



AAHS FLIGHTLINE

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American Aviation Historical Society

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NASA's SOFIA 747 is scheduled for decommissioning in September. (NASA photo)

End of an Era?

Airborne Astronomical Observatories

In another six weeks or so, Boeing 747SP N747NA, formally known as the Stratospheric Observatory for Infrared Astronomy (SOFIA), will be decommissioned, likely ending nearly six decades of airborne astronomy missions flown by NASA. Initially scheduled to

run through 2034, SOFIA's time was cut short by high operating costs—around \$86 million per year—and budgetary competition from other NASA programs, notably the James Webb Space Telescope.

A 2021 report by the National Academies of Science, Engineering, and Medicine pulled no punches: “Relative to its cost, SOFIA has not been scientifically productive or impactful over its duration.” For several years, top NASA leadership took the same stance, but Congress continued to fund the project.

The decision to cancel SOFIA was not without dissent, including that expressed by constituents of the German Space Agency, which contributed 20% of the program costs. This time, however, the end appears to be in sight.

Early Efforts

From the earliest days of manned flight, balloons were used for scientific experiments of the day, but the first serious attempt at airborne astronomy occurred in 1870. The total solar eclipse

of December 22 would be visible from Algeria and Jules Janssen, already a well known astronomer, intended to view it from a balloon. There was one major problem. The Franco-Prussian War was in its closing stages and as the date approached Janssen was in Paris, trapped among two million other starving French citizens, surrounded by Prussian armies.

The international scientific community appealed to the Prussian authorities to allow their colleague safe passage in order to perform this novel experiment. The request was granted but Janssen refused the offer, opting instead to escape the besieged city the same way other high-ranking Parisians had departed—by a one-way balloon trip.

The plan was approved and on December 2 Janssen and his pilot lifted off, carrying only the minimum equipment necessary to analyze the sun's corona and trusting the winds to carry them over the Prussian lines. The balloon and its cargo came to earth near the French coast, none the worse for wear. Janssen went on his

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way, only to encounter some unusually bad weather over the usually dry African desert that completely thwarted the elaborately planned scheme.

Austrian physicist Victor Hess achieved perhaps the first significant scientific breakthrough ever made from an airborne platform. Between 1911 and 1913, Hess made ten balloon ascents, reaching as high as 17,000 feet, to measure ionizing radiation, at first thought to emanate from rocks beneath the earth's crust. In these flights, Hess discovered that radiation levels at first decreased, as was expected, but increased at higher altitudes, indicating that the source was not earthly, as previously supposed.

The most well-known of these experimental flights, during the partial solar eclipse of April 17, 1912, further ruled out the sun. The source had to be farther out in space. Hess had discovered what came to be known as "cosmic rays." In 1936, he was awarded the Nobel Prize in Physics, in part for his pioneering airborne observations.



Physicist Victor Hess, in the center of the basket, gets set launch on one of his pioneering flights. (VF Hess Society)

Taking Wing

Continuing development of the airplane brought renewed interest in aerial astronomy. Now it would be possible to get above at least the lower cloud layers, and an aircraft could be much more easily positioned at a given time and place for optimum viewing.

In 1923, renowned Air Corps test pilot John A. Macready and pioneering aerial photographer Capt. Albert W. Stevens departed McCook Field, Ohio on August 23, headed for San Diego, California, to photograph the eclipse of September 10. On the appointed day, the pair motored south toward Ensenada, Mexico. Their luck was no better than Janssen's four decades earlier.

The trusty DH-4 labored to a bit over 16,000 ft. but could climb no higher. Sandwiched between cloud layers, they could only cruise about, hoping for a hole to appear. None did, and they found themselves "Winging their way along in utter darkness with tongues of blue flames shooting through the

exhaust . . . while the drama of the skies was being enacted."

Seven years later, Stevens got another chance. This time the recon men were less interested in gazing at the sun itself than in comparing the actual track of the shadow along the ground to the path predicted by the astronomers. For various reasons, this attempt too was a bust, but valuable lessons were learned.

A third time would be the charm for Albert Stevens. In 1932, the National Geographic Society (NGS) partnered with the Air Corps to photograph the eclipse that would be visible in the north easternmost portions of the U.S. The eclipse shadow would be some 100 miles in length; to capture it on film would mean flying at the performance limits of early 1930s aircraft and their crews. Even with the primitive oxygen systems of the day, thought and reaction became sluggish at altitude.



A Fairchild F-1A of the type flown by McAllister and Stevens to photograph the August, 1932, total eclipse. Barely visible in this thumbnail is the "Man in the moon" emblem of the 5th Observation Squadron. (AAHS p008357)

On August 31, Lt. Charles D. McAllister nudged a Fairchild F-1A up to 27,000 feet over North Conway, N.H., where he and Stevens awaited the big event. As the moment arrived and he started to maneuver into position, a loop on McAllister's glove caught the throttle lever. The engine stopped abruptly, causing Stevens to contemplate an uncertain future with what appeared to be an unconscious pilot at the controls.

