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Aerospace SAFETY

THE MAGAZINE DEVOTED TO YOUR INTERESTS IN FLIGHT

SPECIAL MAC ISSUE

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SPECIAL FEATURES

CHRISTMAS AT MOUNT RAINIER — *original photo by Bill Kintner, AAVS* .... **Cover**

THE MANY MISSIONS OF MAC — *its leader discusses the program* 1

BIG MAC — *MAC is its name — airlift its game* 2

SUPERCALIFRAGILISTICEXPIALIDOCIOUS — *F-111 flight control systems* 14

SPINS AND THE '84 — *an oldie still around* 16

ANGLE OF ATTACK — *recommended for all pilots* 19

RUN FOR YOUR LIFE — *the heart of this program is running* 22

REGULAR FEATURES

CROSS-COUNTRY NOTES FROM REX RILEY 12 · IPIS APPROACH 13 · AEROBITS 26 · MISSILEANEA 27 · FALLOUT 28 · WELL DONE 29

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MAC

This month Aerospace Safety takes a look at the Military Airlift Command. MAC has come a long way since the days of the Ferry Command back in 1941 and creation of Air Transport Command in 1942.

Today MAC is the world's largest supplier of airlift. It provides weather forecasting and a variety of other weather information services for the Air Force, Army and other government agencies. MAC's Aerospace Audio-Visual Service supplies photographic and video service for many Air Force activities. Crews of the Aerospace Rescue and Recovery Service, part of MAC, have earned high recognition for their heroic work in Southeast Asia. And MAC's Aeromedical Evaluation Service is renowned for its humanitarian contributions both in war and when catastrophes occur anywhere in the world.

This big command provides its many services with the lowest aircraft accident rate of any major command.

Today MAC is setting new records that will last only until tomorrow. The giant C-5A transport is only a little over a year away. Jets will soon replace the old piston powered aircraft of Aeromedical Evacuation and ARRS is updating its equipment.

But we're getting ahead of ourselves. For MAC today, see General Estes' editorial on page one and the article beginning on page three.

THE MANY MISSIONS OF MAC

A varied mission demands a varied safety program and we have both in MAC. As you may see from the accompanying story, MAC does much more than airlift troops and cargo. We support and fly some 26 different types of aircraft, ranging from the U-3A and VC-6 King Air to WB-47, RB-57 and the multi-jet C-135 and C-141. We fly helicopters, amphibians, turboprops and Gooney Birds, too. As single manager operating agency for all DOD airlift, we also supervise the commercial contract carriers and the CRAF (Civil Reserve Air Fleet) program. Our missions are as varied as our aircraft. A partial list includes such exotic and unusual tasks as:

Airlift to Antarctica in support of Operation Deep Freeze.

Airlift of outsize cargo to remote Alaskan and Canadian radar sites in Operation Shoehorn.

Airlift of missiles and nuclear weapon components.

Radioactive atmospheric sampling above 60,000 feet in RB-57Fs.

Helicopter operations in mountainous terrain more than 10,000 feet above sea level.

Combat rescue operations, including jungle and open sea pickups.

Space probe recovery using special inflight techniques.

Typhoon and hurricane penetration to gather weather data.

Aeromedical evacuation, both overseas and domestic.

Weather reconnaissance flights over the North Pole.

Our flying safety record associated with these missions has shown a steady improvement over the years. In 1966, we achieved our greatest success on record. Yet some quarters have greeted the results with polite indifference. The implication is that our mission is not particularly dangerous, therefore we **should** have a good safety record! A glance at the list above should counteract that reasoning.

All Air Force personnel face numerous common hazards on the ground, and every airborne mission, regardless of equipment or mission, can end in a disaster unless everything is done exactly right. The starting point for an effective safety program is a sincere appreciation of these facts and an enthusiastic desire to do something about them.

In MAC we not only insist on consistently safe mission accomplishment, we put everyone to work at it. Each commander, functional manager and supervisor has definite safety responsibilities. I require them to integrate and enforce effective accident-prevention measures in all operational activities. Technical, scientific and safety people provide assistance and guidance **to** them, but cannot and should not act **for** them.

We have made a definite effort to get away from the outmoded concept of safety as a separate entity. Safety can only be productive when it is completely integrated into an operation. That's why we treat it as a necessary and vital factor in everything we do. We have even planned it into the conceptual and design phases of new aircraft development. The C-141, for example, was phased into operation with a special safety plan designed to catch errors and deficiencies before they could cause an accident. We are currently planning an even broader based system to follow the huge C-5A from the conceptual phase to the end of its useful life. Similar work is underway on the new CH-53 helicopter and CX-2 twin jet aeromedical evacuation aircraft.

We have always considered before-the-fact prevention as more productive and efficient than the post-accident variety. To this end, we place most of our emphasis on a network of safety surveys extending down to detachment level; on unrestricted submission and comprehensive staffing of operational hazard reports; on full support of aircrew and maintenance standardization programs; on provocative and penetrating safety publications; on staff assistance visits and on thorough analysis of incidents and other near-accidents.

Above all, I insist that my commanders roll up their sleeves and get with the program on a daily and personal basis. I expect them to preside over their accident-prevention councils, to personally lead such campaigns as 100 per cent Seat Belt and 101 Critical Days, to keep an open door for their safety officers at all times, to participate in accident-prevention meetings, to talk safety at commander's calls and wherever else it might be appropriate.

Our safety successes thus far have taught us that we are on the right track toward our goal of accident-free operations. But our accidents have taught us that we still have a long way to go. We are confident of success, but we don't expect it to come easily. It takes hard work to prevent accidents. There isn't any other way.

Howell M. Estes, Jr.

General Howell M. Estes, Jr.
Commander

MAC

Bob Harrison and Lt Col Henry W. Compton

Mention MAC and most of us automatically think of airlift. In fact, there is probably not a member of the Air Force who hasn't flown with MAC at least once, and most have traveled on MAC aircraft many times.

But there is a lot more to this big Military Airlift Command, commanded by General Howell M. Estes, Jr. The Air Force depends on MAC for photographic support, whether combat photography, safety movies or documentary films. Every time an Air Force pilot flies he is first briefed and his flight plan completed by an Air Weather Service forecaster.

Many airmen owe their lives to prompt rescue by crews of the Aerospace Rescue and Recovery Service; the sick and injured are flown to hospitals by MAC medical evacuation crews.

MAC is many things to many people, but generally, it is thought of as the world's biggest airline. Military airlift is the backbone of modern logistics. The aircraft allow quick reaction in an emergency and their capacity for delivering men and equipment to remote areas where no other suitable form of transportation exists make them indispensable to military operations. This has frequently been demonstrated, most notably during the Berlin Airlift, the Korean War, and today in Southeast Asia.

The major airlift elements of MAC are the 21st and 22nd Air Forces and the 375th Aeromedical Airlift Wing. With its headquarters at McGuire AFB, the 21st provides airlift to the half of the world between, roughly,

MAC Hq at Scott AFB, Illinois

Command Post: nerve center of globe girdling MAC aircraft. This and similar command posts at 21st and 22d Air Forces keep track of all aircraft in MAC airlift system.

the Mississippi River and India. The other half of the globe, including Southeast Asia, is the responsibility of the 22nd Air Force with headquarters at Travis AFB, California.

Command Posts at the two numbered Air Force headquarters and at MAC Headquarters at Scott AFB, Illinois, keep track of all aircraft movements and display the status and position of every aircraft operating in the MAC system. Aircraft are pictorially displayed by cards on a huge map of that Air Force's area of responsibility. Symbols indicate the type of flight, its location and status. A glance at the board tells the duty officer that 5549 is enroute to Yokota, Japan, or that 6626 is delayed at Hickam AFB, Hawaii, for repair of a hydraulic leak. If an aircraft is in trouble, perhaps an engine shut down in flight, or a diversion is required, the duty officer can, by means of a complex communications network, talk to the pilot while the aircraft is airborne in almost any part of the world.

Maintenance teams are spotted at strategic locations throughout the MAC system. Delays are kept to a minimum by dispatch of needed parts on the first available aircraft bound for a destination where another aircraft is grounded awaiting those parts.

The war in Vietnam has been providing the acid test of MAC's ability to deliver the goods, whether men or materiel. Fortunately, the C-141 came along just in time to put a lot of muscle in MAC's airlift capacity. These big birds, with their tremendous range, speed and load-carrying ability are accomplishing new airlift records that were inconceivable a few years ago. To provide an idea of how MAC delivers the goods here are some figures for Tan Son Nhut Air Base at Saigon. In August 1966 MAC aircraft delivered 37,550 passengers, while the high point in cargo was 14,000 tons delivered in October. Traffic has since dropped off some at Tan Son Nhut as other bases picked up some of the load, but the totals for Vietnam have steadily increased.

Station reliability rate has been remarkably high averaging 95 per cent at TSN in 1966 and 99 per cent during the first four months of 1967. (Reliability rate is a measure of how well aircraft adhere to the scheduled ground time. Average ground time for C-141s at Tan Son Nhut is two hours.)

The 616th Military Airlift Support Squadron at Tan Son Nhut handles this tremendous flow of goods and men with 220 people, 198 of them PCS with an additional 22 in TDY status.

MAC is the world's biggest contractor of commercial airlift. Thousands of the men in Southeast Asia flew to the theater via commercial airlines operating under MAC contract. The carriers also haul cargo but do not approach military aircraft in the volume flown.

Perhaps the most dramatic and best appreciated element of the command's airlift capacity is medical evacuation. MAC C-141s fly patients from the Republic of Vietnam to casualty staging areas at Yokota, Japan, and Clark Air Base near Manila. From there they are flown to the States, a typical flight being from Yokota to Elmendorf AFB, Alaska, and from there to Andrews AFB just outside of Washington, D.C., or to Travis AFB, California. Some flights go nonstop from Yokota to Travis. Now, with the 63d Military Airlift Wing at Norton AFB, new capacity is being added weekly.

Last year 102,000 patients were flown out of Vietnam, 7500 of them battle casualties destined for care in hospitals near their homes.

Once patients arrive at Andrews or Travis they are flown to hospitals within the Z.I. by domestic Medevac C-118s and C-131s. This will be speeded up soon when new jets replace the aging prop jobs.

MAC's primary mission is moving men, equipment and supplies in support of military operations. This is a monumental task, considering U.S. commitments around the world. Some idea of the scope can be gained from the following figures.

During Fiscal 1967 MAC flew 5,439,237 ton miles with its own aircraft and those of commercial carriers under contract. By far the biggest part of this tremendous airlift was in support of the war in Southeast Asia — 4,251,695 ton miles. The total far surpassed the figures for FY 66 and the SEA effort was nearly twice as large. These figures include passengers, military cargo and mail.

Since a far greater share of this massive airlift was provided by military aircraft vs. commercial carriers, it is obvious that without a big jet capability MAC couldn't have turned in such a performance. The C-141, therefore, has become MAC's workhorse. This big bird, with its high T-tail and distinctive engine sound has, in a short time, become familiar at airports around the world.

MAC pilots like the aircraft, but an assignment to fly it means a lot of work. First, there's training in the C-141 transition school at Tinker AFB. This takes two months. This is followed by more training at one's unit of assignment. In order to qualify for second pilot, former MAC pilots need only demonstrate proficiency in the aircraft. Those coming into the C-141 from other commands not only must qualify in the aircraft but also complete a copilot indoctrination course, primarily on MAC procedures and concepts. This is followed by at least one overwater flight as third pilot to observe system operations and practices.

After gaining experience as a copilot, the individual may upgrade to aircraft commander by passing a local aircraft check and a line check over water as aircraft commander with a flight examiner aboard. The FE has practically unlimited authority and if, in his opinion, the aircraft commander candidate is not ready for the job the FE may take over at any time during the flight.

Navigators — in short supply these days — come from other aircraft in MAC, directly from training at Mather AFB, or from other commands, primarily SAC. When they arrive at a C-141 outfit their first job is to attend school for two weeks in a Field Training Detachment on C-141 equipment. Non-MAC types also get ground school on a number of subjects pertaining to the MAC operation. Then they fly with an instructor navigator until they qualify. Non-MAC navigators usually make it by about the fourth trip; those with MAC experience normally qualify in two or three rides.

