Adventure

IN PURSUIT OF PERFORMANCE

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SO WHY DID George remove the training wheel from the nose of the Adventure? There were 10 reasons. And if you guessed "go faster" you have 9 of them. This article is going to discuss the "go faster" problem.

There are only two ways to speed up a plane — 1) get smaller and 2) use more power. The "get smaller" is really drag reduction. The "more power" includes the efficiency of the entire power system and is closely tied to several drag reduction items. I'll describe the changes made in N36ME starting with the nose gear removal.

A little background and chronology is needed here to get everybody familiar with the "baseline" configuration. N36ME is the Mead Adventure, designed and built by George Mead in 1978. The Adventure was described in the December 1979 issue of *SPORT AVIATION*. The Continental A-80 that was originally installed developed a severe case of multiple crankshaftitis on the way home from Tullahoma 1980. Fortunately, George was able to get the airplane back to the Shelbyville airport where it was left while a local mechanic was to overhaul the engine. When George went to fly the plane home, he found the engine prone to seizure. To make a sad story short, after 3 trips to Tennessee he had an engine in little pieces, the airplane in a U-Haul and a lot of money and time down the tubes. Shift the scene to Spring 1981. George was in a dilemma on the engine, time was running short for Oshkosh and slave labor was offered. Not one to procrastinate on details, George decided that a sort of "team effort" was in order. Bill Parker, a senior technical writer at Cessna's Pawnee Division, myself, a Flight Test Engineer at Cessna's Wallace Division, and George would make up the team. My contribution was a well used Continental 0-200A, donated for awhile (it'll keep the rust out of the cylinders). Of course, the thought that I might get to fly it never entered my mind — much. Bill's contribution was slave labor — sanding, shaping, glassing and everything else. We haven't quite figured out George's part yet but whatever it was, he sure spent a lot of time on it.

The first item changed was the gear location. On an otherwise clean airplane, gear drag is a large part of the total. Even a small clean gear will account for 0.3 square feet of equivalent parasite area. On an airplane of less than 1.4 square feet total area this is a significant percentage. If we remove the nose gear we might get rid of as much as 0.1 square foot. The fuselage dimensions were such that the main gear and brackets could be removed from their old location and reinstalled, with hard points, ahead of the wing spar. The gear removal took 12 pounds from the nose. The tailwheel added 3.5 pounds to the tail. The tailwheel is a locking, full swivel, non-steerable type. This is definitely the easiest to rig and streamline.

Next, the 0-200 was put on the A-80 mount and the old baffles were persuaded to fit. We originally thought that a new cowl was going to be required but, lo and behold, all that was needed was a 3/4" lip on the rear edge. The A-80 prop was installed and we were ready to go flying. To say the least it looked a little crude. George did the first flights and came back saying that the take-off was the most challenging, that it didn't care much for full stall landings, and that wheel landings were easy. Two degrees of right thrust were added via washers and the cowl "almost" still fit. Just a little wobbling of the drill and the Dzus fasteners lined up just fine. Another flight showed the take-off was tamed somewhat, so on with the program.

(Ted Koston Photo)

The following items were targeted for action:

1. Propeller dimensions (diameter, pitch, thickness and pitch distribution
2. Propeller/cowl blockage
3. Air leakage around the prop/spinner/cowl area
4. Exhaust system
5. Cowl cheek extensions
6. Tailwheel fairing
7. Seals for the movable surfaces
8. Wing root fairing

Seven out of eight isn't bad — we never got to the wing fillet.

The propeller used on the A-80 was a Ted's 62 dia. x 64 pitch. This allowed the 0-200 to wrap up a little too much in flight. It looked like it wanted to turn up to about 3400 rpm in the 200 mph range. Acceleration was borderline phenomenal (less than 8 lbs./hp **during** take-off). George consulted the propeller charts and figured that a 62 x 78 should keep the rpm down to rated rpm + 100 at max throttle, sea level. Ted felt that a 76" pitch would be more prudent so we got a 62 x 76 prop. A 78" pitch would be better, since we can over-rev the 76" prop. The take-off has dropped from phenomenal to just super.

To attack the thickness problem, the Ted's prop was ordered to be made as thin as he felt comfortable with. The biggest room for improvement in propeller efficiency is in the thickness of the blade. Wooden props are the worst. Who'll be the first with a **good, thin,** composite prop? Variable pitch would be nice.

Propeller pitch is limited near the hub unless you have a very thick prop blank. George asked Ted to carry the 76" pitch inboard as far as he could. The reasons for selecting this pitch distribution is the lack of cowl blockage, which brings me to item 2 on the list.

When we put the 6" prop extension on the engine and extended the cowl to match, it looked infinitely long. The original installation had no prop extension. Surely **any** prop would like the lessened cowl blockage. Not true. A prop that is reasonably well matched (pitch distribution) to a blunt cowl will show very little improvement when moved further away from the cowl. Cowl blockage slows the air flow so a non-helical pitch is required for some installations.

The method of cowl modification is certainly worth describing. It was done with cardboard. Plain old poster type cardboard was taped to the spinner bulkhead, wrapped around and back tangent to the existing cowl, and taped again. After a liberal application of wax for a release agent three layers of glass gave us a shell that was later bonded to the old cowl. Therefore, the old cowl is **still** inside the new cowl. No baffle change. Simple, what? It could even have been done with — heaven forbid — instant cure fiberglass (sometimes erroneously referred to as sheet aluminum).

The spinner was carefully cut to match the contour of the prop. There are a lot of losses at the prop/spinner junction. It would be better to reinvent the blade cuff. Maybe we'll try that later. A baffle was installed inside the cowl to lower the leakage around the spinner edge. Leakage louses up the flow, they say.