After a few choice words, McAllister recovered the aircraft, and Stevens went on to capture images of the sun's corona and the shadow that blanketed the earth below. Several of these photos were featured in an article he later wrote for *National Geographic Magazine*. For the corona shots Stevens used infrared film, which is of special relevance to the rest of this story.

Thirteen years would go by before another serious attempt at airborne observation of a solar eclipse was made. This time the Royal Canadian Air Force would be the prime participant, flying a specially equipped Spitfire, a photo-recon Mitchell (B-25/F-10) and a pair of Avro Ansons. Among the innovations were automatically controlled camera shutters.

In May of 1948, the fledgling U.S. Air Force supported NGS's "Operation Eclipse" project, deploying a pair of SHORAN-equipped RB-29s (one of which was 44-61981) from a SAC mapping outfit at MacDill AFB, Florida, to Shemya,

(Cont. on p. 12)

President's Message

Last fall, the Air Force selected the F130 engine made by Rolls-Royce North America for the B-52 Commercial Engine Replacement Program, or CERP. Under the \$2.6 billion contract, Rolls-Royce will equip the B-52 fleet with eight engines each by September 2038, replacing the bomber's aging Pratt & Whitney-made engines.

You're probably asking yourself why I opened my first letter to you as AAHS President with a fact about the B-52 Stratofortress. Well, I did because it is a fitting metaphor for our organization. Like the B-52, we have been fulfilling our mission since the 1950s and, like the B-52, we need to continually adapt and modify ourselves to meet the demands of the world we operate in. Our members and volunteers are the engines of AAHS, and we need new members and volunteers. Our website and digital systems are our avionics that need to be updated to work with "Next-Gen" systems and people.

Most importantly and very much like the B-52, we need to be able to operate more cost-efficiently. The closest analogy for cost per flight hour for us would be cost per publication. Printing and shipping costs have risen, and while we have tried to absorb as much of that increase as we could, members will see a slight increase with their next renewal. As we all look at our budgets, if the print version of AAHS is something you are thinking about not renewing due to cost increases, please consider an e-membership and remember AAHS is a non-profit (501.3.c.) educational organization that is unique in the aviation community.

I plan on focusing the majority of my efforts as president on attracting new members, increasing our engagement with the community and our members, establishing corporate memberships and collaborations, and enhancing our digital presence. Jerri and I have been working on developing a scholarship program and we hope to be able to share the final details with you all soon.

With the new Top Gun movie out, the F-14 Tomcat is back on everyone's mind, but why is such a beloved and capable aircraft no longer in service with the US Navy but the Air Force still has its slow, ugly bomber? Because its primary mission of fleet defense from Soviet bombers was no longer needed, and it wasn't adaptable to the needs of the 21st century. I don't think anyone wants AAHS sent off to the proverbial "boneyard." Our mission, "the preservation and dissemination of the rich heritage of American aviation," is still and will always be needed. Aviation history is being made every day. We only need to be adaptable to ensure we have the capabilities to fulfill our mission. I implore you all to give whatever you can, be it time or resources to help keep AAHS in the air.

Jim Logue
AAHS President



Editor's Note: For this issue of *FlightLine*, we've gathered more material than we have space to put it in—which is a nice problem to have. Rather than add extra pages, we decided to push a couple of things out to the 4th Quarter number, which is scheduled for publication the first week of October.

Here's what changed. For the lead article on airborne observatories, we found much more than we expected in this relatively unexplored nook of aviation history. And we found a bonus in the person of Manny Antimisiaris, who flew the SOFIA observatory for NASA. We're looking to include Manny's "from the cockpit" viewpoint in Part Two.

Our "how to" article connecting the Doolittle Raid and on-line research has been squeezed out as well but will be concluded in No. 206. Meanwhile, the next *AAHS Journal* is almost ready to go to print, so watch your mailbox. And don't forget to check out our AAHS Facebook page. →



AAHS Annual Meeting 2022

An Aviation Weekend in the California Wine Country



Attendees enjoy lunch and some shade at historic Schellville Airport

Hayden Hamilton photo

Our AAHS Annual Meeting 2022 is history. The post-pandemic (we hope) world still presents many challenges, but thanks to some good up-front work by CEO Jerri Bergen and HQ office manager Syndy Resler, aided by members who pulled yeoman duty throughout the weekend, the events came off in fine style.

The temps were toasty, but the group enjoyed mixing and mingling among vintage aircraft, with a sampling of wines adding to the ambiance.

The festivities kicked off with Friday lunch and a talk by Diane Heinz about aviation history in the Oakland area. Then it was off to the Rowland Freedom Center at Nut Tree Airport (VCB), just down the pike from the hotel. General Manager

Paul Mirich gave the group an inside view of the museum's aircraft and its many other artifacts, including the 1912 aeroplane built and flown by the teenage Gonzales brothers. (See their story at <https://gonzalesbrothers.org/>)



Sommelier (and AAHS board member) Les Whittlesey pours for Bert Zimmerly as Bert's wife Jean Anne and fellow board member John Lyon look on. (Hayden Hamilton Photo)

On Saturday, the entourage motored over to Napa Valley's Schellville airport (0Q3) for lunch and presentations by author Don Pattillo and Zipline Logistics director of flight operations Randy Chamberlain.

