Finding Your Fuel Efficiency Potential

Drawing attention to the need and challenging the industry

KRIS MAYNARD, EAA 751966

It was, perhaps, Kermit the Frog who said it first, "It's not easy being green."

As that relates to aviation, most of us—at least until recently—haven't given much thought to how to maximize our fuel economy. The extent of my own conservationism during my first 30 years of flying was reducing power to something other than max cruise setting. I decided a few years ago to do more.

I enjoy long flights in my Aviat Husky. Each year finds me traveling from my Indianapolis base to one coast or the other. In 2005, I decided to not only visit both coasts but also attempt to break a U.S. transcontinental speed record along the way. The eastbound transcontinental record was already held by a Glasair at a speed that resembled my never exceed speed plus a bunch, so I reluctantly decided to make an attempt westbound—into the teeth of the wind—as that record was held by a Grumman Tiger and looked achievable *if* I could: 1) Catch a day with an east-to-west tail wind that covered the entire country (fat chance); 2) Make the 1,812-nautical-mile trip on three fuel stops; and 3) Limit each of those fuel stops to less than 15 minutes. (The record clock continues to tick while the airplane is being refueled.)

The story of that flight can be told another time, but the reason I mention it is that to understand if I could achieve those three fuel stops, I needed to explore (and expand) my Husky's performance and fuel economy envelopes. Going anywhere in a hurry is not the strong suit of a Husky. The Husky is, after all, more about the destination rather than the journey. It took me about seven years of Husky ownership to begin to understand the potential for fuel-efficient flight. The flight manual says that the Husky holds 52.5 gallons—50 of which are usable. I wondered what the airplane's fuel system really held? I decided to test that.

But before I became a test pilot, I decided to seek some advice. I belong to an online owner's group that is well-populated by experienced Husky owners and pilots willing to share their knowledge. There is a vast amount of Husky-related experience on this web forum, which ranges from a pilot with 7,000-plus hours of Husky stick time to new owners. There is much international flavor as well, including an aeronautical engineer in Germany who is constantly seeking ways to improve the Husky (his latest supplemental type certificate, or STC, is for some phenomenal Rosti-Fernandez skis) and pilots from Guatemala, Canada, Australia, and the United States. There is also an unbelievably strong and supportive dealer network willing to help.

The expectation is that the same spirit and drive to excel will foster positive advancements in airplane fuel efficiency.

My friend, Thomas Dietrich, the German engineer, suggested I start by removing the fuel cap from each tank and gently blowing low-pressure air into the tank (keeping my hand sealed over the filler neck) to allow the soft aluminum tanks to expand outward. This process might pick up volume equivalent to another gallon of gas.

I did that, filled the tanks to the brim, and took off on my first test flight. I established a cruise power setting that was indicating 103 knots and 7.5 gph and started flying around Indiana burning off fuel. The Husky has fuel "sight tubes" installed in the cockpit at the wing root; very nice devices, low tech and highly reliable. What you see is what you have in terms of fuel on board. Thomas told me that in level flight the Husky will burn every drop of fuel on board and then the engine will quit. This made perfect sense to me, and because he is a bona fide test pilot, I took his word for that. I spent the next several hours recording vital engine statistics and burning my remaining fuel. With legal visual flight rules reserves indicated in my sight tubes, I maneuvered over an airport, circled a few minutes overhead and landed. After draining the remaining fuel from the wing tanks, the fuel truck filled me back up to the brim on each tank, and the meter read 54.5 gallons, 2 gallons more than advertised. That is nice information to have.

I now knew fuel capacity and my fuel burn rate at desired cruise setting, and therefore I could now calculate distance between fuel stops (if I knew the wind component). I calculated what sort of tail wind I needed to break the transcontinental speed record, waited for the right day, flew the coast-to-coast flight in just under 16 hours, and snagged the record. My aircraft does not have an autopilot, so I was tired but happy.

This flight and follow-up test flights conducted over the next two years started me on the road to awareness of just what my airplane could do. In July 2007, I flew an economy test flight of 13 hours, 2 minutes, 15 seconds, averaging 3.89 gph fuel consumption. I felt after that flight that a nonstop 15-hour flight was possible. My data was confirmed by Jim Wark of Pueblo, Colorado. His 7,000-plus hours in a Husky include numerous long-endurance flights.

