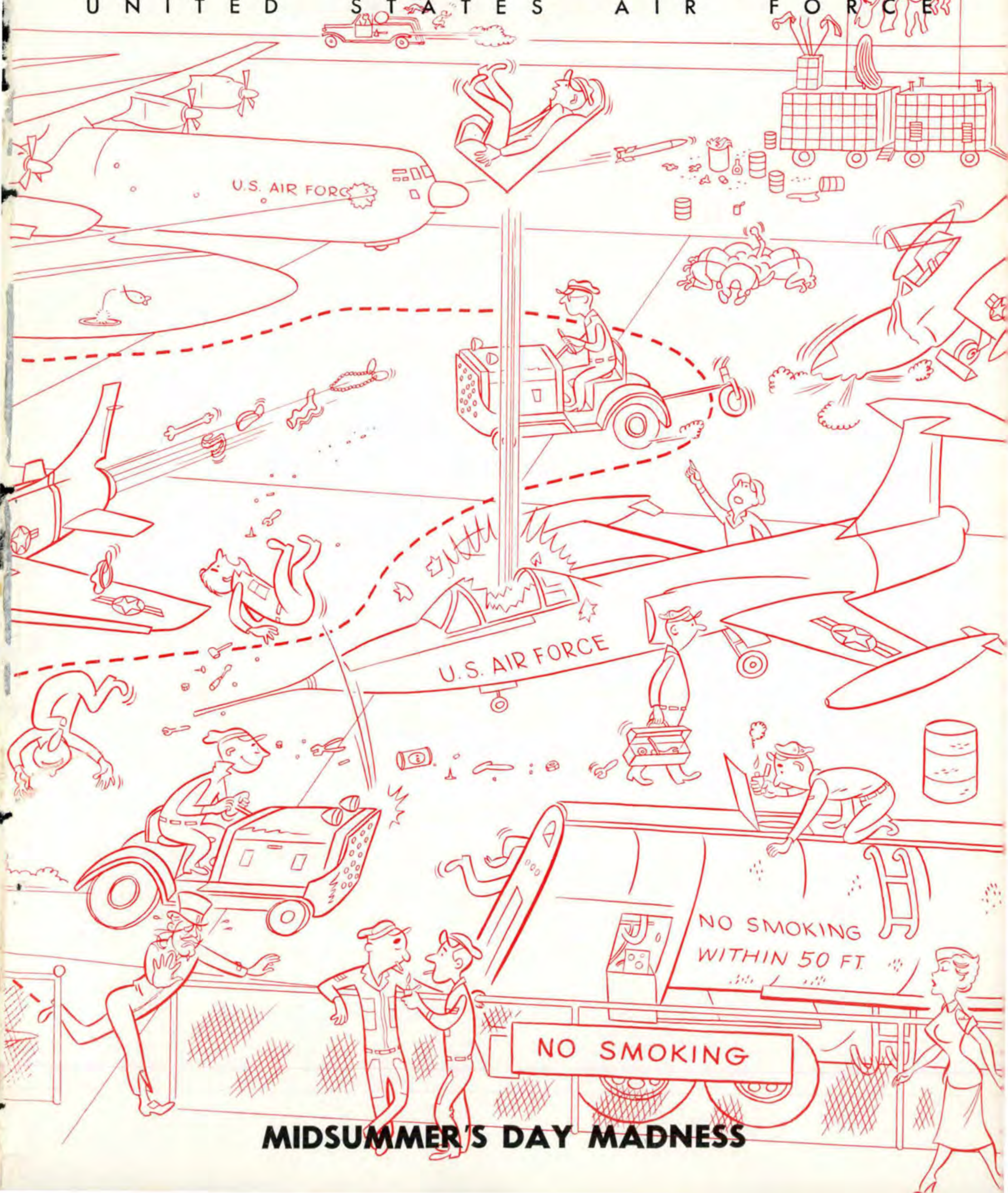
AUGUST 1959

FLYING SAFETY

UNITED STATES AIR FORCE



MIDSUMMER'S DAY MADNESS

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VOLUME FIFTEEN • NUMBER EIGHT • USAF PERIODICAL 62-1

I believe it's too advanced for our weather section, Gridley!

• CONTENTS

SAFETY GETS A BOOST •

On the Second of April, when General Curtis E. LeMay, Vice Chief of Staff, USAF, affixed his signature to a memorandum directing establishment of the Office of Deputy Inspector General for Safety, he set in motion a united effort that is destined to reaffirm and strengthen the role of safety in the Air Force's overall operations program.

Specifically, the new DIG-Safety Office, which came into being on 1 July 1959, embraces the present Directorate of Flight Safety Research at Norton AFB, California; the Office of the Assistant for Ground Safety, in Washington; the Nuclear Weapons System Safety Group, at Kirtland AFB, Albuquerque, N. Mex., and the Missile Safety Branch of Flight Safety Research, at Norton. Under the reorganization plan, air, ground, nuclear and missile safety each eventually will have directorate status.

In recognition of his outstanding record as Director of Flight Safety Research for the past 4½ years, Major General Joseph D. (Smokey) Caldara was selected to become the first Deputy Inspector General-Safety, working directly under the Inspector General, Lieutenant General Elmer J. Rogers. General Caldara's headquarters are in Washington.

During his tenure as USAF fly safe chief, the major accident rate dropped 50.5 per cent from 20.2 accidents per 100,000 flying hours in 1954, to 10.0 as of 31 March 1959. General Caldara asks that his thanks be made known to all commanders and flying safety officers for the excellent support which made this fine record possible. He also asks for continued emphasis on safe operations which will reduce even further the needless attrition resulting from any accident—flying or ground.

Although the task of organizing DIG-Safety is not yet complete, the new Director of Flight Safety Research has been appointed. He is Brigadier General Walter E. (Pop) Arnold, whose 10-year leadership record with the Strategic Air Command has been most impressive. He has been commander of the 817th Air Division at Pease Air Force Base, Vermont, since February, 1956, and before that, he was Chief of Staff of the 15th Air Force at March AFB, California.

