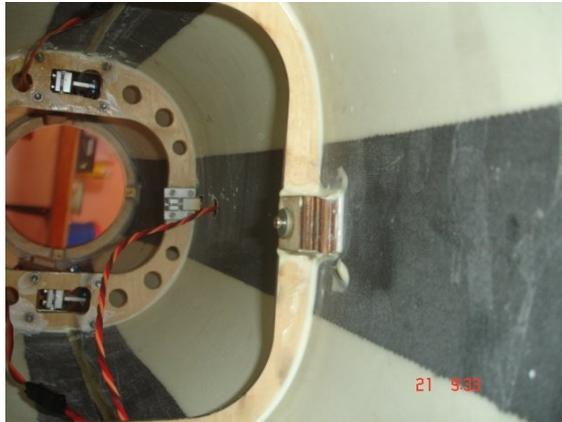
15. Hinges installed on control surfaces.



16. Rudder pushrod detail.



17. Fin forward rod attachment.



18. Fin attachment detail.



19. Bracket for direct nose wheel steering servo.



20. Another view of direct nose wheel steering.



21. Fuel tank assembly.



22. On the right is plywood shelf for filling lines.



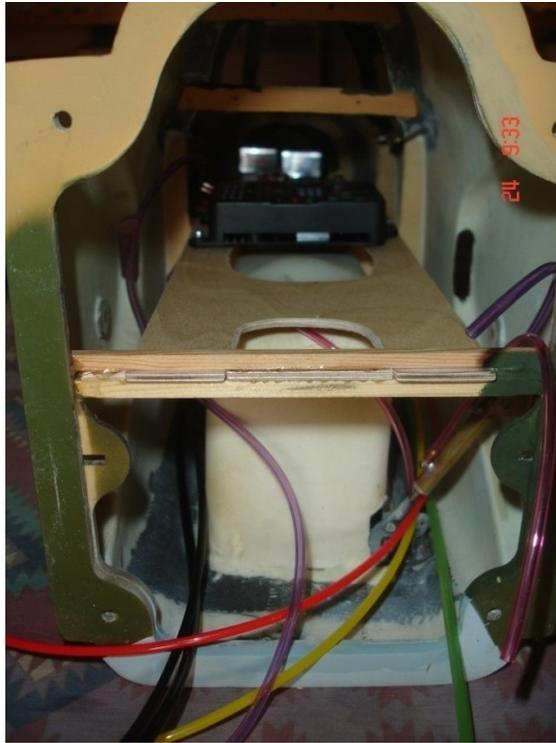
23. Detail of shelf fitting bracket.



24. Notch where shelf slides in.



25. View into nose section showing brake air bottle for brakes and Jet Tronic valves.



26. View into nose section from the rear showing the shelf where the Power Box (towards front) and the Turbine ECU (towards the rear) will be installed. Optional positions are above the landing gear bearer or the space behind the engine intake ducts.



27. Power Box on its tray slid out into the cockpit.



28. The nose section and main fuselage before joining.



29. Fuselage and nose section before joining. Note all the air lines (Looks like spaghetti!!)



30. Dowel rod and hex key to ease the joining of nose section and fuselage. It was wrapped with isolation tape and was strong enough for the task.



31. Aileron pushrod.



32. Aileron pushrod.



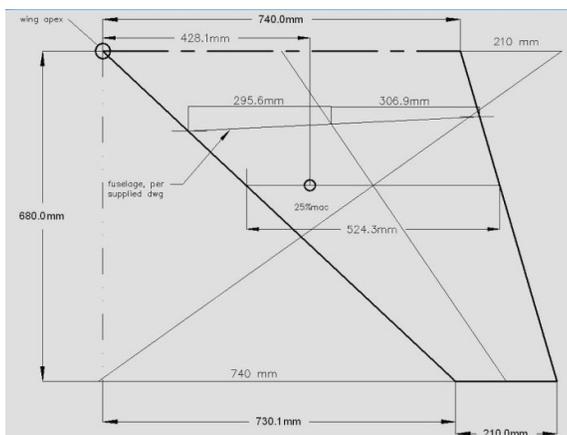
33. Flap pushrod.



34. Flap pushrod.



35. Flap and aileron pushrods.



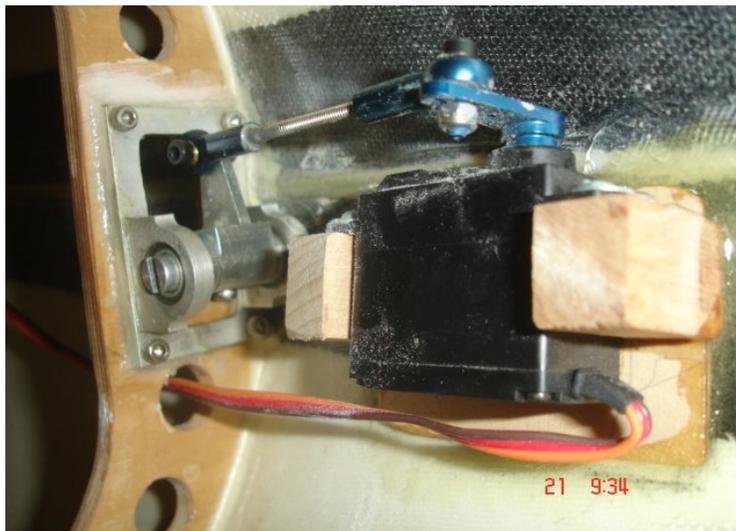
36. CG calculation.



