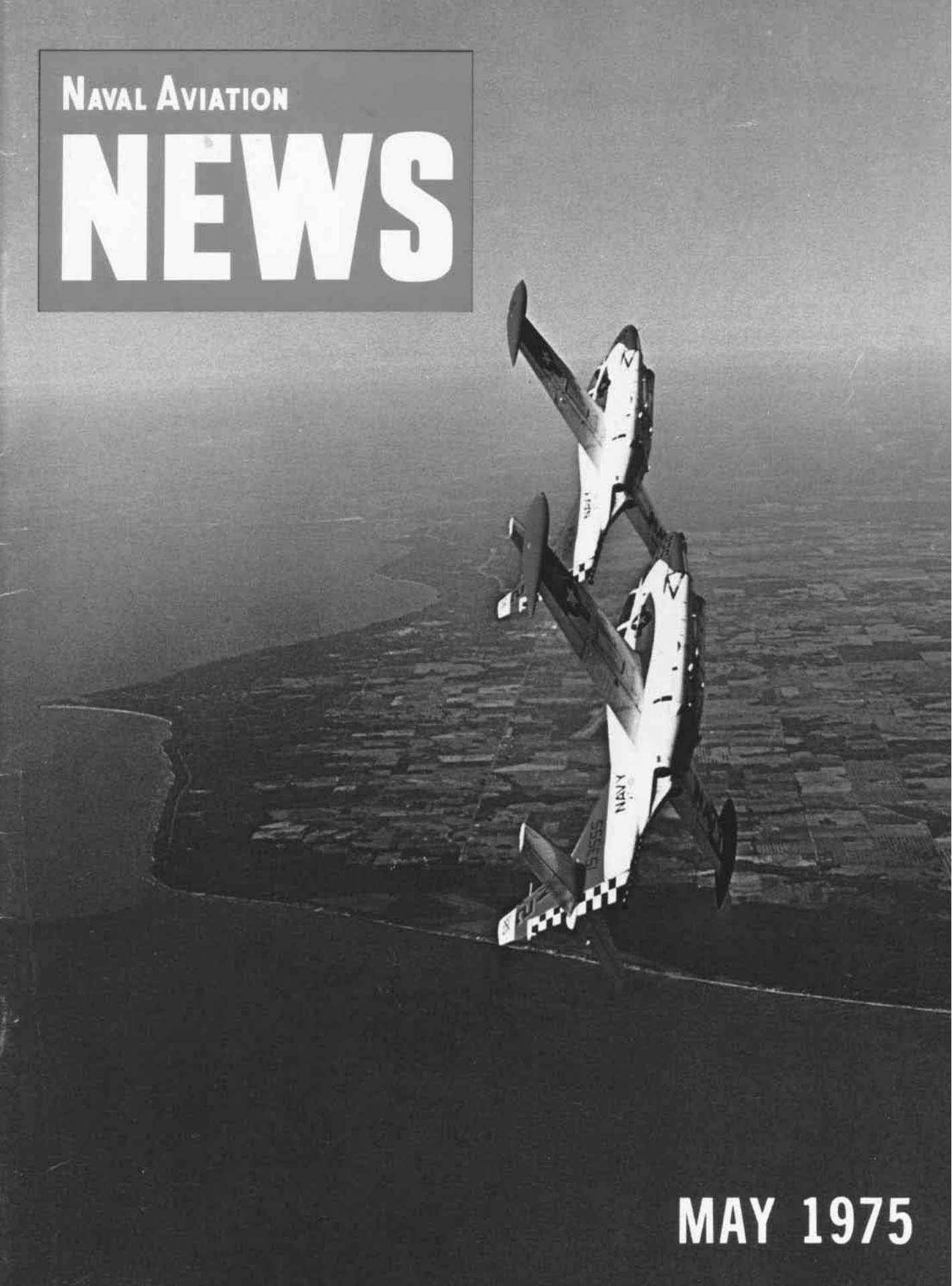
NAVAL AVIATION NEWS



MAY 1975

NAVAL AVIATION NEWS

FIFTY-SEVENTH YEAR OF PUBLICATION

THE STAFF

COVERS — *Front, VT-10 Buckeyes were photographed going up, up and away by Harry Gann. On these pages a Crusader from USS Oriskany (in background) flies alongside a Soviet Bear bomber aircraft last year. VFP-63's Lt. R. Fessenden took the picture from his photo F-8. McDonnell-Douglas' Gann filmed the F-4N Phantom from MAG-11, 3rd Marine Air Wing at El Toro, Calif., on the back cover. A simple, one-word caption for this picture could be HEAT.*

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Letters

Vigilante Reunion

The *Vigilante* community in Key West is planning a reunion May 23-25, 1975, for all A-5/RA-5 flight crew members, vintage 1958 to 1975. Tennis, golf and fishing are on the agenda. Swimmers and sun worshippers will enjoy the warm Florida weather. A reunion dinner party is planned for Saturday evening. Wives are welcome. For additional information or reservations write: Reunion, RVAH-3, NAS Key West, Fla. 33040.

Fly Me

If you're trying to travel space available on military aircraft, there is a new service you should know about. Autovon 690-4377 is a recorded tape of Navy logistics flights originating on the East Coast with seats available.

Flights are scheduled daily by Commander, Fleet Tactical Support Wing One to handle naval transportation and airlift requirements. Most of these are in Fleet Tactical Support Squadron One aircraft, C-9B *Skytrain IIs*, the Navy version of the commercial DC-9s.

Frequent flights are scheduled to Brunswick, South Weymouth, Washington, Charleston, Jacksonville, Key West, Dallas, San Diego, San Francisco and Roosevelt Roads. Occasional fuel stops are made at Omaha, Tinker and El Paso.

Although flights are scheduled to handle commitments, the 89-passenger capability of the C-9 often leaves a few seats available. Regulations require Space "A" passengers to be in an authorized liberty uniform. Schedules are known three to four days in advance.

VR-1 has been the recipient of hundreds of commendations for its hospitality and "first class" service. Have a nice flight!

NOTE: Recommend "Clip and Save"

Space "A" Flights
ComTacSupWing One
Autovon 690-4377
Norfolk, Va.

Buffs

As an ex-Naval Aviation buff, 40 years worth, I read the article on Steve Ginsberg's amazing effort (*Naval Aviation News*, March 1974) with deep interest. Memories of one three-day holiday spent typing 22 letters to COs and PAOs requesting squadron histories and examples of their insignia in color, with only three replies, still linger. Understanding limited squadron funds for insignia, is there any excuse for a shortage of mimeographed squadron histories?

The thought occurs how many other serious Naval Aviation history buffs out there are being rebuffed?

I believe that the nature of the subject demands all possible support.

Bude Donato
16800 Saticoy
West Van Nuys, Calif. 91406

Reprint

On behalf of the National Council on Alcoholism — its board, affiliates and officers — I would like to convey our congratulations for your splendid issue of March 1974 in which you devote considerable space to the subject of alcoholism.

The Navy's program on alcoholism is an outstanding one and continual information about it is essential so that people know of its existence. I wonder if you would consider providing us with reprints of the article and your editorial for us to supply to the alcoholism public at cost? This will fill a gap in our literature on alcoholism.

Whether or not this is possible, let us again congratulate you for bringing this information to the attention of the Navy.

Frank A. Seixas, M.D.
Medical Director
National Council on Alcoholism, Inc.
2 Park Avenue
New York, N.Y. 10016

Ed's note: Thanks.

Airdevil

I am looking at the marvelous issue of *Naval Aviation News* that contains my story. I can in all honesty say that I am sure the March 1975 issue will remain the finest article ever done about me....It is truly faultless and in my opinion...well laid out. It's accurate, factual and...I am pleased beyond measure.

Frank G. Tallman
President
Tallmantz Aviation, Inc.
Orange County Airport
Santa Ana, Calif. 92707

Insignia

Vice Admiral Gerald Bogan advised it was his idea, when skipper of Fighting One in 1926, to design a new squadron badge showing a High Hat Eddie Rickenbacker's 94th Aero Squadron (Hat in the Ring) inspired Bogan who decided to raise VF-1 morale with a new insignia. Bogan stated it worked and an average Navy fighter outfit became a top-notcher. Today VF-14 (*Tophatters*, NAS Oceana) retains Bogan's High Hat but contends the invention was "just an idea" that came along. Can any Old Salt resolve the question? The insignia is the oldest in continuous use in all Navy history.

VF-32's lion with shield and anchor, surmounted on a light blue shield with bend dexter, gold wing atop shield, is one of the most beautifully designed of all naval badges. Apparently it was designed on or shortly after VBF-3 was commissioned in February 1945. The squadron was formed with former Fighting Three personnel on board *Yorktown* (CV-10). Original meaning of the VF-32 squadron insignia symbols is not available in the Aviation History Unit nor in squadron records. Any old *Fighting Swordsmen* (WW II version) have the dope?

Congratulations to Clarke Van Vleet and *NANews* for the splendid historical pictorial issue of February 1975. Beautifully done and a top format certainly.

Thomas F. Gate
25 Sunset Drive
Berkeley, Calif. 9470

Hot and Cold Viking

The S-3A has completed its extreme environmental testing. Service Test Division personnel from NATC Patuxent River tested the *Viking* at temperatures from -65 to +130 degrees F under heavy icing conditions, under tropical rainfalls and in high humidities during four months of testing at the McKinley Climatic Laboratory, Eglin AFB, Fla.

With the aircraft on jacks and securely tied down, the TF34 engines were started and ran at full power at each test condition. Landing gear, flaps, flight controls, arresting hook, wing/fin fold, avionics and other systems were exercised and operated as they normally are in the preflight, takeoff and flight phases of a typical ASW mission. The aircraft was instrumented with over 100 temperature measuring devices which were constantly monitored during tests – to prevent damage and to assess equipment characteristics at extreme temperatures.

As laboratory temperatures were decreased to -20 degrees F, -25, -30, -40 and finally -65 degrees F, starting limits using JP-5 and JP-4 and two types of oil were determined for the TF34 engines and auxiliary power units. The engines were closely inspected and bore-scoped upon completion of the tests and were given a clean bill of health.

During the icing tests, the aircraft anti-icing system was evaluated in light of moderate icing conditions, as were the flaps, windshield, landing gear and auxiliary power unit doors. By cranking a wind machine up to 100 knots and spraying water into the engine inlet at zero degrees F, moderate icing was collected on the TF34 fan blades and inlet guide vanes only to be safely shucked off by increasing engine rpm. As ice was shucked from individual blades, noticeable vibrations due to fan unbalance were initially felt in the cockpit but later disappeared as rpm increased.

In an effort to expose airframe leaks that might create flight hazards due to freezing at high altitudes or any leaks that might damage the sensitive avionics equipment, the S-3A was also pounded for 24 hours by tropical storms simulated by overhead spray rigs capable of producing four inches of rain per hour.

According to Lt. Dave Johnston, project officer, and Mr. Colin Cline, project engineer, the S-3A rightfully belongs to a tough breed, the *Vikings*.

A short time later, VS-21 *Vikings* departed NAS North Island, Calif., for the first operational deployment of the S-3A. Led by Commander G. C. Greene, the squadron joined CVW-1 aboard USS *John F. Kennedy* at Norfolk, Va.

did you know?

MiG Mad Marine

This rarely published photograph of an F-86F is the work of Clay Johnson. Th North American aircraft was flown by Major John Glenn while he was on ex change duty with the Air Force during the Korean War.

Glenn, former astronaut, is now a United States Senator.

P-2 to Interior Department

Patrol Squadron 65, Point Mugu, Calif., has turned a P-2 *Neptune* over to th Department of Interior which will use it to help biologists and scientists obtai information on marine mammals and waterfowl.

The Department of Interior will remove thousands of pounds of electrica gear, the radar dome and tail boom, and modify the aircraft to carry camer equipment. The *Neptune* will fly at low altitudes, enabling personnel in the cle plexiglass nose section to observe and film marine life and waterfowl.

Because of the P-2's flying range of over 3,000 miles, scientists will be able study migratory routes over great distances.