From Schellville, the stout-hearted in the group ventured a few miles up the road to Sonoma Airpark (0Q9) and a visit to Rafe Tomsett's hangar which is . . . well, let's just say it's a whole 'nuther shrine to aviation history!



Paul Mirich gives us the scoop on the Rowland Freedom Center (Hayden Hamilton Photo)

The meeting closed out Sunday at the [Aerospace Museum of California](#), on the grounds of the former McClellan AFB. The museum is also center for STEM education, partnering with other institutions to sponsor a variety of youth programs. Out back is a collection of mostly modern jet aircraft, including examples of the Century Series USAF fighters.



↓ Schellville on Saturday ↓



CEO Jerri recognizes Bob Palazzola for his outstanding contributions to AAHS. (Hayden Hamilton Photo)

It's worth mentioning again that AAHS Annual Meeting 2022 could never have happened without the work put in by Jerri and Syndy in arranging a hotel, dealing with caterers, and all the other logistical details that must come together to make an event like this successful.

Also worthy of a shout out are the AAHS members and wives who helped with registration, setting up tables and chairs, and the other grunt work that has to be done in support of these gatherings. A figurative round of applause for all!

Next up is AirVenture at Oshkosh. After that, we'll start planning for next year's meeting. If you haven't attended an annual meeting, you're missing out on some good times with fellow aviation enthusiasts. We'll post 2023 dates and details as soon as they're available. Be sure to check our AAHS Facebook page, too. →



A sample of the aircraft seen during the annual meeting, beginning at the Freedom Center. (Photos by Joe Martin)



↓ Aerospace Museum of California ↓



These shots represent only about half the collection. As with most museums, space is at a premium and the aircraft are arranged for viewing, not photographing. →

eVTOL in the news again, and a new “world’s largest airplane”

In FL #203 (Q1 2022) we spotlighted an array of electrically powered aircraft, mostly of the Urban Air Mobility “air taxi” variety. All but a handful of these were ranked in the newly rolled out Advanced Air Mobility Reality (AAMR) index.

In the latest AAMR ratings, Joby Aviation retains the top spot with an 8.7 score—and far and away the biggest bankroll. Germany’s Lilium jumped into second place, gaining a full point to 8.4 and pushing Vermont-based Beta Technologies 8.0 score into third place.

All the top three have recently posted significant public announcements. Joby has received FAA Part 135 Air Carrier Certification, allowing the company “to begin on-demand commercial air taxi operations.” Fine and dandy, that, but significant hurdles must be cleared before Joby’s—or anybody else’s—eVTOL aircraft begin carrying passengers.

First and foremost, a type certificate must be obtained, something not yet on the horizon for any of the hopefuls. In late May, Lilium moved a notch closer to the goal when its Phoenix 2 technology demonstrator became the first eVTOL craft to transition from hover to wing-borne flight. Nonetheless, Lilium has pushed its anticipated type certification date for the production version seven-seat “Jet” out to 2025.



Topping off the electrons. Beta Technology’s Alia eVTOL “refuels” in route to Bentonville, Ark., from N.Y. (Credit: Beta)

Meanwhile, Beta Technologies Alia-250 winged its way cross country—as a conventional fixed-wing aircraft—from the company’s test facility at Plattsburg, N.Y., to Bentonville, Ark., in a two-stage, 1,355-mile flight. The first leg, from Plattsburg to Springfield-Beckley Municipal Airport (SGH) in Ohio, was made with three recharging stops in route.

Springfield to Bentonville also required three stops. Distance between recharges averaged about 170 miles. Total flight time for the 8-day trip was a shade under 12 hours. The Alia has been flying in conventional mode since 2021 but has yet to make a vertical takeoff and transition to horizontal flight.

In the electrically powered segment of the regional airliner market, Swedish start-up Heart Aerospace decided to replace its ES-19 model which, under U.S. rules, would have

to operate under the more restrictive Part 23 regulations. The revised design, details of which have not been released, would come under the European agency’s CS-25 category. (>19,000 lbs. maximum takeoff wt.)

Between them, U.S. carriers Mesa and United have ordered 200 ES-19s, but Heart says the decision to change was made jointly “with the partner airlines and all the suppliers we are working with.” Heart is sticking to a 2026 service entry date.



A work in progress: Eviation’s Eve (Credit: Andy Bronson)

Eviation, which previously appeared to be on life support, now cracks the AAMR lineup at #17, but rates only 5.9 score. The company recently announced that flight testing would be moved to Grant County International Airport (MWH), near Moses Lake in eastern Washington State. No first-flight date has been set. Production will remain at Eviation’s Arlington, Wash., facility. →



With the demise of the Antonov An-225 (see FL #204), Scaled Composites Model 351, now known as Roc, can lay claim to title of world’s largest airplane—provided, that is, largest means having the greatest wingspan (385 ft.).



