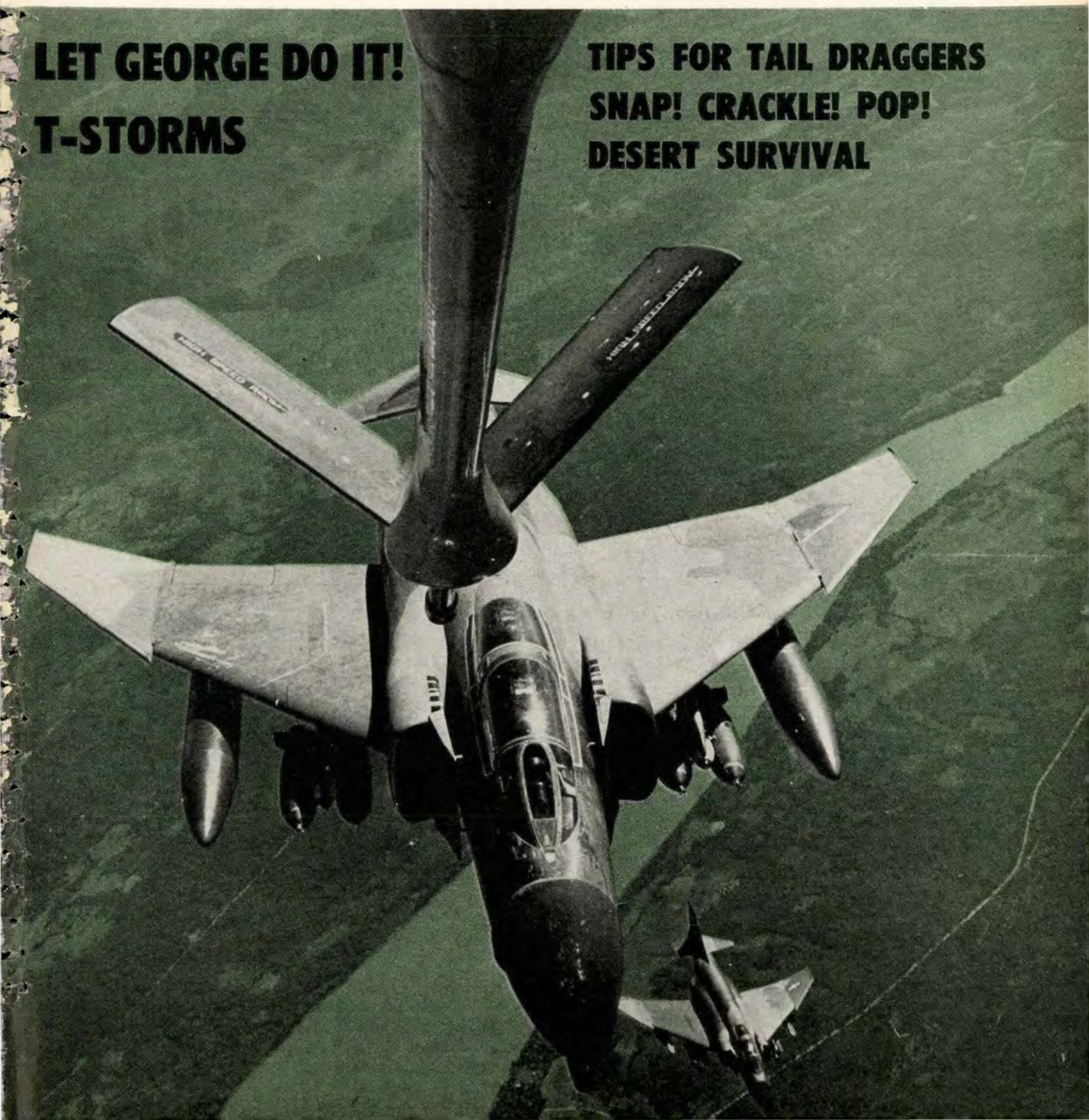
UNITED STATES AIR FORCE • MAY 1968

Aerospace SAFETY

THE MAGAZINE DEVOTED TO YOUR INTERESTS IN FLIGHT

LET GEORGE DO IT!
T-STORMS
TIPS FOR TAIL DRAGGERS
SNAP! CRACKLE! POP!
DESERT SURVIVAL



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SPECIAL FEATURES

REGULAR FEATURES

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PREFLIGHT

How would you like to fly an airplane that does almost everything for you except file the flight plan? **Let George Do It,** page 2, describes systems in the C-5 that almost relegate the pilot to passenger status. But not quite, of course. By contrast, jocks flying aircraft with conventional gears sometimes have more than their hands and feet can handle. For a little advice on landing these birds see **Tips for Tail Draggers** on page 6.

How far will a writer go for a story? Well, Grover Tate, a frequent contributor to **Aerospace Safety** and other safety magazines, went to Death Valley last August to get the story on desert survival beginning on page 18. Death Valley can be pretty doggone hot in winter, but in mid-summer the daytime high temperature is likely to hit around 120°-130°F. Tate has been to survival schools, lives on the desert — he works for Convair in the F-111 program at Edwards — and is an Air Force Reserve navigator. Consequently, he knows something about the desert and its hazards, but he learned a lot more during his "research" on this story. One thing we got out of it is that real concentration during desert survival training may turn out to be a priceless insurance policy.

Our cover photo of an F-4C breaking away from the boom of a SAC tanker over Southeast Asia was the 1967 AAVS Picture of the Year contest winner. The photo was taken by SSgt Howard W. Fisher, Detachment 9, 601 Photo Flight, Udorn Royal Thai AFB, Thailand. ★

THE MEN ON THE MIKES

When a pilot is in trouble in the air to whom does he turn? Chances are it's to a man he's never seen and possibly never will. His ace in the whole is a voice that radio technology has tied electronically to the man in the cockpit. Many of these voices belong to controllers of the Air Force Communications Service. How well they do their jobs seriously affects the fortunes of many Air Force crews. Last year, for example, AFCS controllers saved 180 aircraft, 147 of them military airplanes. An aircraft saved means lives saved and missions completed. Well, 577 persons owe their lives to these invisible voices; there were 81 saves in Southeast Asia, many of which involved tactical fighter bombers.

This is an impressive record but the total picture since AFCS was created on July 1, 1961, is even more striking: 866 aircraft carrying 2615 people were saved. Military aircraft totaled 735 valued at $825 million. Talk about cost effectiveness!

What exactly is a "save"? AFCS defines a save as "the safe recovery by AFCS controllers of an imperiled aircraft through extraordinary and timely application of traffic control knowledge, technique and procedure where there is reasonable doubt that the aircraft would have been recovered without such action." Saves must be documented and each one proposed is evaluated by a Headquarters AFCS Save Review Board. When the board authenticates a save the controllers involved receive a certificate.

Some saves result from pilots asking for assistance; others are due to the alertness of controllers who recognize a dangerous situation developing and do something about it. An example of the former involved a C-130 lost while flying in mountains in Southeast Asia. Lacking navigational equipment, the aircraft very possibly would have hit a 3900-foot peak directly in its flight path. Controllers of the 1972d Communications Squadron at Da Nang vectored the aircraft around the mountain and through a narrow valley toward the base where the crew made a safe landing.

Or how about this one?

Two F-4Cs missed their approach to the runway at Phan Rang during a severe thunderstorm and low visibility. The pilots requested a "straight shot to runway 22" but were informed the runway was not approved for approach due to extremely high terrain. The pilots reported they were on emergency fuel and would have to use the runway or "punch out."

Now aware of the extent of the emergency, the controllers started directing the aircraft for an approach to the runway. Starting at 6000 feet, they "stepped" the planes down to progressively lower altitudes as they passed each high peak. The aircraft broke out of the thunderstorm approximately three miles from final approach and at minimum altitude, the pilots executed a straight-in approach to runway 22 and the emergency was over.

A couple of controllers of the 1974th Communications Squadron in the tower at Korat Royal Thai Airbase, Thailand, provided a good example of heads up thinking. A pair of F-105s landed and the drag chute on Nr 1 opened normally. Nr 2 landed a bit long and no drag chute appeared. The men in the tower saw that 2 was overtaking lead and notified lead to move over. Nr 2 passed with only a few feet to spare. Then his chute opened and the pilot managed to stop just short of the barrier.

One of the strangest saves involved (1) a woman, (2) her car, (3) an Air Force C-141 on takeoff. Lights reflecting on snow alerted the controllers that something was amiss. First, they called the C-141 pilot to abort, then they sent a vehicle out to investigate. A confused woman driver was led off the runway and eight minutes after the initial takeoff attempt the C-141 was on its way.

The responsibilities these controllers bear are mighty heavy. And they frequently aren't appreciated. It wouldn't take much effort for the jocks to drop in once in awhile and give them a pat on the back. ★

After reading this article you may wonder what pilots do. Well they turn knobs and . . .

LET GEORGE DO IT

S. H. Smith and H. A. Valery, Lockheed-Georgia Company

"THIS C-5 feels good manually. Let's set up George and let him do some of the work," said Major Jackson to Captain Kern.

The glistening new C-5 was cruising straight and level at 10,000 on a crew familiarization flight. Major Jackson looked down at the Automatic Flight Control Systems (AFCS) control panel. The MASTER POWER was on since the IAS/HOLD ADJ and the MACH/HOLD ADJ has previously been used to set up a reference indicated airspeed and mach number. Major Jackson depressed the PITCH and LATERAL pushbuttons to engage the basic autopilot.

"We have her in the attitude mode now?" questioned Captain Kern.

"That's right," said Major Jackson. "We can control her by using the pitch and turn knobs on the AFCS panel, or by using the control wheel and its associated control wheel steering function. Now let's climb up to 30,000. I'll engage IAS/MACH on PITCH. Give me climb power."

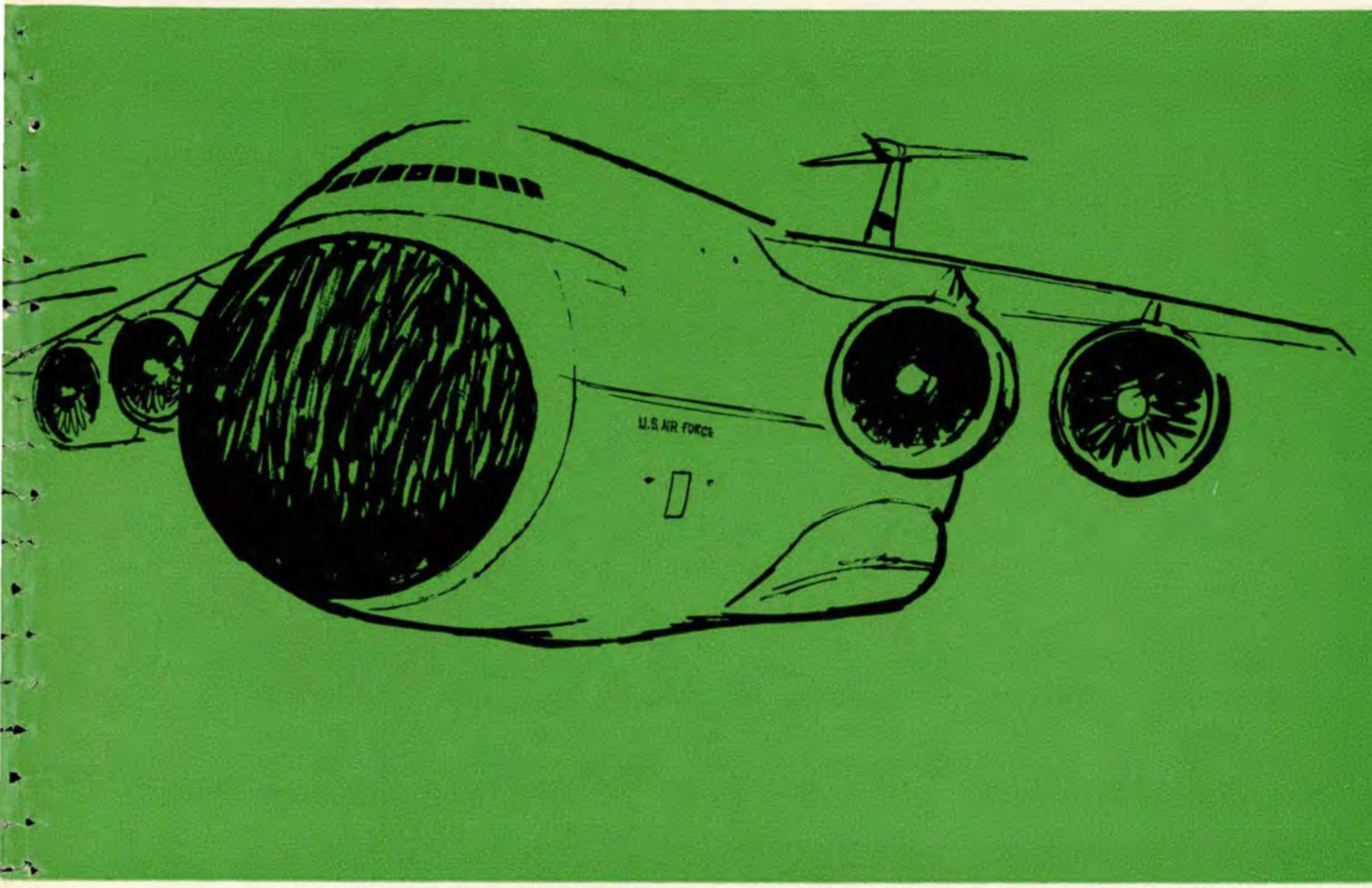
"Power set," said Captain Kern. "Are we on IAS or MACH on PITCH now?"

"We are on IAS on PITCH. IAS is the initial reference mode. Notice that we are now climbing automatically to hold our engagement speed. Look, I'll increase my IAS command marker five knots using the IAS/MACH reference switch. You can see the pitch down adjustment by the AFCS to compensate for the new airspeed reference."

"And now we'll hold the new IAS reference?" asked Captain Kern.

