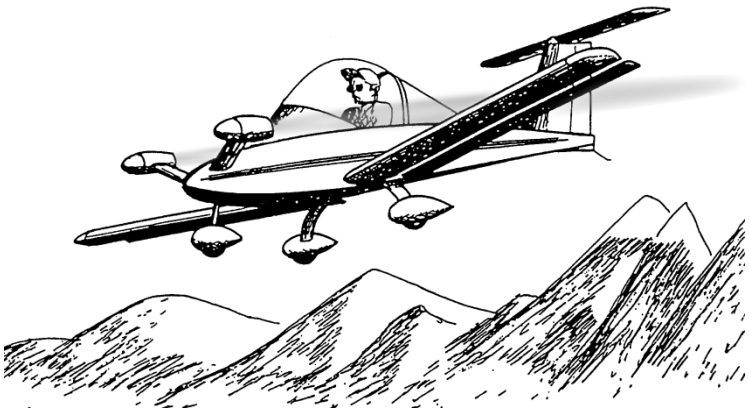
Flying the MC-15J CriCri Jet

The world's smallest airplane, now complete with two jet engines, is zipping around the Western Australian countryside these days. It is the MC-15J CriCri.

Designed by Michel Colomban, a gifted engineer at the *Societe Aerospatiale*, the CriCri is a tiny low wing, tri-gear airplane with two PBS TJ20A turbojet engines mounted on stalks protruding from the nose … just like the antennae of its namesake, the cricket. Despite the *petite* nature of the machine, close examination reveals a multitude of technical innovations.

Why such a small airplane?



Michel Colomban wanted to take small, efficient, light and affordable aircraft construction to new levels while at the same time still allowing an amateur builder with little or no experience to be able to complete the project. With that in mind the CriCri was conceived.

The material cost is minimal. The entire airplane consists almost entirely of commonly available 2024-T3 Aluminium with Divinycell foam used for the wing ribs. To simplify construction, the fuselage is a simple rectangular box with a streamlined canopy on top. The wing skins consist of a single standard sheet (1m x 2m) of Aluminium wrapped around the ribs and simply glued in place.

The tail feathers consist of a horizontal all flying stabilator, perched on top of a vertical fin. This creates a classic T-tail configuration which provides excellent obstacle clearance on the ground and keeps stabilator out of the engine blast.

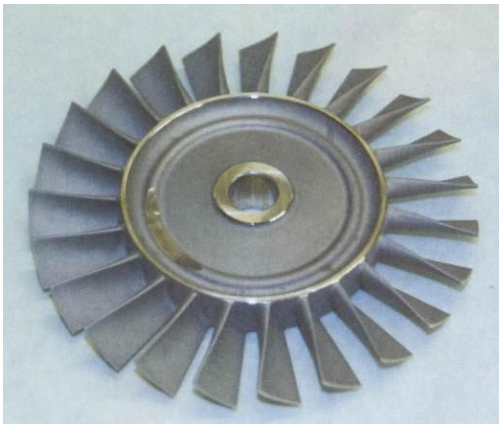
The turbojet engines

After a fair bit of *hanger flying* we decided on the PBS TJ20A engines produced by the První brněnská strojírna Velká Bíteš (PBS) company from the Czech Republic. The engines themselves are little marvels of engineering. The workmanship is superb, combined with very professional support from the PBS engineering staff ensured that everything worked first time!

The TJ20A turbojet is a single-shaft engine with single-stage radial compressor, annular combustion chamber, single-stage axial turbine and output nozzle.

A booster with break-in clutch enabling starting of this engine from the cockpit net is located at the compressor section.

Inducted air is compressed by the radial compressor wheel, passing through radial and axial diffusers to the combustion chamber. Here it is blended with fuel vapour by the evaporating piping. Hot gases caused by fuel burning in the combustion chamber expand through single-stage axial turbine and exhaust at high speed from output nozzle to the atmosphere creating the thrust of the engine. The axial turbine, in turn, drives the compressor via the engine shaft. The engine shaft in held in place by two axial bearings and is lubricated by the fuel.



The engine contains an on-board electronic control unit. The control unit processes data from the speed sensor, exhaust gas temperature sensor and input air temperature sensor. Engine operation is exclusively controlled by the control unit.