When the complete organization of DIG-Safety is complete, FLYING SAFETY will present the new table of organization and its key members to the readers.

CROSSFEED

LETTERS TO THE EDITOR

Radio Transmissions

The article, "Desk Jockey," published in the April issue of FLYING SAFETY, prompts me to write, concerning the poor wording of the radio transmissions made by the pilot in the story. I do not mean to imply that these errors are confined to Air Force pilots. On any given day one can hear the same mistakes being made by pilots of all the services.

The article describes a simulated cross-country flight made in a Link trainer. It has been my experience that voice procedures practiced during such a "flight" are not conducive to good inflight practices because the instructor with whom the pilot talks is usually not a pilot and not acquainted with the fine points and latest changes of voice procedures. Consequently, the pilot develops poor radio habits and speech patterns by listening to and/or repeating instructions and clearances given to him by the instructor. The instructor, of course, fixes his speech pattern by listening to the pilots he deals with when he first becomes an instructor and from that point on, a vicious circle is established.

In addition to this, I have observed that the older pilots just do not bother to change their speech patterns as reporting procedures change. In fact, they're not aware that they use needless words and take excessive time to make a simple position report.

The errors I have reference to, in this particular article, are:

With the weather given as a 100-foot ceiling and ¼ mile visibility, the pilot is given a clearance to contact Idlewild Departure Control after takeoff for climb instructions. Such a clearance would not be given under actual instruments.

The pilot made a position report to Idlewild Departure Control in which he omitted the altitude of his aircraft. He unnecessarily told Departure Control that his destination was Atlanta, and he gave an estimate of the next reporting point but did not state what the following reporting point would be. (There is some room for argument as to the necessity of telling a Departure Control Facility what fix you expect to pass over after the next immediate reporting point, but when done properly this portion of the transmission would only consist of the one or two word name of the fix, as in the example to follow, and would eliminate confusion in the controller's mind as to the intended route of the aircraft.)

I submit that the position report to Idlewild Departure Control should have been:

"Idlewild Departure Control, this is Air Force eight-seven-five-four. Newark one zero. Passing one thousand. (This was omitted.) Washington zero-zero. Clifton."

In this case, Clifton intersection is the next compulsory reporting point or the next point over which the pilot plans to report.

In all the radio transmissions made by the pilot while "airborne" on this flight, excessive words were used, thereby increasing the transmission time. Words such as "at," "estimate," "range," "feet," and "past the hour" are certainly not necessary and are time consuming.

A typical example of this type of transmission is quoted from the article:

"—Five zero miles northeast of your station. Eight thousand feet. Estimate Atlanta Range at one zero past the hour."

If a transmission such as this must be made when the aircraft is not over a fix, the preferred wording is:

"—Five zero miles northeast Atlanta Radio. Eighth thousand. Atlanta one zero."

A comparison of the two transmissions will give some idea of the improvement that can be made.

I have been told by several controllers that the use of the term "your station" by a pilot leads to confusion on the ground. When a pilot reports to one particular ground station as being "over your station" or "estimate your station," there are many ground stations that may receive the transmission on the common frequency being used by the pilot. The confusion arises when the first portion of the transmission is not received but several ground stations hear the latter part concerning "your station." As you can well imagine, the stations that do not hear the entire transmission are apt to wonder if they are being called and may even initiate a transmission to the unknown (to the ground station) aircraft to ascertain this knowledge. The obvious solution to this problem is for the pilot to state the name of the station or fix that he means, as I have done above.

Your magazine is an excellent one and is read with great interest and appreciation by all naval aviators who get to see it. I feel, however, that articles with unintentional errors of the type I have cited, give a pilot who has not yet fixed his "radio habits" a bad start on the road to good radio procedures. When many pilots in a congested area use excessive wording as presented in "The Desk Jockey," it certainly becomes aggravating to the pilot waiting for a clear circuit on which to make his report.

LCdr Ben Goodman, Jr., USN
CFAA STAFF, NAS, Alameda, Calif.

We're with you, Commander Goodman. Pilots and simulator operators both have much to learn about correct R/T procedures. We passed your letter to the Synthetic Training Section here at Norton, and believe that Mr. Deen's comments are of interest to all. Thanks for your letter.

Commander Goodman's letter brings up a situation we are all aware of and are trying to correct. Fortunately, two out of three instructors in our department (including myself) are pilots, and, while we are not without error in our R/T procedures, I do feel that we are acquainted with the fine points and latest changes of voice procedures. In conjunction with our AACS people, I have instigated a training program to cover certain phases of R/T procedure: departure and en route clearances, departure control, en route reporting, holding instructions, approach and terminal clearances. This will standardize our procedures to conform to FAA and AF requirements, as far as the instructors are concerned.

Proper R/T procedures—accuracy, brevity and clarity—cannot be overemphasized. But, in my opinion, more emphasis is placed on pilot R/T deficiencies than is warranted, particularly in the published form. Proper R/T procedure works both ways and a pilot is only 50 per cent of any successful transmission.

Superfluous and/or omitted portions of a transmission are no worse in the final analysis than a "textbook" transmission given too fast. I am referring specifically to departure and en route clearances. In most cases they are given too rapidly and too often do not conform to the requested departure or flight plan route.

To further complicate matters, a pilot may be required to make good a takeoff time. For those pilots who are not completely familiar with a given area, i.e., names and positions of radio and navigational aids, intersections and so on, this presents a formidable problem. Generally, it results in one of three courses of action: the pilot cancels out and replans a flight; he ties up the frequency by having the clearance agency repeat the clearance, or he takes off without proper route orientation. The latter procedure is too often the course taken.

I fully realize that Air Traffic Control, particularly in a high density traffic area such as the Los Angeles complex, cannot divert traffic for one pilot's convenience. I have no "canned" solution for this problem but I do know that a great deal of confusion could be eliminated by reading clearances more slowly and distinctly.

