NAVAL AVIATION NEWS

41st Year of Publication

AUGUST 1960

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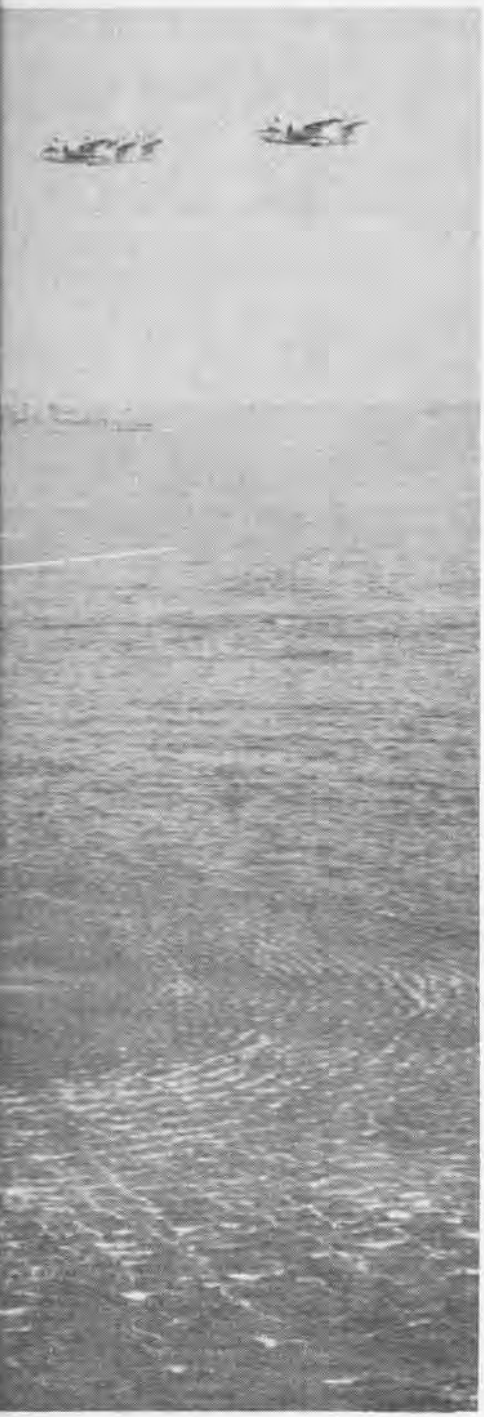
ASW KALEIDOSCOPE OFF KEY WEST

When naval leaders of ten American nations held an inter-American conference in June, the U.S. Navy presented an exhibition of seapower in three dimensions off Key West, Florida. One of HS-1's helicopters demonstrated for the distinguished observers a sonar detection method while S2F Trackers and P2V Neptunes flew over the submarine, USS Darter (SS-576), and the destroyers, USS Calcaterra (DER-390) and USS Hazelwood (DD-531), surface ships in the operation.



NAVAL AVIATION NEWS

FORTY-FIRST YEAR OF PUBLICATION, AUGUST 1960

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■ COVER

Three Gyrodyne YRON-1 one-man helicopters at Quantico, Virginia, are being tried out by Marines for reconnaissance, observation, and liaison. The lightweight "rotocycle" weighs only 425 pounds empty. Powered by a four-cylinder, 62 hp. Porsche engine, it is equipped with twin counter-rotating rotors; can climb 600 ft. per minute.

Use of funds for printing this publication has been approved by the director of the Bureau of the Budget, 10 Feb. 1959.

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NAVAL AVIATION NEWS

HTK Flies Patient Ashore

Flight Controlled from Destroyer

An HTK helicopter with an injured seaman aboard was flown through heavy fog from a destroyer at sea to a waiting ambulance in Newport. It was the first such flight on record.

There was no other rapid means of transporting the injured man from USS *Hazelwood* to the base hospital.

Ralph Lee, Kaman Aircraft's chief test pilot on the HTK drone program, took off from the deck of the destroyer with the injured man aboard just 25 minutes after the man was hurt. Lee flew the helicopter 1000 yards from the ship into fog which restricted visibility to about a quarter mile. The ceiling was between 200 and 500 feet.

At that point Lee turned control of the helicopter over to the radio control point operated by Lt. James Julian, operations officer on the destroyer and chief controller in the drone test program. Stationed in the destroyer's combat information center, Lt. Julian flew the helicopter by radio signals as he watched its path on the ship's radar scope.

His operation of the helicopter was so precise that he brought the aircraft over the shoreline within 100 yards of the spot selected before takeoff. At that time Lee again took control of the helicopter, landed at the Naval Underwater Ordnance Station, and transferred the injured man to a waiting ambulance.

The injured sailor, Steven W. Patryn, SN, was treated for a cut which required 37 stitches. He returned to his ship later in the day.

The HTK was aboard *Hazelwood* in connection with the Dash concept.

VF(AW)-3 Scores Top Honor

Bags a Second NORAD Pennant

All Weather Fighter Squadron Three, judged best in its class in last year's Top Gun meet, has captured for the second time the coveted "A" pennant awarded by the Air Force to outstanding tactical units in the North American Air Defense Command.

MajGen. John B. Stevenson, Commander of the Western Air Defense Force, presented the banner to Capt. Russell F. Trudeau, squadron commander. It was immediately hoisted above the control tower at North Island.

VAdm. Clarence E. Ekstrom, ComNavAirPac, RAdm. Walter F. Rodee, ComNAB 11ND, and BGen. Richard T. Kight, Commander of the Los Angeles Air Defense sector under which VFAW-3 operates, were present.

Citing the fact that no other NORAD squadron had even won the "A" award twice in succession, Gen. Stevenson said: "This took a lot of hard work ... under superb leadership."

Marine Commands Merge

FMFLant, AirFMFLant HQ are One

The headquarters of FMFLant and AirFMFLant were consolidated July 1 to achieve greater command and staff efficiency.

Before the consolidation there were about 900 officers and enlisted Marines assigned to the two headquarters. An initial reduction was made and further reductions are anticipated.

LGen. Joseph C. Burger will continue to be CG, FMFLant. MGen. Richard C. Mangrum, who was CG, AirFMFLant and Deputy Commander FMFLant, will continue as Deputy Commander, FMFLant, dropping his other title.

Landing Safety is Boosted

Norfolk Employs Flare Gun System

Using scrap, salvaged parts and ingenuity, members of the crash crew at NAS NORFOLK have come up with an innovation which might make wheels-up landings a thing of the past.

They have installed a new flare-gun warning system which is electrically actuated, weather protected, highly visible, and effective in warning pilots of incoming planes that they are safe or unsafe to land.

The system consists of four box-like installations set at 200-foot intervals along the runway. A wire runs from each container to a central point at the end of the runway where the wheel watch is normally posted. A switch permits the watch to fire the flares.

Wheel watchers formerly used a Very pistol to warn pilots that their gear was up. Fast jets found it difficult to spot the lone flare. The plane often had sped past the wheel watch's position and learned the hard way that concrete is not soft.

The new system will fire the flares well ahead of the approaching aircraft and provide earlier warning.

F4H-1, *as it will be seen in service by RCVG's who will introduce plane to fleet ops late this year, shows exterior changes from earlier versions. Note larger nose to house latest radar, raised canopy which will permit ultimate installation of controls in rear seat to assist in pilot training. Streamlined shape beneath plane is new type starting pod for use with impingement starting. It can be carried under the fuselage in flight.*

HS-4 Makes Bold Rescue

Yorktown Copters Save Seamen

Pilots and crewmen of HS-4 helped to save the lives of 53 merchant seamen whose ship had run aground and was breaking up on Pratas Reef, 500 miles northwest of Manila.

Typhoon Mary was still blowing strong when the distress call came to USS *Yorktown*. The merchantman *Shun Lee* had been attended by the British Frigate *Torquay* but strong winds and heavy seas prevented transfer of survivors.

Yorktown steamed toward the stricken ship. Forty-five knot winds and spray from windswept seas made it extremely hazardous to move aircraft on the flight deck. When the carrier came within 50 miles of the merchantman, she slowed and changed course so that the wind was across her deck. Seven helicopters lifted from her flight deck and disappeared into the mist.

Controllers on board the carrier vectored the helicopters as they bucked head winds which were half their speed. As soon as the copters were airborne the ship resumed its course to Pratas Island.

When the helicopters arrived over *Shun Lee*, a group of 28 seamen had reached Pratas Island by life boat. One man was lost. The remaining 24 seamen and the master were still aboard the merchantman.

A helicopter piloted by LCdr. S. B. Hooper lowered the flight surgeon to Pratas Island to tend the injured men there, then the helicopters began lifting the remainder of the crew by rescue sling. One man was injured so badly he had to be lashed to the rescue sling.

One by one, all survivors were transferred safely to *Torquay*. Traditionally, the ship's master left last.

A GOOD CONNECTION *is made by an F8U Crusader as the approach is completed and contact made with an A4D jet refueler which supplies the vital "life blood" needed to keep the fighter jet airborne. Both aircraft are attached to Marine Air Group 12, First Marine Aircraft Wing. Capt. Charles C. Hejde, USMC, pilots the Crusader.*

Army Flies Helos on CVS

17 Copters Operate From Antietam

Pilots of 17 Army helicopters practiced carrier landings and takeoffs on the *Antietam* in the Gulf of Mexico. Before boarding the carrier, they were instructed by Marine Air Group 26 in FCLP operations at NAS PENSACOLA. Each pilot made 10 daylight and five night landings on the carrier in the first two days. The balance of the week was spent in tactical flying around the carrier and polishing up techniques learned during the training period.

"This is the biggest effort yet by the Army to train its pilots for carrier landings," said Army Lt. John C. Temple.

The helicopters represented four units of the Third Army; Fort Bragg's 82nd Airborne Division and 8th Transportation Company, Fort Campbell's 101st Airborne Division, and Fort Benning's 19th Transportation Co.

VR(C)-40 is Commissioned

Replaces Fasron 3 in COD Mission

VR(C)-40, first squadron of its type on the East Coast, was commissioned July 1 at NAS NORFOLK. In case the designation throws you, it is Air Transportation (Carrier) Squadron 40.

The new squadron will fly TF-1 *Traders* and will service aircraft carriers of the Atlantic Fleet. Its jobs will entail carrier on-board delivery of mail, personnel and equipment, relieving FASRon-3 which has been decommissioned.

VR(C)-40 will employ 10 *Traders*.

Navy to Convert to New Oil

High Dispersant Oil Passes Test

A new additive type aircraft engine oil which keeps aircraft engines clean is in experimental use in all Atlantic Fleet R-3350's. The new oil, called "high dispersant," prevents the formation of sludge and "coke" or hard carbon. Unlike "high detergent" oil used in automobiles, high despersant oil will not cause engine trouble by dislodging old deposits of sludge and coke. It slowly dissolves old deposits until the engine is clean.

Evaluation has been so successful that the Navy has decided to procure the new oil for use in all its reciprocating aircraft engines. As a first step, preliminary to general procurement, a contract has been let to Ethyl Corporation for development of exact specifications so that oil from various refiners will be compatible.

The new oil is expected to be generally available in the fall of 1961.

GRAMPAW PETTIBONE

One for the Birds

An A4D-2 pilot, one of a flight of three on a training mission, was about to release a napalm bomb on a target just a few miles from the home airfield. He was flying at 100 feet above the terrain and indicating 450 knots when he struck a turkey buzzard!

The buzzard crashed through the port windscreen, dislodged the instrument panel, destroyed the engine instruments, altimeter, and airspeed indicator, and struck the pilot in the chest and face! Fortunately, he had his visor down against sun glare, so his eyes were not injured, although the visor was both broken and smeared with bird debris.

Slightly stunned and realizing he had struck a bird, not knowing whether he still had an engine or not, he eased back on the stick, climbing for a safe ejection altitude. With great difficulty he was able to raise the smashed visor on his APH-5 hard hat. He saw for the first time the wreckage of his instrument panel, the hole in the port windshield, and the rest of the windshield and canopy almost completely blanked out by bird debris. He couldn't see a thing except through the hole in the windshield and using it for occasional

references to the ground, climbed out to sea. After one 360° turn, he eased power off until he felt the A4D was settling, then dropped gear and flaps, got a down and locked indication and put the power on again.

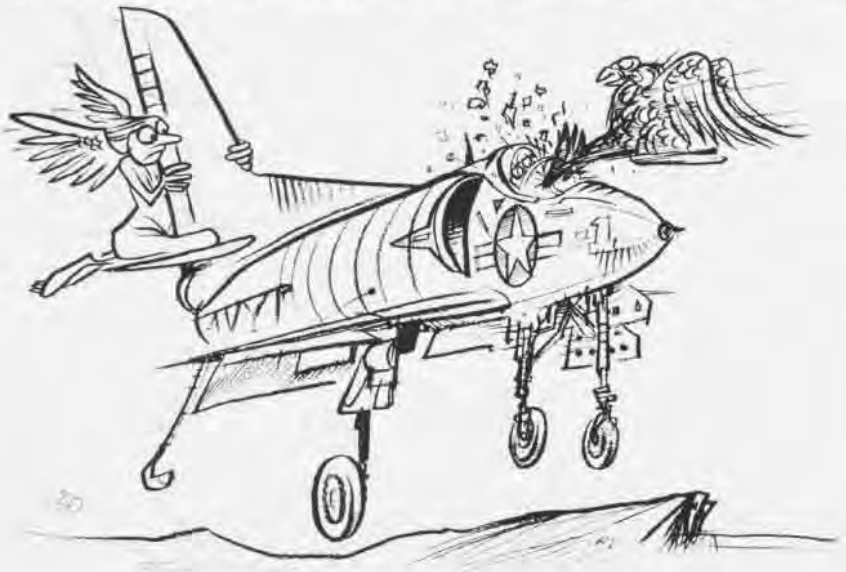
He made another 360° turn, sported the home airfield through the hole in the windshield, saw there were no planes either taxiing or on the runway and decided to try to land, setting it down heading downwind due to a 47-foot cliff at the other end of the runway which he wasn't sure he could see to clear. With no altimeter, airspeed indicator, and a clobbered-up windshield, an approach over land would be easier to judge properly.

The cockpit was a bedlam of noise with the wind shrieking through the hole. His radio had apparently been dead since the original impact. He entered the landing pattern slightly high, rolled into final at about three miles. Heading in he found he could barely discern the runway through the center windshield panel.

He slowed down as much as he felt he dared. When he figured he had the runway made, he took a high dip, popped the speed brakes and made a steep approach. He flared, touched down, cut the throttle to OFF, dropped the arresting hook, raised his flaps and braked hard but intermittently.

The hook missed the runway arresting wire, which was not tensioned up and was rigged for the opposite direction anyway. He saw the field mirror go by through the hole in the windshield, figured "this was it" and opened the canopy manually.

The A4D went off the end of the runway, through 600 feet of overrun and went over the 47-foot cliff at an estimated 80 to 100 knots! It hit nose down in six inches of water over 300 feet out from the cliff and stopped within 15 feet from the initial impact point. The pilot unstrapped and climbed out to await the SAR helo. His injuries—minor lacerations and back strain. The A4D was a strike.



Grampaw Pettibone says:

This lad must of been thinkin' pure thoughts all week 'cause he's just about the luckiest man alive! The particular angel who keeps an eye on pilots, balloonists, trapeze artists, and all the other lads engaged in occasionally hairy occupations must have been pretty close at hand that day! When things are as bad as he had it,

ILLUSTRATED BY Oplom

an ejection would be considered more prudent. He had a real good chance of buying a plot of ground, but permanently.

While engaging the arresting gear from the wrong direction was his only possibility of stopping in time, it was fruitless at his roll-out speed. This type of engagement and its possible consequences are a prime topic for a ready room hull-session in EVERY squadron!

Even if you think the radio is gone, *try it!* Give your buddies a chance to help you. Give all the second-guessers a chance to get in on it first hand!

With more experience this lad will make out. He's tryin' all the way.

Singe Job

After escorting the tow plane and banner to the air-to-air gunnery area, a young F8U pilot was ordered by the flight leader to break off and join the flight passing 2000 feet overhead.

He added power, turned left, eased the nose up, realized he had overshot the flight's heading and started a hard turn to the right. The left wing pitched up suddenly almost inverting the *Crusader*, and after some wild gyrations, the plane settled down into what appeared to be a right spin with the nose yawing violently. He radioed the flight leader and was told to extend his emergency leading edge droop and get out at 10,000 feet if not recovered by then.

The pilot cut the power to idle and began his recovery attempts. He was being thrown violently around the cockpit. Even though he was strapped in securely, he had to use both hands to release the droop handle lock.

Five distinct corrective measures were applied by the time the aircraft had reached 10,000 feet in its gyrations. The pilot glanced at the altimeter, saw 9500 feet, and decided to try one last maneuver. He dropped speed brakes and tried to pull the nose up. It didn't change a thing, so he pulled the curtain at 4500 feet indicated (actually 2500 ft. above the terrain).

Everything worked beautifully, and as the canopy blossomed fully, he felt a wave of tremendous heat from under him! He was just over the top of the fireball of the exploding wreck! After what seemed an eternity, the wind blew the chute to one side, and he hit on hard rocky ground about 20 yards from the blazing wreckage, his chute collapsing immediately. He unsnapped and scrambled behind a sand dune

nearby to take refuge from the exploding 20 mm shells.

After his rescue by helicopter, the pilot's injuries were found to be confined to some mild abrasions and burning of his leg hair and stocking tops. His chute seat pack bottom was well browned, the chute panels within five risers were "crisped" a couple of feet in from the edge, and the nylon G-hose covering was scorched.

Grampaw Pettibone says:

Burn my hide, but this young feller sure cut it mighty fine! One more second and he woulda fried! We've had a rash of fatal accidents these past few months, many among young and fresh pilots who have tried "one last maneuver" in an attempt to save their machine. This is most commendable and shows we've still got the old fighting spirit around, but also shows an appalling lack of knowledge of their survival equipment.

We've all got to remember that the hard-learned lessons of the past five years are "brand new" to all of our younger pilots. Some real detailed explanations of the rules we've set up are necessary. We can't afford to have each new generation of fighter pilots learn 'em the hard way.

Bone Crusher

Early one fine spring morning, a young Marine hydraulics mech was trouble-shooting an hydraulic system gripe on an F8U-1 *Crusader*. The wing had been blown to the UP position in flight after an hydraulic system failure, and the maintenance crew had been unable to lower it after the flight, apparently because of a faulty hydraulic check valve.

While checking the hydraulic system bypass valves, the mechanic placed both hands between the wing and the fuselage just as the normal mechanical up-lock gave way! The wing fell to the down position, crushing both his hands in the slot!

Grampaw Pettibone says:

This lad lucked out. After taking a smashing more than equal to having someone swing a sledge hammer on your fingers while you held them on an anvil, he had no broken bones. Some fine surgical work he's had will make him as good as new.

Betcha neither he nor any other man in THAT outfit will ever work under a *Crusader* wing without first installing the jury-strut required by SOP. How about the rest of you F8U men? You stickin' your hands in that bone crusher too? Life can get pretty dull with BOTH hands in a cast!

Stray Wrench

A JD-1 was turning final for landing after a short and uneventful cross-country hop. The landing touch-down was a good smooth one, right on 105 knots. Immediately after the touch-down, the port tire blew, and in spite of all efforts by the pilot to control the roll-out using both starboard brake and power on the port engine, the JD left the runway after about 3500 feet of roll, struck a runway distance marker and finally stopped about 1000 feet out in the boonies.

Examination of the port tire revealed a broken 12-inch crescent wrench on the INSIDE of the tire!

