



NSM Historical Journal

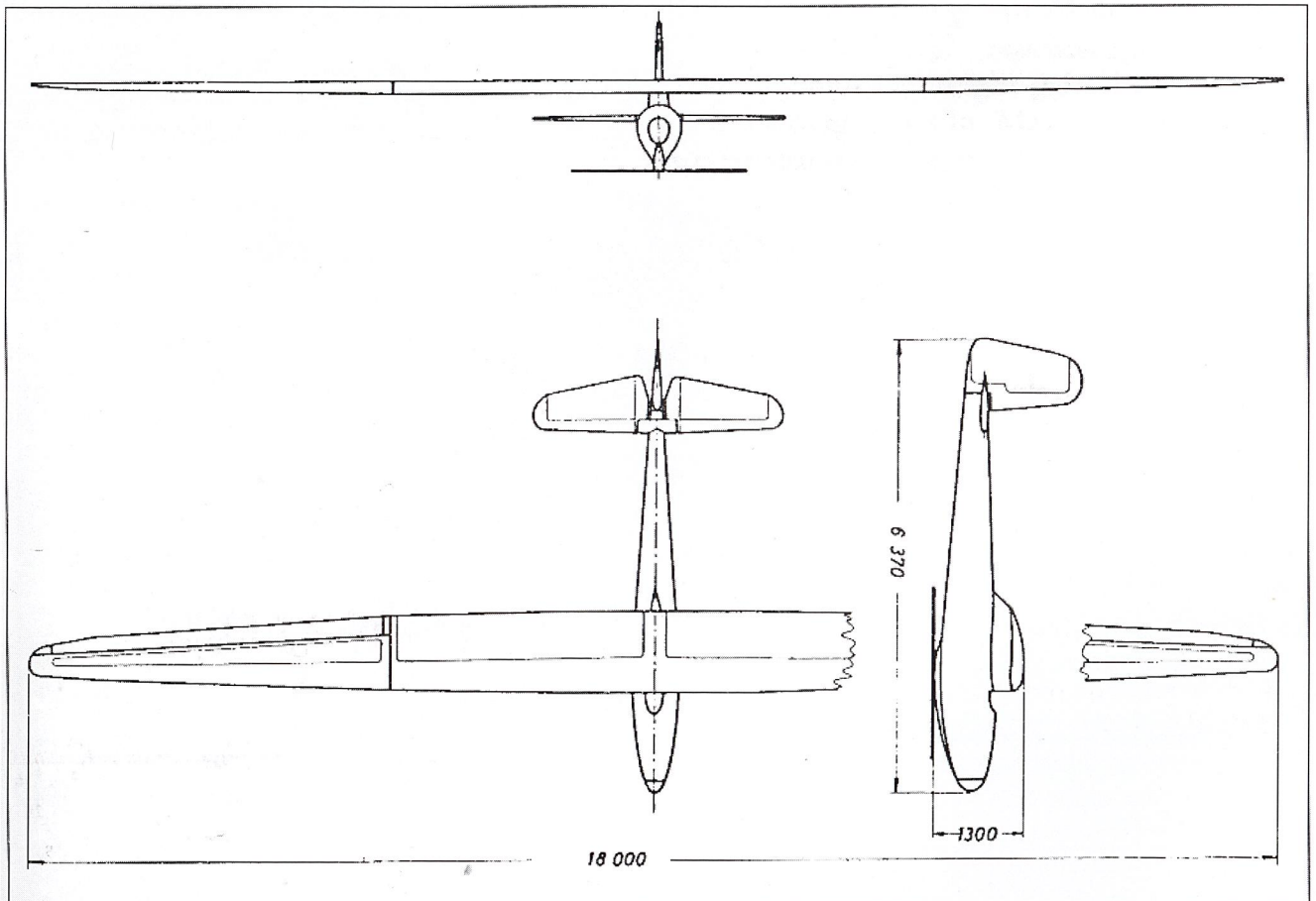
Volume 28

Issue No. 2



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Three-view of the Darmstadt II.

On the cover... the Darmstadt I

The Darmstadt I (D-17) was one of the first true sailplanes to soar in the United States. It was the second in a series of German sailplanes designed by the students of the Darmstadt Akaflieg, and the first by Frank Gross and the Akaflieg in 1927. The Darmstadt I was the result of experience gained from the general configuration of the Konsul (D-9), an outstanding performer at the 1923 German Wasserkuppe Glider Meet. The aim of the Darmstadt I design was to obtain a lower cruising speed and also efficiency at higher speeds. Its successor, the D-19 Darmstadt II built in 1928, set several German and international competition records.¹

In his book *World's Vintage Sailplanes 1908-1945*, author Martin Simons wrote, "New theories showed that a wing of elliptical planform would give less induced vortex drag than any other shape. Such a wing was hard to build, but a very close approximation resulted if the center section was made rectangular and only the outer tips curved." The 16-meter, three-section wing of the Darmstadt I was fitted with long, narrow ailerons, and the tail featured all-moving vertical and horizontal surfaces.

Wing span	16 m
Length	6.7 m
Wing area	16.60 sq m
Aspect ratio	15.4
Wing profile	Goettingen 535
Empty weight	155 kg
Useful load	95 kg
Minimum sink	0.65 m/s
Maximum L/D	20:1

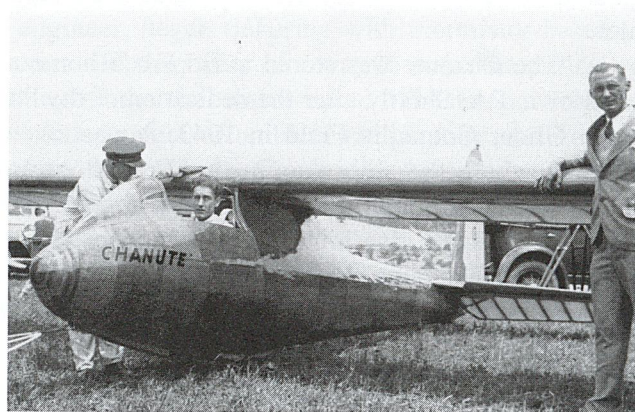
After the 1927 Wasserkuppe competition in which Johannes (Bubi) Nehring flew the Darmstadt I a distance of 51.8 kilometers in ridge lift, the Darmstadt I was sold to the American Motorless Aviation Corporation.

The newly formed AMAC was about to conduct its first trials at Corn Hill, Truro, Cape Cod, MA. At AMAC's invitation, two Darmstadt Akaflieg students, Peter Hesselbach and Paul Laubenthal, acted as instructors there. Both pilots had extensive experience soaring the upward deflected winds that swept in over the sand dunes of Rossitten (now Rybaci) along the Baltic's eastern shore. On July 29, 1928, Hesselbach made the first flight of the Darmstadt I in America. He stayed up for 57 minutes, exceeding Orville Wright's 1911 American record flight of 9 minutes and 45 seconds at Kitty Hawk, NC. Three days later Hesselbach shock-cord launched off the Corn Hill dunes and stayed aloft for over four hours. This flight received wide press coverage, even appearing on the front page of the *New York Times*. These flights and subsequent gliding and soaring activities on

Cape Cod and at West Coast venues energized American air-minded youth, and showed the possibilities of staying airborne in an engineless aircraft... soaring. It was adventurous, fun and inexpensive.

A few days after Hesselbach's American record duration flight, the Darmstadt I was wrecked almost beyond repair. The story of the demise, resurrection and rebuilding of the Darmstadt I was carried in the July 1932 *Aero Digest*.²

The remains were thrown into a box and sold to a manufacturer of pianos. The box remained in a warehouse for three or four years, and next saw the light of day when it was presented for sale at a bankruptcy auction. Capt. Horace C. Wild purchased the box of wreckage. He and Jack O'Meara worked for a full year redesigning and rebuilding the famous German sailplane.