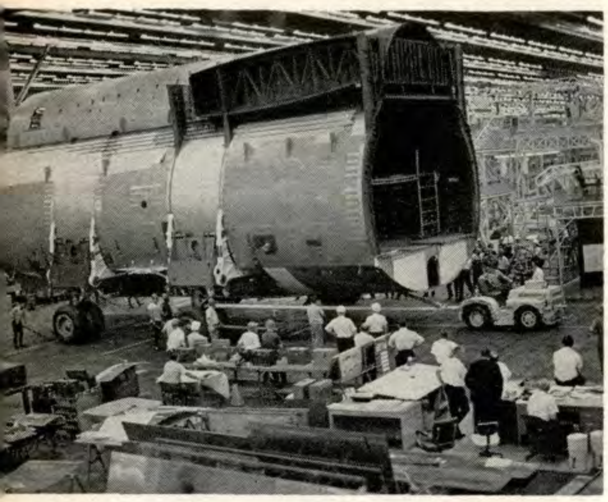
The crews, consisting of two pilots, navigator, two flight engineers and a loadmaster, have a busy time of it. An overseas flight to the Far East, for example, averages about five days. When the crew arrives home they have crew rest at the rate of one hour for three hours of mission time. Then, with 12 hours pre-departure notice, they are eligible to go again.

Normally, however, they have several days between overseas trips during which they do all the things all Air Force people have to do—firearms qualification, physicals, shots, records, etc. But frequently

In MATS, C-124 was workhorse. Today it's MAC, and old recips are giving way to C-141s for overseas flights.


MAC is world's biggest contractor of airlift. Here, commercial airliner flying for MAC is being loaded.

MAC cargo ranges from rifle-toting men, such as these at an aerial port, to dependents, Army tanks, mail for overseas troops.



A glimpse of the future. Mid-fuselage section of huge C-5A, next generation of airlift aircraft to become operational in 1969.

Airlift demands top flite maintenance and MAC gets it from specialists like these.

time between missions is used for tactical training.

We don't normally think of MAC in tactical terms, but by regulation, crews to be combat ready must maintain tactical proficiency. This means frequent low level training flights for aerial delivery of men and equipment.

Frequently aircraft from two or three wings get together for these missions. For example, recently 18 aircraft, six each from the 63d Wing at Norton, 60th at Travis, and 62d at McChord, joined for a drop on the El Centro range south of the Salton Sea in Southern California.

Norton was the host and led the formation. The aircraft rendezvoused over Julian VOR in a race track pattern until all were assembled. Then the flight path took the formation south to just north of the Mexican border, east to near Yuma, Arizona, north along the Colorado River for about 100 miles, southwest to the Salton Sea and over the drop zone for a heavy equipment drop at 130 knots. The formation, led by Brigadier General Gilbert L. Curtis, Commander of the 63d MAW, flew at an average altitude of 500 feet. (A formation of these big birds flying at low level is quite a thrill to see.)

C-141 crews average around 90 hours a month flying time. Maximum permissible without a waiver is 120 hours a month or 330 hours per quarter. They fly about three overseas trips per month to the Far East.

In addition to its major airlift capability and responsibilities for rescue and weather support (to be discussed later), MAC flies many special missions. In this category are training exercises with all services, airlift of missiles and hazardous cargo, emergency situations requiring airlift, and transporting government officials and visiting dignitaries. Not to be discounted are MAC's many humanitarian missions to aid disaster victims as directed by the government.

While the C-141 has revolutionized global airlift, MAC is looking to the day when the giant C-5A begins flying missions in 1969. While the C-141 is about four times as productive as the C-124, the C-5A will provide approximately double the capacity of the C-141. And at less cost. Also it will be able to carry outsized equipment too large for any existing aircraft.

With the C-141 and C-5A, combined with the 463L Materials Handling System and future improvements in materials handling, MAC will have an all-jet global airlift capacity of almost unimaginable proportions.

MAC MAINTENANCE

MAC is no different from other Air Force Commands in that it has continual maintenance problems. They are many-sided and some have been resolved; others have not. Manpower-wise MAC is still suffering. Too many units are comprised of a small skill core surrounded by an overabundance of three level mechanics. It is not uncommon to find more than half of the personnel in a maintenance unit at the apprentice level. This has not only created a tremendous training problem, but has also resulted in some shrewd management procedures to offset a severe disadvantage. For instance, the Isochronal Inspection adopted by C-141 units has made it possible to utilize three-level personnel in a beneficial way. These men can be assigned repetitious jobs in the docks and since they do the same thing day after day, even while in training, they are productive.

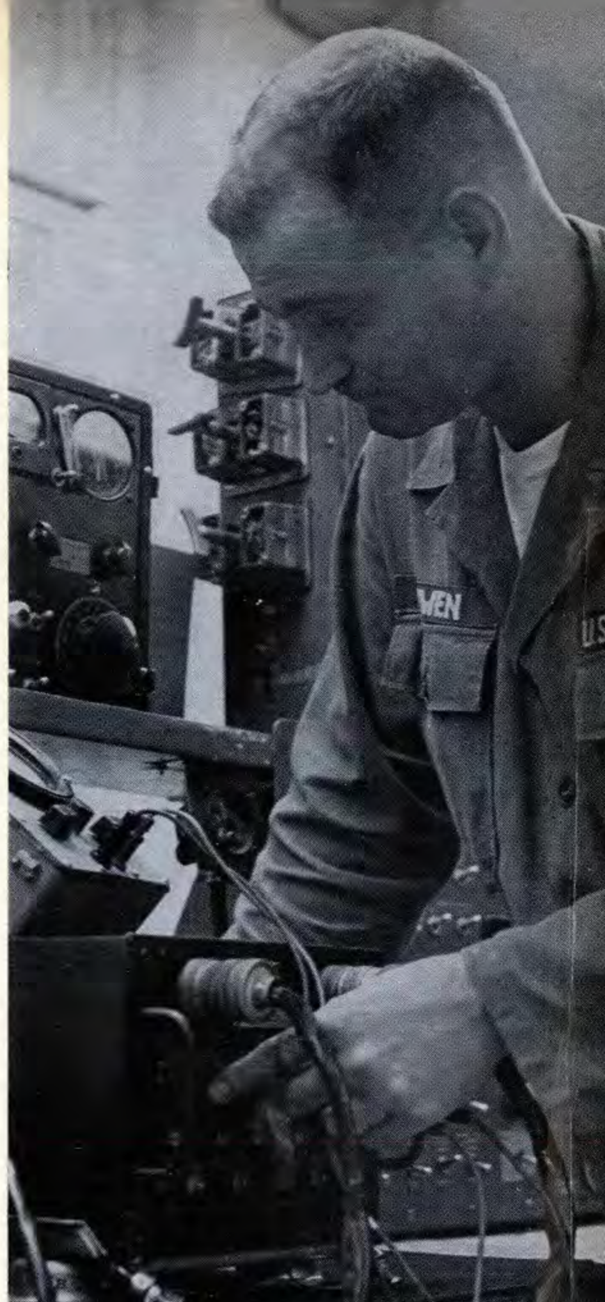
MAC managers have burned a lot of midnight oil trying to decrease aircraft down times, and many concepts concerning aircraft maintenance have been thrown out of the proverbial window. The reasoning now applied is to devise a schedule and force the aircraft to meet the schedule. In other words, if you need the aircraft to fly tomorrow morning, maintenance must be through with it by that time. Many old sergeants have added a few more grey hairs trying to digest this idea. At one time it was thought that a through-flight inspection on the C-124 could never be properly completed in less than 16 clock hours. Now four and even two hour ground times at through-flight stations are the rule, and this has been accomplished without violating safety. The rule still applies that if it is "mission essential" or a "safety of flight" item it will be repaired.

Concurrent refueling and cargo loading is now a way of life in MAC. The procedure, strictly controlled and made as safe as humanly possible, allows several operations to be conducted at the same time. While the aircraft is being refueled, cargo can be off- or on-loaded, maintenance going on, fleet service cleaning the aircraft, and the crew completing a preflight. This procedure enables the aircraft to be readied for flight while the most time consuming operation — refueling — is being completed. Even in this expedited operation innovations are still being introduced to shorten ground times. One unit added an extra hose to their fuel hose carts to shorten refueling time on certain aircraft which have dual refueling receptacles. The authority to refuel an aircraft with one engine operating is in existence. These and other ideas have just one objective — to get the aircraft back into the air where it belongs.

Maintenance in MAC must be conducted in many out of the way places and with a minimum of support. Naturally you just can't place personnel all over the world in little out of the way corners in the event of a possible operation in that area. So MAC has an operation called "Easy Apple." This allows TDY trips by maintenance personnel into out of the way places to support a temporary or even a long range operation. You might visit some little known strip in SEA and find an engine man from Charleston AFB working alongside a prop specialist from Dover AFB. This sometimes creates a shortage of personnel at some permanent station, particularly in reciprocating engine aircraft mechanics, but as the old recips are phased out the problem dissipates.

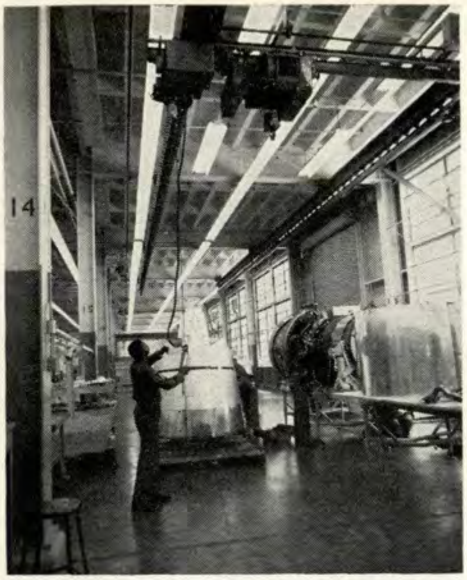
A large part of MAC's routine passenger and cargo carrying is contracted to various airlines. Maintenance involvement with these contract carriers is in accordance with the contract with the airline concerned. Generally it does not involve more than servicing and cargo loading; however, MAC has Commercial Aircraft Inspectors who certify each aircraft for safety of flight. These inspectors can have an aircraft denied a load if it does not conform to the safety standards expected.

MAC maintenance is based on the idea that the aircraft is no good parked on the ramp. In order to do its job, the aircraft must be flying. The Isochronal Inspection tested by the MAC wing at Travis AFB on its C-141s, was originated to achieve and sustain a utilization rate



Maintenance specialists must be versatile. With MAC's many types of aircraft, they may be called upon to work on almost any type of aircraft.

C-141, here pausing for maintenance, revolutionized airlift. Big fan jet often spans Pacific non-stop, has become airlift workhorse.



Huge airlift effort demands quality maintenance.

of better than eight hours a day on each bird. Thus far the program has proven successful. In addition to time-saving through better inspection concepts, MAC believes in mobility of maintenance and all specialist shops are assigned radio controlled vehicles to expedite each and every job.

Housewives who take pride in keeping their homes spic and span could gain a few pointers in the shops of the 60th Field Maintenance Squadron at Travis AFB. The shops are practically spotless. But the neat arrangement of equipment is not just to impress visitors — there are functional reasons. Machines and equipment are arranged for efficiency and for training purposes. Where possible, equipment is so situated that new airmen coming into the squadron may logically increase their skills by moving from station to station in orderly progression. This not only speeds training but gives the man a better grasp of the over-all system.

The squadron has 10 million dollars worth of equipment in its machine, welding, wood and paint shops. In addition to its aircraft structure and engine repair capabilities it repairs personal equipment, conducts non-destructive testing and performs corrosion control. In one 30-day period this year, the squadron processed 8764 reparable items.

Much of the unit's test equipment has been designed and fabricated by shop personnel, indicating a high order of inventiveness and dedication. The payoff under the suggestion program has been pretty big.

Pilots, not well versed in MAC's priority system, are sometimes disappointed in the maintenance afforded them. Often a pilot returning from a strip spends time cooling his heels on some ramp waiting for support, and gets the feeling that he is being ignored. The maintenance effort is controlled by Maintenance Control and the mechanic on the line has a definite assignment. He cannot arbitrarily drop the refueling of a medical evacuation aircraft to change a cowl flap actuator on a homeward bound C-124. If the maintenance work was not rigidly controlled chaos would result.

To the average mechanic, MAC is a hard taskmaster. He might be a C-141 specialist and find himself aiding in the maintenance of a C-130, or called upon to assist in launching a C-97. He often works 60 or more hours per week, under any but ideal circumstances. And when a crisis develops in some remote corner of the globe, he will find himself picked up and moved to some barren strip where his services are needed. No matter how bad the weather, or how long the hours, he is always besieged by his chief to do it right; to do it safely, and to do it fast. How well has Maintenance performed in MAC? Pick up a copy of the command safety magazine, **The MAC Flyer,** and read about their accomplishments in the Honor Roll section.

