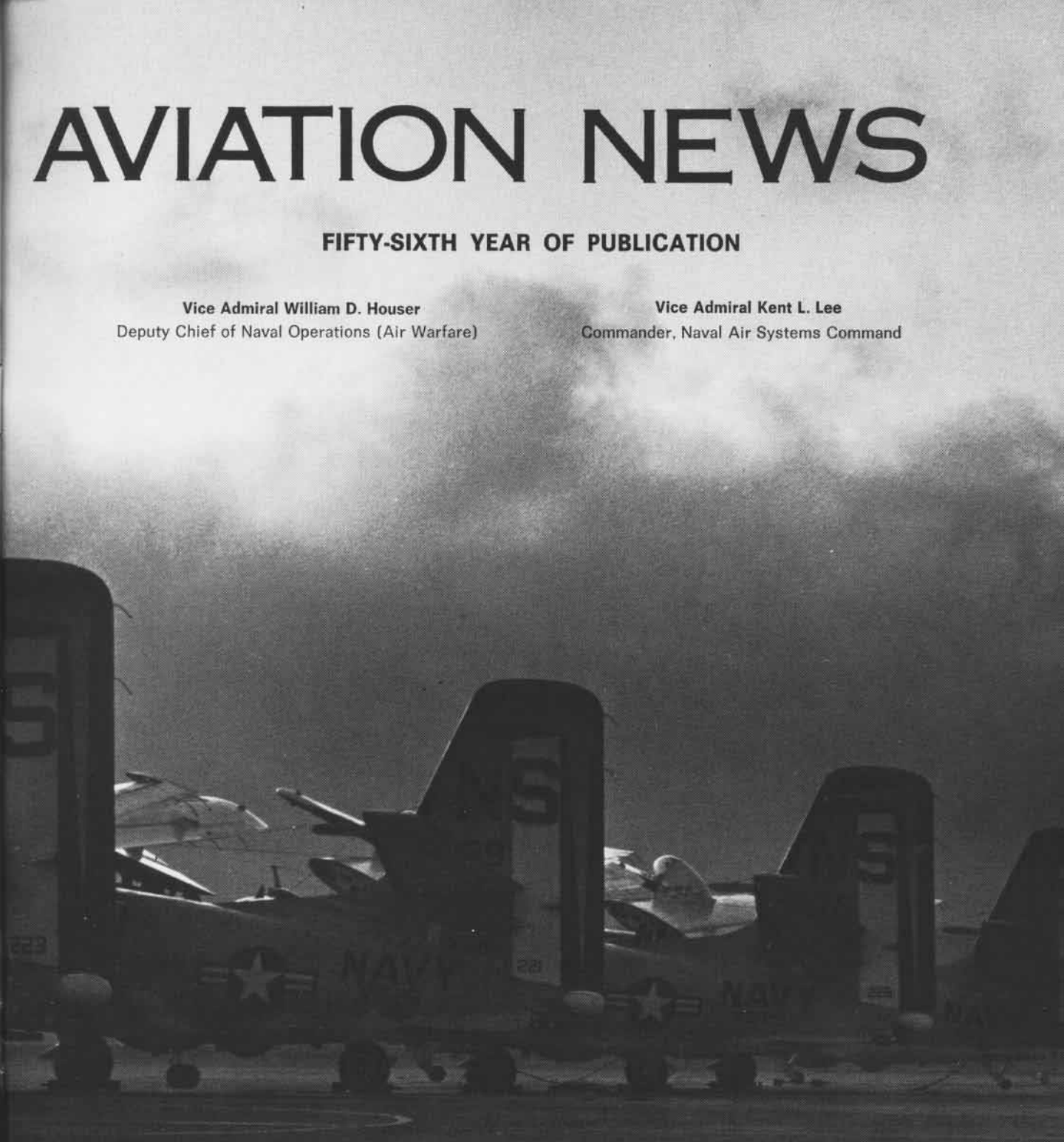

NAVAL AVIATION
NEWS
MAY 1974
The Shape of Things to Come?

NAVAL

COVERS—*This month's front cover depicts an assortment of lighter-than-air vehicles ranging from Blanchard's balloon of 1784 to a modern nuclear conception as discussed in this issue. The photo of VS-29's S-2Es on these pages was taken by PHCS(AC) R. L. Lawson at NAS North Island, Calif.*

AVIATION NEWS

FIFTY-SIXTH YEAR OF PUBLICATION



THE STAFF

Letters

Help!

On July 11, 1941, NAS Quonset Point, R.I., was commissioned, the largest air station in the U.S. at that time. Were you there?

Lt. Kathleen S. Beam, PAO, is compiling historical photographs, documents and related items for a book on Quonset Point and is seeking the help of everyone who had a part in the 33-year history of the base.

If you have items that might be of interest, please contact Lt. Beam at the Public Affairs Office, Room 136A, Quonset Administration Bldg., NAS Quonset Point, R.I.

Transatlantic Request

I've been a devoted reader of *NANews* these 25 years, since the start of Korea.

I am an English author and publishers in the U.K. and U.S. jointly want me to do a book called *The Phantom at War*. It would help me very much if you could insert something along the lines of the attached copy.

Whatever the score, I'd like to say that, out of scores of U.S. magazines I see, *NANews* is one of the three I read.

William T. Gunston
Foxbreak
Courts Mount Road
Haslemere, Surrey, England

Thanks for the kind words. We are glad to publicize your needs.

Request:

Bill Gunston is gathering material for a book on *The Phantom at War* (Vietnam and Israel). He would be delighted to hear from anyone with a good yarn, a little-known fact or any other details, personal or technical. Photos lovingly tended and returned after use.

Bald Tires

The January issue (page 22) of *Naval Aviation News* evidently plagiarized an article from *All Hands* concerning rework of USS *Kitty Hawk's* yellow gear.

When two such prestigious professional magazines goof — that's bad news.

Tilly's tires don't go bald. That's the way she is outfitted. It gave us a good laugh, but it hurt our pride to have a sister ship's Tilly insulted in such a manner.

Crash and Salvage Crew
USS America (CVA-66)

First, our apologies to all the Tillys of the fleet. Second, we are only as good as our source, and that's what the release said. (But guys like you teach us something every day.) As for the plagiarism, we must deny it. When a release is sent to two or more outlets, the chances are that sooner or later two or more will use it in the same time frame.

Books of Interest

Two books on important achievements in Naval Aviation history may be of interest to our readers. *Shenandoah Saga* by Thom Hook, published by Air Show Publishers, is an illustrated account of the first U.S.-built, helium-filled rigid airship. *First Across* by Richard K. Smith, author of *The Airships Akron and Macon*, tells the story of the 1919 transatlantic flight of the NC-4. It is published by the United States Naval Institute.

Reunions

The third reunion of former crew members of USS *Manila Bay* (CVE-61) and members of her aircrews, VCs 7, 71 and 80, is being planned for August. Former crew members should write to Arnold W. Ling, 3661 Trinity Drive, Los Alamos, N.M. 87544.

The Natoma Bay Association (CVE-62) will hold a reunion in San Francisco July 12 and 13, 1974. A general invitation is extended to all CVE men. For further information contact Bob Wall, 141 Boynton Blvd., Apt. 6, Daytona Beach, Fla. 32018.

Patrol Squadron Ten will hold a reunion June 6-9 at NAS Brunswick, Me. The four-day event will be highlighted by a reunion ball on June 8. For further information write Reunion, Patrol Squadron Ten, NAS Brunswick, Me. 04011.

The Soviet Academy of Sciences and NASA have selected this circular design as the official emblem of the joint US/USSR space mission to be flown in July 1975.

did you know?

New CNO

Admiral James L. Holloway III has been nominated by President Nixon to relieve Admiral Elmo R. Zumwalt, Jr., as Chief of Naval Operations. Adm. Zumwalt will retire this summer. Adm. Holloway will be the first CNO to have commanded a nuclear-powered ship in combat. He commanded USS *Enterprise* (CVAN-65) when the carrier went into action on December 2, 1965, in the South China Sea. He is now Vice Chief of Naval Operations.

Adm. Radford Honored

The *Spruance*-class destroyer DD-968 has been named in honor of Admiral Arthur W. Radford (1896-1973). Adm. Radford won his Wings of Gold November 18, 1920, and was Naval Aviator No. 2896. During World War II, he was twice awarded the Distinguished Service Medal as a carrier task group commander in the Gilbert Islands, Iwo Jima and Okinawa campaigns. He also received the Legion of Merit for vastly expanding pilot training programs while Director of Aviation Training, Bureau of Aeronautics (December 1941 to April 1943). After the war, he served as Deputy Chief of Naval Operations for Air; Commander, Second Task Fleet; and Vice Chief of Naval Operations. He earned a third Distinguished Service Medal during the Korean War as Commander in Chief, Pacific, and U.S. Pacific Fleet. In June 1953, he became the first naval officer appointed as Chairman, Joint Chiefs of Staff. He was reappointed Chairman in 1955, and served in that post until his retirement in August 1957. For outstanding contributions to national defense while in this office, he received a gold star in lieu of a fourth Distinguished Service Medal.

Intruder Training

Ens. D. R. Stover, on March 8, was the last bombardier/navigator to complete training in the A-6A *Intruder* with VA-42 at NAS Oceana, Virginia Beach, Va. More than 600 B/Ns have been trained in the A-6A since it was introduced into the fleet. It is being replaced by the A-6E.

Alexander Graham Bell?

A telephone system that carries one's voice by light signals pulsating through glass fibers has been developed by the Naval Electronics Laboratory, San Diego, Calif. USS *Little Rock* (CLG-4) is the first recipient of the new system which is designed specifically for shipboard communications. Six telephone stations and a central switching station comprise the system, with phones located in flag plot, intelligence, supplementary radio, combat information center (two phones) and the chief of staff's office. Fiber optics cables will not emit or pick up electromagnetic radiation. This assures communication security and immunity from interference and cross talk to a degree not possible with electrical cables used in ordinary telephones. The fiber-optic telephone system is completely independent of any other communication system aboard ship. The ringing is readily distinguished from other shipboard sounds by a pulsating, high-pitched, audible tone assuring immediate attention to the call.

did you know?

New Construction

A $1,673,500 avionics facility is under construction at NAS Lemoore, Calif. The 39,000-square-foot, single story, windowless building is designed to consolidate all avionics and avionics supply functions now being carried out in four hangars and the aviation warehouse. Because of the highly critical nature of avionics repair and maintenance, the new building will be equipped with full air conditioning and elaborate air filtration systems, sound attenuation facilities, humidity control and a "clean room" comparable to a hospital scrub room. The building is expected to be completed by March 24, 1975, and is being built by the J. R. Youngdale Construction Company, San Diego, Calif.

Top Ship Handlers

Commander Naval Air Force, Atlantic Fleet has announced the winners in the annual ship handling competition for Atlantic Fleet aircraft carriers. They are Ltjg. Contantice L. Xefteris, USS *John F. Kennedy* (CVA-67); Ltjg. Gregory D. Meadows, USS *America* (CVA-66); Ltjg. Thomas A. Butler, USS *Independence* (CV-62); Lt. John E. Bagby, USS *Forrestal* (CVA-59); CWO2 John J. Sciuto, USS *Franklin D. Roosevelt* (CVA-42); and CWO2 Joseph Woods, USS *Lexington* (CVT-16). The winners competed with other officers on their respective ships. The purpose of the competition is to cite outstanding officers for their ability to handle the ship in a variety of real and simulated conditions. These include navigation, piloting, anchoring, getting underway, tactical maneuvering, positioning for replenishment, flight operations and emergency procedures.

Last Cougar Class

The last class of student aviators to train in the TF-9J *Cougar* has been graduated by VT-4 at NAS Pensacola, Fla. With USS *Lexington* (CVT-16) in drydock in Mobile, Ala., the class of 12 students flew to NAS Oceana, Virginia Beach, Va., in February to carrier qualify aboard USS *John F. Kennedy* (CVA-67). Future classes will train in the TA-4J *Skyhawk*.

Return of the Banshee

Late last year, three aircraft were transported to NAS Whiting Field, Fla., to be refurbished for the Naval Aviation Museum under construction at NAS Pensacola. Each training squadron received one of the aircraft, with VT-2 getting a McDonnell F2H-4 *Banshee*. About 1,200 man-hours were spent stripping, cleaning, repairing and painting the multi-engine, single-place, all-weather fighter. Extensive renovation was also done in the cockpit, with the ejection seat and instruments being completely removed and refurbished. The squadron maintenance officer said the only major difficulties encountered in restoring the aircraft were in getting parts for a plane that has been out of service for 20 years (see page 31).

Safe Flying Patrol Squadron Twenty-Two, NAS Barbers Point, Hawaii, has amassed a staggering 178,000 hours of accident-free flight operations over a 20-year span. The squadron, presently deployed to NAS Cubi Point, R.P., has flown operations throughout the Pacific in P2V-5 *Neptunes* and then P-3B *Orions*. The *Blue Geese* are led by Commander George C. Wheeler.

Golden Mikes USS *Forrestal* (CVA-59), NAS Brunswick, Me., and Attack Squadron Forty-Six have been selected as winners of this year's Commander Naval Air Force, Atlantic Fleet "Golden Mike" award for excellence in internal communications. The award is presented to the carrier, air station and squadron that best keep their personnel and dependents informed of happenings within the respective unit, ComNavAirLant and the Navy.

Orville Wright Award Ens. Richard D. Stark was presented the Orville Wright Achievement Award February 14 for his outstanding performance as a student aviator during training with Training Air Wing Two, NAS Kingsville, Texas. The award was presented by Rear Admiral George Ashford (Ret.), of the Order of Daedalians, during a ceremony at NAS Miramar, Calif. Ens. Stark is training with VF-124.

GRAMPAW PETTIBONE

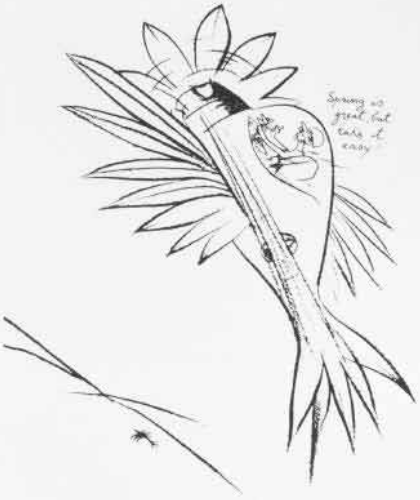
Glider Pilots

A lieutenant and a lieutenant junior grade reported to maintenance control to be briefed on a post-maintenance check flight in an S-2G *Tracker*. Following the brief and a review of the maintenance records, the crew went aboard the aircraft and conducted an uneventful preflight.

The run-up power check was good on both engines and the nacelles were clean and dry. Clearance for takeoff was received with no undue delay in tower release. The brakes were released and the throttles were smoothly advanced to takeoff power. All gauges indicated go! At approximately 95 knots, just prior to liftoff, an acceptable torque pressure split was noted between the port and starboard engines with the port engine lower.

At 100 feet in the air, the port engine torque pressure backed off more, and the aircraft swerved to port. Having passed the abort gear and without sufficient runway remaining to land, flight was continued.

