Among experimental aircraft, there were two remarkable results from the 1988 CAFE 400. The first was the fantastic performance by Mike Melvill in the Rutan Catbird, which set a new all-time high score, and the second was the very close three-way rivalry between the highly modified VariEzees of Gary Hertzler and Klaus Savier versus the prototype Q-200 of Gene Sheehan.

The Rutan Catbird is a triplane or 3 surface aircraft design by Burt Rutan which he first conceived in about 1981, and which required about 3 years to build. The fabrication was predominantly done by Mike Melvill and Bruce Evans. It was designed as a long range pressurized personal and crew transport (5 seats) for Burt Rutan somewhat as a replacement for his Defiant. It is about 40 kts faster than the Defiant, has coast to coast range, and, as we have seen proven, is very fuel efficient. The Catbird had only 40 total flight hours when it arrived for the CAFE 400. Mike Melvill flew these nearly 40 hours of flight test before the CAFE 400 to establish dive speed, stall character, and, of course, optimized flight for CAFE racing. This included a detailed "spreadsheet" of altitudes, speeds, manifold pressures, rpm, mpg, gph, climb and descent rates and CAFE scores for each and all of the specific legs of our CAFE course.

Several features of the Catbird design are important in its ability to achieve such a high CAFE score. First, it achieves a very low drag by both minimizing wetted area and wing drag. The 2 dimensional airfoils on the Catbird, designed by John Roncz, are said to have a drag coefficient of .0029. Laminar flow is expected to 65% on the top surface and 70% on the bottom. The front surface is fixed with no control surfaces, and serves as a CG extender, allowing the 5 seats by allowing the wing spar to pass behind the front 3 passengers. The main wing has no flaps (drag) and has ailerons slightly in-
board from the upswept sheared wingtips. Burt estimates the Oswald span effectiveness ("e") at .97 due to favorable interplay between the flying surfaces.

The symmetrical T-tail is kept low on the fuselage, and is forward swept so as to reduce the torsional loads in the fuselage, allowing a 12% drag reduction due to the narrowing of the fuselage. A ventral extension of the vertical stabilizer provides the necessary tail volume. The forward sweep of the horizontal tail also produces an inboard spanwise flow that greatly reduces the intersectional drag at the T.

The fuselage width is minimized by a staggered seating arrangement in which the pilot sits alone in the midline frontmost (the "catbird seat"), with the forward facing front two passenger's legs passing to either side of his hips. The rearmost two passengers enter through a separate door and sit facing to the rear, each having his own window. The rear of the fuselage converges markedly aft of the rearmost seat, yet still provides plenty of legroom there.

The engine is a stock Lycoming TIO-360 with 7.0 to 1 c.r. and Bendix Fuel Injection, and draws its induction air from the adjustable cooling air chin scoop under the spinner. A manual wastegate controls the turbo boost. Updraft cooling is used. The propeller is a Hartzell constant speed model matched to this engine. Wing area is about 100 square feet and span is 32 feet for an aspect ratio of 10.24, and at 2850 lbs. gross weight, wing loading is 28.5 lbs./sq.ft. The Catbird carries 74 gallons in the fully wet S-glass wing. Carbon fiber is used in parts of the fuselage and all the antennae are flush. Empty weight is a remarkably light 1448 lbs. including about 45 lbs. of structure necessary for pressurization.

The flying surfaces were sanded prior to the race with 400 grit sandpaper to remove the protuberances in the painted finish, which Burt feels are detrimental to laminar flow. Flight testing has shown a top speed of 272 smph at 17,000 feet, and 220 smph at 8,000 feet. Burt stated that a Catbird optimized for the CAFE 400 should not have a turbo, which limited the minimum sfc to about .48 lb./hr./hp. Also, Burt said he would use a higher wing loading and less span in a pure CAFE racer. Interestingly, Bruce Evans is currently building a Continental powered version of the Catbird, although there are no plans for a homebuilt kit program at this time.

In the CAFE 400 this year, Mike Mel-
lower this year in the same aircraft that they flew in last year’s race.

Second place in the 3 or more seat Experimental Class went to Ray Ward in his Super (300 hp) BD-4. His mileage was 1.5 mpg better than at the 1987 race, and thus his score went up by 8.2%. Ray’s CAFE 400 score was below the record for BD-4’s set by Roger Mellena at the 1984 CAFE 400, but Ray did achieve a resounding first place in the CAFE Triathlon (see below).

Experimental 2 Seat Category

Gary Hertler returned home after placing third in the 1987 CAFE 400 determined to get back into the winner’s circle. Having already cleaned up his VariEze to an amazing degree, he dug even deeper in his bag of tricks and attacked the design of new wheel pants. He made new ones that incorporate a 6000 series airfoil top and bottom and area narrower by virtue of him having machined 1” of width out of the center of his Cleveland wheels. Amazingly, this yielded 5-6 mph better cruise and 12 mph more top speed. Gary also repitched the prop on his A-65, Ellison Throttle Body equipped engine. He added a fixed fillet to the fuselage at the root of the curred to reduce interference drag there. Gary also enclosed the main landing gear legs in sleeves with an airfoil shape.