Satellite photo shows typhoon in Pacific near Guam. AWS observer plots position of huge storm.

AIR WEATHER SERVICE

Every time an Air Force pilot flies he uses a MAC service. This is provided by the weather forecaster, a member of the Air Weather Service, one of MAC's major components.

AWS facilities dot the world and the weather information derived from weather stations is fed into a central facility where it is added to other information obtained by observers aboard weather recon-

RB-57F, high flying reconnaissance aircraft samples upper air for nuclear debris.

Weatherman measures snow depth in Japan. Others work with combat weather teams in Vietnam jungles.

naissance aircraft, and from satellites gazing down on the earth from their orbits in space. Quickly processed, this weather data is sent to Air Force bases around the world for forecasters to use in providing service to aircrews.

Air Weather Service this year celebrated its 30th anniversary. In 1937, 40 weather stations with 22 officers and 180 enlisted men were transferred from the Army Signal Corps to the Army Air Corps. Today AWS, with headquarters at Scott AFB, Illinois, has about 11,000 people scattered around the world at some 400 stations. Some fly, others work in ground weather stations and some are in combat weather teams working with Army forward combat units in the Vietnam jungles.

Those who fly probe hurricanes and the secrets of the upper air, cruise for hours on long weather reconnaissance missions and carry on research in a number of areas. The Hurricane Hunters of the 53d Weather Reconnaissance Squadron at Ramey AFB, Puerto Rico, track these violent storms, taking measurements and informing the public at their rate and direction of movement. Recently they have joined Navy scientists in seeding experiments of hurricanes to determine if the fury of these storms can be lessened.

Some aircrews fly high altitude missions in RB-57 aircraft taking air samples. Reconnaissance flights by WB-135s constantly record weather data where ground stations cannot be placed or are not feasible. The weathermen aboard are equipped with computers, radio teletype machines, dropsonde and other up-to-date equipment. The dropsonde consists of a number of instruments and a radio packaged in a small case. The package is dropped and descends by parachute, radioing the instrument readings back to the computers on the aircraft.

The requirements for fast, accurate weather information and forecasting have brought AWS many new tasks and an array of sophisticated equipment. Weather data from around the world pours in 24 hours a day to a big computer center in Suitland, Maryland. Operated jointly by the Air Force, Navy and U.S. Weather Bureau, the center processes, delivers and stores weather data used for a variety of purposes. One product is weather information for MAC flight plans. Stored data are used for climatology studies, and the center also operates a numerical weather prediction unit. In this process upper air observations are fed into a computer that provides numerical printouts which are used to prepare prognostic charts depicting upper winds and temperatures.

AWS recently inaugurated storm detection radar at Dover AFB, Delaware, and, with the Weather Bureau, operates a computer center at Asheville, N.C.

Orbiting satellites introduced a dramatic new factor into weather forecasting. Today AWS operates readout stations around the world to receive up-to-the-minute data from these satellites.

The newest AWS program, and one that will be absolutely necessary as Air Force crews begin to operate in space, is solar observing and forecasting. The sun is a huge, hot, thermonuclear furnace with temperatures ranging from 6000 degrees C at the surface to 15 million degrees at the center. It radiates high energy particles at speeds up to 100 million miles an hour. These particles bombard the earth and other solar bodies including manmade satellites and spacecraft.

This high energy radiation can endanger crews and equipment aboard space vehicles.

Air Weather Service now operates a Solar Forecasting Center at Colorado Springs. Reports from stations flow into the center where scientists analyze the information and issue radiation forecasts for use by the Air Force, NASA and other agencies.

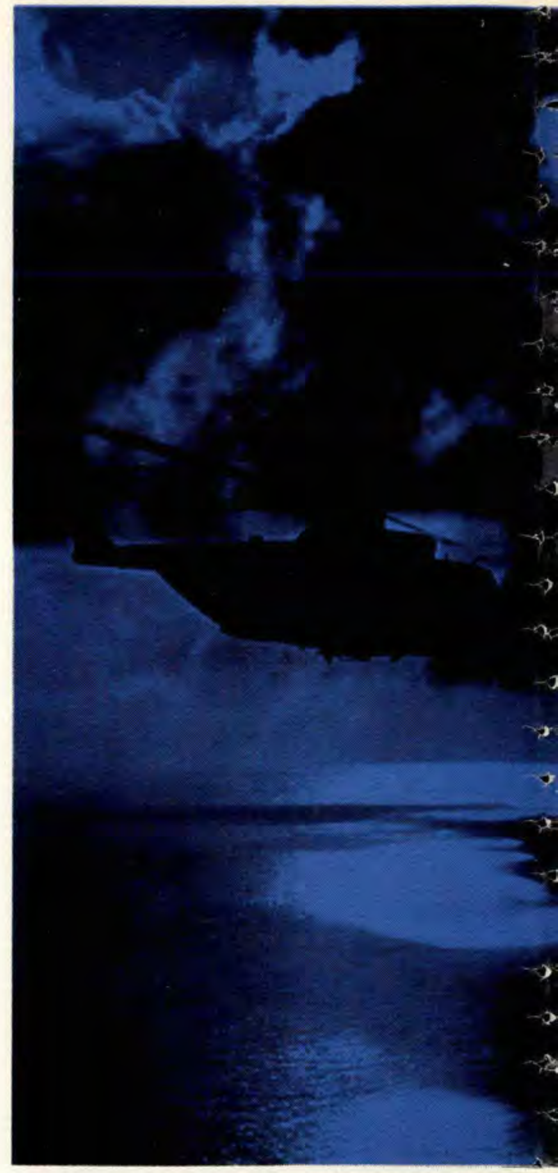
The focus of all the services provided by AWS is the user. The majority of these is still the aircrews who depend upon that man at the weather counter who puts the weather information on the pilot's Form 175. This is the bread and butter of Air Weather Service, the place where all the efforts of thousands of people funnel into the end of a pencil.

Basically, pilots want to know two things: what they can expect in the way of weather along their flight path and what it will be at destination. Enroute weather information comes from reconnaissance aircraft, pilot reports and observers at ground stations. Destination weather information is provided by observers located in small buildings situated as close to the runway as possible. The observer obtains readings from several instruments strategically located to give the most accurate information possible about the approach zone and runway.

The old stereotype of a weatherman poking his head out the window and making a guess has been relegated to the past. An instrument called a rotating beam ceilometer scans the approach zone and reports electronically to the observer.

All of this information is sent by the observer to the tower, GCA, weather counter in operations and any other facility with a need to know. In addition, the observer places this information on the weather teletype for dissemination throughout the country, and it is relayed by other circuits all over the world. Thus a pilot filing out of an airfield in Japan will know what the weather is forecast to be on his arrival. Enroute he can be posted and before he begins his approach he will receive conditions as of that moment.

To continue to provide its vital services requires a constant input of qualified people. AWS participates in a number of educational and training programs conducted by colleges and universities, Air Training Command courses and graduate training programs monitored by the Air Force Institute of Technology.



Aerospace Recovery and Rescue Service helicopters are doing outstanding job on land and sea.

RESCUE AND RECOVERY SERVICE-"That Others May Live"

The first question posed by almost everyone when they become aware of the existence of the Rescue and Recovery Service is "What do they do?" Easily the best answer is a short description of a usual morning briefing with the commanding general. Here's what was doing on one day:

- Piper Cherokee: lost in Colorado with six persons on board; was on a flight from Rock Springs, Wyoming, to Broomfield, Colorado, and last seen over Laramie, Wyoming. Yesterday a search was conducted by 14 Colorado CAP aircraft and 35 civilian volunteer aircraft, negative results.
- Beach Bonanza: lost on VFR flight from Pond to Calexico, California. Route search to be conducted today by the California CAP.
- A Rescue HH-43B delivered vital medicine from Kirtland AFB

Far ranging HC-130H is capable of snatching downed airmen from land or sea.

to Gallup, New Mexico. The crew had to take extra fuel in a 55-gallon drum because of the distance involved. Chalk up one non-combat save.

- Two pilots ejected from an F-4C three miles south of MacDill. A Rescue HH-43B found one in a life raft and one in the water. A crewmember was lowered by hoist to cut one of the men from his chute and both were hoisted aboard the chopper in this non-combat aircrew member save.
- A CH-3C was vectored by a C-54 to the scene of a bailout by two F-4C pilots. Both were injured. They were picked up by the helicopter and flown to hospitals; two more non-combat saves.
- An HC-130 escorted a Navy helicopter to a ship 50 miles southwest of Santa Maria, Azores. A very sick seaman was taken by the helicopter to Santa Maria and subsequently flown by the HC-130 to the hospital in Lajes, Azores. Log one non-combat save.
- An F-105 blew both main tires and caught fire at Korat Air Base, Thailand. An HH-43B scrambled and put out the fire.
- Chalk up three combat saves by an HH-43 from a crashed army plane in South Vietnam.

HU-16, long a rescue mainstay, is being phased out in favor of newer equipment.

This quickly summarizes one, not-too-busy day of worldwide rescue and recovery activities. Not included were some classified activities, and there are frequently some rescue actions which are reported too late to make the daily briefing. Many questions arise when the average reader is confronted with such a list of activities. The first query is probably "What does the USAF Rescue and Recovery Service have to do with lost civilian aircraft?"

This question is easily answered by stating that part of the ARRS mission is "responsibility for the coordination of all search and rescue activities throughout the nation." This includes civilians. The primary mission is "to search for, locate and recover personnel and aerospace hardware in support of USAF and other DOD global aerospace operations, including recovery support with regard to research and development projects and programs." This mission includes all branches of the service and even space vehicles which have returned to earth. The two-aircraft team of HH-3 Sikorsky helicopters and HC-130 aircraft are capable of recovering men and hardware anywhere in the world, under most weather conditions. The HH-3 can carry up to 10,000 pounds thousands of miles while being periodically refueled by the HC-130, and the '130's can now pluck men and equipment from the air, ground or water without landing. To say that ARRS misisons are diversified is a monumental understatement. Experts are strategically placed in centers throughout the world to direct these activities.


Familiar sight at nearly all bases is HH-43 shown here with fire fighting kit attached.

Three Aerospace Rescue and Recovery Centers direct ZI rescue and recovery missions: the Eastern Center at Robins AFB, Georgia; the Central at Richards-Gebaur AFB, Missouri; and the Western at Hamilton AFB, California. Overseas operations are directed by centers in Guam, Okinawa, Panama Canal Zone and 17 foreign countries. These centers use the services of the Army, Navy, Coast Guard, Marines, Forestry Service and Civil Air Patrol as well as any other Air Force agencies who can be of use.

Vietnam helicopter rescue operations have become well known in recent months. In the period of one calendar year the 38th Air Rescue

continued on page 24

REX RILEY'S CROSS COUNTRY NOTES

SAFETY RECORD — There are a number of Air Force units with outstanding safety records that are well publicized by their command magazines. But sometimes we tend to forget about our Air National Guard brothers who fly the same type missions and who have a lot of responsibilities. Generally, they fly older aircraft and have their own problems peculiar to their operations.

One that recently came to our attention is the 188th Tactical Reconnaissance Group based at Fort Smith, Arkansas. On August 29 the Group completed five years of no accident flying. That is *no accident* of any kind, major or minor. Of their total flying time of 21,603 hours, 16,699.9 were flown in the RF-84F, 2,696 in the T-33, 1,989 in the C-47 and 221.7 in the C-54.

During this period the unit grew from a squadron with 25 pilots to a group with 37 pilots. The Group was included in the *Beef Broth* program which meant increased readiness and intensified training. This included deployments within the ZI and to Alaska and Europe as well as maintaining day and night refueling proficiency on the KC-97 and KC-135 tankers.