Roc leaves its nest. (Credit: Stratolaunch)

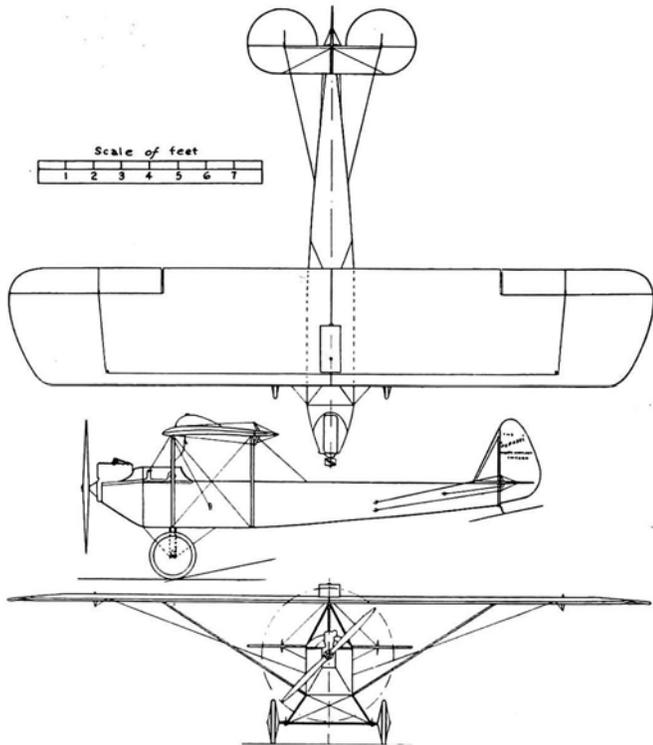
“Stratolaunch,” which the aircraft itself was initially called, is also the name of the limited liability company that now owns it. In any case, Roc will now serve as the airborne launch platform for the Talon-A hypersonic test vehicle, another Stratolaunch product.

A recent test flight, the sixth overall for the giant aircraft, was terminated after flying about 90 minutes of a planned 3.5 hr. mission. The primary test objective was to note any changes in the flight envelop after installation of the centerline pylon to which the Talon-A will be attached. →



A few weeks ago Jan dan Das, a reader from the Netherlands, emailed AAHS with a question about the Heath Parasol, a pioneering sport plane of the mid-1920s, later offered as a best-selling do-it-yourself kit.

Specifically, Jan wondered about the wingspan of these early Parasols. At least for the prototype Parasol, Heath dipped into a stash of surplus Thomas-Morse S-4C Scout *bottom* wings, bolted together to make the “parasol” wing.* Since the S-4 was the subject of our “Restorations and Reproductions” section in FL #203, we decided to help play aero detective. Jan had already checked aviation periodicals of the day, but we followed up as well. Aviation magazines from 1927 contain several short articles on the Parasol, including 3-views and a couple of photos.



3-view from *Aero Digest*, March 1927

No need to show the arithmetic here, but Jan had a hard time making the quoted wing span of 23'0” add up, given the presumably accurate length quoted elsewhere for an individual S-4C wing. Both the 1927 photos and accompanying 3-views show a straight-line trailing edge, meaning that the “scalloped” portions of the S-4C wings would’ve been removed when

the left and right halves were joined to form the single-piece parasol, further confusing the wingspan calculations.



Photo from *Aviation*, Feb 28 1927

Jan included the photo below which clearly shows the scalloped “cut outs.” The obvious conclusion must be that the figures in the 1927 articles were based on “production” examples, in which Heath replaced the “Tommy” wings of he prototype with the more efficient Clark-Y airfoil.

So what was the wingspan of the original Heath Parasol? Sorry, Jan, but we still don’t know! →



*The late Pete Bowers, writing in the January 1982 edition of *AOPA Pilot*, stated that Heath used *upper* SC-4 wings, which would certainly make more sense than cutting away spaces in the lower wings, then fabricating and installing ailerons.



AAHS FlightLine

American Aviation Historical Society

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2021 *Members' Choice – Best of the Best*



At the end of each year, the AAHS membership is asked to vote for the Best Article and Best Painting published in the *AAHS Journal* for that calendar year. This is never an easy choice, which some of you have responded by returning a ballot with the notation, “They are all too good to select just one.” And, while all the articles and paintings for 2021 (Vol. 66) are outstanding and represent hours of research and writing, or slaving away over a canvas, one or two tend to solicit a bit more interest than the rest. This year was no different, with two articles tying for Best Article.

Out of the 29 eligible contributions, David Stringer’s “Non-Skeds: The Story of America’s Supplemental Airlines,” Parts 4 & 5, and Chris Hansen’s “When Pigs Flew: The TFX Affair” both garnered 11% of the votes for Best Article. The next three highest vote getters got between 7% to 9% of the total vote, with the rest being pretty evenly distributed.