"That's correct," said Major Jackson. "Now, we need to set up to capture 30,000. I'll depress my ALT MAN pushbutton, slew my altitude command marker to 30,000, then depress the ALT CAPTURE pushbutton on the AFCS control panel. The aircraft will continue its climb until it arrives at the altitude capture point. Here, the ALTITUDE CAPTURE mode activates and levels the aircraft at 30,000 feet.

... oh yes, push buttons. Mostly, though, they . . . .



...AUTOMATICALLY!

The IAS/MACH on PITCH mode is disengaged automatically as the ALTITUDE CAPTURE mode activates. When the aircraft arrives at the selected altitude, ALTITUDE CAPTURE deactivates and ALTITUDE HOLD activates."

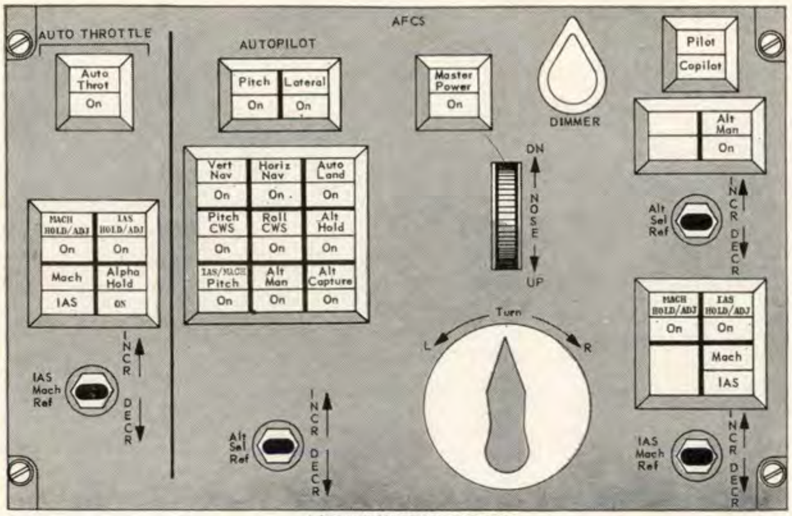
"That ALTITUDE CAPTURE feature is a good safety device," observed Captain Kern.

"Yes, it is," agreed Major Jackson, "and there are many more areas where safety has been included in the AFCS design. For example, during the climb to 10,000 I monitored the basic autopilot at all times to assure proper operation. Had a failure occurred, the autopilot would have disengaged and we would have noticed the AUTO caution light illuminate. Also, an annunciator light would have illuminated to indicate the basic area in which failure occurred."

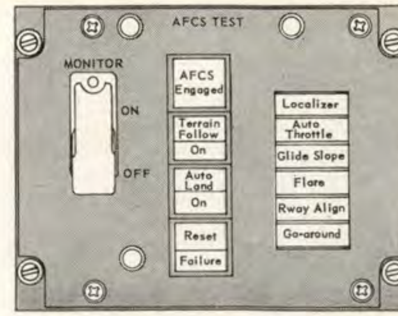
"Is that the only safety feature designed into the AFCS?"

"No," replied Major Jackson. "The automatics on the C-5 have been designed with us in mind. Just a few of the features which yield added safety include:

- A control panel designed so we can see if the mode we select has been engaged or determine at a glance what is left engaged.
- A transfer switch so you can take over control and relieve me during long trips.
- Failure monitoring. The master and annunciator lights keep us informed of the subsystem status.
- Redundancy is used where a failure could involve safety of flight.
- In the event of failure of one axis, the axis failed is disengaged.
- During approach or coupled operation a failure of the coupled signal automatically disengages the mode and the autopilot goes to attitude hold.
- Incompatible or failed functions will not engage.
- We can override the automatics at any time.
- Enroute test is available for automatic landing and terrain following modes."



LOCATED ON CENTER CONSOLE



Automatic Flight Control System panel (left) located on center console. AFCS test panel (above) used to check terrain following and auto-landing modes.

"I see what you mean about safety, but what about the operational capabilities?" asked Captain Kern.

Major Jackson explained, "The C-5 AFCS provides an increased automatic capability for us. Available modes include:

"Attitude Hold. If the pitch or lateral axis is engaged, the aircraft is stabilized with respect to the gyro attitude existing at engagement.

"Control Wheel Steering. Automatically selected when an axis is activated. Permits signals to the autopilot to be generated from movement of the control wheel as well as the control panel pitch and turn knobs. Dual sensors are used in each control wheel and are monitored.

"Altitude Hold. The altitude existing when this mode is engaged will be the aircraft reference altitude about which the air vehicle will be held.

"IAS/Mach Hold and Adjust on Pitch. Aircraft pitch is automatically adjusted to maintain a selected air speed or Mach.

"Altitude Capture. Allows a selected altitude to be preset, and the system armed to acquire the set altitude. At a point prior to the selected altitude, ALTITUDE CAPTURE automatically engages and levels the aircraft at the selected altitude. As the altitude is acquired, the ALTITUDE CAPTURE mode deactivates and ALTITUDE HOLD automatically engages.

"Automatic Approach. We may fly an automatic ILS approach by selecting VERT NAV and HORIZ NAV on the AFCS control panel. We may make the approach using either of two ILS receivers.

"Auto Land. This is a fully automatic landing mode that includes approach, flare, and initial rollout. I set runway heading on my horizontal situation indicator (HSI), select the proper ILS frequency on VHF NAV #1, and select VOR/ILS #1 on my navigator selector panel. I have to select HORIZ NAV and VERT NAV on the AFCS control panel before I can select AUTO LAND. With this setup both VHF NAV's are available for use automatically. At glide slope capture there will be an automatic final approach test. This test checks the monitoring circuitry associated with the final portion of the landing. We will engage the AUTO THROTTLE system to maintain the airspeed/angle of attack reference. During flare the rate of descent will be smoothly decreased and the throttles automatically positioned to accomplish the touchdown. The C-5 crosswind gear capability is utilized during crosswind AUTO LAND touchdown, localizer steering with rudder will control our initial rollout. Many of the circuits involved with the AUTO LAND mode, such as the flare computers and couplers, are triple redundant to increase operational capability as well as add to their safety. Also we can monitor the progress of the landing with our instruments.

"Automatic Go-Around. Provides us with the capability of an automatic go-around maneuver when either of us depresses our GO-AROUND button if the pitch axis is engaged. The roll axis will revert to wings level attitude hold. Any AUTO THROTTLE mode in use will be disengaged and the throttles automatically advanced to go-around power. Pressing either GO-AROUND button a second time will disengage the go-around mode and the pitch attitude existing at that time will be held.

"VOR. To prepare for VOR operation, I select VOR frequency on VHF NAV #1, set the desired radial on my HSI, select VOR/ILS #1 on my navigation selector panel, and select HORIZ NAV on the AFCS control panel. An intercept heading is flown until the selected radial is reached, then the radial is automatically captured.

"TACAN. This is similar to VOR except the TACAN #1 control panel and TACAN #1 navigation selector panel push button are used.

"Inertial Heading. The inertial doppler navigation equipment supplies a constant inertial heading for autopilot heading reference.

"Destination Heading. The inertial doppler navigation equipment supplies an autopilot heading reference towards a pre-selected destination.

"Course Line. The inertial doppler navigation equipment supplies data which allows the autopilot, after intercept, to capture and fly a desired track.

"Heading Select. The autopilot heading reference is supplied from my HSI. In effect, I can control the autopilot lateral movements with my HSI heading set knob.

"Vertical Navigation. The primary navigation computer supplies data which enables the autopilot to fly a selected vertical program. The vertical program may be either a flight path between two selected points or from present position along a selected flight path angle. This mode is compatible with the enroute navigation modes of the inertial doppler navigation equipment and autopilot.

"Automatic Terrain Following. The multi-mode radar supplies data to control the autopilot in the pitch axis. Command signal failure will result in an automatic fly up by the autopilot. Command information may be monitored by either of us on our attitude director indicator (ADI) and on our multi-mode radar scope. The heading select mode may be used to control the autopilot lateral axis.

"Radar Approach. This mode provides a self-contained, automatic, ILS type radar approach capability. mand marker by use of the IAS/ The multi-mode radar and the primary computer supply horizontal and vertical steering signals for the autopilot and flight directors. Command (ILS type) information may be monitored by each of us on our ADI. Glideslope angles from two degrees to seven degrees may be selected by the navigator.

"Air Drop. The inertial doppler navigation equipment supplies data similar to the course line mode, but the signal scaling is different to provide the necessary accuracy."

"This is a lot of capability, but what about the automatic throttles?" asked Captain Kern.

"The automatic throttles have the capability of controlling the airspeed, Mach number, or angle of attack of the C-5 within its altitude, airspeed, and maneuvering envelopes," explained Major Jackson. "Available modes include:

"Direct Throttle. Provides for remote positioning of the throttles through operation of the pilot's or the copilot's IAS/MACH REFERENCE switch.

"Alpha Hold. The angle of attack existing at engagement will be maintained through automatic throttle control.

"IAS Hold and Adjust. IAS existing at engagement will be maintained through automatic throttle control. IAS reference may be changed by slewing the vertical scale flight instrument (VSFI) IAS com-MACH reference switch. The throttles will automatically adjust to the new IAS reference. If the Mach changeover point is reached while in this mode, the automatic throttles will transfer from IAS to Mach.

"Mach Hold and Adjust. This is the same as IAS (above) except Mach is the reference signal. If the IAS changeover point is reached while in this mode, the automatic throttles will transfer from Mach to IAS.

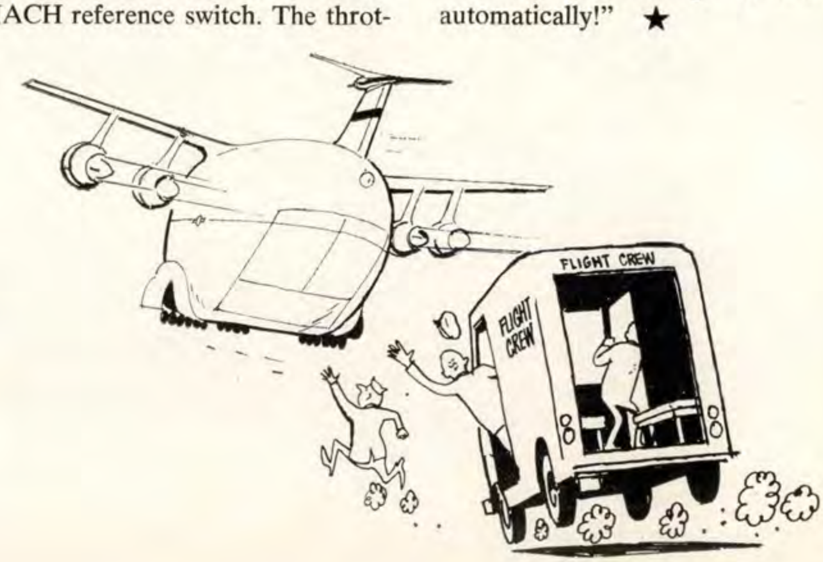
"Go-Around. When the pilot's or copilot's GO-AROUND button is depressed, any engaged automatic throttle mode will be disengaged and the throttles will be automatically advanced to go-around power. The throttles will then revert to the direct mode.

"Flare. A signal from the flare computer during an automatic approach will cause any engaged mode to disengage and the throttles to automatically retard at a rate compatible with the flare characteristics of the C-5."

"What's this AFCS test panel for?"

"Your AFCS test panel permits pre-operational inflight test of the Terrain Following and Auto Land modes," explained Major Jackson.

"This C-5 system does indeed have wide operational capability," exclaimed Captain Kern. "I see why we can say let George do it . . . automatically!" ★



LISTEN to the bar talk from some of the old timers and you'll swear it takes some sort of super human to fly one of the old conventional geared aircraft. True, a few of these beasts do require a little more of your attention during ground operation, but none demand more than you can give. It does help to know some of the pitfalls though. The first one, after you've managed to learn how to S in order to see over the big nose (of an A-1 or F-51) occurs on takeoff. Be very conscientious about rudder trim and throttle friction. The rudder should be trimmed as per the pilot's handbook and you want sufficient throttle friction to hold that throttle forward once you put it there. But let me digress with a couple of stories.

Back during the Korean peace action, a young rather vocal troop transferred into our Mustang outfit. He'd just graduated from an experimental class—had flown nothing but jets and was very disappointed because he'd been sent to fly old fashioned fan type fighters. He made a lot of noise about this and how, with his jet training, it was a big step back and down. The people who checked him out either didn't give him much of a briefing or he didn't listen because his first hop in the wiley 'Stang was a beaut. He left the rudder set at neutral, got lined up on the runway, rammed the needle to that big Packard AND PUSHED THE STICK FORWARD TO GET THE TAIL UP. The bird jumped about a hundred feet, pivoted on its left wheel as the combination of torque and gyroscopic effect took over. He was able to correct, but by then the bird was exactly 90 degrees to the runway and already slamming through the fence around a motor pool located adjacent to our airstrip.

The lesson is obvious. Trim the bird, have that right rudder in before you start adding throttle, then ease on the throttle and don't get in too big a hurry to pick up the tail. Picking up the tail creates a

THIS ARTICLE IS FOR YOU PEOPLE WHO ARE FLYING O-1's, A-1's OR OTHER CONVENTIONAL GEAR AIRCRAFT FOR THE FIRST TIME

TIPS FOR TAIL DRAGGERS

Lt Col Karl K. Dittmer, Directorate of Aerospace Safety

tendency to swing left in direct proportion to the speed of rotation. This is true of all prop types to some degree, but is less than gentle on those that swing a big heavy prop.

My second story is about my own initial flight in a Mustang. I checked out in a B-model, one with the old birdcage canopy. The unit used this particular bird for training because it continually gave trouble and no one liked to take it on combat missions. No sense risking a good bird on training. I got it off OK, although the acceleration left me 'way behind the situation. I reached for the gear and the throttle eased back. I pushed the throttle forward, reached for the gear and the throttle came back again. After repeating this three or four times I wised up and flew with my knees until I could get throttle friction tight enough to hold the throttle in place. This may sound like a nit-picky item but I saw one lad almost fly back into the ground while going through this drill.

