1989 CAFE 400 AND TRIAVIATHON

TECHNICAL DISCUSSION

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The 9th Annual CAFE 400 and Triaviathon again set new highs in scores for 2-seat experimental aircraft, including a new top speed record and course speed record. Another gathering of sleek, carefully prepared aircraft and their owner/designers, this year saw 40 aircraft compete for over $4,000 in prizes on June 23-24 at the Santa Rosa Air Center. Each year, the CAFE Foundation holds the event in the interest of advancing light aircraft design.

4TH ANNUAL CAFE TRIAVIATHON

The Triaviathon included 17 aircraft, each one flying the prescribed flight profile of maximum climb-out from brake release to 6,000 feet msl, then leveling off and accelerating to Vmax, then slowing to Vmin while maintaining level altitude at or near 6,000 feet. A solid state CAFE barograph, designed by Steve Williams and built by Frank Braal, was taped to the wing of each aircraft and continuously recorded dynamic and static pressures, as well as temperature. Recording all three parameters once per second, the flight data was then dumped into a computer, converted to Vmax, Vmin and Time-to-Climb values, and finally sorted by the scoring formula of Time-to-Climb times Vmax divided by Vmin. Each of the three barographs senses pressure from a free-swiveling pilot-static “missile” affixed to the forward end of the barograph boom. Accuracy is well within 1% for all measurements. A trial flight run on an aircraft with barographs on each wingtip demonstrated them to be in 99.7% agreement.

The barographs are battery powered and use solid state transducers on a compact printed circuit enclosed within a 2” O.D. aluminum tube. The tube is about 20” long and has a 1” diameter by about 4 feet long tubular boom extending out coaxially to support the pitot static missile. Fiberglass wing cuffs for different airfoils are taped onto the leading edge and include a 2” I.D. hoister under the wing aligned with the chordline. The barograph slides into the hoister and is secured with stainless steel hose clamps. The cuffs are taped on with Orcon OT-7 tape which has proven quite secure up to 300 mph. The barograph boom length is adjusted to position the sensing missile about 1 chord length forward of the wing leading edge.
Weather conditions for most of the Triaviathon runs this year were 77 degrees F on the ramp at 100’ msl and 70 degrees at 6000’ aloft, in clear, somewhat turbulent skies. This year, the barographs were again reported to show no vibration or significant oscillation and did not significantly affect stall behavior. Rich Gritter (in the Questair Venture) reported the barograph to be “rock solid” at his Vmax and said that the Venture stalled exactly as it had in his previous extensive slow flight testing on that aircraft.

All aircraft were weighed with the pilot to determine take-off weight categories: FAI C-1.b (1102-2204 lbs.) and FAI C-1.c (2204-3858 lbs.). The Vmax runs were made at approximately 6000’ indicated altitude and were taken as the highest speed achieved with no more than 100 feet of altitude loss in the preceding 60 seconds. Vmin was also flown at 6000’ and was taken as the highest indicated airspeed in 10 consecutive seconds of minimum sustained slow flight in which altitude was held level within + or - 30 feet. In reviewing the continuous flight data obtained, these appear to be realistic and fair methods of obtaining Vmax and Vmin.

Rate of climb for scoring was taken as the average rate of climb demonstrated between 1000’ and 4000’ corrected for temperature so that the competing aircraft all essentially experienced the same air densities during their climb.

The Questair Venture’s performance flown at 1590 lbs. take-off weight, with test pilot Rich Gritter at the controls, demonstrated 295.8 mph Vmax, a new Triaviathon record. This speed is 6-9 mph less than speeds it has demonstrated when clocked over known ground distances at low altitudes. This decrement is accounted for mainly by the drag of the barograph, missile and cuff, but may be partly due to the normal reduction in available engine power at 6000’. No one would quibble with the statement that the Venture is truly a 300 mph airplane.

Jim Griswold, the Venture’s designer, said he expected to gain nearly 40 horsepower from the addition of a special new exhaust system not yet on the aircraft. This system will include 1.5” diameter header pipes, each of about 30’ length, merging into a roughly 2” diameter collector.

The Venture’s slow flight was exceptionally good for an aircraft with only 72.5 square feet of wing area and, in fact, IAS crept as low as 60 mph just prior to its gentle stall (4-5 feet per second altitude loss). Outboard leading edge cuffs with 5% more chord and a 2% “camber unit”, along with leading edge slots inboard of the cuffs, have apparently tamed the stall behavior of the Venture’s high aspect ratio 230 series wing. Griswold claims that the 68 inch McCauley “BlackMac” propeller not only outperformed an 80” 3-blade propeller in climb tests on the Venture, but was much quieter. The Venture’s amazing Triaviathon score, 13,449.1, approaches the all-time record of Jim Ewing’s Harmon Rocket, 16,657.3 set in 1987.