Best Painting

In the selection of Best Painting for 2021, the members choice was Terry Williams’ painting of a Delta Airlines DC-3. All eight paintings were equally popular with our members,

but not to the degree of Williams’ DC-3 work, which collected roughly 35% of all votes, with the remainder being fairly evenly distributed among the other seven. →



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Some Fantastic Scale Models

By Jerri Bergan, AAHS CEO

The AAHS Aviation Scholarship Fund, an annual funding of students furthering their education in the aviation industry, has finally gotten off the ground in an unexpected way; with the donation of 20 museum quality aircraft models, scratch built by Larry Klingberg, AAHS member #17072, who passed away unexpectedly earlier this year. Larry's estate bequeathed the 1/3-1/6 scale models to AAHS for the purpose of "display and education."

Larry, who owned his own TV repair shop, spent his leisure time building models, usually starting with just a magazine picture, and eventually ending up with 1/3-1/6 scale masterpieces, with working cables, control surfaces, door handles, propellers and even miniature pilots and accessories to complete a full diorama look. Some wingspans of the models, such as a German Gotha bomber, span 15 feet and more. Larry would spend up to two years on each model, entering the finished piece into an AMA competition, usually to win the 1st, 2nd, (and occasionally, 3rd) place trophies in the scratch-built categories.

Larry modeled early aviation and golden age era aircraft from several countries, including Italy, England and France. He favored seaplanes, as 12 of the aircraft sit atop floats. The models were built in pieces, wings attached to the fuselage with long dowels, so they could be easily disassembled and transported on special jigs. Platforms stood throughout his house to store the models; the wings standing about the living room like a forest of balsa and fabric.

We first had to help Larry's wife, Rose, move the models out of her home to an area where they could be reassembled and photographed. After eight trips to Rose's house using a 16 foot trailer, the models and all the pieces were transported

to a hangar at Cable Airport (CCB), where local Airframe and Powerplant technicians have volunteered to help with the assembly process.

We have begun conversations with several local aviation institutions that have shown interest in owning one of these stunning models in return for support of the new AAHS Aviation Scholarship fund. The Spartan School of Aeronautics at Flabob Airport is the first to claim a model. Their on-site RC Club, led by instructor Adam Hunt, picked out a beautiful 1927 Monocoupe, which the instructors are using to illustrate to students basic control surface motions. Spartan students were among the group of technicians who have enthusiastically pitched in to help put these treasures back together.



Larry's "Gotha" bomber from the 1930 movie *Hell's Angels*

Another local company, Qualified Technologies, has pledged to donate \$1,200 for each of three models to the AAHS Aviation Scholarship Fund. They plan to display these models for customers and employees in their corporate lobby. If you know of an organization that would be interested in displaying one of these fabulous creations while supporting a great cause, give us a call at 714-549-4818!

New Members

Welcome to AAHS!



Justin Matthews
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Your *FlightLine* Editor Joe Martin

Now that I've served as editor for four issues of *FlightLine*, it's time I properly introduced myself. First some general background: I've had an interest in aircraft—meaning just about any human-carrying object that flies—pretty much since I was old enough to tell one type from another.

I never had a burning desire to drive an airplane, but I've always been curious about the machines themselves. My first ride was in a Southern Airways DC-3 back in 1959. A little more than a decade later, I logged around 1,400 hours of enlisted aircrew time aboard one of the least-known variants of the venerable Gooney Bird, the EC-47.

We "back-enders" manned the SIGINT gear in the "Electric Goon," making DF fixes on VC and NVA field radios, mostly from Morse traffic, with some voice here and there. During 22 months in Vietnam, I flew 250+ missions, working areas from the southern tip of Cambodia all the way up to the PDJ. Those who were there know where that is.

I (finally) finished college on the GI Bill. I've spent most of my subsequent working life in the aerospace/defense business, ultimately retiring from Honeywell Aerospace (formerly Garrett AiResearch, later AlliedSignal) then taking various contract jobs. I still do a little part-time work for one of the industry majors.

I find just about any part of aviation history interesting, which is why I'm happy to be working with the AAHS team as we continue to deliver aviation history you won't find anywhere else. That's where our members come in. You *are* AAHS. Sharing research and personal knowledge is what our organization is all about. We're always looking for new content, whether it's in the form of a *Journal* article or a shorter piece like those in *FlightLine*. Don't



Editor's Note: Due to search engines extracting and indexing personal information, the AAHS no longer publishes detailed addresses. Please contact the office if you wish to contact a member.

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MOVING???

Make sure you send the AAHS office a change of address so you will not miss any issues of your Journals.

Or, if you change your email address, be sure to let us know so we can contact you if needed.

consider yourself an author? No worries—we can assist with the wordsmithing. Need more info on a favorite aviation topic? We can probably help there, too.

For me, museums embody some of the most important and enjoyable aspects of aviation history. Living in Prescott, Ariz., I'm within striking distance of the Pima Air and Space Museum down in Tucson. I also do a little traveling in my part-time gig, which enables me to check on other museums across the country, most recently in the Seattle area.