Mobile Fuels Course

The Navy's first Mobile Aviation Fuels Course began in February when perso nel from USS *Kitty Hawk* started their training at the Naval Air Technical Trai ing Center North Island Detachment in California.

"The course was established by CNO after staff studies indicated the need f such training in the fleet," according to Captain E.R. Day, C.O. of NATTC Lak hurst, N.J. The new course provides formal training for ship personnel in th maintenance, operation, and safety aspects of aviation fuels handling equipmen Courses offered are tailored to individual ship systems, with classes conducted training facilities in the ship's home port or home yard.

Commander L. T. Blanchard, director of training at NATTC, points out th while the fuel course is new, the mobile team concept of training is not. Th North Island detachment has been conducting mobile aircraft-launch-and-reco ery-equipment training for Pacific carriers since 1967. Teams travel to hon ports up and down the West Coast, training personnel in the maintenance catapult, arresting gear and optical landing systems.

NPE for YCH-53E

The Sikorsky YCH-53E transport helicopter successfully completed a 26-hour Navy Preliminary Evaluation (NPE) in February. The NPE, an extensive series of ground and flight tests designed to determine the performance and operational suitability of the new Navy and Marine Corps helo, was conducted by a team of military and civilian pilots, engineers and support personnel from the Naval Air Test Center, Patuxent River, Md., and HMX-1, Quantico, Va.

A large and powerful helicopter, the 53E is being developed to meet the mission requirements of the Navy and Marines in the next decade. A growth version of the present twin-turbine powered CH-53, the 53E will be able to carry external loads up to 16 tons, accommodate 56 troops and attain a speed of 170 knots.

Test Center Reorganized

A major reorganization of the Patuxent River Naval Air Test Center will begin on April 1. The existing test divisions — Flight Test, Service Test and Weapons Systems Test — will be disestablished in favor of four directorates, one for systems engineering testing and three for strike, antisubmarine and rotary wing aircraft testing.

The reorganization will be accomplished within current personnel allowances, according to Rear Admiral F. Taylor Brown, NATC commanding officer.

"One of the most important features of the reorganization is the significant potential for increased safety," RAdm. Brown stressed. "Assignment of aircraft and pilots to activities by aircraft type and mission will enhance training, standarization and crossfeed of information."

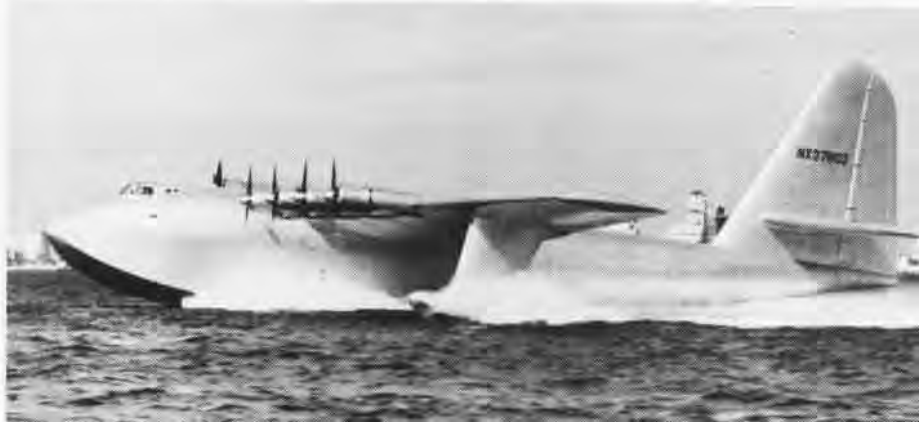
Also significant is decentralization of maintenance assets which permits each new directorate with aircraft to manage its own maintenance effort, the Admiral pointed out.

Flying Boat

When it was announced that Smithsonian Institution was about to acquire a 51-foot wing section of the famed Hughes Flying Boat, Summa Corporation (formerly Hughes Tool Company), owner of the HK-1, was besieged with requests that the aircraft not be dismantled. Summa agreed to delay any disassembly for a year, thus giving interested parties an opportunity to raise money to purchase the aircraft and secure adequate display facilities.

Built during WW II, the HK-1 has a 320-foot wingspan, fully 60 percent longer than the Boeing 747. It remains the largest aircraft ever built. The eight-engine troop carrier, constructed of birch, required fewer critical materials than conventional aircraft. The Flying Boat achieved several engineering breakthroughs, particularly in methods of curing, shaping and layering wood for durability and salt water resistance. It was flown briefly by Hughes in 1947.

The Flying Boat is presently stored on Terminal Island, Long Beach, Calif.



GRAMPAW PETTIBONE

The Big Demonstration

A crew was scheduled for a shipboard operations training flight in an H-46 *Sea Knight*. The flight was to include shipboard landing qualifications for the copilot. Following a complete briefing, the H-46 departed home plate for the ship which was a short distance out to sea. The pilot-in-command (PIC) occupied the left seat with the pilot-under-instruction in the right seat.

The PIC announced his intention to demonstrate the first approach and flight attitudes associated with various hover modes. Ten miles from the ship, he took the controls and notified the crew to man stations for landing. At about five miles he requested landing clearance from the ship. He received the winds, the ship's course and the deck conditions. He confirmed the wind by visually checking the ship's smoke.

The *Sea Knight* was approaching on a southerly heading to the starboard of the ship. An initial low pass was made around the ship, passing astern, and a right turn commenced to permit the pilot-under-instruction to view the flight deck. During the low pass, a "green deck" condition was received from the ship. The landing approach was commenced about 500-1,000 yards from the ship's starboard beam at an altitude of approximately 200 feet for an athwart ships approach and landing. At 200-300 yards from the ship, the airspeed was noted as 40 knots. The landing signal director was on the flight deck center giving line-up signals. As the approach continued, the landing signal director moved backwards along the landing centerline to the middle of the port touchdown circle. The aircraft's approach was slow, flat and low.

As the nose of the aircraft crossed over the flight deck, the director moved backwards and to the left. During the transition for final landing, the pilot (in the left seat) began to have some difficulty seeing the director since the latter was in his blind spot. The pilot lowered the collective and continued forward.

The right main mount hit a mooring bitt and sound-powered phone junction box. The middle of the aircraft's stub wings and main fuselage settled onto these obstructions and the deck edge. The pilot asked the first crewman to find out what was wrong. The crewman reported an external fuel leak. The pilot requested over the radio that the ship tie down the aircraft. When there was no response from the ship's personnel and after determining that the aircraft was controllable, the pilot lifted and safely repositioned the helicopter onto the flight deck.

The pilot secured the engines without starting the auxiliary power unit for fear of fire. Once the rotors stopped, the flight deck crew began to wash the fuel off the deck. There were no injuries. However, the aircraft sustained damage which required over 150 man-hours to repair.

Grampaw Pettibone says:

Great gallopin' ghosts! The potential here for a "fire on deck" was fantastic! Talk about "uncoordinated effort." First of all the pilot made a low approach (some "demonstration" to the pilot he was checking out), then he over-rotated. The landing signal director never knew which pilot was making the approach, so he moved in position to be seen by the other pilot – Great!

The thing that bothers me is why the heck didn't the pilot wave-off when he lost sight of the landing director! That's too simple, I guess! Could this be a case of too much pride on the part of the pilot in that he was demonstrating "how to do it" to the other pilot? Think about it.

ILLUSTRATED BY Osborn

Chain Gang

The pilot and his radar intercept officer (RIO) commenced their briefing for a practice instrument training flight. They covered the route to be taken and the conduct of the flight. The pilot was an experienced aviator with over 3,000 hours and more than 800 hours in the F-4 *Phantom*.

Following the weather check and filing of the flight plan, the two airmen completed a preflight, strapped in and made an uneventful departure. The flight route was to an airfield approximately 350 miles away where the crew planned on hot-refueling and returning to base. This portion of the flight was conducted without incident as was the hot-refueling.

The *Phantom* departed for the return night flight, climbing to 18,000 feet for the first part of the hop. Passing a predetermined point, the pilot climbed to 40,000 feet in an effort to burn excess fuel. Prior to descending to home base, 1,000-1,500 pounds of fuel were dumped to further reduce landing weight.

Passing 7,000 feet on descent, north of the airport, the aircrew was switched from the center frequency to local approach control. The *Phantom* pilot was told "to expect radar vectors to the runway entry point." The surface winds were reported to have a velocity of five knots. The aircrew requested radar vectors to a GCA.

They then received a radar vector to fly a heading of 190 and were told to expect "radar vectors to the precision final runway." This runway was 7,000 feet long. At this time the RIO asked the pilot if he wanted to land on the long runway. The pilot declined and assured the RIO that he could land safely.

While on vectors for final approach, the pilot and copilot discussed arresting gear locations on the runway. The pilot decided to make a long field arrestment in the event of a drag chute failure. A normal GCA was flown with clearance to land given at three miles on final and winds reported at five knots by GCA.

At decision height the aircraft was slightly above the glide path and on course. An on-speed touchdown was made 500 feet down the runway. The drag chute was deployed on touchdown but failed to blossom. At 120 knots the pilot commenced very gentle braking. At mid-field (3,500 feet remaining) the air speed was approximately 110-120 knots.

The pilot then lowered the tailhook with the intention of engaging the long field arresting gear. The arresting gear marker was unlighted. Passing 1,500 feet remaining and feeling no engagement, the pilot selected afterburner, jettisoned the drag chute and initiated a go-around.

The aircraft, in full afterburner, engaged the chain arresting gear located 950 feet from the departure end of the runway on centerline. When he realized he had engaged the arresting gear, the pilot pulled both throttles to off. The aircraft continued to decelerate as it entered the prepared overrun.

The aircraft departed the end of the overrun, continued approximately 160 feet over an unprepared surface and entered a saltwater pond at a speed of 15-20 knots with the arresting cable still attached to the tailhook.

The pilot and RIO exited the aircraft unassisted, walking along the top of the fuselage and stepping from the stabilator to the pond bank.

Neither crew member received any injuries. The aircraft remained semi-submerged in the pond for approximately six hours before the recovery was completed. The aircraft sustained extensive saltwater corrosion damage.

Grampaw Pettibone says:

Jumpin' Jehoshaphat!!! How could so many mistakes be made in one flight? On drag chute failure this driver should'a immediately two-blocked and gone around like Natops sez! When you add this to the pilot's unfamiliarity with the runway, using that runway at his aircraft weight and poor braking technique, this gent just dug the hole deeper and brought himself nearer to disaster. The RIO could have made a stronger case for the longer runway instead of just suggestin' it!

There was a lotta talk about this accident being helped along by the conditions existing at the airfield – as one endorser puts it, hogwash! We just don't have the money to fill in every "pond" or correct what appears to become a discrepancy only when some driver violates Natops. Then we hear the cry WOLF! Nuff sed!

Flying Marines Mark Milestone

Marine Aviation marks its 63rd Anniversary this month On the ground, at sea, or in the air, the flying Leathernecks have gone where needed and fulfilled count less missions for the United States. Their spirit is embodied in the tough, don't-tread-on-me expression of Sergean Jiggs, pictured here in a Vought VE-7 at Quantico, Va AV-8A Harriers are viewed aboard a carrier at sea. Marine troops race toward an objective after disembarking from CH-46F Sea Knight during Exercise Exotic Dancer in North Carolina in 1970. PH1 W. A. Poole was the photographer The helicopter below is a YCH-53E, the likes of which ar destined for Marine use in the near future. The three-engin aircraft will be used for amphibious assault missions, tactica movement of equipment and retrieval of downed aircraft

F3F-2 of VMF-1 over Quantico, 1938.

MCAS Quantico

By Maj. John M. Elliott, USMC (Ret.) and MSgt. Clyde W. Gillespie, USMC (Ret.)

Marine Barracks Quantico was established in December 1918 as a permanent Marine Corps installation and was a major training site during the first world war. With the cessation of hostilities and reduction of military forces, the Marine Flying Field, which was in Miami, Fla., was closed. The aviation component of the Marine Corps was then assigned duties in Haiti; Santo Domingo; Parris Island, S.C.; and Quantico, Va.