Ray Ward placed second overall to the Venture with a truly exceptional score in his 300 hp Super BD-4. The following summary (Table 1) shows how the Triaviathon has prompted steady improvement in Ray’s airplane.

It is noteworthy how many diverse aircraft scored in the 5,000 to 6,000 point range. Remarkable similarity between

<table>
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<th>Year</th>
<th>Aircraft</th>
<th>Vmax</th>
<th>Vmin</th>
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Dan Mortenson and Bill Pieper's Cessna 152 Taildragger flew the short course.
Cafe 400 results

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Over 12 mph from last year. The highest
Vmin was the 77 mph of the Glasair III,
which compares with 64.8 demonstrated
by the Stoddard-Hamilton Glasair III
prototype in 1987.

It should be pointed out that the
speed decrement due to the barograph
installation is more significant on
the smaller, low drag aircraft, and that
true Vmax is probably slightly greater
than that measured. This is mitigated
somewhat by the fact that most contest-
ants flew their aircraft at weights
well below gross, as shown.

It has been proposed that next year
we include a Propeller Shootout at the
Triathlon in which one aircraft with an
unbiased pilot fly the event with each of
several different propellers to
determine a “Best Propeller” award. We have the
tools to make such a contest, and would
welcome input from the aviation
community on how best to proceed.

Thanks to Steve Williams, Frank
Braai, John Long, Bill Van Sice, Del Ott,
Paul Stafford and many others for
making this Triathlon another great suc-
sess.

The 9th Annual
CAFÉ 400

The 367.58 mile race course used
this year was identical to last year
with the exception of a 5 mile lengthening
due to a circling of the airport on departure,
imposed to allow the competing
aircraft to gain altitude through a scattered
stratus layer enroute to the first pylon. The race included 5 new designs
this year: the Questar Ventsure,
Swearingen SX300, Mooney Statesman,
Cessna 337 Skymaster and Erco
eque 415D.

All aircraft were again drained empty
of fuel and weighed on the CAFÉ scales
prior to the event. The payloads shown
in the scoring include the weight of sand
ballast, crew, personal effects, and unburned,
non-reserve fuel. A weight of 6 lbs.
per gallon is used in computing mpg. Scoring was again based on the
CAFÉ Formula of Speed to the 1.25
power times MPG times Payload to the
.75 power. A maximum of 200 lbs. per
seat of payload is allowed.

Experimental 2-Seat
Category

Klaus Saviar and his highly modified
VareEze won nearly every prize in sight
with an outstanding score, setting a new
high for 2-seat aircraft. In fact, his score
is within .1% of that of Dick Rutan’s
score when Dick flew his Long-EZ with
an 804 lb. payload as an exhibit in
1984. Klaus’ performances at the CAFÉ
400 have steadily improved every year.
Flying almost 20 mph slower than in
1988, his mpg improved from 39.57 last
year to 47.73. Klaus’ aircraft uses 9.4
compression pistons of his own design
in his Continental O-200 engine. It is
equipped with an Ellison Throttle Body
and a special crank-triggered ignition
system which allows cruise running at
over 50 degrees of spark advance, ad-
justable from the cockpit. Klaus also
uses a propeller of his own design,
which has produced impressive gains
in the propeller efficiency. He markets
the pistons, ignition system and prop-
ellers to other builders.

For 1989, he reduced his cowl inlet.
Left to right, Jim Horn, CAFE Secretary, Fred Cook of Great American Propeller Co., and Crandon Elmer scales expert, process the race data.

area to 15 square inches by recessing the lip on the belly NACA inlet. He lightened his wheel pants, and built new ailerons weighing only 1.8 lbs. each. His empty weight was 680 lbs. He said, "I don't have the clean airplane that Gary (Hertzler) does and my excess weight relative to his really hurts me in the CAFE. But my engine is really, really good."

Klaus described his technique for leaning the mixture during the CAFE 400 as first leaning to the point of engine roughness, then advancing the timing a little to smooth out the running, then leaning until roughness recurs, then advancing timing still further to again smooth out the running. As he does this, there is a 75-80 degree drop in EGT, and the CHT runs around 325 degrees F.