The gear was raised and power was reduced to 50 inches manifold pressure (map) on both engines. The port engine continued to back off and



swerves were felt to that side. Having stabilized the aircraft in a climbing altitude, the pilot commenced a turn to downwind and explained his intentions to the copilot via UHF so that both he and departure control would know why the aircraft was deviating from departure instructions.

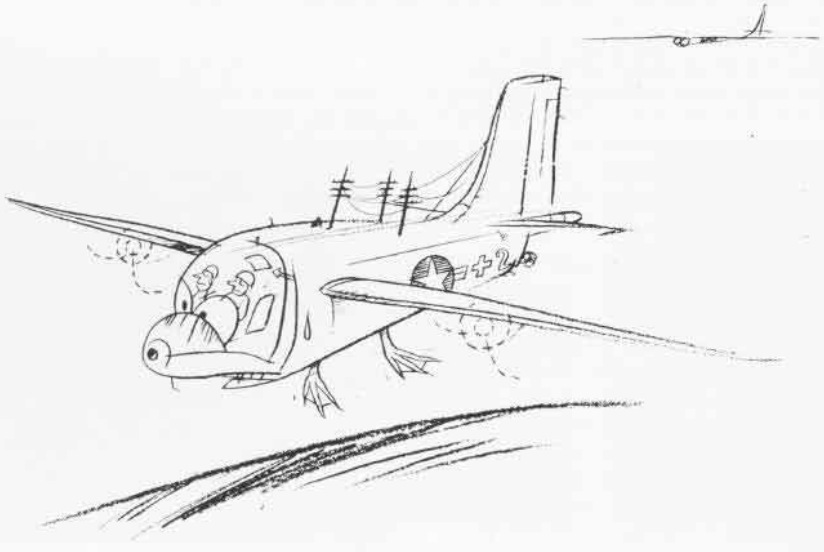
Meanwhile, still in a climbing left-hand turn at about 300 feet, the port engine oil temperature began to rise. Passing 600 feet, the port chip light illuminated and the port engine began to run rough. The S-2 was now heading downwind and attempting to gain altitude. The pilots agreed that the port engine should be secured. The tower was notified and the checklist executed. The feathering cycle was completed normally and the aircraft was trimmed at 800 feet and 120 knots, with full increase rpm and 50 inches map on the starboard engine.

The in-flight secure checklist had been commenced. At this time, both pilots noted *two chip lights*; the one on the port side they expected to see but the starboard one presented the next interesting three minutes of flight !!!! Almost simultaneously, the starboard oil pressure dropped from 65 psi and the starboard engine began losing power. There was no way to make the 180-degree position.

The pilot cut throttle on the starboard engine with hopes of maintaining electrical and hydraulic power and not aiding and abetting a sudden engine seizure. At this particular time, simultaneously with throttle closing, the pilot banked the aircraft over 30 degrees to the left, nose down. He notified the tower that they were landing midfield (in reverse direction on the runway from which they had taken off) and would give a gear check.

The gear was lowered and indicated down and locked by 200 feet, and then the flaps were extended two-thirds. The gliding S-2 was now about 20 degrees off runway heading and around 100 feet with the nose coming up to reduce airspeed. Line-up on final was a shade to the right of centerline, but was corrected prior to touchdown which was a little fast at 112 knots.

On touchdown, the pilot cross-checked the instruments and noted the starboard oil pressure was zero and that both chip lights remained illuminated. Brakes were not required as the aircraft slowed very quickly and turned off the duty runway.



ILLUSTRATED BY Osborn

The flight time was broken down as follows:

Total flight time, two engines — three minutes.

Total flight time, one engine — two minutes.

Glider time — one minute.

Grampaw Pettibone says:

Fantastic! Great! Stupendous! Cool! Tremendous! These two lads remind me of a duck: calm and cool on the surface but paddling like fury underneath. I redesignated both lads Naval Glider Pilots in addition to Naval Aviators. What else can be said but a big Well Done for Lt. R. J. (Moe) Moriarty and Ltjg. Carl Dodd.

Editor's Note: It's a rare day when Gramps is pleased enough to raise the shield of anonymity and mention flight crews by name. Lieutenants Moriarty and Dodd have joined a very exclusive list.

Dump Something

Following a routine carrier-based briefing, the pilot and RIO preflighted and manned their F-4J *Phantom*. Turnup and post-start checks were normal. The F-4 was then taxied to the catapult where normal positioning and hookup were accomplished. Engine instruments during run-up to military power while taking tension were normal and verbally passed to the RIO.

Upon signal from the catapult officer, the pilot selected afterburner. Instruments were again checked and all were indicating a normal condition. After receiving "ready to go" from the RIO, the pilot saluted and the cat officer, after making his checks, which included a thumbs up from the power plants troubleshooter, gave the launch signal.

Just prior to hold-back release, both crew members described hearing and feeling a "thump" from the after section. The RIO states that he felt a thump under his feet. The pilot glanced at the cat officer hoping to see a suspend signal, but when he didn't, he maintained full power and remained positioned for launch. Witnesses state that a large orange flame billowed from the aft section of the starboard engine as the launching stroke commenced. The orange flame was noted to partially extinguish approximately two-thirds down the cat track.

The pilot knew something was wrong, but he was satisfied that the cat shot was a good one. He decided to get his gear up and flaps to one half and fly straight and level, foregoing any clearing turn. The pilot later stated that on the catapult stroke the throttles transmitted a funny sensation in his hand.

Following launch from the carrier, the pilot felt an abnormal acceleration. The RIO asked the pilot if he was in max afterburner and the pilot stated he was. The pilot continued to monitor his instruments and nosed down slightly to decrease the angle of attack and gain airspeed. During a period of noticeable settling, the ship transmitted "you're settling." The RIO states he informed the pilot to jettison everything. The pilot, who was concentrating on flying the aircraft, did not hear the RIO.

During this time frame, numerous "eject" calls from many sources were made to the F-4. As the aircraft continued to settle, the pilot told the RIO to get ready and, as the descent continued, he transmitted "eject."

The RIO initiated ejection via the alternate seat pan handle. The pilot, seeing the water approaching, initiated his ejection using the seat pan handle. Both ejections operated as advertised. Both crew members were picked up by helo and returned to the carrier.

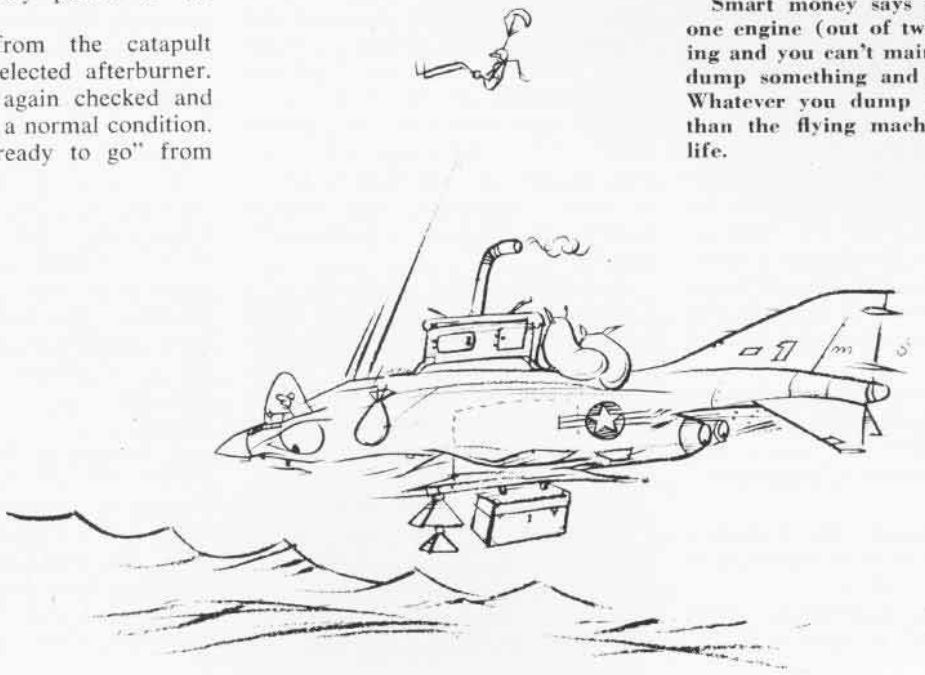
The accident board concluded that a malfunction of the right engine coupled with the pilot's failure to jettison external stores were the causes of this accident.

Grampaw Pettibone says:

Great balls of fire! What in the world was the lad thinkin' of? This driver was concentratin' on his instruments so hard that he "gagged" his brain! What's that? Did I hear someone say aviators must possess "division of attention" capability?

Apparently the RIO tried to be of some service by telling the pilot to jettison external stores, but—he didn't hear; concentratin' too hard.

Smart money says when you have one engine (out of two) malfunctioning and you can't maintain altitude — dump something and see if it helps. Whatever you dump will be cheaper than the flying machine — and your life.



The Circular Runway

By Lt. Gary Caron

The "circular landing theory" was successfully proven in a recent series of flights by the Navy at the General Motors Corporation's Desert Proving Grounds track near Mesa, Ariz.

The pilots, Commander Lloyd H. Smith and LCdr. George H. Furlong, from the Naval Weapons Evaluation Facility (NWEF), Kirtland AFB, Albuquerque, N.M., and Lt. Peter N. Anderson of Air Development Squadron Five (VX-5), Det Alfa, Kirtland, easily made dozens of landings and takeoffs on the completely circular GMC track.

The curvilinear landings culminated several years of concerted effort by a circle of R&D activities.

This all happened in a "roundabout" way.

To begin with, the idea of landing an airplane in a circle is not really as farfetched as it might seem.

There are many potential advantages to be gained by using a circular runway, some of which are: an infinitely long runway available; elimination of the problems associated with takeoff aborts; no runway overrun problems; reduction of taxi length and time; a runway into the wind, regardless of wind direction; the simplest possible low visibility approach (circular); reduced airspace required for instrument approaches; and reduced ground area required for airport construction.

Perhaps the prime reason for using a circular runway is the space saved. Modern airports cover from ten to sixteen square miles. A circular runway would require only three to four square miles, with air terminal buildings located in the center, and taxiways spoking out to the runway.

The circular runway concept was first suggested to the Navy by the late LCdr. J. R. Conrey in 1961, while stationed at NWEF.

LCdr. Conrey's original circle size was based on a standard rate turn, at 125 knots, in a no-wind condition. This was later refined to a circle size of 32,000 feet in circumference, measured about the imaginary "runway" centerline.

To accommodate the different landing speeds of various aircraft, the runway is sloped increasingly upwards (parabolically) from the inner portion to the outer ridge.

This facet tends to naturally steer the airplane toward that portion of the runway which matches its ground speed, just as an automobile experiences lateral forces when rounding a corner at a speed greater, or lesser, than that for which the turn was designed.

If the airplane is landed too fast, on the relatively flat inner portion, it will try to roll to the outside. If the airplane touches down too slow, on the steeply-sloped outer portion, it will drift inboard.

The General Motors track in Arizona represented a ready-made and nearly ideal test facility for the project. The track is somewhat smaller than the theoretical track, being exactly five statute miles, or 26,400 feet, in circumference. It is 45 feet wide and graded from nearly flat on the inside to 22 degrees of bank at the outside. Equilibrium speeds for the track vary from 50 mph at the inner radius to 174 mph (about 152 knots) along the outer edge.

After receiving the project, NWEF assumed contractual authority to reach an agreement with General Motors for the use of the test track. GMC, although receiving no compensation for the project from the Navy, cooperated fully.

For the actual flight tests, NWEF borrowed a T-28C from VX-5, NAF China Lake, Calif. The T-28 appeared to be a suitable airplane to use because of its large propeller-to-ground clearance. The T-28's inherent directional stability during ground roll, owing to its tricycle landing gear, was considered to be an additional advantage.

A drawing of the test track cross section was obtained from General Motors and compared with the silhouette of a T-28 drawn to the same scale. The wing tips cleared the track by almost three feet in the most critical position, and even cleared by a few inches when the plane was tipped

in simulation of a flat tire and collapsed landing gear oleo.

The three pilots selected by NWEF to fly tests had varied aviation backgrounds.

The project officer, Cdr. Smith, had over 10,000 hours flight time, in everything from gliders to globe-girdling jets. Merely landing in a circle could hardly ruffle the feathers of a veteran "bagger" like Cdr. Smith, whose background includes, among other things, crop-spraying, charter flying, sky-writing, advertising banner towing, transoceanic transport driving, R&D project work at Patuxent River and NWEF and heavy attack carrier operations.

LCdr. Furlong's credentials included 1,650 hours flight time—mostly in F-11As and F-4Bs—and the distinction of being a finalist in the screening for the new astronaut group in 1963.

Lt. Anderson's log book showed over 2,300 hours, including training command time in T-28s and T-34s, Fleet duty with AirLant and AirPac in A-1s and all-weather jet time in VX-5 as the squadron's project officer for the operational evaluation of the A-6A.

Pilot refresher training in the T-28 was conducted at Kirtland Air Force Base. Major emphasis was placed on making touch-and-go landings in an arc, and on maintining a constant speed during ground roll-out.

On March 7, 1964, the T-28 and a NWEF C-47, with photographers and support personnel aboard, were flown to Williams AFB, Ariz., which is only two miles from the test track. At Williams, Cdr. Smith conducted a final briefing for all personnel involved in the project, including Air Force support personnel. Williams provided a crash crew, mobile tower crew, crash helicopter crew, and an additional helicopter for photo work.

In addition to the movie-camera equipped helicopter, other film coverage included: one high-speed movie camera set up inside the track; one movie camera in a special high-speed Chevrolet provided by General Motors; and a still camera handled by a roving photographer.

Dawn edged across the desert on the morning of March 8 to provide shadows for the Navy, Air Force and GMC people already at work. Cdr. Smith launched out of Williams on the first sortie and circled the track several times, to get the feel of things.

After three constant speed touch-and-goes, he set the T-28 down at 80 knots indicated airspeed, decelerated to 50 knots, and then throttled forward to 80 knots again and became airborne.

The aircraft responded smoothly and predictably during the "touch-and-slow." Cdr. Smith circled back for another approach and this time he drove the plane all the way in to a full stop.

All subsequent landings were made to full stops.

LCdr. Furlong and Lt. Anderson made their debuts on the track under deliberately different circumstances.

This was done to determine what advance briefing and training requirements should be considered, as a necessary minimum, to adequately prepare pilots for the circular landing situation.

LCdr. Furlong observed a takeoff and landing, from the back seat of the T-28, then moved to the front seat for his series of takeoffs and landings.

Lt. Anderson observed all the other operations, from the deck, and was briefed on the physical factors of the test area, such as dimensions, possible track obstacles, etc., but was not informed of the pilot psychological aspects and aircraft control forces and displacements.

Both pilots adapted quickly to the circular situation, and, surprisingly, they reported separate but similar reactions.

A primary consideration in the project was to find out the psychological reaction of the pilots.

Each pilot had the impression he was "flying into a hole."