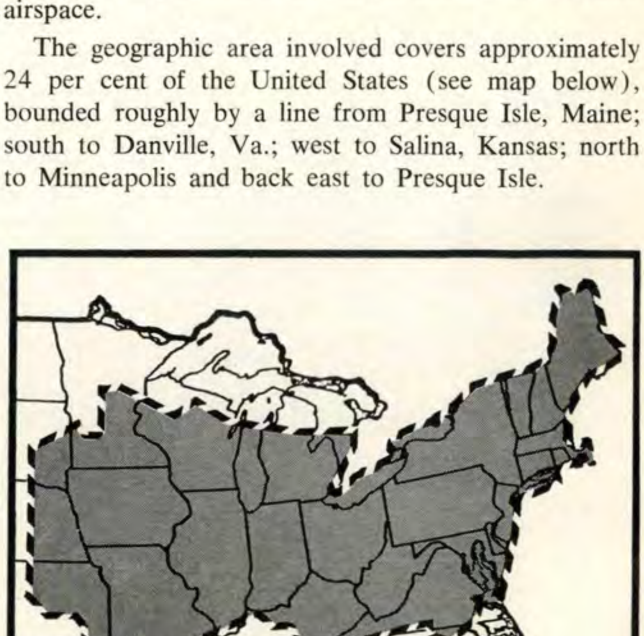
The Commander of the 188th gives a lot of credit to his flying safety officer who has held the job since October 1964 and who runs a very aggressive flying safety program.

ROTOR VORTICES—An HH-43 was taxiing under a telephone line in front of a hospital when rotor wash caused the line to begin oscillating and the wire caught one of the rotor blades. The result was considerable damage to the chopper as well as private property.

It is common practice for helicopters to transport injured persons directly to the hospital. However, there are hazards to operating into unprepared areas; therefore, a need for extreme caution. We know how violent the vortices from rotors can be. Now we know that they can cause overhead lines to whip violently and that without sufficient clearance, mishaps such as this one can occur. Where there is any doubt about clearance, a marshaller should be used.

APC IN NORTHEAST LOWERED — In case you haven't yet got the word, the FAA has lowered the floor of area positive control (APC) from 24,000 to 18,000 feet over the northeastern and north central United States, effective November 9. The reason is to assure safe separation of aircraft in this heavily traveled airspace.

The geographic area involved covers approximately 24 per cent of the United States (see map below), bounded roughly by a line from Presque Isle, Maine; south to Danville, Va.; west to Salina, Kansas; north to Minneapolis and back east to Presque Isle.



the I.P.I.S. approach

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

MINIMUM SECTOR ALTITUDES

Low altitude terminal instrument approach charts revised in accordance with TERPs may depict up to four separate sectors with individual Minimum Sector Altitudes. A Minimum Sector Altitude provides 1000 feet of obstruction clearance within 25 NM of the facility upon which the approach procedure is based (LOM for ILS). These altitudes are the *lowest* altitudes for emergency use in their individual sectors.

Obstruction height variation within 25 NM of the approach facility determines the number of sectors required. Minimum Sector Altitudes will not be shown when the obstruction height throughout the area is uniform. In this case, a minimum *safe* altitude for the entire area will be printed in the lower right corner of the approach chart, e.g., "MIN SAFE 25 NM 0000." A minimum safe altitude provides the same obstruction clearance as a Minimum Sector Altitude.

When obstruction height varies within 25 NM of the approach facility, 2, 3, or 4 sectors may be depicted. A sector will not be less than 90 degrees in spread. Magnetic courses which form the sector boundaries are depicted as inbound bearings. The inbound bearings are centered on an arrow extending in from the 10 NM distance ring. In some cases, priority procedural information may necessitate placement of these magnetic course arrows outside of the 10 NM distance ring. Individual Minimum Sector Altitudes are shown as boxed altitudes centrally located in the applicable sector, e.g., 0000.

LOW ALTITUDE TRANSITION ROUTES

Revised low altitude terminal approach charts depict transition (feeder) routes. These routes are designed to provide an orderly flow of traffic from the enroute airway structure to an initial approach fix (IAF). Route depiction includes an altitude, bearing and range. The notation "NoPT" is added when a transition route permits the approach to be flown without performing a procedure turn. "NoPT" is synonymous with the term "final" used on old terminal charts.

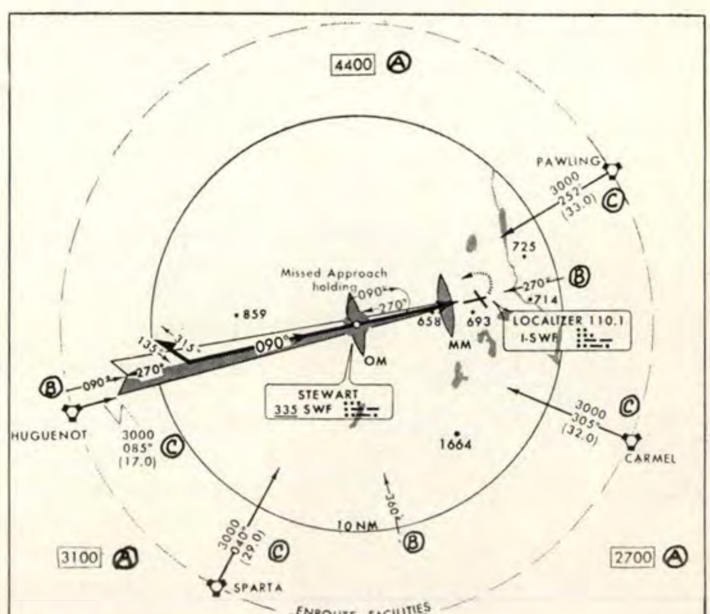
The depicted bearing and range are from the feeder fix to the IAF. The altitude is, for all practical purposes, an MEA. Flight at the depicted altitude will insure the same obstruction clearance and navigational facility reception capability as provided on an airway. ★

APPROACH CHART PLAN VIEW

A Minimum Section Altitudes—Insure 1000 feet of obstruction clearance witthin 25 NM of SWF radio beacon.

B Sector Boundaries—Identified by the inbound magnetic bearing and arrow.

C Transition Routes—Includes MEA, inbound magnetic bearing to IAF, and range.



SUPERCALIFRAGILISTICEXPIAL

Self-Adaptive, High Gain, Triple Redundant Command Augmented Flight Control System

'TIS indeed unfortunate that the magical make-believe world of Mary Poppins and her incantations will not solve our flight-safety problems nor make them easier to solve. However, the F-111 has a flight control system that will give Mary some competition in both departments — names and function.

While Mary develops names like supercalifragilisticexpialidocious, the F-111 flight control system is described as a self-adaptive, high gain, command augmented, and triple redundant system. All of that exotic description reduces to a relatively simple, highly reliable system designed to make the F-111 a safer and easier aircraft to fly.

The primary controls for the system are two sticks and two sets of rudder pedals. Aircraft pitch attitude is controlled by symmetric motion of two horizontal tail surfaces. Roll attitude is controlled by differential motion of the horizontal tail surfaces and is supplemented by the operation of two pairs of spoilers whenever the wing sweep angle is less than 45 degrees. Directional control is achieved by conventional rudder system operation. Continuous automatic damping on all three axes is provided through the functions of rate gyros, accelerometers, electronic computers, and damper servo actuators. Pitch and roll trim are accomplished through trim commands to the dampers, and directional trim by an actuator.

F-111, shown here with wings swept for high speed flight, features highly sophisticated flight control system.

Hydraulic servo actuators, mechanically connected to the sticks and rudder pedals drive the control surfaces as commanded by pilot inputs. The servo actuators are supplied hydraulic pressure by each of two separate hydraulic systems and continue to be fully operable with the loss of one hydraulic system or the loss of an engine.

As for the awesome descriptive name of the system, it all means that the flight control system adapts itself to a steady 0.3 stability damping ratio, that it operates on a fast surface response, that command inputs are augmented to vary the displacement of the control surfaces for compatibility with the flight condition, and that three circuits for each channel provide the necessary redundancy.

The self adaptive stability augmentation system continuously varies the gain of the signals sent to the pitch and roll damper servos as flight conditions change so that airplane response to disturbances will be optimized. The continuously changing gain feature responds to both pilot and turbulence initiated inputs. As the aircraft is disturbed, the rate-gyro accelerometer packages sense the movement and send a signal to the computer for corrective action. The best gain for that correction is automatically selected and an appropriate signal is then sent to the damper. The damper causes the flight control surface to be moved to the correct position at the best rate to stabilize the aircraft. For example, as the airplane tends to be disturbed by random turbulence, the system senses that tendency, computes the required damping inputs and commands damping inputs that reduce the effects of turbulence to almost zero. In the pitch channel the stability augmentation system operates much the same as a highly sensitive automobile shock absorber — you may drive relatively undisturbed over a rough and uneven surface.

The high gain feature operates the system at a high rate of exchange. As in any amplifier, the output or magnitude of amplification of an input signal is controlled by the gain setting. In the F-111 flight control system, these gains are varied as required for a selected aircraft response rate. This is a high gain system in the sense that a high magnitude of amplification is used. This high gain dictates optimized control surface deflections to the dampers which in turn damp or stabilize the aircraft more quickly.

The command augmentation system, through the actions of the pitch and roll dampers augments the stick commands to provide a nearly ideal constant stick force and aircraft response relationship. As the effectiveness of the control surface varies with the flight condition, a non-augmented system would require heavy stick forces at low speeds and very light stick forces during low level, high speed flight. To maintain the near constant feel of stick force and

DOCIOUS

Grover Tate
Ft Worth Div of General Dynamics

aircraft response, the command augmentation system boosts the control stick command through the damper. For a particular gain setting, the damper moves directly proportional to the stick input. The rate gyroaccelerometer package senses the aircraft response and then adjusts the damper input to the desired aircraft response.

At a flight condition where the control surface effectiveness is high, the aircraft response will be large and the damper input will be substantially reduced. In a low aircraft response flight condition the damper input will not be reduced as much. Thus, surface motion is varied with the flight condition so that the resulting airplane response will always be very nearly the same for the same stick force. The continuously adapting gain system helps to approach the ideal of a constant stick force and aircraft response relationship.

Each pitch, roll and yaw command generates three electrical signals. Each of the pitch, roll and yaw channel electronic networks incorporates three signal selectors. When a command signal is generated in either the pitch, roll or yaw channel, the three signal selectors for that particular channel analyze each of the three signals, select the middle value or majority signal and send it to the appropriate damper servo. Should one of the three signals to the selectors be erroneous, each selector will select one of the remaining two good signals and send it to the damper servo. Of the three signals sent to the damper servos, one is used as a model to which the average output of the other two is compared. Should one of these two signals prove to be erroneous, it will be voted out by the damper logic circuitry. So, although not totally semantically proper, we can say the system is a triple system and called triple-redundant.

In summary, we have continuous stability augmentation, an extremely stable ride; high gain, large, quick corrective action for small disturbance inputs; command augmentation, constant stick force to aircraft response; triple redundancy, three circuits for reliability.

Test switches, self test circuits and an array of warning and caution lights are provided so that in addition to automatic system monitoring, the pilot is provided with the means for visual monitoring.

The terrain following radar system (TFR) also operates in conjunction with the flight control system. *(Aerospace Safety,* March 1967) to provide automatic terrain following capability. The TFR furnishes signals to the pitch damper to automatically maintain the aircraft at a pre-selected altitude above the terrain.

Four modes of autopilot control are also programmed through the primary flight control system. These modes are attitude stabilization, Mach hold, altitude hold, and constant track. ★

Spins from which the pilot did not recover continue to cost aircraft and lives more than 50 years after the first spin recovery technique was discovered.

The most positive way to prevent unintentional spins that result in accidents is by good ACM training that insures understanding of the elements that cause spins and proper recovery technique. The following is not new—similar articles appeared in Aerospace Safety 12 years ago—but we thought it would be of interest to F-84 pilots since the F-84 is still active in a number of Air National Guard units.

Mitchell Lopatoff
Asst Chief, Flight Test Engineering
Republic Aviation Corp

The F-84F airplane is not prone to accidental spins; but like most normal aircraft it will spin in either direction when the stall angle is reached and full rudder is applied. Recovery, when using the prescribed procedure (Dash One Handbook) is very positive and it is this positive recovery which is perhaps the most noteworthy characteristic of the F-84F spin and one that might cause difficulty if not understood. This will be elaborated on in this article and a thorough understanding should eliminate any difficulties with spin recovery in this aircraft. The best advice that can be given to F-84F pilots is to thoroughly read and understand the spin recovery technique in the Dash One. The following notes will help you understand the Dash One information and the thoroughly tested characteristics.