Marine Aviators wished to establish the flying field at Belmont Farms near Woodbridge, Va. However, Headquarters wanted it closer to Marine Barracks, Quantico. Land was acquired, under an annual lease, south of the Chopawamsic Creek in an area known as Reid, Va. This is only two miles north of the site where Dr. Samuel P. Langley in 1903 tried unsuccessfully to be the first to fly a powered, man-carrying, heavier-than-air machine.

Squadron C arrived on June 13, 1919. This was a war-time unit which had served in France as a component of the Day Wing, Northern Bombing Group. With the reduction in force, it was now comprised of personnel who had served in other squadrons of the Day Wing, the 1st Marine Aeronautic Company in the Azores, as well as base personnel from Marine Flying Field, Miami.

Under the command of Maj. Francis T. Evans, the troops turned to in a do-it-yourself project to create two flying fields. A small, 2,000-foot field (No. 1), running northeast-southwest, was located on the neck of land which jutted into the Potomac

River east of the Fredericksburg, Richmond and Potomac Railroad tracks. The second, a 2,500-foot field (No. 2), was situated in a generally north-south direction just to the west of the tracks on the present site of the Officer Candidate School. At that time there was no direct connection with Marine Barracks except the railroad trestle across the Chopawamsic Creek. A dirt road connected with the one from Wide Water to Route One, which was also dirt. The road from Marine Barracks intersected Route One about three miles north at Triangle.

As this was to be both a land and water base, three permanent steel land-plane hangars and two seaplane hangars were constructed. In addition, operations buildings, a quartermaster storehouse, a recreation building, shops and numerous small barracks were erected on Field No. 1. The seaplane hangars are still in use, with the gymnasium occupying one and the hobby shop garage the other. Barracks were created from Dixie huts, prefabricated buildings, brought from the deactivated field at Miami.

There had been an aviation unit at Marine Barracks since June 28, 1918 – the Balloon Company, Heavy Artillery Force. It consisted of captive balloons and R-6 seaplanes which provided observation for the artillery units of the 10th Regiment. This outfit operated from the vicinity of the present-day stables and the beach near the docks. A hangar was later constructed on the river bank near the present site of the salvage yard.

The Balloon Company was deactivated on July 1, 1919. The personnel and balloons moved to Marine Flying Field, Reid, Va., where they became part of Squadron C. A large balloon hangar was constructed on Field No. 1 to house the kite and free balloons. Squadron A, another component of the Northern Bombing Group, arrived on September 20, 1919. In June 1920, Marine Corps Aviation at Quantico consisted of only 13 officers and 157 enlisted personnel. They operated a variety of aircraft including the De Havilland DH-4, the Curtiss JN-4, JN-6, and N-9, the Standard E-1, as well as free and kite balloons.

In April 1921, two Quantico-based De Havilland DH-4s made the longest flight of its kind up to that time over land and water. The flight was made without surface vessels to facilitate navigation. The new Officer in Charge of Marine Corps Aviation, Maj. Thomas C. Turner, flew from Washington, D.C., to Santo Domingo and back. For this feat he was awarded the Distinguished Flying Cross.

Marine pilots from Quantico, flying five DH-4Bs, participated in the

Pictured on the flight line in December 1932 upon their return from Nicaragua are, left to right, Captain H. C. Major, Captain F. P. Mulcahy and Lieutenant H. D. Boyden.

controversial bombing of the ex-German battleships off the Virginia Capes in July 1921. The controversy centered around General Billy Mitchell's efforts to prove the value of aerial bombing.

In 1920 the Navy purchased ten Martin MBT/MT aircraft as torpedo planes. It was originally planned that these large land-based planes could be flown on a mission, land in the water and be hoisted aboard to be refurbished for another flight. However, flotation bags were installed in only one plane and the concept was dropped. Five of these aircraft were delivered to the Marines at Reid in September 1921. They participated in maneuvers at Wilderness Run. Eventually nine of the Martins arrived but the tenth aircraft crashed at the factory.

Fields Nos. 1 and 2 became Brown Field on May 5, 1922, honoring 2nd Lt. Walter Vernon Brown, a well-known Marine football player and member of Flight F. He perished in a De Havilland DH-4 a year before en route to a bombing exercise in the Chesapeake Bay. Brown crashed when he apparently became disoriented flying low through a patch of fog.

The newly constructed causeway across Chopawamsic Creek was dedicated the same day in the name of Captain John A. Minnis, another Marine Aviator killed in a night-flying exercise involving the Searchlight Battery located on the site of the present Quantico Naval Hospital. Minnis was diving to avoid being picked up by the lights and did not realize, because of the blinding glare, that he had flown too low. He crashed into the water at the mouth of Quantico Creek on September 23, 1921. Bronze plaques mounted on concrete monuments were dedicated in memory of these flying pioneers. The plaques are now in the Marine Corps Museum.

From June 19 to July 12, 1922, the First Aviation Group, as it was then known, participated in maneuvers with the East Coast Expeditionary Force at Gettysburg, Pa. Three of the Martin bombers, six De Havilland DH-4Bs, six Vought VE-7s and one type-F kite

The changing landscape of Quantico is quite evident in these views. Top photo shows the area with a hangar under construction in February 1931. Above, this November 1955 view is highlighted by paved runways.

balloon were used. All missions assigned to the First Aviation Group were carried out successfully.

In April 1923, the four MTs remaining at NAS San Diego were transferred to the Marine Corps. These were flown across the continent in 11 days. All arrived on the same day, completing what was then the longest and largest aerial delivery of aircraft. In the annual report of the Major General Commandant, this flight was referred to as "one of the most noteworthy achievements of American aviators during the year."

On September 1, 1926, the First Aviation Group was redesignated Aircraft Squadrons, East Coast Expeditionary Force (AS, ECEF).

Throughout the 1920s, Marine Aviation at Quantico continued to participate in the annual maneuvers of the ECEF and in numerous races and air shows around the country. World unrest during this period resulted in Marines being dispatched to China and South America in 1927. Aviation for the first time was deployed as a component part of a Marine Corps expedition. Two squadrons, both with observation missions, were deployed by the AS, ECEF. In March, six planes, equipment and personnel were ready for deployment to China 66 hours after receipt of the movement order. This was considered very good time. Two months later approximately the same amount of material was prepared for shipment to Nicaragua in half that time.

While the expeditionary squadrons operated in Nicaragua, China and the Caribbean, the units remaining at Brown Field continued to keep Marine Corps Aviation in the public eye. One squadron, known at various times as VF-5M and VF-9M, became famous for its precision flying maneuvers at air shows, the National Air Races and other public demonstrations around the country. Most of the senior Marine Aviators of World War II fame were members of this squadron at one time or another.

Activity at Brown Field consisted of training flights for reserve officers on temporary active duty, night flying and all other regular aviation func-

VF-9M pilots won this trophy at Miami Air Meet in 1931.

A two-place 03U-6 is shown at Quantico in 1935.

1929 photo shows F6C-3 Curtiss Hawk at Quantico.

Picture of this OL-9 amphibian was taken in 1933.

Boeing F4B is dwarfed by Marine Corps Ford Tri-Motor.

Curtiss N2C-2 featured unusual vertical stabilizer.

Flying garb of the late 1920s personified simplicity.

tions. However, as aircraft became heavier and faster, it became apparent that the facilities would soon become inadequate.

At that time it was not practical to extend the existing field even though options did exist on all the land surrounding the area. Finally, though, construction began in 1930 on a third field located at the mouth of Chopawamsic Creek. This necessitated cutting away the greater portion of Brown Field east of the railroad tracks for fill, as well as extensive dredging and realignment of the Chopawamsic Creek channel.

The original hangars on the old Field No. 1 were removed and reassembled adjacent to the railroad on No. 2. These hangars are used today as storage facilities for the Marine Corps Museum's aircraft and by a helicopter squadron as a warehouse. The balloon hangar was disassembled for shipment to the lighter-than-air facilities being constructed at Sunnyvale, Calif.

On December 20, 1933, AS, ECEF at Quantico became Aircraft One, Fleet Marine Force.

Filling the swamp proved to be a bigger job than originally anticipated. It was not completed nor was the facility operational until the late 1930s. However, on July 1, 1936, it was officially dedicated as Turner Field in memory of Colonel Turner, Officer in Charge of Marine Corps Aviation. Col. Turner had been killed in Haiti on October 28, 1921, in a ground accident after landing in his Sikorsky RS-1.

On December 1, 1941, the field was named Marine Corps Air Station, Quantico, Va., under the administrative control of the Commanding General, Marine Barracks, Quantico.

With the advent of World War II, all tactical squadrons at Quantico had departed for the West Coast by mid-December 1941. Quantico became an overhaul and repair (O&R) facility as well as a training base. A special building to house the influx of O&R personnel was constructed on the site of Field No. 1. Larsen Gymnasium presently occupies the structure which housed the overhaul facility. It is interesting to note that due to the shortage of materials during the build-up for WW II, the entire back side of the O&R building was made of large wooden beams in place of the steel that was in short supply.

When the Marine Corps determined that observation squadrons for artillery spotting were needed, the mission of establishing them fell to MCAS Quantico. All six VMO squadrons were formed and trained at Quantico. A course of instruction for airborne artillery spotters was also begun. Personnel continued to pour in to support the various activities, so that by the end of November 1944 there were more than 2,000 enlisted personnel, including a squadron of women reserves, aboard.

With the end of WW II, many of the station's missions, including that of the O&R unit, were terminated. One that continued until after the Korean conflict was the Marine Corps Aviation Technical School. This school was established for senior non-commissioned officers and officers in the maintenance, ordnance, supply and parachute-rigging fields.

By the end of WW II all flying had ceased on Field No. 2 and various buildings began to occupy the old runway. However, Turner Field continued to be busy. Aircraft Engineering Squadron 12 (AES-12) flew ordnance missions practically daily in support of the various schools on the base, as well as special demonstrations. In addition, it provided the fixed-wing transport and training aircraft to support the Marine Corps Schools at Quantico. It also provided flight time for aviators attached to the various schools and at Headquarters Marine Corps in Washington, D.C.

On December 1, 1947, HMX-1, the first helicopter squadron in the Marines, was formed at Quantico. Through the years this activity has continued to evaluate and perfect both helicopters and related equipment in support of the Marine Corps Development Center.

The early concept of tactical use of vertical envelopment, which proved so valuable in Korea, was developed by HMX-1. It is also responsible for the Marine Corps' portion of helicopter support for the President of the United States.

In conjunction with the Marine Corps Development Center, a short airfield for tactical support (SATS) was built adjacent to the main runway on Turner Field. This was the first and only time that jet aircraft operated at Quantico. The aircraft were Douglas A4D-2s acquired from an operational squadron at MCAS Beaufort, S.C.

In November 1962, Colonel Robert R. Burns, the air station commanding officer, made the first landing on the new SATS complex. Lieutenant Colonel George E. Mouzakis, the commanding officer of AES-12, made the second landing. Many of the lessons learned on this installation and some of the equipment developed were utilized in the SATS complex established in May 1965 at Chu Lai, Vietnam.

With the arrival of jet aircraft in the military, it was no longer possible to support fixed-wing tactical aircraft at MCAS Quantico on the short runway of Turner Field. They were replaced by the helos of HMM-263, which recently returned from Southeast Asia. In addition to this squadron, fixed wing transport and training aircraft and HMX-1 are active in supporting the needs of the Marine Corps Development and Education Command, as the old Marine Barracks, Quantico is now designated. However, most of the indoctrination demonstrations given to students of the various schools are provided by aircraft of the Second Marine Aircraft Wing from MCAS Cherry Point, and New River, N.C.

While Marine Flying Field, Miami may have been the birthplace of Marine Aviation, Quantico was its cradle. Quantico nurtured it through the difficult growing pains to maturity as a full-fledged component of the Marine Corps.

With today's larger and faster helicopters and more sophisticated jet aircraft, it appears that Quantico is destined to operate medium rotary winged aircraft.