The track being much narrower and more steeply curved in cross-section than an ideal circular runway, this problem might not normally exist. In any case, after several landings this feeling of flying into a hole disappeared.

At first, each pilot had to deliberately fight off the tendency to "level the wings." This tendency, resulting in less than enough angle of bank, caused the airplane to drift slightly to the outside of the track.

Positioning the aircraft over an imaginary equilibrium circle—for a predetermined speed—was easy when the circle (speed) coincided with a painted line on the deck. When the speed required putting the nose wheel more than three or four feet from the painted line, it became a problem of pilot judgment. However, after several landings and takeoffs, this was determined not to be a significant problem. Touchdown/takeoff speed was found not to be a critical element. In any case, color-coded lines, or flush-deck, color-coded lights, could probably be used to indicate the different equilibrium speeds for lineup for a circular runway.

The tests confirmed the validity of LCdr. Conrey/NWEF's theoretical computations.

Touchdown over the correct equilibrium circle matching the airplane's groundspeed resulted in extremely stable rollouts. Each pilot was particularly impressed by the less than "normal" control force required during both landings and takeoffs. The airplane actually appeared to have a greater positive stability in both yaw and roll than on a flat straight runway. Landing outboard of the optimum equilibrium point proved to be more "comfortable" and required less control displacement than landing inboard of the proper point.

Weather was not a factor, except for surface winds. The early landings were made into a six knot headwind. Later, the wind varied in direction and intensity with the worst condition being a direct crosswind of gusts to 12 knots. Theoretically, a headwind should require lesser — and tailwind greater — angle of bank to hold the airplane over the runway. However, the effects of the surface wind on angle of bank, control forces and control displacement were negligible.

It is possible the tests may herald an entirely new concept in airport construction.

In addition to the Navy, the Army and several civilian aircraft companies have shown an interest in the possibilities of circular airfields as a result of the tests.

As a result of NWEF's flight tests at the General Motors test track, the standard axial runway may someday be as obsolete as the Ford Tri-Motor.

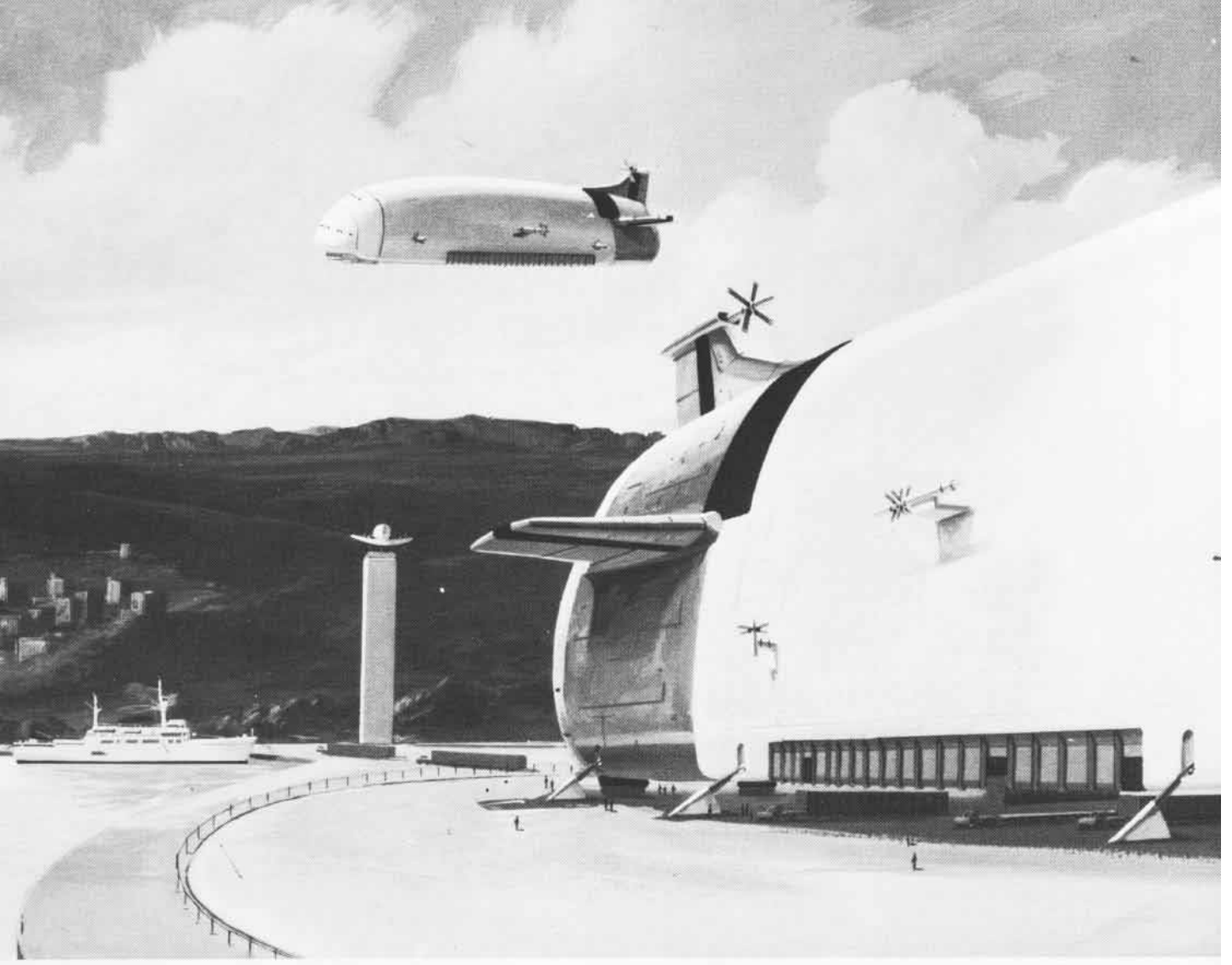
This article first appeared in *Naval Aviation News* in March 1965.

SPEAKING OF

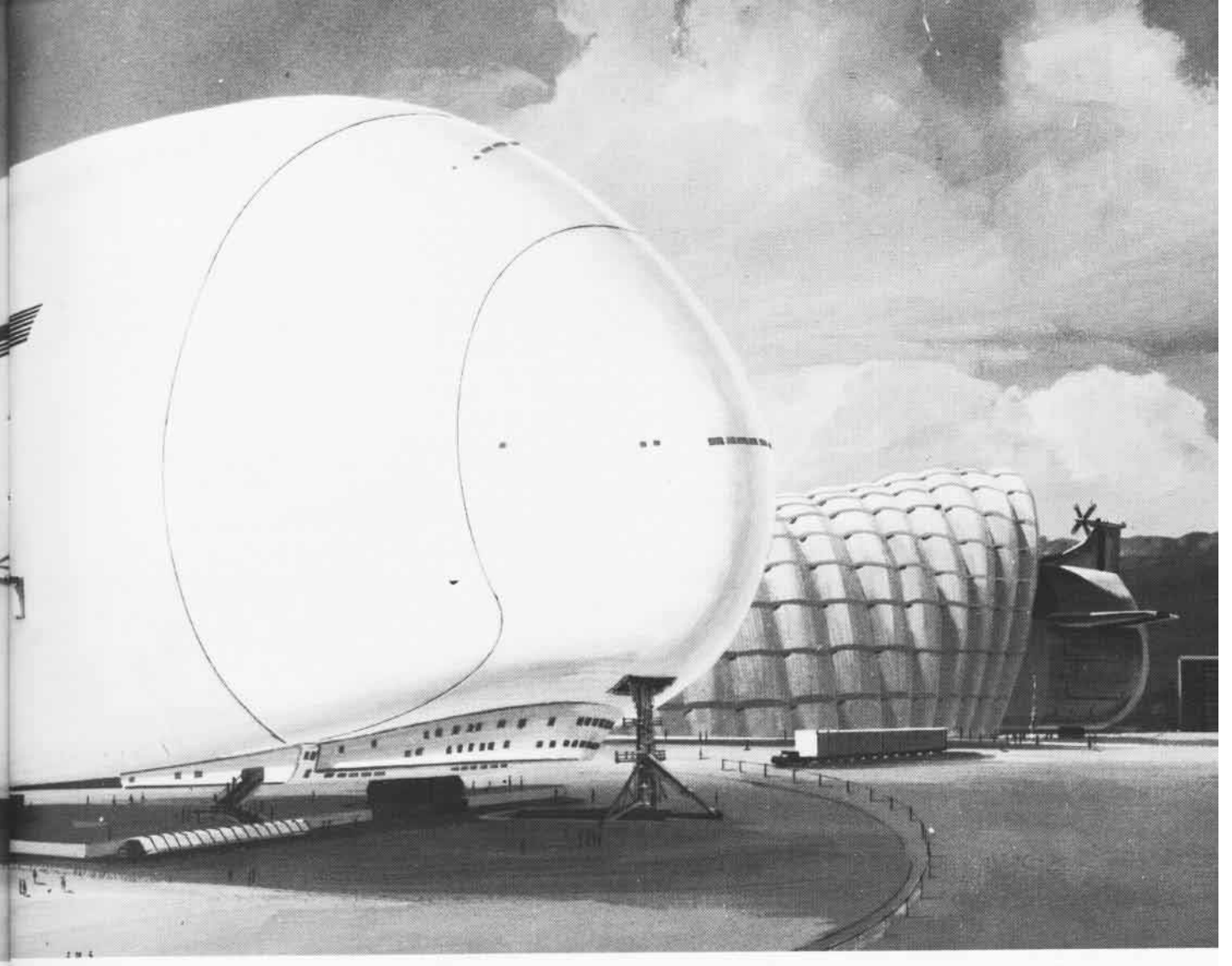
STRANGE

Kurt R. Stehling and J. Gordon Vaeth display two environmental airships at work in artist's concept of modernized dirigibles. Rare French print, below, depicts first balloon ascent.

SHAPES!



A compelling case for THE HELIUM HORSE



Unglamorous? Yes. Slow? Surely. But a potential million-pound payload would go far to overcome these drawbacks and establish the airship as a prime cargo carrier of tomorrow. Above, artist's conception of the helium horse being readied for work.

Airships — longer than three city blocks and of the rigid kind with a hull shape maintained by internal framing — may one day be taking to the skies again.

Lighter-than-air craft of this type haven't flown for 34 years. Not since 1939 when Germany's *Graf Zeppelin II*, sister ship of the burned *Hindenburg*, cruised off England to sample British radar transmissions days before the outbreak of World War II. Hangared when hostilities began, this last of the great dirigibles was dynamited the following year and its aluminum used by the Nazis for airplane production. Airships of such size and type have been a dead issue ever since.

But no longer . . .

Increasingly there's talk of bringing them back. More and more they are being proposed for the next major U.S. aerospace initiative. Some people are even calling them the dream vehicle of tomorrow.

Yet the hydrogen fire that destroyed the *Hindenburg* on May 6, 1937, while completing its 37th commercial ocean crossing, supposedly ended forever America's interest in these flying cigars. What has changed the picture so drastically?

Engineers have begun to look at the rigid airship in a different light, for one thing. No longer just in historical terms of what it could do in the 1930s but, instead, what it can accomplish in the future if given modern capabilities. Progress and breakthroughs in technology haven't been applied to the design and building of a large dirigible in almost 40 years. Give to it, these engineers say, the level of technical achievement found in the jumbo jets, in *Skylab*, or in the space shuttle, and there's no reason why it cannot be

by Kurt R. Stehling and J. Gordon Vaeth

made just as safe, just as reliable, and, in its own way, just as useful as the airplane.

The growing enthusiasm for airships is also explainable on environmental grounds:

Land usage, particularly for airports, has become a nationally sensitive issue. Opposition to the transformation of ever more countryside into acres of concrete and to the introduction of aircraft exhaust pollution and engine noise must now be taken into careful account in planning the nation's aeronautical growth. It explains much of the aerospace industry's interest in quiet V/STOL (vertical/short takeoff and landing) aircraft. It is the basis for the concept of building offshore airports.

The dirigible is actually a VTOL vehicle, with a potential payload as great as a million pounds. It makes no takeoff and no landing run. It needs no costly heavy-duty runways. It simply floats up or settles down. It has to have a clear approach and departure path, of course, but on the ground all it requires is a flat clearing — a grassy field will do—a little more than twice its length to permit it to weather vane around a mast.

Operational concepts being developed even foresee airship "arrivals" and "departures" *without landing*. Cargo and passengers would be taken on and off via airplane hookon. Or, in the case of freight, shipments would be winched up and down while the dirigible hovers overhead. With this operating mode, land usage can be kept to an absolute minimum.

Nor is that all. The dirigible is inherently clean, can be propelled by steam. Powered by large, slow-turning, counter-rotating, stern-mounted propellers, it can also be made exceptionally quiet. Thus it holds promise of being permitted to operate exempt from airport curfew hours or other flight restrictions imposed by environmental considerations.

The airship is attractive, also, in light of the need to conserve energy and energy resources. For an aircraft, it makes efficient use of energy because its lifting gas is what enables it to fly. Since it needs propulsive power only to move through the air, its energy needs are remarkably low.

A dirigible of the 1970s would not simply be an improved larger version of the *Hindenburg* or other pre-World War II rigid airships, such as America's *Akron* and *Macon* or Britain's R-100. (That would be rather like building a modernized version of the Ford Tri-Motor!) Rather, keeping in mind the remarkable recent advances in propulsion, materials, guidance and control, navigation, aerodynamic theory, electronic data management, and structures, it would probably be a very large, say 25 million cubic foot, craft with a pre-stressed metallic or plastic skin and with a minimum of internal girderwork. The skin might even serve as a combination gas container and structure.

Such a vehicle, capable of 100-150 miles per hour, and measuring something like a thousand feet long and 300 feet in diameter, would have a gross lift of about 700 and a useful lift of 400-500 tons. It could be powered by a single lightweight, non-polluting, quiet, liquid-fueled steam turbine driving counter-rotating tail propellers, a distinct contrast to the numerous diesel and gasoline-burning engines (as many as eight at a time) carried by airships in earlier days.

To avoid another *Hindenburg* fire, it would be inflated with helium. The latest lightweight, high-strength alloys would be used and key structural elements made of fiber-reinforced composites. Helium might be cycled, alternately vaporized or liquefied, to help control buoyancy, something done in the past by dropping water ballast and valving off gas. Excess heat from the turbine could perhaps be conducted via the helium to the metal skin and that made use of as the world's largest airborne radiator.

A threefold increase over the 7 million cubic feet of the *Hindenburg* may seem extreme, but designers are no longer afraid of bigness (witness the development of the supertanker), and airship efficiency, like that of the tanker, increases dramatically with size. Helium capacities could go as high as 50 million cubic feet. Actual volumes, however, as well as speeds, ranges, payloads and altitude performance, will vary according to the particular design and its intended role or application. It would be a mistake to think of dirigibles as limited to low altitudes, incidentally. German zeppelins of World War I, specially lightened and designed for height climbing so that they could bomb London, had operational ceilings approaching 25,000 feet.