But back to ground loops. Most occur during landing, and are often set up on final approach. If the bird is drifting sideways at touchdown or if you're too hot and let a drift set in while you're trying to get the bird to sit down, it will almost always start to swing. The front wheels being forward of the c.g. stop the front end from drifting but the rear tries to keep right on going sideways—unless you have the tailwheel down firm.

The cure is simple to talk about but not always so simple to practice. Kill your drift just prior to touchdown and put 'er on three point or slightly tail wheel first and hold full back stick to keep the tail down. If you drop a wing in order to kill drift, and this is the most consistent way to insure that drift is killed at touchdown, then be prepared to correct a sudden swing into the wind when the other main

gear touches. A little rudder and a light tap of brake at this point can save a lot of effort a few seconds later. But if she does seem to get away from you, DON'T GIVE UP. Fight her all the way using hard brake, full rudder and full aileron and, if it seems appropriate, a blast of throttle to increase rudder effectiveness. The throttle is open to argument. If you are able to stop the ground loop, the throttle may have helped and no one hears about it. If you are unable, at least one member of the board will say the burst of power added to the severity.

Flaps will increase the bird's tendency to weathervane when you're landing in a crosswind. If you need a steep approach to keep from tempting Charlie, best slip the bird or use some other technique to steepen the approach.

If wheel landings are your piece of cheese, then expect the bird to swing when you let the tail down. On some birds, the rudder is ineffective once the tail is down—and the swing starts before the tailwheel makes contact.

Ground loops later during the landing roll are generally less severe and are usually caused by daydreaming or by trying to turn off at excessive speed. Think back to when you were taxiing out. If you had to S, you started the turn with a little rudder or by tapping brake, then almost immediately you had to start coming in with rudder on adding a touch of opposite brake to keep the turn from tightening. You were taxiing pretty slow—a must for tail draggers—and had little trouble maintaining control. But if you were to increase the speed you'd soon have your hands full. So, do as the old timers always cautioned. Don't relax 'til you have the beast in the chocks and shut down, and always make sure you have her slowed to normal taxi speed before you try to bend her off the runway. Like any other phase of flying, it's much easier to stay on top of the situation than to regain control. But if you do lose control on the ground, don't lose your cool, which reminds me of a story.

An acquaintance was waiting to take the active at Amarillo one winter during the war and the place was a sheet of ice, which isn't too unusual for Amarillo in the wintertime. As he waited, a WASP—female ferry pilot to you younger types—entered traffic in a Mustang. She'd no sooner touched down than the bird swapped ends, slid backwards a few hundred feet, ending up well off on the shoulder. About all the tower operator could see was the snow she blasted into the air. He radioed, "P-51 that just landed, are you all right?"

Without pause a slightly miffed female voice came back, "Hell yes! I land the &%$*## this way all the time!" ★

T-STORMS...

Ed Minser

TWA Director of Meteorology
Kansas City, Mo.

Reprinted from
FLITE FACTS, July 1967

ABOUT THE AUTHOR

Edward J. Minser, TWA Director of Meteorology and author of this article, died January 14 at the age of 64. A pioneer meteorologist, Mr. Minser made many outstanding contributions in his field. His study of North Atlantic weather led to the development of pressure pattern flying, and he was author of an Air Transport Command study guide in World War II. In addition to TWA, Mr Minser served in the U.S. Navy and the U.S. Weather Bureau.

THUNDERSTORMS are usually classified as local or air-mass, squall line or prefrontal, and frontal or cold-front. This classification associates them with specific features of a synoptic chart, establishes the extent and intensity expected as the storm reaches maturity, and also the rate and direction of movement.

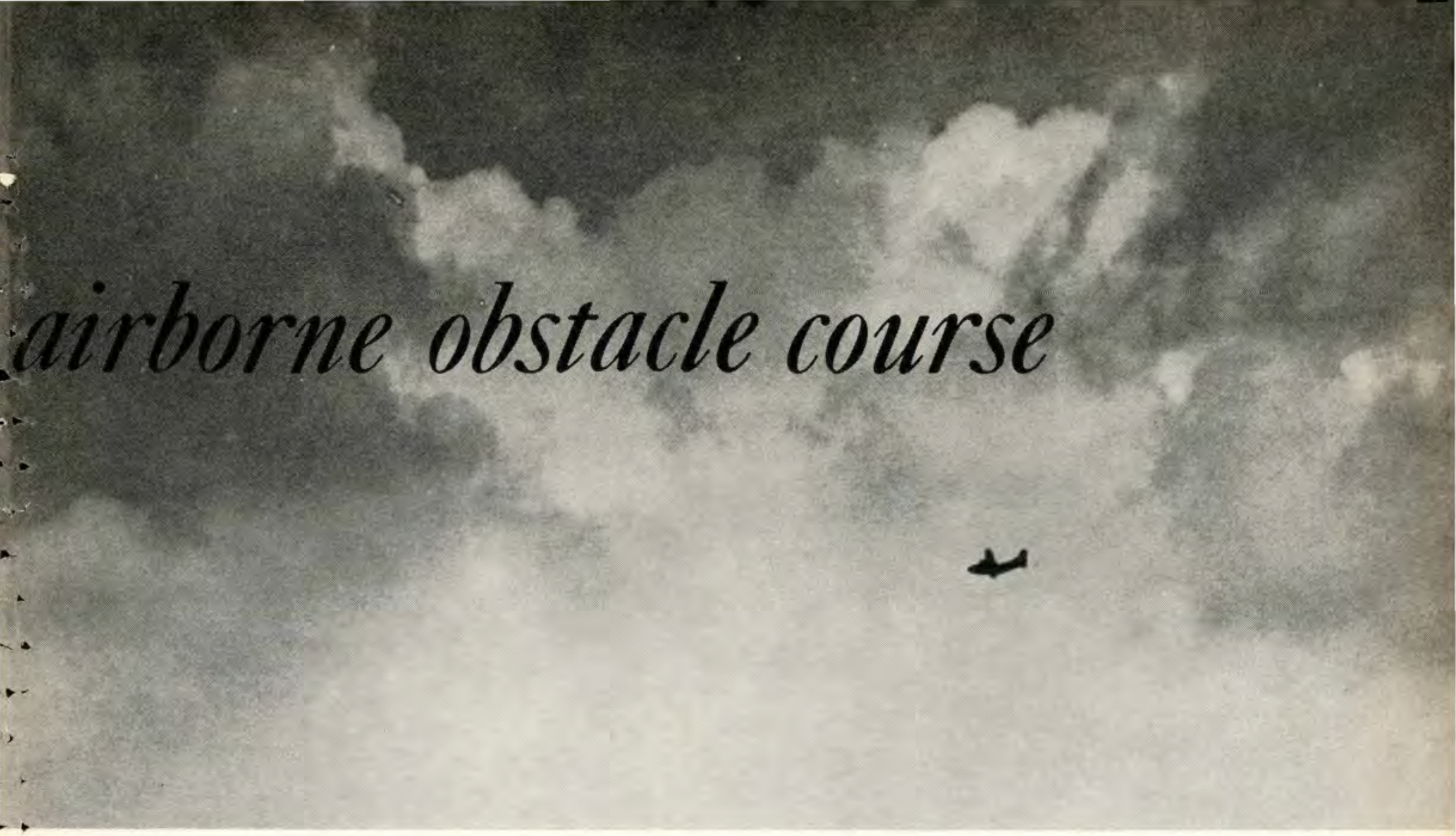
High surface temperatures are required for the development of thunderstorms, but it is equally essential to have a conditionally unstable lapse rate and a high relative humidity in the lower layers to provide the moisture from which subsequent release of latent heat is necessary to support development of the cumulonimbus cloud.

An essential process in the formation of a cumulonimbus cloud is glaciation that occurs around the cloud dome and forms the cirrus anvil that characterizes thunderstorms. In this process, the moisture in the air surrounding the dome forms directly into ice crystals. These crystals provide the nuclei of raindrops. It is a general postulation that rain from a cumulus cloud will not occur until the dome becomes glaciated.

IN THE TROPICS

The above-mentioned axiom does not hold true in the tropics where an abundance of water vapor is present in the lower layers of the air mass during the rainy season. Cumulus clouds that develop over islands, along the coasts, and sometimes over inland barren ground produce heavy rain showers, usually of short duration, through the coalescence of cloud droplets. Temperature in the cloud tops is usually well above the freezing point in this type of shower.

In the tropics, thunderstorms occur most frequently during the wet season which is normally May to September. During these months the southwest monsoon of southern Asia carries heavily moisture-laden air from the equatorial oceans. A similar supply of moisture-laden air is available in the equatorial Atlantic, and is carried into the Caribbean



Sea and the Gulf of Mexico by the southwest trade winds during the summer and fall seasons, to nurture the showers and thunderstorms that are of almost daily occurrence over the islands and the bordering continental coasts.

Thunderstorms occurring in the tropics should be treated with the same respect given extratropical storms, because they can and do produce moderate-to-severe turbulence and excessively heavy rain.

Tropical rain showers usually form in the early afternoon and are of short duration, seldom continuing after dark. However, thunderstorms usually develop during late afternoon, reach maturity after dark, and may continue until early morning. This is especially true where the terrain slopes upward from the sea coast, orographic lifting being sufficient to produce instability after the surface temperature of the day diminishes. Such storms usually remain stationary and are characteristic of India, Burma, the Malay Peninsula, and those islands having mountainous terrain.

Another characteristic of tropical thunderstorms is their formation at night over the oceans where radiated heat from the ocean surface and the cooling of the upper air, also by radiation, produces an unstable lapse rate. Such storms may grow to heights above 30,000 feet, and may persist until sunrise. They are usually isolated and can be seen at distances exceeding 100 miles because of brilliant lightning throughout the cloud.

In certain areas of the tropics, thunderstorms occur during the winter months where the northeast monsoon (or northeast trade winds) have a trajectory over warm water and encounter orographic lifting along a coastal mountain range. The east coast of Vietnam, Puerto Rico, and Ceylon are areas where such storms occur during the dry season.

LOCAL THUNDERSTORMS

In the middle latitudes this type of thunderstorm most frequently occurs during spring and early summer, developing from cumulus clouds during the early afternoon and rapidly reaching maturity. These storms are usually isolated within an unstable air mass, and an individual storm will usually dissipate within an hour after the first rainfall. However, other storms can develop in the general area, and this sequence of developing and dissipating storms may continue after dark until midnight or later.

Being isolated and consisting usually of a single cell, local thunderstorms can be circumnavigated with ease. To avoid the possibility of encountering hail falling from the anvil top, a flight path at least 20 miles from the main cloud should be selected, particularly in passing under the overhanging cirrus or mammatus decks. There is no positive way of determining whether or not hail will be associated with a particular storm, nor can the time of occurrence or location of fallout be gaged. However, there are certain characteristics usually associated with hail-producing storms which can be readily observed, particularly from the air, that will alert a pilot of this hazard.

A hail-producing storm must penetrate to extremely high levels where the temperature is less than —20°C, and have a well developed anvil top with the characteristic mammato base. This cloud form indicates the presence of a strong outflow from the central cell that carries super-cooled and frozen water drops away from the core.

A second characterisitc of a hail-producing storm is its downwind slant produced by a steady increase in wind speed with altitude. If this shear is too large or variable the cloud mass will be distorted. In some cases the upper portion of a cloud becomes separated from the lower section, producing a local area of cirrus. Such tensions will distort the vertical flow of unstable air and the cloud mass disintegrates or becomes cumulus congestus, producing occasional showers.

With a fairly constant vertical wind shear maintaining a downwind slope of the towering cloud mass, the hail and super-cooled water are carried outward from the core and fall either through the clear air or in the fringe of cloud surrounding the cell.

Complete knowledge of the structure and mechanism of a hail-producing thunderstorm is lacking, and it is impractical to endeavor to anticipate when or where hail will fall or to determine stone size. For this reason, all well developed thunderstorms should be cleared at a safe distance, at least by 20 miles at jet levels above 25,000 feet whenever possible.

SQUALL-LINE AND PRE-FRONTAL

When the air mass in the warm sector of an active cyclonic system is conditionally unstable, thunderstorms can generally be anticipated to develop during the afternoon in the area 50 to 150 miles in advance of the cold front. It is characteristic of these storms to form along a line approximately parallel to the cold front. These storms develop as individual towering cumulus early in the forenoon. Surface winds will be light but puffy, with the air having an oppressive effect during periods of calm in the eastern area of the warm sector. In the western portion cumulus may develop but gradually diminish, with scattered patches of altocumulus clouds and some cirrus remaining. Air in this sector, while quite warm, is not normally oppressive.

Thunderstorms develop along the line dividing these two regions of the warm sector. While the line is composed of a number of individual cells, the lower congested cloud masses and the cirrus anvils merge. An approaching squall line presents a solid, ominous picture to an observer on the ground.

The individual cells are usually separated at levels between the altostratus deck and the cirrus anvil, offering clear passageways for jet aircraft. However, individual cells dissipate and new cells develop as the squall line moves east, so there is no assurance that such a patch will remain open for any prolonged period.

While airborne radar will reveal the presence of liquid water, ice crystals and hail cannot be successfully detected. Care must be exercised in transiting a line of thunderstorms to maintain adequate clearance to avoid possible hail fallout from the cirrus canopy.

Surrounding the base of a well developed thunderstorm there is usually a mass of cumulus congestus cloud, most frequently concentrated south to southwest of the main cell, extending to between 12,000 and 18,000 feet vertically and 10 to 15 miles laterally. Towering cumulus erupt from this mass but seldom reach the glaciation stage, dropping back into the pack to be followed by another eruption in an adjacent area.

Near the main cell, these towering cumulus will "lean" toward the main cumulonimbus cloud and merge with it. From a distance the whole storm appears to have a sloping outline from south to north.

It is below this area of cumulus congestus cloud that tornadoes are most frequently observed. As 5-to-10 miles or more may separate them from the main cell and there is seldom rain reported in the immediate area, selection of a flight path below or through the clouds can be misleading. Normally, the cloud base of this cumulus congestus mass is sharply defined with good visibility. Openings between the towering cumulus, even at the base, occur but do not endure for any prolonged length of time. Careful observation of the cloud reveals constant, strong roiling.