Left, AD-5 Skyraider, 1961; below left, HOK-1 helo; below, AU-1 at Quantico loaded with bombs and rockets. Marines fly late model Skyhawks today which are much improved compared to A4D-2 pictured in 1962, bottom.

marine air reserves

By Lt. Pete Mersky
Photos by Sgt. Wade Irwin, USMCR

It was snowing heavily in Washington, D.C. Three men struggled to tow the F-4 inside the hangar marked VMFA-321. The tower at Andrews AFB was barely visible across the dual runways.

Lieutenant Colonel K. W. Langford, the commanding officer of the Marine Air Reserve Training Detachment (MARTD), motioned towards the hangar: "We're operating the F-4 now and it's a wonderfully reliable aircraft."

Langford, a Texan with 18 years in the Corps, helped the first F-8 reserve squadron work-up at Dallas in 1964. As he puts it, "I've been around the block twice now."

Captain E. J. "Whiskers" Chapman lives in Detroit and makes the three-hour flight to Washington in a little *Mooney* aircraft. He's been all over with the F-4 and says he would go anywhere to fly it. Chapman was the original check pilot for VMFA-321 when the first *Phantoms* arrived in January 1974.

Captain T. J. Billison flies in from Wichita where he is a demonstration pilot for the Cessna *Citation*. Other squadron members come from North Carolina, Delaware and West Virginia. With their pilots averaging 1,500 hours, the 321 crews have as much experience as their active-duty counterparts.

VMFA-321 wrung out its *Phantoms* for the first time on January 4, 1975, when eight F-4s were flown to MCAS Yuma, Ariz., for two weeks' training. Maj. G. R. Hamilton, Jr., operations officer, still talks about the experience which included everything from the Air Combat Tactic Instructor Course to fighter intercept exercises. With OV-10s as forward air controllers (FACs) the squadron flew ground attack missions at Twenty-Nine Palms, Calif., and made alpha strike escort flights with Navy and Marine *Intruders* and *Skyhawks*.

The major training achievement occurred at the Air Combat Maneuvering Range with its six interrogator and receiver sites, 25 miles east of Yuma. Maj. D. V. Denton, the MARTD ex-

Phantom crew prepares to taxi out for weapons training flight, top. Middle, ground crew checks bomb rack prior to launch; rocket pods are positioned in foreground. Marines check landing wheel strut on squadron F-4, above.

Crewmen work off discrepancy during Yuma deployment, below. Right, plane captain helps strap in pilot. VMFA-321 was first Marine reserve unit to fly the Phantoms.

ecutive officer, was enthusiastic about the new computer-fed setup where special pods on the aircraft relay altitude and position data to the site vans which record the information on tape and display it on video screens.

Personnel in the vans can view the hop in progress, and flight crews can see it later on "instant replay." The range also gives "G" data and *Sidewinder* kill-information, after the pilot has pressed the trigger.

Maj. Denton and his fellow pilots developed the head-on visual identification method — known as the Hook VID. This procedure, according to Denton, provided "greater vertical separation before engagement and enabled both aircraft to engage the enemy in a simultaneous strike, rather than the old 'shooter and wingman' methods."

Maj. C. S. McLeran, an Eastern Airlines pilot and 321's commanding officer, says, "We operated that airplane in every environment it was designed for. We have proved the reserves can handle the F-4." The major is proud of his squadron which flew 196 out of 199 scheduled sorties at Yuma and 323 out of 326 scheduled flight hours. "We were smoothly coordinated into a fully operational unit."

Sergeant Major J. Sanchez, MARTD NCOIC, is one of 60 regular Marines who advise the enlisted reservists. Active duty Marines maintain the F-4s during the week, then turn major maintenance duty over to the reserves on weekends. MSgt. J. L. Hopewell, the senior reserve NCO, who works for several magazines including *Leatherneck* when not on duty with the squadron, says, "Around here you can't tell the difference between reserves and regulars — the harmony is so complete."

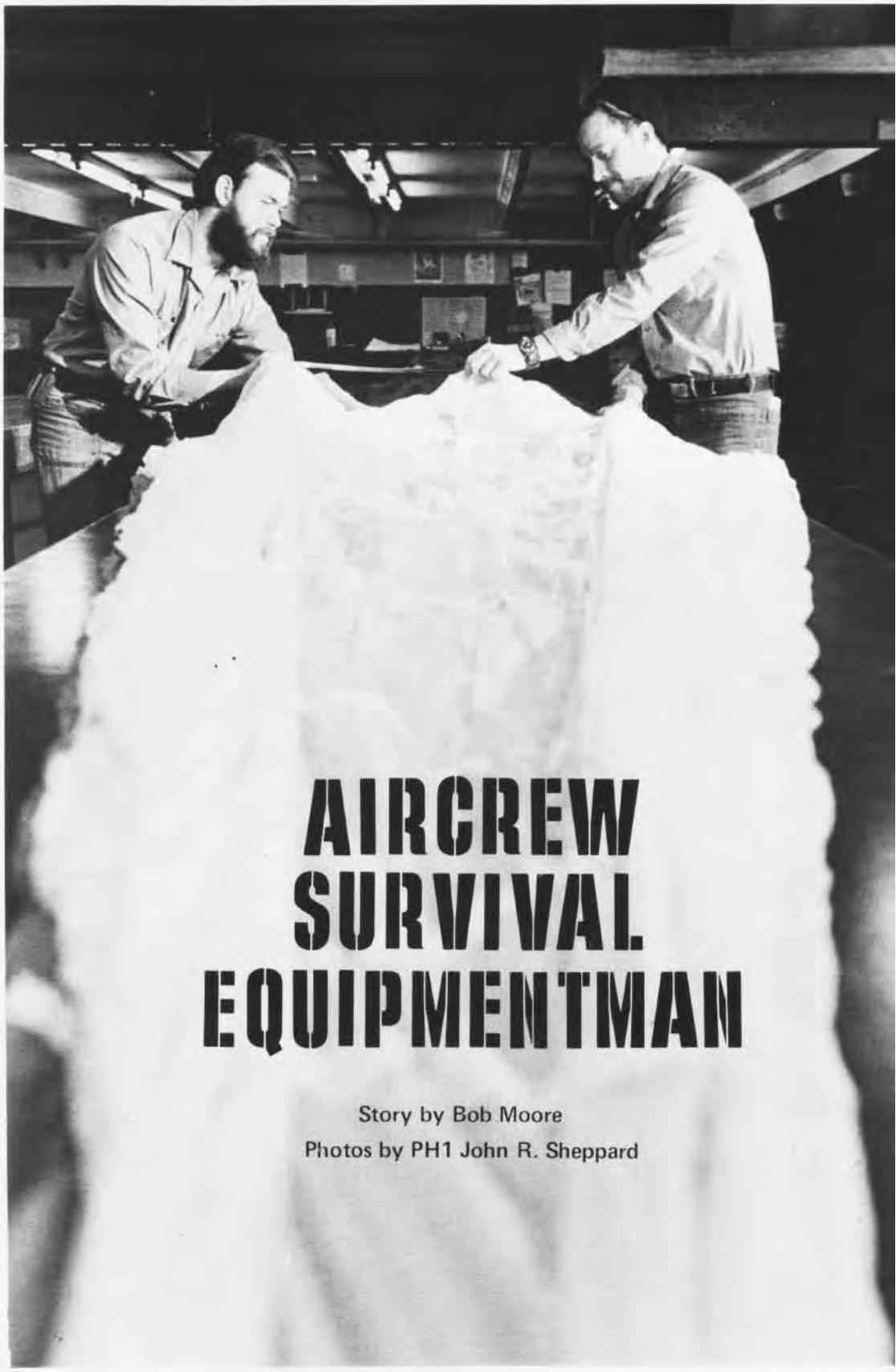
By early afternoon the snow began to lighten and the green-clad Marines scurried around and over their big fighters, eagerly anticipating a launch.

Left, maintenance man puts muscle into wheel repair task. Lower left, F-4 is guided to parking area. Below, flight crews underwent survival training while in Arizona.

PAINTING BY JOHN AMENDOLA


MF-4
2-MF-1
MARINES

ENLISTED RATING SERIES 2



AIRCREW SURVIVAL EQUIPMENTMAN

Story by Bob Moore

Photos by PH1 John R. Sheppard

He went past the long polished tables in the main loft, past the sewing machines and side rooms with all the life vests and rafts and oxygen testing equipment. He walked through the door beyond the old 60-foot drying tower where parachutes used to hang full length to dry and lose their static electricity.

Selecting a chute from a shelf-type storage bin, he returned to his partner across the table. They opened the pack, laid out the chute for inspection, whipped and folded the canopy, and carefully began to push the shroud lines into hesitator loops, using tools like oversize buttonhooks.

He didn't have to measure. There were 1,055 feet of line. And each foot must be felt for a flaw and each stitch must be studied for a break. Without counting, he knew there were half a million stitches in this chute. Each one was strong and evenly spaced.

Were there holes in the canopy panel? Any chafed, weak areas that might tear? Was the canopy safe? The pack secure?

Aircrew Survival Equipmentmen (PRs) double-check each of the five major parachute parts – the pilot chute which pulls out the main 28-foot canopy, the canopy itself, the suspension lines, the harness and the pack.

The ripcord assembly receives special attention. Twenty-two pounds of pull should release the pilot chute. Automatic actuators are installed in high performance ejection seat systems to trigger the parachute at 10,000 feet of altitude.

Although one man can pack a chute, it's never done that way. There are always two riggers to pack, with double checking done by the quality assurance inspector. No matter how experienced the riggers, they always double-check – that chute has to work the first time.

Packing a huge mass of rip-stop chute, shroud lines and a house-size canopy is painstaking work. But two PRs take just 30 minutes to neatly tuck a parachute into its compact container. And the Navy's 1,500 PRs inspect and repack a score of different types of parachutes.

Parachutes packed by IMA personnel, top, will be delivered to the squadron paraloft to be stacked, checked, folded and repacked. After the whip and fold cycle, opposite, the quality assurance inspection, below, must be completed before the packers can continue placing the parachute panels and shroud lines in the backpack parachutes.

Lines are stowed in hesitator loops with a sewing hook, right. PR trainees at NAS Lakehurst line up for their first jump, below.

Most people have trouble just packing their raincoat into its small plastic packet. But several weeks of A School at NAS Lakehurst, N.J., are mandatory for all PRs and make parachute packing a science of simplicity.

It has been this way since September 1924 when two Navy chiefs checked into an unheated shed at Lakehurst to teach 15 sailors how to rig a chute. The motto of that first class was: "No job too great, no detail too small, to save a life."

At Lakehurst the prospective rigger began to earn his rating. He learned to maintain and repair the various parachutes, life preservers and life rafts. His graduation was highlighted by his free-fall parachute jump with equipment that he had packed himself.

The first PRs jumped from the wing tips of biplanes. Later, they let go from short rope ladders suspended from open gondolas of airships. These were replaced by training and patrol airships and then the C-117.

On joining a fleet squadron, the PR maintained and repacked all the squadron parachutes, flotation gear and life support equipment of his day. Being one of these first "parachute men" was a collateral duty for Aviation Machinist's Mates and Carpenter's Mates who proudly wore a small parachute specialty badge on their left sleeve. World War II focused the Navy's attention on the importance of survival equipment and the rating of Parachute Rigger was established in February 1942.

Since 1965, PRs have been called Aircrew Survival Equipmentmen. Quite a mouthful. But the job grew like the name.

With jet aircraft, the duties and responsibilities of the PR began to change. New planes generated a wide variety of requirements and problems. High-speed flight meant escape systems with multiple parachutes and exact, split-second timing. High-altitude flight meant testing and repairing complex oxygen systems, full-pressure flying gear and anti-exposure suits.

So squadron riggers began to limit their efforts to aircrew equipment and personal survival items, while leaving repacking or bench testing of general life support equipment to other riggers

This student from the first PR class jumped from the reinforced lower wing of a biplane, above. Other early training jumps by PRs were made from a blimp gondola, below.

The Rigger's Creed

P ack every parachute as if you were going to jump with it.

A llow for human frailties and look twice for mistakes.

R emember that the other fellow's life is as dear to him as yours is to you.

A lways be sure. Never leave it to guesswork.