Grampaw Pettibone says:

Son-of-a-gun! The JD's are pretty much in the Model T category age-wise, but they have a real job to do and we need every one we've got.

This tire was mounted some two months previously. The wheel and tire were changed on the JD just prior to this hop. Some sad sack's boo-boo could have cost us two experienced pilots and the airplane.

You should inventory everything you've got in your tool box and account for each tool after a job is completed. Sure wonder who supervised THAT work! Usually takes TWO men to mount a tire as big as this one!

SWIRBUL MADE HISTORY

AFTER WW II, VADM. MITSCHER VISITED GRUMMAN AND SWIRBUL (C) AT THEIR PLANT

DEATH from post-operative pneumonia closed the life of one of the nation's top aviation experts 28 June when Leon A. Swirbul, dynamic president of the Grumman Aircraft Engineering Corporation, died at Long Island Memorial Hospital.

One of three founders of Grumman, he had been with the firm since it first was organized just two months after the 1929 stock market crash. In early 1930, the firm opened its doors in a makeshift garage in Baldwin, Long Island. He served as general manager and executive vice president until his election to president in 1946.

Known as Jake to his employees and to leaders in the aviation world, Swirbul with his cofounders, Leroy R. Grumman and William T. Schwendler, provided the kind of leadership that made Grumman a name to be reckoned with. "Thank God for Grumman!" were the words of one admiral as he watched *Hellcats* pound the Japanese in the Pacific during WW II.

From the FF-1 to the F11F *Tiger*, Grumman has spelled fighter power for the U.S. Navy. Official statistics show that of the 9,249 planes shot down by all types of Navy and Marine Aircraft, Grumman planes accounted for 6548, or more than two out of every three.

Of the personal qualities which made Jake Swirbul the successful leader of the company, perhaps none was so important as his ability to establish rapport between himself and the working man. He was a shirtsleeve worker, a man who wandered up and down the frantic wartime production lines handing out coffee to riveters with no time to eat lunch; a president whose office door was always open to any member of Grumman Aircraft who had a beef, and a president who could handle beefs.

These were leadership qualities which guided Grumman to the unequaled production of 664 *Hellcat* fighter planes in one month and five Navy E Awards for proficiency during World War II.

Among Mr. Swirbul's many honors was the nation's highest possible civilian award, the Presidential Medal of Merit Award, given by President Truman in 1946 for aircraft production leadership in WW II. A graduate of Cornell University, he served in the Marine Corps in World War I.

MR. SWIRBUL AND VADM. PIRIE, DCNO (AIR)

VAP-62 Practices Bailouts

Survival Officer Directs Training

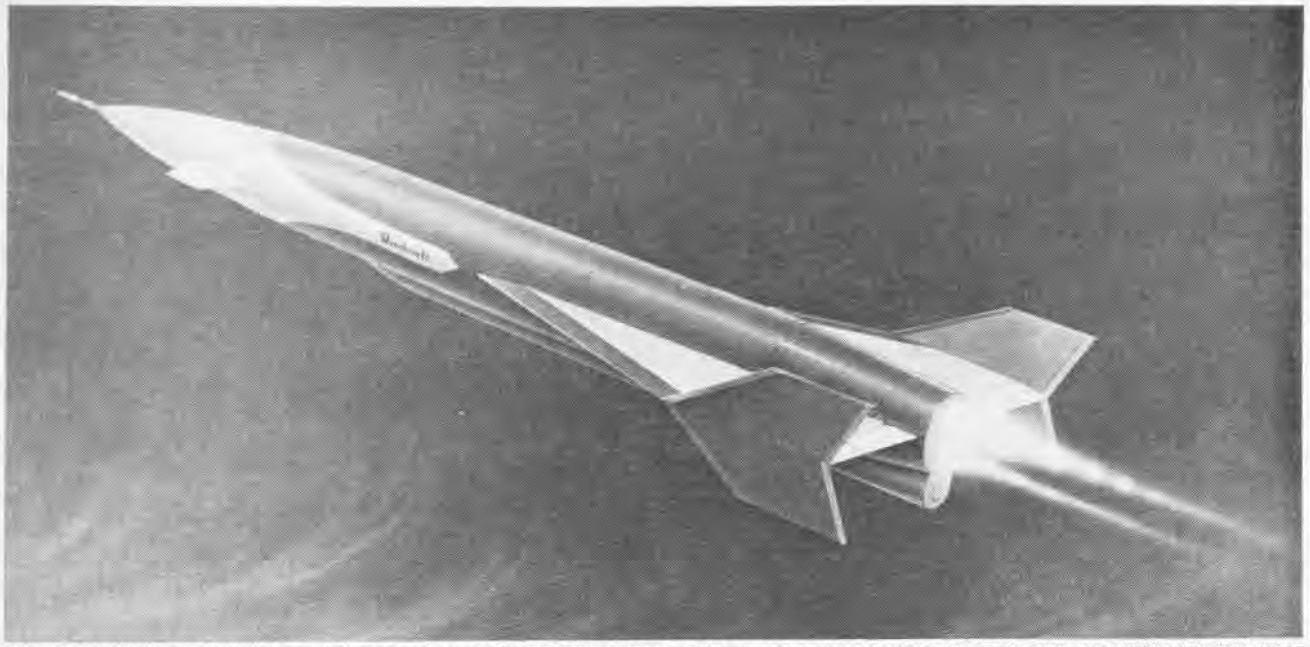
"Four seconds and safe" was the record of pilot Lt. Bill Hagensick and his crew during Heavy Photographic Squadron 62's monthly crewmember training. Survival officer, Ltjg. Duane Cox (right in picture) instructs each crewmember associated with VAP-62's A3D-2P type aircraft.

At the command of "Bailout!" the timer, Robert Dumont (left in picture) records the three-man crew's departure from the aircraft. Lt. Hagensick's crew bailed out in an outstanding four-second fashion. Average crews, according to VAP-62, require a minimum of six seconds.

In the A3D-2P aircraft, the only method of bailing out is the same route taken in getting aboard; therefore, it is a "must" that each crewmember be more than familiar with the available escape route. When the hatch is opened during flight, it rends to break the wind, enabling each integrated harnessed crewmember to depart with his chute automatically opening after a three-second delay.

Simultaneously with ditching and bailout procedures, VAP's flight crews undergo lectures and visual classroom instructions concerning survival tactics, flight equipment and attire.

BAILOUT RECORD TIME IS FOUR SECONDS



THIS STREAMLINED BEECHCRAFT XKD2B-1 IS A SUPERSONIC MISSILE TARGET NOW UNDER DEVELOPMENT BY THE NAVY AND THE USAF

SOMETHING TO SHOOT AT

By LCol. D. W. Thomson, USMC

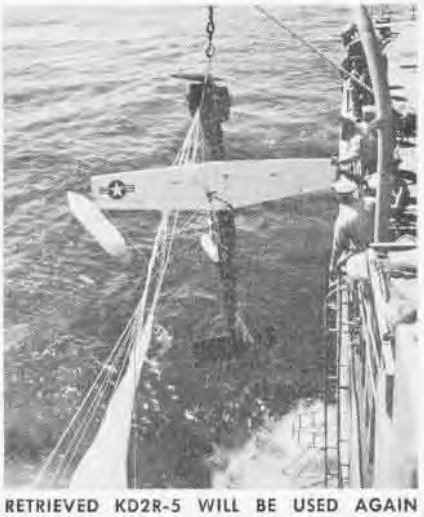
FOR MANY years fleet commanders have been concerned with the ability of their ships, aircraft, crews and weapons to stop a known or expected threat from the air. It is neither desirable nor convenient to have a real shooting neighbor handy to test the fleet's air defense capability. The feasible substitute for the obviously ideal test is to simulate a potential enemy's threat as closely as possible without facing the consequences of a defensive "miss." (No pun intended.)

KD2R-5 IS LAUNCHED BY AN AT-1 CATAPULT

There was a time not too far back when ships formed-up family-style for an afternoon turkey shoot. If the little red drone survived the first several passes by the many smoking guns, it was usually flown down the gun-barrel. Small pieces of target splashed around the ships while crews cheered. The low, slow, and frequently unreliable, powered targets filled most of the training needs of our combat ships. A few types of towed banners and sleeves fairly well took care of the aerial gunnery requirements. However, opportunities for F4F, F6F and F4U pilots to intercept and shoot at a drone occurred with about the same frequency as an August snowstorm.

Times have changed. Modern weapon systems are tremendously expensive. As a general statement, the cost of firing one missile today would have supported a week of gunnery training ten years ago. For anti-air warfare training, the number of lethal missiles to be fired from aircraft and ships during Fiscal Year 1961 will be numerically infinitesimal compared to the number of training rounds expended during the Korean War. Today, the total costs for a single fleet missile firing may run as high as $300,000. The target used for the missile *expenditure* should be capable of honestly testing weapon system performance against the system's design parameters. The target should also offer the fleet commander a good measure of his effectiveness against the potential threat.

A very high percent of personnel training in new missile weapon systems is done at desks, in shops and in training simulators. However, nothing can take the place of actual firings to



RETRIEVED KD2R-5 WILL BE USED AGAIN

test all human factors under operational conditions, to give a man the confidence of "can do," or to accomodate the essential production monitoring of delivered missiles.

Two fundamental considerations are common to any discussion of aerial targets: First, *confidence* in weapon system answers; second, *cost* of the target and target operation. All other factors are subordinate.

THE Navy's Aerial Target Program has been undergoing a thorough reorientation during the past several years. The "All American Boy" type of target will soon be history. Emphasis is placed on procurement of aerial targets today for the known training requirements several years from now and to use those targets now in inventory in the most productive way. The procurement process takes about two years from statement of target requirements until the target can be delivered to the fleet. Even more time is required if a target has to be developed and put through R&D. For example, the F4H weapon system training target has been under development since the fall of 1958. When the first F4H is delivered to the fleet, the first F4H C.O. will have "in hand" an operational target that can test all of the F4H capabilities.

The target program has two closely related objectives: First, the program must provide the essential medium through which fleet units can gain and maintain combat efficiency with anti-air warfare weapon systems. Second, during the development, test and evaluation stages of anti-air warfare weapon systems, RDT&E activities must be provided with a means to establish confidence in specific design parameters and, in general, to gain knowledge on system performance.

To satisfy the two program objectives, targets must be procured for four different types of requirements:

1. Air-to-air missile training requirements are to be primarily satisfied by high-performance tow target systems. By the end of Fiscal Year 1961, all VF type squadrons will be equipped with the new Aero-45 tow system. The Aero-45 will tow monostatic, bistatic and "IR" reflective shapes at distances greater than 30,000 feet.

2. Surface-to-air training requirements demand powered targets capable of flying at very high altitudes and high subsonic or supersonic speeds. Naval Aviators staunchly support procurement of powered targets for *Talos*, *Tartar* and *Terrier;* envisionment of a "blip" travelling up a steel tow wire is discomforting. SAM (surface-to-air missile) targets must carry sufficient augmentation devices to electronically make the target look like an actual aircraft or offensive missile. SAM targets also must be capable of transmitting miss-distance and other desired information back to the missile ship.

HIGH ALTITUDE Q2C IS BEING PROCURED

3. Fleet gunnery training requires tow targets and small low performance powered targets. Towed banners and sleeves are used for both aerial and surface gunnery. Towed shapes are used for air-to-air rocketry. Small powered targets are used for 3" and 5" surface gunnery.

4. Research, development, test and evaluation of new missile weapon systems require relatively sophisticated (and expensive) targets. RDT&E requirements frequently demand targets capable of very high performance with substantial augmentation loads. Some RDT&E tests can use fleet training targets or other low performance targets such as F9F-6K that can carry heavy loads of special "environment" and test equipment. Testing design parameters of an experimental missile under closely controlled conditions requires a very different type of target vehicle than those used for fleet training. A test missile may perform well against a relatively low, slow target, but the low, slow target does not establish *confidence*.

The question that RDT&E activities must solve is this: *Will a missile intended for future fleet use stay together long enough, guide to and fuse against design points many times the speed of sound at extremely high altitudes or on the deck?* RDT&E activities must establish confidence in the capability of a new missile to meet its designed performance parameters. Unless an adequate target vehicle is provided to test a missile's design parameters, the missile will remain a big question mark in the hands of fleet units until after the red alarm button has been pushed. Such unfortunate

KDB-1 MISSILE TARGET HAS SERVICE CEILING OF 40,000 FEET, SPEED OF 300 KNOTS

DOUGLAS F4D SKYRAY SUCCESSFULLY 'LOCKS ON' THE 1905-POUND AERIAL TARGET KDA-4

occurrences have happened in the past. We must ensure that an inadequacy is not discovered *after* somebody has pushed the red button.

Regardless of who wants what kind of a target, all target requirements end up in OPNAV for final evaluation. Program coordinator for the Aerial Target Program is RAdm. F. "Hy" Massey, Director of the Aviation Plans Division, OPNAV. Specialized targets used exclusively for missile research, development and test are funded by DCNO (Development), VAdm. J. T. Hayward, from the Navy's R&D appropriation. (NAVCOMPT instruction 7040.12 of 10 March 1960 covers program identification and related funding responsibilities for aerial targets.)

In general, requirements for targets required for expenditure during FY's 1962 and 1963 are assembled and submitted for the Fiscal Year 1961 budget during FY's 1959 and 1960.

The number of various types of targets placed in an initial fiscal year budget submission to meet stated requirements for following years seldom bears much resemblance to the numbers authorized for procurement in the final budget authorization. Depending on type of target and carefully weighed urgency, the target program can usually provide between one-half and two-thirds of the targets stated in the initial minimum statement of requirements.

During January and February of each year, the Aerial Target Program manager under the Director of the Aviation Plans Division starts preparing the annual Aerial Target Program (current directive: OPNAV Instruction 03110.18E of 11 May 1960). The annual OPNAV instruction allocates the number of targets that major fleet or R&D commands can expend during the fiscal year. This instruction also provides usage guidance and general information that will promote the most efficient and effective use of aerial targets.

In BUWEPS, two key offices supervise all the technical details of target development, procurement, production, "complete system" aspects and distribution as directed in OPNAV Instruction 03110.18E: The Director, Support Systems Programs (Code CS) is responsible for coordinating all the various offices within BUWEPS to ensure a complete target program; the Target Systems Officer (RM-4) under the BUWEPS Missile Officer (RM) is responsible for the research and development of aerial target systems.

PARACHUTE PROVIDES FIREBEE RECOVERY

Three powered targets for fleet use are included in the budgets of fiscal years 1960, 1961 and 1962: KD2R-5, Q2C and F9F-6K2.

Radioplane KD2R-5's are powered by a six-cylinder McCulloch air-cooled reciprocating engine that will take them to altitudes above 20,000 feet. The 2R-5 is procured primarily for 3" and 5" shipboard gunnery training, and also is used for low altitude surface-to-air missile firings. Utility Squadrons 1, 2, 3, 5, 6, and 10 are equipped to provide KD2R-5 target services.

Ryan Q2C targets are being procured for high altitude surface-to-air missile training. This jet-powered target is a more reliable growth version of the Air Force Q2A and the Navy KDA and is designed for much higher performance than its predecessors. The prime question that a ship's C.O. wants answered when he fires a SAM is: "Would the target have been destroyed if the missile had a warhead?" The Q2C will provide the answer.

Unless there is a direct hit, the Q2C will radio back to the firing ship information on a missile's performance including whether or not the target was within the lethal envelope of the missile. The Q2C will provide more information on missile performance than if a warhead is used. For this reason and for target economy, very few warheads will be used in SAM training. Considering that a small target flying at 55,000' or 60,000' and close to the speed of sound cannot be seen by the naked eye, the additional information received from the still-alive but theoretically "dead" target should compensate for the pleasure of seeing little pieces float down to the sea.

During the first part of FY 1962, Q2C services will be available in the Caribbean Missile Range from VU-8 at Roosevelt Roads, off the southern coast of California, from VU-3 using San Clemente Island, and in the Pacific Missile Range from the PMR Target Department located at the Naval Missile Center, Pt. Mugu, California.

The workhorse target of missile test activities is the Grumman F9F-6K. This converted obsolete fighter can

LOW ANGLE VIEW OF THE KD2U TARGET

carry very substantial loads of R&D augmentation and test equipment. The Norfolk Overhaul and Repair Department is "mother" for all F9F-6K's. Experience gained from the first year of operational experience is now being applied to F9F-6 target conversions in the way of the F9F-6K2. The 6K was originally conceived as both a fleet training target and an R&D target. The 6K2 will be used exclusively for R&D activities and OPTEVFOR at Roosevelt Roads, Naval Missile Center, Pt. Mugu, and NOTS CHINA LAKE.

No longer under procurement but still in Navy inventory are two other fine targets: the KDB-1 and the KDA-1/4. Stocks of both targets should be exhausted by the end of FY 1961.

The Beech KDB-1 was developed as a replacement target for the KD2R-5, and it was planned to have this target double in brass as both a gunnery target for fleet units and a target for missiles. Although the KDB-1 has flown at altitudes above 40,000 feet, the rapidly increasing demand for higher target performance by fleet weapon systems forced CNO to abandon procurement of this target in order to more equally satisfy all target requirements with available procurement funds. The KDB is still in production for the Army. VU-6 in Norfolk and VU-3 in San Diego will provide KDB-1 target services throughout FY 1961.

The Ryan KDA was a radical departure from conventional fleet targets when it was first flown in the summer of 1955. Two versions of the KDA *Firebee* were purchased. The KDA-1 with a J44-R-20 jet engine had design performance of Mach .86, altitude of 32,000 feet and an endurance of 40 minutes. There are a few KDA-1's still in use by VU-8 at Roosevelt Roads. KDA-4 procurement started in 1958. The "4", with an improved autopilot and J44-R-20B, easily flies at 40,000 feet, has flown as high as 48,000 feet, and has an endurance of over 1 hour.

When the *Regulus II* SSM missile program was cancelled, completed and almost-completed *REG II*'s were converted into the KD2U R&D target. KD2U operations are confined to R&D tests at Point Mugu. The Air Force has used KD2U's for weapon system tests at Eglin Air Force Base in Florida.

By the end of FY 1961, all fighter squadron skippers will have new tow target systems to enable them to conduct training without having to ask anybody for target assistance. All VF and VMF squadrons have been given an allowance of two Aero-43 tow systems, manufactured by the Del Mar Engineering Laboratories of Los Angeles, and "on hand" allowance of 10 specialized target shapes for the type of missile in use by the squadron. (See

CHANCE VOUGHT KD2U DURING TAKE-OFF

enclosure (1) to OPNAV Instruction 03110.18E.)

These systems will be delivered to fighter squadrons complete with target repair kits, launchers and reel installation kits for the type aircraft in the squadron. Associated equipment for the Aero-43 systems can be flown aboard or easily carried aboard ship. Because of the weight, Aero-46 reel rewind stands will be assigned to all CVA's and Naval Air Stations supporting VF squadrons. VMF and VMF(AW) squadrons will find their Aero-46's assigned to the parent Marine Aircraft Group. On page 40 is a glossary of the "Aero" numbers that concern tow targets.

There are two interesting target systems now in the development stage. The first is a supersonic missile target that can electronically simulate a large bomber type aircraft. In January 1959, 18 contractors submitted design proposals to BUAER for a powered target design that could be launched from all Navy and Air Force fighter aircraft. Beech Aircraft Company won the design competition and was awarded a contract in July of 1959 for development of the XKD2B. The first powered flight of the XKD2B is scheduled next month at Point Mugu. The Air Force is funding half of the development costs for this target system. The KD2B has a strong potential for use as a SAM target as well as an AAM (air-to-air-missile) target. Studies are being conducted to adopt a small booster that will permit the target to be launched from any SAM launcher. Such use would give fleet units a vastly expanded training capability; ships could

FOUR KD2B TARGETS ARE FLOWN TO SEA FIRING RANGE UNDER WINGS OR F3H DEMON

train with their weapon systems anywhere in the seven seas without range restrictions or target recovery problems.