It is generally accepted that a tornado initially forms in the lower portion of this cloud mass, usually within one of the more active towering cumulus that has merged with the parent thunderstorm. At first the vortex may be invisible, but as its speed of rotation increases and extends to the surface, condensation of ingested water vapor soon reveals its characteristic snake-like form.

The number of individual tornadoes associated with a single thunderstorm may vary from one to several. Three or four are not unusual, and many more have been observed.

Because of the severe turbulence associated with a tornado and the explosive effect of the difference in pressure in the vortex, it is axiomatic that these storms must be avoided. Of equal importance, it is wise to avoid flight through the cumulus congestus cloud that spawns tornadoes, for it is never certain where or when a vortex may form. ★

the I.P.I.S. approach

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

Q When flying an ILS or PAR approach, must the pilot initiate the missed approach procedure above the published decision height (DH) to ensure that the aircraft does not descend below the DH?

A No! AFR 60-27 defines DH as: "An altitude specified in feet above MSL, at which a missed approach will be initiated when either visual reference has not been established with the runway environment or the aircraft is not in a position to execute a normal landing."

Descent on a precision final should normally be continued to DH. The published DH is the lowest altitude on the glide path at which the decision, to either continue the approach or go-around, may be made. If aircraft performance capabilities dictate the use of a DH higher than the published DH, an approach should not be started when the weather ceiling is at the published minimum value. For example, a pilot should not attempt an approach to a 100-foot weather ceiling if he must make his missed approach decision no lower than 150 feet.

Q Must the USAF pilot still use both ceiling and visibility to determine if a field is above approach minimums when runway visual range (RVR) is published and reported?

A Yes. The USAF pilot is required by AFM 60-16, Chapter 8, paragraph 16, to use both ceiling and visibility to determine the minimum weather required to fly an approach. The minimum weather ceiling required is shown in parenthesis in the new landing minima format. The minimum visibility required for straight-in approaches is runway visual range (RVR) or runway visibility (RV). Pilots will use prevailing visibility: (1) when RVR or RV is not available, and (2) for compliance with circling approach minima.

Q Why are some of the new approach chart formats depicting a statute mile visibility instead of an RVR for the straight-in approach visibility minima?

A Initially, all straight-in approach runway visibility minima were converted to RVR and depicted in the terminal approach chart as RVR. RVR will not be reported, however, unless a transmissometer is available for the landing runway. For this reason a statute mile runway visibility value will be depicted instead of RVR for straight-in approaches to runways that do not have a transmissometer available. (A transmissometer is an electronic visibility measuring apparatus calibrated to measure visibility in 200-foot increments down to a minimum visibility of 1000 feet — RVR 10.)

Q Are military pilots required to read back clearances received from civilian air traffic control agencies?

A Pilots will read back clearances when *requested* to do so by the agency issuing the clearance.

Q The FLIP Enroute High Altitude charts show the abbreviation ATIS followed by a VHF frequency at several airdromes, e.g., Atlanta and Memphis. What does ATIS mean and what are the frequencies used for?

A ATIS is an abbreviation for Automatic Terminal Information Service. The associated ATIS frequency is used for transmitting recorded noncontrol terminal information to include sky condition, visibility, wind, altimeter setting, instrument approach and runway(s) in use. NOTAMS, Airman Advisories, or other information pertinent to the airport will be broadcast as appropriate. Broadcasts are normally updated hourly, or more frequently should a significant change occur. Each time the message is updated, a subsequent phonetic alphabet code word will be used, e.g., "This is Memphis Metropolitan airport in formation ECHO, two thousand overcast, etc." The broadcast should be monitored prior to requesting taxi clearance or prior to entering the airport traffic area and requesting instructions. Upon initial contact with ground control, tower or approach control, the pilot should state that he has received the ATIS information and repeat the code word. This procedure reduces chatter on primary traffic control frequencies and will allow the controller to devote more time to the specific control of aircraft. ★

Once upon a time, not so very long ago, a squadron maintenance officer visiting in a southern land decided to check the G meters of his airplane after they returned from a hard day's work on the range. You can probably guess what he found. Every airplane registered in excess of the 5 G Flight Handbook allowable load factor with tanks installed. Most showed about 6 G, and some even showed that a load factor of 6.5 G had been reached.

This evidence points to the possibility of an "understanding gap" among aircrews as to just how acceleration limits are established and how high stress loads affect the machine. Informal discussion (bar talk) seems to indicate many pilots still subscribe to the misconception that published limits provide a 50 per cent safety margin. Others advocate an even cruder philosophy that, if nothing fell off yesterday at 6.5 G, it's proof enough that nothing will fall off today under the same circumstances.

To really explain what happens when an airplane is overstressed, we have to go all the way back to the original specifications. Say we want to build an airplane that will sustain a limit G of +7.5. To the manufacturer, this means that the Air Force wants an airplane that will withstand a load of 7.5 G without damage. The engineer will do his best to design a structure that will sustain this G load and no more, since extra strength usually means extra weight, which the engineer feels duty bound to eliminate. He is bound by one more factor. The airplane must remain flyable, though not necessarily "unbent," until it reaches a load 50 per cent greater than the limit of 7.5, or in this case, until it reaches 11.25 G. Given these ground rules, the engineer attempts to design the airplane as close to the prescribed strength values as he can. Depending on his success, the manufacturer then delivers an airplane which will:

- Suffer no permanent damage at loads up to 7.5 G.
- Start to "bend" out of shape above 7.5 G and become severely twisted, but not disintegrate until the 11.25 G is exceeded.

In actual fact, it never works out that way, because the designer frequently has to use the standard hardware which is stronger than he wants. For instance, if he needs a bolt .5126 inches in diameter, but standard bolts only came in .50 and .60 inch diameters, he has to use the .60, which gives him unwanted extra weight. As a result, some parts of the aircraft are always stronger than necessary. On the other hand, some place on that airplane it probably worked out that a .50 inch bolt was exactly what was needed for the 11.25 G ultimate load. But to the pilot, what does it matter that the slab will stay on until 14 G, if the wings separate at 12 G?

Now a few words about the safety factors. The 50 per cent, in which so many pilots place their childlike faith, is a one shot deal. The manufacturer guarantees only that the aircraft will stay together up to the ultimate load or the 11.25 G for one performance. Merely exceeding the 7.5 G limit load warrants in-

Maj Richard P. Kolbenschlag, 49 Tac Ftr Wg, APO New York 09012

spection for possible overstress damage. If the engineer has been successful in paring the airframe down to minimum possible weight, it will incur damage when 7.5 G is exceeded because the metal will be stretched or bent beyond its elastic limit; that is to say, it cannot quite return to its original length or shape when unloaded. If visual inspection does not detect damage, an alignment check could be made if warranted.

The other half of the aircraft stress story concerns the fatigue factor; so now for a few words on that aspect. When any G load above or below +1 is applied and removed, the aircraft structure is subjected to a cyclic action of stretching and contracting. Eventually, this working of the metal will cause fatigue, as is indicated by the occurrence of small cracks. When they become big enough to see, the metal may have used up a large percentage of its life expectancy, and a one-time restricted flight to the boneyard may be in order if replacment components are not obtainable (example: cracked wing spars on T-33 and F-86 aircraft).

Let's go back again to the original specifications and design. In addition to considering vertical acceleration load limits, the engineer must also design our fighter to hold up under a specified anticipated fatigue loading. It works like this. Standard life expectancy for a fighter is ten years. Let's say we expect our fighter to be subject to the following G forces during one year's normal operation: 7G X 2; 6G X 20; 5G X 200; 4G X 1000; 3G X 2000. These figures are multiplied by ten and the engineer designs to meet the total fatigue requirements. When these precomputed loadings have been experienced, the manufacturer's warranty expires and, if the engineer did his job perfectly, the airplane disintegrates.

The hitch here is that he doesn't design for ten years regardless of use; he designs for a specified fatigue load. You can use the airplane the way you said you were going to use it and it will last ten years. You can use it ten times as hard and it will last one year. It's all the same to the engineer. He just said it would withstand a given amount of stretching and contracting for a given number of times. He knows that fatigue is a progressive and cumulative process. He knows that it is constant and irreversible. He knows that if he designed it to withstand 7 G 20 times and 6 G 200 times, but you pull 7 G 50 times and 6 G 1000 times, you're going to get a hell of a lot less 4 and 5 G pulls and you're going to run out of the ten year operating life in a hurry. He expects you to know that, too.

So, just because the tanks didn't fall off when you pulled 6.5 G on a dive bomb recovery is no proof that you haven't used up some more of this airplane's ten year life prematurely. You may have even initiated a fatigue crack in the wing spar!

The purpose of my article is not to make fighter pilots overly apprehensive or to suggest that their aircraft must be handled with kid gloves. I do hope, however, that it has given a better understanding of why you should strive to fly the airplane within the operational limits of the Dash One Flight Handbook.★

REX RILEY'S CROSS COUNTRY NOTES

LOOKING THROUGH WATER OFTEN does odd things to the images your eyes receive. Fact is, refraction can change nearby objects to such an extent that you either can't see 'em or they look like something entirely different. Contrast looking at fish through smooth water and choppy water. They may disappear altogether when the "sky juice" gets turbulent. Heavy rain flowing rapidly off a windshield is anything but a smooth sheet and distortion of outside objects is often extreme.

In flight, the resulting refraction error can make an object appear to be as much as 200 feet lower than it actually is. On the ground, it can render other aircraft virtually invisible. Impossible, you say? Talk to the O-1 pilot who taxied into a parked O-2 during a recent heavy rain. Result: two much needed birds out of commission—better you should get your head wet.

WE SWIPED the following from the February Flying Safety meeting notes of the 4510th CCTW at Luke. Points up the hazards of pilot preoccupation with a minor problem which may cause something serious to develop.

"We had an incident during formation takeoff where the student moved out of position and, in moving back into position, forgot the gear—until 270 knots. Needless to say, he lost a few gear doors. Just enough deviation during the takeoff to distract him and he forgot one of the steps in the sequence of events he was supposed to perform. What was the element lead doing at this time? I have watched many formation takeoffs in which the student lead never did look at the wingman again from the time he released brakes until possibly they moved out into route formation after join-up. Let's look around and always check your buddy, especially during formation takeoff and landing. When the gear, flaps, and speed brakes are being cycled, look for malfunctions or abnormal indications. Watch your buddy and if you think he has problems, warn him if he is too slow, or getting into a dangerous position.

"The word is positive aircraft control. Look around —and check your aircraft malfunction or wingman much the same as you check for an ordnance malfunction on the downwind leg in a gunnery pattern. One thing at a time. Check outside of the office between the inside checks."

Darn good advice. Don't let yourself get so involved with a little nit-picky problem that you let the whole ball of string unravel.

PERSONAL LOCATOR BEACONS exist for one

purpose and one purpose alone. And they have been a godsend to the many crews who have used them to direct rescuers to their location. Therefore, they should be reliable devices. But there's the rub. They are so reliable that when they are accidentally actuated they do their beeping right on schedule, which causes complications. According to a message from AFCS, these locator beacons have become a widespread problem which could jeopardize the safety of an aircrewman and which also disrupts air traffic.

These things won't blow up in your hand but they should be treated as if they would. No one wants to kick off a frantic search for a beeper accidentally actuated in the parachute shop or a parked aircraft. But this has happened. Neither would anyone want to jeopardize the life of a man who may be depending on his radio by setting up interference or misleading searchers. So, please, when you handle these radios make absolutely, positively sure they are OFF except under approved test conditions.

WE IN THE AIRPLANE DRIVING BUSINESS and those who support our activities are naturally interested in improving the odds favoring safe recovery of our expensive machinery. The USAF Air Weather Service continues its experiments to improve fog dissipation techniques. A brief summary of their activities was presented in the January *American Meteorological Society Bulletin.*

"During this winter Air Weather Service is testing one airborne and four ground-based methods for dissipating super-cooled fog around airports.

"The air-borne method, planned for Elmendorf AFB, Alaska, consists of seeding fog layers with crusted dry ice by planes flying in five parallel lanes, each two mi (3.2 km) long and 1500 ft (457 m) apart. This rectangular-patterned seeding is made parallel to the target area and displaced upwind sufficiently to allow the hole to form and drift over the target. The crushed ice (ranging in size from powder to BB) is released at the top of the fog layer in the case of thin fogs, and the 300-ft (91-m) level in thick fogs. A seeding rate of 25 lb per mile is used.

"The four ground-based schemes to be tested were:

"Project Warm Fog I: This is an 'emergency' technique using the heat from jet engines to burn off runway fog. The test at Travis AFB will use four C-141 aircraft (16 engines) lined up on a runway at 750-ft (229-m) intervals. According to computation, this should provide enough heat to vaporize the liquid water droplets in a dense fog in less than five minutes. If these tests are successful, Project Warm Fog II will be conducted with the aircraft parked alongside the runway at angles to compensate for surface wind conditions.

"Project Fog Fan: For this test, a tank of liquid carbon dioxide will be mounted below a vertically oriented propeller on a trailer. As carbon dioxide is vented into the fog, ice crystals form due to the low temperature of vaporization. Propeller action pushes the crystals aloft to clear the area.

"Project Fog Wand: This program is similar to Project Fog Fan, but does not use a propeller to disseminate the ice crystals. The liquid carbon dioxide is vented directly into the fog and the atmosphere.

"Project Cold Fog III: A derivation of the balloon technique used in the earlier projects Cold Fog I and II, this program uses five tethered balloons spaced at 100-ft intervals with four dry-ice cakes per balloon. In the earlier tests employing balloons spaced at greater distances and with fewer dry-ice cakes, ice crystals formed but not in sufficient quantities to produce the desired clearing. It is hoped that this configuration will work better."

The staff of your *Aerospace Safety* magazine is collecting material on this interesting subject and intends to publish an article as soon as the results of the above tests are available.