C hance is a fool's god. Don't depend on it.

H unt for trouble. Don't wait for it to corner you.

U nless you would jump with a parachute yourself, don't expect the other fellow to.

T ill men grow wings, they'll need parachutes that they can depend on.

E very time a rigger makes a mistake or an oversight, there is a potential murderer loose.

S ee that it isn't you.

From the time Leonardo DaVinci first sketched his parachute in 1495 until WW I, many considered the chute a dangerous device for exhibitionists and thrill seekers.

Even when parachutes were designated as mandatory gear for all military flyers in 1923, many pilots still chose to ride their disabled planes to the ground. Then it was reasoned that if the riggers had the confidence to jump with chutes they packed themselves, aviators might be more willing. This reasoning proved correct and entire crews were saved when they jumped.

In October 1922, Lt. Harold Harris made a successful parachute escape from an aircraft over McCook Field at Dayton, Ohio. McCook Field, which later became Wright Field, was also the scene where another test pilot saved his life with an emergency parachute jump. After this second jump, McCook Field's parachute section formed a club symbolized by a caterpillar lowering itself to earth on a silken thread. The club grew to include Jimmy Doolittle, Charles Lindbergh, and thousands of airmen.

Almost as old as aviation itself, the Caterpillar Club is made up of pilots who owe their lives to parachutes and to the proud men who pack them.

The Caterpillar Club

at an Intermediate Maintenance Activity which serves various squadrons.

Although no longer a mandatory rating requirement, most PRs are still jumpers. They call it good training – especially for a man who wants to get into parachute design and testing at the El Centro, Calif., Naval Aerospace Recovery Facility.

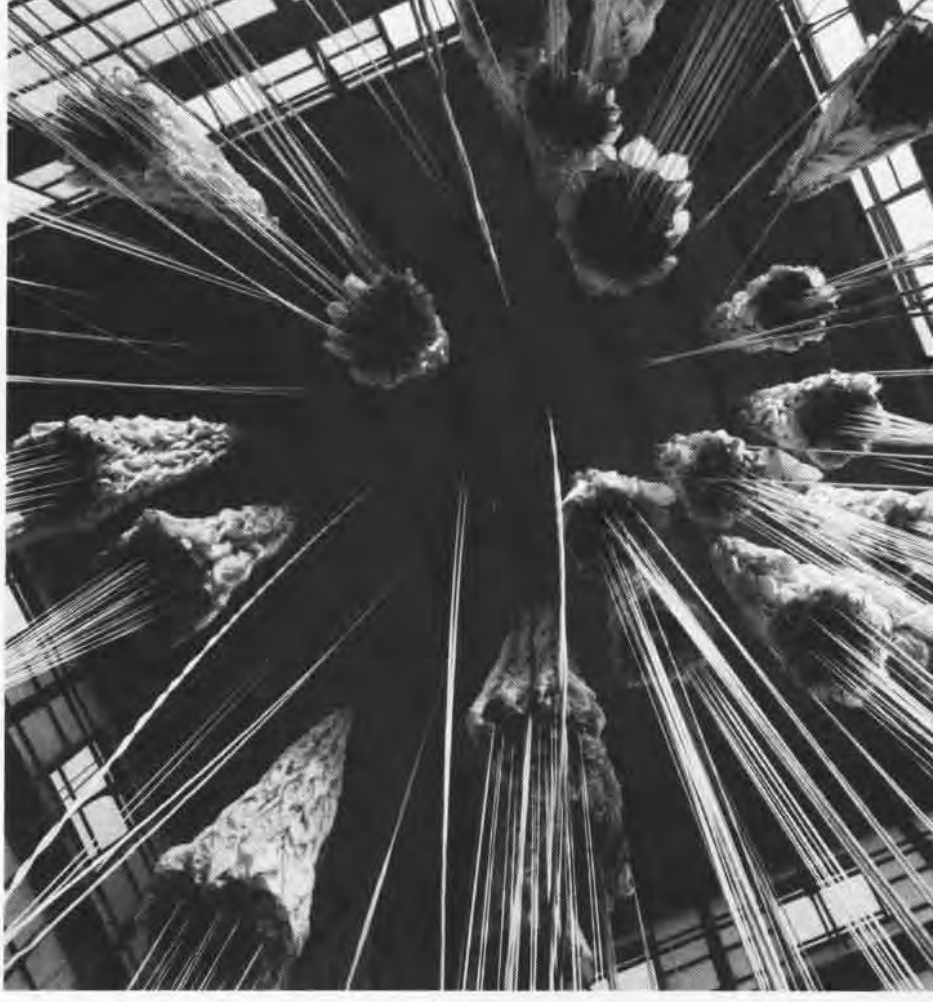
Because nylon doesn't absorb and give off moisture like silk, today's parachutes don't require drying in the loft. But they still must be inspected with the check-cycle of the aircraft, along with life rafts. Maintaining life rafts and vests comprises the PRs' most time-consuming work. It takes a day or two just to check for leaks. Then all faulty flotation gear is patched and rechecked by PRs in the raft shop.

These men who wear the winged-parachute rating badge on their shoulders also measure and sew aircrew clothing and flight bags and aviation equipment like seats, engine covers and tie-down straps. They maintain oxygen regulators, liquid oxygen convertors and components, carbon dioxide inflation bottles, exposure and anti-G suits, communication and jungle rescue equipment, first aid kits and protective headgear.

Today's Aircrew Survival Equipmentman is more versatile and involved than ever. He is an effective safety instructor and an expert at briefing pilots on the correct use of life support equipment. Perhaps the best way to describe him is to say he does whatever is necessary to ensure aircrew survival.

He may still squint through the eye of a needle like an oldtime sailmaker, but he works with modern fabrics and machines to guard the lives of his shipmates on aircraft carriers or naval air stations. No job is too great, no detail too small, when perfection is a necessity.

When not on the flight line or hangar deck, the Aircrew Survival Equipmentman does his thing in the parachute loft, separated from the center of maintenance activity. But rather than the forgotten man, he is the invaluable man in Naval Aviation. And until men grow feathers, Navy parachute riggers are the best and last chance for an aircrew's survival.



Parachutes no longer hang in the drying tower before packing, but they are still inspected on a check cycle by conscientious men who wear the winged parachute rating badge of the Aircrew Survival Equipmentman.

PH1 Harold Phillips

Cdr. John S. Brickner, skipper of the VF-111 *Sundowners,* recently made his 1,000th carrier arrested landing aboard *Coral Sea.*

Following a routine training mission Capt. Jerry O. Tuttle, Commander, Carrier Air Wing Three, flew an F-4 *Phantom* aboard USS *Saratoga,* marking his 1,000th trap.

Fleet E-2 *Hawkeyes* and C-2 *Greyhounds* are getting new propellers. Navy units are installing the Hamilton Standard fiberglass propeller systems on E-2Bs and C-2As. Flight limitations imposed in 1972 will be lifted upon incorporation of the system permitting the aircraft to utilize the full Natops flight envelope. While E-2s and C-2s are being retrofitted, E-2C versions of the *Hawkeye* yet to be delivered will have the new props already installed by the Grumman Corporation, builders of the aircraft. Conversion of the *Hawkeyes* and *Greyhounds* began last September after extensive preliminary tests.

Shown in the photograph are the test C2A used in the prop development program and the first converted E-2C at Grumman Bethpage flight test facility.

The *Warhorses* of VA-55, commanded by Cdr. A. C. Vold, celebrated their 32nd birthday while deployed aboard *Hancock* in February.

En route home from the Hawaiian Islands aboard *Kitty Hawk,* the *Golden Dragons* of VA-192 observed their 30th birthday. The squadron is led by Cdr. David N. Rogers.

MCAS El Toro shares its birthday with St Patrick. The Marine Corps air station was commissioned 32 years ago on March 17, 1943, situated on what had been a flat bean field on the Irvine Ranch. Today it is comparable to a city twice the size of adjacent El Toro. The first 30 Marines were bedded down in a ranch bunkhouse. Today MCAS El Toro has a population of more than 10,000 military and civilian personnel. El Toro is presently under the command of Brig. Gen. R. W. Taylor.

The Texas Society of the DAR recently presented Achievement Awards to outstanding Navy, Marine Corps and Coast Guard student Naval Aviators of 1974 in the Naval Air Training Command. RAdm. Wesley L. McDonald, CNATra, was guest speaker at the ceremony held at NAS Corpus Christi.

Winners were: Navy -- Ens. John G. Eager, VF-24, NAS Miramar; Marine Corps -- 1st Lt. Lynn Klinefelter, VMAT-203, MCAS Cherry Point; and Coast Guard -- Ltjg. John W. Whitehouse, CGAS North Bend, Ore. Ens. Eager and 1st Lt. Klinefelter earned their awards while assigned to VT-25, NAS Chase Field. Ltjg. Whitehouse trained with HT-18, NAS Whiting Field.

The CNO Golden Wrench Award for outstanding aircraft maintenance has been won by VP-22, Barbers Point, for the January 1973 to June 1974 competitive cycle. LCdr. William L. Rice is skipper of the squadron. LCdr. David R. Houghton is the maintenance officer and AVCM John Driver is senior maintenance CPO.

Navy's new Lockheed S-3As joined the Atlantic Fleet on March 13 when three *Vikings* flew nonstop from NAS North Island to NAS Cecil Field to open formal fleet introduction ceremonies. They are assigned to VS-22, one of six *Viking* squadrons which will comprise Air Antisubmarine Wing One at Cecil Field. The squadrons will be deployed aboard carriers on a rotational schedule beginning this year.

One of Navy's newest and least known flying activities is nestled atop Honshu Island 400 miles north of Tokyo -- Commander Fleet Air, Western Pacific, Det Misawa. Since July 1972, Capt. Arthur K. Bennett, Jr., and the detachment have provided all operational support, including maintenance and fueling, for all U.S. aircraft stopping here. The activity has grown from one man, the officer-in-charge whose official transportation was a bicycle, to over a hundred military personnel, including seven officers. Whenever patrol squadron planes operate in the Misawa area, the flying Navy's population goes up another hundred. When a carrier air group uses the airfield, the Navy population swells to over 400.

During his normal workday at MCAS Beaufort, 1st Lt. Richard Stearns, USMC, trains with weapons which make him a most sophisticated fighting man. But after he climbs down from his *Phantom* and takes off his flight suit, Lt. Stearns becomes a Confederate Civil War private.

He explains that he has been around guns, especially old ones, all his life. As a member of the Low Country Bark Busters Black Powder Club in Lobeco, S.C., the Civil War buff can be found firing his vintage weapons, usually on the second Sunday of every month. As a member of the North-South Skirmish Association in Winchester, Va., he participates in outings during which he wears a Civil War uniform. And on Monday morning, he is once again today's up-to-date fighting man.

Secretary of the Navy J. William Middendorf II visited MCAS Yuma in March on the occasion of Military Appreciation Day, sponsored by the Chamber of Commerce. He had brunch with a number of Marines and sailors at the enlisted dining facility and visited VMFAT-101, VMAT-102 and VA-174. At a banquet that evening the Secretary commented on the high degree of mutual respect and cooperation between the local civilian and military communities.

In February, one of Navy's most distinguished living aviation pioneers, LCdr. Patrick J. "Pappy" Byrne, USN (Ret.), was the honored guest at the dedication of NAS North Island's new enlisted dining hall which bears his name. LCdr. Byrne is considered a living legend who flew 140 different Navy aircraft over a 40-year period.

Pappy joined the Navy in 1917 and as a machinist's mate flew as copilot, plane captain and signalman with the seaplane patrol unit based at NAS Norfolk, Va. In 1920 he graduated from flight training with the first class of enlisted men and was designated Naval Aviation Pilot No. 10. Pappy's accomplishments resulted in his being awarded the Legion of Merit in 1955 for his services to the government.

Eighteen air crews of Kaneohe-based VMFA-235 deployed on board *Kitty Hawk* (CV-63) in March for carrier landing qualifications. Flying F-4J *Phantoms,* the *Death Angels* conducted 60 touch-and-go and 96 arrested landings.