Klaus' performance shows a 3.3 gph fuel flow at 45% power and computes as a 1.33 sq. ft. drag area. After winning his second LoPresti Trophy, Klaus says he has a whole "bench full of tricks" that he hopes to use in next year's event.

Gene Sheehan's Q-200 placed second and was 10 mph slower than his 1988 race speed with about 1.4 mpg better mileage. Gene also uses a spark advance system, but his is accomplished with a cable from the cockpit to a mechanism that rotates both magnetos on their mounting pads to achieve up to 45 degrees of advance in cruise. Gene is very pleased with his augmentor cow exit in which the thrust of the exhaust gases ejects the cooling air from the cow through a pipe-like opening on the belly. With this system, the CHT actually rises when the throttle is closed down. The cow exit has 55% of the cow inlet area.

Gene had carefully mapped out his climb and descent profiles for this race with lots of flight testing, and planned to use medium descent rates rather than protracted descents or screaming dives. Gene used a calculated 53% power this year. He monitored his leaning and power with a very accurate digital tachometer (fixed pitch prop).

Gary Hertzler placed third in his very clean VariEze, burning 3.27 gph at 56% power. His Continental engine uses a 9.3 compression ratio and an Allison Throttle Body. New for this year, Gary incorporated Eisenmann magnetos which allowed a second set of breaker points so he could advance the timing. A cockpit toggle switch selects 28 degrees advance (for take-off) and 40 degrees advance for cruise at reduced power. Gary has noted a 50-75 rpm boost in cruise when he switches to the 40 degrees of advance. He has done some porting and polishing on the engine, and added some fillets inside the cow to try to improve its exit flow. Turbulence on the course this year posed an inordinately severe speed penalty to the VariEzes that encountered it. And the luck of choosing a smooth air altitude may account for some scoring differences among the VariEzes.

Mike Maxwell's Lancair 235 improved his score over last year with a speed 16 mph slower but with 6 mpg better mileage. He flew at peak EGT at 2450 rpm indicating 5.2 gph. This computes to a 1.59 sq. ft. drag area. Mike's high compression O-235 has been ported and polished.

That the Questair Venure set a new course speed record of 270.3 mph and still scored better than several Glasairs, VariEzes and a Lancair is a strong indication of the very low drag it produces. Rich Gritter flew the race at full throttle and 2700 rpm, leaning at altitude to slightly leaner than peak EGT. Burning 17.05 gph, he climbed at 207 IAS. Cylinder head temps ran 410 degrees mostly, with oil at 225. He was unable to find any favorable winds, an experience shared by most of the racers this year. He said the air was quite bumpy, and Rodie Rodewald, his co-pilot/navigator and a former fighter pilot, was
even requesting that they slow down through those bumps. The turbulence was obviously felt more in such a fast aircraft, and the stiffness of the all metal wing with a high aspect ratio may also be responsible for some ride harshness, but most of the racers reported significant turbulence this year. The Venture used 83% power and showed a 1.38 sq. ft. drag area at its race speed. Its empty weight was 1338 lbs.

Production Stock Retractable Class

Cris Hawkins had won this class for two consecutive years in a rented Mooney 201. This year his track record earned him another chance to fly a brand new Mooney 201 to represent the Mooney Aircraft Corporation’s reign in efficiency champion. Cris rose to the occasion with another excellent performance. He flew at just 44% power, 645 gph, but outscored all others in his class to win yet another LoPresti Trophy. Cris leaned to 25-50 degrees lean of peak during the flight. This Mooney was IFR equipped and weighed 1843 lbs. empty. The 201’s drag area computes to 3.83 sq. ft.

Jim Rust’s Cessna 210 is a stock "workhorse" airplane based in Red Bluff, CA. In his third CAFE 400, at only 22 years of age, he scored second to the 201 by less than 8%, carrying a 1200 lb. payload. He used 2550 rpm and 21 inches of MP. Jim feels he could do even better next year.

Phil Wilkinson of Santa Rosa placed third in his first CAFE 400. Since unburned fuel is credited as payload, Phil flew at reduced power so as to obtain a full 800 lb. payload credit in his Mooney 231. He averaged 7.43 gph.

Production Unlimited Retractable Class

Paul Loewen of Lake Aero Styling in Lakeport, CA again worked his magic to win first in this class with a highly modified Mooney M20C. Weighing only 1679 lbs. empty, this now 200 hp bird sports all of the Lake Aero speed mods, and was expertly flown. Brent Silver from Aviation Consumer served as co-pilot. Paul used 2400 rpm and leaned to nearly 100 degrees lean of peak EGT. Paul won his second LoPresti Trophy. It is interesting to see that this Mooney narrowly outscored the Questair Venture.