REVERSE THE TREND. Two aircraft accidents highlight a very undesirable trend. Some stateside crewmembers are not aware of the operation of the personal locator beacons. In one accident, both crewmembers ejected close to home base after flameout. Terrain was flat, cap aircraft were overhead immediately, and the control tower was close enough to have picked up any signals emitted by the beacons. But they heard none. Why? Very simple: the switch was off. If flameout had occurred two minutes sooner, the two crewmembers might still be in the high snow country.

Investigation of a recent bomber accident where the crew bailed out in the far north revealed that four out of five beacons failed. Two types of beacon radios are used, each requiring opposite arming procedures for automatic activation. This creates confusion among crew personnel. Why spend time freezing because no one knows where to look for you? A few minutes of your spare time familiarizing yourself with the operation, problems, and history of the beacon will enhance your chance of survival if a nylon approach is forced on you. Ask an SEA airman who preflights his personal locator beacon. They *insist* on knowing it will function properly. ★

Lt Col Thomas B. Reed
Directorate of Aerospace Safety

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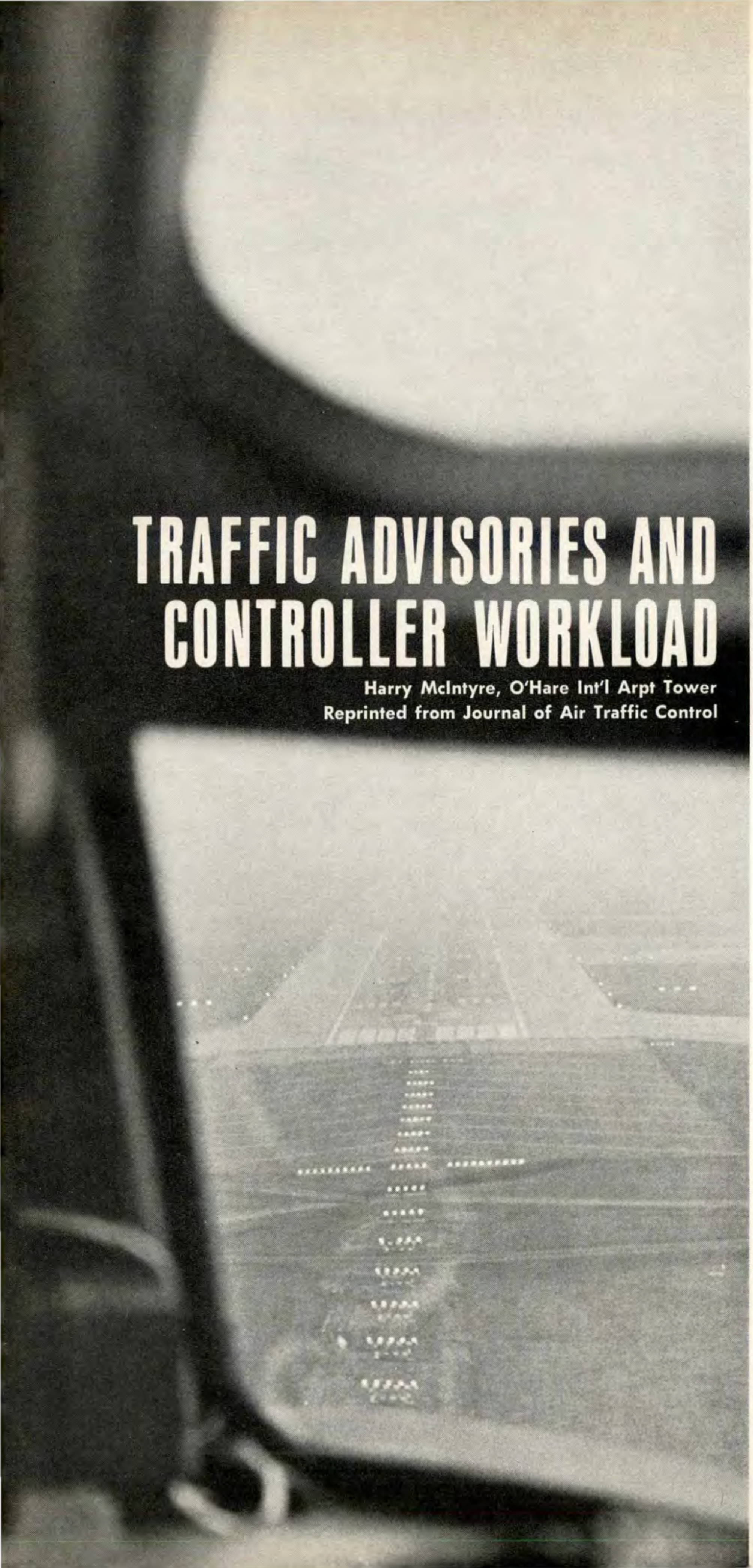


TRAFFIC ADVISORIES AND CONTROLLER WORKLOAD

Harry McIntyre, O'Hare Int'l Arpt Tower
Reprinted from Journal of Air Traffic Control

EVERY controller who has listened to himself on tape during a heavy rush of traffic will usually exclaim, "I was really busy during that session, but on tape it sounds like a midnight lull." This is a common remark of controllers and proves that "you can't judge controller workload by frequency congestion alone." There is more to controller workload than the constant chatter heard in the cockpit speaker.

Let's examine controller workload with specific emphasis on the radar controller's duties and responsibilities to see why this is true. The radar controller's primary responsibility is the separation of IFR aircraft. As an additional service, he provides IFR aircraft (VFR on request) with information (position and direction) on identified, uncontrolled aircraft. Because this "target information" is an additional service outside the controller's primary responsibility, he performs this task when time permits—dependent upon workload. Due to the heavy concentration of controlled IFR and unidentified, uncontrolled VFR traffic around major airports, this additional service can get to be a near impossible chore. Consequently, many uncontrolled aircraft that pass near the controlled IFR traffic go unissued.

As an example of workload, consider the inbound radar controller (either center or tower) working a busy sector. We'll give our man six to eight IFR aricraft to control to insure he has plenty to do. The key to his workload goes a bit further than talking to a group of aircraft. It depends upon the vector pattern (simple or complex), whether he is vectoring from a holding pattern or radar hand-offs, mixture of traffic, noise restrictions, coordination with other controllers and facilities, quality of radar and a host of other small but important details.

To continue this explanation of reasons for nonissuance of uncontrolled traffic, we must delve into the controller's duties a bit deeper. Many people who visit the radar facility marvel at the ability of the controller to watch six, eight, or more aircraft simultaneously and effect separation between them. The general misconception drawn is that "controllers watch each and every individual target under their control constantly." We do not and cannot. True, the controller is able to provide separation to all IFR aircraft under his control and does employ what he sees and hears for separation. However, he does not keep his eyes "glued" to each and every target constantly. Instead, he uses a combination of separation "tools" that allow him to get the job done without individually "eyeballing" each target. Ever try to watch three events in a three-ring circus simultaneously and catch the finer points of each act? So goes it with the controller, who keeps an overall "picture" of his traffic insuring separation between controlled aircraft.

Why is it that the controller cannot continuously "eyeball" each target, and what draws his eyes and immediate attention away? Many times it is because of more pressing and critical duties elsewhere. Just as the pilot scans his instrument panel, so does the controller scan his radar scope—determining who must be turned, who must be descended, who must slow down, who needs approach clearance and frequency change-over, while making a constant assessment of his changing "picture."

To put the controller's decisions into action he must transmit his instructions to the pilot—timed to the proper sequence of events. Meanwhile, the pilot who has received his instructions, that in effect "squares him away for awhile" (in the controller's mind), is passed over for more pressing and critical duties. This is when the pilot who has just passed unissued traffic may remark, "Who's this at my altitude?" or "Say, approach, do you have this traffic that just passed us on radar?" Sure, the unissued traffic was probably there—painting loud and clear —but because the controller's eyes and attention were drawn elsewhere, such as a final approach turn, the target was not issued.

It must be pointed out that if the controller was aware that the unidentified, uncontrolled traffic was at or near the altitude of the controlled aircraft, the controller would be compelled to issue the traffic, therefore constituting his most pressing and critical duty. However, because of equipment limitations (mainly the lack of altitude information on uncontrolled traffic), this additional service (target in formation) gets to be a "sticky business." Because the controller lacks altitude information on uncontrolled traffic and because the pilot may have a limited view (haze, smoke, aircraft design), a great percentage of the traffic that is issued is never spotted by the pilot.

This brings us to one of the more critical dilemmas facing the aviation industry today, that of seeking means and developing ways to segregate controlled and uncontrolled traffic. Under the present system of mixing IFR and VFR uncontrolled traffic in the same area, the controller is hard put with even minimum workload to spot and point out each conflicting uncontrolled flight pattern. Couple this with the fact that the "issued traffic" could be 5-10,000 feet above or below the controlled aircraft, and you have a meaningless advisory.

To conclude, we must develop more positive measures that will insure separation between IFR aircraft and all other traffic—not just between IFR aircraft alone. It seems that if a pilot "buys" an IFR clearance, he should be afforded more than just separation from other IFR aircraft. ★

Air Force survival schools provide excellent training. Nevertheless, it is a bit shocking when one faces the real thing as the author deliberately

DESERT SURVIVAL

—OR— THERE'S NO TEACHER LIKE EXPERIENCE—OR— THERE'S NO FOOL LIKE AN OLD FOOL!!!

Grover T. Tate, General Dynamics — Ft Worth Division, Edwards, AFB, California

These are oft repeated axioms which I recently proved to be eminently correct.

As an aircraft crewmember, I have attended the full spectrum of survival schools. I have accepted the teachings of survival instructors, but until I had tried to do the things I was taught, there was always the element of doubt. So—I was allowed to wander the hills of Nevada and New Mexico, to traipse the jungle of Panama, to play in the snow of Labrador, to drink of the waters of both the Atlantic and Pacific and to jump from an aircraft at 12,000 feet. Now to add another link, the taste of desert heat in the summer needed to be experienced.

To make the experience realistic, I drove a topless car from Edwards Air Force Base, California, to Death Valley in the middle of August. The car was stocked with standard survival gear with the exception of beacon or radio equipment. Friends and neighbors were advised of my intentions, route, destination, and planned time of arrival back home. Disregarding their native instincts to have me jacketed and incarcerated they agreed to come to my aid if I didn't show up for breakfast the next morning.

The drive to the valley was somewhat less than stimulating and it served to induce some of the fatigue one might experience during a flight that would lead to a survival situation.

The first stop was near a place called Immigrant Pass, a few miles from Stovepipe Wells on the very edge of Death Valley. With a full canteen of water, I crawled among the sharp and jagged rocks until I became tired and overheated. Only after I stopped to rest did I realize how near I had come to exhaustion. Perspiration flowed from every pore and there was no escape from the searing ambient heat that was augmented by the direct rays of the high sun. I rested, drank my fill of water and constructed a two-layer parachute canopy shelter. After this labor, the craving for water returned but I resisted drinking from the canteen so I could experience and evaluate the agony of thirst. The temptation to drink grew stronger, but the knowledge that water was available reduced the frustration. The canopy gave some protection from the brilliance of the sun although it did not seem to offer any relief from the heat. I made a sun shield of parachute nylon and started a search for food.

A few birds of various types flew from bush to bush and seemed as restrained in their activity as I was in mine. It would have been an easy task to shoot some of them for food. Near a small canyon I found a group of burros. They did not move as I approached them and only turned their heads away when I reached to pet them. Perhaps they were as drained of energy as the birds I had seen. It appeared that any of them could have been captured and using parachute shroud line for harness could provide transportation, or they could have led me to water or I could have shot one to use as food. I was so tired by this time that I could have used the burros' native intelligence which I was sure was superior to mine.

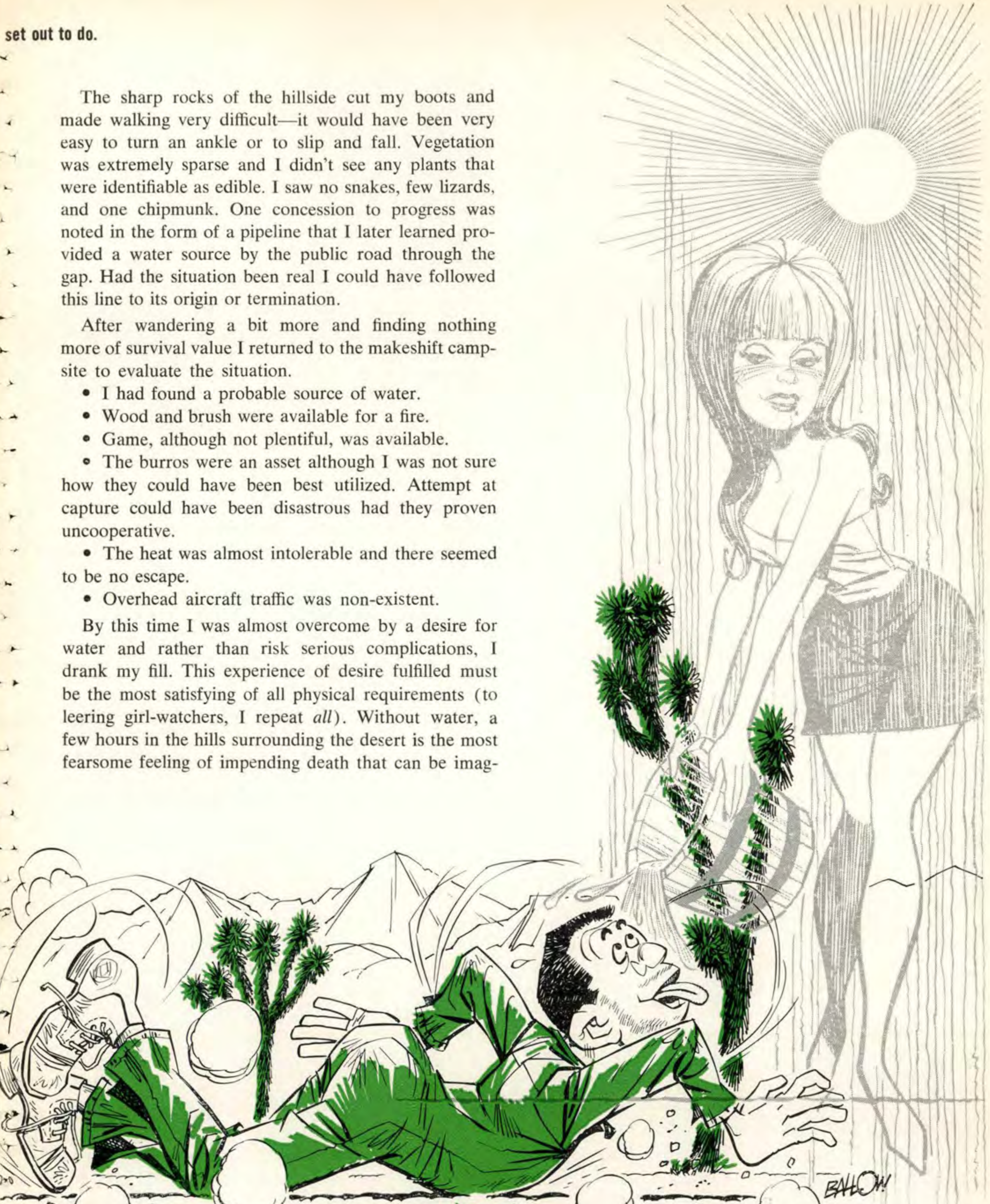
set out to do.