ComNavAirLant has announced the winners of the annual ship handling competition. They are: Ltjg. J. P. Mulroy, *JFK;* LCdr. W. B. Ison, *America;* CWO3 L. R. Thomas, *Independence;* Lt. T. H. Hartung, *Lexington;* and Ltjg. M. P. Walsh, *Forrestal.*

SN Robert M. Cheeks of USS *Caloosahatchee* (AO-98) was on his way to South Weymouth to be with his wife over the weekend via a VR-1 transport. It was a very special flight because it made him the 200,000th passenger to fly on a VR-1 C-9B. In honor of the occasion SN Cheeks received a photo of two *Skytrain IIs,* a C-9B lapel pin, a specially reserved seat -- and also free pizza during the flight.

The *Blue Geese* of VP-22 have surpassed the 21-year mark in accident-free operational flying. The achievement was observed not by the usual ceremony but by simulating an aircraft accident in which squadron personnel had to review and practice accident/mishap procedures. The mock accident showed where improvement was needed but also demonstrated that crisis brings out the best in a person.

The Captain Robert M. Hanson Marine Fighter Squadron of the Year Award for fiscal year ending June 30, 1974, was won by the *Red Devils* of VMFA-232, MCAS Iwakuni. During its deployment aboard *Kitty Hawk,* the squadron passed the 10,000th accident-free flight hour mark.

Cdr. J. B. McKamey, commanding officer of VT-9, logged his squadron's 50,000th accident-free flight hour on January 11th. This record was set during 33 months of operations.

NAF Sigonella has been cited for nine years of accident-free aircraft operations. During this period over 20,000 flight hours were flown by Sigonella-based aircraft, including C-117 and C-131 cargo planes, H-34, HU-16, H-2 and H-46 helicopters, and S-2 patrol planes.

VXN-8 has flown more than seven years and over 40,000 hours of accident-free operations throughout the world since its commissioning. This record was made possible by attention to detail in mission planning, flight execution and maintenance. The maintenance and flight crews take pride in their worldwide endeavors.

During the Battle of the Coral Sea, Capt. B. J. Perlman, commanding the cruiser *Portland,* took a picture of USS *Lexington* (CV-2) just before she blew up, burned and had to be abandoned. It is the only operational photo of the ship showing her wartime aircraft and the absence of her 8" turrets. Recently, the original of the photo was presented to Capt. D. Moore, skipper of *Lexington* (CVT-16) by the president of the Coral Sea Association, William F. Surgi.

Surgi is an AK2 in VR-2106, a reserve unit of NARU Washington. He was a streamliner, part of a reduced complement, aboard *Lexington* in WW II. Streamliners were not permitted to make takeoffs and landings but Surgi finally made his carrier landing 30 years later on *Lexington's* namesake, CVT-16, in a C-1 COD aircraft when he journeyed to *Lex* for the presentation.

After a cyclone struck the tiny island nation of Mauritius in the Indian Ocean in February, three Navy ships, *Enterprise* (CVAN-65), *Camden* (AOE-2) and *Mars* (AFS-I), aided in disaster relief operations. One of the major problems was restoration of the island's water supply. Helos from *Camden* and *Mars,* operating off *Enterprise,* moved sections of pipe into place for local crews to hook up. The carrier's engineers restored the water filter beds to serviceable condition and also supplied local fishing boats with 60,000 gallons of fresh water. Crewmen restored a school for mentally retarded children and helped clear roadways of fallen trees. Public officials and the people themselves expressed their appreciation for the help that had been so spontaneously given.

Cdr. K. R. McCarty has relieved Cdr. J. V. Davis as C.O. of Jacksonville-based HS-15. Cdr. Davis is now assigned to NavAirSysCom in Washington, D.C.

In a ceremony at NAS Whidbey Island

command of VA-52 passed from Cdr. R. S. Owen to Cdr. Clifton E. Banta III.

RAdm. James D. Ramage assumed two new commands, Naval Forces Caribbean and Naval Base Roosevelt Roads, in an administrative realignment of the Caribbean Sea Frontier/Tenth Naval District. He continues as Commander, Antilles Defense Command.

Command of VA-12 passed from Cdr. John F. Calhoun to Cdr. James M. Hickerson in ceremonies at Cecil Field. Cdr. Hickerson, who was among the POWs released in North Vietnam in March 1973, came to VA-12 from refresher training at VA-174.

LCdr. William F. Knobloch, a Boeing 727 pilot with Pacific Southwest Airlines, relieved Cdr. Victor R. Ligtenberg as C.O. of VAW-88, a reserve squadron, on March 15.

Cdr. Edwin R. Kohn, Jr., has been relieved by Cdr. Gerald L. Riendeau as commanding officer of Attack Carrier Air Wing One, currently deployed aboard *Kennedy*.

Less than a year after becoming Navy's first female aviator, Lt. Barbara Allen Rainey became the first woman in the Navy to qualify as a jet pilot. She is attached to VR-30 at NAS Alameda and flies the T-39 jets used for VIP flights and transporting ferry pilots.

John F. Kennedy (CV-67) was a training platform for MAG-32's Beaufort-based A-4 *Skyhawk* squadrons during 10 days of carrier qualifications off the coast of South Carolina. The ten-day period included day and night operations for VMAs 311 and 331.

Filipino students who are receiving their high school education with the aid of *Coral Sea* sailors came aboard the carrier to thank the crewmen for contributing to Operation Schoolhouse. The project was organized 10 years ago by a lone sailor at the San Miguel naval communication station ninety miles northwest of Manila. He had learned that many youngsters were being deprived of a high school education because they could not pay the tuition cost, small as it was. *Coral Sea* and other Seventh Fleet ships, together with an interested U.S. Navy community in the Philippines are helping to keep Operation Schoolhouse afloat with money and administrative assistance.

A 33-man team aboard USS *Okinawa*, headed by ABC Billy Barnett, launches Marine Corps helicopters for flight and secures them to the sometimes tossing deck upon their return. The flight deck crew feels that the pace aboard a helo carrier is a little slower than on carriers which launch and receive jets simultaneously. During flight quarters, safety is uppermost to ABC Barnett. "The primary thing I watch for is unauthorized people wandering near the flight deck...." *Okinawa* is currently operating in the Western Pacific.

During the first extensive Atlantic Fleet F-14 operations in March VF-32 recorded 69 day and 45 night traps and 26 practice touch and go's. The *Swordsmen*, under Cdr. J. G. Knutson, carqualed onboard *Kennedy* off the coast of Virginia and North Carolina.

CORROSION

CONTROL IN NAVAL AIRCRAFT

By Alfred M. Malloy

Aircraft corrosion in the Navy probably started with the Curtiss N-9 single-float seaplane during World War I. Since then, natural elements have rotted wood, mildewed doped fabric, rusted iron, caused magnesium to disappear in the form of fine powder and induced several varieties of catastrophic corrosion in high alloy aluminum. Not only are millions of dollars spent in the anticorrosion battle, but a great number of man-hours also go into maintenance, repair and replacement of parts. Loss of life has been attributed to corrosion-induced failures of critical aircraft parts. Increases in downtime of aircraft may be traced, at least in part, to the need to fight corrosion continually and efficiently. But corrosion continues to plague the fleet.

Protection against deterioration of aircraft, always an important Navy function, has become increasingly effective. Problems of water absorption by wood were attacked in the early days with varnish. Copper cladding was used to reduce water absorption on wooden floats and to discourage barnacle formation. Galvanic action at fasteners was arrested by electro plating. Faying surfaces initially were insulated and sealed with flannel tape then with zinc chromate impregnated tape. Later zinc chromate paste was used. A very popular and widely used item in the early 1940s was W. P. Fuller Company's TL-284 zinc chromate paste. Even then, clad aluminum alloys, because of their softness, scratched easily and corrosion occurred at the scratches.

Experience varied. Some models received only minimum protection – the P-59 which went into Chesapeake Bay at Patuxent River and had to be stricken because the structure was eaten away after only one day in salt water; or the magnesium inlet duct on the F-8 which became perforated in the first few weeks of its initial deployment. Other models remained in good condition, such as the F6F which was in the ocean for years before it was pulled out, and the B-24 which went into the North Sea and when pulled out a couple of months later showed practically no evidence of

corrosion. In brief, some models lasted better than others and some showed horrible examples of corrosion.

More recent Naval Air Systems Command (NavAirSysCom) anticorrosion efforts involve design changes, scientific and technological research and development, improvements in maintenance, and pursuit of breakthroughs in research and development. NavAirSysCom also benefits from the experience and research of private industry and the other Services. Since the major material of aircraft construction was, and still is, aluminum alloy, this article will deal largely with aluminum – even though problems and failure modes characteristic of high strength steel, titanium and magnesium (the latter vulnerable mainly in a salt air environment) also exist and cannot be lightly dismissed.

There are four conditions that must exist if corrosion is to occur. There must be an anode, a cathode, a metallic path for the conduction of electrons, and an environment – the so-called "vicious circle of corrosion." Remove any one of these and corrosion will not occur.

In a marine environment, such as on shipboard, which readily supplies a saltwater connection between the anode and cathode, corrosion can be of several types occurring singly or in combination. The main types are: galvanic attack, pitting, stress corrosion, intergranular attack, exfoliation (metal sloughing off in layers), crevice, fretting, filiform (threadlike), and corrosion fatigue.

In the 1940s and 1950s, airplanes were made of AA2024 aluminum alloy, their thin skins clad with pure aluminum. The net result was that corrosion was easily overcome. Replacement of the skin sections was not much more difficult than repairing or replacing the fenders on an automobile. The fasteners were installed in dimples impressed on the thin sheet and the alclad surface of the sheet itself acted as a bearing surface for the head of the fastener. Very few access panels were required. The result was an aircraft relatively free of corrosion and easy to maintain.

The inexorable drive for higher performance aircraft, starting in the 1950s, forced aeronautical designers to use non-clad aluminum alloys for higher strength. Unfortunately, these are both more highly stressed and more corrosion prone. Aircraft skins are now made of high-strength aluminum alloys machined out of large slabs of metal, such as wing planks. Cladding is increasingly rare on modern Navy planes. Permanent and removable high-strength steel fasteners (cadmium-plated) are inserted into drilled and countersunk holes. These have a built-in potential for dissimilar materials to be in contact with, and create a gap around, the border of the fastener head which entraps dirt, soil, detergents, salt, etc., and provides an easy access route for the environment, inducing galvanic corrosion. In addition, in modern high-performance aircraft, there are many access panels, structurally loaded, with hundreds of fasteners which are removable for periodic inspection and maintenance. The paint finish is broken whenever these are removed, resulting in continuing paint touch-ups which rarely achieve the quality, appearance or anticorrosion value of the protective finish applied by the original contractor or naval air rework facility (NARF).

These and other differences result in a corrosion-prone aircraft which requires a large and continuing maintenance effort to keep it flying.

Two of the current factors which expose aircraft to more heavily loaded usage, distortions, cracking, fatigue failure, etc., are the length of sea deployments and the extended time we now keep aircraft in service.

A fighter used to be in first-line service only a relatively short time, particularly in a shooting war. Today, we extend our F-8s and F-4s through several extra tours. The "design" life has been increased from 1,000 or 1,500 to about 6,000 flight hours. Since many existing aircraft are getting older, there is a substantial replacement of corroded parts, such as fasteners, gun mounts, piano hinges, brackets and hinge fittings. At the same time, partly as a result of extensive paint touch-up, there is a more frequent need for paint stripping, followed by repainting with the new high-performance finishes which have become standard.

In many types of deterioration – specifically stress corrosion, intergranular corrosion, and hydrogen embrittlement of high-strength steel or titanium (resulting from plating practices, paint-stripping operations and some other reactions) – there is not much visible corrosion damage. However, damage may, in fact, be severe and hasty conclusions should not be based solely on the quantity of visible corrosion products.