The second of the new target developments is a supersonic tow target system. BUWEPS recently submitted design specifications for this target concept to industry for consideration and proposals. On the basis of proposals received, the Allison Division of General Motors Corporation was awarded a development contract this past June for a tow reel having a minimum capacity of 50,000' using .045" wire and for use with a low-drag target containing necessary radar, IR and scoring augmentation.

Ground support equipment and specialized aircraft are essential parts of powered target operations. All targets require ground check-out equipment, maintenance and repair facilities, catapult, zero-length launcher or airborne release equipment and control equipment. In general, the amount of support equipment and degree of technical complexity increases in direct ratio to increased target performance. As an example, one KD2U flight requires hundreds of man-hours in preparation for one flight; two control aircraft, an F8U-1D and a TV-2D, are required to be airborne during a KD2U target mission. Many skilled technical people are involved in a single KD2U flight, including controllers in a ground control center to "fly" the target and technicians operating an automatic ground control landing system. All KDA and some KDB and KD2R-5 flights require a helicopter for recovery. KDA's are launched from P2V-5D's and JD-1D's and the Q2C will be launched from the P2V-5D or may be zero-length launched using JATO bottles for initial thrust boost.

On the other end of the scale of complexity, the KD2R-5 may be taken aboard ship, launched by a catapult or zero-length launcher with JATO assist, be controlled and recovered from the sea by the launch ship for repair and another flight.

If the XKD2B proves to be a successful target, the performance-complexity trend ratio may be reversed. This 70,000-foot, Mach 2.0 target will have a 90% manufacturer guarantee and check-out, prior to its one flight, will be a simple "go—no go" unit.

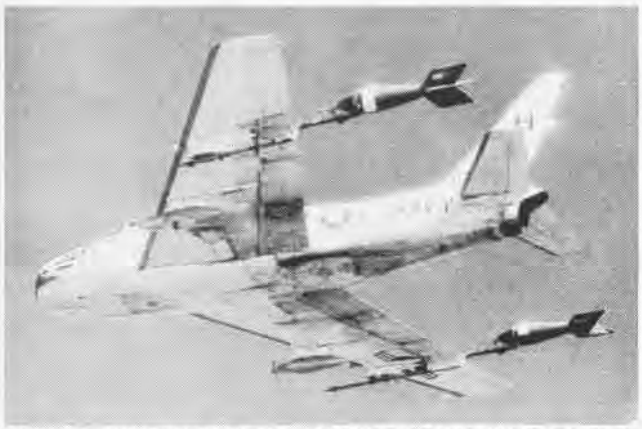
Procurement of powered targets to satisfy SAM and conventional gunnery training requirements is computed on the basis of four or five missions for each target (depending on type target) before expenditure. It has not been possible to procure sufficient targets to meet all of the training requirements. This situation is not helped one bit by increasing target system costs caused by the necessity for increased target system performance and sophisticated target augmentation devices.

Efficient and economical handling of limited target procurement requires the best in the way of professional performance on the part of all target operating units. Recipients of target services must have an understanding of the problems involved in target delivery and recovery. Complete planning is essential for all target operations; coordination between target operator and the recipient of the target services must include determination of target augmentation, telemetery presentation, altitude and speed, transfer of control (if any), *and recovery*, if possible. Fleet staff officers should try to double or triple-up training firings against a single target presentation.

No one shoots at a target hoping to miss. However, we do know that many non-warhead shots would have killed the target and the target has been recovered for many more flights. The optimum goal for fleet units to achieve is to get as many presentations as possible from their expenditure allowance of targets and to exhaust their annual expenditure allowance by the end of each fiscal year. All targets are bought for ultimate expenditure. Unused target expenditure allowances at the end of the accounting year can only be reflected in a corresponding loss in training facility.

The true cost of a target is the cost for a target presentation. If a $100,000 F9F-6K is lost on its first target mission, the cost of the mission is $100,000 plus the other overhead and operational costs. If the same F9F-6K is used for 10 presentations prior to expenditure, the cost of each presentation is only $10,000 with generally lower overhead costs.

The target business is going through a dynamic and most interesting period. Development of targets to keep pace with the new missile weapon systems being introduced, or to be introduced, to the fleet is a real challenge. The day of fulfillment will be when we can realistically simulate an actual enemy threat, satisfy all fleet requirements—and keep everybody happy—on a minimum budget. Until the arrival of this improbable day, the Navy's target people will remain a hard-working intense crew with their sights set on many very difficult but fascinating goals.



VIEW OF DUAL DEL MAR RIG ATTACHED TO THE WING OF FJ-4B

'OLE 23,' FAMED F9F-6K TARGET DRONE, MADE 15 FLIGHTS

NAVY HOSTS FLY-IN AT PMR

NEARLY 150 private planes, ranging from twin-engined Beechcrafts to an experimental craft designed for skin diving operations, carried 450 California fliers to Pacific Missile Range headquarters in mid-June for PMR's second annual general aviation fly-in.

Designed to promote closer cooperation between civilian and military aviation interests, the one-day aviation symposium attracted private pilots from all over the state.

Since the establishment of the Pacific Missile Range on the West Coast June 16, Navy officials there have worked in close harmony with private and commercial aviation to insure joint maximum usage of its necessary and vital restricted and warning airspace.

150 PRIVATE AIRCRAFT *carrying 450 civilian flyers responded to Navy PMR second annual fly-in invitation to Pt. Mugu. Symposium saw Navy honored for unique airspace programs.*

FLYING FAMILY, *J. S. Broomes of Oxnard, view PMR's new bio-astronautics display.*

In one of its programs, PMR inaugurated the first combination warning/control area through the center of the sea test range. The mechanization of this program resulted from the need for two well-separated control areas to permit commercial jet transports to safely enter and depart the Los Angeles area on trans-Pacific schedules. When not in use, the entire range is turned over to the FAA via hotline, and the corridor becomes a controlled airway. During range operations, every effort is made to schedule missile and space launches around a commercial aviation flight schedule furnished the PMR and kept up to date by the Air Transport Association in Los Angeles. This arrangement not only saves time and money for commercial airlines, but promotes increased flight safety as well.

In another instance, PMR realized that its two major coastal launch facilities at Point Mugu and Point Arguello and their attendant warning and restricted areas would cause undue hardship to private fliers navigating the California coast during periods of marginal VFR weather. Steps were taken to minimize these obstacles. Special radio watches on frequencies common to private aircraft advise flyers of immediate dangers in the areas and when private aircraft are free to fly via the coastal route.

STATE AERO *official, Leroy Lampson, and his wife inspect Sparrow II missile.*

Letters were sent to more than 3000 private pilots between San Francisco and San Diego warning them of the danger of mid-air collisions with jet and remote controlled aircraft in the Point Mugu area. They also told of the availability of corridors to overfly or circumnavigate at low altitudes and how to obtain a direct clearance through the restricted areas as traffic permits, via radio.

At this year's fly-in, following a keynote address by PMR Commander, RAdm. Jack P. Monroe, California Aeronautics Commission Chairman Norman Larson presented the admiral with a certificate of merit in recognition of his interest and ". . . awareness of the importance of general aviation" to the state's economy.

The citation said: "Under your guidance, the Pacific Missile Range has set a commendable example in the promotion of Flight safety and civilian-military aviation relations."

RADM. J. P. MONROE, *PMR Commander receives citation from Norman Larson.*

TRANSIT GIVES NEW MEANING TO SPACE

By Marie Pfeiffer, BuWeps

TWO SATELLITES were fired into orbit by a single U.S. rocket when the *Transit 2A*, the Navy's second navigational satellite, was launched into orbit on the nose of a *Thor-Able-Star* missile from Cape Canaveral, at 1:55 A.M. on 22 June. This firing was an epoch-making event in that it marked the first time two payloads were ever put into orbit at one shot.

The *Transit 2A* went beyond the objective of its predecessor, *Transit 1B*, and included a "bonus" payload for return of solar-emission phenomena data in addition to the basic Doppler-instrumented navigation aid. *Transit 2A* and its guest satellite were placed in an orbit of 66.69 degrees inclination with an apogee of 657 statute miles and a perigee of 382 statute miles. The eccentricity is .03076. The period is 101.5 minutes. The *Transit 2A* is expected to have a life of more than 50 years.

Speaking of the successful launching, RAdm. T. F. Connolly, Assistant Chief of the Bureau of Naval Weapons for the Pacific Missile Range and Astronautics, said, "It has proved a more perfect experiment than we dared to expect." Results to date strengthen Navy's conviction that *Transit* will be an operational navigational system in 1962.

The *Transit* shots are all part of the program of the U.S. Navy's Bureau of Naval Weapons designed to re-evaluate a centuries-old technique of navigation by celestial bodies. The current experimental *Transit* project is giving a new meaning to space and helping make tomorrow's aerial and maritime navigation more accurate than ever under any weather conditions.

The major breakthrough in the program occurred April 13, 1960, when the Navy/Advanced Research Projects Agency *Transit 1B* became the world's first man-made navigational star. Its successful launch from Cape Canaveral demonstrated the feasibility of using artificial satellites to obtain position "fixes" for planes in flight, ships at sea and submerged submarines. The real significance of this achievement becomes evident in the fact that, when using *Transit's* precise navigational data, the accuracy of our ballistic missile submarines will be greatly improved and navigation for all military and civilian air and sea units—of all nations—ultimately will benefit.

ARTIST'S DRAWING *depicts the double-header satellite, Transit 2A, in action. The Greb satellite is shown shortly after it has been separated from the top of 2A.*

The success of the *1B* launching opened the door to the establishment of an all-weather, global navigation system, expected to be in operation in 1962. The system will consist of a network of four *Transit* satellites in orbit at the same time, passing frequently within receiving range of every point on earth. It will assure navigational fixes anywhere, in either hemisphere, on the average of once every hour and a half. Completing the system will be ground receiving stations in strategic locations throughout the continental United States, a computing center, a data injection station, and user navigation stations. Worldwide receiving locations are required only during the research and development phase, but will continue in use after the operational date for continuing research.

Transit originally was a project sponsored by the Advanced Research Projects Agency in the field of military space technology. ARPA assigned the Bureau of Naval Weapons the mission of developing the satellite payload, and the Ballistic Missile Division, Department of the Air Force, the responsibility of placing the payload in orbit. Recently, the full responsibility for the *Transit* program was transferred to the Bureau of Naval Weapons. The Applied Physics Laboratory, Johns Hopkins University, where the concepts on which the navigation system is based were originated, is carrying out the development work on the satellite under contract to the Navy.

Orbiting of several experimental satellites is contemplated before the *Transit* system becomes operational. The first attempt to launch a *Transit* satellite into orbit on September 17, 1959 was classed as unsuccessful due to failure of the rocket booster Thor-Able second and third stages to separate properly. The satellite, however, reached an altitude of 400 miles, exactly the altitude planned for the test. Information was received on all four of its frequencies from the moment of lift-off at Cape Canaveral, Florida, to its destruction. Although only a partial pass of the *1A* satellite was obtained, it provided the mechanism for determining in a preliminary way the feasibility of making refraction cor-

rections, and determining the orbit by means of the approaching and receding "squeals" of the satellite, commonly known as Doppler signals, as it passed.

THE TRANSIT 1B thus became the first satellite in a navigational pattern. It was at the time of the *1B* orbiting achievement that Admiral Arleigh Burke, Chief of Naval Operations, sent a congratulatory message to the Astronautics Group of the Bureau of Naval Weapons and the Applied Physics Laboratory, stating that he considered the new *Transit* system an important milestone in the Navy's future as well as a major contribution to the nation's total space effort.

Transit 1B is a 3 foot, 265-pound sphere. It was placed into an elliptical orbit at approximately 235 to 475 miles altitude, instead of a desired circular orbit, with an inclination of 50° to the equator. The *1B* has no protruding antenna. It might well be mistaken for a giant-size barber pole—or a Christmas bauble. An unusual and versatile antenna, painted as a spiral band of essentially pure silver around the surface of the satellite, is part of the vital communications link between the sphere and the stations and ships or planes which it will serve. Instead of providing a separate antenna for each frequency being transmitted, the broad band antenna in the form of a logarithmic spiral is used to transmit on all four frequencies. The silver spiral pattern is painted onto the outside of the fiberglass hemispheres. The inside is coated with a gold film to help maintain a favorable heat balance.

Four frequencies are being used in early tests. Once the most desirable frequencies have been determined, only two frequencies will be required.

Since orbiting, the *Transit 1B* satellite has met several test objectives and notable progress has been made on others. The pickaback satellite separation technique was successfully demonstrated, and designed de-spin of the satellite occurred. Telemetered data from the satellite continually indicate that the temperatures are within design limits, and that the solar cell power supply is functioning as designed. From the tracking data, excellent orbits are being determined, and experiments to determine the relative positions of several *Transit* receiving stations have been conducted. The use of two frequencies in making corrections for the refraction effect of the ionosphere has proved effective. Investigation of the earth's gravitational field, and the geodetic surface of the earth, has been started. The reduction and analysis of the tracking data and experiments on position determinations are continuing, but the results to date clearly indicate the feasibility of using the *Transit* system to perform navigation with the precision that may be required for any military applications.

The object of the high orbital latitude in *Transit 2A* is to expose the satellite to the more intense disturbances of the ionosphere. The new orbit carries the *2A* over areas of the earth not covered by its older sister, the *1B*. The new satellite, in a higher orbit than that of *1B*, is affected differently by the bulges of the earth which it surveys. Contrary to popular opinion, the earth is not a perfect sphere, but bulges at the middle.

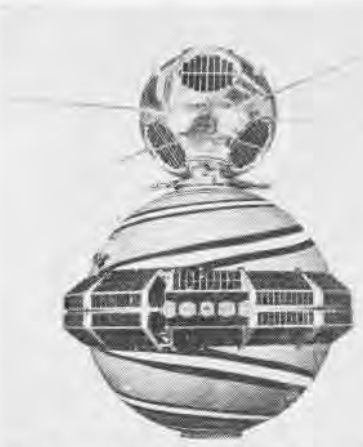
The *2A* satellite is similar in appearance to its predecessor. Unlike the *1B*, the new sphere is dependent upon solar cells to generate power for the transmitters. It includes twice as many solar panels as its predecessor. A nickel-cadmium battery stores power for use by the satellite when it is not in the sunlight. The *1B* carries an auxiliary transmitting system powered by chemical batteries, as a precaution. Also new in the *2A* is a digital timer, based upon the ultra-stable oscillators, which may open the way to providing a world-wide time standard to replace chronometers in ships.

The *Transit 2A* satellite, developed by the Naval Ordnance Test Station, China Lake, Calif., includes an improved telemetering system. Like the *1B*, it carries an infrared scanner to measure the rotation of the sphere.

The bonus payload, riding pickaback fashion on the *Transit 2A*, was a 40-pound, 20 inch sphere, the *Greb* satellite, developed by the Naval Research Laboratory. It was armed with special devices to detect and analyze solar radiation, and to provide new information on the ionosphere. Bound to the *Transit* by a metal ring, *Greb* was separated by spring force from the *Transit* satellite after orbital injection. *Greb* operates independently, in its own orbit. It will have an operational life of one year, the life of its chemical batteries, although it may remain aloft for as long as 50 years.

A special Canadian antenna and receiver to detect cosmic noise beyond the ionosphere was also a *2A* passenger, connected to the *2A* de-spin weights. Noise levels measured in the satellite are telemetered to the *Transit* ground stations for decoding. After a week, the equipment was shut off, and the satellite continued its normal functions. The de-spin weights were programmed to fly out and separate from both sides of the satellite. This was to bring the *Transit* spin to a near stop. However, some wires hampered the outcome, and the de-spin did not come off. De-spin was later accomplished by magnetic means.

The Canadian experiment in the *Transit* satellite is in preparation for the launching of their top side ionosphere sounding satellite. It is being conducted by the Defense Research Telecommunications Establishment, located at Toronto.



AFTER ORBITAL *injection, the pickaback package is released by spring force into its independent orbit.*

The feasibility of the new navigational system is based upon the capacity of seven ground receiving stations and a computing center to extract positional information from the signals of the orbiting spheres.

The signals as measured on the ground, although originating in an ultra-stable oscillator, nevertheless change their frequency as they approach and pass over the ground station.

Measurement of the Doppler shift permits scientists of the Applied Physics Laboratory and Naval Weapons Laboratory to predict the future orbit of the satellite, perhaps days ahead.

DR. W. H. GUIER *(L) and Dr. G. D. Weiffenbach (R) of John Hopkins Applied Physics Lab, first employed Doppler tracking system to determine satellite orbits. Dr. F. T. McClure (C) recommended the concept as a basis for world-wide navigation.*

These data, when later provided to navigators through another signal from the satellite, will permit ships and aircraft to mark their positions to a very high degree of accuracy.

The *Transit* system also will permit man to measure accurately the distances between land masses. Other techniques have been inadequate to give precise positions between land masses.

Transit 1B and *2A* are being tracked in their orbits by seven ground receiving stations stretching from England to Newfoundland, and from the United States to Brazil. These scientific ears are recording *Transit* signals broadcast on frequencies of 54, 324, 162 and 216 megacycles. The headquarters station is in Maryland.

Other *Transit* stations are in Austin, Texas; Las Cruces, New Mexico; Seattle, Washington, Argentina, Newfoundland, and Canada. The last two are van-mounted. A sixth station has been provided with the cooperation of the British Government at Lasham, Hants, England. A new improved seventh station has been put into operation at San Jose dos Compos, Brazil.

Currently *Transit 1B* is being tracked by an instrumentation ship off the Florida coast in the first experiments designed to lead to operational shipboard receiving equipment. The ship will not attempt to actually navigate in real time with the Doppler shift data it receives from the *Transit 1B*, since this satellite does not contain a memory unit needed to store orbital data. The Doppler shift, however, will be recorded and plotted to determine just how accurately the ship could have navigated had it relied upon the *Transit* data.

The objective of the tracking station is to deliver to the Computing Center accurate data showing how the Doppler signals received from the *Transit* satellite vary from second to second during passes of the satellite within receiving range of the tracking station. The output of the station is put on tape for transmission by teletype. The position and number of holes in the tape indicate time and frequency. This paper tape is automatically produced by the station during the tracking run, and is then fed to a teletype machine which transmits it to the Control and Computing Center at the Applied Physics Laboratory, during the experimental phase of the program. The same information is also printed out by a digital printer for the convenience and use of the people running the tracking station.

Transit 2A, like *Transit 1B*, will supply the tracking stations with data from which the following objectives are expected to be finally realized:

- A basis for navigation trials and demonstrations in elementary form.
- An improved understanding of the effects of ionospheric refraction of radio waves at higher latitudes.
- Increased accuracy in geodetic measurement such as a better knowledge of the earth's shape and the distances between land masses and of the earth's gravitational field.
- Improved orbital tracking.
- An accurate time standard for the *Transit* tracking station.

A third test vehicle launch is planned for the Fall. The orbit and mission of this *Transit* vehicle will be a low-latitude orbit inclined close to the equator to study the exact gravitational forces to which a satellite is subjected, and to gain improved data on the shape of the earth.

Subsequent launchings to further develop the objective of this project are planned for the future, prior to putting the system into operation.