After receipt of START command, the control unit checks all connected accessories and performs the start of the engine automatically. The control unit has full authority control of the starter, fuel sensor, starting and main fuel valve based on data from all sensors. After engine shutdown the control unit automatically starts after-cooling by switching on the starter as long as the temperature of exhaust gases remains above the pre-set value (normally 100 °C EGT).

The control unit conforms to the standard principles of PWM technology (variable width of pulse, 1 to 2 milliseconds with a frequency of 50 Hz).

The engines are supplied complete with all accessories including electronics, pump, electric valves, igniter plug and sensors integrated directly into the engine. A high power electric motor connected to the compressor allows for electric starting. The TJ20A engine provides constant engine thrust independent of ambient temperature.

All that is required to start the TJ20A engine is to connect a 12V battery, supply a mixture of fuel with 3% turbine oil and send the start command.

PBS guarantees the product for a full 2 years and provides all the external accessories like fuel filter and hose, fixing clamps, flanges and an Electronics Data Terminal (EDT) for configuration and testing of the engine.

Operations

Operating the CriCri Jet is somewhat different to what we were used to. For example, with a jet exhaust of many hundreds of degrees Celsius whizzing past you, having the canopy open with the engines running is most certainly *not a good idea* The CriCri Jet is therefore equipped with an air conditioner … well sort of … in reality it is a glorified computer fan, but it is enough to provide adequate cabin ventilation with the engines running.

Given the fairly limited fuel load and the disproportionate fuel consumption during ground operations, the aircraft is towed to the threshold. Once there all the pre-flight actions are completed and only then are the engines started.

The engine start is simplicity itself. Push the start/stop button, cycle the throttle from IDLE to 100% and back to IDLE. The engine will perform a self-test and if all parameters are nominal the engine will start without any additional input from the pilot.

Once the engine is started and stable at IDLE, you are on the clock! Advancing the throttles to 15-20% thrust will start you moving.

It takes a little bit of practice on the ground not to “chase” the power. Initially I had a tendency to apply too much power to start moving, only to then back off. The change-check-hold-adjust mantra works best!

You make the radio call, line up and push the power levers to 100%. In the CriCri Jet the pilot has a fairly unique vantage of looking right into

the business end of the little turbines. At full power there is an impressive red glow emanating from within the guts of the engine. With the turbines spinning in the region of 120,000 rpm, things are pretty angry in there right about now!

The airplane accelerates briskly and v_r of 50 kt comes around in about 17 seconds. Apply a little back pressure and you are airborne almost immediately. The take-off flap must be retracted before 70 kt and then the power is typically reduced. Depending on the load-out, 80 to 90% power provides a decent rate of climb.

It is after levelling off that the payoff with a turbo jets really starts becoming apparent. The thrust remains mostly unaffected by the increasing airspeed and we just keep going faster and faster. Ooh, Yeah!

There is little to no vibration and the noise level is about the same as in a commercial airliner. Controls are light, well harmonised and very effective. Both pitch and roll can be trimmed by means of simple friction and bungee levers.

When flying the CriCri Jet, you feel as if you are sitting on top of the little airplane, surrounded by a panoramic bubble canopy with unobstructed visibility in all directions except straight down! It certainly provides the pilot with a unique perspective on how small the airplane really is.

Single engine

The CriCri Jet is a obviously a multi-engine aircraft, but not really a *twin* in the true sense, since there is very little by way of asymmetric thrust in the event of an engine failure. This is easily demonstrated by setting one engine to idle, and the other one to 50% thrust. The airplane will happily maintain altitude and the airspeed stabilises at around 60kt. Only the merest touch of rudder is required to correct the yaw.

Circuit

Flying the circuit is conventional for the most part. On downwind the first stage of flap (12º) can be taken at below 70kt and, the second stage (27º) any time after that if needed.

On final approach reduce speed to 65 kt aiming for 55 kt over the fence. Touchdown occurs at around 50kt. During roll-out, the thing to remember is that the brakes are located on the control stick and not the rudder pedals. However, because the airplane has so little mass, once settled on the ground, the speed bleeds off rapidly and very little braking is normally required.

Shutdown

The PBS TJ 20A engines are shut down by simply pushing the START/STOP button with the throttle set to idle. The engine will immediately shut down and enter the pre-set cool down program. Once the program is complete the master switches can be turned off.