In feedback to contractors and in instructions to the naval air complex, the protective measures NavAirSysCom commonly employs include any of the following which may be appropriate and feasible at the time: anodizing or chemical surface passivation, sealing joints, crevices and depressions with sealing compounds, insulation of coupled dissimilar metals, passivation of drilled holes and cut edges, filling gaps in the external skin, shot-peening to incorporate a compressive stress to balance tensile stresses, drilling holes and connective channels to assure adequate drainage of water, use of metallic coatings or metal spray, and modification of the heat treatment. Changes in the metal are sometimes made but this is harder to do because of strength and weight considerations.

Besides changes in the basic design specification (SD-24) to preclude recurrence of difficulties in later designs, maintenance manual No. 01-1A-509, "Aircraft Cleaning and Corrosion Control," has been revised, incorporating the latest procedures based on experience and experimentation.

Successful as the remedial process may have been, it became increasingly apparent that correction of in-service failures, breakages and loss of critical components was an after-the-fact activity and therefore could never solve the basic causes of failure. What was needed was an accelerated effort toward *preventing* the corrosion problem. With this in mind, NavAirSysCom expanded its search for solu-

tions in several areas.

In addition to a comprehensive in-house program at the Naval Air Development Center – individual projects in protective coatings, chemical and physical metallurgy, chemical engineering, and non-destructive testing to detect corrosion – several R&D contracts were awarded to civilian firms to mount a massive attack on corrosion.

The main R&D programs, now or recently under way, are:

Heat treatment – One of the most important procedures developed is the T-73 heat treatment of high-strength aluminum alloys. This modification of the formerly widely used T-6 temper on 7075 alloy products produces material resistant to exfoliation, stress corrosion and intergranular corrosion susceptibility, at a penalty of about 10 percent in initial design strength.

New aluminum alloy – Exfoliation corrosion and stress-corrosion cracking problems afflict the aircraft models in the inventory which were originally built to requirements and practices of the 1950s and 1960s. The major cause is attributed to aluminum alloys which are inherently susceptible to exfoliation corrosion and stress-corrosion cracking when used in sculptured thick sections.

Although new programs, including the S-3 and F-14, have been contracted under up-to-date specification requirements (for example, the J versions of SD-24 and MIL-F-7179), certain models procured essentially off-the-shelf unfortunately do not lend themselves to specification control for reasons inherent in the military acquisition process.

The issue of what should be done with older and in-production aircraft built to old requirements has been raised before but has stumbled over the question of financial resources. And so, with few exceptions, problems were addressed on a piecemeal basis instead of as an across-the-board program of prevention.

R&D for improving the corrosion resistance of currently used high-strength aluminum alloy has resulted in new protective procedures and new heat treatments for the AA7000 series alloys. These are being extensively used in new designs such as the S-3. Because of the sacrifice in strength as a result of these heat treatments, substitution of these new tempers in older aircraft would unfortunately require redesign of the part.

NavAirSysCom now has a new aluminum alloy, AA7050 (developed by ALCOA under a NavAirSysCom contract), which combines resistance to exfoliation and stress corrosion with high strength, superior toughness and excellent fatigue behavior. This combination of properties enables, with very few exceptions, the direct substitution of AA7050 for corrosion-prone materials without redesign of the part. It is somewhat subject to pitting corrosion under severe exposure, but not as much as 7075-T73, and therefore still requires surface protection by organic coating. By using protective coatings, we can more readily protect against pitting-type corrosion than against exfoliation corrosion.

The alloy has been well characterized in the laboratory and there is no question as to its producibility and its being an improvement over all existing aluminum alloys. It is now replacing 7079-T6 and 7075-T6 in several aircraft on a part-for-part basis. Its strength equals or exceeds that of the previously existing highest-strength aluminum alloys in thick sections; its toughness and fatigue properties are higher than those of commercial aluminum alloys; and its resistance to exfoliation corrosion and stress-corrosion cracking substantially exceeds those of any commercially established aluminum alloy of equal strength. Its cost and fabrication characteristics are comparable to those of other high-strength aluminum alloys, and no special equipment is required. Several production lots of three-inch-thick 7050-T73651 plate (over 70,000 pounds) have been manufactured for the forward and aft fuselage bulkhead of the A-6.

In the NARF modification Bee-Line program for F-4s, the main wing-to-fuselage attachment, which is presently made of 7079-T651 alloy, has been replaced on two airplanes by 7050 alloy. A number of other products and parts are being manufactured from 7050 and are being evaluated by several aircraft companies. Examples include forgings for the A-7 nose landing gear outer cylinder, wing planks for the S-3A, H-2 transmission covers and A-7 wing attached bulkheads.

A design data test program is near completion. It is hoped it will generate a more complete mechanical property data base. This will permit the development of statistically meaningful design properties and specification limits. It will also provide dependable levels of fracture toughness, fatigue strength and crack growth rates, and corrosion resistance.

The technology to produce large ingots and extrusions, for parts such as large wing planks, is being developed by the Air Force under its manufacturing technology program.

No discussion of corrosion protection would amount to anything without a detailed discussion of protective coatings (paint).

Organic coatings have been important in the progress of Naval Aviation. The early airplanes, constructed of wood, fabric and wire, with a few bolts and sheet-metal fittings and with speeds not much in excess of sea-going ships of today, were well protected by the organic finishes which had already been developed for ships. Red lead, long-oil varnish and blue-steel-wire lacquer were the early standbys and except for nitrate dope which was introduced to tauten cotton fabric endured until the end of World War I. Then spar varnish brought improved moisture resistance to wood, and acetate dope brought a degree of fire resistance to fabric. As aluminum came into the picture, red oxide primers, navy gray enamels and aluminum-pigmented dope became the standard organic finishes and "served the purpose" well.

In the 1930s, radical changes were being made in construction of naval aircraft. The design was passing from the stick-and-wire type of construction to the welded-steel-tubular type, and experimental work was under way on the monocoque system of design in which the utilization of light alloy appeared to offer marked advantages

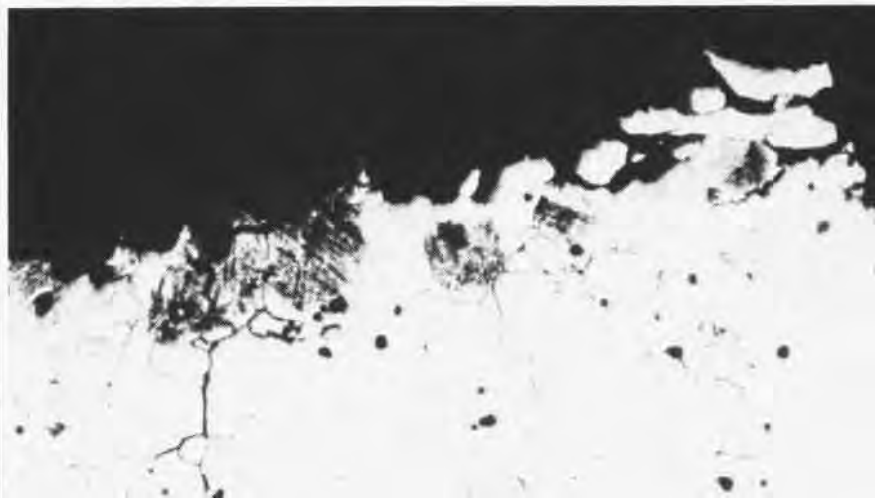
Obviously, these changes in construction demanded new and better materials and the preparation of specifications controlling their procurement. New fabricating and maintenance techniques were also needed, which in themselves created new problems and initiated research and development work along previously unexplored lines. Later in the 1930s, the red oxide primer was replaced by zinc chromate primer, a distinctly aeronautical development which practically eliminated corrosion of aluminum *at that time* as a factor in the service life of airplanes. Navy gray enamel was later supplanted by lacquer and the acetate dopes were replaced by the fire-resistant cellulose acetate butyrate type (accomplished "overnight" by the author in response to an urgent fleet fire hazard situation).

Dr. Henry A. Gardner was prominent in the technology of aircraft finishes in the 1920s and the 1930s as consulting chemist to the Bureau of Construction and Repair. (In 1924, Dr. Gardner headed up his own laboratory on Constitution Avenue, known as B Street at that time, and later the Henry A. Gardner Paint Laboratory in Bethesda, Md.)

Together with Mr. George Sward, he was responsible for development of most of the sophisticated test equipment and test procedures employed by BuAer and other government agencies in evaluating paint materials. They also authored the manual "Physical and Chemical Examination of Paints, Varnishes, Lacquers and Colors" which was the "bible" for everyone concerned with military type finishes and commercial "trade sale" finishing materials. (Later, Dr. Gordon M. Kline and Mr. Gene Hickson, National Bureau of Standards, Washington, D.C., developed and published another valuable manual on equipment and procedures in advanced-paint-materials R&D and which is used in the preparation of federal paint specifications.)

As early as 1918, Dr. Gardner's laboratory had a great number of proposed and actual use-type paints on test panels mounted on wires on the roof of his building on Constitution Avenue being exposed to the outdoor

Above, sea water is a fierce ally of corrosion. Stormy conditions, especially, can be harmful, as shown in these views of USS Hancock's hangar deck. Below, a photo-micrograph reveals intergranular corrosion, a serious hazard to aircraft.



weather. Results of this experimentation contributed importantly to the field of paint technology.

In the late 1930s, a group of development type engineers and officers from the Specifications Section of BuAer were transferred to a special unit. One of the group, LCdr. C. F. Cotton, was oriented toward prevention of deterioration, and participated in and encouraged a large-scale effort in protective coatings development.

In 1940, the author reported to the unit which later became the Equipment and Materials Branch of the Bureau as a chemical engineer. He was in charge of paints and finishes, corrosion, plastics, camouflage and chemical matters. Although he started out with the entire gamut of materials protection, he found himself gradually concentrating more and more on the most troublesome areas of corrosion, such as paints and finishes, paint stripping, and camouflage, during the period of many changes at the beginning of World War II. It was no coincidence that there was a highly aggressive fleet reaction and feedback during that period.

The development of methods for preventing corrosion of aircraft metal parts is contained in specification MIL-F-7179 (formerly SR-15) which started in 1940 as five pages mimeographed on both sides. The specification-controlled paint systems, including primers and surface pretreatments for adhesion of organic and inorganic coatings, anodizing of aluminum and chemical surface treatment of magnesium alloys, all plating processes, and such miscellaneous processes as sandblasting, passivating, pickling, and phosphate treatment. The latter was used for the purpose of improving corrosion resistance of steel components. Concepts and innovations were continuously fed into this specification by the writer on the basis of on-going Navy experiences in the field and contemporary developments. Because of the expansion in technology in the areas covered by MIL-F-7179, the specification grew too cumbersome to administer, so a spin-off document covering the painting processes, MIL-F-18264, became necessary.

As a result of expanding aircraft production, much time was devoted to working with aircraft contractors in an effort to ensure that an adequate finish was applied – one which would not adversely affect the production program, yet which would result in satisfactory service performance of the aircraft. It was not unusual to have half a dozen finish specifications from aircraft contractors for detailed review, all at the same time. Voluminous correspondence and negotiation with the aircraft companies then ensued, which really turned out to be a give-and-take, spanning weeks and often months of technical negotiations in an effort to establish a common meeting ground. Ltjg. Gordon S. Mustin, who had been assisting the author in this work, took over active control of MIL-F-7179 toward the end of WW II.

In the 1950s, BuAer's method of handling aircraft contractors' specifications changed from a detailed review at headquarters to approval by a local Navy representative. Essentially, we lost effective and timely control of the corrosion/protection dialogue with the contractors. What part this played in the accelerating corrosion problem can only be conjectured.

The development of protective coatings for specific uses, as a function of NavAirSysCom (BuAer, BuWeps), dates from the introduction of chromates into paints by Dr. Gardner.

Subsequent refinements resulted in a primer consisting of zinc chromate as the inhibitive pigment dispersed in a varnish-type vehicle which was compounded by Mr. Harold Acker of the Naval Aircraft Factory, Philadelphia, in cooperation with LCdr. Cotton and the Hi-Lo Varnish Co. of Brooklyn, N.Y. This primer was designated P-27 and was a vital contribution to corrosion inhibition of aluminum.