Jack O'Meara in the Chanute; 1930. M.I.T. professor Karl Lange at right. Dana Darling photo, NSM Multimedia Archives.

Each part of the broken fuselage and what was left of the wing was carefully assembled and drawings were made. On completion of the plans, those parts of the original ship that could be used became part of the reconstructed and modified Darmstadt I. It was renamed "Chanute" in honor of the great nineteenth-century glider pioneer, Octave Chanute. Some of the modifications included the addition of a "five-meter wave length short wave" radio. A single landing wheel with brake replaced the underside skid, and the streamlined fairing behind the cockpit was built up and extended so that its upper edge conformed closely to the shape of the lower wing camber. "The pilot's cockpit was enclosed with a quickly removed cowling of celluloid with sliding windows on each side," *Aero Digest* reported. Cockpit reshaping provided room for the pilot to wear a back-type parachute.

After the Chanute was completed, a trailer was built. *Aero Digest* described it: "The trailer had a variety of forms necessary to hold each part of the glider firmly in place as it was pulled over rough back roads as is necessary in reaching localities where soaring may be at-

tempted.” O’Meara later piloted the Chanute to an American altitude record of 4,190 feet, and an American distance record of 72 miles.

A 1998 letter from NSM member and old-time sailplane pilot Lewis W. Hull described the Darmstadt/Chanute’s last days: “At the time of Lewin Barringer’s death [1943 - *ed.*] the Chanute and Franklin were in his estate.³ The Franklin was part of the Air Train involved in towing four Franklins to Cuba, as I recall the event. (See NSM Historical Journal, Volume 28, No. 1, 2006 ‘The First Overseas Glider Sky Train: To Cuba, 1935.’)

“Ed Fox and Roscoe Christman purchased the two gliders from the Barringer estate. To the best of Ed Fox’s recollection, the price for both was somewhere in the range of \$300.

“Ed and Ros picked up the two gliders from the vicinity of Wings Field, near Ambler, PA, a few miles north of Philadelphia. The Darmstadt/Chanute had a very large and unwieldy enclosed trailer. The Franklin had no trailer.

“The Chanute was stored at Ed Fox’s home near Quakertown, PA. Shortly after the dedication of the Philadelphia Glider Council’s Field in 1943, it was taken to that field, where the ship was much admired, caressed and inspected. Although there was much concern about the condition of the glue joints on the wooden wing, the urge to fly it overcame the anxiety. Roscoe Christman, Ed Krauss, and Ed Fox each made one flight. I believe

that Ed was the last to fly this historic ship. Having flown the ship, they decided to do some rather extensive reworking and it was taken then to Roscoe Christman’s home in Trumbauersville, PA (near Quakertown) with the thought that Al Krause and Roscoe Christman would do the rework. After a very thorough inspection, the rework plans were reconsidered. It was decided that it would still be too unsafe to fly.

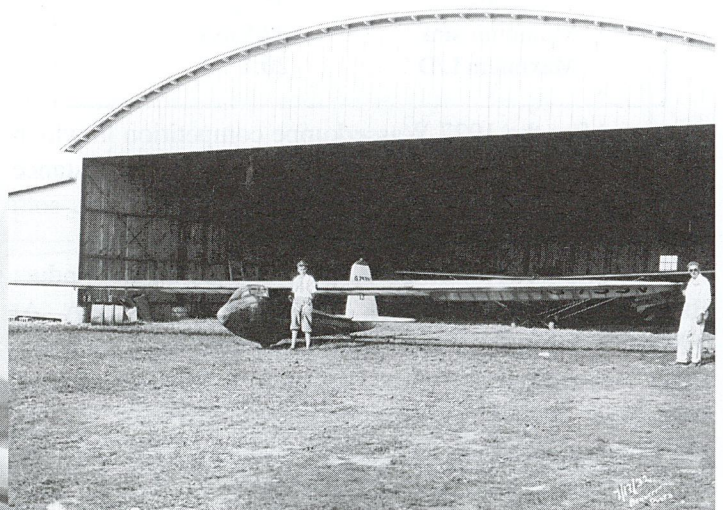
“In considering the disposition of the ship, they decided to donate it to the Franklin Institute in Philadelphia. As Ed Fox recalls the situation, the Franklin Institute requested ten dollars in cash to accompany the ship, and required that the ship be delivered to the Museum [*Institute - ed.*]. The fact that it would cost real money to donate the equipment did not sit well with the owners, and it was finally decided to cremate the ship. It was then taken to an open field near Roscoe’s home, or possibly to the Philadelphia Council Glider Field, and went up, not as in soaring, but in flames!”

References

1. Storia de Evoluzione dell’ Aliante - History and Evolution of the Glider by Giorgio Zanrosso, p. 73.
2. *Aero Digest*, July 1932, The Chanute Sailplane, pp. 56-57.
3. Lewis Hull wrote: “We don’t know how or when Lewin Barringer became the owner of the Chanute. We believe that Dick duPont, who shared many soaring experiences with Lewin, may have been involved in the acquisition.”



Jack O’Meara (center), with Soaring Society of America president Warren Eaton alongside the Chanute, early 1930s.



Tri-Cities Airport, Endicott, NY, early 1930s; Jack O’Meara with the Chanute. Fred Freiberg photo, NSM Multimedia Archives.

Cambridge Aero Instruments, 1972-2002: The People Behind the Products

The 35th Annual Ralph S. Barnaby Lecture, by David M. Ellis, PhD



David M. Ellis, Warren VT, delivered last year's Barnaby Lecture Saturday evening, Sept 30, at the Doubletree Albuquerque (NM) Hotel. He opened by saying, "At this time in the life of the Soaring Society of America, I thought that you might enjoy the ways of exploring the idea that people with a common interest tend to discover each other at opportune times." Then, Ellis adroitly piloted his audience through the land of "techie," introducing them to Cambridge Aero Instruments, and the people behind the products.

These lectures, delivered annually since 1973, are named in memory of Capt. Ralph S. Barnaby, USN. They are delivered by personalities who have made noteworthy achievements in our understanding of flight.

Ellis said that Cambridge Aero Instruments from 1972 to 2002 could be described by "following of products that we designed and sold." He traced how the people at Cambridge Aero came together, worked together, and ultimately bonded with the small worldwide community of soaring pilots.

Ellis said Raouf Ismail "was the guy who started it all...while I was the guy who ran the company from 1986 to 2002."



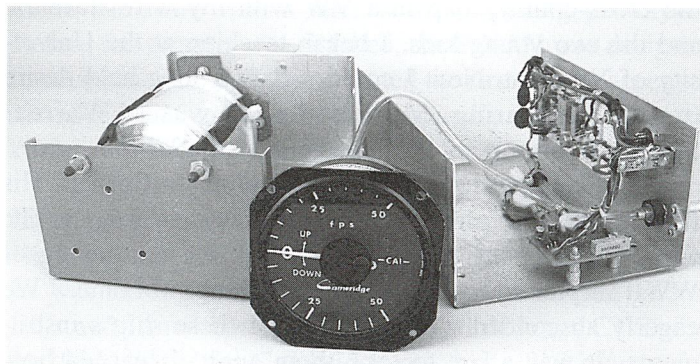
Raouf Ismail, September 2006, at the Warren-Sugarbush Gliderport. Photo courtesy of David Ellis.

Ismail, trained in the mechanical sciences, arrived in the U.S. in 1968 as part of the "brain drain" affecting England at that time. He flew gliders and Tiger Moth tow planes during his student years at Cambridge University. He was hired by the Dennison Company to de-

velop retail sales systems.

"As is so often the case," Ellis said, "British tinkers led the world in exploring new technologies. Peter Bulman at Cambridge University was the first to add a third 'heater' thermistor, in addition to the sensing thermistors as a way to increase linearity and sensitivity of the electronic flow meter used in flask-based variometers." While Ismail never met Bulman, a confluence of ideas began to form.