Aeroplane Efficiency Record

The National Aeronautic Association (NAA) was founded in 1905 and since its inception has been the official record keeper of aviation records in the United States. Together with the Fédération Aéronautique Internationale (FAI), the two bodies work to process all world and national records that are attributed to U.S. pilots.

From the time of Orville and Wilbur Wright and Glenn Curtiss, aviation records have revolved around three elements: speed, distance, and altitude. For 103 years the pursuit of these record categories has been a never-ending quest for those individuals and companies who desire to go faster, farther, and higher than ever before. That challenge has been a positive force in the advancement of the science of flight.

As of March 1, 2008, a new category—aeroplane efficiency—was added to the record books. The expectation is that the same spirit and drive to excel will foster positive advancements in airplane fuel efficiency.

I thought it would be an honor to have a tiny little footnote in aviation history by becoming the first person to place a record under this new category. More importantly, however, I wanted to post a mark that was respectable in terms of what production aircraft achieve today. When I first examined the rules, I felt my airplane would not be capable of completing the minimum distance requirement. I was intrigued enough by the idea, though, that I pursued the issue.

The record requirements for aeroplane efficiency specify that a one-lap triangular course must be flown, the length of which is determined by the weight classification of the aircraft. Table 1 provides a partial listing of these weight classes and the distance requirement for each.

TABLE 1

WEIGHT CLASS	WEIGHT RANGE (at takeoff)	MINIMUM COURSE LENGTH (nonstop)
C-1.a/0	< 661 pounds	540 km/335 sm
C-1.a	661 to less than 1,102 pounds	865 km/537 sm
C-1.b	1,102 to less than 2,205 pounds	1190 km/739 sm
C-1.c	2,205 to less than 3,858 pounds	1515 km/941 sm
C-1.d	3,858 to less than 6,614 pounds	1840 km/1,143 sm
C-1.e	6,614 to less than 13,228 pounds	2165 km/,1345 sm

This triangular course must be flown nonstop and without refueling. The airplane is weighed in the fueled configuration just prior to takeoff and then weighed again at the termination of the record attempt. The difference in the start weight and the finish weight is the weight of the fuel consumed, and the flight performance is then stated in terms of kilometers flown divided by the weight of fuel expended (expressed in kilograms).

The flight must be monitored by an official assigned by the NAA (there is a fee involved), and you must carry a sealed flight recorder on board the aircraft. This flight recorder contains both GPS and barograph databases and records data for latitude/longitude, groundspeed, altitude, and elapsed time. The pilot may alter altitude as appropriate on course to take advantage of the most favorable wind conditions.

As a result of my test flights, I grew more confident that I could not only complete the course but also establish a fuel-economy mark that would compare favorably with the fuel mileage achieved by Dick Rutan and Jeana Yeager during the Voyager flight in 1986. That was a vastly more complex flight than my little triangle, but I so respected

courtesy Kris Maynard

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Kris, left, is congratulated by NAA Official Observer Brian Utley on the completion of his triangle course. The NAA/FAI have yet to verify the record. That will come in about a month.

Climbing aboard for a dawn departure, Kris wants to take advantage of the calm morning air.

Fuel sight gauges at each wing root are a standard feature in the Aviat Husky. Low tech, but highly reliable.

their 24.45 mpg fuel economy that I secretly coveted that number as my goal.