The spin recovery technique, stated in the Dash One, has been successfully demonstrated for all models of the F-84F and RF-84F airplanes. The recovery technique is based on a comprehensive flight test program conducted by Republic Aviation that included 63 individual spin demonstrations. The various airplane configurations demonstrated covered the extremes of forward and aft center of gravity (CG) positions in the clean configurations, empty and full 230 gallon and 450 gallon external tanks, speed brakes extended and retracted, and in the landing configuration with flaps and gear down. Both erect (most common) and inverted spins were tested. Entries were from both one-G stalls and from accelerated turns. The two piece stabilizer-elevator and the one piece stabilator configurations were spin tested. Likewise, spin tests were conducted with the enlarged vertical tail incorporated on the late model F-84Fs and on all models of the RF-84F. The results of these tests have indicated very satisfactory spin recovery characteristics with all models, all external loading configurations and all methods of spin entry.

The recovery technique presented in the Dash One and repeated below is as follows:

Apply full back stick and approximately 1/3 aileron with the spin, then apply full opposite rudder. When the spin rotation stops, neutralize rudder and ailerons and when the pull-out is well under way ease the stick forward slowly. Premature forward movement of the stick during recovery attempt will cause the nose to go under excessively which may result in an inverted spin.

This recovery technique when used during the flight test program never failed to produce a satisfactory recovery. This includes configurations with 450- and 230-gallon external fuel tanks installed both empty and with full fuel.

Republic Aviation test pilots found there were three primary control motions that must be adhered to, once the spin develops.

1. Apply full back stick.
2. Apply approximately 1/3 aileron with the spin.
3. Apply full opposite rudder.

These optimum control inputs were determined after various techniques were investigated during the flight test program. During the program ailerons were held full with the spin, neutral, and against the spin with the following conclusive results:

AILERONS FULL WITH THE SPIN

The most rapid recoveries were made with ailerons held in the spin. The angle of attack decreased rapidly as soon as corrective controls were applied. The angle of attack decrease was so pronounced that if the pilot permitted the stick to come forward (while concentrating on holding the ailerons full into the spin) there was a tendency for the airplane to pitch to a negative angle of attack. Thus it was found to be important that the primary emphasis be placed on holding the stick full back during the "aileron with" recoveries.

AILERONS NEUTRAL

"Ailerons neutral" recoveries were, in general, a little slower than the "ailerons with" configuration. The decrease in angle of attack was not as abrupt and therefore the tendency for the aircraft to go inverted was not as strong. The test pilots felt that ailerons "neutral" recoveries were better in that they appeared "more stable."

AILERONS AGAINST THE SPIN

When ailerons were held against the spin the aircraft would not recover. In each of four spins where ailerons were held against the spin there was no recovery. Even a small amount of aileron *against* the spin is critical in this respect. When an aircraft is spinning, the side forces tend to push the pilot to the outside of the cockpit (the right side in a left spin). This disturbs the pilot's reference in the cockpit so that while he may think that he is holding neutral aileron he is, in fact, holding aileron slightly against the spin. This effect coupled with a natural tendency for a pilot to stop the aircraft from rolling with opposite ailerons is the reason that the Dash-One tells the pilot to concentrate on putting the ailerons on the "with" side of neutral to insure recovery.

As noted from the above comments, the more aileron held with the spin, the more positive the recovery. Because the recovery of the F-84F is very positive, unless full aft stick is maintained there is a tendency for the angle of attack to reduce (pitch down) too quickly causing a negative angle of attack stall with the result that the airplane may enter a secondary inverted spin. It has been shown that holding full aft stick softenes this nose down pitch in recovery and precludes inadvertent entry into the secondary spin.

INVERTED SPINS

As stated above, if improper recovery procedure is used for a normal erect spin the aircraft in recovering may go into an inverted spin. It must be noted that the direction of rotation of an inverted spin is easily confused, which can cause the pilot to apply corrective control *opposite* to that for recovery. The inverted spin can be recognized by

the negative G and the tendency for the pilot's hands and feet to pull away from the controls. Also, the inverted spin is much tighter.

The recovery from an inverted spin, as stated in the Dash-One, is (1) neutralize controls, (2) apply full rudder opposite to the direction of rotation.

DETECTING DIRECTION OF THE SPIN

The following comments should be thoroughly understood in determining the direction of rotation of an erect spin and an inverted spin. Assume, for example, that a pilot is in an erect spin to the left. If the pilot sights over the airplane's nose and makes visual contact with some reference on the ground he will notice that the ground reference will pass from the left to the right of his windscreen. This direction of rotation is easily recognized and correct recovery would be 1/3 left aileron and full right rudder while maintaining full back stick. If, in the process of recovery, the airplane pitched to a negative angle of attack and entered an inverted spin, the original control action applied to recover from the left erect spin, would now hold the airplane in the spin. If this did occur, the pilot, while sighting the same ground reference, would notice the ground reference come in to view to the right of his windscreen and pass to the left. Proper recovery would then be to apply left rudder after neutralizing the stick controls. It must be recognized that the direction of rotation of an inverted spin is easily confused and it is so stated in the Dash One. Therefore, if the recovery is not accomplished in two turns, it must be assumed that the pilot has interpreted the spin direction improperly and therefore the rudder should be reversed.

EXTERNAL STORES

Of the 63 spins demonstrated during the program, 15 were performed with external fuel tanks installed. The spinning characteristics of the airplane with the external tanks are essentially the same as those of the clean airplane. In all cases, recovery was easily accomplished with the same recovery procedures used for the clean airplane. When the rotation stopped, the ailerons and rudder were neutralized and the stick was kept back until the pullout was well underway.

The spin with external tanks installed is slightly more oscillatory, with the nose coming higher for the first two turns, then the spin tightens up and the spin axis becomes steeper and more vertical than the clean airplane.

There is no apparent increase in rate of descent or altitude loss per turn with increase in gross weight due to external fuel but the pilot did comment that the airplane felt sluggish with full 450-gallon tanks. The altitude loss in the pull out was greater due to the heavier gross weight and to the more nearly vertical attitude of recovery.

In summary, good spin recovery and rapid recovery necessitates maintaining back pressure on the stick to avoid an inadvertent secondary spin. Inverted secondary spin direction, if encountered, can be confused which could cause a pilot to hold the aircraft in the spin. Also, like all high density aircraft, the pilot should allow sufficient time for a given control movement to take effect. If, however, recovery doesn't take place after two turns, it is probable that the spin direction has been misinterpreted and control direction should be reversed. ★

There's always an angle

Angle of attack is a frequently misunderstood term. For those who have grown a bit fuzzy on their aerodynamics, the author offers an explanation. Reading recommended for all pilots.

Maj Frank A. Hughes, Air University

Since the beginning of aviation in the United States, engineers, pilots, psychologists and scientists have all made major contributions toward the rapid advancement of technology. As aircraft performance was increased from the 50-knot cruise speed of the early 1900's to the high speed jet aircraft of today, certain slow speed aerodynamic characteristics were necessarily sacrificed, primarily as the result of the change from straight-wing to swept-wing aircraft. Of course the swept-wing was necessary in order to increase the limiting Mach number to higher values.

As the slow speed characteristics of the swept-wing aircraft were changed, it became necessary for jet pilots to learn the new techniques to be used during takeoff, approach and landing. However, pilot-error accidents, involving swept-wing aircraft continue to occur during these phases of flight.

An indicating system that will inform the pilot of aircraft performance relative to the critical angle of attack can prevent accidents. Let's talk about the critical words in the above sentence—angle of attack. The U.S. Navy defines angle of attack as follows:

"The angle between the chord line and the relative wind (Fig. 1). It is important to differentiate between pitch attitude angle and angle of attack. Regardless of the condition of flight, the instantaneous flight path of the surface determines the direction of the oncoming relative wind and the angle of attack is the angle between the instantaneous relative wind and the chord line. The angle of attack indicator measures this angle."

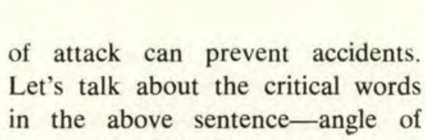


Fig. I

Control of angle of attack is a frequently misunderstood subject. The lack of complete understanding is not restricted to any particular group of pilots. Some confuse angle of attack, *pitch angle* and climb or dive angle. Basically, *pitch angle* can be defined by a line drawn through the longitudinal axis of the aircraft relative to the true horizontal. *Flight path angle* is the actual flight path of the aircraft through space relative to the true horizontal. Angle of attack is the difference between the two.

From this, it is possible to visualize the theoretical extremes: an aircraft can be pointing straight up (90 degrees flight path) thereby producing an angle of attack of zero. Conversely, an aircraft can be level with the horizon (0 degrees pitch) but falling straight down (—90 degree flight path) thereby creating an angle of attack of 90 degrees.

From a practical standpoint, everything an aircraft does is based on angle of attack. It takes off at a given angle of attack, it cruises under optimum conditions at still another angle of attack and it stalls at a known angle of attack. Angle of attack is a function of gross weight, indicated airspeed and G loading. Altitude change has no effect since the interest is in indicated airspeed and not true airspeed.

Many pilot error accidents have occurred as a result of the pilot's losing aerodynamic control of the aircraft. This is usually caused by the fact that the airspeed indicator is the only indication of aircraft performance which the pilot has to maintain an adequate margin above stall speed. The fallacy of this system is that the airspeed indicator is accurate only in wings-level, one G flight. Some of the wide variations in airspeeds are discussed in the following sections.

THE EFFECT OF WEIGHT CHANGES

Modern configurations of aircraft are characterized by a large per cent of the maximum gross weight being fuel. Hence the gross weight and stall speed of an aircraft can vary considerably throughout the flight. The effect of any change of weight on stall speed can be expressed by a modified form of the stall speed equation where density ratio, CL-max and wing area are held constant (Fig. 2).

V_{S1} = Stall speed corresponding to same gross weight, W_1

V_{S2} = Stall speed corresponding to different gross weight, W_2

$$\frac{V_{S2}}{V_{S1}} = \sqrt{\frac{W_2}{W_1}}$$

Fig. II

As an illustration of this equation, assume that a particular aircraft has a stall speed of 100 knots at a gross weight of 100,000 pounds. The stall speeds of this same aircraft at other gross weights would be:

Gross Weight, lbs.	Stall Speed kts. EAS*
100,000	100
110,000	105
120,000	110
140,000	120
90,000	95
80,000	90

* EAS = (Equivalent Airspeed) calibrated airspeed corrected for compressibility effect.

THE EFFECT OF HIGH G MANEUVERS

At any time high G forces are necessary to complete a maneuver, the range in airspeeds can be great. It is possible to compute these air speeds using the equation as illustrated in Figure 2. This assumes that an increase in G forces, is in effect, a change in gross weight. For instance, the F-104 has a minimum control speed of 220 knots at a gross weight of 23,500 pounds with gear and flaps retracted, but the minimum control speed during a 5G maneuver is 484 knots.

THE EFFECT OF MANEUVERING

Turning flight and maneuvers produce an effect on stall speed which is similar to the effect of weight. Any steady turn requires that the vertical component of lift be equal to the centrifugal force. Thus, the aircraft in a steady turn develops a lift greater than weight and experiences increased stall speeds.

Trigonometric relationships allow determination of the effect of bank angle on stall speed and load factor. The load factor, N, is the proportion between lift and weight and is determined by:

$$N = \frac{L\ (\text{lift})}{W\ (\text{weight})} = \frac{1}{\cos\varnothing}$$

N = load factor (G)
COSØ = cosine of the bank angle Ø

Typical values of load factor determined by this relationship are:

Ø =	0°	15°	30°	45°	60°	75.5°
N =	1.00	1.035	1.154	1.414	2.0	4.0

There is no appreciable change in load factor or stall speed at bank angles less than 30 degrees. Above 45 degrees of bank the increase in load factor and stall speed is quite rapid. This fact emphasizes the need for avoiding steep turns at low airspeeds—a flight condition common to stall-spin accidents.

CL VERSUS ANGLE OF ATTACK

The maximum coefficient of a particular wing configuration is obtained at one angle of attack and one pressure distribution (Figure 3). Weight, bank angle, load factor. density altitude and airspeed have no direct effect on the *stall* angle of attack. During flight maneuvers, landing approach, takeoff, and turns, the airplane will stall if the *critical angle of attack is exceeded.* The equivalent airspeed at which stall occurs will be determined by weight, load factor, and altitude but the stall angle of attack is unaffected. At any particular altitude, the indicated stall *speed* is a function of weight and load factor. A given wing configuration stalls at a given *critical angle of attack* every time regardless of the number of variables affecting an aircraft.