In our instrument school we have a period devoted to copying clearances. I have had a shorthand list compiled of the most frequently used clearance terms, and each pilot is given a copy when he attends the instrument school. The clearances we use for practice are actual ones which I have secured on tape from the LA Center. This part of our program has been very successful and the pilots have been enthusiastic about it.

It is refreshing to know that pilots outside the Air Force are interested in and read FLYING SAFETY MAGAZINE, which I consider a must in reading for all AF pilots.

M. T. Deen
Chief, Synthetic Training Section, Norton AFB, Calif.

Ejection!

Undoubtedly you've had some letters criticizing your narrator for failure to have his Capewell release ready. Any such criticism is unfair and I must rise to his defense.

The Capewell release is not a satisfactory device for any user except experienced parachutists. It demands intelligent, coordinated action, and I believe this is too much to ask of the average pilot in bailout. The pilot, in shock—with fingers numb from cold, trailing a broken arm or swallowing buckets of salt water—is called upon to use the tiny quick release.

We've been sold a bill of goods by the parateepee boys (see T. O. 14D1-1-1, Sec. III, Par. 16). I'll worry about parateepees when I find poles in the North Sea. The method is unimportant—a box release, explosive bolts, spring-loaded knives — just give us a sure method to get rid of the canopy in minimal conditions.

Capt. Robert W. Robinson
82d Tac Ftr Sq, APO 755, NY.

FAA *and*

The Federal Airways System has been basically unchanged since its inception in 1935. Now modernization's the order of the day; many improvements are upon us.

On any one day you care to choose, there are several thousand planes in the airspace over the United States. They vary in kind from high-mach fighters to two-seaters that hardly hold their own with a strong headwind. Their takeoffs and destinations make a complex and mysterious pattern with which the air traffic controllers of the Federal Aviation Agency must deal every day of the year.

Since each aircraft making up one point in the pattern is changing its position every second, the problem these controllers deal with is a tough and constantly varying one.

With the need for air defense of the United States and the rapid rise in all types of flying, air traffic control is one of the big and important jobs of the Federal Aviation Agency.

What is the FAA doing to come to grips with the problem of safety and control in our vanishing airspace?

The answer can be given in terms of four facets of this problem: congestion, control service, aircraft performance and control system. Although today's air traffic management problems are many and complex, they can be summed up in these terms:

- *An increasing demand for service—more service to handle more traffic in areas where traffic is controlled today, and expansion of service into new areas where none exists today.*
- *Increasing congestion in the airspace and inefficient use of the airspace.*
- *Wider performance ranges of aircraft, increasing the differences between various types of operations.*
- *A control system that is based on slow, manual methods.*

To fulfill immediate needs for increasing the capacity and efficiency of the Federal Airway System to overcome these problems, FAA's planning is directed toward expansion and modernization of the existing air traffic control system, using available equipment and known techniques.

A complete five-year program based on this concept was first presented to the Congress for approval in 1955. It was well received. Congress recognized the urgency for immediate action and appropriated funds so that parts of the improvement program originally proposed for following years could begin during the first year (Fiscal Year 1957).

This program has been and is now being carried out at a rapid rate. It is reviewed continually and extended each year for the ensuing five years so that it is current with respect to the latest information on traffic demands, forecast growth trends, types of equipment available and changing philosophies of operation.

As the plan is revised from year to year, provision is made for the introduction of new equipment, techniques and concepts resulting from research and development efforts. The program has had favorable response from the Congress each year it has been presented and we are now beginning to attain the benefits of some of the operational improvements which were started several years ago.

For example, in the field of air navigation aids, the FAA has placed in operation over 554 VORS. This year, we shall install an additional 13 VORS and 62 VORTAC facilities (the combined VOR and TACAN facility which provides VOR azimuth indications and TACAN azimuth and distance information from a single ground station). Also, about 150 of existing VORs will be converted to VORTAC operation this year. The number of navigation aid installations will be increased each year until, by 1965, more than 1100 complete VORTAC facilities should be available.

Expansion of the VORTAC network of aids will extend navigation coverage into new areas and provide additional flexibility and efficiency, both in the conduct of aircraft missions and performance of the air traffic management function. Concurrently, with the expansion of the VORTAC system, we are undertaking the progressive decommissioning of low and medium frequency four-course ranges. Discontinuance of IFR use of the four-course range will serve to eliminate what is probably the most difficult single problem facing air route traffic controllers today—providing separation to traffic using different types of navigation aids and two non-coincident, incompatible route structures (the colored and VICTOR systems).

Air Traffic Control

E. R. "Pete" Quesada, Administrator, Federal Aviation Agency

Washington Air Route Traffic Control Center showing controls around horizontal radarscope and manual control board in background.

Establishing the VORTAC SYSTEM as the only navigation system for IFR use will have the immediate effect of greatly expanding available airspace and eliminating numerous points of traffic conflict.

We are also making good progress in the installation of radar, on which the immediate improvement program relies heavily to provide better utilization of the airspace and overcome some of the problems associated with the tremendous performance range of present-day aircraft. At present, 30 Air Defense Command radars and one Air Training Command radar are being used to provide flight advisory service to civil jet airliners during the en route portion of their flights.