When the smoke cleared, not only was Gary back in the winner’s circle, he had achieved a score that surpassed the existing all-time high score of the White Lightning. His numbers are hard to imagine, with almost 50 mpg at 152 mph. Empty weight was 1 lb. lower than in 1987 at 626 lbs. The brilliance of Gary’s relentless work to improve his VariEze is reflected in the listing of his performances (see Figure 1). Not far behind was Gene Sheehan in the prototype Q-200 with a score just 1.6% below Gary’s. Gene is fresh off of his project with the record setting Olds Aerotech car, and is using ceramic coated pistons with 9 to 1 compression and a very clever cockpit adjustable spark advance. The Q-200 uses an augmentor tube cooling system with a tuned exhaust. Gene’s score of 2.32 million bettered his previous best of 2.28 million. Empty weight was down about 4 lbs. over 1987 to 636.7 lbs. Gene had also coated the external surfaces of the cylinder barrels with a special black coating used on gun barrels to improve the cooling.

Klaus Savier, the defending champion from the 1987 CAFE 400, placed a close third behind Sheehan’s Q-200 with his exceptional VariEze. Klaus bettered his 1987 score by 1%. He had re-

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<th>PAYLOAD</th>
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**FINISH BY CLASSES**

**EXPERIMENTAL, TWO SEATS**

1. N99VE  VariEze
2. N81QG  Q-200
3. N57LG  VariEze
4. N123MX Lanci 235
5. N92MC Glasair RG
7. N66RY RV-5
8. N95LR Glasair FT
9. N306AT Glasair RG
10. N24NR RV-4
11. N78WB Barracuda
12. N82RQ Super BD-4

**EXPERIMENTAL, THREE OR MORE SEATS**

1. N187RA Catbird
2. N62RW Super BD-4

**PRODUCTION, SHOWROOM STOCK, RETRACTABLE GEAR**

1. N5792D Mooney M20J
2. N201QG Mooney M20J
3. N552B V-35 Bonanza
4. N666RB Mooney M20J
5. N2026Q Cessna Cardinal
7. N30C Cessna 310
8. N6061A Derninger

**PRODUCTION, UNLIMITED, RETRACTABLE GEAR**

1. N5791Q Mooney M20E
2. N7893P 250 Comanche
3. N6087H Piper Turbo Arrow
4. N2783W Mooney M20C

**PRODUCTION, SHOWROOM STOCK, FIXED GEAR**

1. N1550R Grumman Tiger
2. N19XMC Cessna 185
3. N7389B Cessna 172M

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**PRODUCTION, SHOWROOM STOCK, FIXED GEAR**

1. N1550R Grumman Tiger
2. N19XMC Cessna 185
3. N7389B Cessna 172M
1988 TRIATHLON RESULTS
CLASS C-1.b (1102-2204 lbs.)

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<th>TAS Vmin</th>
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CLASS C-1.c (2204-3958 lbs.)

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<th>IAS Vmin</th>
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PRODUCTION, UNLIMITED, FIXED GEAR

1. N2822D | Grumman Tiger | Maybell Fletcher
2. N7680G | Cessna 172 | Jack Hurt
3. N8679W | Cherokee 235 | Tony Tirtillii

EXHIBITION AIRCRAFT

1. N65FD | SF-260C | Jan Morgan

Best Experimental Award (sponsored by GREAT AMERICAN PROPELLER CO.)
Ray Ward in Super BD-4
Best Production Award (sponsored by TRW, HARTZELL PROPELLER CO.)
Jan Morgan in Slai Marchetti SF-260C

First Place, Class C-1.b
Ray Ward in Super BD-4
First Place, Class C-1.c
Mike Salish in Piper Turbo Arrow

Mike Melvill accepts the LoPresti trophy from CAFE 400 founder Brian Seeley ... for the best Experimental score.

rigged his winglet incidence angle, moving the trailing edge outboard about .25", and had reduced the compression ratio on his O-200 engine to 9.3 to 1. He used a cockpit adjustable MSD multiple spark ignition system and ran 45 degrees of spark advance with an .040" plug gap on his Champion REM37BY plugs. In retrospect, Klaus felt that this was too much spark advance and that he was “down on power”. He never saw more than 350 degrees F. CHT, and feels his cooling drag is excessive. He felt the winds were light and so stayed high as much as he could along the course, using 70% power outbound and 90% power inbound.

Mike Maxwell, who is in the high-tech composite fabrication business, along with Ray Cote, well-known as Formula One National Champion at Reno, flew Mike’s new Lancair to a best ever score for Lancairs. Mike’s aircraft has a Lycoming O-235 engine with high compression pistons and specially “breathed on” cylinders, with an exceptionally clean airframe. The wings have been contoured to a sailplane-like smoothness, and the engine uses an Ellison Throttle Body. With a course average of 188.8, this has got to be one fast Lancair.