Ismail's Indian father had a small business in the United Kingdom building radios and record players. Raouf, who really wanted to be a businessman rather than an engineer, began tinkering with thermistor-based variometers. His discovery of a way to make the critical zero-reading of the thermistor-based Wheatstone Bridge circuit, independent of ambient temperature wasn't long in coming. By 1972, the Cambridge Aero Instruments CVS Variometer was launched.



Cambridge Aero Instruments CVS Vario Serial #2 (1972). Returned in 1999 from a Canadian glider—still working! Photo courtesy of David Ellis.

Ismail worked part-time with Cambridge Aero for two years, earning a Harvard MBA (with Cambridge Aero financial support) then went full-time in 1976. But the business stayed in his basement until 1980.

Beyond superb design, Ismail was attuned to another important factor: marketing strategy. Discussions with Graham Thomson led to a sales team that became a key component of the mix. Ismail paid generous commissions. Domestic shipments soon exceeded 400 instruments in a single year and dominated the US market. Ellis said that the formula of simplicity, reliability, performance and strong marketing worked.

In the 1970s the US accounted for around 25 percent of the world glider market. Internationally Germany was 50 percent, and the rest of the world, 25 percent.

Ellis said that it was hard if not impossible to compete with the German instrument makers on their home turf. "In the rest of the world they were just another foreign player. But they worked hand-in-glove with the German glider manufacturers. Cambridge could not do this," he said.

Raouf set out to build an international network on the US model in France, Germany and the UK, with local service, strong dealers and high dealer discounts. The same formula was used with equal success in Australia, Argentina, and many other countries.

By 1979 Ismael had a complete line of products, including the AU-20 Audio and the Mark IV Speed Director. The follow-on products were designed to be added easily to the original CVS Variometer.

Silicon-based piezoresistive pressure sensors came on the scene in the late 70s. They could potentially sense atmospheric pressure with sufficient resolution to make obsolete the variometer flask and the ubiquitous Total Energy Probe. Being totally immersed in running a business, Ismail was too occupied to investigate this development.

Ellis continued, "The same year that Raouf arrived in the US, I finished my PhD. in Electrical Engineering at the University of Washington in Seattle. After the cross-country trip in a VW with my wife Barbara, and the two young kids, I began teaching at the University of Vermont. Now I could satisfy a long-held desire to take up soaring. My first lesson was at Warren-Sugarbush airport in 1969 at the age of 32."

He grew up in Ithaca, NY, close to Cornell. His first exposure to aircraft instruments was at age 13. The Cornell Aeronautical Lab was, with its smattering of WWII surplus aircraft, within bicycle range of home. "We eagerly absconded with the some of these ship's instruments. It was a joy to take them apart. I learned how selsyens work, and used a compass indicator to construct a wind direction meter for my bedroom. If my parents only knew!"

Ellis said that he was attracted to the simplicity of soaring and by 1970 had his glider license. He was soon rebuilding both pellet variometers used in Schweizer gliders at that time, and the ingeniously constructed Winter Variometer.

By 1970 Ellis started consulting work for Vertek Inc., a startup company that made instruments for human respiration. This involved measurement of small air pressures across a laminar flow resistance in the patient's air supply. By 1972 he was working full time at Vertek Inc., when it was purchased by the Medical Electronics Division of Hewlett-Packard.

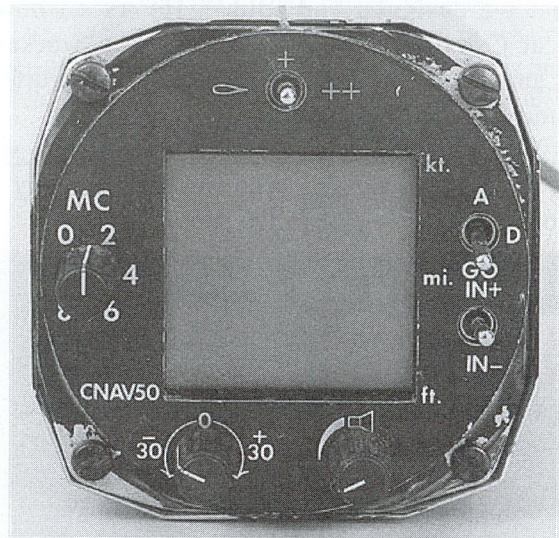
While still doing consulting work in his basement for another company, Ellis got a call from Raouf Ismail. He was looking for an engineer and glider pilot who knew

about pressure sensors and he had heard about Ellis.

At the time and with H-P's blessing Ellis was building a simulator for invasive blood pressure monitoring in his basement. He said, "I had a deal with Bio-Tek, Inc., a small Vermont company and the project was behind schedule." When Raouf called, Ellis said that he was too busy to think about another consulting project. "I suggested that he call back in six months, and he did."

Ismail asked Ellis to design a CPT Variometer, the first Cambridge device to utilize pressure transducers instead of thermistors to measure altitude change and air speed. "The CPT is the worst variometer in Cambridge history," Ellis said. "It was susceptible to radio interference and suffered from poor circuit design, courtesy of yours truly. Despite this, Raouf needed to design a microprocessor-based flight computer, and asked me to lead the project."

Ellis persuaded a personal friend, Rick Spofford, to take over the H-P circuit design and microprocessor code work while he concentrated on glider functionality, LCD Display and User Interface. The Cambridge Mar/IV NAV or C-NAV, released in 1981, was successful worldwide.



C-NAV, first Cambridge final glide computer, 1981. Photo courtesy of David Ellis.



GPS-NAV Secure Flight Recorder Model 20, 1995. Photo courtesy of David Ellis.

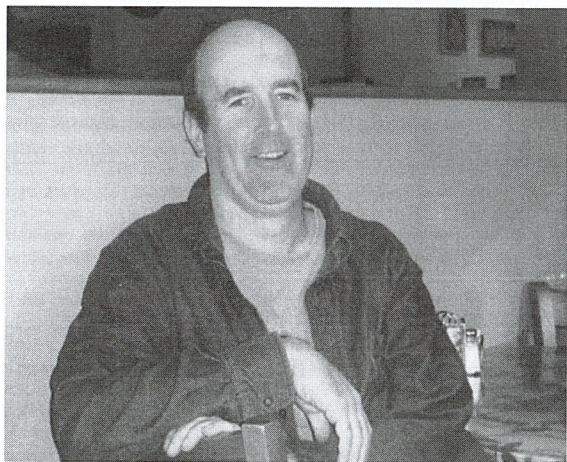
Ellis said that whereas the C-NAV used either The Cambridge CVS or CPT variometers as “front-end,” the “Mini-NAV” or M-NAV, released in 1985, brought the traditional Cambridge flow sensors inside the instrument case, thus reducing total cost.

Collaboration with Ismail on several industrial product designs led to Ellis sitting on the Cambridge Aero Instruments, Inc. Board of Directors. By 1985 the industrial business was growing, whereas the glider business was quite stagnant. “In January 1986, we had an S-NAV display running in an M-NAV case. I was so entranced with it that when Ismail proposed selling off the glider business at a Board meeting, I said that I would consider purchasing it.”

Ellis was frustrated with H-P’s unwillingness to listen to its nearby customers, the teaching hospitals in Boston. He vowed that if he bought Cambridge, he would listen to customers. “And where better than a hangar at my beloved Warren-Sugarbush Airport?

“In retrospect it was a crazy decision. We worked without salary for the next two years: building shop space in a hangar, learning how to actually build product, fixing bugs, and finding help in rural Vermont. But it certainly was not boring.”

After completing his BS in EE and MS in Computer Science at U of Vermont, Phil Schlosser joined Cambridge full time in 1986.



Phil Schlosser at ease, September 2006. Photo courtesy of David Ellis.

Ellis said that Phil is the real engineering force behind Cambridge, “though he probably wouldn’t admit it.”