From the days of "stand-up aviation" —

Launching Air Show Publishers new book, "Shenandoah Saga," on the Golden Anniversary of the Navy's first helium-filled large rigid airship, Annapolis author Tom Hook (right) welcomed this Navy trio to an illustrated talk at a recent Smithsonian Institution Lunchbox Forum. Captain Joy Bright Little Hancock Ofstie (second from right), twice widowed by the budding airship service, was the first editor of Naval Aviation News and was later WAVE Director in WW II. Veteran airshipman Vice Admiral T. G. W. "Tex" Settle and his wife also were honored guests. Adm. Settle has been the subject of NANews articles.

The End of An Era?

Inside the landmark Hangar One at NAS Moffett Field these twisted tracks are among the last vestiges of lighter-than-air activity at the California station. When the giant structure was built in 1933 to house the airship USS Macon, railroad tracks were laid to guide the mobile mooring mast into the huge building.

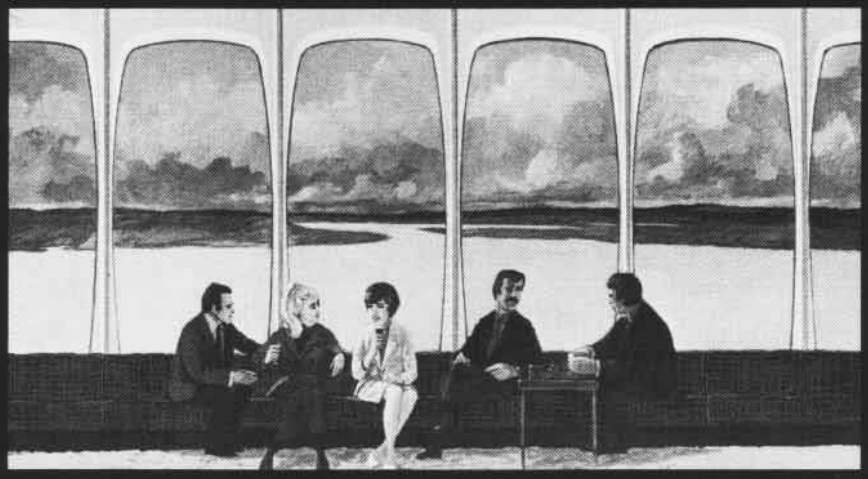
The Macon crashed in 1935 and, as time passed, other uses were found for the edifice. A succession of Army planes, WW II blimps, Navy transports, jet fighters, light attack planes and finally the P-3s of VP-31 have used the hangar.

The floor, laid over 40 years ago to support a lighter-than-air dirigible, proved unable to support the large sub hunters and is now being resurfaced.

By July only memories of the huge self-propelled mooring mast which guided the monster airship into her berth will remain.

Photo by PN2 by Tim Gilliam

Aren't Airships Really Dangerous?



Leisure, elegance could mark cruises in airships, striking a welcome blow against crowded seating, noise, vibration. The ship could be employed as an aerial resort.

Did the Hindenburg fire in 1937 end forever the era of the great airships? The authors think not. A doubt, inspired by the dirigible wrecks of four decades ago, lingers about this question . . .

Now little remembered is the fact that the finest engineering talent in the country was asked through the President's Science Advisory Board to provide an answer following the loss of the Navy's *Macon* in the Pacific in 1935. The so-called Durand Committee resulted, and it included Stephen Timoshenko, father of mechanical engineering, and Theodor von Karman, perhaps the most renowned of all names in the aeronautical sciences. The Committee found unanimously: ". . . *with special reference to airships of the larger sizes, we believe that it is practicable to design, construct, and operate such airships with a reasonable assurance of safety.*" The 590 flights (144 of them ocean crossings) of the million-miler *Graf Zeppelin*, the 8 years of operational use seen by the USS *Los Angeles*, and the 12-year service of the pioneering metalclad, the ZMC-2, support that conclusion.

Those still unconvinced of the dirigible's ability to survive the weather should recall that every day countless aircraft, many far more turbulence-sensitive than a large airship, are safely and routinely guided around dangerous situations. Tomorrow's dirigible, assisted by radar, direct readout weather satellite pictures, special advisories, and speeds high enough to outrun storms, will be also. This, plus stronger framing, greater structural flexibility, and a computer-based control system to take the ship's pulse in flight and prevent excessive forces from being applied to the fins and hull, will do much to provide the level of safety required.

No matter its size or capabilities, the dirigible, in being reborn, will necessitate also the rebirth of a lighter-than-air technology long abandoned. Designers and constructors will have to start again almost from scratch. Theirs will be the task of applying to the rigid airship the modern technology developed out of NASA, Defense Department, and industry programs. The opportunities offered them for creative engineering and technical innovation—including the application of nuclear propulsion—will be virtually without limit.

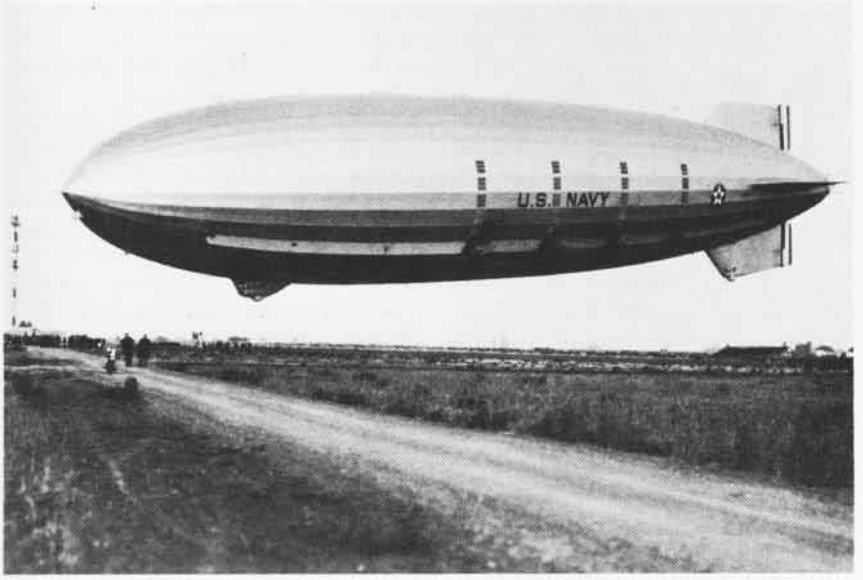
Engineering challenge and appeal, however, will not by themselves revive the airship. It must meet the needs of the times and meet them better than can other vehicles. It must have capabilities that are both advantageous and unique.

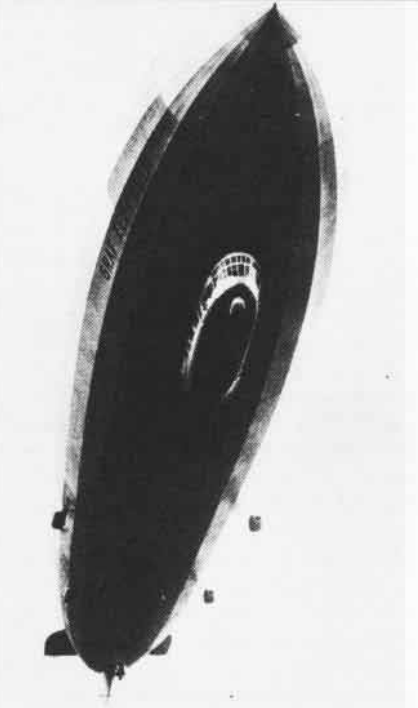
Various uses are foreseen for the dirigible that fulfill these requirements. They range from recreational vehicles, to scientific platforms, to humanitarian ships of international goodwill, to carriers of cargo. Let's look at some of these applications, starting with the "flying cruise ship."

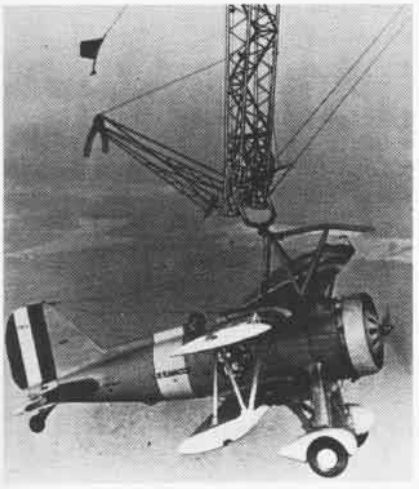
The *Hindenburg* was an airborne hotel. Inside its cavernous hull, it provided the 50 passengers — who paid $400 for a North Atlantic trip between Frankfurt, Germany, and Lakehurst, N.J. — with staterooms, lounges, promenade decks and even a bar and smoking room, the latter kept slightly pressurized to discourage the entry of any free hydrogen that might be about. Noise level was remarkably low, only 40 decibels. Vibration was virtually non-existent, the water or wine in the goblets on its dining room tables showing hardly a ripple. It was so steady and stable that cut flowers could be placed in tall vases with little risk of tipping over. The meals, selected from the ship's larder and cooked on board in an electric kitchen, were first rate. And no one was ever airsick. The crossing was so restful and appealing that passengers had a saying: "You fly in an airplane, but you voyage in a zeppelin."

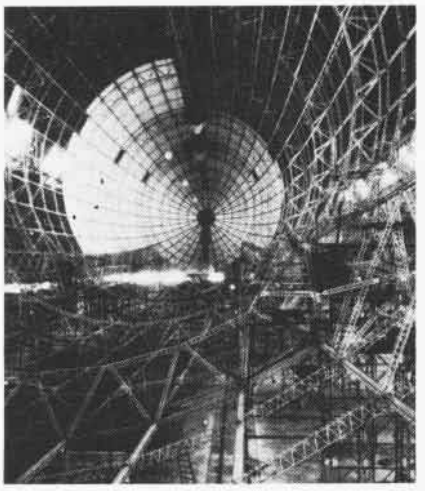
That same appeal could be recreated today. Only now, 200 to 500 could be carried who would dine and dance in a glass-covered "ballroom beneath the stars," located atop the ship. Their bedrooms and public rooms would rival those of a luxury resort. At an altitude of a thousand feet, they would glide quietly over some of the most spectacular sights and scenery the world has to offer, stopping in midair for a closer look through the ship's draft-proof open windows before moving on. Those wanting to "go ashore" could do so, geography permitting, by helicopter or airplane carried on board and used as a shuttle back and forth to the ground.

A trip up the Amazon . . . a photographic safari to observe the plants and animals of distant rain forests,









One of most famous dirigibles of the past was the 6.5 million cubic foot Akron, top, landing at San Diego. A $5.4 million ship, it had tail design weakness. Below right, view of its cavernous interior. At left, a Curtiss Sparrowhawk hooks on to Macon, the Akron's sister ship, in midair. The trapeze retracted, lifted plane inside. Such maneuvers would be routine in the future. Above, the fabled Graf Zeppelin, which flew the Atlantic in the 20s and the 30s.

The Navy's ZMC-2, informally known as The Tin Bubble, was completed in 1929. Its unprecedented all-metal, 202,000-foot hide, executed in 0.0095-inch Alcad alloy, was of revolutionary design. Dismantled in 1941, the Bubble is being eyed as predecessor of airship design to come.

THE HELIUM HORSE

'The answer to achieving successful levels of survivability lies in employing the airship in missions for which it is particularly suited and in tactical environments for which it has been designed.'

jungles, and plains . . . an airborne sightseeing tour of the ruins of ancient civilizations in Latin America . . . a history-laden cruise along the perimeter of the Mediterranean (with particular attention to the fabled islands of Greece and the site of Carthage) . . . an aerial exploration of the Spanish Main . . . and, in summer, a flight above the permanent ice pack to the North Pole . . . these are some of the unusual sightseeing experiences a dirigible could offer the public.

Nor is the appeal of the airship for this purpose solely recreational. The cruise trade now belongs almost entirely to foreign flag vessels. As a new type cruise ship, offering something excitingly different, the dirigible should prove a popular drawing card to U.S. and other travelers alike. Its role in helping keep American dollars at home and in attracting foreign currency should very substantially reduce that portion of the balance of payments deficit attributed to overseas recreational or tourist travel.

As for transporting passengers point to point, the 100 to 150 miles per hour dirigible is not a likely contender with the jet airliner for moving people who have places to go. Admittedly there is probably a segment of the non-flying American public that would be attracted to the airship *vis-a-vis* the airplane. And admittedly airships (the first *Graf Zeppelin* and the *Hindenburg*) provided a transoceanic service at a time (1928-1937) when it was beyond the capability of the airplane to do so. Even so, dirigibles should not today be considered an economic competitor to the airplane for routine passenger carrying. Their role is more properly glamour trips and luxury travel — for which there is plenty of unfilled demand.

The airships' on-board roominess and steadiness in flight, so useful in making passengers comfortable, could be put to good use in the service of science as well. These characteristics, plus the ready availability of its structure for the mounting of equipment, would make it specially suitable as an environmental sensing and work platform, one with very long range and very long staying power.

Its hull could mount antennas larger than any ever carried by an aircraft (two hundred-fifty feet in diameter, for example). With this increase in size would come, also an increase in gain and performance. New frequencies might become practicable for use in radiometric work.

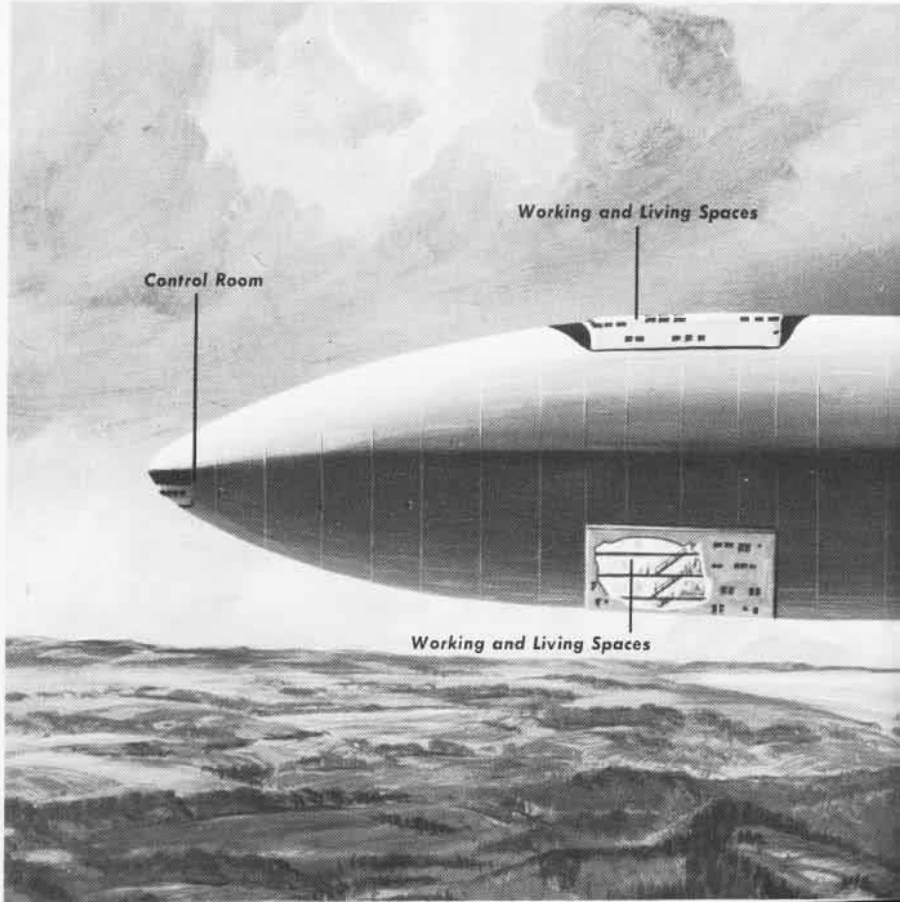
For underwater studies, very large sonar arrays could be towed and without disturbing interference of surface ship hull and propeller noises.