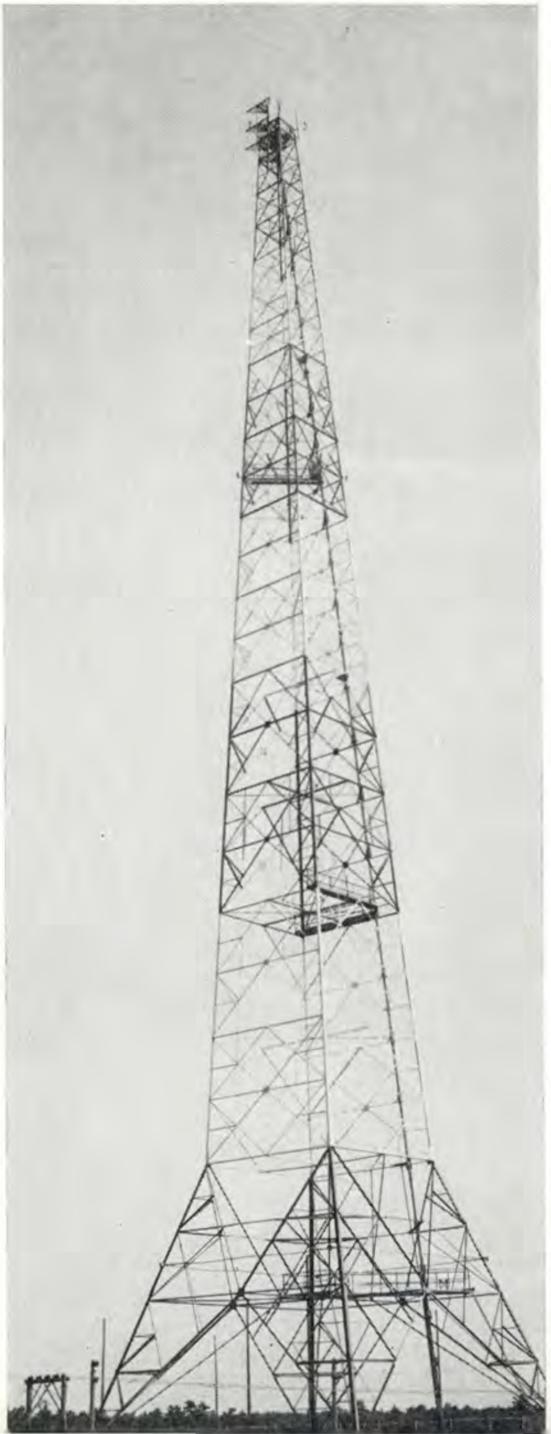
In the field of long-range radar, FAA had five long-range radars operating in 1958. Eleven additional systems have already become operational this year, and 24 more are scheduled for commissioning before the end of the year. These high-powered radars, capable of detecting aircraft up to 200 miles in range and 60,000 feet in altitude, are being located to serve air traffic in the vicinity of busy terminals and in the extended area around airports where severe problems associated with the climb and descent of aircraft are encountered. It is planned to provide long-range radar coverage throughout the airspace above 15,000 feet over most of the domestic U.S., and to lower altitudes on high density routes. The FAA is cooperating closely with the military services in the installation of these radars, as it became apparent early in the Agency's program that air defense and FAA radars could be used jointly in certain areas and thus avoid duplication of effort. A joint radar program has been worked out which has not only resulted in a great saving of money and equipment, but has helped to reduce critical frequency-interference problems.

Of the 40 long-range radars scheduled to be operational for air traffic control use by the end of this year, 12 are military-installed, and 28 are FAA. Over half of them will be used jointly. Sixteen long-range radars are planned for installation in 1960. Seven of these are to be FAA-installed; nine will be military, and 10 will be used jointly.

During the calendar year 1961, the FAA plans to commission 13 systems for air traffic control, and eight of these are to be FAA-installed and five military-installed Of the 15 additional long-range radars planned for 1962, it is anticipated that nine will be used jointly.

The number of FAA airport suveillance radars, which are capable of detecting aircraft within a 50-60 mile

VORTAC installation, Herndon, Va., one of first of its type established by FAA. With proper receiving equipment, pilot gets precise direction and distance from transmitter. 260 units operate now. FAA plans 1100 installations by '65.



radius and up to altitudes of 25,000 feet from the antenna, will be expanded from the 47 now operational to 82 by the end of 1961, according to present planning. These radars, located at major terminals, have permitted a considerable reduction in the interval between successive landings and departures, resulting in less delay to aircraft.

Both the long-range and airport surveillance radar systems will be equipped with radar beacon capability. The radar beacon will increase the efficiency and safety of radar control by providing a usable radar reply from aircraft that can be distinguished through all but the most dense areas of ground and precipitation "clutter." This will permit radar control to be continued under conditions which now require curtailment. Intensified target returns will also permit tracking of aircraft at a greater range and altitude than possible with primary radar alone.

During calendar 1959, the FAA expects to establish radar beacon capability at 34 long-range radar and five airport surveillance radar locations. It is planned to provide radar beacon equipment for all remaining long-range radar systems and at 27 additional airport surveillance radar systems during the calendar years 1960 and '61.

