

CAFE AIRCRAFT PERFORMANCE REPORT

Prepared by the
Comparative Aircraft Flight Efficiency, Inc.

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Propless in California

BY C. J. STEPHENS, CHIEF TEST PILOT

CAFE Foundation

FLY WITHOUT A PROPELLER?

The control tower had closed the runway for a few minutes for us to proceed with our operation. It seemed very strange to be sitting in the little Cessna 152 in the "ready for takeoff position" with no engine sounds. The propeller was sitting on the hangar floor. The moment was at hand that would tell the world if we were 'nuts' or doing scientific research. The Piper Pawnee tow aircraft was in position and the ground crew had connected the glider tow rope to the release hitch that had been fashioned to the end of the crank shaft. Signals were given to take

the slack out of the rope. It was time to fly!

BACKGROUND

Several months before as the CAFE board was covering new business on the agenda, an idea was presented that in order to confirm our methods of zero thrust measurements it would require flying the Cessna 152 test mule without a propeller. At first I wasn't very comfortable with the thought, as the idea unfolded, of removing the propeller, towing the plane to 10,000' and releasing it. There was comfort in the fact that the CAFE foundation had two test pilots and perhaps the other guy,

Russell Scott, would be selected for this mission. Almost immediately, however, he packed up his household and moved permanently to North Carolina. I am not sure if the proposed propless flight had any bearing on that move. I was then further comforted when it was announced that it would require a licensed glider pilot to fly the C-152. Although I did have a glider CFI, I didn't think anyone knew about that and I wasn't going to bring it up.

About an hour into the discussion my 'friend,' Otis Holt, casually mentioned that he was aware that I had such a rating. Now out in the open I listened more intently as the plan unfolded. Our reams of zero thrust glide data, which was obtained with this Cessna by gliding it at the zero thrust revs per mile value (See Jack Norris' article on Zero Thrust Glide Testing in *Sport Aviation*, March and April 1995) were to be compared with data obtained by repeating the glide tests after removing the prop. There now seemed no graceful way for me to avoid the inevitable.

FLIGHT TEST APPROVALS

Brien Seeley, CAFE president, with his boundless energy and unbelievable perseverance was able to obtain all of the necessary approvals. This was no small feat when you consider that the FAA (both mechanical and operational), local airport management, control tower, EAA National, tow plane, tow release systems, and safety procedures all had to be coordinated



CAFE Foundation Chief Test Pilot, C.J. Stephens, in the propless Cessna 152 as it is towed aloft by the Piper Pawnee over California's Mendocino Coast. The Cessna's glide ratio is approximately 13 to 1.

and satisfied. All of this was completed in less than three months. I would hate to see his phone bill.

FIRST TAKEOFF

One more confirmation from the control tower that the tow plane and Cessna were cleared for takeoff and the signal flag was dropped. The power surge was smooth and rapid as the Pawnee's power pulled vigorously on the tow rope. There was very little time to enjoy the exhilaration for it was time once again to mentally review the abort procedures. A quick look at the tow release handle that had been placed in the middle of the instrument panel gave some confidence that, if necessary, I could locate and pull it quickly. Nose wheel shimmy at 40 kts. Should I release? Last chance! No! Back stick to lighten the wheel and the shimmy let up. 60 knots, lift off, all abort options are gone, any trouble now would mean an early release and an emergency landing. A left cross wind departure was flown to allow a landing on the other runway. There was only the sound of the wind as the plane settled down to quietly follow the tow plane.

The nose seemed a little high and the angle-of-attack meter was on the edge of the yellow caution arc but within tolerance. To fly the proper tow position it was necessary to raise slightly in the seat to place the Pawnee just visible above the cowl. I verbalized to the video recorder a reminder to put in another seat cushion and try using 10 degrees of flaps on takeoff and tow for the next flight.

Passing 1,000', rate of climb 600 fpm, now we could breathe a little easier. A release here would give time for a normal engine out landing pattern. For the next 30 minutes the Pawnee pulled, with about 130 lbs. force, on the end of the rope. For the Pawnee, this was like towing three sailplanes at once.

A FULL AGENDA

During the slow climb was a good time for me to review all that I had to do during the powerless descent. There was a full agenda of airspeeds that had to be held to within 1/2 knot, if possible, for a period of 35 seconds each, then transition to the new airspeed and hold it for an equal amount of time and so on during the entire descent. In ad-

dition to those tasks, care had to be used to judge where to fly, look out for traffic and when to stop testing to set up for the traffic pattern. The schedule called for powerless glides with airspeeds as high as 130 knots. The aggressive push-over needed to quickly get to the 130 knot airspeed with no engine to help the acceleration reminded me a little of sky diving. Just prior to stabilizing at 130 knots, a quick look at the VSI showed it to be pegged DOWN!

After completing 35 seconds at 130 knots, the remainder of the free flight glide segments seemed both brief and busy.