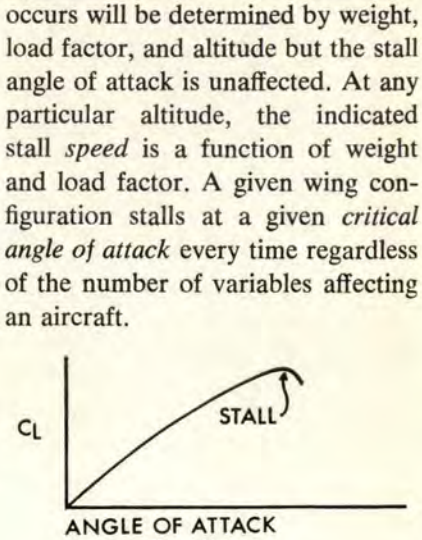


Fig. III

ANGLE OF ATTACK INDICATING SYSTEMS

Angle of Attack Indicating Systems indicate aircraft performance during all phases of flight. Since angle of attack is, in effect, airspeed, an optimum angle of attack provides an instantaneous optimum airspeed. However, a computed airspeed does not reflect an optimum angle of attack during all phases of flight. For example, computed airspeed would be for a specific flight condition, where direct angle of attack would be displayed and referenced to margin above stall or margin from optimum. Thus it can be said that an angle of attack indicating system is the only means which the pilot has to insure a margin of safety throughout the flight.

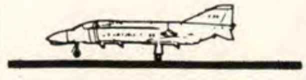
There are many angle of attack systems used in Air Force aircraft but the only truly useful operational angle of attack indicating system is installed in the F-4 aircraft. The F-4 (Figure 4) has this system for a good reason. The aircraft was de-

Fig. IV

MAJOR USAF OPERATIONAL AIRCRAFT WITH ANGLE OF ATTACK HARDWARE

AIRCRAFT	SENSOR	DISPLAY	FUNCTION
C-123A-J	Diff. Press	Fast—Slow	Stick Shaker Stall Warning
C-123K	Vane	Vert. Meter	Stick Shaker Stall Warning
C-130	Vane	Horiz. Meter	Horn Stall Warning
C-133	Vane	Round Dial	Stick Shaker Stall Warning
C-141	Vane	Vert. Meter	Stick Shaker Stall Warning
C-5A	Vane	Vert. Meter	Stick Shaker Stall Warning & ADC
B-52H	Vane	———	Terrain Avoid & Fire Control
B-58	Vane	Round Dial, Indexer	Stall Warning
B-70	Vane	———	Engine Control
T-37	Diff. Press	Fast—Slow	Stick Shaker Stall Warning
SR-71	Diff. Press	———	Fire Control
F-111	Vane	Vert. Meter Indexer	Stall Warning & Terrain Avoid
YF-12	Diff. Press	Vert. Meter	Stall Warning & Fire Control
F-4C	Diff. Press	Round Dial, Indexer	Pedal Shaker
F-101	Vane	Round Dial	Stick Shaker
F-105	Vane	Vert. Meter	Appch. Aid, Fire Control, ADC
F-106	Vane	Vert. Meter	Appch. Aid, Fire Control, ADC
F-104	Vane	Round Dial	Stick Shaker
F-102	Vane	———	Fire Control

Fig. V

INDICATOR	INDEXER	ANGLE OF ATTACK UNIT	AIRSPEED	ATTITUDE
		**20.3-30**	**VERY SLOW**	
		**19.7-20.3**	**SLIGHTLY SLOW**	
		**18.7-19.6**	**ON SPEED**	
		**18.1-18.6**	**SLIGHTLY FAST**	
		**0-18.0**	**VERY FAST**	

veloped for U.S. Navy operations and all Navy carrier jet aircraft have angle of attack indicating systems. It is only with the use of these systems that carrier operations are successful.

Other Air Force angle of attack systems (Figure 5) provide stall warning by means of stick shakers, rudder vibrators, etc., and some prevent stalls by pushing the stick forward. All of these devices are a step in the right direction of preventing stalls, but these are after the fact devices. An indicating system keeps the pilot informed on aircraft performance throughout the flight.

In conclusion, the maximum lift coefficient of a particular wing configuration is obtained at one angle of attack and one pressure distribution. Weight, bank angle, load factor, density altitude and airspeed have no direct effect on the *stall* angle of attack. This fact is sufficient justification for the use of angle of attack indicators and stall warning devices which sense pressure distribution on the wing.

During flight maneuvers, landing approach, takeoff, and turns the aircraft will stall if the *critical angle of attack is exceeded.* The airspeed at which stall occurs will be determined by weight, load factor and altitude but the stall angle of attack is unaffected. At any particular altitude, the indicated stall speed is a function of weight and load factor. An increase in altitude will produce a decrease in density and increase in true airspeed at stall. The angle of attack indicating system will inform the pilot of the performance of the aircraft in relation to the critical angle of attack throughout the flight. This makes it unnecessary to compute airspeeds for all phases of flight except takeoff speed. Therefore, many accidents which are attributed to pilot error may be prevented if the aircraft has an angle of attack indicating system. ★

Lt Col William R. Detrick
Professor of Aerospace Studies
Denison University, Ohio

Would you believe? . . . exercise actually can be fun? If you would have asked me this six months ago, I would have taken my feet off the desk and politely (or maybe not so politely) asked you to leave. While I support the 5 BX program (who doesn't?) for its basic necessity, one thing it *isn't,* in my humble opinion, is fun. Another thing, it's very easy to goof off until testing time comes around. Since I am currently on a "remote" assignment at a midwestern university, the temptation is even stronger.

Six months ago, the university's head football coach, with some encouragement from university physicians, proposed a program to get the old ticker back in shape to a group of local business and professional men. The "heart" of his program was running. Now, of course, running for good health is not new. It has been advocated by many, particularly in recent years.

The coach proposed to set up a routine of starting slowly and gradually building up. We set up our class for 7 A.M. five days a week.

Our original meeting disclosed a wide cross-section of middle age (35-55) business and professional types. Also represented were various sizes, shapes, and conditions of physical well being—one man had already suffered two heart attacks, and of course had to stick to a special schedule tailored for him. I went along just to support the program and contribute to community spirit, since obviously I didn't need the exercise!

Our gathering included, among other walks of life, several doctors, ministers and an undertaker. We made due note of the point that the coach was drumming up business for all — he got us there, and if we got into trouble the physician could help. If the medicine man should fail, the minister and undertaker could finish the job!

The coach's big pitch at the start of our program was "begin slowly." (About the second or third day our sore muscles convinced us he was absolutely right!) He stressed that, even though we might have been in good physical condition at one time, we just could not start in where we left off years before.

The schedule called for warm-up calisthenics, not over 15 minutes, an interval of training on the running track, a short swim, steam bath and shower. The program was designed to build up the heart and lungs primarily, the increased muscular prowess being secondary. That's why the running was most important. Since it was still the middle of winter, the indoor dirt track was used, 1/12th of a mile around. Below is the schedule he set up for us. As you can see it starts slowly and builds up. Do each exercise at least three times a week before going to the next week's exercise.

The coach also stressed that exercise has been too strenuous if:

- Your heart refuses to stop pounding 10 minutes after the exercise.
- Your breathing is still uncomfortable 10 minutes after the exercise.
- You are still shaky and worn out 30 minutes after the exercise.
- You cannot sleep well the night following the exercise.
- If you carry fatigue into the next day (muscle soreness doesn't count).

The key to the program is getting started on a set regimen. This is where being in a group comes in. It could be easy, particularly on the 7 A.M. schedule we were following, to skip a day — and another — and another — if you were strictly on your own. The group helped carry its members along by encouragement or admonishment from one to another. Besides, the warm-up calisthenics, as well as the running, were more fun with the group! Keep smiling! Fun, fun, fun!

First week	Run one lap (1/12 Mi)	Walk one lap	three times
Second week	Run one lap	Walk one lap	four times
Third week	Run one lap	Walk one lap	six times
Fourth week	Run two laps	Walk one lap	three times
Fifth week	Run two laps	Walk one lap	four times
Sixth week	Run three laps	Walk one lap	three times
Seventh week	Run three laps	Walk one lap	four times
Eighth week	Run three laps	Walk one lap	six times
Ninth week	Run four laps	Walk two laps	three times
Tenth week	Run four laps	Walk two laps	four times
Eleventh week	Run four laps	Walk two laps	six times
Twelfth week	Run as many as you can. Walk three or four and then finish the balance of a mile.		

In successive weeks continue to increase successive laps weekly until you can run a mile without stopping.

The calisthenics got progressively more rigorous along with the running, while keeping within the same time limit (12 to 15 minutes). The swim and steam bath were relaxing extras after the running, and in my estimation are not essential to the program's success.

Well, sir, after the twelve weeks were up, instead of quitting, most of us kept right on going. By now the habit was formed, and we didn't want to slip back into our lazy mornings and flabby shapes. Many got to the non-stop mile level and just stayed there. Others have been steadily increasing up to two miles and beyond. We are now lording it over the next group as "old timers." (A class of women has started also.)

If you would have told me four months ago that I could run three miles before breakfast and still be able to go to work for the day, I would have recommended you for a section 8. (To you younger birdmen, that's a discharge for mental incompetence.)

The facts are that anyone with an organically sound heart can run "to your heart's content" and with pleasure. Running isn't just a young man's game, although it will also benefit the young. Nearly half of all deaths among executives in the U.S. today are due to atherosclerosis . . . hardening of the arteries! You can help keep that biological rust out of your pipes by proper diet and a good running program. I assure you, you will feel better for it. One of our ministers in the group preached a sermon about it—it's not so much the accomplishment but the trying that counts. I think he's right. The trying will benefit your future, both mentally and physically.

Come on, join the club. Run for *your* life!! ★

Another MAC service. Audio-visual service team at work making Air Force film.

continued from page 11

and Recovery Squadron flew over 10,000 sorties and logged more than 20,000 flying hours in support of combat operations in Southeast Asia. Through mid-September 1967 ARRS has made 694 saves, 295 combat and 399 non-combat saves. The high-quality training received by these crewmen is the foundation of their efficiency and their esprit de corps is seldom equaled in any branch of the service.

The rescue and recovery schools at Eglin AFB, Florida, take minimum qualified helicopter pilots from the school at Sheppard AFB, Texas, and make them polished, standardized rescue and recovery pilots. They train fixed wing pilots to do their stuff in the HC-130 Hercules. Pararescue technicians are trained at Eglin to be precision parachutists who jump day or night into water, trees, jungles or mountains; SCUBA divers; jumpmasters; aeromedics; communications specialists; pyrotechnical experts; mountaineers well-versed in crash access (including legal aspects) and the recovery of NASA hardware. While learning these specialties their bodies are molded to near-physical perfection. In the process of graduating over 3000 pararescue technicians only one man has been injured badly enough to require hospitalization. These men are duly proud of their boss because Brigadier General Allison C. Brooks, Commander of the ARRS, leads his rescuemen by example. He has been snatched from the ground and water by the HC-130s and joins his troops in living their motto "That others may live."

AEROSPACE AUDIO-VISUAL SERVICE

Daily, Air Force pilots in SEA are documenting airstrikes against Communist forces, resulting in the best film footage ever obtained. They get clear detailed shots of Bullpup missiles impacting several miles in front of the aircraft and bombs falling several hundred yards behind. The Aerospace Audio-Visual Service designed the photo equipment upon which this new system is based. AAVS had a different purpose in doing so, however — the production of training and orientation films.

In addition to documentation of combat and experiments, AAVS produces and procures orientation and training films for indoctrination and information purposes. When you see a film introduced by a general or high ranking civilian, chances are he is seated in an "office" which is located in one of Audio-Visual Service's sound stages. AAVS will have some of the finest facilities of this kind in the world when the organization moves to its new studios located at Norton AFB, California.

Extensive film files are catalogued and carefully preserved for future reference and analysis. A worldwide network of film libraries is kept up-to-date so that Air Force personnel can have complete refresher and initial training material when and where it is needed. These aids are vital to Air Force safety efforts because they increase efficiency and safety as a by-product of any job well done.

ANG SUPPORT

In December 1965 "Operation Christmas Star" was initiated by the Department of Defense to carry gifts to our servicemen in Vietnam. This airlift was requested of the Air National Guard since MAC was heavily involved supporting Southeast Asia's military requirements. The response was immediate and so successful that MAC then asked the Air Guard to provide additional airlift on a monthly basis, airlifting military tonnage and personnel.