“I had hoped to make the S-NAV our first successful product based on pressure induced technology.” Developed in collaboration with Rick Spofford, an advanced circuit design showed promise. But a Vermont-based developer was needed to complete this project. Enter Rick Sheppe, who had recently moved to Vermont and started Post Hills soaring. “Here was the right mix of talent to a starving woodchuck,” Ellis quipped. They discussed and argued their way through ideas and details

until finally they had an S-NAV. Through its five-year production life it was very successful and provided a great platform for new, unknown gliding instrument functions.

In those pre-email days, processor firmware was delivered as an EPROM chip. Deliveries were arranged at the Chelsea Diner, midway between Sugarbush and Post Hills. “Other patrons, mostly farmers and lumberjacks, must have thought that we were government spies—or worse. Occasionally Rick would throw a parachute-guided film canister with an EPROM inside from the cockpit of his J-3 Cub as he made a zooming low pass over our airport,” he said.

One example of new sensor technology first exploited in the S-NAV was the G-meter or accelerometer. Pilots of that era complained about the “Flap Switch” or “Hold Switch” used to change from Cruise Mode to Climb Mode. (Cruise Mode switched on Speed-to-Fly Audio; Climb Mode suspended distance accumulation in Pre-GPS final glide computers.) “I felt that there would be an advantage if we could eliminate the switch,” Ellis said.

“Spencer Webb and I were having a beer one day after a good day of flying when the ‘hold-switch’ topic came up. He said that he knew how to make a good, cheap g-meter, and grabbed a linear movement meter from an early Cambridge speed-to-fly instrument. He came back two weeks later with a working prototype. Before the g-meter was finished, the S-NAV was designed to accommodate it. Rick perfected the firmware that senses air speed and g-force to automatically switch between cruise and circling climb modes,” he said.

Ellis said that John Murray was Cambridge Aero Instruments’ most successful agent for more than 20 years. He knew that Ellis was a competent design engineer, but he was lacking in the thrill of long, marginal final glides. Ellis and Ismail bought a Schempp-Hirth Janus CT Turbo in 1984, partly for Cambridge research, “but mostly for fun,” Ellis admitted. Murray convinced Bruce Dyson (Y3) to compete in the 1987 Sports Class Nationals at Elmira,



The Three Stooges: Dave Ellis, Bruce Dyson, and Spencer Webb (1987). Photo courtesy of David Ellis.

with Ellis or Webb in the back seat gathering g-meter data. "My chance to experience the reality of competition."

"But there is more to the story," the speaker said. "Gerhard Waibel (*an eminent German aerodynamicist and designer - ed.*) approached me, shortly after the ASW-24 was used in competition. He said that some pilots were thermaling too slowly in the '24', which has a stable, high sink rate near stall. He asked if we could make an audio alarm for this condition. We listened. The S-NAV soon featured a user-configurable, 'di-di-dah' Slow Alarm audio sound, appreciated by some pilots and hated by others. Gerhard was fond of calling this the 'Radetzky March' after the popular Johann Strauss, Sr. cadence piece."

The best example of planning or luck was the addition of serial data interface to the S-NAV. Originally planned for connecting to a printer that would show flight statistics, the data interface allowed the S-NAV to interface easily with future GPS Navigation equipment. Software is quite easy for customers to upgrade, and the simple addition of a data interface gave Cambridge a significant competitive advantage in the early days of GPS navigation.

Semiconductor technology keeps offering the same functionality at lower cost, so the team decided in 1990 to design the L-NAV. A single PC board replaced three in the S-NAV. Based on experience with the S-NAV a new, simplified user interface was designed. Introduced in 1991, the L-NAV was the fourth successive product in the Cambridge family of glide navigators.

Ellis said that by 1990 the team was working smoothly in Jim Parker's hangar at Warren Sugarbush Airport. The photo below shows the cramped space in which they worked during that period.



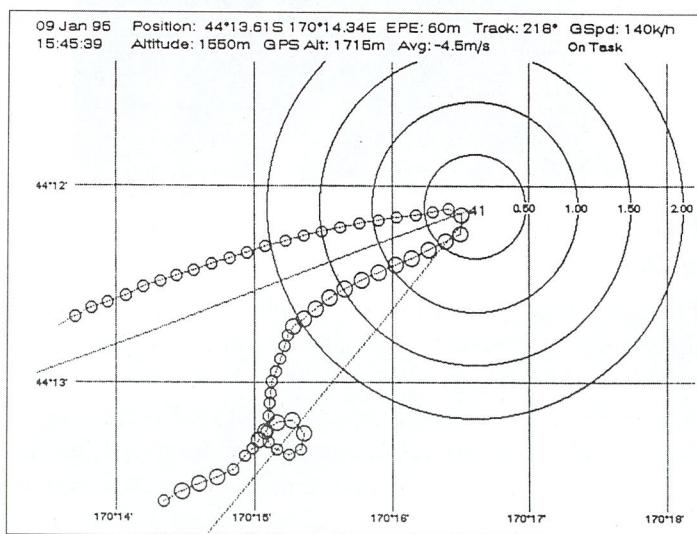
Dave Gilcreast, Phil Schlosser, Rick Sheppe, Barbara Ellis, Ben Santora and Dave Ellis. Photo courtesy of David Ellis.

Re-connecting with Bio-Tek, the biomedical product manufacturer in 1987, the Ellis team worked on a simulator for non-invasive blood pressure monitors. In 1989, Ellis got approval to develop a new instrument for Bio-Tek Inc. Using the same development team—Schlosser, Sheppe and Ellis—and the same processor and LCD technology base as that for the L-NAV, "the biomedical device was produced by our contract manufacturer. It yielded profits that sustained our next, high-risk adventure," he said.

Early in the S-NAV development, Ellis met Bud Schurmeier and Jack McKenney, recipients of an OSTIV award. In 1990 Ellis got a call from Bud Schurmeier that a guy working for Trimble Navigation had parachuted with a GPS antenna on his helmet and a receiver on his back. The guy recorded the jump and both position and altitude were displayed on a graph. Bud suggested that this might be a good substitute for turnpoint cameras.

Ellis called Mike Sennet, a graduate school buddy who worked near Trimble in Santa Clara. Mike called another friend who also worked at Trimble. Finally, Ellis traveled to California and flew around the Bay area with Mike in a Cessna 172 with the Trimble experimental equipment in Ellis' lap. He said the GPS satellite constellation was far from complete so reception was spotty, but the opportunity was obvious.

Since the 1991 World Championships were to be held in Uvalde, and OSTIV meetings are held at the same venue, Ellis thought it would be fun to outline the possibility of GPS-based scoring in an OSTIV paper. He said, "Bernald Smith and John Roake attended the session and the rest of that story is recorded in a *Soaring* magazine article."



Copy of PC screen showing glider navigation around a turnpoint. From *Soaring Magazine*, April 1996.

By February 1992, John Good was at Omarama, NZ, and a box consisting of an H-P calculator and a Garmin 100 GPS receiver was tracking pilots around the course. "Four months later we found ourselves at the pre-Worlds in Borlange, Sweden with two prototype recorders in two 15-meter ships, one piloted by Akke Petersen and the other by Eric Napoleon. Starting at the same time they finished within 15 seconds of one another. John Good printed out the flight, and within 10 seconds they each pointed out their flight and where they made their "big mistakes," Ellis added, "Aaah, if only I could make such mistakes."

"Under the watchful eye of the IGC, we agreed to have 15 flight recorders in the 1993 Worlds. We decided that pilots wouldn't buy this gear unless it did navigation as well as logging, and so began the most intensive period of my life. A few pilots actually purchased the product, sight unseen. We arrived at Borlange with barely-functioning hardware and last-minute software. During the practice days we discovered the software would either navigate or log, but not both. We decided in favor of those who bought the product and against the IGC who wanted a test of logging.