*"I've been with the
FAA for 28 years and I
thought I'd heard just
about everything, but
I've never heard this
one before. You've got
a new one on me."*

—Del Ott, Oakland FSDO

The control tower needed a call at release at 5,000' and upon entering the Class D airspace. Five minutes had elapsed since releasing at 8,000' and it was already time to find out if my planned traffic pattern was going to work exactly as intended.

The initial traffic pattern check point was at 2,500' on downwind heading abeam the departure end of the runway. Then it was a 360 turn back to the same point, leaving that position at 1,500' to arrive at the point opposite planned touch down at 1,000'. By extending and retracting the electric flaps, as well as using mild slips, I was able to effectively control the glide angle. Wind was not a factor since the test requirements had demanded that we select a day with very still air.

Once the runway was assured any excess altitude could be dissipated with flaps. From there on a visual judgment could be made as to where the touch down will occur relative to each end of the runway. As it happened, I was able to coast to the turn off, clear the runway, and roll a short distance back toward the hangar on the parallel taxiway.

DO IT AGAIN?

With the first flight behind us and the data downloaded into the laptop computer, once again it was all business as the crew hooked up the tow line. Having done it once successfully, confidence was a little higher. That seemed to be an excellent time to caution myself not to get too cocky and drift away from the focus of professional flying on these "one shot" approaches. By the end of the morning a total of five flights had been flown, each collecting data for a different part of the "J" curve. We experienced great cooperation from the control tower with the sequencing of traffic patterns. During the final landing I noted three hot air balloons, powered and unpowered Cessna traffic (me) all in the pattern at one time. I wonder if the FAA tower operators' handbook covers how to deal with these types of situations.

CRUNCHING THE NUMBERS

A sense of well-being had been restored within me and those insidious little stress lines had begun to vanish from my forehead as we pushed the Cessna back into the hangar late that afternoon. All of the data was in the computer, and the engineers were happily crunching numbers to really learn the answers to some serious questions. The five flights in the propeller-less Cessna were now history.

The spring in my step and confidence I had gained was to be short lived, for at the next CAFE board meeting, following a discussion about the results of the powerless glide test, it was determined that there was a need to repeat some of the tests. The influence of gently rising or settling air was thought to have affected the results. Though the air seemed smooth, there was a concern that the land mass may be causing an air mass circulation pattern that was adding energy to skew our data. More testing was necessary.

When the idea was presented to me, I accepted it about as gracefully as I did the first time I heard about flying without the propeller. Only this time the propellerless tests were to be done well out over the Pacific Ocean from 12,000 ft. to avoid any land mass effects! Now I was sure there was someone on the board who didn't like me.



Brien Seeley installs the Tost tow hook onto the Cessna crankshaft flange.

PROPLESS OVER OCEAN

The site of Mendocino County Little River Airport was chosen because it was only about 2 miles from the shoreline, it had a nice long runway and very little traffic. Its airport manager, Andy Becker, was very accommodating to our flight test team, providing us with convenient ramp space and needed electrical power.

Again, thanks to Brien Seeley's efforts, the coordination went surprisingly smooth. On these flights it was re-

quired that we stay as far at sea as possible to get the best data before abandoning the test and heading back for the landing. Since there would be no ground references to aid in glide distance determination, the handheld Trimble GPS was set up with the center of the runway as the waypoint. This enabled a continuous DME to the airport for recovery.

Much effort was expended to obtain the use of a more powerful tow plane since 12,000 ft. was the new target altitude for release. At the last minute we lost the use of a 600 hp banner towing Stearman which would have proved very effective. Soar Minden came to the rescue by providing a Pawnee 260. Paul Clark flew it all the way from Nevada to provide the over ocean tows.

The Mendocino site brought new challenges since we would not be working out of our CAFE test facility. The newly acquired motorhome/mobile lab proved extremely valuable during the cold night preparing the plane for the dawn takeoff. It also proved wonderful when Larry Ford brought to life the 'C.A.F.E. cafe' and served some outstanding lasagna to the hungry crew. Later, most of the crew managed a few hours of sleep in sleeping bags, on the floor of the motorhome. During the night Otis Holt, our lead technician, had again ballasted the Cessna, removed the propeller, and prepared the flight. To obtain the smoothest air mass, all effort was made to be airborne at first light. Mother Nature must have been

smiling upon us, since we awoke to see the stars shining brightly in this, an area that is known for its many foggy mornings. All was ready.

This time I really had to stop and question if I had lost my mind or not. I found myself sitting in a Cessna 152 with the propeller removed, being cartowed in the dark to a runway, to be dragged far out to sea behind a Piper Pawnee and released, only to push over into a serious dive, then try to make it back to an airport that had little to offer as far as off field landing options. It was becoming clearer to me why the other test pilot moved to North Carolina.

With no engine running there was no heat to defog the windshield. Frequent cleaning of the inside, and outside, of the windshield was necessary to see out and a fresh dry towel was kept at the ready to use in flight. The sun had risen sufficiently to fly, so the tow rope was connected and all key items such as the CAFE barograph and camcorder were double checked.