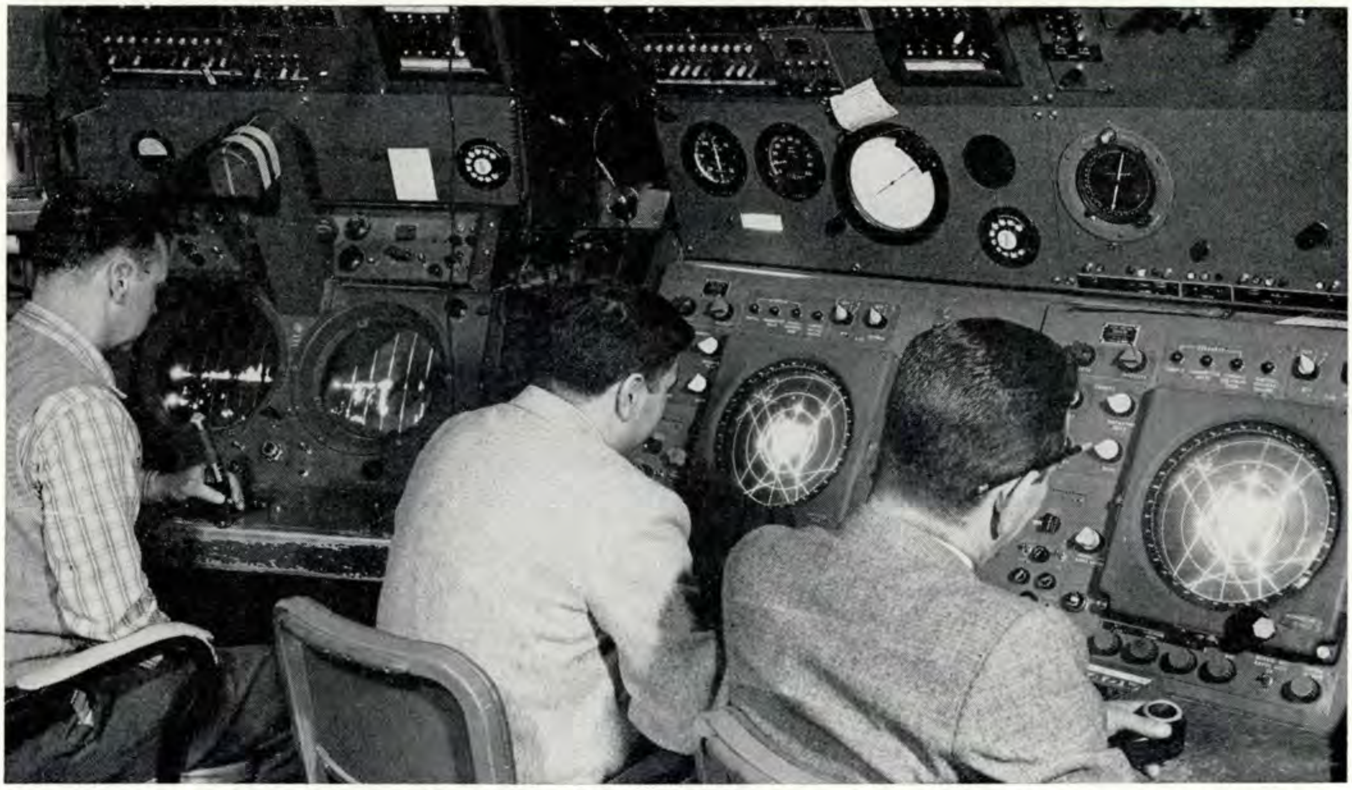
In the field of radar displays, there is promise of defeating some of the problems associated with present equipment. The horizontal radar displays presently in service have many shortcomings. They are not large enough; they are not bright enough to be used in a well-lighted room, and the target quality and definition are only fair.

The FAA has moved a step closer to the solution of these problems with the procurement of television scan-conversion units. Experiments with the scan-conversion technique revealed that equipment could be made to convert radar information into a television-type presentation. A television presentation is much brighter than a conventional cathode ray tube radar picture, and units are now being used successfully in airport traffic control towers and in well-lighted air route traffic control centers.

Further plans for the improvement of radar displays include the addition of such features as the integration of radar data from two or more sources on a single display, the ability to insert symbols for identification purposes, and the ability to transfer aircraft identity electronically from one radar system to another.

Improved techniques for simplifying coordination between radar controllers are also under investigation. Closed circuit television is one. Another development being studied is a technique whereby a radar controller can select a target on his scope and simultaneously have this target identified on another radar scope through electronic means. These developments when perfected will do much to smooth the handling of traffic in and out of the major terminals.

An important factor in some of the more spectacular "black Fridays" in the past history of air traffic management has been the inability to get flight information posted and displayed rapidly enough in the manual system. Fortunately, experiments have shown that standard digital computers can be used to process much of the data required and speed up the flow of information. One such machine has been in operation for almost two years at the Indianapolis center, and two more went into service recently at New York and Washington.



A typical instrument flight room at a large terminal airport. Two men on right monitor surveillance scopes. Man on left works precision radar.

When this program is more fully implemented it will be possible for a flight plan to come from an outlying point by wire directly into the computer where it will be processed by the machine, flight times calculated, and flight progress strips printed for each fix, ready for insertion on the display boards.

Flight plans will be stored in the machine, revised and updated by the controller by means of an input device at the control board. Then, when a flight is about to pass into another center's area, the plan will be transmitted automatically to the adjacent center's computer where the whole process will be repeated.

The use of business computers is merely an interim step toward the introduction of a specially designed air traffic control data processing system now in the advanced stages of development. This is the data processing central, which will provide a much more advanced semi-automatic data processing and display system to replace interim computers and the existing manual systems in all major high density areas. Briefly, this system will be capable of accepting data from many sources, such as automatic data links, teletype circuits and manual controller inputs, processing these data and then feeding them to automatic pictorial and tabular displays.

One section of the system consists of an en route computer (digital), en route sector consoles, departure console, supervisor's console, radar supplements (displays) and automatic flight strip punch and print units.

The other section of the system is made up of transition and terminal area equipment consisting of a transition computer (digital), a terminal area computer (analog) and, for handling military high performance aircraft, a transition terminal computer (digital).

Delivery of the en route equipment is anticipated during the period May through this month, and delivery of transition and terminal equipment from September through November of this year.

Initial system testing and experimentation with a simulated air traffic control environment will be undertaken at the FAA National Aviation Facilities Experimental Center at Atlantic City, New Jersey. Early in 1960 the equipment will be installed and operated in the New York complex, initially in association with the existing air route traffic control center, then finally on its own. Equipment is being provided for a major part of the New York control area, and Idlewild Airport, Westchester County Airport and Suffolk County Air Force Base. The FAA five-year program calls for establishing approximately three of the systems per year, starting in the Fiscal Year 1961, following installation and de-bugging of the prototype equipment.

One item from an early version of the five-year plan which has been largely completed is the expansion of direct pilot-controller communications for control centers. Through the use of remotely controlled communications facilities, it is now possible for center controllers to talk directly to pilots of aircraft throughout the airspace above 15,000 feet over the United States, as well as down to minimum instrument altitudes in and around the larger terminal areas and along the more heavily travelled routes. This eliminates many communications delays which plagued controllers and pilots alike for years when communications had to be relayed.