"The whole GPS Flight Recorder thing was a sequence of near disasters, but one deserves special mention. During practice days at the 1995 Worlds at Omarama, NZ we noticed logging failures after high altitude flights. Justin and Gillian Wills were our hosts during this very intense three weeks of installing GPS-NAVs in more than 90 gliders. In desperation we put a few recorders in Gillian's kitchen freezer to duplicate high altitude temperatures. Phil Schlosser saved our bacon as he noticed tiny pin prick marks made by connector pins touching the painted metal recorder cases. We recalled all the recorders just before the competition started. Phil, Barbara, and I, set up an assembly line. Overnight we took 98 flight recorders apart, cut the offending pins, reassembled the recorders, reloaded each pilot's information, and turnpoint data bases, then reloaded the boxes."

Bob Fletcher (90), who was with the company for several years, was vital to the IGC-led process of standardizing flight log formats. This basic work was key to the spread of GPS flight logging worldwide.

Absent detailed accounts Ellis said, "I am quite sure that Cambridge made no money on its GPS-NAV flight recording products. Profits from the Biomedical product kept the company alive. But what an adventure! It's been very gratifying to watch the sport evolve in response to GPS technology."

The year 1996 was the turning point for the company. "I was fresh out of ideas for the gliding market. Other GPS markets had an irresistible appeal," Ellis said. He patented a secure GPS Recorder for lowering insurance cost. For Xerox Corporation, Cambridge proposed

monitoring their service cars to detect personal use. They participated in an SBIR-funded (Small Business Innovative Research) development of a low-cost Flight Data and Voice Data Recorder for light aviation. "We even developed a GPS-based system to monitor the delivery of pig manure in Dutch 18-wheelers to farms in eastern Holland." They also looked into building real-time GPS monitors for commercial hydrofoils operating off the coast of Denmark.

Hango Streifeneder needed help in developing a Ballistic Recovery System (BRS) for Schempp-Hirth. "I share Hango's crazy devotion to this sport so we agreed to develop a new PCB for the GPS-NAV and new firmware for his project at no cost. Meanwhile Cambridge lost the market for flight recorders to Volkslogger and Colibri. It was price versus functionality," the speaker said.

For the biomedical organization, Cambridge designed a new lower-cost version of its successful tester for non-invasive blood pressure monitors. Two new staff members were added for the project.

Problems arose as a direct consequence of GPS flight logging in complex European airspace. For the first time competition and badge pilots were caught in restricted air space. Competitive companies offered primitive electronic maps of pilots' relative airspace boundaries. "We did not," Ellis said. Another problem was the rise of American currency 30 percent over a two-year period against European money. He continued, "The result was declining sales and increasing overhead, an unsustainable situation for a tiny company with little accumulated capital."

Finally in 1998, Cambridge launched a new product development cycle for the glider market. The semiconductor technology finally permitted direct conversion of air pressure signals to a high-resolution format at low cost. "Processing capability went up by a factor of greater than 10, without increasing cost. The Cambridge 302 is a technological tour de force. But it was 18 months late, and its development broke the company. We stopped the Biomedical effort and shrank the staff to nine," Ellis noted.

Jerzy Plaszcwiecki, a then-recent Microsoft retiree and developer of Pocket PC software, approached Ellis in 1997. He had a proposal to use Pocket PC for graphic display in cockpits. Ellis gave Plaszcwiecki specifications for the Screen Design and Touch Screen User Interface. Jerzy said that he would have a prototype ready for the Pre-Worlds in Bayreuth, Germany that year. The trial was a success, but Ellis was unable to lure Jerzy to the Cambridge base in Vermont. This led to Chip Garner joining the Cambridge Aero Team and developing Glide Navigator II. "Suddenly we were in the graphic display business," Ellis said.

But with Bio-Tek's abrupt cancellation of its con-

tract with Cambridge in May 2001, Cambridge Aero Instruments went up for sale.

"The sale was a disaster," Ellis lamented. "The new owner was drastically under-funded and had no understanding of the business. Within a year, my three-year employment was cancelled and the company's operation was taken over by a sleazy group based in Virginia. That lasted about a year, after which the company was taken over by yet another group headed by the original purchaser's lawyer. Expensive litigation continues to this day."

Sales and service are under the care of long-time Cambridge employee Gary Kammerer. Bug fixes and product upgrades have not happened because the current operator has no product development capability.

"My story of Cambridge Aero Instruments ends in 2002. But my love of soaring, shared dreams, and friendships outlasts lawyers and scandals," Ellis said fondly.

Ellis said that the quest for a fast, accurate variometer has repeatedly been foiled by pneumatic noise from either the TE (total energy) probe or separate air-speed sensors. Fast indicators were developed by Wil Schuemann and others, only to find that bandwidth-reducing gust filters were required for them to be useful.

The Cambridge 302 combined very high resolution analog converters with very rapid sampling of dynamic pressure (airspeed) and static pressure (altitude). "It was massive over-design in a variometer. But it enabled me for the first time to see the exact source of pneumatic 'gusts' in variometry. With a triple probe protruding from the nose of my LS-4A sailplane, special firmware in the 302 and the datalogging software in a Pocket PC, the answer was clear. Most airspeed "gusts" appear in the airspeed channel. I began to think of a very different way to achieve total energy compensation in a gliding variometer."

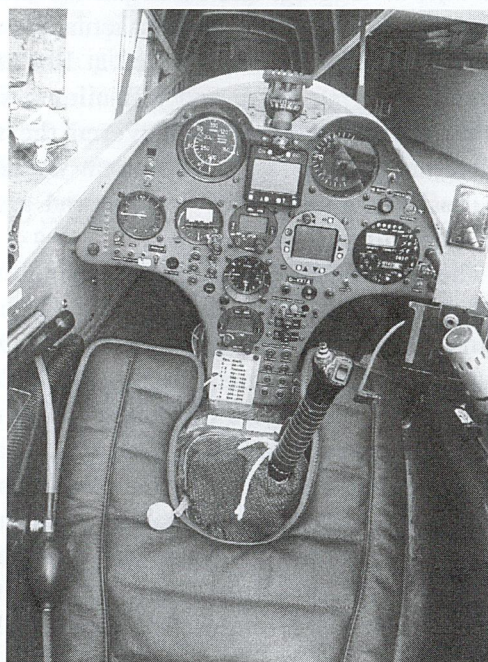
In his last year of Cambridge ownership, Ellis and Phil Schlosser developed a new way to achieve total energy compensation. Two years of his personal test flying confirmed that further refinement of gust-free TE compensation is both practical and helpful.

"The possibility of another new product for the advance in soaring instrumentation, plus the fact that I love design work, led me to Richard Kellerman, of Nielsen-Kellerman. We've gotten to know each other over the past three years and are now working on a new product for the gliding market."

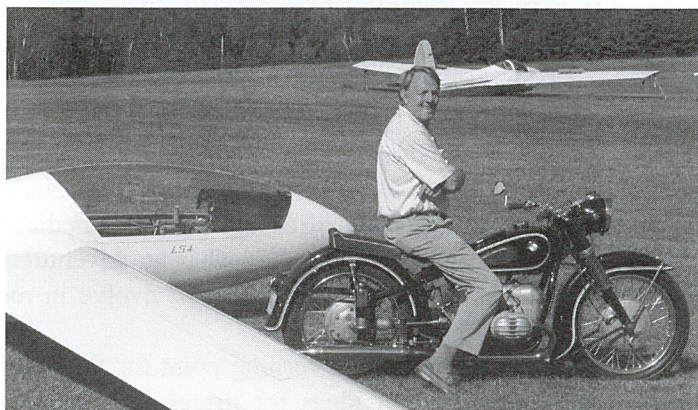
Ellis closed the 35th Ralph S. Barnaby Lecture optimistically. "In October 2005, this group held a meeting at our house. The Cambridge design team is back together again with new leadership, energy, and exciting plans."