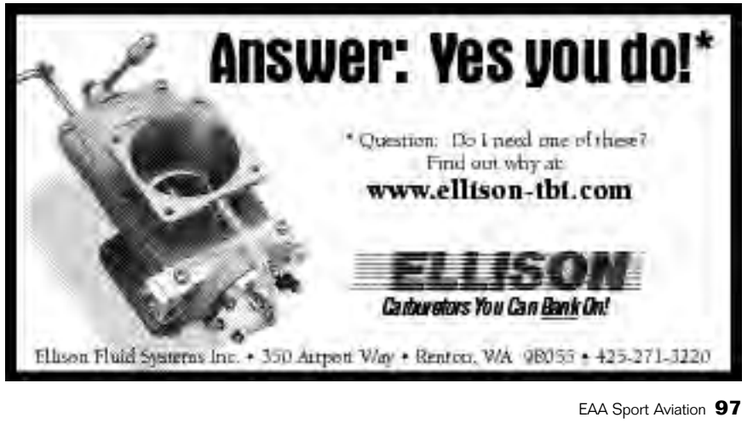
My flight was conducted at relatively low altitudes—anywhere between 5,200 and 1,100 feet MSL—and at low power settings. My Lycoming O-360 and 76-inch Hartzell propeller were adjusted to 15 inches manifold pressure and 1775 rpm, respectively. This configuration yielded a true airspeed of 65 knots and an average fuel burn of 3.48 gph. The flight took 9 hours and 18 minutes to complete at an average groundspeed of 71 knots.

I tried to aerodynamically clean up the Husky as much as I could with the primary contributor being a set of recently STC'd wheelpants from Germany. I placed vinyl tape over various areas of the airframe, much as a glider pilot does to streamline the airflow and reduce drag. A fresh coating of Slick 50 wax made all surfaces as slippery as possible.

The Flight

My flight originated in Sheridan, Indiana (5I4). This airfield is not my home base, but it is one of the friendliest airfields I have run across in 35 years of cross-country flying, so I elected to start my attempt here. My good friend, Jeff Apple, runs the airport and offered a heated hangar the night before the flight and a place to weigh the aircraft along with several volunteers to assist with the prelaunch duties.

I climbed to 5,200 feet as I headed off to Danville, Kentucky, and enjoyed 1 hour and 40 minutes in a 35-knot tail wind. That euphoria dissipated as I turned into the wind on my second leg and fought the wind for 4 hours and 4 minutes, winging my way to Sikeston, Missouri, I stayed low on this leg to minimize the impact of head winds that were 10 to 15 knots at an altitude above 2,000 feet AGL. Rounding Sikeston, I headed back for the finish point at Sheridan with wind conditions varying from a direct crosswind to a small quartering tail



wind. As it was now mid-afternoon I was able to find some bubbles of thermals. By raising the nose slightly in these thermals I was able to gain altitude without slowing down a great deal. This increased altitude came in handy later in the flight, particularly allowing me to have somewhat of a final glide at reduced power as I approached Sheridan.

The final analysis of my record flight produced a result of 13.71 km/kg of fuel. That translates to about 23.4 mpg; a result I view with mixed emotions. On the one hand, 23.4 mpg represents just about the best performance possible from any production aircraft, in any weight class, capable of making the demanding triangular flight distance. It also compares favorably to the 23.45 mpg performance by the Voyager.

On the other hand, I feel we should be capable of much more. One of the primary reasons I went to the expense and effort of making this record attempt was to draw attention to the need for greater fuel efficiency from our production aircraft. My attempt was made, in part, to scratch a line in the dirt and say, "Here is where we are today. I challenge the industry to do better."

My EAA friends have long understood the need for fuel-efficient flight and, as always, are out in front of the manufacturers on this point. Aircraft in the future will need to be both efficient and fast. My flight was efficient, but slow. I know my record will fall one day, perhaps even before the year is out. I welcome any pilot to try to better my mark. This is the spirit and essence of aviation record setting—to ask us to stretch our capabilities and to understand our aircraft. There are many experimental aircraft capable of surpassing my mark. I also challenge all pilots to more fully understand the fuel-efficiency potential of their aircraft, even when they're not flying for a record. This is knowledge that may one day save your life.

Not Official, Yet

My record documentation has been submitted. At this point the record remains "unofficial" until the NAA and FAI have completed their review.

There was enough expense involved with this flight that I am grateful to have received financial support from George Jones and Specialty Fasteners Inc. of Grand Prairie, Texas, and from AeroShell and Sheridan Airport. It is terrific to know there are folks who support the continual quest for advancement in aviation. EAA

Interested persons may e-mail Kris at maynard.kris@gmail.com *to receive additional information about the test flights leading up to this record flight and strategies he developed to undertake the record attempt. For more information on the rules, check out the NAA website at* www.NAA.aero.