The response again was immediate and the Air Guard assumed the responsibility of 75 missions per month over and above all their other commitments. This support continued throughout 1966, resulting in 95,273 hours, 2500 overseas missions, airlifting 32,103 tons of military cargo and 26,386 passengers in support of MAC.

More than 600 of these flights went directly into South Vietnam. Their 25 heavy transport squadrons, operating primarily from civilian airports, also made 579 aeromedical evacuation flights for MAC, carrying 6375 sick and wounded, and 5727 other passengers from such offshore bases as Greenland, Bermuda, Puerto Rico, Cuba, Panama and Alaska. They also assumed the responsibility of regular runs to Australia and Spain, and twice-a-week support flights on the Atlantic Missile range, to Ascencion Island via Brazil and a weekly flight through the West Indies to Brazil and Argentina to support U.S. embassies and military missions. Their 200 transports completed 1966 with an unprecedented "zero" accident rate.

For 1966 MAC's aircraft accident rate was .70—less than one major accident per 100,000 hours of flying. That's flying jet and piston powered transports, helicopters, converted jet bombers—about 26 different kinds of aircraft. That's flying in all kinds of weather all over the world—from the poles to the equator. That's hauling people, missiles, Army tanks, explosives—you name it, MAC hauls it.

Indications are that the MAC rate for 1967 will be about the same as it was for the previous year. The curve over the years shows MAC gradually reduced its rate until the past five years. Since 1963 the rate has held almost constant—right around *one*.

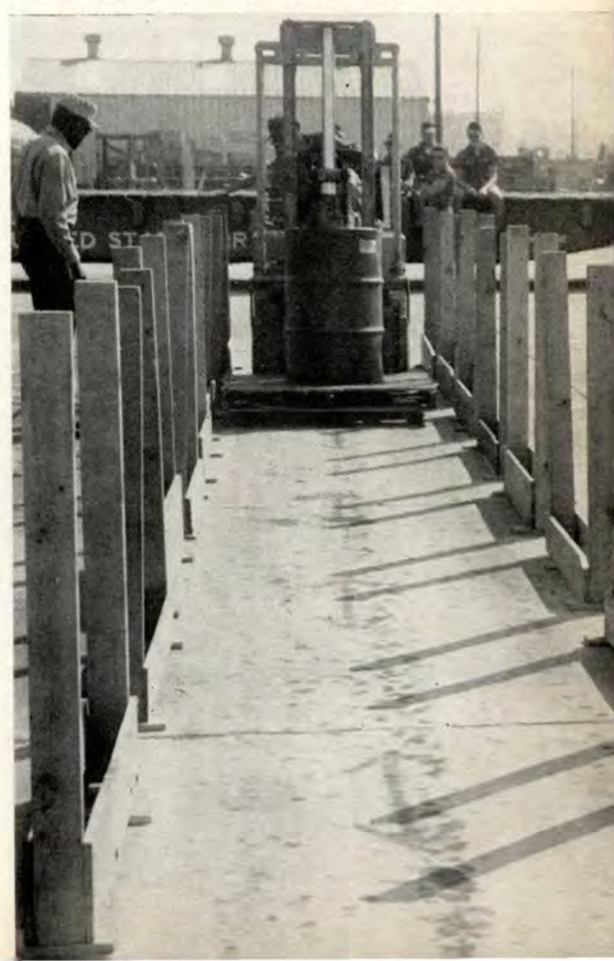
While this is quite an accomplishment, to fully appreciate it one must consider the factors influencing the accident potential during the past three years. The war in Vietnam caused the workload to increase faster than manning. This has meant longer working hours, accelerated operations with a tendency for shortcuts. The demands of the war put emphasis on *getting the job done*. Supervision has been stretched pretty thin. Crowded work areas, less time for training, while the need increased, presented a real challenge.

MAC has been meeting the challenge both by command-wide actions and local efforts. Safety education has been intensified, more emphasis placed on supervisory responsibility. Where the need is indicated, retraining and retesting are being accomplished. Locally, MAC wings have shown determination to keep accidents to a minimum. For example, the 63d MAW at Norton set up its own course for drivers of flight line vehicles. Incoming airmen, for the most part, were completely unskilled. Rather than risk damage to multi-million dollar aircraft, the wing set about training drivers in the classroom and on the equipment in a remote part of the base. The result: trained drivers, few accidents.

MAC has safety officers and safety organizations. But the command emphasizes safety as the result of professional performance. The results speak for themselves: MAC delivers the goods, anywhere, anytime. Safe! ★

Air National Guard C-97 at Da Nang. ANG crews fly heavy schedule for MAC, had "zero" accident rate in 1966.

Trainee negotiates obstacle course with forklift during training at Norton AFB.



ACCIDENT TRENDS—A review of aircraft accidents in recent months points out the absolute necessity for attention to detail by everyone concerned, from the designer to the aircrew member.

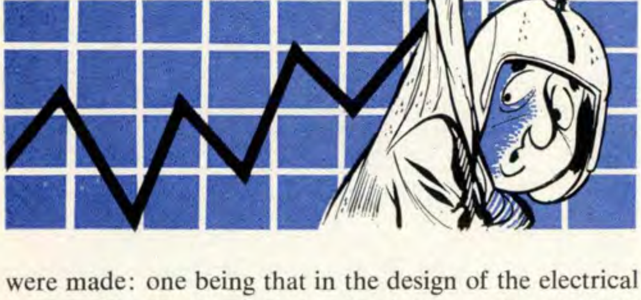
A four-engine jet transport crashed when the spoilers, unnoticed by the pilot, deployed on takeoff. It was a dark night and the only warnings the aircrew members had were the spoiler indicator and the green "takeoff light" going out. The spoiler indicator is hard to see, and almost unnoticeable if you're not expecting it. Pilots are not conditioned to react to the green "takeoff light."

The aircraft crashed into the bay approximately one mile from the end of the runway. The cause was pilot factor in that he missed a checklist item and failed to place the spoiler selector switch in the proper position. As a result of this accident the aircraft are being modified to include wiring the spoiler selector switch through the takeoff light so the correct position must be selected before the light will illuminate. Modification is also being accomplished for automatic closing of the spoilers when the throttles are moved to a high power setting.

Why wasn't this situation anticipated and corrected prior to this accident? We all knew that this could happen with the present design and through the grapevine we hear that it did happen to crews who, under more favorable conditions, caught it in time to prevent a crash. Reluctance to admit a mistake led to this not being reported. If crews are left with the feeling that only reprimand awaits the results of a mistake, we are defeating one of the most important aspects in our accident prevention program. If others can benefit from our mistakes, *let's get the word out!*

Then there was a four-engine cargo aircraft that ditched soon after takeoff because of a power loss on all four engines. Impossible? Read on.

Reviewing a previous accident report (on the same type bird—cause undetermined), a lot of conjectures



were made: one being that in the design of the electrical system, if one terminal was broken, power could be lost to all four propellers, causing them to go to a fixed pitch position. This could result in a flameout in all four engines. The cause of the ditching in the above

case was, as you have guessed, this very thing. Why wasn't something done prior to this accident?

Accidents involving supervisory factor appear to be on the increase. Failure to follow published directives has been indicated in several accidents; airfield surveys were not performed before sending the aircraft on an operational mission; airfield information was not given to the flight crews prior to dispatching them to the field. These and similar omissions are reported frequently by accident investigators.

If we are to eliminate these cause factors of accidents, then we've got to get at the details. If we do, the broad picture will take care of itself.

Maj Everett E. Ruble
Directorate of Aerospace Safety

FATAL BIRDSTRIKE—Recently a T-38 aircraft on a functional check flight for dual engine change was destroyed as the result of a birdstrike. During maneuvering for entry into the pattern the aircraft was observed to descend as if to land. The witness observed the aircraft for approximately one mile prior to impact. Analysis of the aircraft configuration revealed the landing gear and wing flaps were up and the speed brakes were probably extended. There was no attempt by the pilot to eject.

Analysis of material from inside the cockpit revealed bird remains in several areas. The front canopy bow on the right side contained bird feathers, muscle and lung on the mirror and on canopy fragments. Bird remains were also found on the rear instrument panel shock mounts. The flight surgeon member of the accident investigation board concluded that the pilot was incapacitated due to birdstrike at the time of the crash.

The recommendations of the accident board were:

- That immediate action be taken to modify T-38 aircraft with a thicker and stronger front canopy and windscreen.

- That expeditious action be taken to develop and procure stronger pilot helmets and visors.

- That this article be published and that all T-38 pilots be made aware of conditions surrounding this accident.

Since 1964 there have been two fatalities, three T-38s destroyed and 12 windscreen/canopy bird penetrations in the USAF. Action is being taken to expedite a modification to strengthen the windscreen and canopy of the T-38. A comprehensive study of birdstrikes with USAF aircraft was completed, and an article published in the November 1967 issue of *Aerospace Safety*.

Lt Col John F. Thornell, Jr.
Directorate of Aerospace Safety

MISSILEANEA

AIM-4D FALCON—The cooling gas exhaust port plug was discovered blown on six missiles aboard alert aircraft at four separate bases this year. The discoveries were made during down-loading operations; and in each case subsequent maintenance checks proved the squibs were blown. Proper reporting was accomplished, the appropriate AMAs are working on the cause, and a fix will be in the field shortly.

This sounds like well handled reporting and also like the end of the story. However, there is a sidelight which points up the safety officer's function as an "advisor" to the commander. His overall objective is the conservation of assets to achieve effective mission accomplishment. In only one report was mention made of the number of times the aircraft had flown with the missile aboard. Only this one report, and this one statement, reflected any concern for the impact of the incident upon the mission.

Since there are no procedures for inspecting the exhaust ports on AIM-4Ds between flights, the number of times the aircraft had flown with an unserviceable missile was unknown. Several questions arise:

Were the operations implications immediately brought to the attention of the commander?

Were all alert aircraft in each command inspected?

Were local procedures adopted for a quick post-flight visual examination of the exhaust ports until the AMAs could get a fix to the field? Let's not permit our safety interest to stop with the submission of the report. Keep the mission in mind!

Lt Col M. H. Jackson
Directorate of Aerospace Safety

TOM, DICK AND HARRY are three missile maintenance men assigned to a typical strategic missile wing. Each has an attitude placing him in the category of "an accident waiting to happen." Why do I place them in this category? They have different and adverse attitudes toward safety that have been developed over the years.

A brief analysis of their attitudes toward safety follows. Does it describe you?

Tom has the "Law of Averages" attitude. Nothing bothers him and he readily shrugs off accidents and near-misses. He proclaims to all who will listen that these mishaps are due to the law of averages. His feeling is that whatever he does or attempts to do will still end up with the law of averages and that someone is bound to get hurt sometime.

Dick has the "Other Fellow" attitude. He assumes that an accident always happens to the other fellow and never to himself. He seems to think he is luckier or smarter than the other fellow. The other fellow is not bright, or is a dope, and will become an accident victim.

Harry has a "Your Number is Up" attitude. He feels an accident just happens or it doesn't. Accidents are inevitable so when your number is up, you'll have one. Harry will insist that no matter what he or anyone else does to prevent a mishap, you can't beat the numbers racket.

As you can surmise, the above attitudes have an unfavorable effect on safety and the safety program. It is a known fact that accidents don't happen—they are caused.

Only when all personnel acquire a *positive attitude toward safety* and *think safety* can we eliminate accidents. The task itself cannot cause an accident but when Tom, Dick or Harry go to work—Look Out!

Lt Col William R. Robinson, Jr.
Directorate of Aerospace Safety

★

FALLOUT

FROM THE ANG

The October issue has several goodies, as usual; however for some reason I can't help but respond to the following:

- Ban the Bold Face Blues: As Ann Landers would say, "RUN, don't walk, repeat RUN," to the nearest (and farthest) offices as are necessary to implement this most important life-saving idea (although not new) since the invention of sliced bread. There *must* be some way the Chief IG can pressure using commands to institute this common language—common procedure in flight manuals in order to save our lives. You can bet your bottom buck that when our aircrews go to the next RF-84F flight manuals review board they will be instructed to *insist* the changes as outlined for emergencies in the Aerospace Safety article be made—yesterday.

- Throw Away X-C Checklists: In our Wing (with first line obsolete aircraft) you wouldn't believe the number of transient maintenance airmen who say, "I've never even seen one of these before." That's for our RF-84F's. Our RB-57A's they've never even heard of. The X-C (navigational training flight) throw away checklist is an excellent idea for this situation and I have already instructed our personnel to make them up for our aircraft.