The exhaust system was the next item on the list. George's old exhaust pointed aft about 60°. The rule of thumb that I read somewhere is that you can imagine the column of exhaust coming out of the pipe as equivalent to a foot or so extension of the pipe itself. And it's probably true. George's old exhaust stain impinged on the **bottom** of the wing. To get there it had to travel at least 12" below the exhaust stack exit. We cut off the ends of the pipes and rewelded pieces pointing back-

wards. The drag gospel by Hoerner says that exhaust thrust is 11% of the total.

The aft ends of the old cowl cheeks were blunt and old oil slicks showed a significant area of reversed airflow behind them. The cheeks were lengthened back to even with the leading edge of the wing. The new exhaust stain appears to stay attached to the cowl and fuselage at least as far as the trailing edge of the wing.

A fairing was made to cover the tailwheel spring, looking like a small ventral fin. The tailwheel was supposed to have a miniature fairing of its own, but this item went undone in the pre-Oshkosh panic. The airflow around the tailwheel is still understandably confused.

The aileron hinge line was sealed with tape. The aileron counterbalance is difficult to seal so we compromised and just sealed the hinges. A P-shaped self sticking strip was placed in the flap gap so that the flaps would seal in the cruise position. Again, we were trying to minimize drag caused by air leaking through the gap at high speed.

The most honest appraisal of the new Adventure's performance is the Oshkosh 500 race. We turned in a 188 mph average for 500 miles from a standing start using 95 pounds of fuel. If you want to fudge the figures to match non-race performance, you might subtract 2 minutes for take-off and acceleration and add 8 miles for sloppy course work. This brings the speed number to 193 mph. The Continental power charts show that we pulled 67 hp for the first five laps and 72 hp for the last lap. The average power figures out to 68 hp. 190+ on less than 70 hp is not bad cruise performance.

With all of our clean up items and the 100 hp engine, the Adventure has a maximum level flight speed of 217 mph, two miles per hour over the old **redline** established for the 80 horsepower nose dragger.

A new redline airspeed (Vne) has been established at 225 mph IAS. You can get 212 TAS at the optimum altitude 75% cruise point. If you're wondering why we didn't fly the race at 205+ mph, the answer is that it needed an oil cooler — and we didn't have one. We're still flying a cooling system optimized for 80 horsepower and trying to cool 100 hp with it.

It appears that the aerodynamic modifications improved the performance by about 10 mph, and the increase in horsepower was worth another 19 mph in top speed. A verification of this is a comparison of the Adventure's Baker Competition results for the 1979 Oshkosh 500 and this year's results (193 vs. 200 mph). This removes most of the power effects from the problem. The fuel specifics for the 0-200 were not as good as the A-80, so 10 mph seems reasonable.

So what's left to be done on the Adventure? These things for starters — better fuel distribution, better engine SFC's, plug the holes in the baffles, stiffen the cowl so that air doesn't leak out the edges, put an oil cooler on the engine, make a wing root fairing and the "biggy" — make the gear disappear.

Oh, yes!! The 10th reason for the landing gear change — it **looks** a **bunch** neater.

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(Photo by Ted Koston)
PIONEER AGE (PRIOR TO 1981) CHAMPION — This magnificent Curtiss JN4-D is owned by Dan Neuman (EAA 871) of 1521 Berne Circle W., Minneapolis, MN 55421. It actually is a restoration of an earlier restoration — and has been a trophy winner in both reincarnations. Dan is a retired Northwest Captain and has a sizeable collection of rare antique airplanes

(Photo by Ted Koston)
CONTEMPORARY AGE (1933-1945) — OUTSTANDING OPEN COCKPIT BIPLANE — A 1941 Waco UPF-7 owned by Ray Fow (EAA 122494) of 9075 SW 96th Ave., Miami, FL 33176. Powered by a 220 Continental.

(Photo by Norm Petersen)
OUTSTANDING IN TYPE, CLASSIC — 1954 Cessna 170B owned by Don Jensen (EAA 132141) of RR 2, Box 288, Albert Lea, MN 56007.

(Photo by Gene Chase)
CONTEMPORARY AGE (1933-1945) RUNNER-UP — 1938 Beech Staggerwing F17D restored by Bill Morrison (EAA 107037) of 5537 W. 133rd St., Hawthorne, CA 90250. Powered by a 330 hp Jacobs L6MB.

(Photo by Norm Petersen)
OUTSTANDING IN TYPE — CLASSIC — 1952 Cessna 195 owned by Kent Blankenburg (EAA 147057) of 214 Whitley St., Arroyo Grande, CA 93420.

(Photo by Ted Koston)
This rare 1928 Pitcairn PA-5 Mailwing is owned, appropriately enough, by Stephen Pitcairn, son of Harold Pitcairn, the man who built the original Mailwings. It is powered by a Wright R-760 of 230 hp.

(Photo by Norm Petersen)
OUTSTANDING IN TYPE, CLASSIC — 1949 Navion A owned by Myra Dunn (EAA 124589) of P. O. Box 93, Crawfordsville, IN 47933. Powered by a 225 hp Continental.

(Photo by Norm Petersen)
CLASS I CLASSIC (To 80 hp) CHAMPION — 1948 Luscombe 8A restored by Steve and Debbie Lund (EAA 163521) of 410 E. Main St., Flushing, MI 48433. Powered by a Cont. A-65, N1850B has two wing tanks (no fuselage tank). A new rear fuselage bulkhead and stabilizer spar were installed during rebuild, along with new glass and new hardware. The engine was majored by Ted Travis of "Rag Rose" fame. Painted with Imron, even to the firewall and engine mount. Metal in cabin also white. Makes it appear much larger and eliminates constant eye compensation for dark/light/dark when looking outside and back to instrument panel.