The operational navigational system will consist of several satellites in orbit at altitudes ideal for accurate tracking, and a network of ground stations. A ground injection station will transmit to the satellite its orbital data for a minimum of one day in the future, which will be recorded on magnetic tape. Thereafter, until new orbiting data are transmitted, the satellite circles the earth transmitting on two stable, harmonically related frequencies. Thus navigators will need only special receiving equipment to obtain their positions from the satellite. There will be no need to trigger or interrogate the satellite.

Operational satellites will weigh 50 to 100 pounds, and will be designed to have an operational life of five years. They will contain a miniaturized digital memory unit for storing orbital data received from the ground injection station, and a system for transmitting this information to the navigating stations. The satellites will be completely transistorized, and will use solar power.

The BUWEPS Astronautics Group believes that the Navy will have sufficient answers to questions concerning the refraction effects of the ionosphere and the gravitational forces to which the satellite will be subjected, to permit the navigation systems to become operational sometime in 1962.

MARINE CORPS HUS-1 WITH BULLPUP MISSILE ON STARBOARD SIDE

SUCCESSFUL LAUNCH MADE FROM 500 FEET AT 90 MILES PER HOUR

Copter Launch of Bullpup

Marines Try Out Tactic with HUS-1

The successful launching of the *Bullpup* air-to-surface missile from helicopters promises to provide Marine assault troops with additional offensive and defensive firepower.

The missile-helicopter combination has been undergoing tests at the Naval Air Test Center, Patuxent River, using a Marine Corps Sikorsky HUS-1 helicopter.

The radio-controlled missile had previously been fired only from such fast planes as the A4D and the FJ-4B.

In recent tests, *Bullpup* was fired while the Marine helicopter hovered at 1500 feet. Seconds after the fiery-tailed missile left the craft's side, it splashed within inches of a target disk 10,000 yards out in Chesapeake Bay.

The Marine pilots report that there are no stability problems with the helicopter and that control of the missile is no more difficult than from a fixed wing aircraft.

Once the *Bullpup* is launched, the pilot guides it to the target by a switch on his control stick. The missile can be steered up, down, or to either side. Flares in the aft section help the pilot keep the missile in sight as it streaks toward target.

Hypo Needle is Chucked

Jet Injector Gun Takes Its Place

Marines at Kaneohe Bay now can look at a hypodermic needle and laugh. The "Spike," with all its jokes of bends and breaks, is on its way to obscurity along with leggings and long bayonets.

Replacing the needle is the latest thing in speedy and painless innoculation—the Multi-dose Jet Injector.

The gun has no needle. It employs the principle of forced injection through skin pores. It needs no changing between individual shots; just a flick of a switch and it's reloaded and ready for the next man in line.

The first shots administered with the Injector were poliomyelitis boosters; a perfect test, inasmuch as the polio vaccine itself is painless.

DADDY LONGLEGS AND FRIEND? *No, it's Cdrs. J.E. Kendall and S.G. Gorsline, CO's of VA-22 and 23, looking over A4D-2 Skyhawks just received at Alameda. The legs belong to men who* ***provided boost.***

NASA Studies Ion Engine

Would Power Future Space Craft

An experimental ion engine, whose ultimate use will be to propel spacecraft on interplanetary missions, has been ordered by NASA. Hughes Aircraft Company of Culver City, Calif., was selected to design, develop and laboratory-test the experimental engine in a year-long program.

Estimated cost of the project was set at more than $500,000.

The ion engine development departs from conventional rocket engines in that there is no combustion. An alkali metal atom (cesium) stream passes through a hot tungsten electrode which pulls an electron away from the cesium atom, creating positively charged ions.

This ion stream is accelerated and focused by several more electrodes. Finally, other electrons are mixed with the ion stream so that a neutrally-charged beam emerges from the engine. No nozzle is needed.

In the space of a few inches, the ion stream develops speed of more than 100,000 mph. The cylindrical ion engine measures about eight inches long and four inches in diameter.

The laboratory-type engine will be built to develop only about 1/100th of a pound of thrust. If test data prove the program is feasible, later engines will be built to develop higher thrust

Scientists hope ultimately to use engines of this type to propel spacecraft on interplanetary missions.

Ion engines will not be used as primary launch engines because of their low thrust output. They would be built into spacecraft and turned on after the spacecraft achieves a predetermined trajectory, according to NASA.

NRL SCIENTIST DECORATED

DR. PETER KING OF NAVAL RESEARCH LAB

ELEVEN YEARS after his discovery that Russia had exploded its first atomic bomb, Dr. Peter King of the Naval Research Laboratory has been awarded the Navy's Distinguished Civilian Service Award.

Presentation was made in the Pentagon by Dr. James H. Wakelin, Jr., Assistant Secretary of the Navy for Research and Development.

Dr. King was doing research on paints, varnishes and other protective coatings at NRL in 1948. A fellow scientists told him one day that the lab's Geiger counters appeared to be working overtime after rainstorms.

The chemist collected a rainwater sample from a nearby roof, tested it, and found it to be radioactive. He theorized that the radioactivity must have resulted from nuclear test explosions made some six months earlier in the Pacific.

But to accurately associate radioactive water with the Pacific explosions, he needed samples of rainwater which had fallen just after the tests. He learned from an acquaintance that in the Virgin Islands rainwater is kept in cisterns. Furthermore, natives of the island could tell precisely when it fell.

He sent an assistant to bring back a sample of the rainwater which was known to have fallen soon after the atomic tests. It was "hot" with radioactive cerium and yttrium, both typical products of nuclear fusion.

Dr. King arranged to have Navy planes bring him a sample of rainwater from Kodiak, Alaska, about once a month. At the time, the United States had a monopoly on nuclear weapons. Calling his project Operation *Rainbarrel*, Dr. King regularly examined samples of the Alaskan rainwater. For months the water remained normal.

In September 1949 he struck pay dirt. He had heard indications that Russia might have exploded a nuclear weapon, so he radioed Kodiak to disregard the monthly routine and rush a rain water sample immediately to him.

He was able to tell within a few hours of the water's arrival that it contained cerium which could have come only from a nuclear explosion.

Soon afterward President Truman announced that the Russians had broken America's atomic monopoly.

In 1954 Dr. King was named Superintendent of the Chemistry Division at NRL. Two years later he was promoted to Associate Director of Research for Materials.

He received his doctorate in chemistry from Catholic University in 1942.

Navy Tests ASW Copters

Key West, Pax, Quonset Get HSS-2

Sikorsky HSS-2 helicopters have begun full-scale demonstrations and trials at Key West, Patuxent River and Quonset Point. The three helicopters being used in the tests are the first to make cross-country flights.

The twin-turbine, boat-hulled HSS-2 is equipped with the latest sonar detection gear and has all-weather, around-the-clock flight capability.

PIREPS Program Extended

In-flight Data Urgently Solicited

An improved system for collecting and distributing pilot weather reports (PIREPS) on the continental U. S. and off-shore routes has been initiated by the Federal Aviation Agency and the U. S. Weather Bureau.

Both agencies, and also the Naval Weather Service, are urging pilots to cooperate in reporting significant en route weather to the nearest FAA station. "Significant weather" includes such items as cloud tops, upper level clouds, turbulence, icing, hail, thunderstorms, etc.

"This is the pilot's own program," says E. R. Quesada, Administrator, FAA. "To make it truly successful, it is essential that every pilot in every facet of aviation cooperate in the program by providing reports on in-flight weather at the earliest practicable moment and as frequently as changing en route weather conditions justify."

Capt. John F. Tatom, Director of the U. S. Naval Weather Service, points out what he calls the weather facts of the pilot's life: "There is a dense network of stations giving surface reports every hour with 'specials' in between. Upper air observations are obtained by relatively few stations and usually no more frequently than once every 12 hours. If pilots want to know what's going on upstairs, they will have to report the weather they encounter."

The new PIREPS program makes it obligatory, rather than optional as in the past, for FAA Flight Service Stations to solicit and distribute PIREPS when either thunderstorms or ceilings of 10,000 feet or below are reported or forecast within a radius of 100 miles of the Flight Service Station.

Pilots are urged to report significant weather encountered on climb-out, at cruising altitude, and during descent. This information is very valuable in supplementing that which is obtained from surface and upper air weather observations for use in pre-flight briefing and forecasting. These data are also used by FAA and or Weather Bureau in air traffic control and the issuance of in-flight advisories.

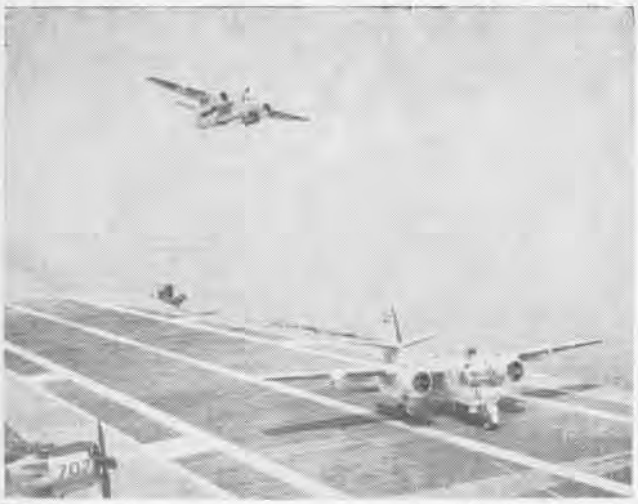
PIREP summaries are broadcast hourly. Individual PIREPS on severe weather conditions, (FAWS), however, are immediately broadcast by FAA and by the U.S. Weather Bureau.

THREE-MILLIONTH *gallon of Navy Special fuel oil pumped by Lake Champlain to its escort destroyers is handed to W. P. Dietrich, BT1, Oil King, by Cdr. E. T. Thomassen, XO, for delivery to USS Barton.*

SEATO'S 'SEA LION' ROARS

USS YORKTOWN, *CVS-10, was one of the carriers used in the international exercise. RAdm. Joseph D. Black declared that the fact that all SEATO nations were contributing to "Sea Lion" illustrated the growing cooperation that prevails among SEATO nations.*

MILITARY ADVISORS *to the Southeast Asia Treaty Organization paid a courtesy call on SecDef Thomas S. Gates, Jr. (C) and Gen. Nathan F. Twining, Chairman of the Joint Chiefs of Staff (far left), before meetings. At the far right is Adm. Harry D. Felt, CinCPac.*



ONE OF THE *American types of aircraft used in "Sea Lion" was the S2F Tracker. Here Grumman airplane lands aboard Yorktown.*

LOGISTICS WAS *an international affair. Here USS Yorktown takes in fuel from Her Majesty's Fleet Auxiliary Oiler, "Wavemaster."*

ONE OF THE big events in the Far East a short time ago was sponsored by the Southeast Asia Treaty Organization. Its largest maritime exercise, called Operation *Sea Lion,* took place in the waters off Manila Bay and Bangkok.

The armada of more than 60 ships included those from the U.S. Seventh Fleet, Australia, France, New Zealand, Pakistan, the Philippines, Thailand and the United Kingdom. These constituted a powerful aggregation.

Three task groups formed around the carriers, USS *Yorktown,* the Royal Australian Navy's *Melbourne,* and the British Cruiser, HMS *Belfast.* Senior ranking U.S. Naval Officer was RAdm. Joseph D. Black, ComCarDiv 17 of the U.S. Antisubmarine Hunter/Killer Group, whose flagship was *Yorktown.* CVS-10 was skippered by Capt. Louis H. Bauer.

Off Corregidor, U.S. Marine Corps *Crusaders* simulated attacks against the fleet units. ASW exercises involved the USS *Maddox* (DD) and the submarine USS *Medregal,* HMAS *Melbourne* and, in addition, three Pakistan frigates.

HELICOPTERS, *whose usage has been constantly expanded during recent years, were on hand. Airmen adjust blades on Yorktown copter.*

TOP RANKING *Naval officers of SEATO nations participating in "Sea Lion" marched to monument of Philippine hero, Jose Rizal.*

A REPRESENTATIVE *of the Seventh Fleet, USS Yorktown made this dramatic silhoutte as she passed Corregidor Island early in exercise.*

WHIRLYBIRD AS A MINESWEEPER
HELICOPTER UNDERTAKES NEW ROLE

By Cdr. John A. H. Torry, Jr.

MINESWEEPING has always been a very dangerous business. In the Korean conflict in the early fifties when a ship went down, it was all too often a minesweeper.

Minesweeping plays its part in Herman Wouk's *Caine Mutiny.* At one point, the question is asked, "But who sweeps for the lead sweep?"

A good question and a fair one! What about a Navy minesweeper making its way through an uncharted field of shallow-moored mines. The very fact that the minesweeping ship is the natural target of the devices it seeks to destroy gives it a vulnerability that must be offset or else—WHOOM—and no more minesweeper! Such a possibility raises beads of cold sweat on the brows of even veterans of minesweeping operations during WW II and the Korean conflict.

In fact it was during the First Marine Division landings at Wonsan, Korea, in 1950, that the vital nature of the present development work was dramatically and tragically highlighted. The harbor area had been heavily mined with the result that two minesweepers, *Pirate* and *Pledge,* were lost within minutes, and the entire task force was compelled to steam for over a week while an approach was cleared to the beachhead. In this operation a helicopter was used for aerial spotting of mines. From that moment, the possibility of letting the helicopter do more than spot was at least a thought.

Losses at Wonsan stirred at that time the imagination of a few men working in BUAER'S Armament Division. Aware of the events which had taken place at Wonsan when the *Pirate*

THIS SKETCH OF SURFACE MINESWEEPERS AND HELICOPTERS INDICATES THE WELL-PLANNED SCOPE OF OPERATIONS AGAINST MOORED MINES

and *Pledge* were sunk (and aware also that the mine spotting helicopter did not or could not prevent the destruction of these vessels), these men asked themselves these questions: Why not protect the surface minesweeper with a helicopter? Why not let a helicopter tow minesweeping gear and become the lead sweep, thereby protecting the following surface minesweeper? Out of these original thoughts came the development of the airborne mine countermeasures program.

In wartime, the three major hazards to shipping, military or merchant, are air attack, the submarine menace and enemy mines. Of these three, the mine threat is certainly one of the hardest to combat. The threat is both physical and psychological, for the real value of a mining campaign lies not only in total tonnage sunk but in the intangible factors of transit delay and lowered morale.

Offensive mines are designed in terms of the normal characteristics of ships. Moored mines are set at a depth that will cause a moderate or deep draft ship to set them off, whereas floating debris or a small, unimportant

boat will not "trigger" the mechanism. Acoustic mines, sensitive to sounds generated by ships, are designed so that they will not respond to underwater noises of nature. Similarly, magnetic and pressure mine mechanisms are designed to accept ship signatures but ignore others.

In order to protect minesweeping ships as much as possible, they have been designed so that as nearly as possible they will not appear to mines as ships. This, of course, increases substantially the cost of construction maintenance and operation, but at best, it cannot totally eliminate the dangers minesweeping ships must face.

Thus the advantage of using the helicopter is obvious. It operates in a different medium and provides an excellent platform from which to conduct mine countermeasures. By exploiting this advantage, aviation can augment existing mine countermeasures surface forces in such a way as to increase their efficiency and reduce their inherent vulnerability.

Naturally Bureau of Aeronautics personnel wanted to evaluate the feasibility of using the helicopter as a lead sweep. Working with helicopter pilots in the Rotary Wing Design Branch of BUAER and in CNO as well as with helicopter manufacturers, the originators of the tactic arranged for the project to be assigned to the Commander Operational Development Force (now Operational Test and Evaluation Force) who, in turn, assigned the undertaking to an appropriate evaluation activity, namely, Air Development Squadron One and the Mine Evaluation Detachment Seven in Key West.

HSL TOW CAPABILITY FULLY DEMONSTRATED

NAVAL AIR MINE DEFENSE DEVELOPMENT UNIT CONDUCTS PROJECTS AT THIS FACILITY

The feasibility of using a helicopter in minesweeping was first demonstrated in tests using the Piasecki (now Vertol) HRP-1. This whirlybird proved to be a most efficient tug since its maximum draw-bar pull of 7000 pounds was in excess of its gross weight. As the tests continued, other possibilities appeared. With tow boom and hook extended, the helicopter not only could pick up and take over a tow from a surface vessel, but it could execute the same maneuver from another helicopter. This permitted continous sweep operations by alternating helicopters. Furthermore, if several helicopters in echelon were used, the swept path could be extended.

These first experiments with helicopters in a mine countermeasures role, undertaken by Air Development Squadron One at Key West, date back to 1952. Their success warranted an increase in the scope of the test program with an attendant increase in technical assistance. Therefore, a small group of helicopter personnel were detached from Air Development Squadron One and, with their HRP-1 helicopters were relocated at the Navy Mine Defense Laboratory in Panama City, Florida. Here the helicopter unit could receive the expert technical guidance from mine countermeasures personnel of the Laboratory. The unit itself increased in size and received its present name, the Naval Air Mine Defense Development Unit (NAMDDU). Operating under the management control of the Bureau of Aeronautics, NAMDDU made great strides in preparing the helicopter for mine countermeasures operations. All projects today originate in the Mine Countermeasures Section of the ASW Detection and Control Division of the Bureau of Naval Weapons. These are assigned for conduct to the Mine Defense Laboratory. The flight portions of all projects are carried out by NAMDDU.

Panama City was an ideal location for the helicopter experiments since it gave its members easy access to the specialists at work in the Mine Defense Laboratory. Certainly helicopters in their new role would not be operating alone, and the expert knowledge of specialists in surface defense was essential.

The newly inaugurated test program had four objectives:

1. Evaluation of current service type helicopters in terms of their use in countermeasure operations, since the HRP-1, while it proved the feasibility of the operation, was out of date.

2. Development of safe and efficient

operating methods of combining the use of helicopter and surface ships.

3. Investigation of all types of mine countermeasures equipment for use by Navy helicopters.

4. Development of new equipment and procedures that would take advantage of the special operating capabilities of the helicopter.

In line with the first objective, the unit in its early days took steps to determine what available helicopters would be the best tow vehicles. One of the first tried was a Marine HRS-3 (Navy HO4S-1). Whatever its virtues, towing was not one of them. Under certain circumstances the pilot would discover suddenly that he had run out of lateral control. So the HRS-3 candidacy in a countermeasure role was ended.

When the Vertol H-21 used by the Air Force, was tried out, it also had its limitations. But probably the clinching argument against the H-21 was that they were not in Navy use and procurement of a new helicopter for mine countermeasure was not really warranted.

Another helicopter to enter the field was the Bell HSL-1, designed originally an ASW vehicle. The HSL-1, although an efficient tow helicopter, was similarly not anticipated for fleet use. After the ASW testing program was completed, the Sikorsky HSS-1 was selected as the Fleet's ASW rotorcraft. However, since there were some HSL-1's that could be made available for research and development in the mine countermeasures program, it was decided to utilize a limited quantity.