Very high resolution cameras — airships have always made superb photographic platforms — would be carried . . . as would laser profilometers . . . gravitometers . . . magnetometers (trailed, perhaps, to keep them at a distance) . . . and various atmospheric and oceanic sensing devices.

Not to be overlooked is the substantial data processing capability that the dirigible would carry with it wherever it went. Observational results could be obtained, at least in rough, on the spot. An experimenter could thus sort out quickly the data that seemed questionable and repeat the test or observation, using the same or different techniques, instruments, frequencies, or spectral intervals. In making his original or repeat observations, he would appreciate, in many cases, the ability given him by the airship to do so while standing still in the air.

As a remote sensing vehicle, the dirigible could play a major role in environmental and earth resources work . . . also as a measurer of "ground truth," obtaining temperature and other data used to evaluate the accuracy of such values as reported by satellites or other aircraft.

But it is for oceanographic work that the revived and modernized rigid



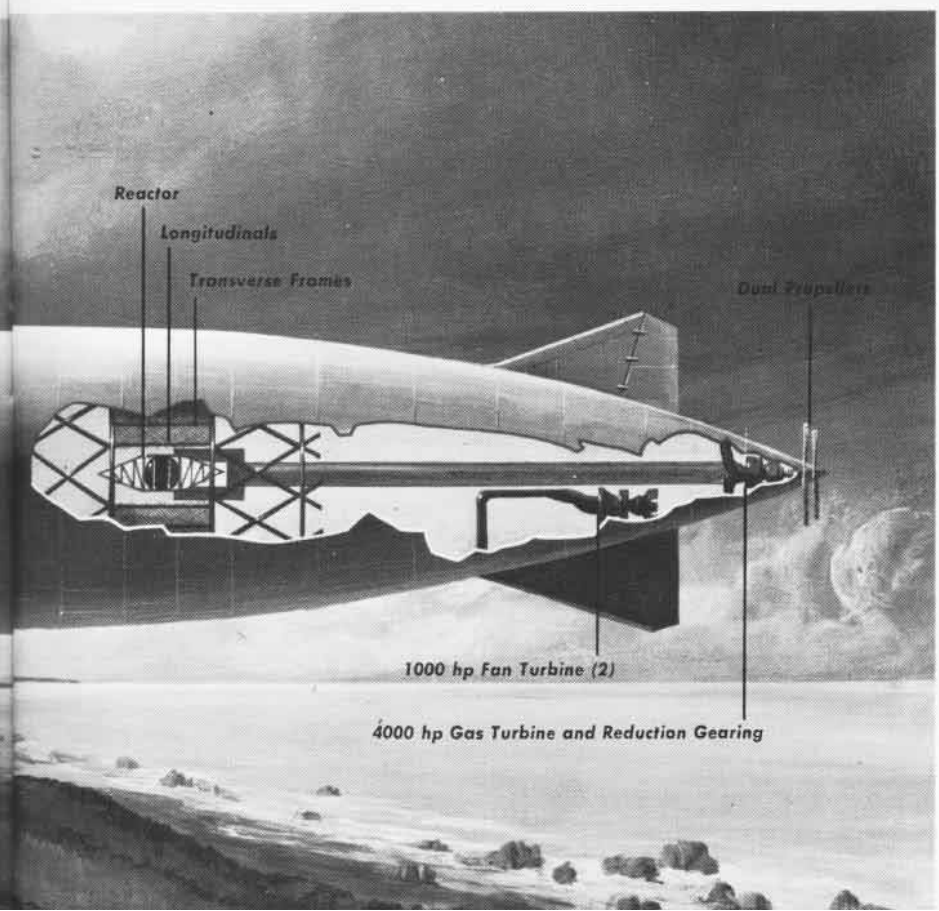
A version of tomorrow's giant airship approximates 12.5 million cubic feet, is nuclear-propelled, is under development by Boston University scientists.

airship holds promise of being particularly useful . . .

Unlike surface craft, it would not be sensitive to sea state. Its transit time to, from, and between stations would be very much shorter. Its range, about 10,000 miles if non-atomically powered, unlimited if atomically powered, could be extended by in-flight refueling from ships at sea. Endurance could be further prolonged by anchoring or engaging in protracted hovering flight. Ice-blocked regions, normally out of bounds to surface ships, could be overflown and reached. The air/sea interface could be sampled from above, using a sensor string, and with a minimum of disturbing influences such as propeller slipstream or rotor downwash (as would be the case if an airplane or helicopter were used). As for aircraft, several of them would be based on the dirigible to be deployed, like launches from a survey ship, to extend its radius of observations.

Buoys could be lowered from its belly without the danger, so common with a surface vessel, of damaging them by striking the hull while they're being put over the side in heavy seas. Repeating the process in reverse, it could also retrieve and bring them back on board for servicing and maintenance. With a surfeit of power provided by nuclear propulsion, this airborne tender might even recharge a buoy's power supply in mid-ocean by maneuvering into position close overhead and aiming microwave energy at it. As mother ship to one or more research submersibles, to sounding and survey boats, and also to an underwater habitat, it would keep its winches busy indeed.

The oceanographic contributions possible by the dirigible, its aircraft, buoys, submersibles, and workboats, are considerable. With its speed, range, and sonar, it should be able to keep up with and successfully track the migration of whales. Given the advantages of a slow-moving airborne platform, who knows what it might do in the way of marine surveys, location of promising fishing areas, and the clean-up of marine pollution? Able to operate above and well clear of an oil spill or sizable accumulation of tar, plastic, or other particles, the airship should be in an advantageous position to deal with same. Crisscrossing the area, it could lay down chemicals or physically mop it up by towing booms, sweeps or other devices to clean the surface. Not out of the question would be scooping or vacuuming up the surface water and straining out the gunk before dumping it back. One of its more important environmental roles in years to come may be that of an airborne scavenger of marine pollution.



For natural disaster relief, too, a dirigible seems ready made. Delivery of food, water, medical supplies, shelter, clothing, and other urgently needed items to survivors is the inevitable aftermath of every such calamity, be it storm surge, flood, earthquake, landslide, or whatever. Often the runways and airports by which such help would be flown in have been crumpled or washed away. And if helicopters are used, the loads they can carry over the distances required may be pitifully small compared to the need.

In this kind of situation, a large airship, fitted out as a flying first-aid center or hospital and carrying perhaps 500,000 pounds of emergency provisions and equipment — including heavy stuff like power generators and bulldozers — could reach the scene, take up a hovering position overhead, and lower its cargo of help to those on the ground. The seriously injured it would hoist on board for medical treatment.

While performing these roles, the ship would be relatively unimpeded in its operations by the extent or severity of the destruction on the ground. Conditions accompanying a major natural disaster may be so chaotic that provisions airlifted in cannot be moved or distributed.

Not so if brought in by airship! Not only could it deliver its supplies and equipment but it could also:

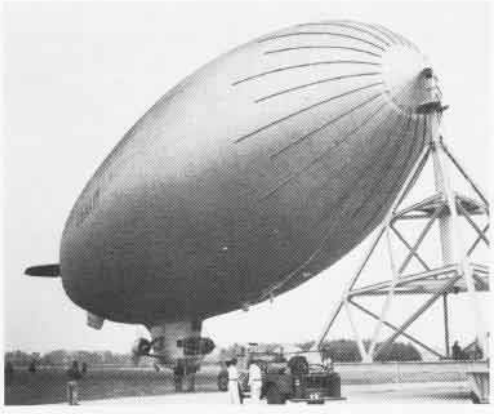
Illuminate the stricken area by night with powerful searchlights provided on board for the purpose, and

Serve as a vantage point for overseeing rescue, firefighting, and demolition activities going on below.

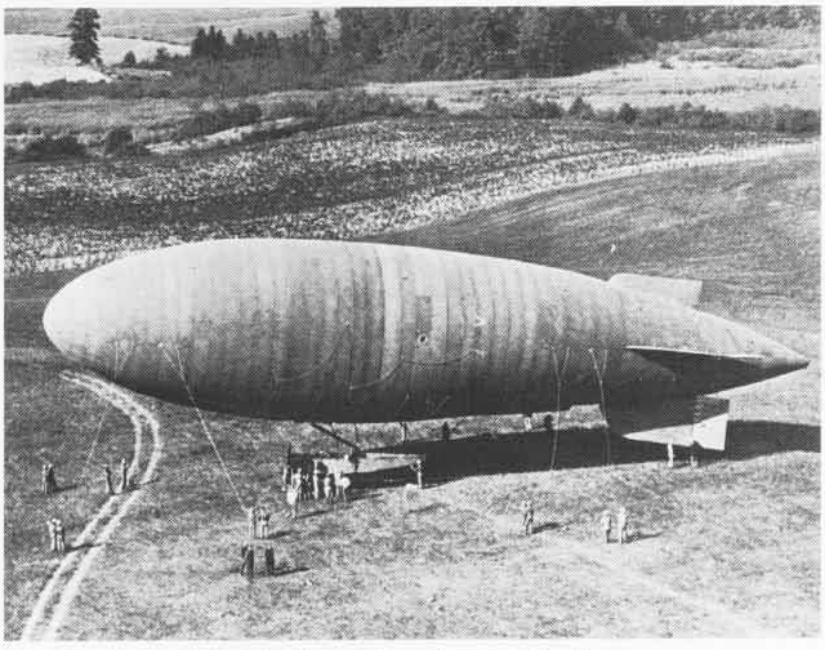
To be sure, the dirigible is no match for the airplane in reaching a disaster site as fast as possible. (Even so, at 150 miles per hour, it would cover a nominal 3,600 miles in 24 hours.) But once it arrived there, such would be its capability for giving help that local officials, after boarding it by hoist, helicopter, or airplane hookon, would be sure to press it into service as their headquarters or command post for the salvage and rehabilitation work remaining.

Text continued on page 22

AIRSHIPS

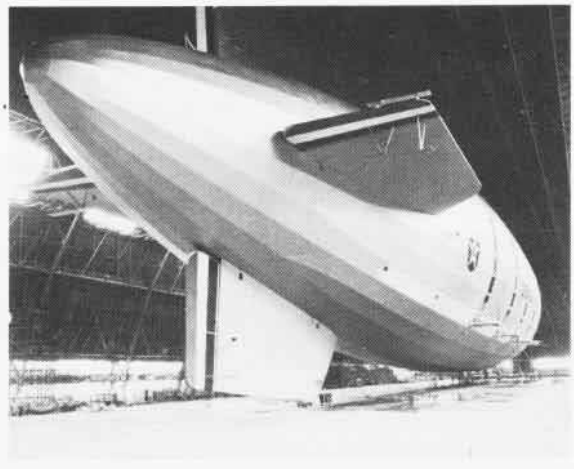


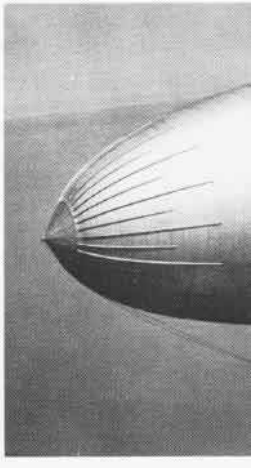
Postwar modifications of K class had several designations; this is ZP4K, later ZSG-4.



WW I B-class single-engine were first Navy production types, from 75 to 84,000 cu. ft.

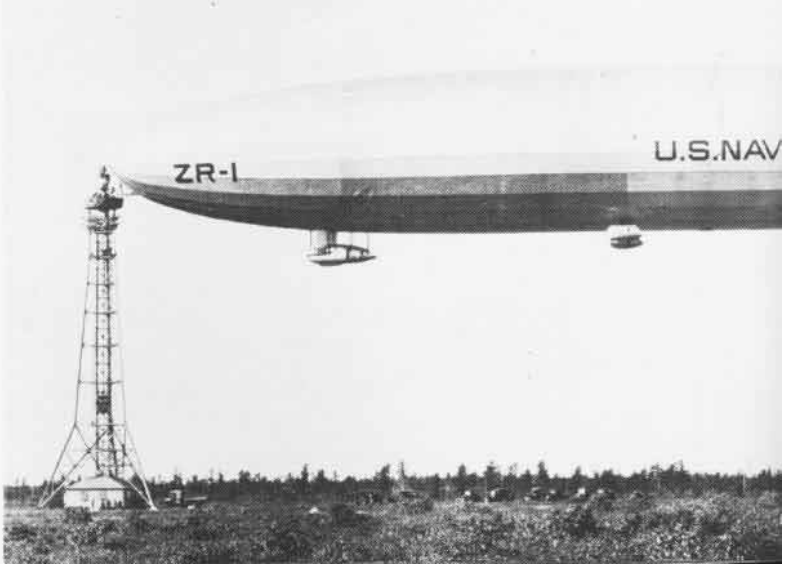
ZR-3, German-built Los Angeles, 1924, had five-engines, was 2,472,000-cu.-ft. dirigible.





Akron and Macon were near twins: powered by eight engines; 6,500,000-cu.-ft. volume.

First Navy airship, the 150,000-cu.-ft. DN-1, made only a few flights in April 1917.

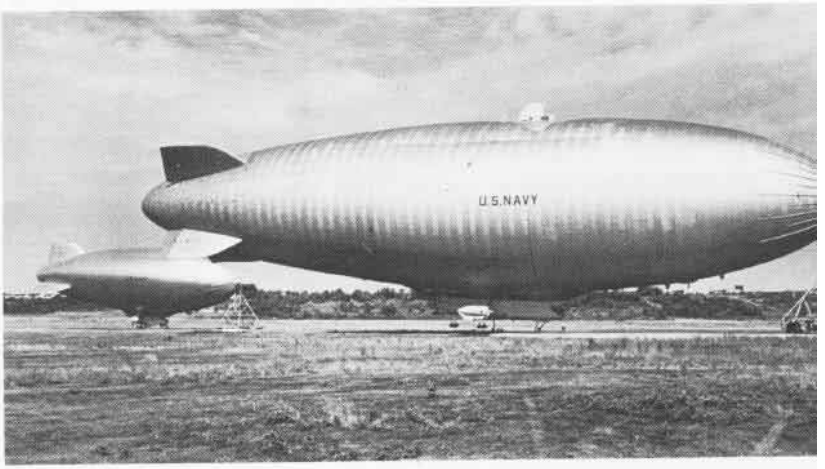


First Navy rigid airship was 2,115,000-cu.-ft. six-engine ZR-1 Shenandoah of 1923.