Replacement of this type of primer by the present epoxy-based MIL-P-23377 primer, containing strontium chromate as the inhibitive pigment, occurred in the early 1960s. This made possible the ideal adhesion to metal obtainable from a two-component, catalyzed material such as was provided by epoxies.

NavAirSysCom moved to an all-epoxy system from the previous lacquer-over-primer method to obtai better scuff and abuse resistance, bu soon found that epoxy topcoat chalked badly and, being quite brittle cracked to an unacceptable degree. I the meantime, I had been explorin the potential of a brand-new class o materials called polyurethane eve since it was uncovered at the end o WW II. I followed the British exper ences and obtained encouraging firs hand reports of the results of the service trials on military aircraft. Cor currently, trials in the United State on commercial planes confirmed th excellent chemical characteristic scuff resistance and outdoor weathe ing durability of this material.

With this accumulated data and background of information on poly urethanes extending over a period o almost two decades, the powers-tha be agreed to convert our paint topcoa to polyurethane in the late 1960s. Th began a progressive movement into th present polyurethane-topcoat-ove epoxy-primer system.

Lockheed-California applied an service-tested the newly availabl linear-type polyurethane on ten P-3C at the time when industry introduce the new aliphatic type of materi which had better color retention an gloss properties than the aromat type. Lockheed's successful progran coupled with a parallel NAR Alameda program, clinched the cas The new paint was introduced into th Fiscal Year 1969 production schedul and continues in use to the prese time. Polyurethane was authorized b CNO on December 20, 1969, as th standard for virtually all naval aircra

Glossy polyurethane paint as a to coat is non-chalking, considerab easier to maintain in a clean conditi for a longer period of time than th lacquer and epoxy finishes previous used, and is more scuff resistant. Ho ever, it is subject to some loss of glo in one and one-half to two yea (earlier if abused by use of stro cleaners or repetitive use of waterle cleaners without periodic washdo with fresh water, which is necessary prevent a buildup of residual haze a film).

The chromated, inhibitive epo

primer overcoated with polyurethane topcoat finish is effective in preventing surface corrosion. However, at breaks in the film which occur around highly stressed, fixed fasteners, additional protection is needed. Thick MIL-S-8802 or MIL-S-81733 polysulfide rubbery sealant is applied over the fastener rows. The standard finish is then applied on top of the sealant to protect it from degradation by the weather. Although some hairline or herringbone pattern cracks may occur in the topcoat in such sealed areas, the underlying sealant remains intact and protective.

Unfortunately, the same measures cannot be used on removable access plates because the finish must be periodically broken to remove inspection panels. One approach tried on a limited scale involved precoating some access panels with an extremely tough, baked-on finish prior to installation, and then topcoating with the standard paint scheme after installation. Hopefully, breaks in the topcoat which occurred when the panel was removed would not impair the protection afforded by the tough underlying baked-on coating, provided the latter remained essentially intact. For this to be effective, methods still need to be found to provide a high degree of adhesion under wet conditions and to inhibit corrosion around fastener holes.

Use of polyurethane for touch-up requires special precautions to avoid health hazards to personnel in the immediate vicinity who may be exposed to overspray which contains toxic and allergenic isocyanate compounds. Personnel must be properly suited and equipped to comply with all safety regulations covering polyurethane for touch-up purposes. The alternative is to fall back on the use of acrylic lacquer.

During the early 1950s, fleet units and commands mounted a campaign to obtain carrier aircraft without exterior paint, somewhat after the fashion of Air Force planes. BuAer was hard pressed to resist the pressure of the arguments of weight saving and exemption from continuous paint touch-ups. This was particularly true because paint adhesion was only marginal and touch-ups were time-consuming and laborious. I can still remember the division director saying that he couldn't defend the use of paint anymore on aircraft exteriors against those pressures.

On the positive side, we were entering a period of improved paint adhesion. The new highly adherent wash primer was coming into wider use and our paint application instructions and specifications were being more generally used. But, more importantly, since I firmly believed unpainted airplane exteriors would impose an undue burden on fleet units which had to polish and keep them clean and free of corrosion and pitting, I asked CNO for a representative to meet with me to try to come up with a solution to the problem. The representative agreed to my proposal to produce 250 "unpainted" airplanes and place them in operation aboard carriers for extended sea duty. The final decision was to be based on the results of a one-year service test.

We procured about one-third of this number in F9F-5s, another third in F2H-3s and 4s, and the balance in F-7Us. The F9F-5s were anodized to retard corrosion and resist scratches. Most of the planes were soon deployed on carriers. Instructions went out on April 29, 1952, for all recipients to report to BuAer quarterly on the results of periodic inspections and the extent of the workload imposed. About 1,000 reports and pieces of correspondence came in during the next 18 months.

For the first three months of carrier duty, things were fairly serene and most reporting units claimed improved speed and a minimum of care and maintenance. A few expressed reservations and some units indicated the concept was unacceptable.

During the second three months of carrier duty, we began to receive complaints about the work involved in polishing out "pits" and removal of stack-gas deposits, stains, etc. Requests for an improved cleaner-wax mounted and there were complaints about the added work necessary to keep the planes polished and bright. Some squadrons found it necessary to apply

Technician inspects the leading edge flap area of an A-7 Corsair using ultrasonic equipment. Sophisticated devices like this preclude need for disassembly of aircraft components.

F7U Cutlass, like this one over NAS Moffett Field in the 1950s, participated in the bare aircraft program, top. Above, P-3 Orion gets a bath at the taxi-through wash rack, also at Moffett Field. Below left, sealant is applied on row of fixed fasteners of F-4 Phantom. Below right, hydrogen permeation apparatus is used to check for stress corrosion and hydrogen embrittlement characteristics of new aircraft metals.

1010 oil regularly.

The third set of reports, covering between seven and nine months of carrier duty, brought many strong complaints concerning the amount of maintenance required on the base airplanes, together with requests to stop the entire program, induct the planes into overhaul and return to painted aircraft. As a result, BuAer cancelled out the changes on the balance of unpainted carrier planes which had been contracted for but not yet delivered. The contractors involved went back to delivering painted planes. Also, a change to unpainted A-4Ds died aborning. The cost of reinstalling paint on some contracts turned out to be considerable and the program ended, for all practical purposes, in December 1954.

The program proved that unpainted airplanes have no business aboard carriers. But the experiment did save the Navy untold millions of dollars and maintenance man-hours that would have been expended if the Navy had gone to bare airplanes.

When Air Force planes were ferried overseas during the Korean War, they had to be cocooned with plastic to protect them in transit. This cocoon then had to be removed at destination. In contrast, paint protected the Navy planes against corrosion.

One of the more effective procedures used in aircraft construction and repair is sealing with a polysulfide rubber-base sealant in tape or trowelled-on form over high-strength, fixed fastener areas. The sealant excludes moisture and other corrosive liquids and is used prior to application of the full paint finish. By incorporating a chromate in the rubber sealant and employing a gun, a high degree of corrosion protection in the form of leachable inhibitive chromate ions has been obtained in practice, resulting in a reduction in rework man-hours as in the case of a typical F-4. Spray application of rubber-based sealant on other than fixed fastener areas may be condoned on very carefully selected, small areas to solve severe corrosion problems not otherwise capable of correction. The weight factor militates against any usage on large surface areas

of this material as a crutch, since thickness of well over six mils would be necessary to seal out the environment. New cut-resistant elastomeric tapes for application in fastener areas are being explored at the laboratory level.

To fight corrosion successfully, it must be detected in its incipient stages and the extent of damage must be determined during the course of the corrosion process, be it pitting, intergranular attack or whatever. To be effective, non-destructive test instruments must "see" under the paint film to avoid the almost prohibitive chore of stripping off paint, and a check must be made periodically on what is happening underneath.

The naval aircraft rework facilities and intermediate maintenance activities are utilizing magnetic particle, dye penetrant, x-ray, ultrasonic and eddy current techniques to non-destructively test aircraft and associated parts and equipment. Detection of cracks in A-7 nose landing gears by means of ultrasonics is a standard routine procedure. Current Department of Defense and Naval Air Development Center Laboratory efforts include holography inspection of adhesively bonded helicopter panels for corrosion and potential delamination; infrared radiometric scanning of integrated circuit boards in avionic equipment; use of ultrasonic C-scanning for internal flaws such as porosity; and autoradiography using radioactive krypton to detect and measure external pitting-type corrosion.

The areas on naval aircraft most generally susceptible to corrosion are those adjacent to fasteners. The failures initiated by galvanic attack as a result of the dissimilar metals involved are often aggravated by the entrance of moisture and other corrosive elements. These can lead to exfoliation at the edges of the fastener hole. The corrosion progresses parallel to the skin surface. This was experienced in F-4 aircraft but is now largely corrected by changing the aluminum from 7178-T6 to 7178-T76 temper.

Several new coatings for steel fasteners have recently been service-tested on carrier-based aircraft. Results indicate that aluminum coatings prevent rusting of the fasteners for at least one year, whereas cadmium-plated coating used for controls failed in roughly half that time. Results of an Air Force study conducted on land-based aircraft during the same period show agreement on this.

Although aluminum coatings protect steel fasteners better than any of the other coatings evaluated, they are very expensive to apply and their effect on fatigue and torque-tension relationships needs to be determined. Uncoated titanium fasteners also performed well. At one time the author suggested the use of shallow-headed fasteners in areas of minor aerodynamic importance for cutting down fastener corrosion in at least these areas. But it soon became apparent that the problems of standardization and procurement would negate any advantage which might accrue. Aircraft fasteners need both galvanic protection and a lubrication effect to avoid galling. Both are obtained by cadmium plating. Cadmium is less noble than steel but does not adversely affect aluminum or magnesium in respect to dissimilar metal contact.

Space does not permit a complete listing of NavAirSysCom's R&D projects in the corrosion-prevention area. However, the main ones which are at NADC Warminster are as follows:

Development of a flexible inhibitive primer. The new material will be based on a sprayable polysulfide sealant or on an epoxy-urethane copolymer.

Development of exterior aircraft cleaners that will not adversely affect the polyurethane topcoat.

Development of a paint stripper that will not affect composite structures.

Investigation and use of laboratory instruments in ancillary metallurgical areas such as hydrogen embrittlement, fretting and wear, which have been found to contribute to aircraft material deterioration.

The Naval Research Laboratory is developing a fluorinated epoxy-urethane paint for NavAirSysCom which is hard to soil and can be easily cleaned by the fleet, conserving man-hours of labor.

Conditions aboard a carrier aggravate the corrosion problem by the nature of the carrier's environment.

The relative scarcity of pure water aboard ship militates against achieving anything approaching an industrial type of corrosion-control operation under carrier conditions. Corrosion removal methods are often severe because of the short time available for such activities; turnaround time is drastically shortened under war or warlike conditions. Problems of corrosion are already built into the older aircraft and defy practical correction, certainly by fleet level maintenance. NARFs and IMAs can and do correct some of the problems, mainly by substituting better materials or applying fixes. But even at such levels only so much is possible.

A bright spot in the picture is the development of the new AA7050 aluminum alloy. Aircraft "downstream" will contain more and more of this material. Current R&D and other measures being taken are expected to lead to other new materials and methods for preventing corrosion. The improvements stemming from this work are expected to increase safety, reduce maintenance and overhaul man-hours and costs, and increase aircraft availability.

Corrosion problems will never go away but we should and do expect greatly lessened severity.

Mr. Malloy retired from the government in 1973 after 32 years of service, four of them as a naval officer. He was Head of the Materials Protection Section in the Naval Air Systems Command and has been cited for numerous milestone achievements in the field of corrosion control of naval aircraft.

PHOTOJOURNALIST OF THE YEAR—1974

Naval Aviation News' JOCS Dick Benjamin has been selected as Photo-journalist of the Year 1974, by the Chief of Information. Associate editor of the magazine from September 1970 to April 1975, Benjamin is now assigned to the office of the Chief of Naval Material. He joins an exclusive list of five earlier winners: PHCS Berger Anderson, PH1 Robert E. Woods, PH1 John P. Francavillo, JO1 Kirby Harrison and last year's winner, JOCS John D. Burlage, also a former *NANews* associate editor.

These pictures comprise a Benjamin sampler.

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