- Well Done: Pro and Con (Fallout letter): I think I'll have to add my support to Captain Crouch, (AFRES) who wrote about the inconsistencies between Well Done awards and articles urging early ejection. This is *not* to take anything away from a Well Done award, mind you, but to speculate that if *any little* mishap had happened while a pilot tried to save a bird, he would be crucified for not jumping out as opposed to being a hero. I've been in dozens of discussions about this problem and unfortunately, due to circumstances, there is no one best answer, except, perhaps "to each his own," chances/decisions?

Lt Col Howard C. Strand
Base Det Commander
127th Tac Reconn Wing, Mich ANG
Inkster, Michigan 48141

Thanks for your comments.

ACM TRAINING

The cover of the August issue illustrating the article ACM Training is one of the most realistic pictures of the F-105s in action—for a former "Thud" pilot with 125 missions (100) up north.

This scene brings back memories of anxious moments when I was flying down "Thud Ridge" and having similar experiences as illustrated by the picture. I would greatly appreciate information as to where I could obtain a copy of it. The crewmembers in my squadron thoroughly enjoy the magazine and hope you'll keep up the good work.

Maj Philip A. Goodwin
Tyndall AFB, Florida 32401

ACM TRAINING

I have long enjoyed the excellent features in AEROSPACE SAFETY and have often thought about writing and expressing my appreciation. After reading Major Robert M. Bond's article "ACM Training" in the August issue, I've decided to write.

Please convey my thanks to Major Bond for his much-needed and very fine article. As a recent returnee from 100 missions in the F-105, I couldn't agree more with his statement that "this training must be accomplished prior to the crews arriving in the area of conflict or penetrating into that hostile environment." When you are coming down "Thud Ridge" with MIG-21's turning in is NOT the time to be going through one's ACM learning process. As Major Bond pointed out, there are countless instances where crews have encountered both SAMs and MIGs and survived only through the direct application of ACM.

My compliments also to your Art Editor, Mr. David Baer. His F-105/MIG-21 illustration is excellent. He has so completely captured the action that it immediately brings to mind the excitement of such moments. I have talked to others who have flown down "Thud Ridge" in the F-105 and this reaction is common to all. I would be most appreciative if I could get two large reproductions of this fine piece of work. If this is possible, please send them to my home address.

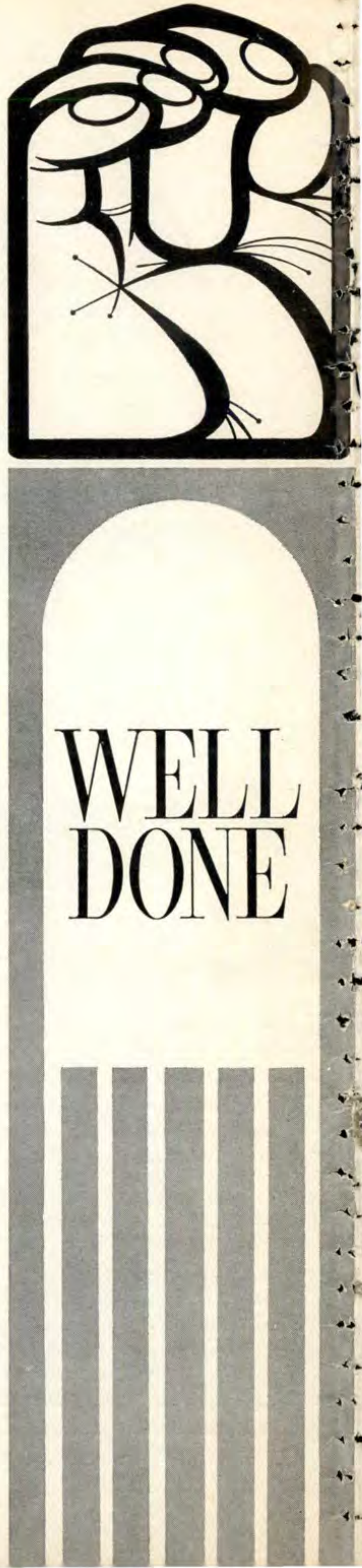
My thanks again to you and your fine staff.

Maj George R. Hennigan
2741B Delta Avenue
Tyndall AFB, Florida 32401

The artwork's on the way.

AEROBIT CORRECTION

The term "VFR positive control area" was used last month in an Aerobit item reporting on a near-miss between an Air Force trainer and an airliner. This terminology was unfortunate in that there is no VFR positive control area. What this referred to is a training area near an air base. Base aircraft are under local military control while in the area, but that is the extent of the control exercised.



☆ U.S. GOVERNMENT PRINTING OFFICE 1967 301-211/3

CAPTAIN
Robert D. Sweetwood

518 FIGHTER SQUADRON
U.S. MILITARY ASSISTANCE
COMMAND, VIETNAM

On 23 January 1967, Captain Sweetwood was flying as a wingman in a flight of A-1H Sky raider aircraft on a direct air support mission in RVN. During a rejoin with the VNAF flight leader, Captain Sweetwood heard a round of 20mm ammunition fire or explode in one of his right wing guns. He quickly rechecked the gun switches at "safe" and lowered the landing gear handle in an attempt to interrupt the gun fire circuit. Before the gear locked down, three more rounds exploded and a fire was observed in the right wing gun bay area. Captain Sweetwood immediately threw the gear handle back up, prepared to crash land in a rice paddy, and pulled his hydraulic bypass handle to relieve the hydraulic pressure on the lines in the fire area. The altitude of the aircraft at this time was approximately 2000 feet. The pilot attempted to open the canopy, but was unable to by either normal or emergency systems. He then encountered difficulty in keeping the right wing up, even with full left aileron and full left rudder. When the right wing continued to drop as he neared his intended touchdown point, Captain Sweetwood applied a burst of power to pick the wing up with propeller torque. As a result, the touchdown was smooth and level, with minimum damage resulting from the belly landing in the rice paddy. The pilot opened the canopy manually and departed the aircraft. A rescue helicopter extinguished the wing fire and picked up Captain Sweetwood.

After the A-1H was recovered, it was found that the linkage to the right aileron had burned through. The cause of the fire and explosion in the right gun bay was attributed to ground fire. The aircraft is in repairable condition because of Captain Sweetwood's decision to dump hydraulic pressure and minimize the intensity of the fire, and because of his skillful use of propeller torque to counteract wing roll. Captain Sweetwood's cool analysis and skillful reaction to a rapidly compounding emergency saved the Vietnamese Air Force a valuable combat aircraft and reflected great credit upon the USAF Advisory effort. Well Done! ★

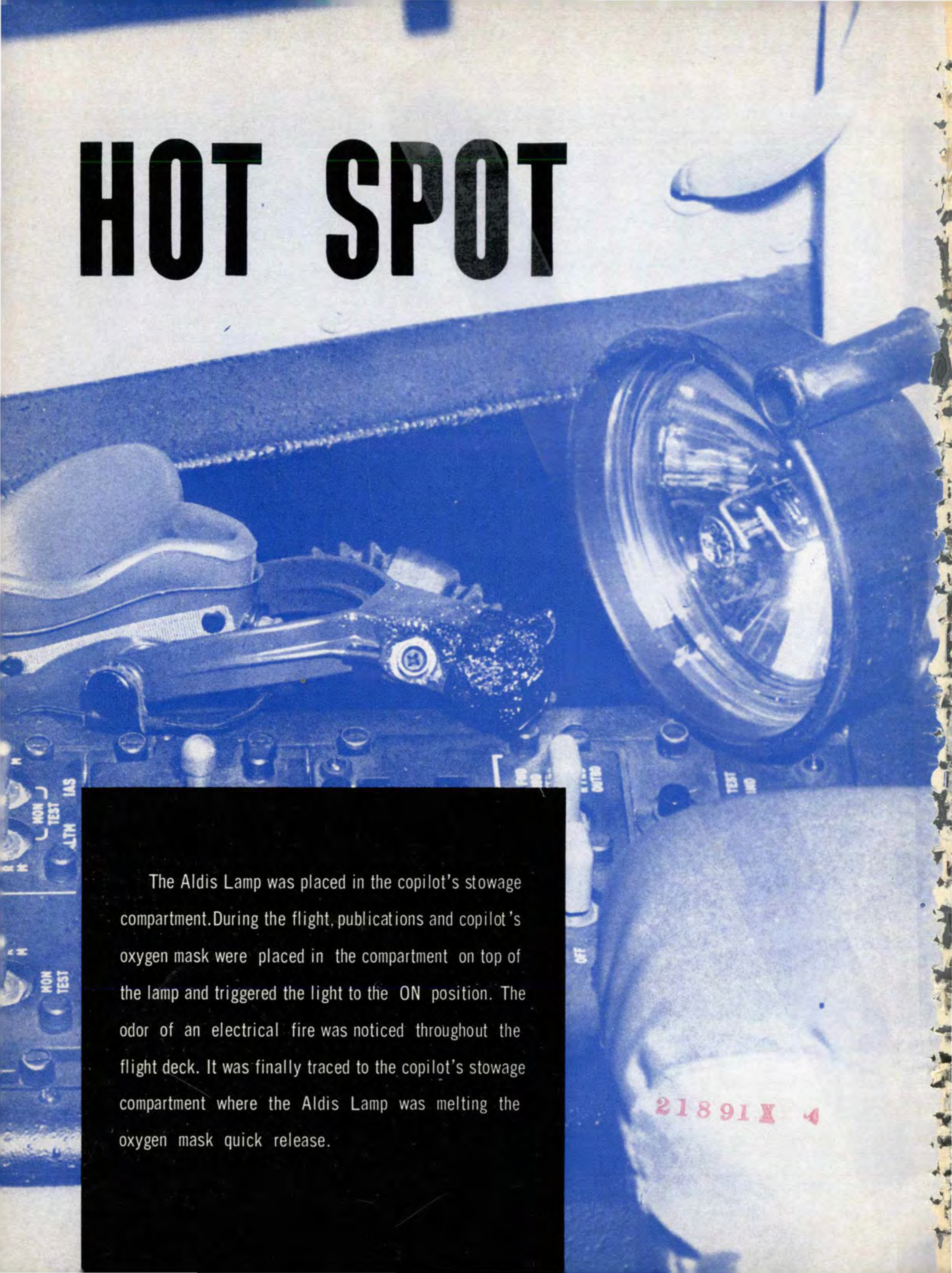
CAPTAIN
Fred R. Golish

82 FIGHTER INTERCEPTOR
SQUADRON
APO SAN FRANCISCO 96235

On 28 October 1966, Captain Golish was at 45,000 feet on a day practice intercept mission, acting as target for another F-102. Following the intercept, Captain Golish felt a jolt in the aircraft and saw his "AC Power Failure" light come on. The AC generator could not be reset and an immediate return to base was begun. After declaring an emergency, he requested the other F-102 to join up as chase. During the turn to home base, the oil pressure fluctuated and the oil low pressure light came on. As chase relayed information, Captain Golish began a climb to 47,000 feet, requested air-sea rescue and attempted to jettison his tanks. Only the left one parted the aircraft. At 70 miles from Naha, rpm decayed rapidly and was followed by fuel flow fluctuations and rising EGT. The throttle was stop-cocked at 850° EGT, rpm 85 per cent and falling. When hydraulic pressure dropped to 800 psi, the RAT was dropped. As Captain Golish reached the field at 20,000 feet, the aircraft began to oscillate and did not cease until the gear was lowered on the emergency system at high key (12,000 feet). On base leg at 5000 feet, airspeed was increased to 250 KIAS and Captain Golish rolled out wings level at 3000 feet. Once assured the field would be made, he dropped the hook and leveled at 100 feet to clear the BAK 9 at the approach end. Touchdown was near the 4000-foot mark and the drag chute was deployed. The second BAK 9 was engaged at approximately 50 knots with no damage to the aircraft.

Captain Golish displayed outstanding ability and exceptional flying skill when faced with a hazardous flight condition that could have resulted in the loss of an aircraft and possible injury to himself. Well Done! ★

HOT SPOT



The Aldis Lamp was placed in the copilot's stowage compartment. During the flight, publications and copilot's oxygen mask were placed in the compartment on top of the lamp and triggered the light to the ON position. The odor of an electrical fire was noticed throughout the flight deck. It was finally traced to the copilot's stowage compartment where the Aldis Lamp was melting the oxygen mask quick release.