The new Cambridge team, October 2005. Photo courtesy of David Ellis.



ETA (32 Meter 2-seat Open Class) - Hans-Werner Grosse (2003) "I can assure you that our new product will NOT make your cockpit look like this." Photo courtesy of David Ellis.



Dave Ellis in retirement, on his vintage 1953 BMW motorcycle, and in front of his LS-4 sailplane. Photo courtesy of David Ellis.

Dr. Frank Gross and the Gross F-5 Four-Place Glider



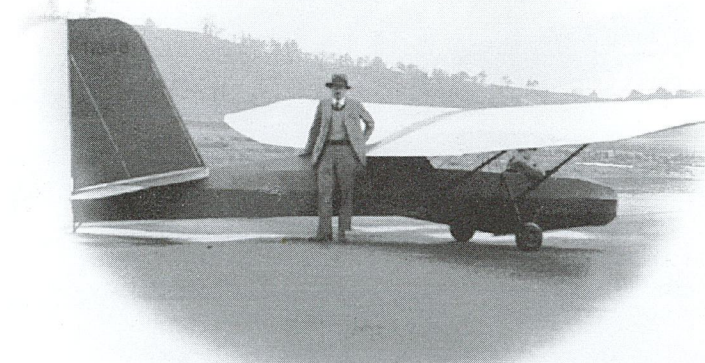
Few soaring enthusiasts remember the first four-place sailplane, the 1935 Gross F-5 Four-Place Glider. The circumstances under which it was built were right out of stories from the golden age of flight. The four-place glider idea came as a result of Dr. Frank Gross's experience designing and building America's first two-place glider, the "Sky Ghost," in Akron, Ohio.¹ Unfortunately while the "Sky Ghost" did advance interest in motorless flight with passengers (\$1 a ride), student instruction, and in competition at national glider meets, the ship's income did not cover operating expenses. Dr. Gross wrote, "It occurred to me that increasing the number of passengers per flight could possibly turn out payloads sufficient to support our program. What better vehicle than a glider that could carry three passengers plus the pilot? A lengthy and careful study brought such a project into the realm of possibility."

Gross became involved with gliders during his years as an engineering student at the Universities of Stuttgart and Darmstadt in Germany. Because of the power plane limitations imposed on Germany by the Treaty of Versailles at the end of World War I, German youth experimented extensively with motorless aircraft. In a 1943 *Cleveland Plain Dealer* interview Gross said, "We had no money to travel in Europe for various gliding contests, so when a meet was scheduled we all pitched in, disassembled the glider and towed it in an old Opel automobile to the town where the meet was to be held. We depended on the prize money, which we usually won, to pay for our expenses and to finance our experimental work."

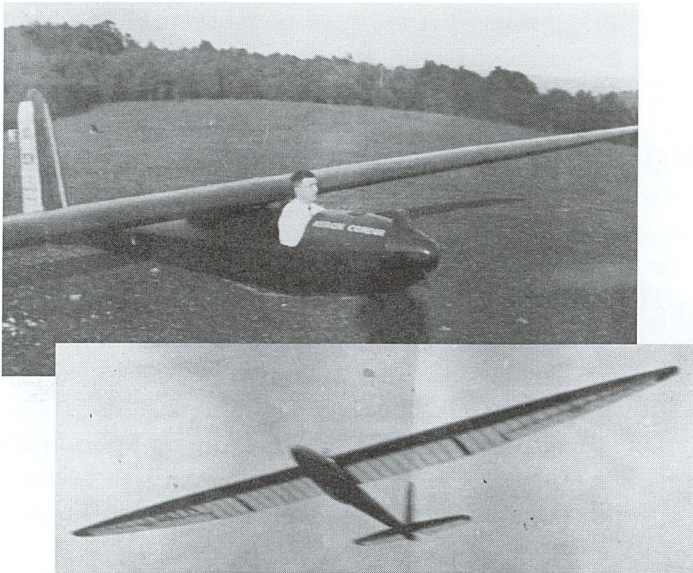
While in Germany, Gross designed the Darmstadt I and II. The Darmstadt I was purchased by the American Motorless Aviation Association and used for flight instruction on Cape Cod.² The Darmstadt II garnered two world soaring records in Germany in 1929.

It was the late 1920s when Gross first emigrated to the United States. He returned to Germany to marry his first wife, Herta and to take his engineering doctorate at Stuttgart University before returning to Akron. In Akron he designed the highly successful "Akron Condor," based on the Darmstadt series, and the popular "Cadet" for the Baker-McMillen Company.

Already recognized as an expert on multi-place gliders, Gross started on the design and engineering development phase for his new four-place glider. It would be the first four-place, and biggest glider in the United States, maybe the world, at that time (1934). Research showed that the two additional passengers should be under the center of lift of the wing, seated side-by-side. The



Dr. Frank Gross and the Gross "Sky Ghost." Frank Gross Collection, NSM Archives. Top photo: The Gross F-5 in flight (1934). Frank Gross Collection, NSM Archives.



Dr. Wolfgang Klemperer in the Akron Condor, Uniontown, PA; the Condor in flight (1929). Frank Gross Collection, NSM Archives.

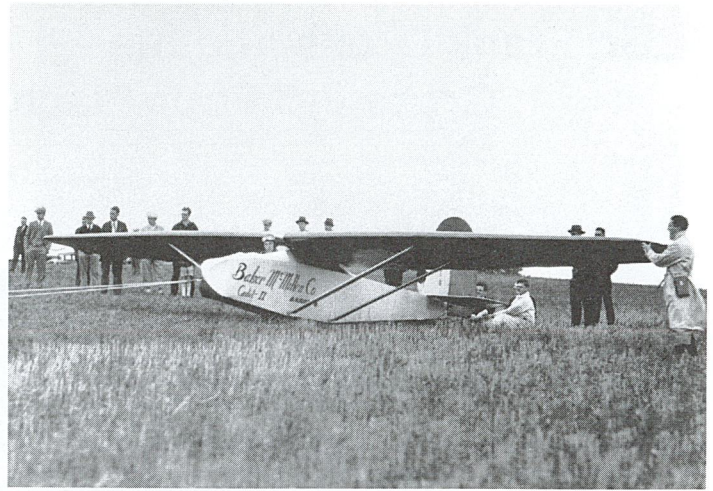
third passenger would sit forward, next to the pilot. Gross wrote that this arrangement also provided an advantage for use as a glider pilot trainer, since the instructor sitting alongside the student would allow for easy communication.

In 1934, the U.S. was still suffering a financial hangover from the market crash of '29. Money was scarce, and seed money for an unproven glider was even more so. If the four-place was going to be built at all, Frank Gross realized that it was going to be with his own resources. Meantime, he began working as a draftsman for the B.F. Goodrich Company in Akron. He soon became involved in the design and development of plants and equipment to produce synthetic rubber and polyvinyl chloride (PVC) plastics.

He studied chemistry at the University of Akron, and transformed himself from a mechanical engineer into a chemical engineer, to support his growing family and also to subsidize his glider activities.

Bill Bodenlos, a structural foreman at Akron's Goodyear Zeppelin Corporation, was interested in gliding and joined the designer in the construction of the four-place project. "Bodenlos was a skilled mechanic and pilot. He had learned to fly a glider without ever having been in a power plane," Gross wrote.

"Behind his house in Northeast Akron, Bodenlos had an empty chicken coop with a wooden floor, an ideal place to build a glider...something to really crow about," Gross quipped. "I furnished all the drawings and materials. Bill did most of the construction and was also our chief pilot. We normally worked together in the chicken coop Saturdays and Sundays, with his faithful dog, Maestro, supervising us." The finished project took 8 months.