Sadly, Covid struck Paine Field (PAE, Boeing's widebody plant) with a vengeance. The greatest loss may be the late Paul Allen's Flying Heritage & Combat Armor Museum. Selling off such a magnificent collection piecemeal would be about as tragic as that sort of thing can get. On the bright side, the Museum of Flight down by SEATAC was booming, so maybe there's hope.

I got a little off the beam here, but one of my objectives is to establish a very informal network of folks who live near aviation-related museums and would be willing to keep the membership informed of goings-on in their areas.

If you fit that bill and would like to help, please give us shout. For that matter, if you have questions, comments, or squawks of any sort, feel free to sound off [here](#).



**Next FlightLine:
Week of October 3-7**

(Cont. from p.2)

at the western tip of the Aleutian Islands. Weather forced the Superfortresses to climb above the planned altitude, where the optical glass covering the camera portals began to crack in the sub-zero environment.

Fortunately, everything held together and the B-29s maintained their critical centerline heading. Much to the relief of the NGS, excellent coverage was obtained, offsetting the poor results from several socked-in ground sites.

By the mid-1950s, observation of solar eclipses from aircraft was becoming almost routine. For the September 1954 eclipse, at least two British teams were airborne, one in an Avro Lincoln bomber at 30,000 ft., the other in a Handley Page Hastings transport flying at only 8,500 feet. Both reported excellent results. The following year, a French team in a modified Noratlas 2501 transport took off from Saigon's Tan Son Nhut airbase to photograph the July 20 eclipse at 26,500 over the South China Sea. Unfortunately, overexposed film and aircraft instability rendered the imagery unusable.

“A New Era in Astronomical Observation”

January 1, 1964, to 31 December, 1965, was designated the International Quiet Solar Year (IQSY), so called because of the relatively benign sunspot activity expected during that time. About six months earlier, a total solar eclipse would be visible in northwest Canada.



APEQS personnel pose for a group photo around N801E (Credit: Delta/Tim Williams via AAHS)

As it had for such events in the past, NGS swung into action, but this time no military aircraft would be involved. Thanks to scientific interest within the Douglas Aircraft Co., arrangements were made to briefly lease a DC-8 scheduled for an engine upgrade. The chosen vehicle, N801E, was already an historic aircraft. The 14th ship off the Douglas DC-8 line, it was Delta Airline's first, and on Sept. 18, 1959, made the world's first commercial DC-8 flight from New York to Atlanta.

For Project APEQS (Airborne Photography of the Solar Eclipse of the Quiet Sun, pronounced “apex”) the DC-8 would be modified to accommodate a variety of scientific gear. Tim Williams documented the DC-8 story in “Airborne Photography of the Solar Eclipse of the Quite Sun; Project APEQS,” for the Spring, 2010, issue of the [AAHS Journal](#).

The shadow of the July 20, 1963, eclipse raced across the landscape at 1,700 mph, but with the DC-8 at 40,500 ft. and zipping along underneath the sun's path at 525 mph, the

time of totality was stretched to 142 seconds, compared to 100 seconds at an observation point on the ground.

In all, APEQS involved 11 organizations from the U.S. and other nations. Fifty-five scientists and observers were aboard for the eclipse mission, including Mercury astronaut Scott Carpenter. In addition to the eclipse study, some 25 other experiments were conducted. In the words of Scientific Director Dr. Wolfgang Klemperer, the success of APEQS “pointed to a new era in astronomical observation.”

N801E was immediately returned to Delta where, after conversion to DC-8-51 configuration, she flew for another 14 years before being sold for scrap in 1977.

NASA's Convair 990 “Galileo” and AEC NC-135s

The APEQS project convincingly demonstrated the advantages modern jet aircraft offered to astronomers, particularly when observing a solar eclipse. For example, meaningful analysis of the sun's corona, impossible at ground level because water vapor blocks the infrared portion of the solar spectrum, could be made from a high-flying aircraft. Thanks to increased jet speeds, the time spent in eclipse totality would be increased by roughly 50% over the best a ground site could hope for.

After some urging by agency scientists who had participated in APEQS, NASA purchased the first example produced of the Convair 990 airliner. in 1964. (N5601, later re-registered as N711NA.) The ship was one of five initially retained by Convair and as such had an essentially bare interior, simplifying the installation of scientific gear. Cutouts for thirteen 12 x 14” viewing ports, angled upward at 65°, were made in the left side of the fuselage.



NASA's Convair 990 “Galileo” with viewing ports installed in the upper fuselage (NASA Photo)

Meanwhile, the Limited Test Ban Treaty of 1963 ending atmospheric nuclear testing had placed a trio of specially equipped NC-135 variants of the KC-135 tanker in a state of underemployment. Although still in the USAF inventory, the NC-135s were under the direction of the Atomic Energy Commission (AEC), with mission tasking coming from the three national laboratories associated with nuclear weapons development and production. A repurposing of sorts was arranged whereby the 135s could be used for scientific research, provided their test ban violation reporting mission was not impacted.