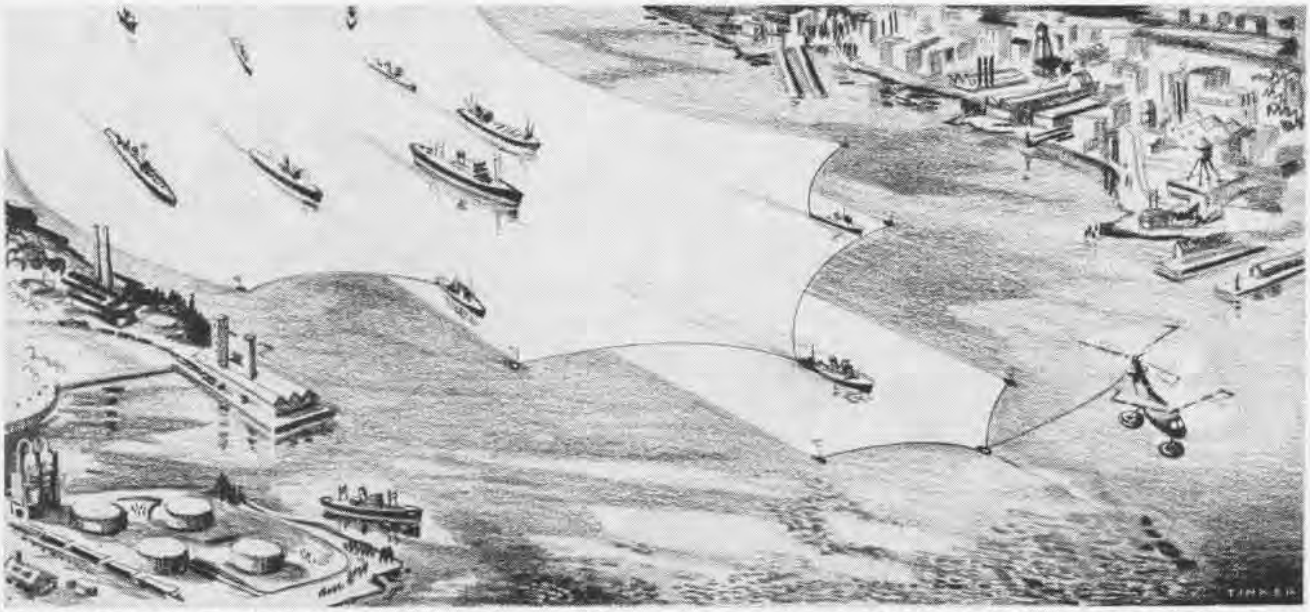
The HSL-1 had been extensively modified by the contractor and tested at NATC PATUXENT RIVER and thus became the first copter to undergo complete evaluation as an airborne minesweeping vehicle. In all, six of these helicopters were modified. While the process was expensive, it was essential since the copters had to be capable of coping with tow cable tensions of some 7000 to 10,000 pounds and of functioning at fuselage angles of inclination as much as 45 degrees nosedown. No unmodified HSL could do this. The modified vehicle held up well, for until April of 1960 the last of these HSL-1 helicopters was still in use at the Naval Air Mine Defense Development Unit at Panama City.

Right from the start, the HSL-1 indicated the feasibility of operating as such a vehicle in conjunction with the existing mine countermeasures forces. Fleet exercises in August 1957 demonstrated that two copters were very effective against moored mines because they took minesweeping personnel in the lead sweep out of the water, and gave them a safer vantage point. Not only was the HSL-1 used to tow standard 5G moored minesweeping gear, but it was evaluated to determine its capability against acoustic and magnetic mines.

But good as the HSL-1 was, it was still far from the ideal visualized by mine defense experts working with it. Since it was never to be used as an ASW vehicle by the operating forces, there were fewer and fewer of the type available. This created a shortage of parts support and an increased cost for modification. Consequently the interest shifted to the HSL-1's original ASW competitor, the HSS-1.

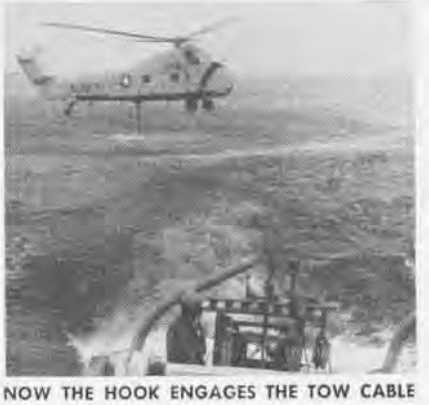
This helicopter was in wide use in our armed forces and used as well abroad. Logically it seemed wise to get it modified for the towing mission and see if it couldn't serve as an airborne mine countermeasures vehicle.

In the meantime, great interest in the helicopter as a mine countermeasures vehicles was being exhibited in Europe where the Vertol Aircraft Corporation had taken H-21's. European leaders were inclined to stress mine countermeasures, and no wonder, for they were certain their ports would be primary targets for mining operations in the event of war. The whole



THE ARTIST'S CONCEPT, DONE IN THE MIDDLE FIFTIES, COMBINES A VERTOL H-21 WITH GEAR DESIGNED FOR EFFICIENT MINESWEEPING

COPTER APPROACHES FOR TOW PICK-UP


NOW THE HOOK ENGAGES THE TOW CABLE

HELICOPTER IN MINESWEEPING ATTITUDE

overseas logistics chain could be disrupted if their harbors were mined. Efficient mine countermeasures would be of utmost importance, and they considered the helicopter well worth exploring in that particular field.

The tow-configured H-21 was a likely candidate in the countermeasures race. By the time the H-21 was exhibited to the overseas market, Vertol had modified and corrected many of the discrepancies which had marred the performance of the H-21 at Panama City. What the Europeans could buy was something abreast of the most recent developments worked out in the Panama City experiments.

Certain countries took advantage of this, and ironically, by October 1959, they had in service the first mine countermeasures helicopters while the U.S. Navy was still using the HSL-1 which was not going to see fleet service. The HSS-1 was still undergoing evaluation. No mine countermeasures helicopters were with the fleet.

But a solid program was going on in the Navy, and in the long run, the continued experimentation and evaluation should pay off spectacularly. In April 1958, Sikorsky test personnel were ready to try out their first tow-configured HSS-1 helicopter. Successful testing at the contractor's plant proved the design, and now Sikorsky was ready to perform dynamic load testing using the standard 5G moored minesweeping gear.

But since this basic aircraft had not been developed for the Navy in terms of towing applications, problems were inevitable. Oscillograph records indicated that the tail rotor transmission was forced to absorb higher horsepower than it was designed to accept. Malfunctions of the tow boom and hook occurred, and there were other discrepancies. But while these points were discouraging, they could be solved. The main object had been achieved—the HSS-1 could certainly tow. It remained for the technical experts to correct the various discrepancies encountered.

Out of the years of experimentation has been evolved the concept of developing a basic helicopter airframe and attaching pods to it which will enable the helicopter to meet the requirements of any military mission which does not exceed the lift or tow capabilities of the machine itself. Rotary Wing people call such a machine the Universal Tactical Vehicle. Sikorsky calls this proposed vehicle the S-64 Physically it resembles that company's S-60 *Skycrane*.

When recently demonstrated this year, the twin-engined Sikorsky *Skycrane* carried new lightweight minesweeping gear within a mine countermeasures pod attached beneath the airframe. The gear was lowered, streamed, finally towed and retrieved by the *Skycrane* which, in effect, proved itself to be a self-sufficient aerial minesweeper.

SKYCRANE WITH NEW MINESWEEPING GEAR

The pod used in the demonstration was adapted from an old Bell HSL-1 helicopter fuselage and fitted with hydraulically-driven winches loaned by the U.S. Air Force and modified by Sikorsky engineers. As the *Skycrane* flew low over the Gulf of Mexico, a few miles offshore, the winches streamed out 600 feet of cable normally used for towing aerial targets.

In another phase of the demonstrations, conventional mine-sweeping gear being towed behind the minesweeper, USS *Venture*, was picked up and towed by a Bell HSL helicopter, transferred to a Sikorsky HSS-1 helicopter and, finally, returned by the HSS-1 to the minesweeper.

Vertol Aircraft Corporation also proposes a helicopter mine countermeasures concept which is perhaps equally adaptable to many military requirements. Known as their module or package concept, the idea centers on the Vertol YHC-1A. This tandem rotor aircraft has a large aft loading ramp through which, for mine sweeping, a package containing all of the elements of the same lightweight minesweeping gear can be installed rapidly and operated efficiently.

The Bureau of Naval Weapons is determined to continue its effort to develop these new techniques and to reduce the hazards surface minesweepers face. Proper coordination of airborne and surface minesweeping has proved in experiments to offer a defense against mines greater than ever.

USS Forrestal to the Rescue

CVA-59 Divers Help Patch DD Hull

Two USS *Forrestal* (CVA-59) divers braved cold water—temperature in the fifties—and choppy seas to aid the crew of the USS *Perry* (DD-844). The operation took place in Augusta Bay, Sicily.

Ltjg. David B. Jones, and Bernard A. Kreusch, Mineman First Class, of *Forrestal's* Bomb Disposal Unit, each made three dives. On the first dive they installed a temporary patch and determined specifications for the permanent one. On the second dive the permanent patch was positioned for welding from inside the hull. A third dive was needed in order to remove the temporary patch.

Welding Process Improved

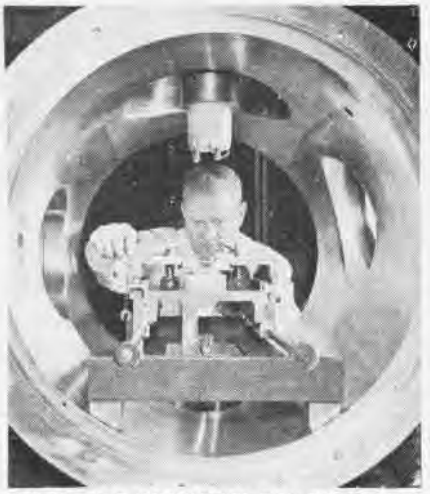
Better Spacecraft Welds is Goal

Research engineers at Republic Aviation Corporation are developing a new welding process, using a high-powered electron beam gun, which may speed the fabrication of space ships and other space vehicles.

They have made progress in achieving welded joints capable of withstanding temperatures of 3000° F through use of the new technique.

The procedure has been applied to such space age metals as molybdenum alloy and pure tungsten. These two metals are considered ideal for use in outer space craft because of their resistance to high temperatures.

The electron beam gun operates in a cylindrical vacuum chamber which



METALS ARE POSITIONED FOR EXPERIMENT

establishes a contamination-free atmosphere for welding. The weld joint area is bombarded with a narrow, concentrated beam of fast-moving electrons to generate about 6000° F heat required for the welding. Welding speeds reach as high as one inch per second, approximately 150 percent faster than other welding processes for these metals.

It results in welded joints that have deep penetration and narrow weld beads, and which are virtually free of contamination which often makes a joint fracture because of brittleness.

Named a Senior RN Pilot

LCdr. Miller Cited by Adm. Smith

Selection of LCdr. Richard A. Miller, USN, to be a senior pilot in a British squadron has drawn the commendation of Adm. H. P. Smith, Commander, U. S. Naval Forces, Europe. LCdr. Miller is an exchange pilot.

As Executive Officer of British 820 squadron at Royal Naval Air Station, Culdrose, Cornwall, England, he is responsible for the training and operational efficiency of squadron pilots, flying and maintenance schedules.

Mighty Blast at Lockheed

Mach 5 Tunnel Nears Completion

Operating checks began in July at Lockheed's new Supersonic wind tunnel which is being built to evaluate futuristic aircraft and missile shapes designed to fly at speeds up to 3800 mph. The Mach 5 tunnel is the first major facility scheduled for completion at the company's multi-million dollar California Division Research Center near Burbank, Calif.

The tunnel will employ a "blow-down" technique which uses stored air for its wind supply, as contrasted to installations using a continuous flow of recirculated air. Company engineers feel that greater operating economies, with equal air power, are afforded by the blow-down type.

When air stored in four huge containers is released, it will attain a maximum rate through the tunnel of 3600 pounds a second, the equivalent of 500,000 horsepower or enough energy to drive two *Forrestal*-class aircraft carriers at full speed.

Containers measuring 10 feet in diameter and varying from 78 to 88 feet in length will hold enough air to sustain a Mach 5 wind for two minutes.

LEATHERNECKS *of VMF(AW)-115 form unique arrangements of aircraft, equipment and men at MCAS Cherry Point. Arc of F4D fighters was a backdrop for ceremonies conducted by Marine Air Group 24 as tribute to "a unit upholding highest Corps traditions."*

'AN OUNCE OF PREVENTION'

ATTN ATU-301 X RECOMMEND RELEASE AD-6 BUNO 132507 CMM ENG R-3350-26WC SER C-591542 AND SUBMIT OIL SAMPLE AFTER FIVE ADDITIONAL HOURS OPERATION X ANALYSIS OF SAMPLE SUBMITTED IAW MY 182144Z INDICATES METAL CONTENT REDUCED AFTER NR 16 CYLINDER CHANGE X NEW SUBJ X RECOMMEND GROUND AD-5N BUNO 132584 AND SUBMIT SPECIAL OIL SAMPLE EARLIEST FROM R-3350-26WC ENG SER W-531409 DUE

PENSACOLA LABORATORY *which developed oil analysis program is headed by B. B. Bond.*

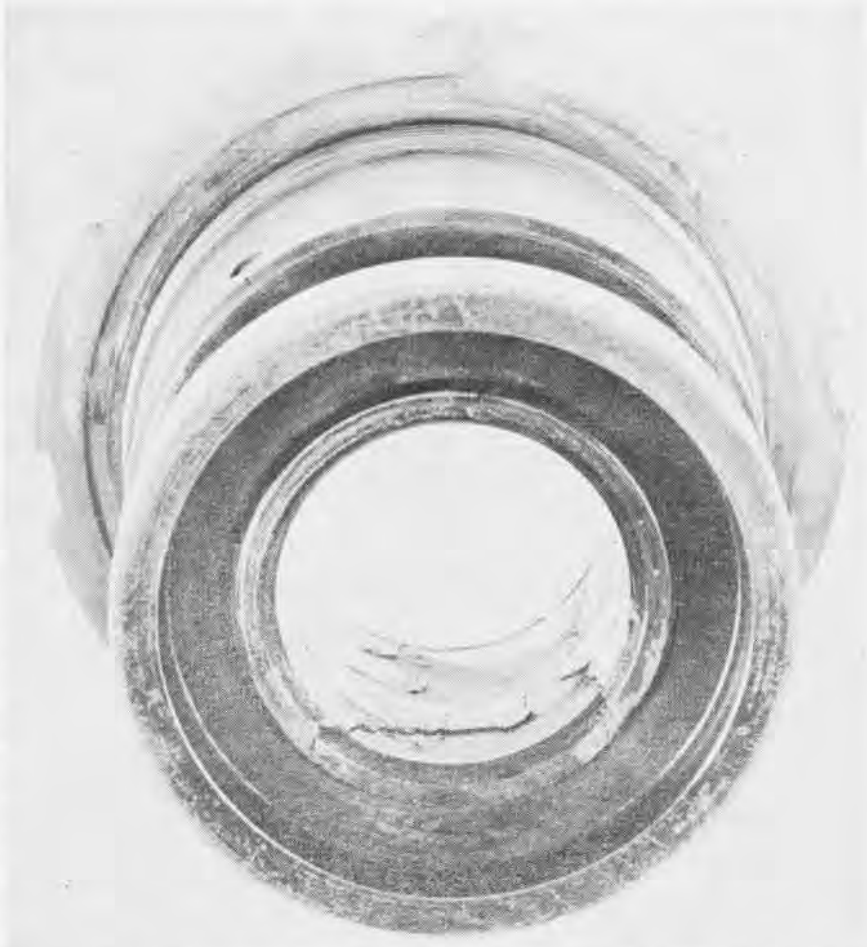
HIGH CONTENT IRON CMM CHROME CMM ALUMINUM X ALSO SUBMIT SPECIAL OIL SAMPLE FROM AD-6 BUNO 139656 CMM R-3350-26C ENG SER C-591345 DUE TO MARGINAL CONTENT IRON

Such messages from the BUWEPS Fleet Readiness Representative are routine to squadrons participating in a BUWEPS research project TED PEN MA 3601, "Determination of Engine Conditions by Analysis of Used Oil samples." Now pilots and maintenance people of those squadrons do not think it unusual to change an apparently perfectly good engine on a recommendation initiated by a chemist miles away who has never seen the engine, but merely analyzed a tiny sample of its oil. This is, in a manner of speaking, the proverbial "ounce of prevention."

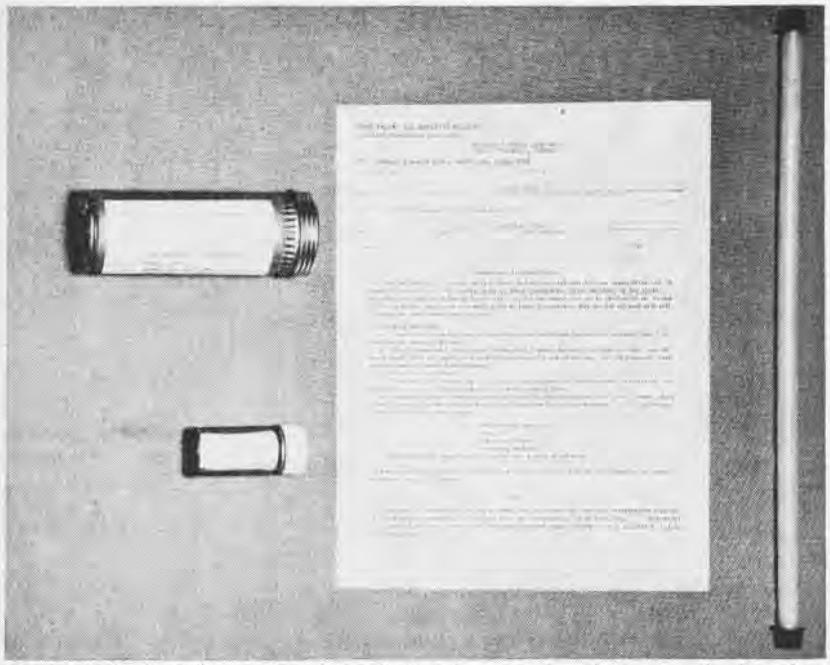
JACK WITTEN *of BuWeps Maintenance Programs Branch conceived oil research project.*

Project TED PEN MA 3601 was officially initiated by the Bureau of Aeronautics in October 1955. Personnel of BUAER—particularly Mr. Jack Witten who is generally credited with having fathered the project—had been following with interest the developments in spectrographic analysis of used engine oils as applied to railroad diesel maintenance. According to the theory of oil analysis, internal engine conditions can be monitored through measuring the amounts of wear metals suspended in the used engine oil.

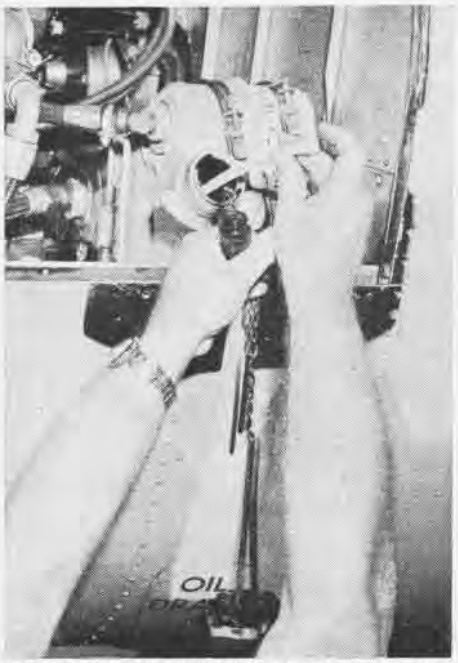
THE Materials Testing Laboratory at PENSACOLA O&R was selected to conduct the experiment. It had the advantage of proximity to a large number of operating aircraft and was part of an O&R which overhauled many of



DAMAGED IMPELLER *bearing above came from supposedly sound R-1340 which was first engine pulled on basis of oil analysis program. Discovery verified basic theory of system.*



SAMPLING KIT *includes, right to left, plastic tube cut to length for aircraft, data sheet, sample bottle, and mailing carton. To prevent contamination, gear is used only once.*



SURGICALLY CLEAN *bottle and tube are used to extract sample before new oil is added.*

the engines operating in the local area. Another reason for the selection of Pensacola was that the Materials Lab under the direction of Mr. Bernard Bond, an engineer of national reputation, had a record of success in development work. In this lab the processes for tin-cadmium plating of engine parts, porous chromium plating of aircraft engine cylinder bores, and other major developments were worked out.