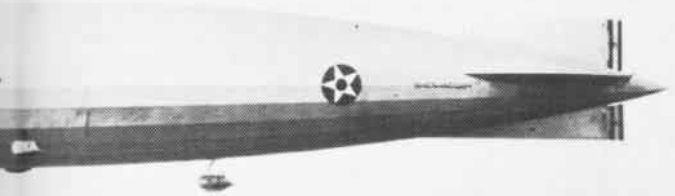
Twin-engine 178,000-cu.-ft. Goodyear G-1 was typical of between-wars non-rigids.

Unusual among Navy airships was 1929 200-000-cu.-ft., twin-engine, metal-clad ZMC-2.

Postwar N class became widely used ZPGs; this is AEW ZPG-2W of over 1 million cu. ft.



Final Navy non-rigids were 1.5-million-cu.-ft. ZPG-3Ws, AEW airships of the late Fifties.



WW II K class saw extensive use in ASW ops; twin-engine, varied from 416 to 456,000 cu. ft.

THE HELIUM HORSE

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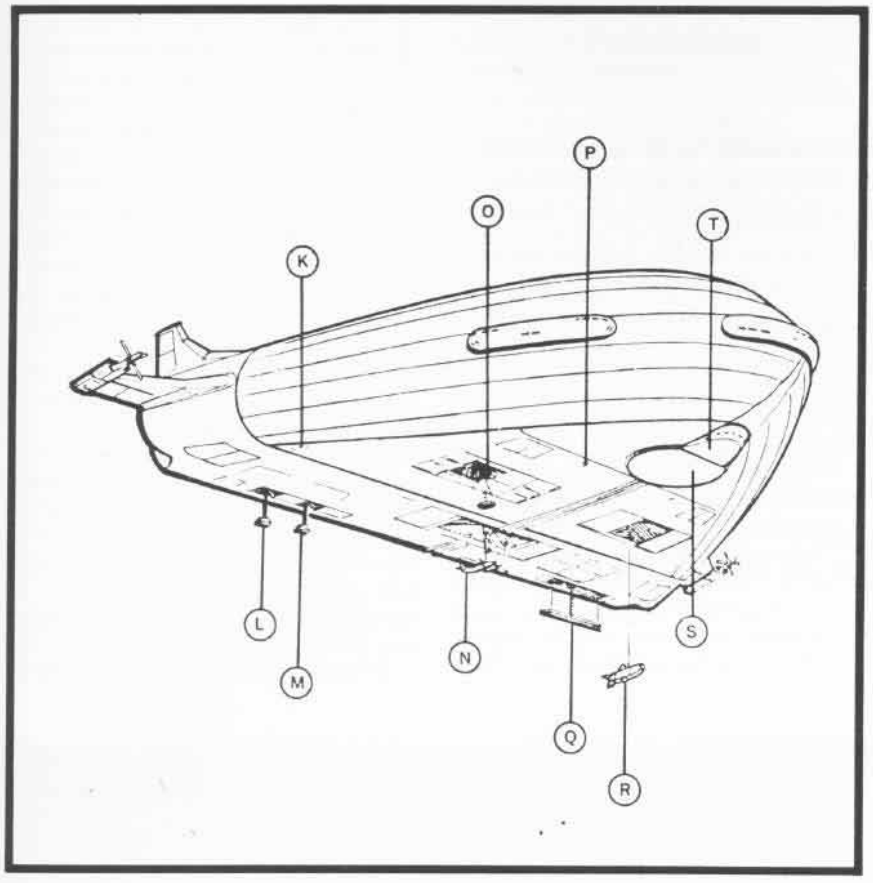
Since the writing of the "Helium Horse" last year, a number of developments have taken place to support the belief that the dirigible may indeed be on its way back. Mr. Vaeth brings us up to date with the following observations.

Three major aircraft manufacturers with no previous experience in building large lighter-than-air craft have revealed in-house study efforts on their part to determine the applicability of airships to modern transport needs. The American Institute of Aeronautics and Astronautics (AIAA), responding to the increasing professional interest in the subject, scheduled a special panel session on airships on January 29 as part of its annual meeting. This special session drew one of the largest crowds of the overall meeting. During that session, a NASA representative announced a forthcoming Request for Proposals for a feasibility study of potential applications of buoyant and semi-buoyant aircraft. Further, NASA and MIT are planning a jointly sponsored summer workshop on airships and their uses.

In a completely different arena,



Key to Illustration

- *A Rankine engine*
- *B Radar in fin*
- *C Solar cell array*
- *D Rocket launcher*
- *E Helicopter pad*
- *F Astrophysical observatory*
- *G Balloon launcher*
- *H Meteorological laboratory*
- *I Bridge and data management center*
- *J Living spaces*
- *K Search lights*
- *L Chemical dispensing nozzle*
- *M Pollution cleanup pump*
- *N Hookon airplane*
- *O Environmental buoy*
- *P Laser illuminator*
- *Q Marine sampling scoop*
- *R Submersible*
- *S Microwave radiometer*
- *T Marine laboratory*

deficit. The airship is thus increasingly being looked at as a transport vehicle for certain types of agricultural exports, produce being one of them.

And, lest it be lost sight of, the dirigible, we should remember, is itself an exportable item—worth perhaps $30 million apiece in production.

Which raises the question of costs...

What would be the price tag of a 22 million cubic footer configured as a cruise ship or as a transoceanic transporter of small or compact cars (200 might be carried at a time, at four or five times the usual speed, and at considerably less cost if one takes into account transshipment and storage requirements)?

The first large rigid airship of modern design would weigh in at between $200 and $400 million, depending on its mission and upon how it must be equipped. Follow-ons would decrease in price until, in quantities of a dozen or so, they would approximate the cost of a Boeing 747, which is to say between $25 and $30 million. Before any large-scale operational prototype could be begun, however, a training airship, of perhaps 3 million cubic feet, should be constructed to develop the critical piloting and ground handling skills required. This scaled-down craft, which would serve also as a flying testbed for developmental items, might be put into the air in two years and at a cost of about $50 million. It, and the larger ships that would follow, could be built in the 13 airship hangars still standing and potentially available for such use in the United States.

How well the amortized costs of large dirigibles, also their operating costs per ton mile, would permit of their being competitive with other forms of transportation remains to be seen. The answer depends on many factors, not the least of which is the means by which their technical development happens to be funded. If industry or a commercial user pays the price, that's one thing. If a government agency foots the bill, it's quite another. An agency, for example, might build one to move a space shuttle about or quickly recover the shuttle's expended reusable boosters from the ocean before saltwater corrosion can set in. Once resurrected and brought to a state of operational usefulness, however, it appears that the large airship can be extremely competitive, with operating costs approximately those of merchant ships.

Taking all these things into account, will the dirigible be returned to the skies? No one can say as of now. But the more that its quiet operation, environmental cleanliness, energy conservation, long range, large payload, stable and vibration-free flight, onboard roominess, and ability to "land" without landing are recognized, the greater are its chances.

Is it possible, as some people think, that the dream vehicle of tomorrow, instead of being the supersonic transport, the rocket or the surface effect ship, will be the dirigible?

There's increasing reason to believe that it may!

The preceding article appeared in the October 1973 issue of NOAA, a quarterly publication of the National Oceanic and Atmospheric Administration.

THE HELIUM HORSE

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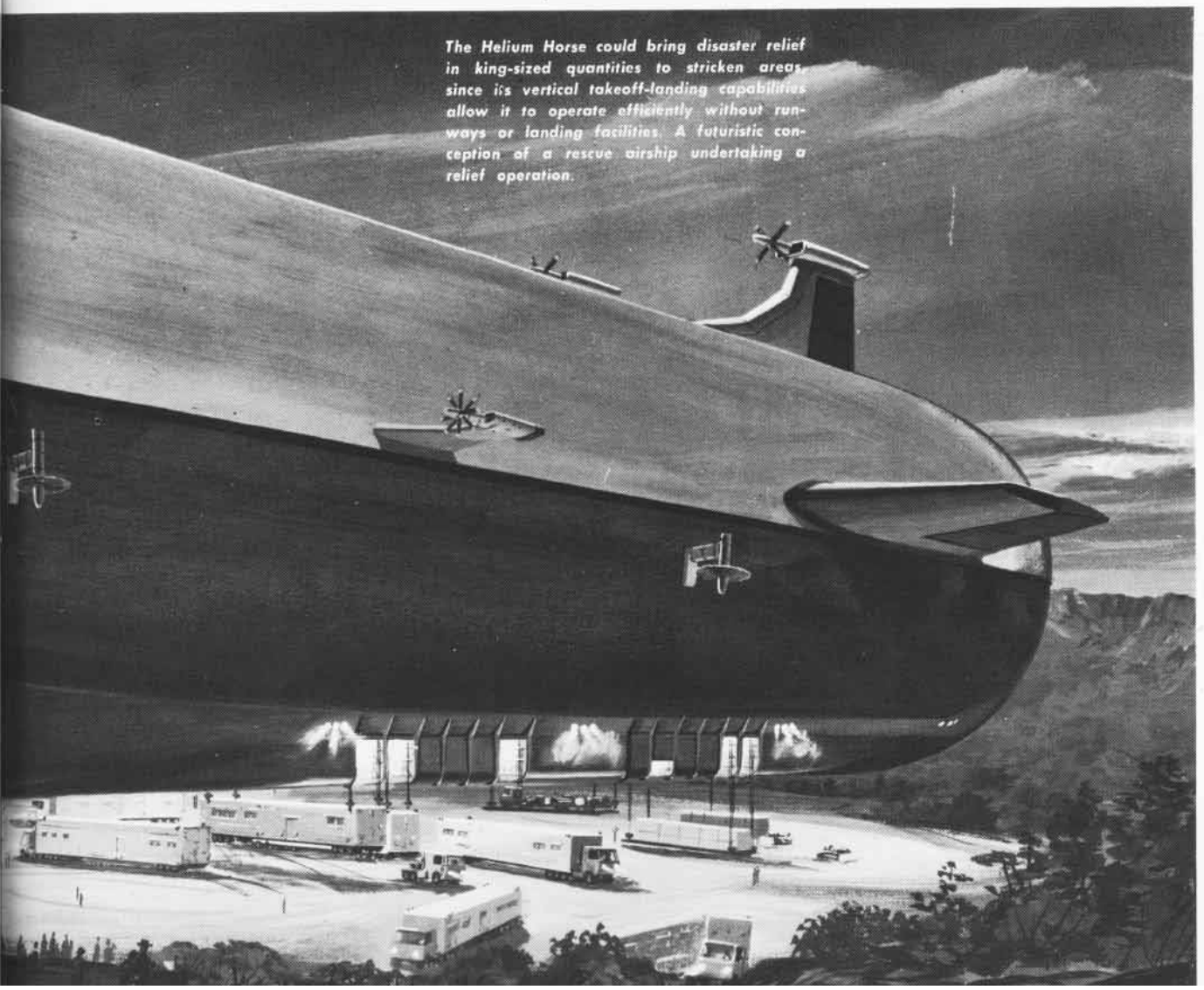
In a completely different arena,

major interest has developed in using the characteristics of dirigibles to develop the interior regions of Latin America. This interest has demonstrated itself by a pre-proposal solicitation to industry from the Organization of American States, inviting industrial participation in a proposed airship pilot or demonstration program in South American countries. Similarly, studies and discussions of a like use of airships with regard to assisting the developing countries of Africa have begun not only in this country but also in Europe.

The energy crisis, of course, has focused attention on the fact that airships, since they overcome gravity by virtue of their lifting gas and not through the expenditure of fuel, are substantial energy-savers. This information has naturally attracted the airship to the attention of agencies and planners concerned with moving air cargo with minimum expenditures of petroleum resources.

The resurgent interest in airships has, not surprisingly, reached various working levels within the Department of Defense and particularly within the Navy. Informal interest in using large dirigibles for strategic airlift has come from the Air Force. Informal interest in using airships as long-range, long-endurance trailers of passive listening arrays has come from individuals concerned with antisubmarine warfare. As a "quiet presence" for protracted surveillance of suspected submarine operating areas, the dirigible seems to be fast acquiring friends. Others are taking note of the similarity between an aircraft-carrying dirigible and a sea control ship, noting that they compare roughly in cost and airlift complement, but that they differ substantially in speed and mobility. It is not impossible that these naval concepts that now exist almost entirely as the views of individuals may someday find themselves incorporated in Navy programs and budgets.

Finally, in recent weeks, as word that the U.S. Government has ended its helium conservation program, the question has arisen whether there is enough helium available to support an airship revival program on a long-term basis. Helium that has been extracted from natural gas and stored undeground now totals about 30 billion cubic feet. A careful analysis of long-term helium reserves (raw helium), particularly that found in natural gas which is not well suited for heating, shows that lack of helium should not be a problem and that a major airship effort can go forth without concern over this point.



The Helium Horse could bring disaster relief in king-sized quantities to stricken areas, since its vertical takeoff-landing capabilities allow it to operate efficiently without runways or landing facilities. A futuristic conception of a rescue airship undertaking a relief operation.

GROUND CONTROLLED APPROACH

Story and Photos by JOC R. P. Lucasey

Thanks GCA. Nice job!"

Four little words. Two short sentences. But to AC3 Stephens M. Conn, they are some of the most important words he hears in a day. AC3 Conn works in the ground controlled approach (GCA) trailer at NAS Norfolk, Va., talking pilots down to safe landings during bad weather.

"Many pilots don't thank you," says AC3 Conn, "but once in a while, especially after you've talked some guy in through a blinding snowstorm or heavy rain, he'll go out of his way to say he appreciates it. His appreciation makes the work and study worthwhile."

Steve's hard work and study began immediately after boot camp in 1971 when he was selected for special training as a control tower operator. It was a tough school, with only 19 out of 35 classmates making it to graduation day. Then, he was picked for training as a ground controlled approach operator — where the attrition rate was even higher. But he graduated, was sent to Norfolk, and is already certified by the FAA.

"You just can't beat the schooling," Steve says. "Where else could I move into so much responsibility so fast. I've also had a chance to travel and get my civilian pilot's license through a Navy flying club."

On a busy day there are more than 150 landings and takeoffs at the air station. On an average day in the GCA trailer, he will assist 20 to 25 planes "since most pilots want GCA assistance, even during good weather."

AC3 Conn feels that it is a very challenging job and that the sky is the limit if you're willing to stay put and take advantage of the opportunities.

He was notified recently that he has been selected for promotion and for transfer to Keflavik, Iceland.

"The Navy is particular about whom it sends to operate GCA gear in Iceland," says one pilot. "The weather gets pretty bad up there and we don't want someone on the job who can't handle the responsibility. If I were landing during one of their bad snowstorms and had to ask for GCA, I'd feel a lot better knowing that AC3 Conn was the one bringing me in."

Steve and his supervisor, AC1 Benny Holmes, keep the traffic flowing in, out and across runways and approaches, above. In the GCA trailer, right, Steve concentrates on two radarscopes as he talks down a Galaxy.

Naval Aviation News Survey

Naval Aviation News is required to conduct a reader survey periodically. Therefore, it would be greatly appreciated if you would complete and forward this tear sheet to us. Just tear, fold where indicated, staple and mail. As needed, extra copies of this page may be reproduced and forwarded.