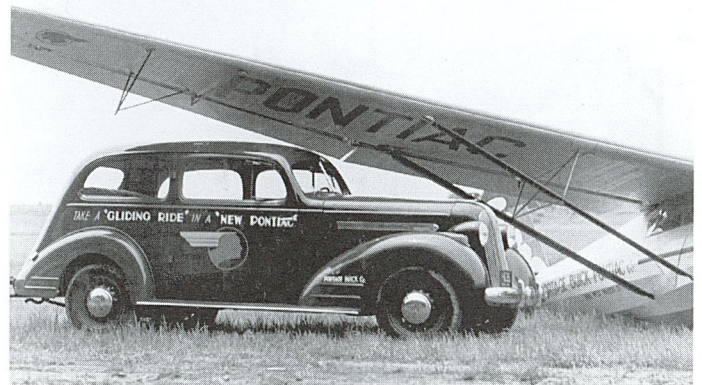


The Baker-McMillen Cadet II. Frank Gross Collection, NSM Archives.

"This glider carried passengers at Akron Fulton Airport and generated much interest in aviation, not to mention gliding. We flew passengers on a routine basis, and once squeezed in four passengers. All this preceded by many years the troop-carrying gliders of World War II.³

"As we became better known, we obtained the free use of a tow car by advertising a local automobile agency in large letters on the fuselage and wings of the glider. Our business arrangement did not last long because towing a four-place glider is hard on the tow car. We soon had to replace it with another car, but the F-5 was too expensive to repaint, so the automobile agencies got a bargain."

The 1935 Gross four-place flight from Akron to Columbus, the state capitol, sponsored by the Akron Junior Chamber of Commerce, was especially memorable. Bill Bodenlos and Willis Sperry in the F-5 were towed

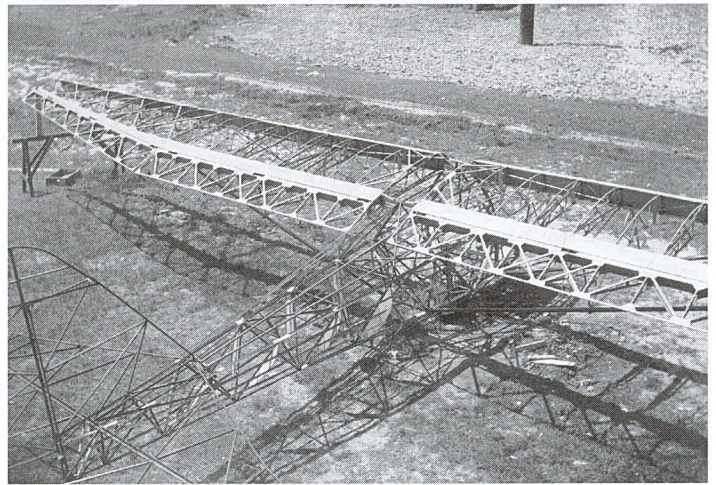
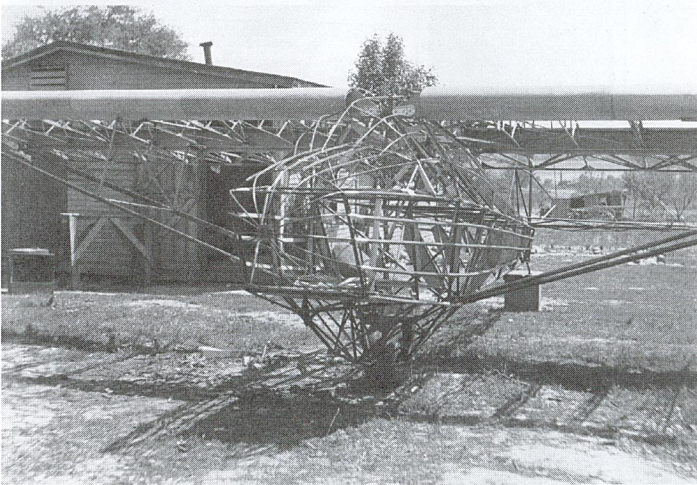
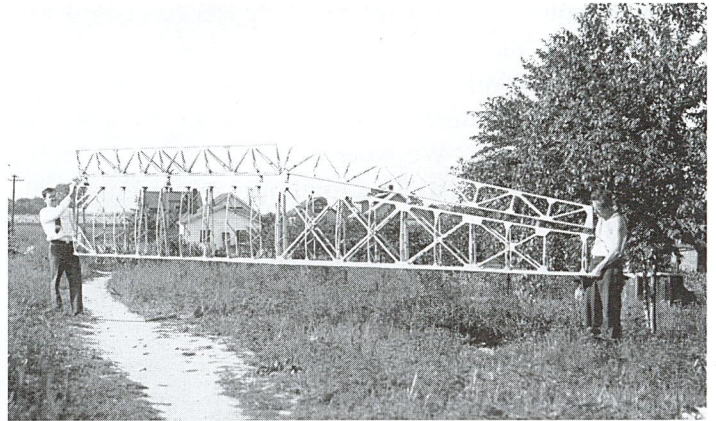
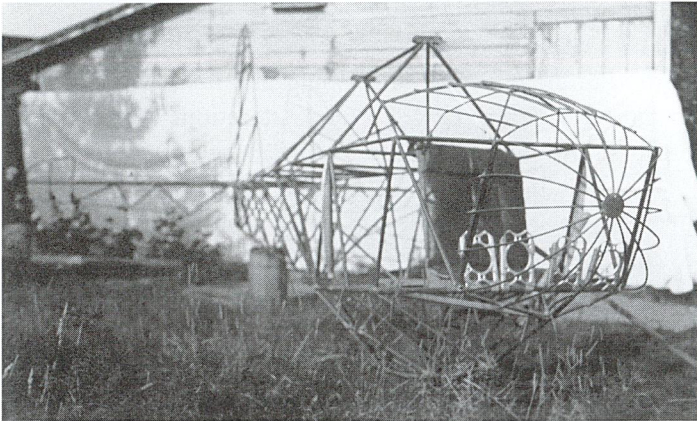


The "New Pontiac" provided as tow car for the F-5, along with the advertising painted on the wing. Frank Gross Collection, NSM Archives.

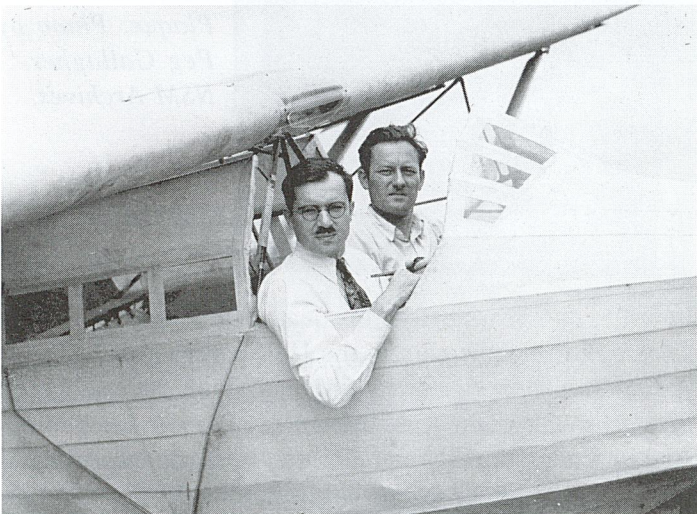
Specifications:

Span	48 feet	Undercarriage	Single wheel landing gear; fittings for additional two-wheel gear attached to fuselage
Wing structure/covering	Wood/Cloth	Aspect ratio	11.2
Fuselage structure/covering	Steel tubing 1025/Cloth	Gross weight	830 pounds
Tail surface structure	Steel tubing and channels		
Wing area	206 square feet		

Gross Four-Place Construction Photos



Photos of the F-5 framework during construction (1933). Frank Gross Collection, NSM Archives.



Gross (left) and Bodenos in the cockpit of the completed F-5. Frank Gross Collection, NSM Archives.