Although direct pilot-controller communications facilities are a great improvement over the relay system and have been a tremendous value in expediting the flow of

FAA and Air Traffic Control (Cont.)

air traffic, they also set definite limitations on the capacity of the individual controller to handle volume traffic. Recognizing that, in the not too distant future, these limitations will become a restrictive influence on the expansion of the air traffic control system to meet anticipated needs, the FAA five-year implementation program includes provision of funds in the Fiscal Years 1963 and 1964 for the installation of an automatic ground-air-ground communication system (AGACS) to mechanize much of the communication between pilots and controllers in both the civil VHF and military UHF bands. The system is intended to handle routine communications between controller and pilot, relieving congestion on radio channels and providing time for non-routine messages and emergency uses. Equipment will first be installed in the New York area, and serve in conjunction with the data processing central. It will permit direct routing of information to the computers without human intervention, thus reducing controller workload and risk of errors.

These are the major items in the FAA implementation program for the next five years, although there are many other items of hardly less significance. Now what do they all add up to in terms of meeting current problems and providing better service to all of the airspace users—military, air carrier and general aviation?

The VORTAC system, being implemented as a common system designed to meet the need for joint use of the airspace by military and civil aircraft, will provide coincident azimuth information on which the common tracks and networks of routes so essential to proper performance of the air traffic control function may be attained. At the same time, the VORTAC facilities furnish distance information from a single point source, setting up the common position fixes and reporting points also needed for efficient air traffic control. As soon as the low-medium frequency network of aids can be reduced and converted to VFR use only, we shall thus have in VORTAC the long-sought common system of air traffic control and navigation.

The availability of accurate and continuous position information made possible by VORTAC can be translated into reduced separation between aircraft, with increased safety. In particular, present standards of longitudinal, or fore and aft, spacing of same-direction aircraft on the same route can be reduced from the present 10 minutes to approximately five minutes. Ten-minute spacing between two aircraft making good a ground speed of 600 knots requires 100 nautical miles of separation between aircraft, whereas if both have the distance measuring capability of VORTAC, this separation needs to be only 50 nautical miles. Existing separation criteria for crossing traffic and for aircraft climbing or descending through the altitudes of other aircraft can also be reduced proportionately and still meet safety standards.

More precise holding can be accomplished with VORTAC, thereby releasing a substantial amount of airspace for other purposes, and holding patterns can be established where they will be most effective from an air traffic control standpoint.

Position reporting will need to be done less frequently. Radar identification will be more easily obtained by means of the azimuth and distance information available from VORTAC.

Many other benefits will most certainly accrue, both to pilots and the air traffic control system. These benefits will result in more expeditious movement of traffic and reduction of delays.

Radar has proven to be the most effective tool available to the controller thus far in the history of air traffic management. Airport surveillance radars have proved their worth in service for over 10 years, and long-range radars have also been in service long enough to establish their value. The air traffic control radar beacon system has potential uses in addition to its obvious advantages of aircraft identification, improved tracking in bad weather, and better coverage.

All of this radar equipment gives controllers the ability to "see" the aircraft they are controlling. Since they provide precise position information on a continuous basis, they also will permit a drastic reduction in separation standards and consequent increase in system capacity. Translated into plain language, this means more flights can be fitted into a given amount of airspace. There will be fewer delays in getting off the airport or in starting an approach, and greater flexibility to fly at the altitudes and on the routes desired, where radar coverage is available as an air traffic control tool.

The keystone effort in the program to modernize the internal functioning of air traffic control facilities to meet current demands is the automation of data processing. This is typified in the present use of digital computers and the data processing central. A substantial part of the time of the controller must be spent in communication, coordination, note-taking and posting flight data, making estimates of flight progress, and so on.

All of these routine duties take time, distract him from his primary function, and make more difficult the job of making control decisions. By accomplishing most of these functions automatically and thus relieving the controller of much of his clerical workload, the data processing central equipment will bring about a precise and much better organized approach to the solution of control problems. Although pilots will not notice any particular changes in the handling of their flights from a procedural standpoint, they will find that they are accomplishing their assigned missions with less confusion, delay and inconvenience.

The advantages of direct pilot-controller communications are readily apparent to pilots of aircraft properly equipped to use the full capabilities of these facilities. Installation of the mechanized system of direct communications (the aforementioned AGACS) will extend these benefits by simplifying reporting procedures, reducing frequency changing and reducing congestion on voice channels.

It takes time, much effort and a considerable expenditure of funds to expand and modernize a system which has not kept pace with advances in aircraft performance and capability. The system is basically unchanged since its inception in 1935. However, we in FAA feel that our plans for solving the problems are sound and that progress toward increasing the capacity and efficiency of the federal airway system to meet immediate needs has been good.

I believe that during this year, and at an accelerated rate during the next three years, every pilot who flies will see substantial improvement in service resulting from the FAA's modernization program. ▲

BEWARE THE DOG · *days*

William F. Ashe, M.D., Chrmn., Dept. Preventive Medicine, Ohio State University

Summer is about gone — come month of August—or so it seems, but there is still some hot weather ahead. And as Rex might say, all of these warnings appear in military tech manuals but invariably somebody forgets to read them. Take care that *you* do not fall victim to these three common hot weather maladies:

- *heat exhaustion*
- *heat stroke*
- *salt depletion cramps*

These are not giddy spells that affect old ladies in crinoline who've forgotten their parasols. They are serious afflictions that can incapacitate and even kill people. The healthiest, huskiest laborer, athlete or pilot can succumb with dismaying rapidity, if exposed to excessive summer heat without proper precautions.

During the winter months, those of us who live in the temperate zones lose our ability to react effectively to summer heat, and then in the early summer months we must regain it. This process is called acclimatization and is protective within a wide range. Similarly, altitude acclimatization is protective against the risks of hypoxia to the aviator or mountain climber up to altitudes of nearly 18,000 feet.

The name's the same, but the two processes are entirely different and one is neither beneficial nor usually detrimental to the other. Acclimatization to heat, in simple terms, is the ability of the body to transfer large quantities of circulating blood from internal organs to the skin. This results in a marked increase in sweating which, when evaporated, is our major method of cooling. Approximately 90 per cent of acclimatization to a given hot environment may be accomplished in five days, and is complete in about two weeks.