Success in the program demanded accurate measurement of wear meta's in parts per million (ppm). Accuracy in the range of one to 10 ppm was particularly important. The early work was tedious and exacting. With the spectrographic equipment and the processes used in Phase I, only four samples per day could be analysed

Phase I involved tests every 30 operating hours on 20 engines. For over a year testing went on with no results; nothing to prove the theory or disprove it. Finally in February 1958 the first trouble was spotted. Tests on a Corry Field SNJ engine, which had been running 2 ppm chromium, 35 ppm copper, and 50 ppm iron, suddenly went to 41 ppm chromium, 150 ppm copper, and 320 ppm iron. After analysis of two check samples, the engine was removed and torn down.

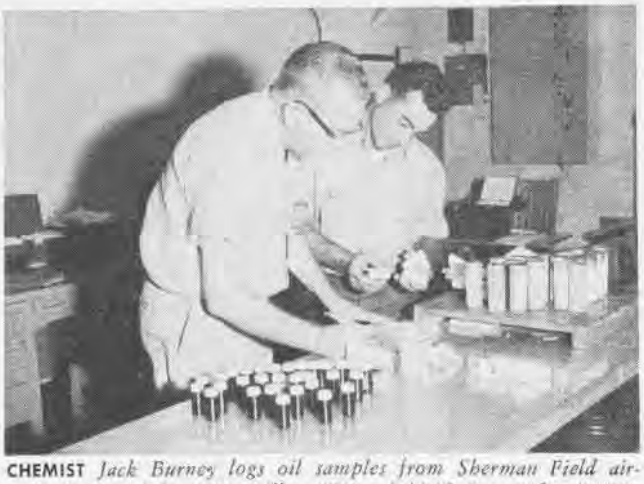
It was found that "the front impeller shaft bearing had failed completely; the impeller shaft journal was scored and discolored from heat; the mating surfaces of the impeller shaft nut and the front impeller shaft bearing were excessively scored and worn; the impeller vanes were worn, and the rear case was scored in the throat area."

It is very doubtful if that engine, with only 252 hours since overhaul, would have continued reliable operation for many more hours, and almost certain that it would have failed prior to completing its service tour. A short time later, an R-985 was pulled on the basis of oil analysis and was found to have a substantial internal defect.

With the encouragement of this early success, $44,000 was allocated for procurement of a direct reading spectrometer which would reduce analysis time from two hours to one minute, while substantially increasing accuracy

After the installation and calibration of the direct reading spectrometer, Phase I was terminated, and Phase II began on 18 September 1959. Phase one had been devoted to preliminary verification of the theory and to development of procedures. Phase II could be considered "pilot production." In Phase II—the current phase—the program was to be gradually expanded

DIRECT READING *spectrometer, in service less tha a year, now monitors 1164 engines, 77 copter transmissions. Oil is analyzed every 30 hours and when damage is suspected.*



CHEMIST *Jack Burney logs oil samples from Sherman Field aircraft delivered by S.M. Cillo, AD2, of NAS Pensacola ACMD.*

EARLY SPECTROGRAPH *above required two-hour lab period for each analysis. Later model reduced processing time to 60 seconds.*

until the capacity of the laboratory was reached. Not only aircraft engines, but also helicopter transmissions were to be monitored.

With the new equipment, accurate analysis is a relatively simple operation. The sample bottle is first shaken by hand and a portion of the oil poured into the cap. The cap is positioned in the spectrometer. A rotating wheel electrode is immersed in the sample. The oil on the wheel is burned by a spark emitted from a pencil electrode mounted just above the wheel's rim. As the sample burns (or is excited, as the scientists say) it emits light.

The exact wavelengths of the light emitted depend on the elements present in the sample. The light is separated into a spectrum by passing through a series of lenses and a grating. The light from the spectrum is "filtered" through slits which are so placed that they pass only the characteristic light for the elements of interest. The intensity of the light passing through the slits is proportional to the amount of the elements present in the sample. Behind each slit is a photomultiplier tube which amplifies the received signal and causes it to actuate the "read out" dial to indicate directly the amount of the element in ppm.

With the operation of the "direct reader", the progam expanded rapidly. By May of 1960, 913 engines and 47 helicopter transmissions were being monitored. The engines included 536 R-1820's and 206 R-3350's. Among those R-3350's were 12 from VA-196 at that time deployed to the Far East on the USS *Bon Homme Richard*. Well over 1000 engines and transmissions are now being monitored.

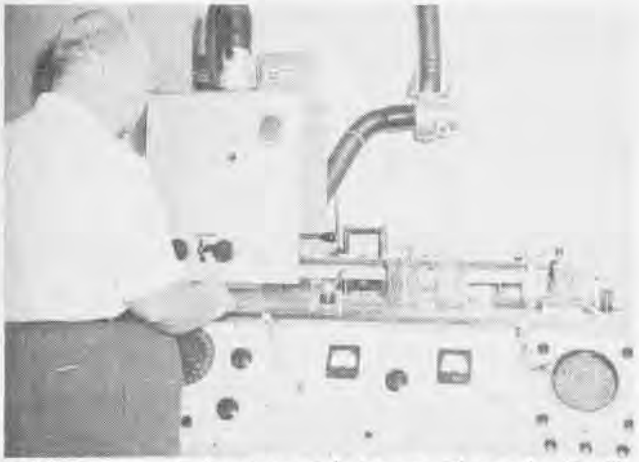
In the R&D phases of the program, it has been conclusively demonstrated that through analysis of the wear metals in used engine oil, important information on internal wear can be derived. However, we still have much to learn about translating the language of the wear metals. We know in general that abnormally high iron content indicates trouble in piston rings, gears, etc.; that high aluminum shows excess wear in pistons, intake valve guides, or bearing housings; that copper and tin denote bronze bushings or bearing wear; that silver—always serious in any significant concentration—shows master rod bearing trouble, and that chromium comes from cylinder walls. Each type engine has its own peculiar symptoms which can be accurately interpreted only after much experience with the type. At the present state of the art we can tell merely that *something* is wrong in an engine. In the future we should be able to tell *what* is wrong, to pinpoint the trouble so that, in many cases, it can be corrected in the field with squadron level maintenance.

The scientists' attempts to learn the language of the wear metals have caused some misunderstandings. Some operators have interpreted a message requesting removal of an engine for disassembly and inspection as a prediction of imminent in-flight failure. Actually all the scientists were saying was "There is something unusual going on in that engine. We need to know what it is." Thus, while the scientists considered minor internal damage as proving the validity of oil analysis, some operators tended to the opposite view. In spite of this minor misunderstanding, on the whole pilots and maintenance people of squadrons under the program endorse it enthusiastically.

Before it was proved, many "experts" believed that the program would never work because of the high oil consumption characteristic of reciprocating aircraft engines. Experience has shown that high oil consumption has actually simplified the interpretation of wear metal "symptoms." For with the oil being "used" rather than remaining in the engine, the wear metals tend to indicate current engine conditions. While the Navy has been able to detect several defective engines after only one sample—plus the check sample, of course—railroad maintenance people find they must study the entire history of a diesel before making a maintenance decision.

Now that the value of oil analysis has been conclusively demonstrated, the Navy is developing plans to extend the program to all its reciprocating aircraft engines and helicopter transmissions as rapidly as physical facilities will permit.

The squadron looking forward to inclusion in the program has a lot to gain, and very little to lose. On the plus side is safety. (Very few engines under the program have had an in-flight failure for any of the reasons which are susceptible to detection by oil analysis.) It is estimated that approximately 75% of the in-flight failures of reciprocating engines are preceeded by abnormal wear in the oil-wetted portions of the power plant.



CHEMIST *James C. Jennings analyzing an oil sample. Oscilloscope, lower right, is used to monitor excitation conditions.*

CAP OF OIL *is placed in the "direct reader." Viewing window, right, permits precise operator control during critical test.*

When a squadron is brought into the program, its personnel are given a four-hour indoctrination course consisting of a training film and a lecture illustrated by slides. The indoctrination is essential because of the critical importance of obtaining standard samples. General Reciprocating Engine Bulletin No. 199 sets forth complete instructions for taking the samples and forwarding them to the laboratory.

Because of the possibility of inaccurate data or an exchange of samples, standard procedure includes a check sample to verify the findings of the first suspect sample before recommending removal of the engine. Of course, if the first sample indicated a critical concentration, the aircraft would normally be grounded until the results of the second sample were determined. Probably the greatest source of inaccuracy is failure to take the sample until after make-up oil has been added.

Samples are taken routinely after every 30 flight hours, and non-routinely whenever there is reason to suspect engine damage, such as following an engine overspeed, or the discovery of metal particles in the oil screens.

If the results of the sample show the engine to be in imminent danger of failure, the squadron will be notified immediately by phone or message.

In order to support the planned expansion of the program, five new spectrometers of advanced design are to be ordered. Specifications call for machines that will automatically produce a typed and punched card covering each analysis. In addition, a slave electric typwriter will print out results on a laboratory record sheet with all results shown in ppm. Phased delivery is expected beginning in December of this year with the last of five delivered before June of 1961. They are to be placed at Pensacola, North Island, Norfolk, Alameda, and Quonset Point.

In addition to the production phase of the program, research and development will continue on other potential applications of oil analysis.

Results with jet engines have so far been inconclusive. Oil analysis can only detect trouble in the oil-wetted portions of the engine. While in the reciprocating engine most of the components likely to cause in-flight failure are oil-wetted, it is not so in the turbine engine. Another problem is that some turbine engines do not have a wet sump, but vent oil from the main bearings overboard. A successful system for trapping samples of this oil is yet to be developed. An attempt will be made to monitor conditions in the compressor and combustion chamber of turbine engines through analysis of exhaust residue trapped by some, as yet undeveloped, means.

Other potential applications to be investigated include the detection of incipient trouble in turbo-prop gear boxes, constant speed drives such as Sundstrand units and cabin superchargers.

As the Navy gains increased experience with this new tool, we will gradually learn to exploit it to its full potential. The railroads have already demonstrated the improved availability and reduced maintenance costs possible through oil analysis. They have abandoned overhauls based on mileage in favor of a maintenance program based completely on oil analysis. Overhauls and heavy maintenance are conducted only when oil analysis shows them to be needed. The New York Central System alone has been able to close several engine overhaul shops at a savings of millions of dollars annually.

Through oil analysis we can give the "stitch in time that saves nine." Failed parts can be replaced before secondary damage results. The dollars and cents logic of timely repair is illustrated by some railroad cost figures. If a diesel connecting rod bearing is changed before the onset of secondary damage, the cost is $600, but if the crankshaft is scored, the cost jumps to $7000.

At the present time our progam for precautionary engine overhaul—that is for overhaul of engines which have not actually failed—is based on "probability," on a "calculated risk" if you prefer. Engines are sent to overhaul for such reasons as high time, overspeed, metal in the oil strainers or sump, etc. In each of these cases, they are overhauled because of a "probability" of future failure, not because of a "known condition." Upon dissassembly, many of these engines are found to be sound.

Oil analysis gives us a tool through which we can "know" the actual conditions inside the engines. We will no longer have to rely on "probability."

With the help of oil analysis used in conjunction with other tests, such as power output and oil consumption, we can approach the ideal: *No unsound engine scheduled for flight; no sound engine scheduled for overhaul.*

Weekend Warrior NEWS

HS-722 OPERATIONS *are explained by C.O. Cdr. R. W. Henson (L) to "boss" Sam Catalano (R) and D. R. Johnson during "Bossman."*

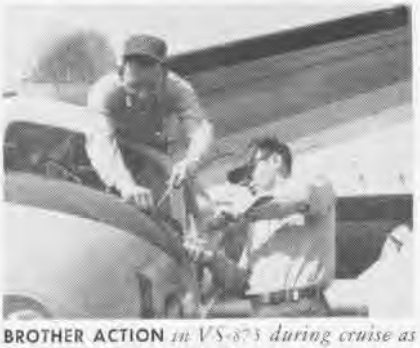
LAKEHURST *photog. Dick Hadsall (R), flipped camera (to friend) for this shot with ex-Constellation sailor, 80-year-old S. C. Mandell.*

NAS Los Alamitos

A good boss keeps a check on his employees and this particular ground rule caused some 50 employers of personnel assigned to HS-722 to come aboard Los Al recently to observe a weekend operation.

In a special project labelled Operation *Bossman*, the squadron was spotlighted for the day. Employers of the officers and men enjoyed a tour of the station, a look at the helicopter's role in antisubmarine warfare, and a flight in a whirlybird.

Typical of the make-up of reserve squadrons, HS-722 is commanded by Convair aeronautical engineer, Cdr. R. W. Henson of La Jolla. In addition to other representatives of the aircraft industry, the squadron is manned by a plumber, a retired police officer, a chemist, a house painter and a sprinkling of civilian educators.



BROTHER ACTION *in VS-875 during cruise as George (L) and Billy Sansome fix an S2F.*

NAS Oakland

Two annual training duty cruises pointed up the intensive effort which has been underway at Oakland by VS squadrons to achieve peak combat readiness.

Operating from NAS NORTH ISLAND, VS-875, skippered by LCdr. Glenn Hongola, logged a healthy total of 812 hours while participating in Fleet ASW exercises off the coast of San Diego.

Squadron pilots qualified in instruments as well as in the use of rockets and bombs while enlisted personnel checked out in sonar, radar, ECM and MAD. Others qualified as aircrewmen and plane captains in the S2F to round out a most successful cruise period.

Meanwhile, back at home base, VS-871 commanded by Cdr. Art Dunlap set its sights on the difficult task of shaping an operationally proficient unit from pilots and men with varied backgrounds.

Composed of personnel drawn from VF, VS, VP and VA Fleet and Reserve squadrons, VS-871 was commissioned last October. In its first training duty stint, emphasis was placed on pilot checkouts, ASW training, instruments and survival procedures for all flight crew personnel.

NAS Seattle

Seeking out highly qualified candidates for Navy flight training is a speciality of the Reserve Training Command. To one of its procurement teams at NAS SEATTLE has fallen the mantle of being the longest-ranging NAVCAD/AOC hunters in the U.S., including Alaska.

Originally, Seattle's area was the three state region of Washington, Or-

VETERAN *Naviator processor, Bert Monette, YN1, of Seattle "relaxes" after jaunt.*

egon and Idaho. When NAS DENVER closed, Seattle fell heir to Montana and later acquired Alaska when it became the 49th state. Its Naviator Information Teams now visit some 52 colleges and universities in the five states covering a total area of almost a million square miles.

Teams usually consist of one officer and one enlisted man. Trips may require only a single-day visit to a school nearby or a two-week jaunt which includes several schools and as much as 4000 miles of traveling.

NAS SEATTLE's Cdr. S. K. Smith and Chief Yeoman J. L. McHugh made the first trip to the University of Alaska on 1 May 1960. Fairbanks, site of the university, is 2432 road miles from Seattle and more than 700 of these are over gravel roads. With dog sleds hard to come by, the team traveled a 1600 mile air route in an R5D piloted by Cdr. Smith and netted 16 qualified applicants during a three day stay.

NAS Grosse Ile

A landmark familiar to three generations of Naval Aviators has been torn down at NAS GROSSE ILE.

The checker board balloon hangar that Naval Aviators, yachtmen and Lake Erie duck hunters have used for a landmark since 1927 is being demolished as a "hazard to air navigation."

Originally built by the Metalclad Airship Corporation, the hangar has been used mainly for storage since the early 1930's.

Naval pilots will be greatly relieved that the hangar, located within a few feet of the intersection of two runways, has been completely removed.

NAS Minneapolis

Fifty thousand sightseers crowded aboard the Twin Cities Naval Air Station during a recent Open House to view a display of Fleet aircraft, Reserve Training, a plastic tower and two Misses—America and Minnesota.

Miss America, Lynda Lee Mead, who was in Minneapolis for the crowning of Miss Minnesota, Jean Marie Elverum, toured the facility and accepted an invitation to participate in ceremonies connected with the observance.

Other attractions included static display of a *Crusader* and a *Skyray*, and the erection of a unique 95-foot plastic tower. Held up by a column of air pumped into it by a small base unit, the tower has a number of uses among which is the raising of antennae under emergency conditions.

NAS New York

Floyd Bennett Naval Air Reservists took part in a small scale NATO antisubmarine exercise named "Short Stop I" which was held jointly by U.S. and Canadian Naval and Maritime Air Forces in the Western Atlantic Ocean.

The exercise was scheduled by Adm. Robert Dennison, USN, Supreme Allied Commander and Commander-in-Chief, Western Atlantic area. It was conducted by VAdm. E. B. Taylor, USN, Commander North American Antisubmarine Defense Force, Atlantic.

"Short Stop I" provided NAS NEW YORK Squadrons, VP-831, VP-836 and composite teams from VS squadrons here, with antisubmarine training in the defense of the North American continent against attack from the sea and included emphasis upon defense against guided missile attack by enemy submarines. Other objectives of the exercise were to test and develop tactics, doctrines and procedures for coordinated NATO antisubmarine warfare operations.

A total of 28 ships and six aircraft squadrons took part in the "Short Stop I." Among the ships were the aircraft carrier USS *Valley Forge* and HMCS *Bon-Aventure*. Floyd Bennett units operated from Brunswick, Me., and South Weymouth, Massachusetts.

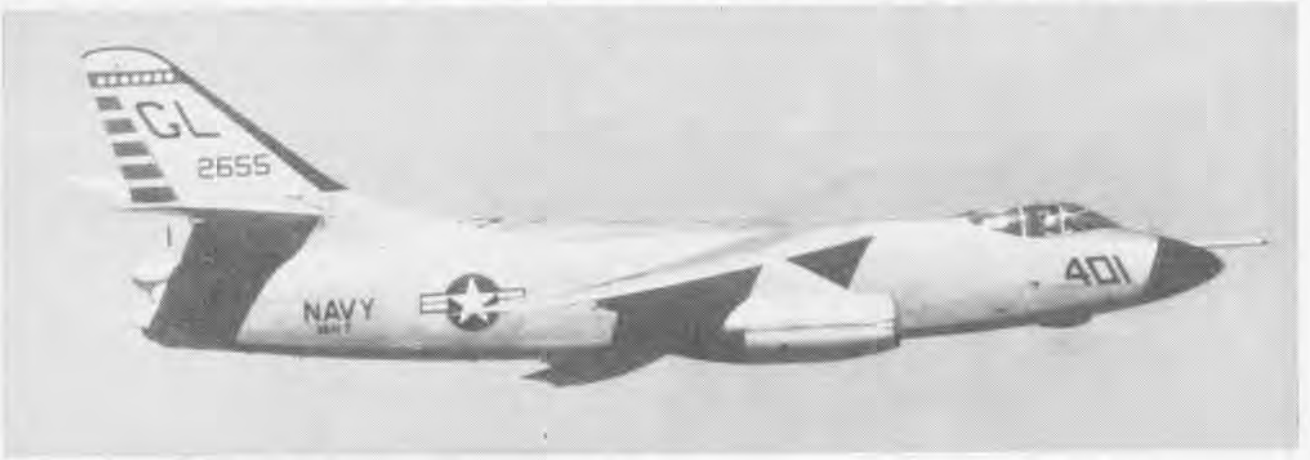
MISS TIGER, *an F11F built of salvaged parts, is NARTU Norfolk's latest mobile display. It features cutaway fuselage, moving parts.*

VERTICAL LIFT *extremes are posed at NAS South Weymouth. Both blimp and helo are used by Navy and Marine Weekend Warriors.*

A FAMOUS *Grosse Ile landmark, dodged by generations of Naval pilots, is demolished.*

MISS AMERICA, *Lynda Lee Mead, visits NAS Minneapolis; adds great appeal to the F4D.*

VAH—7: LOW-LEVEL GO-DEVILS



BLUE-TAILED BIRD OF VAH-7, AN A3D-2 SKYWARRIOR, THUNDERS THROUGH FLORIDA SKY ON SANDBLOWER MISSION FROM SANFORD

By Ens. Paul S. Goldman

A COW WAS peacefully grazing by a stand of slash-pines, a woodpecker was busily knocking out CW nearby, and a rabbit scurried for cover under the surveillance of a hawk wheeling above. Commencing a max "G" descending turn, the anxious hunter came face-to-face with an apparition—the treetops rustled, and a great, glass-beaked bird of prey rushed towards him. Evasive tactics were employed, and the pale-faced hawk cowered among the pine needles. The woodpecker resumed his tattoo, and the rabbit gratefully bade farewell as 70,000 pounds of A3D-2 thundered away.