The May 20, 1965, solar eclipse period of maximum totality (5 min. 15 sec.) would occur at a spot in the mid-Pacific just below the equator, some 2,100 miles southeast of Hawaii. Here was a mission tailor-made for NASA's CV-990 and the AEC aircraft. The 135s had sufficient range to fly round-trip from Hickam AFB, Hawaii, but the 990, staging out of Hilo, would require a post-mission refueling stop in Tahiti.

Much elaborate planning and more than a little logistical scrambling was required, with a few rehearsal flights squeezed in. When the time came, all aircraft were on target and almost all the many experiments aboard yielded good results. To honor a well-liked Italian member of the expedition, the participants elected to name the Convair "Galileo."

Galileo, first in the long line of NASA airborne observatories, would go on to support many other projects before being tragically lost in 1973 when it bumped a Navy P-3 on approach to Moffett Field. Both planes crashed, killing all aboard.

Another CV-990 (N712NA), named Galileo II, was later purchased. This aircraft was also destroyed (but with no injuries) in a fire that followed a blown tire and rejected takeoff from March AFB, July 17, 1985. The NC-135s continued to support NASA's almost yearly eclipse missions through 1980.



Right side view of N711NA shows the black painted anti-glare panels on the left side. (Credit: Leo F. Buczynski)

An Open-Port Observatory

Among the advances in astronomy realized by Galileo was the use of sophisticated instruments to obtain measurements in wavelengths outside the visible light range. But it was apparent that gathering meaningful data in the infrared spectrum would require larger and more powerful telescopes than the Convair's observation portals could accommodate.

The obvious solution was a larger hole in the fuselage, but this raised its own set of issues. When in use, the observation port would be open to the atmosphere, but otherwise must remain covered or closed. At altitude, how would airflow around the opening affect the aircraft's performance and hence flight safety?

Scientists at NASA's Ames Research Center proposed mounting a 12-inch telescope in one of the agency's Learjets. The proposal was accepted, and modifications undertaken. Rather than wait for wind tunnel results, a small air dam was installed just ahead of the open port, with a mock-up telescope in the cabin. Test flights revealed no adverse effects on flight characteristics affects and the program proceeded as planned.

The result was something of a jury-rigged setup, but the first observations from the Lear were made in October, 1966.

The aircraft could operate up to 50,000 feet but the telescope installation meant working in a cabin altitude equivalent of about half that, necessitated the wearing of oxygen masks. Problems with both the port and the telescope were encountered but gradually overcome, paving the way for NASA's future airborne observatories.



The 12" telescope mounted in NASA's Learjet (the "dot" just above the wing) meant that oxygen masks were needed at altitude. (NASA photos)

Concorde and "The Eclipse of a Lifetime"

The solar eclipse of June 30, 1973, would be literally a once-in-a-lifetime event. Totality was predicted to last seven minutes, four seconds, the longest in hundreds of years and only 28 seconds short of the longest duration possible for *any* eclipse ever visible on Earth.

Astronomers quickly recognized a special opportunity. The eclipse path would cross central Africa, away from sizable populated areas. At top speed, the Concorde could very nearly match the speed of the eclipse shadow as it hurtled along, affording scientists an unprecedented length of viewing time.

A luncheon conversation with an intrigued Aérospatiale test pilot yielded fortuitous dividends. Concorde 001, the virtually empty French prototype, would be made available. With little time to spare, an international team was assembled

and the rather complicated flight plan worked out. The mission would launch from the Canary Islands, off the west coast of Africa. Concorde would climb to 56,000 ft., accelerate to Mach 2.05, intercept the eclipse over Mauritania, follow the eclipse track as long as possible, then make a wide turn to land in Chad.

Timing was near perfect, only one second off plan. Concorde and its busy passengers kept pace with the darkness of the total eclipse for an astonishing 74 minutes before running out of airspace—a record likely to never be broken.



The KAO in flight, with the observation port open.

The Kuiper Airborne Observatory

The Concorde eclipse chase was a spectacular one-shot accomplishment, but in reality no new scientific knowledge was acquired. NASA had learned much from Convair Galileo and the LearJet experiments. Regularly scheduled flight operations demonstrated that an open-port airborne observatory was not only feasible but was in fact the only way hitherto inaccessible astronomical data could be obtained. The unique flexibility and mobility offered by an airborne platform made for a powerful argument to fly even larger telescopes.

As early as 1970, NASA had drafted specifications for a 36-inch infrared telescope to be mounted in Lockheed-Georgia's solitary L-300, the proposed civilian version of the USAF C-141 Starlifter. The airframe, Lockheed constructor number 300-6110 (N4141A), later registered by NASA as N714NA, was snatched at a bargain price when the L-300 program was scrapped.

As would prove to be the case right up through the SOFIA program, bureaucratic wheels at NASA turned with agonizing slowness. The telescope was finished in the fall of 1972, when Lockheed Air Services began the modification work to integrate the astronomical gear. Preliminary flight testing began at NASA's Dryden Flight Research Center in early 1973.