The individual, if suddenly exposed to work in a hot environment to which he is not fully acclimatized, may develop a flushed face, rapid heartbeat, some shortness of breath, headache, light headedness and dizziness. He may vomit and collapse. He will sweat profusely and be mentally confused. His body temperature will rise to 102°—104°F. This condition is called heat exhaustion. It results from the body's gaining heat from the external environment while producing heat internally by metabolism at a rate faster than the individual can dissipate it. All of his natural cooling mechanisms are working but not at maximum efficiency.

Here's a quick review of the treatment which is simple and no doubt familiar to everyone. Find a cool, shady spot and remove most of your clothing; lie down and rest until your body temperature and heartbeart have returned to normal. As soon as nausea has subsided, drink as much water as possible.

Now then, if warning signs are ignored and the individual continues to work in a hot environment, he is inviting real trouble. He may pass out—but before that happens he may develop a much more serious disorder called heat stroke. When this happens he will stop sweating and his skin will become very hot and dry. He will become confused, even maniacal, and his temperature may go up to 106° or 112°F. Shock will follow, and then coma. In this condition, the temperature regulating centers of the brain have been seriously injured, even destroyed, and the body quits trying to get rid of heat. If the individual is not treated quickly and promptly this condition can be fatal.

All clothing should be removed and the body vigorously massaged with ice or very cold water until the temperature has fallen to 102°F. The patient should be hospitalized immediately and given intravenous fluid therapy. Recovery is slow and the individual's thermal mechanisms may never function normally again.

Here are some of the things that will increase the risks of heat exhaustion and heat stroke: fatigue, alcohol, mild infections, excessive eating, arteriosclerosis or heart disease, impervious clothing or clothing which does not permit you to sweat. The lack of adequate fluid and salt intake will also increase the risks.

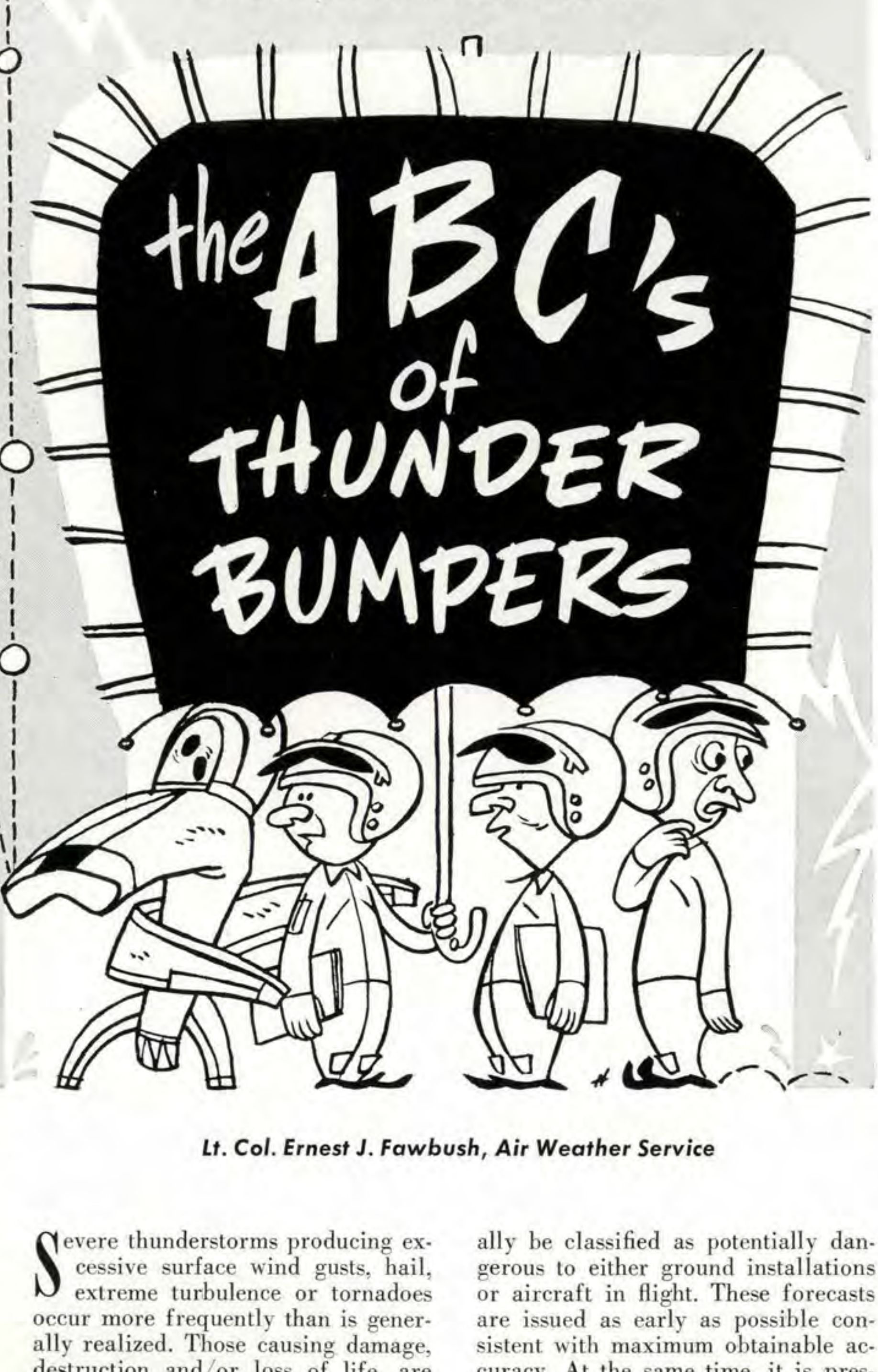
The amount of water loss during moderate work in a hot environment may range from one pint to three quarts per hour in the fully acclimatized man, depending on the degree of heat stress he is exposed to. Water, therefore, must be consumed at very nearly the rate at which it is lost; otherwise, mental confusion, lack of interest and poor judgment may develop. A pint is a pound, and if a man loses more than three or four pounds of water rapidly without replacing it, he will no longer be entirely normal. But—as with hypoxia—he will swear that he is all right.