Production Stock Fixed Gear

Carl Stone flew his Tomahawk all the
Klaus Savier displays his 1st Place 2-seat Experimental Category trophy for his Varieze. The award was presented by Frank Braal.

way around the long CAFE 400 course to win this class, narrowly beating the Ercoupe, which had flown the short course of 230 miles.

**Production Unlimited Fixed Gear**

Maybelle Fletcher again won this class with her special modified Grumman Tiger. A soft foam seal applied to the cowl just aft of the spinner base yielded 3 mph more cruise speed.

**Exhibition Aircraft**

Ray Ward set a speed record around the CAFE 400 course for fixed-gear aircraft with his 300 hp Super BD-4, averaging 214.1 mph at 91% power.

Dan Wright's SX300 buzzed around the course at 263.6 mph and 23.54 gph in what must have been a race with the Venture.

John Parker attended the race without his new JP-350 racer because of last minute fuel leaks in its wet wings. He expects to have it ready to wage an assault on the Venture's new CAFE 400 course speed record next year.

**Volunteers Make It Possible**

The CAFE Foundation is deeply grateful to all of the hard-working, dedicated volunteers who make this great flying event possible. We cannot possibly acknowledge all of them, but wish to thank members of EAA Chapters 124, 427, 393, 20, 62, the Santa Rosa 99s, all of the excellent pylon teams and ham operators, and Bill and Sandy Wright.

**AWARDS**

Ben and Marty Ellison and Sue Beard presented the Bob Beard Memorial Award in memory of Bob's great dedication and skill in aircraft design.

Gene Sheehan presented the Tom Jewett Memorial Award sponsored by Aircraft Spruce & Specialty Company.

Triaviathon:

$300 - Best Performance by an Aircraft with a Constant Speed Prop, sponsored by Hartzell Propeller Company - Rich Gritter, Questair Venture.

$300 - Best Performance by an Aircraft with a Fixed Pitch Propeller, sponsored by the CAFE Foundation - Budge Brown, RV-4.

Best Performance by an Experimental Aircraft, sponsored by the Great American Propeller Co. - Rich Gritter, Questair Venture.

CAFE 400:

$1000 - CAFE Achievement Award. Score exceeds by the greatest margin the mean score of its category, sponsored by the CAFE Foundation - Klaus Savier, Varieze.

$1000 - Bob Beard Memorial Award. Best score by a 2-seat experimental aircraft, sponsored by Ellison Fluid Systems - Klaus Savier, Varieze.

$1000 - Outstanding New Design Award, sponsored by the CAFE Foundation - Jim Griswold, Questair Venture.


It should be noted that Jim Griswold most graciously donated his $1000 award back to the CAFE Foundation to be used for next year's event.

**Summary**

The CAFE 400 thrives successfully thanks to EAA, Piper Aircraft Corporation, Aircraft Spruce & Specialty Company, Ellison Fluid Systems, Hartzell Propeller, Great American Propeller Co., David Clark Co., Stoddard-Hamilton Aircraft, Accurate Forklift, Hansel Ford, Aero Design Products, Ken Erock Manufacturing, Braal Micro Instruments, SZ, Inc., Santa Rosa Airport Associates II, Woody Ersted, Fred Walters, and many others. We look forward to an expanded, very special 10th Anniversary CAFE 400 June 22-23, 1990. For comments or information, write to CAFE Foundation. The CAFE Foundation is a non-profit, tax exempt organization. CAFE, CAFE 400 and Triaviathon are copyrighted by the CAFE Foundation.
1989 CAFE 400
A Personal Look

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Monday, June 26 ... the airport is quiet today. The acres of concrete apron on the southwest side of the field are empty again. The owls have returned to their roosts in the rafters and stories up in the big wooden hangar. An Aeronca, a Luscombe, an ancient Cub and pieces of a PT-19 rest quietly again inside, patiently awaiting their mechanic's attention to resume the maintenance and restoration work interrupted by the flurry of activity of the past weekend.

How different things were just three days ago, when the former Naval Air Station teemed with activity as the 1989 CAFE 400 swung into high gear.

Thirty-nine contestants from as far away as Greensboro, North Carolina and Houston, Texas came to fly this year, with spectacular results as reported in Brien Seeley's article. By now, most readers of SPORT AVIATION are familiar with the format and technical side of the CAFE 400 and Triathlon. But there's a people story here, too, and as you might expect it's an EAA story.