The sharp rocks of the hillside cut my boots and made walking very difficult—it would have been very easy to turn an ankle or to slip and fall. Vegetation was extremely sparse and I didn't see any plants that were identifiable as edible. I saw no snakes, few lizards, and one chipmunk. One concession to progress was noted in the form of a pipeline that I later learned provided a water source by the public road through the gap. Had the situation been real I could have followed this line to its origin or termination.

After wandering a bit more and finding nothing more of survival value I returned to the makeshift campsite to evaluate the situation.

- I had found a probable source of water.
- Wood and brush were available for a fire.
- Game, although not plentiful, was available.
- The burros were an asset although I was not sure how they could have been best utilized. Attempt at capture could have been disastrous had they proven uncooperative.
- The heat was almost intolerable and there seemed to be no escape.
- Overhead aircraft traffic was non-existent.

By this time I was almost overcome by a desire for water and rather than risk serious complications, I drank my fill. This experience of desire fulfilled must be the most satisfying of all physical requirements (to leering girl-watchers, I repeat *all*). Without water, a few hours in the hills surrounding the desert is the most fearsome feeling of impending death that can be imag-



ined—I thought that drowning in cool water would be a welcome relief. Other than the extreme thirst and physical exhaustion, I noted no other symptoms such as stomach cramps, dizziness, blurred vision or heat stroke.

After packing the gear back in the car, I drove to Stovepipe Wells, checked the ambient temperature at 123°F, had a glass of iced tea and drove on toward Death Valley Scotty's Castle. About 20 miles from the castle I took a ragged road into the open desert, parked and packed my gear off about 100 yards from the car. The temperature on the desert floor must have been 170°F—the extreme heat was unbelievable. Again I drank no water and after a very few minutes the pangs of thirst started to nibble and gnaw. The desert floor was of small rocks and sand and offered nothing as an obvious survival aid.

Briefly, I reviewed the various ways to make a shelter and decided to use the "sand bag" method. This is done by tearing squares of nylon from the parachute canopy, heaping sand upon the squares and then tying the corners of the nylon together—much as our school lunch coins were tied in handkerchiefs when we were kids. Enough of the sand filled bags are made to construct four stacks of pylons, and then a big square of nylon is laid across the pylons to make a roof. Other sand bags are then added to the pylons to retain the roof. The roof should be a double layer of nylon with an airspace between the layers. The idea was great, but construction was a different matter—the desire was strong but to get moving was difficult.

I made the four "cornerstone" sand bags and was completely pooped. The sun was almost directly overhead and absolutely dominated the cloudless sky and empty desert. I pulled the parachute canopy above me to shield my face and head from the sun, but it was of little help. The large canteen of water was within reach but I still regarded it as forbidden fruit.

After a short rest, I made more sand bags, noting that each successive bag was smaller than its predecessor. I gave up the idea of a luxurious shelter and put together a makeshift affair of sand bags, rocks, parachute nylon and shroud line. Then I rested. By this time my system was demanding water and I noted a vague hint of hunger. The desire for food never developed to the point where it was uncomfortable, but I ate anyway. The jellied candy in the ration was good although it accented the increasing need for water.

A couple of hours had elapsed since the beginning of this exercise and after deciding there wasn't much to do to improve the situation, I gave up. I drank the water from the canteen until I was about to pop. Because of a fear of creating nausea I did not take any salt pills. I poured water over my head and crawled under the shelter to review the situation. I reached several conclusions:

- Had the situation been for real, I would be in deep serious trouble.
- Water is an absolute must—it overshadows everything else.
- There was absolutely nothing available to eat.
- The distance to the mountains surrounding the desert was foreboding and any traveling toward them would have to be done at night. I doubt I could have made it even at night.
- The lightest labor is difficult and demanding.
- The loneliness and the vast expanse of nothingness conspire to instill a desire to surrender to the overpowering odds.

Being alone in the desert—even with the provisions I had—in the middle of August is pretty damned stupid.

Later, I stopped and talked with an old prospector and told him of my amateurish adventure. He was in complete agreement that it wasn't a very smart idea and that it could have easily developed into a real and dangerous situation. He observed that regardless of the many advances of science that desert survival had changed little. Water and protection from the heat are absolute essentials.

In retrospect, I feel that although the effort was amateurish in most respects, it was worthwhile. For while I am an amateur at desert survival, so are most of my flying colleagues. For the troops taking off from a green and wet base it is difficult to realize that within an hour or two or less, they could be sitting on the hot sands of the desert looking skyward for help, so they aren't too prepared for that event. The knowledge gained in survival school is not as easily put into practice whenever the instructor and the handy-dandy props are not available. The thought processes are slowed and befuddled by the heat, doubt, and uncomfortable surroundings of the desert.

Survival there is not a matter of popping up a shelter, digging a hole and finding water, shooting a stray animal, roasting it over a fire and sitting back to dream of Playmates while waiting for help to come. It is a mean, demanding situation from which only the well prepared will emerge.

If one can retain and practice those things taught him in survival school, has water with him, or can locate a source of water, he can survive in the desert—not easily, but he can survive.

As an old hand of two score and five, I proved this to my own satisfaction. In 123°F. heat and with nothing more than a car filled with equipment, I survived—for a whole day. ★

ALTITUDE KILLER

Lt Col Thomas P. Broe, Senior AF Repr
U. S. Army Engineer School, Ft Belvoir, Virginia

In August 1965, an airliner crashed into Lake Michigan. The Transportation Safety Board has been unable to determine the cause. However, the board's report stated there was no evidence to indicate other than operation of the aircraft was involved. The board said the aircraft had been cleared to descend from its cruising altitude of 35,000 feet to an approach altitude of 6000 feet. Plots obtained from military SAGE radars showed that the aircraft maintained a steady rate of descent of approximately 2000 fpm from its cruise altitude to impact.

On October 1 1966, the crew of another airliner requested and received descent instructions from 14,000 feet for an approach to the Portland, Oregon, airport. The clearance was to 9000 feet, which was acknowledged, "Roger, descend to nine, leaving one four." Approximately one minute later, the Center Controller transmitted, "Niner five six, request altitude, squawk zero four zero zero." The crew responded, "Zero four zero zero and we're out of twelve and, what was the landing runway at Portland?" The controller advised that runway 28R was in use and following radio contacts with several other aircraft, instructed the flight to "turn right heading three zero zero." After questioning the direction of the turn, the crew acknowledged, "Right turn to three zero zero, Roger." Radar contact was lost in the turn and the last transmission received from the flight was an acknowledgement to report established on a heading of 300 degrees. The aircraft crashed on the eastern slope of a 4909-foot ridge in the Salmon Mountains at an elevation of 3830 feet. The investigation revealed that the flight had descended in a normal manner to 4000 feet and leveled off.

Why did these highly qualified crews descend below their clearance limits? Could they have misread their altimeters or misunderstood their assigned altitudes?

The proper techniques of correctly reading altimeters have been emphasized for years, and will not be belabored here. But what about misunderstanding the assigned altitude?

As an Air Force pilot with 25 years of flying experience, I submit that currently this is perhaps our weakest area in the over-all effort to improve our flying safety. In the past few years, I have often observed that both the pilot and copilot were uncertain as to the newly assigned altitude.

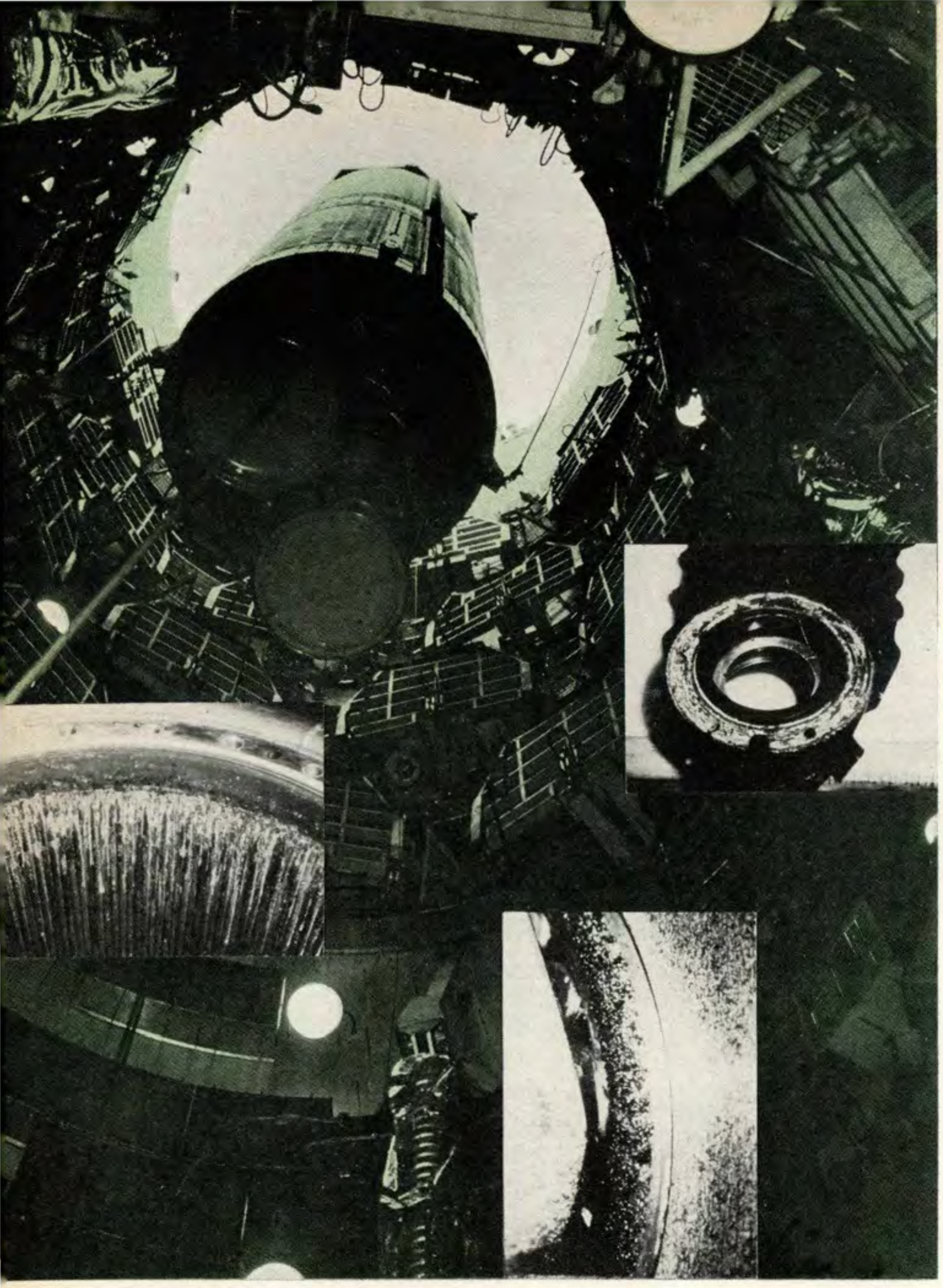
The problem is to receive, understand, acknowledge and remember the altitude to which one is cleared, and then to descend or climb, level off and maintain that altitude.

While it may seem like any child should be able to remember an assigned altitude, it's really not quite that simple. For one thing, in the voluminous information frequently given in a clearance to an initial or a new altitude, other data is often more immediately required and therefore given priority in the memory cycles. Take this clearance for example, "Air Force zero four niner three, current Andrews altimeter two niner three four, descend to six thousand, squawk zero four zero zero leaving niner, turn right to a heading of one four zero degrees, contact Washington Approach Control on UHF frequency two six nine zero." How easy to misplace an altitude in a clearance like that—which can be further complicated by aircraft performance and landing data, landing weather and landing runway information.

Now that we have described the problem, what can be done about it?

In my opinion, we are not stressing the problem enough. Therefore, in offering possible corrective action, shouldn't education be given immediate priority? Other things that can be done include improved standardization techniques such as requiring the copilot to jot down any newly assigned altitude for ready reference and requiring him to automatically warn the pilot at the prescribed level-off lead point.

As for altitude instrumentation, the majority of us do not have altitude memory devices or command altitude information. Development of such equipment for round dial altimeters and installation in our aircraft would benefit the pilot and be a step toward preventing accidents. ★



Time For Overhaul

Dwight W. Johnson
Directorate of Aerospace Safety

Examples of corrosion found during SLAP. Left, thrust chamber corrosion; center, rust on race of a main propellant valve bearing; above right, dissimilar metal corrosion on a housing flange.