The Go-Devils of Heavy Attack Squadron Seven, HATWing One, pressed on to complete their "sandblower" flight.

Rabbits, hawks, and woodpeckers are getting used to Heavy Seven's blue-tailed birds, while pilots with 2500 hours of single-seat flying are getting accustomed to being told what heading to fly, and when to take a fuel check. Cdr. Kenneth F. Rowell's Go-Devils, after more than a year of evaluating the low-level concept for A3D's, are practicing what they preach.

The nucleus of today's Navy is, of course, the carrier. What gives the Atlantic Fleet a good measure of its awesome offensive capability is the all-weather A3D *Skywarrior*, stabled at NAS SANFORD, Florida, when not poised for action on the flight deck.

EXTRA LONG FLIGHT REQUIRES REFUELING

The men who drive, direct, and data-keep the Navy's Sunday punch, as well as those who keep them flying, are exemplified by the members of Go-Devil Seven. Unity of purpose and smooth coordination make this squadron one of the best in the Heavy Attack program. The spirit of teamwork is not only the hallmark of the flight crews, but is evident as well in those who maintain operational aircraft availability—the ground crews.

Seat number one is occupied by a man whose background might include tours with VF, VA, or VS squadrons, and a great deal of experience in getting aboard ship in any, or most, of these aircraft. On the other hand, he might have served a stint in the second seat, that of the bombardier/navigator, upon completion of flight training.

Versatility is the keynote in seat number two, that of the "right hand" man. The bombardier/navigator must be able to coordinate the entire crew's efforts at delivering the right weapon to the right place at the right time. In order to do this, he must be well-versed in navigation, whether celestial, radar, or pilotage techniques are to be used. A combination of all three is often employed. He must be a technician in that he knows his radar intimately. First, he must have a canny knack of interpreting what he sees in the scope. Secondly, he must utilize the gear to its greatest capacity, while paradoxically being discreet in its use. He must be able to correct or compensate for any malfunctions which may occur enroute. Finally, this harried individual must handle the radios, the inflight refueling apparatus, and the pilot's high and low-altitude enroute charts, let-down plates, and other impedimenta necessary for flight. The man in the right seat is the Go-Devil of the crew.

Bombardier/navigators come from as many and more various parts of the fleet than do the pilots. Rank or rate is no limitation in being selected for

this heart-of-the-crew position. VAH-7 sports a greater range of B/N types than does any other squadron. The two men at the top of the competitive HATWing tree, for example, are an AD2 and a senior lieutenant. Brash young ensigns, salty and some not-so-salty whitehats, as well as wise LDO's, fill the ranks. There is a great deal of room for personnel desiring this billet, particularly in Heavy Seven, owing to the recent retirement of men who have capped their careers with this tour of duty.

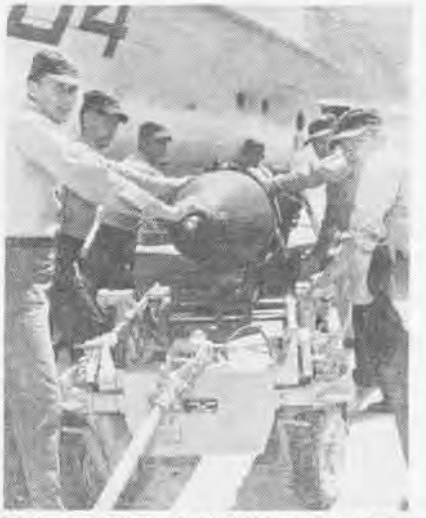
A. G. DUCKETT, AN, KEEPS TAB ON SPARES

The third man on the scene, the gunner/third crewman, monitors the flight as a sort of airborne maintenance man. It is his essential knowledge of the bird that permits the pilot to collaborate closely with the bombardier/navigator. While the pilot is so engaged, number three monitors the *Skywarrior's* complex systems. He is not sitting on his hands, however, as he must aid the B/N with the navigation problem and the bombing run. He must be proficient in star identification and the use of the bubble sextant. He must anticipate what information the B/N needs and produce it when desired, whether it is navigational or bombing data. Further, he is occasionally required to enter the bomb bay while in flight to perform certain procedures. Even in these days of sophisticated electrical and hydraulic systems,

J.M. SHIRK, PR3, SERVICES OXYGEN GEAR

A3D'S HYDRAULIC SYSTEM GETS WORKOVER

ENGINE CANS ARE REMOVED DURING CHECK



BOMB LOADING IS PRACTICED REGULARLY

GO-DEVIL NUMBER FOUR IS REFUELED AT NAS SANFORD PRIOR TO SANDBLOWER MISSION

THREE-MAN CREW IS READY FOR MISSION

SQUADRON FLIGHT CREWS AND MAINTENANCE MEN HELP TO KEEP VAH-7 ONE OF THE SHARPEST OUTFITS IN HEAVY ATTACK WING ONE

$2.5 million worth of aircraft may require the services of man and crowbar.

The presence of the third crewman has given rise to a paraphrase of an old saying: "Two's company, three's a crew!" Every rate imaginable is included in the Go-Devil third crewman fraternity. AM's, AT's, AK's and AD's have all been found suitable for this spot, as well as many others. The need for third crewman is as great as that for bombardier/navigators.

In order to reach the spot from which to drop large, heavy objects on the opposition, a "fourth man" is required, a "man" of many parts—the ground crew. The aircraft cannot get off the deck without the support of Air Frames and Power Plants. Once airborne it relies on Ordnance and Avionics to successfully complete the mission. Parachute riggers supply the extra measure of mental well-being with both equipment and survival advice. "Rowell's Raiders" have the finest ground support available.

A typical mission will serve to illustrate the blending of all the talent the squadron requires and gets. The mission is outlined as follows: Seek out a submarine pen in X-ray harbor and destroy it. The route to be followed is that which affords the enemy minimum opportunity for detection and interception. The flight gets a scheduled time from Operations, and an aircraft is readied by Maintenance. While the flight crew is seeking the ideal combination of altitude, route, fuel consumption, and navigation details, Air Intelligence prepares a thorough briefing for the crew.

The ground crew swings into action as soon as the aircraft is assigned; the plane captain gives the bird its initial preflight check, working with Air Frames and Power Plants. Avionics preflights the electronics, and the parachute riggers ascertain that the survival equipment and drag chute are ready to go. Ordnance goes to work in the bomb bay, loading the weapon.

Their careful planning completed, the pilot and his crew go out to the aircraft just prior to launch to give it the final preflight, and the bomber is ready to go. The ground crew supplies power and the pilot goes through the checklist with the third crewman while the B/N checks his gear. The engines are started, external power is removed, and a blue-tailed Go-Devil taxies out to the runway. Full power is applied as the *Skywarrior* is aligned with the duty, and the B/N sings out as speed is picked up:

"One Thousand!"

"Two Thousand!"

"Three Thousand!"

The bomber unsticks . . . .

"Four up!"

"Flaps up!"

The upper hatch is secured, and the scream of the engines is subdued. Once the point of departure is reached, the bombardier/navigator monitors the mission's progress and keeps the pilot informed.

"Come left to 260°—next checkpoint bears 275°, 42 miles."

"See that red barn next to the water tower? At the mark come right to 300°—mark! Next checkpoint bears 280°, 61 miles."

"Three, how are we doing on our time?"

"Seven seconds behind on last checkpoint."

"Let's pour on some more coal."

The target is identified, the B/N locks on it while the third crewman scans the computer to see that it has the correct inputs. The pilot has his eyes glued to his instruments—"ready, ready, ready, PULL UP!" The *Skywarrior* completes its loft maneuver on instruments under the guidance of the pilot, and the escape route home commences.

"At the mark, come right to 115°—mark! Next checkpoint bears 100°, 38 miles."

A cow was peacefully grazing by a stand of slash-pines, a woodpecker was knocking out CW, a rabbit scurried....

DOUBLE-QUICK PLANE HANDLING

MEMBERS OF VP-56 BEACH CREW FOLLOW 'MARLIN' INTO WATER

BEACHING GEAR DETACHED AS PILOTS PREPARE TO CAST OFF BUOY

OFF THE BUOY, THE BIG MARTIN 'MARLIN' ADDS POWER TO JOIN OTHER SQUADRON AIRCRAFT IN THEIR PRE-TAKE-OFF CHECKS

EARLY ONE morning at NAS NORFOLK, the VP-56 beach crew launched nine of the squadron's P5M Martin *Marlins* in 38 minutes. At 0650, the crew launched the first *Marlin*, and by 0728, the ninth one had gone off the ramp and cast off the buoy—or 4.2 minutes per aircraft.

Eight of the nine planes remained on the water until all were ready to take off. The first plane launched by the beach crew took off immediately as an observation plane. The remaining eight took off on an operation that required radio silence at an interval of 1.37 minutes for a total elapsed time of about 11 minutes. Consequently not a word was spoken over the radio from the eight planes until the mission had been accomplished and the planes returned to Norfolk some five hours later.

Upon returning to Norfolk, the nine seaplanes landed minutes apart and started taxi-ing toward the VP-56 buoy where the beach crew was ready to retrieve them from the water. From the time the first plane was on the buoy to the time the ninth was "high and dry," only 1 hour, 24 minutes had elapsed for an over-all beaching time of 9.3 minutes each. The average time for on-the-buoy to high-and-dry was 5.5 minutes each.

Occasion for the record was the Operational Readiness Inspection.

VP-56 an ASW force, is commanded by Cdr. B. S. Larking. It has operated with Task Group Bravo since 1958.

RETIRED ADMIRAL *Jerry Bogan (R), famed task group commander in WWII, visits two friends aboard USS Oriskany off California: Capt. William S. Guest (L), carrier C.O. and RAdm. J. C. Clifton, ComCarDiv-7.*

Zorn Scores a New Success

Selected Student of Week by VT-2

Ltjg. Nicholas D. Zorn, product of the Navy's Seaman-to-Admiral program, has been cited as student of the week in Training Squadron Two on the basis of academic and flight grades. He is in the instruments phase of flight training at Whiting.

Enlisting in 1951, Mr. Zorn had advanced to first class petty officer by 1958, when he applied for a commission. He entered OCS, graduated, served a year aboard USS *Davis*, then received his orders to flight training.

Dr. McLean Honored Again

Given Blandy Gold Medal Award

Dr. William P. McLean, Technical Director of the Naval Ordnance Test Station, China Lake, California, has been honored with the Admiral Blandy Gold Medal Award by the American Ordnance Association. RAdm. P. D. Stroop, Chief of BuWeps and Gen. E. P. Mechling, USAF (Ret.), representing the AOA made the presentation for Dr. McLean's contribution to naval defense.

Citation of the award read: "Distinguished physicist and leader in naval weapons dvelopment, Dr. McLean . . . was in the forefront of nuclear experimentation during his assignment in the National Bureau of Standards, and at the Naval Ordnance Test Station he applied his talents to avionic developments of far-reaching importance. . . . His able leadership and insistence on a minimum of complexity is represented typically in the Navy's rugged and easy-to-produce *Sidewinder* air-to-air missile. For his part in directing this achievement, Dr. McLean has received the acclaim of a grateful Nation."

Special awards given Dr. McLean include a federal government award of $25,000 for the development of *Sidewinder* (1956), commendation by California State Legislature (1957), and Distinguished Federal Civilian Service Award made by President Dwight D. Eisenhower only last year.

THESE OFFICERS, *part of the first class of 47 who entered the "Five Term" program July 1958, are the first to complete the Naval Science course at the Naval Postgraduate School, Monterey, Calif. Remaining members of the class completed their work in late July. Each graduate was awarded a Bachelor of Science degree as well as a Certificate of Completion for the General Line Course. "Undergraduates at Monterey," in a forthcoming issue will give information concerning programs at the General Line and Naval Science School.*

LCDR. E. H. GUNTHER, XO, HOLDS BIG RED

VA-22 Gets New Rooster

Mascot 'Big Red' is Cock of Walk

A fighting cock, known as "Big Red," is mascot of Alameda-based Attack Squadron 22. Big Red has been with the squadron for two months now and lives luxuriously in his newly constructed abode on the shady side of squadron headquarters.

Oblivious of the fate which befell his predecessor, Red is allowed to strut out of his coop during the day and very strictly rules the part of the lawn limited to him by a short leash.

The first Big Red's life ended rather abruptly one morning some months ago when (it is supposed) he crowed a bit too loudly into the unappreciative ears of a pair of sailors from a nearby rival squadron. The culprits "what done the deed" were never apprehended and, for all VA-22 personnel know, may still be lurking nearby hoping for a chance to use Red as the chicken part of their chicken and noodles. Thus Big Red must be guarded closely and loyally against all connoisseurs of chicken flesh and from rival squadrons.

The new Big Red is two years old and hails from Bakersfield where he was hatched on the ranch of Mr. G. McNatt. Mr. McNatt is the father of Aviation Structural Mechanic G. P. McNatt of VA-22. McNatt, protector and trainer of Big Red, a short time after the mysterious death of the first Big Red was commissioned by the squadron to procure Big Red No. 2.

Big Red No. 2 will be a bit harder to deal with if the culprits should get to him—"he sleeps with his spurs on."

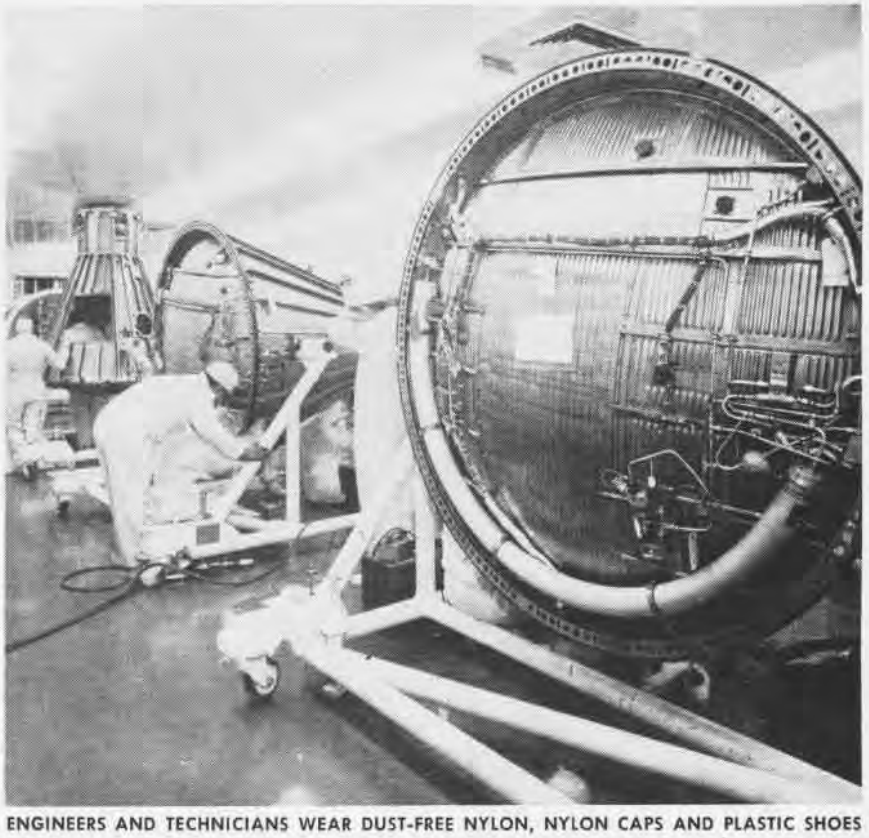
CAPSULE BOTTOM WITHOUT PRESSURE LID

IN 'SUPER-CLEAN' WHITE ROOMS
MERCURY CAPSULES BUILT

THE PROJECT Mercury space capsules, in which the first American astronauts will go into orbital flight are being assembled in McDonnell Aircraft's "super-clean white rooms" to insure reliability of the environmental and reaction control systems.

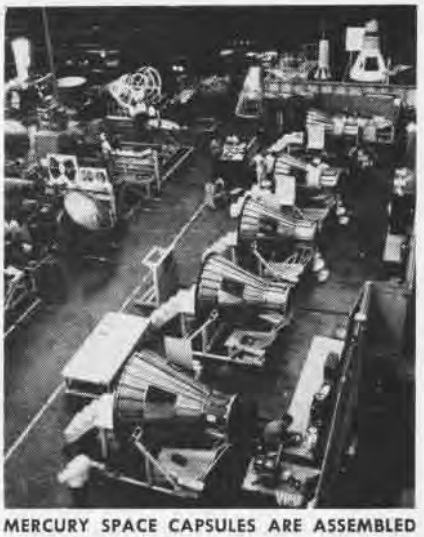
An air-conditioning filtration system removes dust particles down to .3 of a micron in size from the air entering the rooms. The "clean rooms" are equipped with a vacuum system for immediate removal of room-generated particles and compressed air in the air distribution lines is filtered to the same rigid standards. Even what engineers and technicians wear has been selected with a view to keeping the air free of contaminating particles.

McDonnell Aircraft Corporation is a prime contractor for the National Aeronautics and Space Administration.



ENGINEERS AND TECHNICIANS WEAR DUST-FREE NYLON, NYLON CAPS AND PLASTIC SHOES

AT THESE BENCHES, SMALL COMPONENTS ARE WIRED PRIOR TO ASSEMBLY IN CAPSULES



MERCURY SPACE CAPSULES ARE ASSEMBLED

Claims to be Youngest P.O.

Makes First Class at Twenty Years

NAS SAN DIEGO claims to have aboard the youngest first class petty officer in the Navy. He is Billy D. Southerland, 20, who advanced to AT1 May 16.

Billy made his first attempt to join the Navy in Tampa, Fla., at the age of 15. The recruiter asked for further proof of age which was supplied by Billy who filled in a blank page of the family Bible with an acceptable birth date.

Southerland attained each rate in a minimum time after becoming a third class petty officer at the age of 16. While in Aviation Machinist "A" School, he notified BUPERS of his correct age and requested to be allowed to remain on active duty. This was granted on the ground of his good record, high motivation and the fact he had notified BUPERS voluntarily.

STRIKING POWER *of the F8U-2N has been doubled to four Sidewinders through the use of this recently developed, and relatively inexpensive, Y-shaped pylon. The new pylon is interchangeable with the single mount.*

Heroic Action Recognized

Airman's Fire-Fighting Commended

Heroic action of young Airman David L. Shoemaker during a disastrous Sasebo, Japan, fire has been officially recognized and commended. He is credited with helping to save the lives of several Japanese citizens during the fire last January.