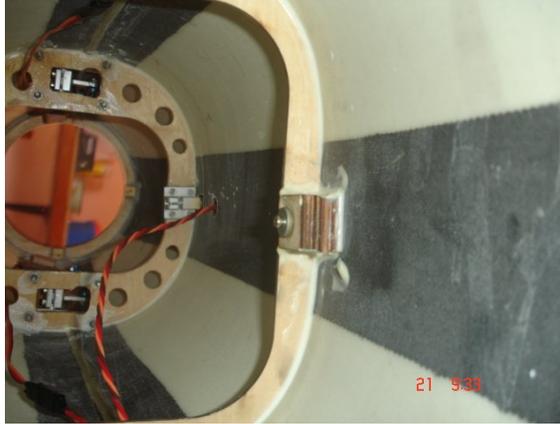
37. Wing underside with missiles attached.



38. Elevator pushrod connection.



39. Elevator control detail.



40. Fin installation bolt and fitting.



41. Equipment arrangement in front cockpit area.



42. Equipment in cockpit.



43. Cockpit rear view.



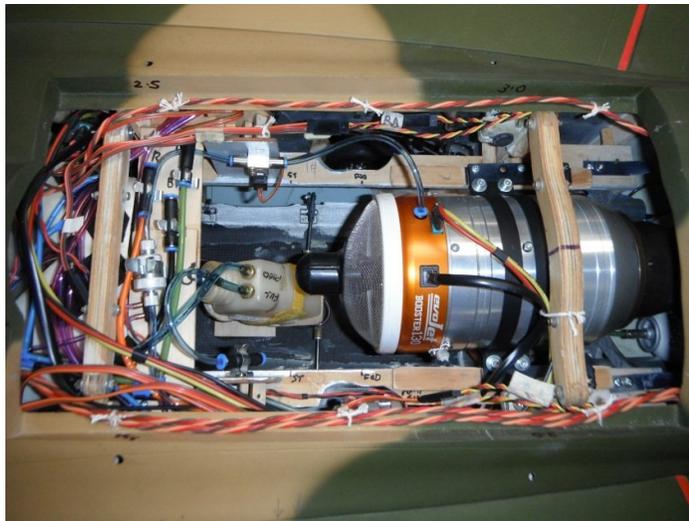
44. Cockpit details with pilot.



45. Instrument panel.



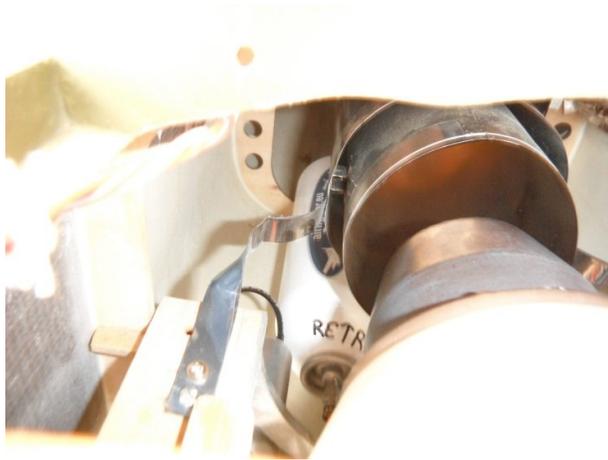
46. Fuel tank viewed from cockpit.



47. Engine bay from left.



48. Engine bay from right.



49. Pipe and exhaust.



50. Rear of engine.



51. Below engine. Note lower pipe support.



52. Right landing gear wheel well area.



53. Right landing gear details.



54. Right wheel bay and ECU switch under the air brake.



55. Rear right view.



56. Tailpipe rear view.



57. Rear view into rear fuselage.



58. Right front view.



59. Left front view.



60. Final preparations for maiden flight.



61. Engine start for maiden flight.



62. Airborne on maiden flight.



63. Shortly after take-off flying beautifully.



64. Ready for next sortie!!



65. Dawid Visser with Feibao Mirage F1.

Credits:

I would like to say thank you to the following people who made this project a success:

1. Feibao for being brave enough to produce this wonderful aircraft.
2. My family who support our hobby.
3. Mike Starke, a fellow jet modeller for all your advice and sharing your knowledge.
4. Chris Pretorius, a pilot of the real Mirage F1 for advice and support.
5. Colin Strauss who shared information also by means of articles of the aircraft in "Radio Controlled Jet International".