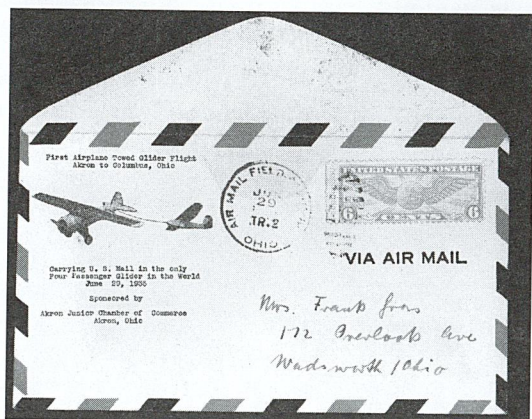
View of the F-5's windowpane-style canopy. Frank Gross Collection, NSM Archives.

behind a high-powered plane. They were carrying 2,500 special envelopes (cachets) imprinted with "First Airplane-Towed Glider Flight From Akron to Columbus Ohio, carrying US Mail in the only Four Passenger Glider in the World - June 29, 1935." Unfortunately, pre-flight planning overlooked the airplane and glider mismatch due to the high speed of the tow plane and the low-speed design of the four-place glider. There was no radio communication between the two crews, and the tow plane pilot did not see the pre-arranged signals from Bodenlos and Sperry in the F-5.

On take-off, the tow plane staggered into the air, just managing to clear the Goodyear Zeppelin dock. Pilot Bodenlos said, "We were unable to gain much altitude for some reason. The towline trailed through the woods just beyond." As the combination proceeded, the tow plane's airspeed started to build to an alarming 60, then 70 miles an hour—even nudging 80—trailing the glider that had a designed towing speed of around 35. Each time Bodenlos waggled the wings signaling the tow plane to slow down, the glider nearly rolled on its side. Halfway through the flight came an ominous "woosh." The transparent windshield serving as the cockpit roof began to slip off. "We steered with one hand and held on to the canopy with the other," co-pilot Sperry said. Next, threatening noises erupted from the tail section. That prompted the co-pilot's plea to release and find a safe landing spot, fearing the glider was about to break up. No luck—the glider release jammed. "We didn't get loose from the plane until it was time to land at Port Columbus," Bodenlos said.

The tense hour and forty minute flight, with glider on tow all the way, finally released and landed without further mishap at Columbus. The glidermen and tow plane pilot were greeted by Ohio's Attorney General John W. Bricker, and postal authorities who sent the specially cancelled glider mail on its way.

Shaken by the strain of the flight, Bodenlos and Sperry sought a trailer to take the ship back to Akron, then went to bed in a Columbus hotel. "In the middle of



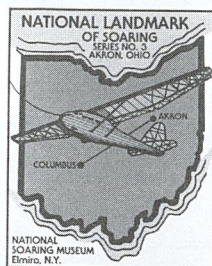
Copy of the envelope flown by Bodenlos and Sperry in the F-5, June 29, 1935. Frank Gross/NSM Archives.

the night, I was awakened by a terrific bang," said Bodenlos. "Willis had fallen out of bed. He was screaming 'the tail has come off!' and was having a terrible nightmare."

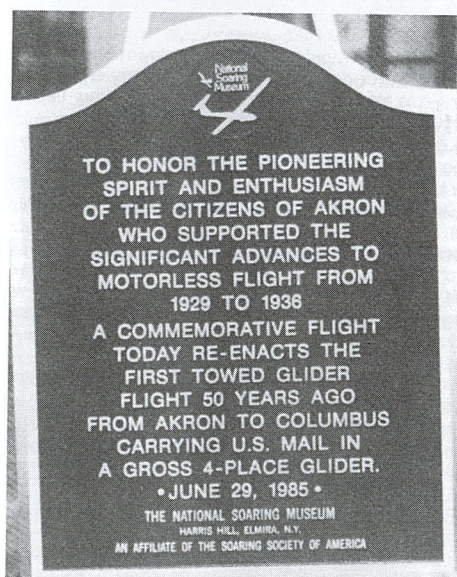
Early next morning four homing pigeons were released from Columbus Airport and flapped their way to Akron, with a message to Akron Mayor Myers and the two Akron newspapers. "Arrived OK 3:10. Greeted by Postmaster McCoy and Atty. Gen. Bricker and a large delegation. Almost lost the glider in flight."

Years later Dr. Gross wrote, "I sold the Four-Place to the Purdue Glider Club, hoping that it would help them in their Academic Glider Club. Alterations there made it unfit for flying and it disappeared."

On June 28 and 29, 1995, the third NSM Landmark of Soaring was dedicated in front of the Administration Building of the Akron Municipal Airport.⁴ Following the dedication, the 1935 historic flight was reenacted in a modern two-place Grob Acro sailplane piloted by Gross's son Bernard, with the elder Gross acting as co-pilot.



THIS 1935 FLIGHT IN THE GROSS FOUR-PLACE GLIDER F-5 PIONEERED MULTIPLE-PASSENGER GLIDERS.



Envelope and plaque used for Landmark of Soaring No. 3, Akron, Ohio. Envelope: Frank Gross Collection, NSM Archives. Plaque: Photo by Peg Gallagher, NSM Archives.

In 1995, two years before his death, Dr. Frank Gross was selected for membership in the US Soaring Hall of Fame. A life-long supporter of soaring and youth, he established the Gross Sky Ghost Achievement Award for demonstrated leadership, scholarship and commitment to aviation. Another Gross award is given annually for the most outstanding glider restoration of the year as determined by the Vintage Sailplane Association.



The F-5 at the Municipal Airport in Akron, OH, 1935. Herta Gameraer and Bill Bodenlos occupy the front seat; Mrs. Bodenlos at left; lady exiting cockpit unidentified. Frank Gross stands at right. Frank Gross Collection, NSM Archives.

A rare sight: the F-5 shares the field with a Goodyear blimp. Frank Gross Collection, NSM Archives.



Footnotes

1. In 1934 Gross designed and built the "Sky Ghost," the first two-place glider in the United States. It flew in the Elmira, NY, 1931 and 1932 Nationals, establishing unofficial records for endurance. It was sold to the Western Hills "Y" Albatross Club of Cincinnati, OH, in November 1932. After it had been severely damaged, the "Sky Ghost" languished for about 40 years in an open field behind a barn near Columbus, OH. Gross purchased it from the owner and had it restored to museum status by Bill Robie of Greenville, OH. In 1987, Dr. Gross donated it to the National Soaring Museum, where it is now on exhibit.
2. Paul A. Schweizer wrote in *Wings Like Eagles: The Story of Soaring in the United States*, p. 14, "Peter Hesselbach, a German pilot, and AMAA's chief instructor, launched from Corn Hill, Cape Cod [in the Darmstadt I] and stayed aloft over four hours in August, 1928."
3. "Parts of Dr. Gross' doctoral thesis were applied in WWII when both Germans and Americans used gliders to carry troops silently over enemy lines," from the *Akron Beacon-Journal*, June 27, 1985.
4. *NSM Journal*, Summer 1985, Vol. 8, No. 1.

From the archives...



1934 Topical Press Photo (London): "Gliding at Sutton Bank, Thirsk, Yorkshire, England. Photo shows one of the gliders in flight." Glider at lower left is an Abbott-Baynes Scud 2. Glider over the field is unidentified. From NSM Multimedia Archives.

ISSN # 0892-0516

NSM Historical Journal is a publication of the National Soaring Museum
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Anyone is invited to contribute material and pictures with identification about historical soaring activities, renovation of old sailplanes, soaring pioneers, unusual uses of sailplanes, etc. Manuscripts are subject to whatever revisions, additions, or deletions are necessary to make the material conform to the space limitations and standards of the NSM.

Material that is to be returned must be accompanied by a self-addressed stamped envelope.

No compensation other than credit will be given.

Publisher: National Soaring Museum / **Director:** Peter W. Smith
Editor & Layout: William E. Gallagher / **Production & Layout:** Julie Munson

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