Howie Keefe, also well known for racing P-51s at Reno, flew his beautiful 180 hp Glasair RG at about 71% power to average 209 mph around the course. His was the top score among the four Glasairs in the race, but was not as high as the best score ever achieved in a Glasair - that of Tom Hamilton and Lyle Powell in 1981 in the prototype Glasair TD 160.

Dick Van Grunsven, a perennial CAFE racer, flew his prototype RV-6 and surprised many by beating two Glasairs. With mileage identical to Lyle Powell’s fixed tri-gear 180 hp Glasair (with wooden prop), Dick’s 180 hp constant speed prop RV-6 was 1.2 mph faster around the course.
<table>
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<th>Reg. #</th>
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<th>Score</th>
<th>Speed</th>
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<th>Empty Weight</th>
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Production Aircraft Categories

Cris Hawkins did it again. He rented a Mooney 201 from Performance Aircraft in Hayward, CA, and won highest score among the production aircraft. With the experience of piloting in three previous CAFE races, Cris has proven himself to be the man to beat here. He averaged only 7.72 gph around the course, about 53% power.

Ben DeRosier’s Cardinal RG scored higher than any other Cardinal in our eight-year history.

In the fixed gear categories, Rich Daflurn and Maybelle Fletcher each bested the previous high score by a Grumman Tiger. Maybelle has an impressive string of victories in the 99’s Powder Puff races.

Third Annual CAFE Triavilation

Ray Ward’s 300 hp BD-4 scored

Bert Cosgrove of Northstar Avionics presents Burt Rutan with the Outstanding New Design Award for the Catbird. The prize? A $4,000 Northstar ionan!

Gary Hertzler, left, receives the $1,000 award for Advancement of Aircraft Efficiency from race chairman, Bill Bedstubner.
6% improvement over last year's performance by being 1 mph faster at Vmax and 4 mph slower at Vmin with nearly the same climb rate. Ray had added 3' more wingspan compared to last year. VanGrunsven's RV-6 achieved a reading of over 200 mph for Vmax but was only credited with 186 mph due to not holding the reading long enough according to the rules. Unaware of the need to hold Vmax for 60 seconds, Dick peeled off into slow-flight mode prematurely. The same situation also cost Frank Sigler's Glasair about 5 mph of Vmax credit. In spite of this, the RV-6 was slow-flight champion and had the highest speed ratio.

Among production aircraft, Piper Aircraft and Mike Salish should be proud of the remarkable speed ratio and climb ability of Mike's Turbo Arrow. Not many were predicting that he would outscore a V-35 Bonanza.

It should be noted that Vmax and Vmin were flown at 6000' indicated altitude, and that the average rate of climb is that computed between 1000' and 4000' MSL corrected to a Standard Day Atmosphere. Score is computed by multiplying speed ratio times the rate of climb. Vmax readings required 60 continuous seconds of no more than 100' altitude loss just prior to taking the reading. Vmin readings were the highest of the 10 slowest consecutive seconds readings in indicated airspeed while the aircraft held altitude plus or minus 30 feet.

The CAFE Triaviathon is made possible by using the solid state recording barographs designed by Steve Williams for Braal Micro Instruments, Petaluma, CA, the gimbaled pitot-static sensors built by Chris Hawkins for the CAFE Foundation, and the special Orcoptape provided by Orcon through Andy Marshall. Funding for this event was by Great American Propeller Company, TRW Hartzell Propeller Company and the CAFE Foundation. Special thanks to Del Ott, John Long and all the volunteers who made it possible.

**CAFE 400 AWARDS**

1. LePresti Award - Best Experimental: Rutan Catbird, Burt Rutan
2. LePresti Award - Best Production Showroom Stock Aircraft: Mooney M20J, Chris Hawkins
3. LePresti Award - Best Production Modified Aircraft: Mooney 20E, Paul Loewen
4. CAFE Award for Advancement of Fuel Efficiency: VarEze, Gary Hertzler
5. Outstanding New Design: Rutan Catbird, Burt Rutan
6. Tom Jewett Award - Best MPG Times Payload: Rutan Catbird, Burt Rutan

**Next Year**

There was a unanimous opinion expressed by the contestants that this was the best CAFE 400 race course ever, due to the ease with which pylons were identifiable and the assurance of being within gliding distance of flat terrain at all times. We intend to use the same course at our 1989 event, to be held June 23-24 at the Santa Rosa Air Center. Please write to CAFE Foundation, 4370 Raymonde Way, Santa Rosa, CA 95404 for information. The CAFE Foundation is a non-profit, tax exempt, educational foundation dedicated to improving personal aircraft. CAFE, CAFE 400 and Triaviathon are copyrighted by the CAFE Foundation.