

Aloft with a Set Jet

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I want first of all to refer to the article entitled "Auxiliary Turbo-Jet Engines for Sailplanes" which I introduced in the November, 1963 issue of *Soaring*. Briefly I described there the different power systems from the piston engine to the various types of jet propulsion applicable to self-launching sailplanes. I arrived at the conclusion that small Turbo-Jet engines in the 100 lbs. thrust class seem to be most suitable for this kind of job.

Engines of this type and size have been successfully flown in France (Fouga-Sylphe), Germany (Heinkel-Grieff and Huetter T-30) and Russia (A-13) on specially designed prototypes or on standard sailplanes modified to mount them. Most of these engines are prototypes or experimental models that were designed for purposes other than launching sailplanes and none are presently in production. They tend to be fairly complex mechanically and consequently they are very expensive and are likely to cost anywhere from \$11,000 to \$32,000 a unit.

Because its running time is somewhat limited during each flight a Turbo-Jet in the 100 lbs. thrust class used to power a sailplane can be simplified to some degree mechanically. No expensive gear-reduction box to drive auxiliary systems (fuel pump, oil pump, governor



Max Dreher's Prue 215 with Baby Mamba jet attached. The extreme compactness of the unit is obvious in this picture.

generator) is necessary for example. Engines this size use small amounts of fuel and this can be supplied readily with an electrically driven pump or with a pressurized system. Bearing lubrication can be handled with a bleed air/oil mist arrangement. I do want to point out, however, that there will never be a cheap gas turbine engine. Despite their simple looks and operation they are very complex machines with high rotor and air speeds and high operating temperatures. There are no production short cuts. Precision workmanship is absolutely necessary.

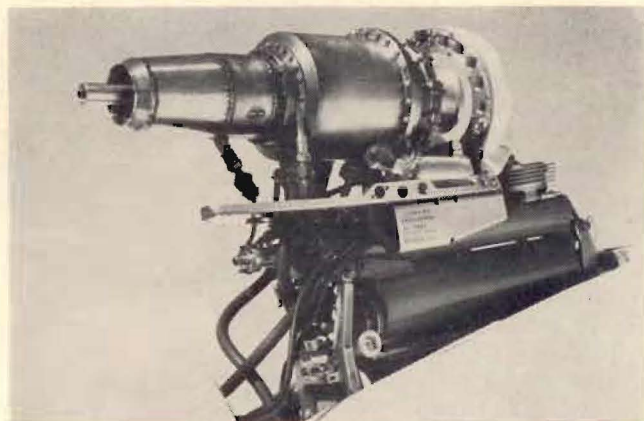
In 1963 I began work on the design of the youngest member of my turbine family, the T.J.D.-76A *Baby Mamba*. It was designed to power a sailplane and had a static thrust of 55 lbs. I tried to keep it as simple and light as possible. No gear reduction was used and it had a free-spinning rotor. I selected a single-stage mixed flow compressor, an annular combustion chamber

and a single-stage axial-flow turbine for the basic layout. This had proven successful on all my previous jet engines. The whole job, from beginning to end, took about 3,600 hours. Since then the *Baby Mamba* has logged many starts and many hours, both on the stand and in flight tests. Specifications are as follows:

Static thrust (sea level)	55 lbs. max.
Rotor speed	96,000 rpm max.
Air flow	1.1 lbs./sec.
Fuel consumption	1.35 lbs./lb./hr.
Type of fuel	gasoline

The dry weight of the engine is 17 lbs, or one pound less than estimated. The rotor is suspended on two high-speed turbine ball bearings which are cooled and lubricated by means of air/oil mist spray generated from compressed air. This flow, is bled off the after diffuser section, then cooled, filtered and mixed with a synthetic gas turbine oil. When the mist has done its work it is discharged through the turbine and burned out the tail pipe. The wheel and nozzle of the turbine are made by investment casting from an alloy with high temperature resistance. Most of the other parts are fabricated from stainless steel.

After initial running on the test stand I set about installing the engine on my *Prue 215*. To do this I designed a jet pack consisting of the engine, the pressurized fuel system and the lubrication unit. The total



The uncovered Baby Mamba can be seen clearly here. The entire engine was built by Dreher whose workmanship is superb.

dry weight of the pack is 25 pounds. An auxiliary oil tank is mounted separately, and employs an electrical driven gear pump. A third unit, the Jet control pack (engine controls, instruments, switches) is located in the cockpit.

These three packs, which have a total weight of 34 lbs., can be installed or removed by means of pins and quick locks in less than half an hour. This permits the ship to be flown with or without the jet which permits the pilot to adapt the ship to whatever conditions he encounters.