Rate/Rank _____

Job in unit _____

Type of unit _____

If civilian, occupation _____

Age _____

1. How often do you read *Naval Aviation News*?

   ☐ Every month
   ☐ Frequently
   ☐ Occasionally

2. Is the magazine readily available to you?

   ☐ Yes ☐ No

3. Which of the magazine's features do you enjoy the most? (Please rate in order of preference.)

   — Editor's Corner
   — Did You Know?
   — Grampaw Pettibone
   — Feature articles
   — Naval Aircraft
   — People, Planes and Places
   — Letters
   — Squadron Insignia
   — Historical articles

4. Do you find the magazine educational?

   ☐ Yes ☐ No

5. I would like to see more articles on:

   ☐ Ships
   ☐ Air stations
   ☐ Squadrons
   ☐ Aviation support facilities
   ☐ Research, test and development
   ☐ History
   ☐ Human interest
   ☐ Photo features
   ☐ Humor
   ☐ Other

6. Do you have any suggestions on how to improve *Naval Aviation News*?

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Fold

Ejection Seat for AV-8A Tested

By Bob Bush, Project Engineer
NWC China Lake, Calif.

A series of service release tests on the SIIIS-3 ejection seat system for the AV-8A *Harrier* was recently completed at NWC China Lake, Calif. The 25 system tests were conducted on the center's supersonic track (SNORT) from July 1, 1972, to January 12, 1974.

The SIIIS-3 system furnishes escape and recovery capabilities over a wide range of adverse attitudes and flight conditions at very low terrain clearance altitudes. It is being qualified for retrofitting into existing Navy, Marine Corps and Air Force aircraft, as well as new aircraft.

Testing at the SNORT consisted of initiating escape from the *Harrier* sled at velocities ranging from zero to 600 knots equivalent air speed using both three and 98 percentile anthropomorphic dummies as test subjects. Only three percent of all pilots in the service are as small, or smaller, than the three percentile dummy, while the 98 percentile dummy is larger than 98 percent of all pilots.

Two adverse attitude tests were accomplished using the dummies. One was at 30 degrees pitch (nose down), and the other at 30 degrees roll (wing down).

The concept of the SIIIS-3 ejection seat is believed to have great potential for providing significant advances in safety for military aircraft flight crews. Under comparable inverted flight conditions, the SIIIS-3 requires only 140 feet of terrain clearance for safe escape as compared to 540 feet for several of the most modern in-service systems. The SIIIS-3 attains its improved performance through four automatic modes of operation.

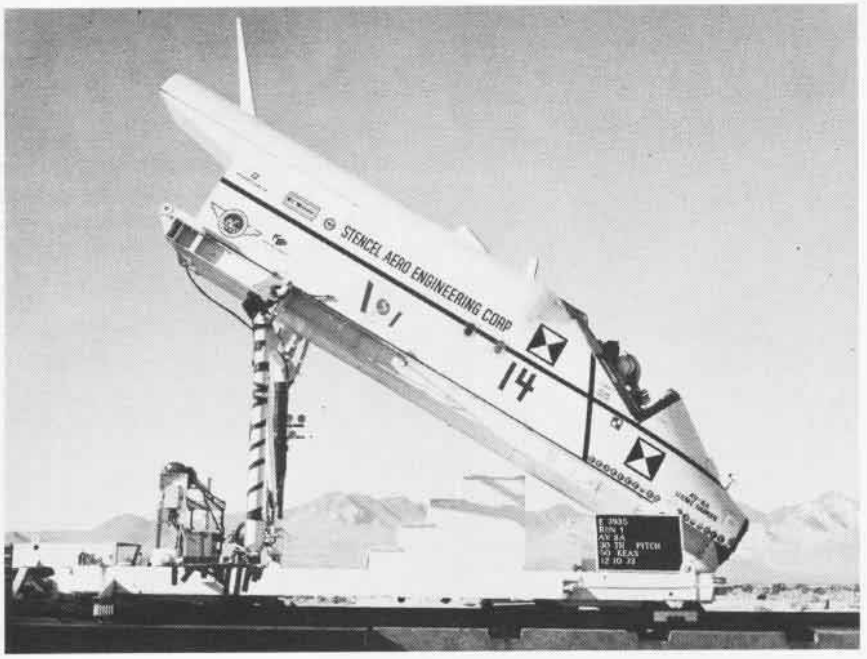
At low altitudes, below 250 knots air speed, the system provides a parachute pack opening in only 0.1 second after the seat/aircraft separation.

Above 250 knots at low altitudes, the parachute pack will open in only 1.2 seconds after seat/aircraft separation.

At medium altitude, between 7,000 and 14,000 feet (pressure), the delay of the parachute pack opening is only three seconds.

At high altitude, above 14,000 feet, the parachute will delay opening until the seat/man has descended to 14,000 feet.

A final series of service release tests will be held at the Naval Aerospace Recovery Facility, El Centro, Calif. These tests will be performed from the rear compartment of a modified F-4.



A dummy is ejected from a test sled during 435-knot tests of the SIIIS-3 ejection seat, top. Tests were also made at under 250 knots with the sled in a nose-down position, left.

PEOPLE PLANES AND

Training Squadron Two, NAS Whiting Field, Fla., logged its 50,000th accident-free flight hour March 4. LCdr. D. J. Elliott, squadron aviation safety office, piloted the T-28 *Trojan* during the record hop.

LCdr. Rusty Scholl, VA-22, NAS Lemoore, Calif., has amassed 2,000 hours in the A-7 *Corsair II*. He accumulated the time over a seven-year period, beginning in 1967 with VA-147. He has also flown the *Corsair* with VA-122.

USS **John F. Kennedy** (CVA-67) is at the Norfolk Naval Shipyard, Portsmouth, Va., for her first major overhaul period since she was commissioned in 1968. She will be converted to a CV and will be able to carry the F-14A *Tomcat* and the S-3A *Viking*. Since her commissioning, *Kennedy* has logged 67,977 arrested landings.

In March, **Patrol Squadron 90** received the first of 18 P-3 *Orions* slated for NAS Glenview, Ill. Another 17 of the long-range patrol aircraft are scheduled to be delivered to the air station by May 15.

USS **Enterprise** (CVAN-65) was the site of the maiden landings and takeoffs of the first operational fleet F-14A *Tomcat*. Piloting the fighter on its first day was LCdr. G. "Skip" Giles of VF-1. He was assisted by LCdr. Roger McFillen in the rear seat. The fleet *Tomcat* was joined for its first day of operations by two F-14s from NATC Patuxent River, Md.

The *Hawkeyes of* **VFP-206** completed two weeks of special active duty for training at NARU Washington, D.C., March 9. During the active duty period, the squadron

flew 61 sorties, completing 120 flight hours in day and night aerial refueling, defensive electronics countermeasures and day and night photo reconnaissance missions in its RF-8 *Crusaders*.

Two young **British** midshipmen recently journeyed from Subic Bay, R.P., to Hong Kong aboard USS *Oriskany* (CVA-34). Midshipmen Alan Gregg and Stephen Ramm are assigned to the British frigate HMS *Chichester*, which serves as guard ship for the harbor of the British Crown Colony. While aboard *Oriskany*, the Britishers observed the various functions of an attack aircraft carrier, from engineering to flight deck operations.

USS **Coral Sea** (CVA-43) presented the city of San Francisco a valentine which will reside in the San Francisco Children's Zoo. The valentine is Catapult I, a

PLACES

young Alpine goat, who was accepted by Joseph Caverly, general manager of the city's Recreation and Parks Department. Captain Thomas S. Rogers, Jr., the carrier's skipper, made the presentation.

Later, it was "all hands and toes on deck" last month when USS *Coral Sea* and the San Francisco Ballet teamed up to present a command performance. Scheduled for April 20, the **Ballet on Board** was to be performed exclusively for the families and crew of the Alameda-based carrier.

Technology has forced **seat-of-the-pants** flying out of the repertoire of most pilots in today's Navy. There are a few, however,

who search out this type of "diversion" and thrive on it. One such aviator is LCdr. Andrew J. Moore, Jr., a 36-year-old Selected Air Reservist attached to VS-81 at NAS North Island, Calif.

LCdr. Moore is a crop-duster by trade and says he loves every minute of it. He divides his life into two parts. One part is devoted to life at the controls of a biwing Stearman, and the other as a pilot in the S-2 *Tracker* with his squadron.

Attack Squadron 153 has been awarded the **Arleigh Burke Fleet Trophy** as the Pacific Fleet squadron that achieved the greatest strides in battle efficiency improvement. Vice Admiral George P. Steele, Commander, U.S. Seventh Fleet, presented the trophy to the squadron's commanding officer, Commander Denis R. Weichman, during a ceremony March 12 aboard USS *Oriskany* in Subic Bay. R.P. VA-153, based at NAS Lemoore, flies the A-7 *Corsair II*.

Twenty-three men of VR-52 Det. Washington, D.C., recently completed a 14-day **mini-cruise** in the nation's capital. During the cruise, NATOPS, instrument and routine checks were performed to upgrade pilots, navigators, flight engineers and flight attendants in the squadron's C-118 *Liftmasters*. VR-52 made flights to 14 cities around the country as well as to Lajes, Azores, and Guantanamo Bay, Cuba.

Most people think of the **Last Chance Saloon** as a watering place in the Old West, but for Navy Seabees of MCB-71, it's where they migrate at the end of a long day at South Pole Station, Antarctica.

The 146 Seabees at the construction camp, nicknamed Dry Gulch City, built the popular spot from scrap material during their off-duty hours while on their latest tour with Operation *Deep Freeze*.

An SNJ *Texan* and an F8F *Bearcat* were renovated at NAS Saufley Field, Fla., during a six-month project and then towed to NAS Pensacola where they will rest in the **Naval Aviation Museum** under construction at the naval air station.

A rescue swimmer from HC-7 drops into the water from the squadron's HH-3A, left. In Naval Aviation search and rescue philosophy, what comes down must go back up, as the rescue swimmer demonstrates for the students, below.

A Refreshing Course

By Ens. Sharon Hamric

Photos by PH2 C. B. Hensley and PH3 P. S. Burns

A water survival safety stand-down at NAS Cubi Point, R.P., has provided a much needed refresher course for area pilots, NFOs and crewmen.

The two-day course stressed individual knowledge and proper use of water survival equipment for airmen who have not been able to return to stateside schools because of scarce temporary additional duty funds. Participating were aviation personnel from HC-7, VC-5, VP-22, VRC-50, HMH-462, Jungle Environmental Survival Training (JEST) staff and the naval air station.

Events began with a briefing on personal survival gear. Life rafts, vests, parachute harnesses, signaling devices, radios and various models of survival kits containing dye markers, shark repellent, whistles, compasses and desalting kits were carefully explained and demonstrated by the JEST staff. Later the participants practiced pinpointing a target with a signal mirror and set off MK 13 day/night and MK 79 pencil flares.

PR1 Bob Hudson of VC-5 then demonstrated how to put it all together. After jumping from an aircraft, he floated slowly down through the sky, inflated his life raft at the proper moment and made a perfect water entry. He moved away from his parachute shroud lines to avoid becoming entangled in them, climbed into the one-man life raft, deployed a bright green dye marker and set off a signal flare.

The water survival students then began wading into the water, presenting an unusual scene for those on the family-oriented Dependents' Beach. Donned in green flight suits, orange life vests and yellow and blue cranial helmets, they swam out to deep water.

An HH-3A *Sea King* of HC-7 then flew overhead and dropped a rescue swimmer into the water. The helo picked up the "downed flyers" in groups of five and dropped them at a nearby helicopter pad. During the two days, HC-7 made 81 water pickups which doubled as training for squadron SAR crews.

The water survival course was the brainstorm of PR1 Hudson, who supervises his squadron's aviators' equipment shop. A master parachutist, he was looking for a new and dynamic way to put across vital training information and approached the squadron aviation safety officer with his idea of a water jump.

Local aviation safety officers and training personnel were so pleased with the entire effort that they hope to make it a regular event. It is anticipated that air crews from Guam, Japan and units embarked in CVAs and LPHs will eventually be included.

AMAN Fred Beall, rescue swimmer, rides up the hoist to the HH-3A with one of the water survival students, left. The water survival safety stand-down was an outgrowth of a desire of PR1 Bob Hudson, above, to put across vital training information in a new and dynamic way.

Life Down Under

By JOC Willie Stephen

Photos by PH1 Ken K. Thornsley and PH1 Gary E. Roth

About 350 Navy men of Antarctic Development Squadron Six returned from a four-month tour in the Antarctic to their new home at NAS Point Mugu, Calif., February 26. This marked the end of the 19th season of polar operations for the squadron.

During their assignment at the bottom of the world, the squadron's aviators flew almost a million miles in over 4,000 hours and hauled more than three million pounds of supplies in support of the U.S. Antarctic Research Program. Seventeen nations are involved in Antarctic research.

The unpredictable Antarctic environment plagued VXE-6 throughout the austral summer season. Violent snowstorms, aided by hurricane-force winds, more than once stopped the aircrews from flying supply missions and buried the living quarters under snow.

"It was miserable for awhile, but we made it," says a VXE-6 navigator, Lt. Thomas J. Preato, of the Antarctic weather.

During November it was a common sight to see squadron aircrews digging their living quarters out from under the snow. It was also routine to see ground support personnel sliding down through narrow holes in the ice into their work areas.

In spite of the weather, squadron aircrews hauled 1,060,000 pounds of materials to various Antarctic locations during the month. Most of the materials were delivered to South Pole Station for Navy Seabees who were constructing a massive geodesic dome at the pole. The building, similar to the Houston Astrodome, now houses scientific workshops.

December was one of the warm-

PH1 Gary Roth relaxes in his ice house during survival training in Antarctica, opposite. A UH-1N Huey crew prepares to move a drilling unit to another location in the Dry Valleys in support of scientists in Antarctica, above. Ltjg. Robert A. Nyden builds a statue of ice, left. Playing with seals is a popular off-duty pastime, below.

est months in Antarctic history. The highest temperature ever recorded at McMurdo occurred January 2 when a balmy 47 degrees above zero was reached.

The warm weather forced the squadron to start operations from the ski-way. The permanent ice of the ski-way requires the planes to use their skis to take off and land.

It was during this warm period that VXE-6 helicopter crews established what they believe is a *Deep Freeze*, and possibly a Navy, record for the UH-1N *Huey*. In addition to delivering 758,000 pounds of cargo, the helicopters transported 800 passengers and accumulated over 400 hours in the air.

Battling an increased number of in-flight emergencies, the *Hercules* crew managed to deliver 1,437,000 pounds of supplies in December.

"We had six in-flight emergencies in December," comments Commander Vernon W. Peters, the squadron commanding officer. "Four of the engine problems occurred several hundred miles from home." According to Cdr. Peters, two of the engine malfunctions caused the pilots problems that resulted in their flying 700 miles under abnormal conditions.

Besides solving their own problems, VXE-6 aircrews assisted other units in trouble, including a civilian pilot lost in the Antarctic. A Canadian aircraft en route to Byrd Station journeyed off course when its inertial navigation system failed while the aircraft was still 600 miles from its destination.