Airman Shoemaker on liberty from the USS *Bon Homme Richard* on 16 January 1960, came upon the scene of the fire soon after it started in a business establishment in downtown Sasebo.

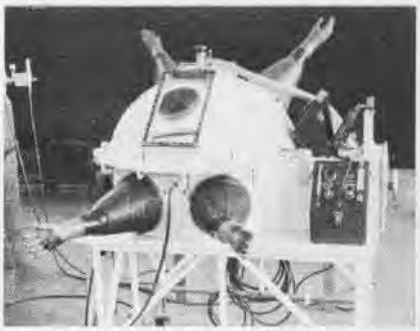
He immediately began to help in evacuating people from the area of the rapidly spreading fire. He personally removed four persons from flaming buildings and manned a fire hose alongside Japanese firemen.

After fighting the fire for three hours, he finally succumbed to smoke and gases. He spent the next day and a half recovering in an oxygen tent.

The commendation was presented to Shoemaker on behalf of the Navy by Cdr. B. E. Michael, C.O. of FASRon-117, to which Shoemaker is attached.

VADM. THISTLETON-SMITH, *head of the British Joint Services Mission, Washington, D. C. is escorted by RAdm. B. E. Moore (R) and Capt. W. H. Munson, VX-6 skipper (c), through facilities at Quonset Point.*

• Since her recommissioning in 1951, the USS *Wasp* has completed one round-the-world cruise, two Far Eastern cruises, three Med trips besides visits to nearby ports, such as Quebec and Bermuda in this hemisphere.



NOT REALLY *an octopus, this device is an argon-titanium welding chamber adapted as a dry-air chamber for assembly of multiple panes of optic glass for astronauts' viewing window in Mercury space capsule.*

VT-4 Teaches Jet Gunnery

Students Rake Banner at 300 Kts.

Training Squadron Four has initiated jet gunnery training in the Basic Training Command. Three VT-4 students, 1st. Lt. D. H. Yon, NavCad C. H. Hubbard, and NavCad K. R. Corrin, flying T2J *Buckeye* trainers, were the first students to receive air-to-air gunnery training in jet aircraft.

VT-4's goal is to teach students to shoot in the same pattern as fleet pilots flying supersonic aircraft. Students fire at a 6x30 foot banner towed by another T2J over the Gulf of Mexico.

They must control the relative motion between their aircraft and the gunnery banner while flying at 300-knot speeds. Flying at 15,000 feet, and making a diving flight path toward the gunnery banner, students learn to fly within 1000 feet of their target before firing at it.

The T2J mounts two 50-caliber guns.

ONE OF FOUR *C-130BL Hercules cargo aircraft is readied at Lockheed's Marietta plant for duty with VX-6 in the Antarctic. Ski-equipped behemoths can deliver 25,000 pounds of cargo to geographic South Pole in one flight from air base at McMurdo Sound. In earlier Deep Freeze operations cargo was air-dropped from C-124 Globemasters. Last year extensive tests of the C-130D proved that heavy loads could be landed at Pole and Byrd Stations.*

LOCKHEED PLANES *in unusual Navy service include C-130A shown in refueling tests above, and F-104 Starfighter below, which Navy is using to conduct high altitude and high speed Sidewinder tests at NOTS China Lake. The C-130A which was used to refuel Navy F3H Demon and F11F Tiger above was forerunner to current Marine Corps GV-1 which extends paradrogues on hose from pods under both wings to refuel jets at rate of 300 gals. per min.*

VP-47 Moves to Whidbey

Chased from Home by Driftwood

Patrol Squadron 47, based at Alameda since 1951, has been transferred to Whidbey Island, Washington. Cause of the transfer was excessive and uncontrollable driftwood and debris in the Alameda seadrome.

RAdm. Murr E. Arnold, ComFair Alameda, said debris hazards to the flying boats had increased to such proportions that daytime training and operational flights had to be reduced and night flights eliminated. He said night training is vital and must be accomplished. To do this, the squadron had to fly to San Diego at considerable cost.

"In addition to seriously curtailing our training program," he said "the clutter in the bay prevented full use of VP-47 aircraft in local ASW training patrols. This limited the seadrome to the role of staging area for flights to WestPac."

In one week, he said, six aircraft were forced to circle the area for periods of 30 to 90 minutes while they waited for the seadrome to be cleared.

The Alameda seadrome consists of two sealanes approximately 10,000 feet long and 500 feet wide. When the tide shifts, the area often is filled with debris in minutes. Most logs and timbers that drift into the area could rip the bottom out of the P5M *Marlins* at landing speed.

Aerojet Gets Navy Contract

'Hybrid Rocket' Research Pushed

Aerojet-General Corporation has a Navy contract for $580,000 to explore a revolutionary approach to rocket power plants, namely a "hybrid" rocket.

A hybrid rocket is one designed to combine the best features of present liquid and solid-propellant rocket power plants. Aerojet will be attempting to make advances on work already accomplished on hybrid propulsion systems by the U.S. Navy.

A successful hybrid propulsion system would offer advantages of significantly greater ranges for conventional weapons, provide the start-stop and variable thrust capability needed for space missions and give propulsion scientists much greater latitude in selecting the best possible fuels and oxidizers for optimum propulsion systems.

The contract represents the first large scale attempt by a government agency to combine the high performance capabilities of liquid propellants with the simplicity and compactness of solid fuels. Essentially the hybrid rocket would employ a liquid oxidizer which would be sprayed into a core of solid fuel.

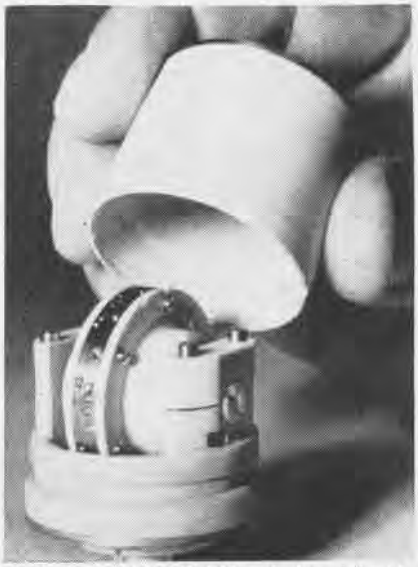
SecNav Citation is Given

Chief Preston Praised for Valor

At a personnel inspection aboard the USS *Franklin D. Roosevelt* (CVA-42), Robert E. Preston, Chief Aviation Boatswain's Mate, was awarded a Letter of Commendation and the Commendation Ribbon with Metal Pendant for his skill and resourcefulness as Leading Chief Petty Officer of the Aviation Feuls Systems. His service to the air group was noted.

His excellent maintenance record of the fuel systems on the carrier and his courage and initiative in entering a compartment flooded with aviation gasoline to avert a major disaster were cited.

On 26 September 1958, Chief Preston entered a compartment which was flooded with 1800 gallons of high octane aviation gasoline to a depth of three feet, and secured the leak in a gas line. With explosive meter readings indicating 100%, he blanketed the gasoline with foam, then cleared the gasoline and foam from the compartment. Despite painful burns from contact with the gasoline, he washed the compartment, educted the water and remained until all danger of fire and explosion had surely passed.



TINY GAS-BEARING GYRO, *designed by the Minneapolis-Honeywell Co. for space guidance systems is clearly dwarfed by the human hand. Gas bearings application was made possible by use of precision ceramics.*

LETTERS

SIRS:

You might check the caption under the F8U-1P on page 19 of the June issue. That bird is going off the angle with tail hook down. Looks like a good old bolter to me, Dad, or do these Marines all bolter before "hurtling skyward on a reconnaissance mission?"

W. J. SCOTT, CDR.

SIRS:

A letter in your June issue written by Chief Mayo took exception to a statement made in an earlier NANEWS article concerning ramping of seaplanes at Kwajalein. Perhaps you will permit me to add my "two cents."

It has been my privilege to serve a tour at Kwajalein (1955-1956) and also to have spent some ramp and bouy time there as a P5M pilot. To the best of my knowledge, large seaplanes were ramped via the old Japanese ramp at Ebeye island, just north of Kwajalein. Personnel and parts were ferried back and forth between the two islands.

The absence of ramping facilities at Kwajalein island itself was always a source of annoyance to both island personnel and the pilots of seaplanes needing repair. I had to make the ramp at Ebeye in 1956 and again in 1957 while serving with VP-47. In both instances the stay was one week with work performed by my plane crew, including a prop change. I was through Kwaj in late 1958 and do not recall that ramping facilities were available on Kwaj itself.

I most certainly could be in error, but I rather believe that the facts contained in NANEWS article were correct.

J. W. BRADFORD, JR., LCDR

NAMC PHILADELPHIA

CDR. 'PETE' TORRY, *OinC of Naval Air Mine Defense Development Unit, writes about the helicopter as minesweeper, pp. 20-24. A copter pilot since 1948, he has pioneered using whirlybird as mine countermeasure.*

SIRS:

At the top, inside back cover of the May 1960 issue, it is stated under the picture of the USS *Independence* that the *Crusaders* parked on the port bow are those of VF-84.

These planes do not belong to the famed *Jolly Rogers*. They are F8U-1's belonging to the world famous *Red Rippers* (VF-11) who were at the time filling in for VF-84 during the "Big I's" shakedown cruise, at which time this photograph was taken.

Distinguishing marks are the radome and the "Primus Principes" emblem beneath the "AG" on the tail.

At the present time the "Rippers" commanded by Cdr. M. M. Prichard are aboard the *Franklin D. Roosevelt* deployed in the Med. We are flying as high as 59 hours per day during the daylight hours with some of the oldest *Crusaders* in the fleet.

THE RIPPERS

¶ Who can argue with the Rippers? We put our best glass on the cut in point—couldn't see identifying emblem—but we'll take your word for it.

RATTC Unit Logs 130,000

Unit OinC Makes Record Landing

Radar Air Traffic Control Center Unit 16 at NAS CORPUS CHRISTI completed its 130,000th ground control approach in June when an R5D transport flown by Cdr. Richard Shafer was landed safely.

The R5D pilot was officer in charge of the RATTC unit. Co-pilot was LCdr. James R. Van Landingham.

Radar controller for the approach was James M. Jackson, AC1, who has completed more than 6000 runs during his nine years as a controller. He reported to Corpus in 1955 after air control duties on board USS *Kearsarge*.

The Corpus Christi unit was started in 1948 when it was commissioned GCA-16. It was redesignated RATTC-16 in 1957 with its duties expanded.

TOW TARGET 'AERO' LINGO

FOR THOSE who belong to the 99.98% group of Navy and Marine Corps aviation personnel who wonder "What is that?" when confronted with an Aero number, here is a handy glossary to explain away part of the mystery of an apparently illogical numbering system. (BUWEPS people say the Aero system is "convenient.")

Aero-26C—Banner Target: Designed for air-to-air gunnery; 6'x30' radar reflective with a 5" spinner.

Aero-33A—Dart Target: Designed for air-to-air gunnery; 4'x12' plywood dart target with metal trihedral reflector. A "snatch-drag" bit of kindling with no expenditure restriction.

Aero-35—Banner Target: Designed for high altitude (above 30,000') air-to-air gunnery; 7½'x40' high visibility, radar reflective.

Aero-36—Tow Target: Designed for 2.75 HVAR rocketry and air-to-air gunnery; 28" x94" styrofoam rotating 17-pound shape; can be used with Aero-37 and Aero-43 reels; monostatic reflectivity.

Aero-36A—Tow Target: Designed for CW semi-active homing missiles; 28"x94" styrofoam rotating 19-pound shape for use with the Aero-43 reel; bistatic reflectivity.

Aero-37—Target Tow Reel: Designed for towing the Aero-36 target; externally carried two-way air-driven reel; wire capacity of about 20,000'.

Aero-38—Target Launcher: For launching Aero 36, 26A and 42 targets; compatible with F4D, F11F, FJ, F9F-8T and TF.

Aero-38A—Target Launcher: For launching Aero 36, 36A and 42 atrgets; compatible with F3H-2.

Aero-38B—Target Launcher: For launching Aero 36, 36A and 42 targets; compatible with F8U-1 and 2.

Aero-39—Radar Optic Scorer: Scoring system using a modified APG-30 radar split on 35 mm film; externally carried.

Aero-40—Dart Target: Designed for 2.75 rocketry and air-to-air gunnery; 6'x 16'; recoverable; high altitude, low drag, radar reflective, honey-comb.

Aero-42—Tow Target: Designed for IR seeking *and* CW semi-active homing missiles; 28"x98" styrofoam rotating 49-pound shape. Bistatic reflectivity and four IR reflective flares. Internal radio receiver to command flare ignition.

Aero-43—Tow Reel: Designed to tow Aero 36, 36A and 42 targets; externally carried air driven reel; requires special installation kits for different types of aircraft; 35,000' wire capacity (approximately).

Aero-43L — Combination Reel and Launcher: Designed to tow Aero 36, 36A and 42 target from #1 wing station of F3H-2; requires special installation kit.

Aero-44—Tow Target System: Designed to tow Aero-40 dart target; one-way reel and parachute cannister for dart recovery.

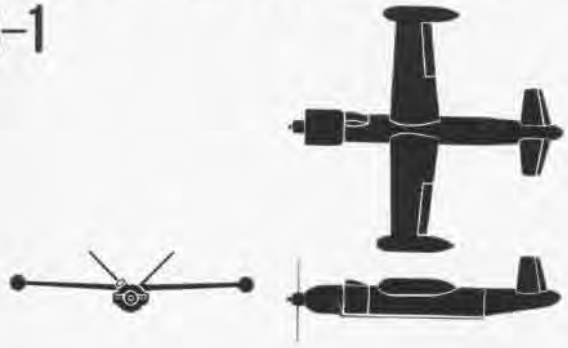
Aero-45—Supersonic Tow Target System: Designed primarily for F4H; system is in development stage for future evaluation.

Aero-46—Reel Rewind Stand.

Aero-47—Supersonic Tow Target: Under development for possible use with the Aero-45 tow system.

VITAL STATISTICS ON AERIAL TARGETS

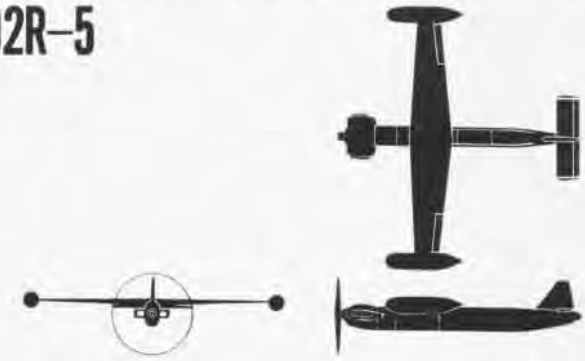
KDB–1



Span: *12' 10"*
Length: *15' 1"*
Height: *3' 4"*
Gross Wt.: *594 lbs.*

Svc. Ceiling: *30,000 ft.*
Max. Speed: *275 knots*
Endurance: *1 hour*
Engine: *McCulloch O-150-4*

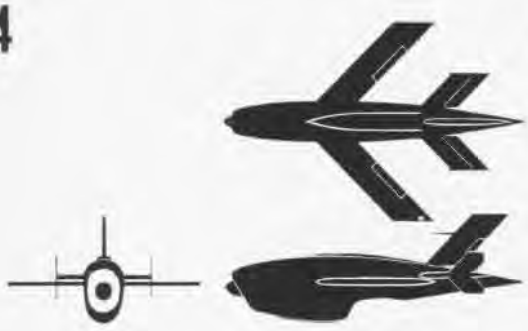
KD2R–5



Span: *13' 2"*
Length: *12' 3"*
Height: *2' 7"*
Gross Wt.: *352 lbs.*

Svc. Ceiling: *20,000 ft.*
Max. Speed: *175 knots*
Endurance: *1 hour*
Engine: *McCulloch O-100-2*

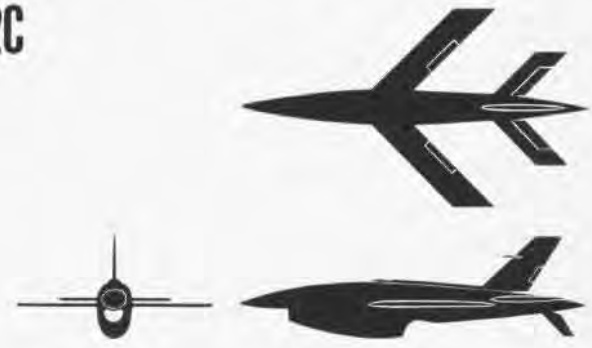
KDA–4



Span: *11' 2"*
Length: *17' 6"*
Height: *6' 3"*
Gross Wt.: *1905 lbs.*

Svc. Ceiling: *40,000 ft.*
Max. Speed: *500 kts @ 40,000'*
Endurance: *1 hour*
Engine: *144-R-20B*

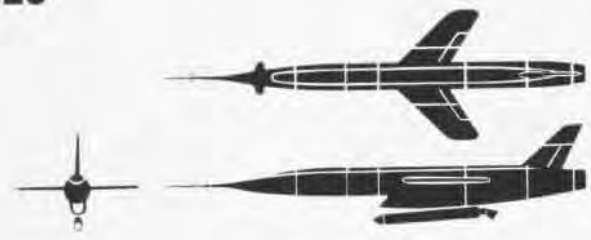
Q2C



Span: *12' 11"*
Length: *22' 11"*
Height: *6' 8"*
Gross Wt.: *2039 lbs.*

Svc. Ceiling: *55,000 ft.*
Max. Speed: *600 knots*
Endurance: *1 hr, 20 min.*
Engine: *J69-T-29*

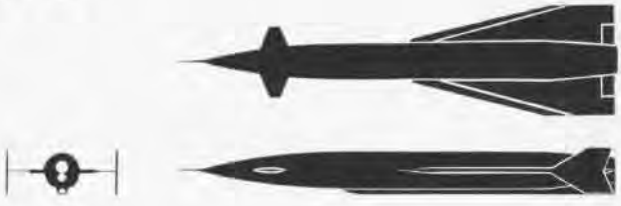
KD2U



Span: *20' 1/2"*
Length: *67' 2"*
Height: *12' 6"*
Gross Wt.: *21,500 lbs.*

Svc. Ceiling: *65,000 ft.*
Max. Speed: *Mach 2.0*
Endurance: *45 min.*
Engine: *J79-GE-3*

KD2B



Span: *3' 3"*
Length: *12' 10"*
Height: *3' 4"*
Gross Wt.: *560 lbs.*

Svc. Ceiling: *(see chart)*
Max. Speed: *(see chart)*
Endurance: *(see chart)*
Engine: *Liquid Bi-propellant*

	Altitude	Speed	Flight distance Boost	Flight distance Cruise	Flight Time Boost	Flight Time Cruise
Launch at 35,000'	70,000'	M2.0	12 NM	90 NM	60 sec	5 min
	70,000'	M1.5	10 NM	110 NM	60 sec	8 min
	35,000'	M2.0	5 NM	31 NM	28 sec	100 sec
	1,000'	M0.9	½ NM	37 NM	3 sec	225 sec

NAVAL AVIATION NEWS

KNIT, PICKED AND PRIMED

A few oldtimers will recall that the first seven carrier air groups took the names of parent carriers: Saratoga Air Group, Ranger Air Group, etc. In 1942, CVG-9 became the first numbered unit and before the end of WW II Naval Aviation counted 77 CVG's plus 4 training groups. At present, 14 CVG's, 2 RCVG's and 7 CVSG's constitute hand-picked, superbly trained first teams which are capable of undertaking strategic or tactical missions anywhere in the world.