Officially named the Kuiper Airborne Observatory in honor of astronomer Gerard P. Kuiper, sometimes called the father of modern planetary science, partly because of his extensive work with the Galileo aircraft. The KAO, as it was universally known, became operational in 1974, logging just over 100 hours on 18 scientific or engineering flights (out of 47 total flights for 177 hours.) KAO would go on to serve NASA and the scientific community for 21 years, retiring in

1995 having flown almost 2,300 missions, 70% of which were for research purposes of one sort or another. Only 136 aborts were noted, although this figure must represent airborne only, since almost 400 flight hours were still recorded.



The business end of the KAO, with the port closed.

The Rest of the Story

According to a NASA history, during its operational lifetime KAO research involved more than 600 investigators who produced over 50 PhD theses and a thousand scientific and technical papers.

As noted elsewhere, space limitations have meant carrying over some material to the Fall, 2022, *FlightLine*. KAO set the stage for the even more capable SOFIA Boeing 747, which will be covered in No. 206. →

Article by Joe Martin

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Book Reports



Air Power Over Gallipoli, 1915-1916, by Sterling Michael Pavelec. Naval Institute Press, 291 Wood Rd, Annapolis, MD 21402. <https://www.usni.org/press/books>. ISBN 9781612510231, 2020. Hardbound, 9" x 6", 240 pages, 16 B&W photos, 2 maps. List price: \$42.00, also available in electronic format.

Aviation's role in the Gallipoli Campaign of 1915-16 is little known to all but the most dedicated students of aviation history. In this addition to the Naval Institute Press's History of Military Aviation series, author Michael Pavelec aims to shed light on this "first significant air battle" of World War I. The story is broken into nine chapters, plus three useful appendices. Incidentally, a look at the first two of these, as well as the aircraft photos and map following p. 98, will facilitate better understanding of the main narrative.

After an introductory chapter on The Birth of Airpower, which includes a summary of the soon-to-be-opposing air forces, Pavelec examines the thinking behind the Gallipoli Campaign, the ultimately futile attempt to force a passage through the Dardanelles—the narrow 40-mile-long waterway between the Aegean and the Sea of Marmara—and thereby reestablish maritime communication with hard-pressed Russia via the Bosphorus and the Black Sea.

If Constantinople [Istanbul] could be seriously threatened or taken outright, Turkey would be forced out of the war. Generally regarded as the brainchild of Winston Churchill, the idea had much strategic appeal but also entailed risks which the army was unwilling to underwrite. The initial scheme therefore devolved to a purely naval operation. By mid-February 1915 a formidable armada was in place, headed by dreadnaughts and battleships capable of delivering an awesome barrage of heavy metal and high explosives.

Among the support vessels sailing from Britain was the world's first purpose-built seaplane tender, HMS *Ark Royal*, with her contingent of six mixed breed floatplanes plus a couple of Sopwith Tabloid scouts on wheels. Soon augmenting this meager force would be No. 3 Squadron, Royal Naval Air Service, redeployed from the Dunkirk area, where it had already made something of a name for itself. Strictly land based, No. 3 would function throughout the campaign as an essentially independent unit, led by Wing Commander Charles Rumney Samson, one of the most colorful, if oftentimes controversial, pioneers of naval aviation. Visual observation and early attempts at photo reconnaissance yielded valuable intelligence and airborne spotting of gunfire, when it could be done, proved to be very advantageous. While the naval aviators did much useful work, they were hampered by bad weather and poor equipment, a recurring theme in early military aviation, made worse by Gallipoli's low logistical priority.

Although outgunned by more than ten to one, the Ottoman forts proved to be tough nuts to crack. The entire allied endeavor was sunk, literally and figuratively, by that most primitive of stealth weapons—the mine. When, on March 18, four battleships were put out of action in a matter of hours, the naval attack was called off. The Turkish forts would have to be disabled from the landward side. But the Turks, forewarned and now forearmed with the help of German advisors, were ready. The allies' amphibious landings of 25 April 1915 set in motion some of the most hellish fighting of World War I.

The aerial operations that make up the core of the book are covered in just over 130 pages, which means only superficial treatment can be given to the ferocious land battles that the airmen of both sides supported as best they could. In his introductory remarks, Pavelec notes that at Gallipoli "airpower was important, interesting, and innovative." That it was, and given the small number of aircraft involved, the air action can be chronicled on an almost daily basis. The exploits of the *Ark Royal* "air group" and No. 3 Squadron are recounted in detail. Including reinforcing units that arrived late in the game, in the end the RNAS fielded a respectable air force.

The British effort was aided by a lone French squadron operating on the Asiatic flank, but as the author notes, not much can be found concerning its activities. The Turkish side of the story is even less well documented. Rarely were even a half-dozen planes airworthy, and much of the flying was done by German pilots. But in the final weeks of the campaign, at least three RNAS aircraft were shot down by Fokker *Eindeckers*.

Snippets of the air war over Gallipoli do indeed make interesting reading, and author Pavelec has done a first-rate job of piecing the story together. He concedes, however, that airpower "was barely relevant" at Gallipoli. Nonetheless, even readers familiar with the bloody ground war that immortalized the Australian and New Zealand Army Corps, the ANZAC, will find much new material here. →

Joe Martin

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