The CAFE 400 is an all-volunteer effort and, although not affiliated with EAA or any particular EAA Chapter, EAA members provide most of the people power and airplane savvy needed to stage an event of this size and complexity.

For the ninth consecutive year, President Denny Parmer and the Board of Directors of Santa Rosa EAA Chapter 124 provided volunteers, the Mt. St. Helena pylon crew, and essential field equipment: picnic tables and benches, slachronix and bases, traffic cones, and a booth for T-shirt, banquet and raffle ticket sales. President Ernie Morena and a crew from Chico EAA Chapter 427 manned the pylon at Black Butte Lake, while Al Johanson and members of the Redding and Red Bluff EAA Chapters set up shop at the Inskip Hill pylon and the top (literally) of the Bully Chopp Mountain checkpoint. Pete Wiesbins (Concord EAA Chapter) ran the Sutter Buttes pylon. Thanks also go to Bruce Cruickshank from EAA Chapter 20 in Redwood City, who acted as volunteer coordinator, and the ten chapter members who came along as volunteers. And special mention to Walt Cannon and George Deavex who came all the way from Seattle, WA and Los Angeles respectively to work as volunteers, and perennial volunteer Bill Van Sice from San Jose who worked the Triathlon.

EAA Chapter 124 member and past-president Ken McDermott brought his Macintosh computer to the race, complete with custom payload processing program to assist contestants with this sometimes complicated chore. John Long, member of both Chapter 124 and the Petauluma Area Pilo Association, was our communications chief and ran the pylon radio net from his perch atop Mt. St. Helena. The radio man at the Air Center was Brien Perkin.

The CAFE 400 is traditionally held the last weekend in June, a convenient date in most respects, but always a conflict with the amateur radio operators annual Field Day. Nevertheless, the "hams" work the CAFE 400 every year, providing the vital communications link between the pylons and race central that contributes so much to the safety of the event.

The CAFE 400 has some of the best food you'll find at any air meet - thanks to the Santa Rosa 99s who provide homemade deli sandwiches, cookies, cold drinks, and the hot coffee and donuts that get the race going on Saturday morning.

Thanks to all these folks and many more, the competition got off to a good start on Friday, with completion of all race processing by 5:30, in plenty of time for all to make it to the traditional pesta feed at Brien and Anne Seeley's house. This despite a record 17 entries in the Triathlon which is also run on Friday.

Despite a forecast of low overcast and fog, conditions looked good on Friday afternoon, so the Saturday pilots' briefing was moved up to 0800 in anticipation of an earlier start in smoother air. Well, the stratus came in overnight as forecast and just sat there. Saturday dawned with a layer between 2800' and 3800' - high enough for flying underneath, and low enough to expose the Mt. St. Helena pylon, but with no way to get there VFR. It seemed unlikely that Bay TRACON would approve requests for pop-up clearances to VFR on top with departures every 30 minutes apart, so we waited for the layer to break up and activate Plan B.

Plan B called for a climbing left 360 over the field on the traffic pattern track, maintaining required cloud clearance. By 12:45, we could make out Mt. St. Helena in the distant haze and the overcast had become scattered clouds, so we launched aircraft using the circling departure. The take-off was flawless, and the sight and sound of contestants in the climbout pattern was truly spectacular. The weather along the course was CAVU, and all airplanes completed the course without incident.

Post-race aircraft processing and data reduction went off without a hitch, and for the first time in recent memory, all the CAFE Board members made it to the banquet in time to actually eat dinner. A highlight of the CAFE Banquet in fact, a tradition ... is the slide show featuring photographs taken at the Air Center. As the planes round the Mt. St. Helena pylon, Bill Wright, an EAA Chapter 124 member, does the photography, gets the slides processed and mounted at a commercial lab that stays open on Saturday just for us. He then loads the carousel and sets up the projector. The film is donated to the CAFE every year by Jan Morgan. Thanks to Jan's generosity, we have an extensive photo archive covering all our activities back to the original 1981 CAFE 250.

Well, the equipment is put away for another year, and the sore muscles, sunburn and achy feet are almost dim memories. What will remain fresh in everyone's minds for a long time though are the great contestants, the fine group of dedicated volunteers, the generous sponsors and even a cooperative Mother Nature who made the 1989 CAFE 400 successful, safe and fun.

Hope to see you in Santa Rosa for the CAFE 400 next year.