"We located the aircraft while we were on our way back to McMurdo and led him to a safe landing," says LCdr. Floyd Eldridge, the VXE-6 pilot who performed the airborne rescue.

After a few months at Point Mugu, the squadron is scheduled to begin flying ice-sensing missions north of the Arctic Circle. "When we start flying in the Arctic region," says Cdr. Peters, "we will become the first aviation unit to operate at both ends of the world for an extended period of time."

The squadron is scheduled to return to the Antarctic in November.

PO2 Mark Jordan, a member of VXE-6's pararescue team, heads for the South Pole 13,800 feet below during a jump in December, above. On the opposite page, the squadron's ski-equipped LC-130 Hercules, top; a maintenance crew works on a Hercules in sub-zero weather, center left; weekly services are held in the Chapel of the Snows, center right; squadron members board a Hercules bound for Christchurch, N.Z., where they will change planes for the trip to NAS Point Mugu, ending the squadron's 19th year on the ice, bottom.


JD
9129


CHAPEL OF THE SNOWS


9129

Best of the Buffs

Steve Ginsberg rates four stars for winning the hand in marriage of his wife, Cheryl Ann. She also deserves four stars — and then some. She has married an insignia buff, an act requiring extraordinary devotion and perseverance.

Steve, 27, a chemical laboratory technician, is perhaps the most prolific collector in his field. Last summer, he brought his bride from their Far Rockaway, N.Y., home to Washington, D.C., for their honeymoon. Shortly after arriving in town, they entered the Naval Aviation history office hand in hand. For the better part of a week, with Cheryl Ann either looking on with amused patience or functioning as a clerk assistant, they churned through voluminous piles of documents, photographs and books from the historical files.

Steve's collection of aviation memorabilia includes about 600 patches, 500 command histories, 200 photographs of insignias and aircraft carriers and more than 300 aircraft pictures.

This fire of interest was ignited when Steve, as a sixth grader, saw a film on ships. He soon procured Fahey's 1945 edition of *Ships and Aircraft of the U.S. Fleet*. In subsequent years, through communication with the Naval Photographic Center and the Government Printing Office, he enlarged his scope of source material. Looking through *Naval Aviation News* one day, he became particularly excited with the squadron insignia page. That excitement has not diminished.

Over the years, he has tenaciously issued a fusillade of letters to just about every aviation command in the Navy, requesting insignias, command histories and photographs.

His barrage of question-saturated requests to the aviation history office

reached impossible proportions. (The one man, one secretary staff in that office simply cannot handle the continuing string of requests for historical information it receives.) Mr. Clarke Van Vleet, the historian, advised Ginsberg, "Take a vacation, come to Washington and we'll open the files for your perusal."

Of course the historian didn't expect that a young man on his honeymoon would have the courage and audacity to expend precious hours buried in historical files. Thus our recommendation that Mrs. Ginsberg receive some sort of award for achieving new highs in wifely understanding and perserverance.

This brand of perseverance, on Steve's part, has stood him well. He recalls three squadrons, unmentioned here, who stalled him for more than six years as he tried to get copies of their insignias. He wrote PAOs, C.O.s, the unit's home stations, air wing staffs and host carriers. He even made long distance telephone calls, always with the offer to pay for material. In one case, his efforts included sending 12 letters over a seven-year span before he got results. Eventually, he succeeded and now has patches from the three outfits.

Not without its frustrations, Steve's hobby represents a continuing challenge. "I wrote the *Ticonderoga* for its *Tico Tiger* patch a few years ago," says Steve. "In answer to my first request, they said they had run out of patches. I wrote again months later, hoping the supply had been replenished. They answered they were sorry but they had just completed an *Apollo* recovery mission and the supply again was sold out. So I waited another period and wrote once again. This time they were sorry because the ship was being decommissioned and they had no patches left. Sometimes you win, sometimes you lose."

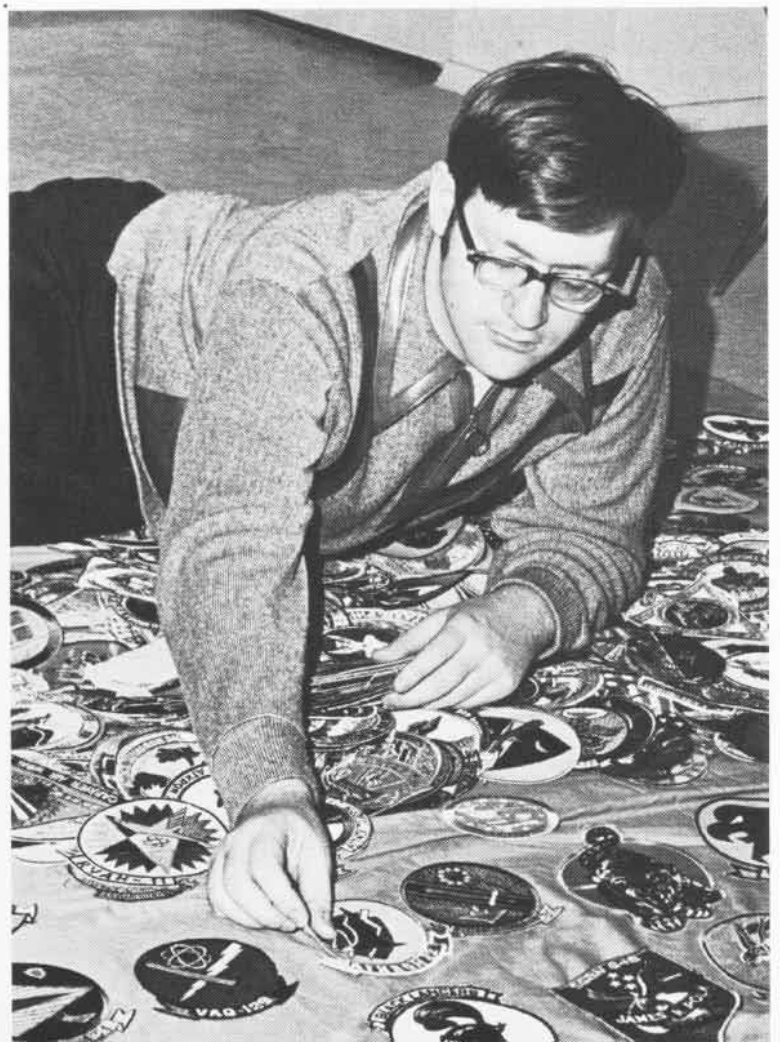
In another case, he sought insignias from an air station and the ComFAir located there. He was advised to contact the Navy exchange. He did. The Navy Exchange wrote back with regrets saying they could sell items only to military personnel.

"I finally asked a Navy friend of mine to write for me," relates Steve. "But by this time the patches I wanted had been discontinued and were no longer in supply."

More often than not, though, Steve Ginsberg does succeed and he is pressing on with his quest. He is currently compiling a pictorial on insignias for the American Aviation Historical Society. His pace of letter writing continues and he expects to add significantly to the 2,500 he has written since 1967. One of his other goals is to go aboard a carrier one day and film flight operations.

It will not be surprising to see Steve and Cheryl Ann grace the doorway of the aviation history office sometime soon — on their first anniversary?

Opposite, Ginsberg wades through aviation history files as Cheryl Ann looks on. Left, until he gets a chance to go aboard a real carrier, Steve's model of USS Enterprise must suffice. Below, he arranges some of the 600 patches in his collection. Over the years, Steve has written 2,500 letters in pursuit of his hobby. In addition to insignias, he has also accumulated 500 command histories.

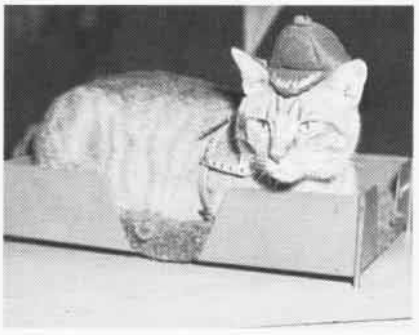


EDITOR'S CORNER

Long ago and far away. No one in this day and age doubts that inflation flavors, or should we say, disflavors, our lives in distressing proportions. Interesting and albeit redundant proof of the inflation dilemma has been extracted from the 1929 version of the *Bureau of Supplies and Accounts Manual* (reprinted in 1942). The volume was retrieved recently from the former aircraft carrier USS *Bunker Hill*. In the earlier years of WW II, for example, vice admirals received an annual stipend of $8,000. Lieutenant commanders earned $3,000 and an ensign with less than five years' service collected a grand total of $1,800 yearly. Worse yet, first, second and third class petty officers then earned $114, $96 and $78 per month.

Beefalo Burgers? Isaac "Bull" Sowell, a senior chief aviation machinist's mate, recently retired from the Navy in California. Once an expert on aircraft, he has turned his efforts back to the earth and is working diligently at what some might call a far out project but which others look to as a possible booming business. He is Kings County's first registered breeder of the "beefalo," a hardy hybrid, a cross between the American bison and domestic cattle. On his modest 15-acre ranch in Lemoore, Sowell may soon produce what many farsighted cattlemen recognize as the space-age cow and possibly the American breed of the future. Sowell is not the sole pioneer in this field but if things go right for him and his animals, the typical beefalo will grow to prodigious size and heft, retain the docile temperament of the domestic cow and produce meat which is leaner, tastier and higher in protein than standard market beef. Since beefalos flourish on grass rather than expensive feed grains, it is foreseeable that their meat will cost from 25 to 40 percent less than beef. "I've been calling myself half sailor and half farmer lately," says Sowell, "so my branding iron combines the letter S and the Navy anchor."

Animal department continued. Now on hand as a welcome aboard host for visitors at NAS Cecil Field, Fla., is a soft-coated feline named Commander Frank (see photo). Assigned the title of deputy air operations officer, Cdr. Frank already lists the *Skylab II* astronauts, Conrad, Kerwin and Weitz, among important personages he's greeted.



Note from the Past. Retired Vice Admiral Selden B. Spangler wrote us with an interesting vignette on the O2U-1 observation plane. He was the senior officer of the observation detachment aboard USS *Saratoga* (CV-3) shortly after the ship was commissioned in the late 1920s.

"I was the senior officer of the observation detachment, equipped at that time with UO-1s," writes Spangler. "However, we were given three O2U-1s in crates before we sailed. Since the original plans for *Saratoga* contemplated operating squadrons from the ship on a permanent basis, the ship was equipped with the equivalent of a shore-based assembly and repair establishment including, incidentally, engine overhaul shops.

"So, we uncrated the O2U-1s [like those in photo] and set them up while underway to Panama. This required some ingenuity since airplanes in those days were assembled and aligned with the liberal use of plumb lines to determine verticality.

"Obviously these were of little value on a ship underway. Particularly so on *Saratoga*, with her propensity to roll in the slightest seaway. So we had to manufacture a set of trams from the blueprints in order to ensure correct assembly.

"Since I had the responsibility for the integrity of the assembly job, Pete Mitscher, who was our air officer, gave me the honor of flying the first airplane off the ship as we approached Panama. Needless to say, there was a crowd of curious onlookers when I took off to see whether or not the experiment was successful.

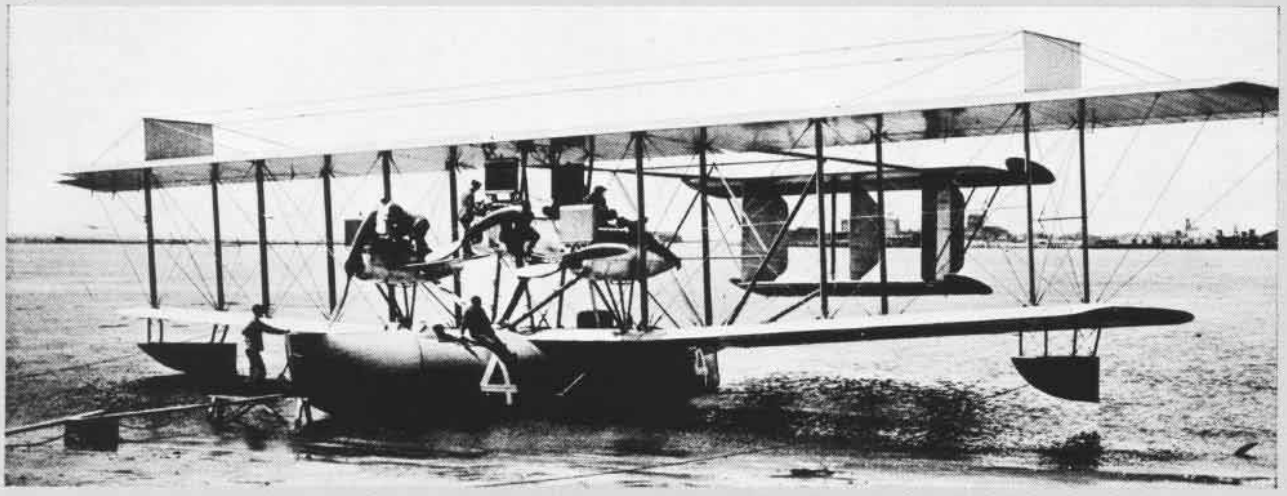
"As it turned out, the only thing wrong with any of the three airplanes was with the one I flew. The airspeed meter was hooked up backwards. So ended the first and, as far as I am aware, the only time airplanes were received aboard a carrier in crates, assembled and flown off the ship."

Good Idea! The other day we read about a conscientious Air National Guard pilot who knows how to use time well. While driving to and from work, he activates a cassette recorder and listens to his own tape recordings of operating and emergency procedures for the jet he flies. Smart way to bone up, we think.

SQUADRON INSIGNIA

At VT-9, NAS Meridian, Miss., T-28s are used as the training vehicle for the fledgling aviators. In Texas, students of VT-22, NAS Kingsville, and VT-25, NAS Chase Field, fly the TA-4J; at NAS Corpus Christi, pilots of VT-27 operate T-28s.

BEFORE LINDBERGH TOOK OFF, THE NC-4 HAD LANDED.



Everybody knows about Lindbergh, "The Spirit of St. Louis," and crossing the Atlantic.

Only a few know about the NC-4, the Navy seaplane that successfully flew the Atlantic, Newfoundland to the Azores, eight years before Lindbergh.

Great achievements in aviation have long been a proud part of the Navy tradition. And they still are today. That's why young people who dream of flying should know about the opportunities to win their wings in the new Navy.

Today's Navy trains qualified college graduates to be the kinds of pilots or flight officers who can honestly say of themselves, "I am one of the best flyers in the world." Confident, because Navy flying is thorough and rigorous. Because Navy flyers handle some of the most advanced aircraft in the skies.

There are several excellent Navy aviation programs available. We would like to send more information about them to someone you know. Someone who is interested in following the spirit that Lindbergh followed across the Atlantic

Capt. Robert W. Watkins
Navy Opportunity Information Center
P.O. Box 2000, Pelham Manor, N.Y. 10803

Please send more information on the Navy's Flying Program. (If you don't want to wait, call 800-841-8000 toll-free, anytime.)

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