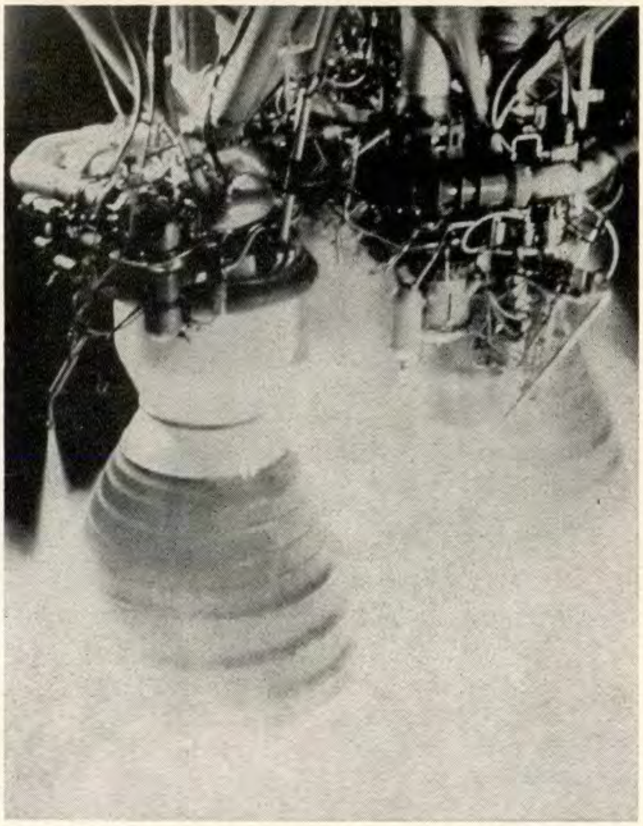
HOW long can an engine sit idle and still be counted on to perform satisfactorily at a moment's notice? This was the question facing the Air Force Logistics Command in 1960 about the liquid rocket engine powering the Thor missile. The Air Force Systems Command had said 30 months when transferring management responsibility for the missile to AFLC but this was based on a design commitment imposed on the manufacturer. Practical substantiation was not available. No one really knew what engine deterioration would take place under service conditions. And the stakes were high. If reconditioning were scheduled too late, our defense posture would be jeopardized; if too early, a lot of money was being thrown down the drain.

To answer the question, the Service Life Analysis Program (SLAP) for liquid rocket engines was born. This was a program for determining optimum periods between overhaul, and grew to encompass every Air Force large liquid rocket engine—the engines for the Thor, Jupiter, Atlas D, E and F, and Titan I and II missiles. Many unique problems were encountered in this attempt to apply validity to a new approach to engine service life—one based solely on calendar time rather than operating time. A fundamental difference was the lack of a reliable baseline to start with—a well substantiated initial time interval before overhaul.

Engine durability—the measure of engine life obtained while maintaining the desired reliability—is usually considered as a function of operating time. In the ground transportation field, improvements to reliability and durability standards have relied on the pressures of competition. Substantial improvement has taken place over the past 200 years. Cugnot, a Frenchman, produced a steam powered vehicle in 1769 that could carry four passengers at 2¼ miles per hour. It failed to survive because its boiler was too weak to last at this speed more than 15 minutes—a far cry from the present 50,000-mile warranty. As we progressed to air transportation, the demand for safety increased, and competition as the controlling factor for reliability and durability was supplemented by regulations. Prior to flight, testing was required to demonstrate the ability of the engine to perform at the manufacturer's established ratings for a given duration. This held in check the manufacturer's optimism on what his engine could do. The final performance rating was his best judgment within the standard of reliability demanded by the proof test.

Since before World War II each new model aviation engine, whether civil or military, has been required to complete successfully a vigorous 150-hour endurance test. Although this is a proof test of design rather than service life, it does give a good basis for projecting an operating time interval between overhauls before service experience guidelines are available.

The liquid rocket engine entered the picture in the 1950-1960 time period. A proof test was established—10 full flight duration runs—but little knowledge could be gleaned from it as to the engine's ability to withstand service conditions. Initial service life in calendar time since manufacture had to be based on engineering judgment which, to a large extent, was an educated guess of the aging characteristics of the soft goods and the corrosion resistance of the metal parts. For the Thor and Jupiter propulsion systems this initial time



Titan II first stage engine test firing. During SLAP approximately every third engine was static fired prior to teardown to test performance.

period was chosen as 30 months; for the later Atlas and Titan series of missiles, 42 months.

The Service Life Analysis Program inaugurated in 1960 was a program to determine the useful life of liquid rocket engines without reconditioning. AFLC was responsible for ensuring that the engine reliability demonstrated during development and production was being maintained in service. Because of the conjecture involved in establishing the initial service life for each system, the primary purpose for SLAP was reliability assurance. Within the scheduled overhaul period, was deterioration taking place which would prevent successful completion of the mission? If so, what could be done about it? If not, how far could engine life be safely and reliably extended?

The SLAP plan established early in the program remained essentially the same throughout the progression from the Thor through the Titan II propulsion systems. The plan included gathering and analyzing all launch, field, and overhaul data available. But the heart of the program was the detailed teardown and engineering analysis of selected high-time engines. Three such propulsion systems would be critically examined to verify the originally established life and additional systems analyzed at periodic intervals of increased age (usually three month intervals). If possible, from the results of the analysis, the scheduled overhaul period would be projected six to 12 months in advance for logistics planning purposes and then verified as the program progressed. Of special importance was a static firing requirement imposed on approximately every third engine in the "as received" condition to ascertain its performance capability prior to teardown.

A major problem from the onset of the program was obtaining sufficient, representative information from which to make sound judgment. The establishment of a service life for a family of engines implies that all are alike and are given the same usage. But such was not the case for missile engines. Deficiency data first had to be culled to isolate the service-oriented problems and then had to be correlated with the engine configuration and history to determine applicability to the "family." The sources of data were rather limited, at least until the Titan II came along. Most engines involved in launches were either too young, without field installation time, or were given special treatment prior to launch. Field deficiency data, although directly applicable, could not give much insight to conditions inside the engine. The main burden of proof of the engine's ability to withstand service treatment fell on teardown inspection and analysis of the selected high-time engines, which were few in number, and information that could be obtained from the engines undergoing routine overhaul.

Special studies were soon initiated to support the basic Service Life Analysis Program and to take full benefit of the information obtained. It was recognized that identification of deterioration in a component was not, by itself, enough to determine service life. Information as to the cause and rate of deterioration, and how much could be "lived with," also was needed. Evaluations were conducted on failure modes to pinpoint critical components and events, and on failure characteristics related to corrosion and soft goods (seals, O rings, gaskets) discrepancies. For soft goods, whose ability to resist aging was suspected as being a prime limiting factor, information was lacking as to what measurable characteristics were significant in forecasting trouble. This was further complicated by the wide variation permitted in their shelf age at the time of installation. The difference could be as much as three to four years between soft goods installed in new production and overhauled engines—as much as the scheduled engine service life.

The potential of the program was handicapped at the beginning because of restrictions placed on engine component replacement in the field. One weak link could limit the life of the complete engine. This restriction resulted from performance limitations, not maintenance. If the component's effect on engine performance was not known, replacement would require engine recalibration. This meant return to the depot or contractor, overhaul, and static firing—a costly endeavor in the neighborhood of $200,000 an engine, plus logistics problems. Studies were implemented to find out how much production variation between components could influence performance and the feasibility of adjustments or special selection of replacement parts to stay within the engine performance limits.

The Service Life Analysis Program has proven very successful. Not only has the life been extended on most liquid rocket engines evaluated, confidence has increased in their reliability. The progressive extension of engine life as provided by the program plan has never been terminated by engine condition; but always by discontinuation of the analysis program with missile phaseout. The only ICBM liquid propulsion engine remaining on operational status (Titan II) has had its service life ceiling lifted entirely. Reconditioning is accomplished only on engines that cannot be repaired in the field. With most engine components now field replaceable, engines undergoing overhaul should be few and far between.

Other benefits derived from SLAP and supporting programs include decrease in duration of post-overhaul static firing, improved field and overhaul inspection criteria, and a great deal of enlightenment on what is going on inside dormant liquid rocket engines. This information should be invaluable to future programs. Soft goods, the most worrisome items in the beginning, have held up surprisingly well. Corrosion has been a more serious problem, but experience coupled with relatively slow progression has permitted remedial measures to be enacted. Better protection of corrosion susceptible components, improved cleaning of corrosive residue, and incorporation of more corrosion resistant materials have minimized this problem as a service life limiting factor.

Close surveillance of aging is continuing on the Titan II propulsion system but without a finite life limit. Recently the SLAP program was reactivated on the Thor and Atlas engines that had been in storage since missile phaseout. This will contribute to determining their capability for use in space boosters. Engines approaching nine years since manufacture are being evaluated. The present outlook is that only engines flunking an extensive inspection and checkout will be overhauled. The end of a service life limit for liquid rocket engines appears to be near. ★

MISSILANEA

SUPPLEMENTAL REPORTS ON MISSILE INCIDENTS—Instances have occurred of incomplete reporting on missile incidents wherein additional information relating to the cause and corrective action taken is not submitted subsequent to the original report. AFR 127-4 and AFM 127-2 provide for the forwarding of supplemental messages when additional or corrective information becomes available after the preliminary five-day message report is dispatched.

The 28 June 1966 edition of AFR 127-4 deleted all reference to the "one-time," five-day message report. This terminology is still being used by field units. One reason for deletion of the "one-time" report was to remove the inference that one report would always suffice. The subject of missile incident reports should be stated in accordance with Attachment 5 of AFR 127-4.

It should be remembered that facts discovered and not reported have little effect in accident prevention.

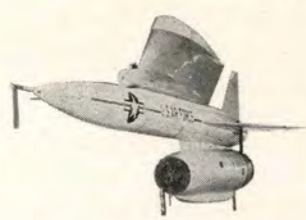
Dwight W. Johnson
Directorate of Aerospace Safety

HOUND DOG FIRE—The underwing check of both AGM-28s mounted on the B-52 had been completed, and the #1 AGM-28 was running at idle while trim was being accomplished on the #2 missile. One of the checkout crew noticed an "electric out" light and electrical power failure on missile #1. He immediately notified the rest of the checkout crew. The Team Chief, observing a slight trace of smoke coming from the #1 generator exhaust, ordered the AGM-28 shut down. The missile equipment compartment door was removed to determine the source of the smoke. At this time, flame was observed in the equipment compartment, plus numerous wires to various circuitry charred or burned.

Cause of the fire was undetermined. However, it is suspected that a short circuit in the DC portion of the generator or a broken wire in the excitation circuit of the voltage regulator was the culprit. Since no maintenance was performed in this area since original installation, the broken wire was attributed to vibration.

Prompt action on the part of the missile maintenance crew was instrumental in confining the fire damage to the AGM-28 and preventing possible loss of a B-52. Teamwork and professionalism once again pay off.

Maj Edward D. Jenkins
Directorate of Aerospace Safety



DIRTY CONNECTORS. Recently an Atlas booster with a research payload was launched at the Western Test Range. Performance was normal for the first few seconds of flight then suddenly the missile malfunctioned. Why? After an extensive investigation, it was determined that a most likely cause was that a hydraulic connector leaked. How can this happen after the years of experience with launches of the Atlas system? Someone was careless. They disregarded the basic concept of "do it right the first time." Unlike aircraft, the maintenance team cannot "run-up" the engine of a missile to see if all connectors are tight. Missile systems must perform correctly the first time. The above accident could have been caused by a dirty or defective connector or by improper torquing.

If the above accident was caused by a dirty connector it could have been easily avoided. Where special cleaning precautions are required, instructions will be contained in appropriate technical data. Many causes of contamination can be detected by "eyeballing" the connector. The human eye can easily detect contamination such as dirt, grit, and wire and metal particles. The key to a clean installation is still the maintenance man installing the actual equipment. Don't be afraid to take a look—see if that connector looks clean! ★

Lt Col Moses R. Box
Directorate of Aerospace Safety

THE F-106 PILOT STATED that he had checked his ejection seat safety pin out, that he moved the canopy latch handle forward, and that the canopy warning light was out. During takeoff roll the canopy departed the aircraft and the flight was aborted on the ground. Investigation proved that the pilot had failed to properly stow the seat ground safety pin streamer and it became wrapped around the canopy handle. The handle could not be moved full forward; therefore, the canopy was not properly locked. Cloth streamers are tough and strong. They can do a lot of damage; stow them carefully!

AN AIRCREWMAN noticed a red colored fluid had drooled from the engine oil filler doors on three of the four engines of a large jet. Although maintenance insisted the bird was serviced with engine oil, the aircrew refused the aircraft on the possibility the engines had been serviced with hydraulic fluid.

Although red is the code for hydraulic fluid, jet engine oil, type MIL-L-7808 contains an oxidation inhibitor that causes the oil to turn red after it ages awhile. So if you see something that looks a little like hydraulic fluid around the engine oil filler, check with maintenance to see that the bird was serviced from the correct cans. Hydraulic fluid comes in red cans while MIL-L-7808 oil comes in aluminum colored cans.

AN F-4 PILOT couldn't get a BLU-27/B to release from the right inboard station so he headed out over the drink to try to jettison it. Normal jettison procedures were unsuccessful, so he asked another F-4 pilot to take a look. This troop reported the BLU-27 hanging from the aft lug only, with the front lug open. He then moved out about 100 feet while the first pilot got rid of the thing by punching the external stores emergency release button. This cleaned the bird. In fact, the observing pilot was soon dodging part of the load.

He wasn't quick enough. An AIM-7E from the left forward fuselage station drifted outboard under the left wing, under his bird and bashed into his left 370-gallon drop tank. Luckily, damage was limited to the drop tank.

For the benefit of you people who are new to the fighter bomber business, this is not at all unusual. Empty drop tanks and other relatively light weight stores frequently go through some remarkable gyrations when jettisoned.

RAMBLIN' RECK. THE AC-47 pilots were conducting a pre-taxi check on a blacked out ramp. The pilot was busy checking his fuel gages and had just retarded his throttles for an ignition check when he felt a hard jar. At first the pilot thought that he had been hit by another aircraft or vehicle, but actually his aircraft had rolled forward about 200 feet and bashed another AC-47. It was suspected that the parking brakes were not set and the chocks had been removed without the pilot's direction or knowledge.