It was again time to fly. The cold morning caused a brisk acceleration of the two aircraft that had been tied together with a thin nylon rope. Of concern was a rope break since this was the home of many redwood trees (see photo) and, after the end of the runway, few good options for emergency landing were available. Ed and Daniel Vetter, stalwart engineer and his son, had taken off a few minutes earlier in Ed's Mooney to check weather and assist from the airborne position. CAFE Secretary Cris Hawkins was on the radio frequency back at the motorhome to call out my speeds and clock times.

Just after breaking ground, as I peered down the rope at the tow plane in the pre-dawn light, the Pawnee seemed to be vanishing!! The visibility was crystal clear looking vertically skyward. However, with such a slow, shallow climb it took a substantial period of time to pass through each altitude. I watched as the tow plane faded into the fog leaving only the rope and a dim pair of Pawnee wing tips to follow. To make sure I wasn't just seeing condensation on the windshield, I used the dry towel to wipe the windshield with one hand while my other hand on the control yoke worked to follow that tow rope. Within seconds, we had climbed above this fog layer, which was no more than 20 ft.



BRIEN SEELEY

Larry Ford, chef at the CAFE Cafe, served his famous lasagna to the flight test crew in the motorhome.



LARRY FORD

The dense forest and rough coastline at Mendocino demanded that the free flight glides reach the runway at Little River airport every time!

thick, and the situation cleared up with the climb proceeding normally. I breathed a little easier as we circled to the east around the airfield to gain altitude before heading west and out to sea. The progress in the climb seemed very slow. Out of the corner of my vision I saw the coast pass quietly behind us leaving nothing ahead except water. Four thousand feet, 5,000 feet, slowly the altimeter climbed toward the 12,000 ft. goal. After a full 40 minutes on tow we were six miles from the airport and about four miles off shore.

THE RELEASE

There seemed a sense of abandonment as I pulled the release handle and watched as the rope snaked away behind the tow plane. It was business first, because the altitude that we had worked so hard for was already beginning to disappear. The first test was the 130 knot glide speed, which in this situation nearly fills the windscreen with ocean due to the nose down attitude. I found exact airspeed control more difficult due to the lack of visual references on the smooth ocean and flat lighting conditions.

Gliding southeast, parallel to the coast, the flight path generally remained about six miles from the airport. The data collecting continued in 45 second increments, taking brief time between the samples to look at the GPS distance and check altitude. Cris would announce on the radio every ten seconds during the data collection intervals since it took total concentration on the air-

speed to fly to the accuracy required. As luck would have it just after the release, about five airplanes reported in for traffic advisories. It seemed that we would all be arriving at the airport at the same time. We just happened to pick a morning that there was a fly-out breakfast and Young Eagles Day at Mendocino. Thankfully, they were very cooperative in allowing my powerless Cessna priority in the pattern.

During these flights I eliminated the 360 circle on downwind and made a direct entry to the pattern. This was to gain more time in the test area; however, it did require more precise timing. After landing we discovered two very worried lady passengers in one of the arriving airplanes. It seems that they had overheard on the radio, that a Cessna was landing without power and they became very concerned. They looked on in what must have been utter bewilderment as the rope was again connected and the plane was readied for the second launch.

At this point in the series, the flights were becoming quite routine. The small crowd that had gathered seemed to be enjoying the project. The most asked question by the onlookers was, "Why fly without the propeller?"

The airport layout even allowed me to borrow a page from the great Bob Hoover's routine, wherein he precisely manages his dead engine aircraft's kinetic energy in the rollout. After each glide, I was able to roll to a stop next to the CAFE motorhome parked on the ramp. The other CAFE Board members just shook their heads and smiled.

CONCLUSIONS

The CAFE Foundation continues to progress in its ability to measure aircraft performance. In future articles the conclusions and data from these tests will be shared with EAA members and the public at large; however, in the mean time, it seemed prudent to tell the flying tales of going 'Propless in California.' For me personally, it was a challenge and privilege to participate in this CAFE flight test series. In addition to the experience I take along with me a renewed confidence in engine out patterns and landings. ♦

CREDITS

Projects such as the one just described could never happen without abundant help from many selfless people outside of the CAFE Foundation. The Calistoga Soaring Center donated the Tost Tow Hook and the use of their Piper Pawnee thanks to Gino Ferrario and Steve Richards. They volunteered and arrived very early to enthusiastic arrival very early on the morning of our first glide to provide the first towing of the propless Cessna 152.

FAA Inspector, Del Ott again came to our rescue with mechanical inspection and airworthiness permits. Brian Ashley, another FAA inspector that not only helped by providing the FAA waivers required, but joined Del Ott in driving from Oakland at about 4 AM to be on site to witness and assist in the operation. Many thanks to them for their very helpful support.

When we were in a last minute need for a tow plane, Tony Sabino and Paul Clark of Soar Minden, came to our rescue with their Pawnee 260. Paul's willing attitude and professional towing skills added to the overall success and safety of this effort. The CAFE board members extend a hearty Thank You to each of these individuals for their support.

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