Without getting into the obvious hazard of removing wheel chocks without coordination, this accident points out an aircraft operator's problem—movement of the aircraft without the knowledge, consent or intention of the operator. There are very few pilots or run-up personnel who have not had the panicky and sickening sensation of suddenly realizing that their bird is rolling or sliding. Fortunately, most of these little trips are not of sufficient duration to cause any damage, other than momentary shock, but in some cases they have been calamitous. A C-47 and a DC-6 have both clobbered ground power units under similar circumstances and in each case it was a major accident.

It is best to remember that the aircraft power plants are designed to move the rest of the bird—and you must assume that they will perform as designed.

CMSgt Willis C. Brenton
Directorate of Aerospace Safety

IF YOU ARE going to fly VFR at or above 10,000 msl (or more than 1200 feet AGL, if higher) you will have to have at least five miles visibility and 1000 feet vertically and one mile horizontally from cloud formations. This new FAA ruling became effective March 16.

These minimums were already in effect above 14,500 feet, so the rule now covers from 10,000 feet up to positive controlled airspace, either 18,000 or 24,000 feet to 60,000 feet.

RCR procedures specified in T. O. 33-1-23 were developed from decelerometers mounted on vehicles equipped with regular tires. No data are presently available for an adjustment factor when other than regular tires are used. ASD will conduct tests with vehicles equipped with studded snow and other type treads.

The T. O. will be amended, as necessary, upon completion of the tests.

Lt Col Robert D. Lutes
Directorate of Aerospace Safety

THE AIRCRAFT HAD JUST COMPLETED multiple passes on a tactical target. The pilot was orbiting at 10,000 feet when he felt a sudden attack of nausea and started to feel faint. He immediately went to 100 per cent oxygen and made a complete functional check of the oxygen system. Everything checked O. K. and in a few minutes he felt normal again.

After an uneventful landing the oxygen system was purged and rechecked; it was normal in every respect. The pilot then reported to the flight surgeon for an examination. He stated that for six hours prior to flight he was painting squadron signs, using enamel thinned with JP4 in a room with poor ventilation. The "hangover" from prolonged exposure to JP4 fumes caused airsickness. This was followed by hyperventilation resulting in faintness. Almost any paint thinner or cleaning fluid can have the same effect, so make sure the room is well ventilated during sustained use of any aromatic liquids.

THE FIRST TIME F-4s showed up on the range to fire their Sparrows their terminology wasn't up to par. They wound up firing simultaneously with an F-100 Dart mission. Luckily there were no mishaps. The situation was corrected and the range controller waited until the Sparrow shooter had vacated the range before clearing a Dart shooter in. The Dart shooter started hammering away only to find out that the Sparrow shooter was still there.

Well, this was ironed out and shortly thereafter an F-104 Sidewinder shooter came on the scene, launched a weapon, and exposed some film. When the film was developed and reviewed it showed a target rocket with an AIM-9B going like mad after it, and right in the middle an F-100. Nobody knows where he came from, but it's for sure that he was there.

There are adequate procedures covering all USAF ranges and the routes in and out of them. All the users have to do to avoid hairy messes like these is stay completely current on these procedures. IPs and squadron commanders must ascertain that solo students are up to snuff.

Adapted from article by Col B. H. Clayton,
4510 CCTW Fly Safe Bulletin

THAT AGELESS PITCHER, Satchel Paige had a humorous philosophy. One of his basic rules was "never look behind you 'cause somebody might be following you."

Very few USAF aircraft enable a pilot or his crew to look directly behind while taxiing so we're forced to follow Satch's advice. Having the hind side as a blind side can be deadly when the man in the tower isn't completely aware of all local traffic activity.

The other day a century series bird landed on an inactive runway that was occupied by a transport which had been cleared to use it as a taxiway. The fighter had been cleared by approach control to land. The transport crew quite logically submitted an OHR on this very hairy situation.

A few weeks prior to this, two aero club planes were approaching the active for a landing—one was a considerable distance behind the other. The bird farthest out called "on final" and the tower cleared him number one to land. Well, little friend knew better 'cause he could see the other bird approaching the threshold, and he informed the tower. By this time the pilot in the bird nearest touchdown realized that he had been forgotten by the tower, had that uneasy feeling that comes with the knowledge that someone might be crawling up his back, and "cobbed" his machine for a go-around.

His failure to submit an OHR was an open invitation for a tower operator to continue to "sleep at the switch." Protect yourselves and your fellow birdmen; submit OHRs when needed. OHRs aren't just for military aircrewmen—they can and should be submitted by mechanics, any other direct support function members, and aero club pilots. (SPECIAL NOTE: Aero club safety officers, discuss this one at your next meeting.)★

USE OF AIRSPACE

Many thanks for your most excellent article on midair collision avoidance in the February issue. It was certainly a good comprehensive review of the foremost problem presently facing all segments of the aviation industry today. However, I am disturbed by the complacency of my fellow military pilots and the airlines as we wait for solutions based primarily on black box avoidance systems or major changes in general aviation procedures. I submit that we big aircraft operators are still reluctant to change our operating procedures or missions as required to improve the see and be seen system. For instance when the FAA placed a 250-knot airspeed restriction on operations below 10,000 feet, I believe there were too many negative reactions of "that's no way to fly fighters" or "the flight handbook requires that climb speed," etc.

For operations in joint use airspace I'm not certain that everyone has reviewed every flight handbook, TERPS and operational procedure that still "requires" speeds exceeding 250 knots below 10,000 feet. Just because we have always climbed or approached at 300 knots doesn't necessarily mean that the mission will be unsafe or degraded at the lesser airspeed. I wonder if many waivers to the 250-knot restriction haven't been issued since they were easier to obtain rather than preparing paper work to change the current procedures? Also, why not get every one up above 10,000 feet at any airspeed if the aircraft has the capability and no low level requirement exists? There are still too many military and airline aircraft barrelling along at altitudes below 10,000 feet only because the crew wants to look at the scenery. I agree with the pilot who was scared stiff by light plane traffic in the Norton area. But I wonder how all the jet and other military traffic looks to them? Our idea of a VFR approach or departure can utilize a lot of airspace and often ignores operations at other light plane airfields in the vicinity. I believe that we and the airlines should consider specified VFR arrival and departure corridors for our use and that these be published on the local and sectional charts for the information of light aircraft pilots, so they can plan their flights to avoid our traffic.

I think a lot of congestion occurs because we too often assert our right to schedule training into areas already saturated with air traffic. Too many joint use airfields and terminal areas are dangerously saturated while another field thirty minutes flying time away is not fully utilized. In cooperation with the FAA we should publicize all facilities that have the capability for additional training traffic, especially IFR low approach training.

Col Robert L. Moeller
Cmdr 53 Weather Recon Sq
APO New York 09845

T. O. 00 - 20 - 5

Pilots from my outfit traverse USAF bases throughout the world on a recurring basis. Recently many of them have reported a lack of understanding and compliance with T.O. 00-20-5 by many transient maintenance personnel. Occasionally problems have even been experienced at some of the bases that currently display Rex Riley Transient Services Awards. Most of the difficulty is associated with compliance with paragraph 1-91. Frequently transient maintenance personnel overlook the requirement for routine inspections, particularly post flights, and necessary entries in AFTO Forms 781.

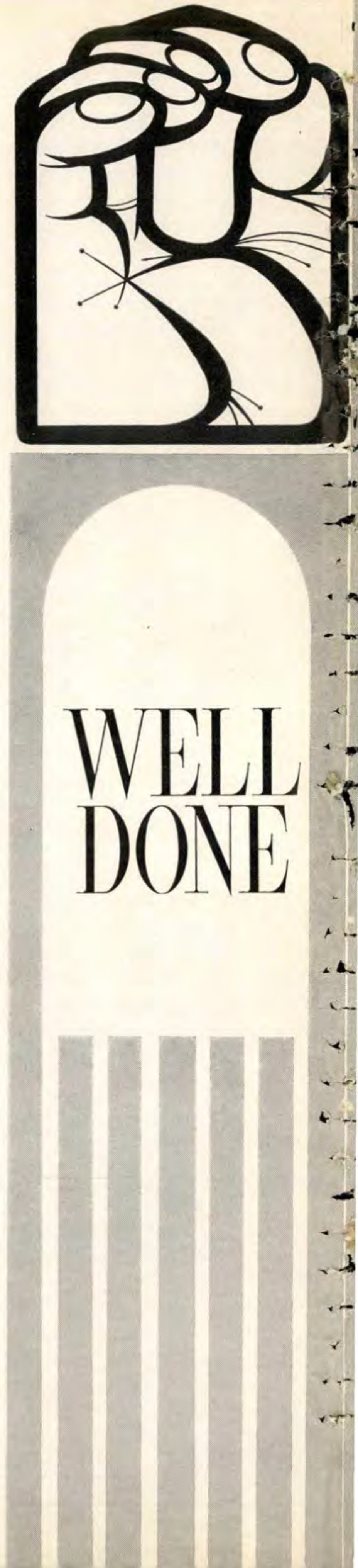
Our pilots have been dealing with this problem on an individual basis; however, we suggest an appropriate item be published in "Rex Recommends" to bring this subject to the attention of all transient maintenance personnel.

Maj Jack W. Reynolds
Flight Facilities (AFCS)
Scott AFB IL

The suggested item was published in the May issue of *Aerospace Maintenance Safety* in the "Rex Recommends" column. Please, all you aircrewmen, when you spot discrepancies like non-compliance with T.O. 00-20-5, drop me a line.

CORRECTION

The Well Done published in the March issue of *Aerospace Safety* was awarded to Captain (now Major) Richard G. Woodhull, Jr., 349 Strategic Reconnaissance Squadron, Davis - Monthan AFB, Arizona. Unfortunately, we renamed Dick and called him Willard—how, we don't know. Our apologies. The award will be accurate, we promise. Ed.★



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Lt Col Earle L. Trimble, Jr.

602 FIGHTER SQUADRON, APO SAN FRANCISCO 96237

On 11 November 1967, Colonel Trimble was flying a search and rescue mission in an A-1 in SEA. While conducting a low-altitude visual and electronic search in a heavily defended area, Colonel Trimble's aircraft received numerous small arms and AW hits knocking out his main hydraulic and aileron boost systems. Since he was able to safely control his aircraft, Colonel Trimble continued his vital search and rescue mission. During the ensuing two hours a Jolly Green helicopter received a damaging hit and had to be escorted out of the area by Colonel Trimble's wingman. Colonel Trimble remained in the area alone to suppress ground fire and to keep the downed pilot's position in sight in order to be able to safely bring the second Jolly Green in for the pickup.

After another 30 minutes of low-altitude flight, Colonel Trimble's aircraft received a direct hit in the left wing by 37mm AAA fire, knocking a large hole in the wing and aileron, causing an immediate and severe left roll condition. Colonel Trimble found that his aileron trim system was inoperative and that the left aileron was "frozen" in a near neutral position. Without aileron boost it took both hands and almost full right aileron, plus right rudder to keep the aircraft approximately straight and level. Finding that the aircraft would fly acceptably well in this condition, Colonel Trimble decided to carry the external stores to the home base jettison area. After an hour enroute, and in deteriorating weather conditions, Colonel Trimble arrived at the jettison area where he dropped all external stores and performed a controllability check. He found that 130 knots was the minimum control airspeed after emergency gear extension (tail wheel would not extend) and also discovered that the aircraft would not bank and turn to the right. A straight-in GCA to a foamed runway was requested. With an unknown precipitation ceiling and visibility reported at two miles, Colonel Trimble picked up the runway at one-half mile and completed a perfect no-flap touchdown on the two main gear and tailhook. Using brakes to maintain directional control, he engaged the mid-field barrier at about 40 knots and the aircraft was brought to a smooth full stop without further damage.

Colonel Trimble's accurate analysis of a serious inflight emergency, his thorough knowledge of the aircraft capabilities, and his professional airmanship resulted in the safe recovery of a valuable tactical aircraft. WELL DONE! ★

URC-64 *NEW* Survival Radio

Survival radios and locator beacons have been a Godsend to aircrews downed in Southeast Asia and elsewhere. Now there's a new, improved survival radio coming — the URC-64. You should start seeing it before long. The first units were scheduled for OTE sometime in March or early April, with field deliveries targeted for May. However, the URC-64 won't show up in appreciable quantities until some time during the third quarter of calendar '68 — sometime between July and the end of September. The operating instructions shown here were taken from a pilot model and may change slightly on the production model.

COMBINATION ANTENNA SWITCH
Pull it out all the way, about 22 inches. When the stripe comes up the radio should be on.

MOD meter. You can use this as one test of whether the set is working. Push the push-to-talk switch on the left hand side and the needle will deflect if the set is on and the battery is good.

VOL This is the volume control. To test the set you can turn up the volume and listen for speaker noise.

MODE This knob is marked V (voice), T (transmit), CW (Morse code). For voice operation hold the mouth piece close to your lips and depress the push-to-talk switch.

FREQ There are four frequencies, one always guard channel and three replaceable crystals. There are 600 channels available and the crystals used will depend on the users' needs. Guard channel is primary and, normally, crews will fly with the radio set on this freq.

REL This little button can be tricky. Remember, anytime you push it the set will automatically go to guard. Also, you use it to release the frequency lock so that you can change frequencies. If you want to change frequencies push the REL button and turn the frequency dial. If you are on another channel and want to go to guard, just push the REL button, and presto! Guard.

WATERPROOF
This little dandy has a waterproof case which ought to solve the dampness problem. Also, the battery case is isolated from the radio so you can change batteries in heavy rain or, even, in the water. Be sure to get the contacts dry, but the rest of the battery can be wet without hurting a thing.

NOTE: If you hear a beeper, someone else is transmitting a tone so you should go to the pre-briefed alternate frequency. Incidentally, you have a Tone selection on all channels, which gives you more versatility.

CAUTION: The frequency plate on the face of the set should indicate the actual crystal installed. During P.E. inspection users should check that the channels indicated match those currently in use.