Such sweat losses also produce a large salt loss of about 5-25 grams per day, which must be replaced. This may be done by heavily salting the food intake, drinking 0.9 per cent salt water or by eating salt tablets. The gastric distress caused by salt tablets can be avoided by chewing the tablet and drinking a full glass of water with it. The body needs about one standard salt tablet—like those provided near the drinking fountain—for each two large glasses of water you drink. Illness, resulting from loss of salt, or salt depletion cramps, may occur to anyone if he does not stay ahead of his salt losses. These severe cramps often develop suddenly and should certainly not be ignored. The person should rest immediately, and take salt either by vein or mouth. If this is done, recovery will be both rapid and complete. A good schedule for work during the first five days after being exposed to excessive heat should include frequent rest periods. Thereafter, the usual work routine may be resumed.

In hot weather, be sure to drink enough water to assure a normal (wintertime) urine production each day and double the amount of salt normally consumed. Wear light porous clothing and avoid all excesses of fatigue, alcohol and loss of sleep. Bathe frequently in cool water when you feel too warm. Keep the air in your home or office moving. Avoid airconditioned rooms which are more than 20°F. cooler than the outside air.

A final word of caution—take it easy! Sunburn is never fun and it can be fatal. ▲

Severe Weather Warning Center forecasts "hardcore clouds." Draw up a chair and learn . . .



Lt. Col. Ernest J. Fawbush, Air Weather Service

Severe thunderstorms producing excessive surface wind gusts, hail, extreme turbulence or tornadoes occur more frequently than is generally realized. Those causing damage, destruction and/or loss of life, are emphasized by publicity. Those which occur over barren or sparsely settled areas may be unnoticed or, if detected, become mere cold statistics.

The mission of the Severe Weather Warning Center *(SWWC)* is to forecast thunderstorm occurrences whose severity is in excess of established criteria and those which may generally be classified as potentially dangerous to either ground installations or aircraft in flight. These forecasts are issued as early as possible consistent with maximum obtainable accuracy. At the same time, it is presently possible to forecast limited areas only and for short periods of time.

The Severe Weather Outlooks and Severe Weather Advisories posted in your base weather station and disseminated by the SWWC comprises three parts:

- *A—General Information.*
- *B—Severe Weather Areas.*
- *C—Tornado or Damaging Windstorm Areas.*

Part A describes in a general, abbreviated form the expected development of thunderstorms regardless of intensity. Identification of squall lines, instability lines, cold frontal thunderstorms, air mass thunderstorms, overrunning warm frontal thunderstorms, general areas and/or isolated air mass thunderstorms are forecast in general terms. Additionally, forecasts of motion and general intensity of the thunderstorms are indicated by reference to expected surface gusts, hail size aloft and/or surface and minimum level and intensity of turbulence in thunderstorms.

Part B delineates the area and range of time that forecast thunderstorms are expected to be of severe intensity. A thunderstorm is defined as severe if it produces a minimum of 55 knots of surface wind gusts, or ½ inch hail at the surface or aloft, or vertical up-rush at the -5° C level of 66 feet per second *(39 knots)*.

Part C delineates the area and range of time that the maximum severity of thunderstorms capable of producing tornadoes and/or damaging windstorms are forecast to occur.

Fixing of areal limitations of thunderstorms is done by reference to distance on either side of an axis, or by designation of geographical boundaries.

Reference to an axis is used most often in association with frontal systems or prefrontal squall lines as the primary thunderstorm producers. Area reference is utilized when widespread convective thunderstorms are expected to occur, or when the thunderstorm development results from mountainous or warm frontal overrunning. Depending upon developments, an axis reference will be used within a large area of thunderstorms to indicate where the more severe thunderstorms are expected.

Severe thunderstorms are seasonal as to general area and frequency of occurrence. Broadly, a migration from the southeastern states into the Great Plains takes place during late winter and early spring, with recession to the Southeast in early winter. The areas west of the Continental Divide usually experience their severe thunderstorms during winter and early spring, while the northeastern areas of the States have theirs during summer and early fall. The maximum frequency of occurrence, however, is in the Great Plains area.

The seasonal distribution of severe thunderstorms suggested that certain identifiable criteria existed which could be useful as predictors of potential severe thunderstorms. These predictors have been identified as follows:

- The vertical stability of the atmosphere.
- The horizontal and vertical wind shear. (Shear occurs when wind flow in adjacent areas varies in direction and/or speed.)
- The wind velocity.
- The presence or forecast availability of a "trigger mechanism" in the general thunderstorm areas. The term "triggering mechanism" is a general term used to identify features *(fronts, squall lines, instability lines, instability areas)* which can produce forced lift of the air.

The forecast problem is divided into three basic stages:

- Evaluation of the stability of the atmosphere from observed and forecast data.
- Analysis of the wind field for strong windshear, vertically and/or horizontally.
- Determination, or forecast, of the presence of a "triggering mechanism." For better utilization of the advisories, an understanding of the above three portions of the forecast problem is desirable.

All thunderstorms are not of similar intensity.

First, the average intensity of a thunderstorm can be computed from evaluation of the vertical structure of the atmosphere as depicted by rawinsonde observations. Variations in stability are caused by temperature advection *(horizontal movement usually involving change)* at various levels, moisture advection at various levels, insolation *(heating by the sun)* and radiation effects in the surface layers, evaporation and condensation; and convection *(vertical movement usually involving change)* or turbulent mixing. Analysis and computation of the stability factors provide values for forecasts of hail size, turbulence levels, surface wind gusts and potential for tornadoes.

Second, the evaluation and analysis of the upper air wind field provides identification of the favorable areas for severe thunderstorms. It has been determined that the more severe thunderstorms are located near the axis of a belt of strong winds aloft, sometimes as low as 10,000 feet above the terrain, but usually higher; and primarily in the shear zone between these strong winds and adjacent winds of lower speed. When the upper wind field is rather flat with no marked shear, the forecaster applies the aforementioned method of evaluation and analysis of the upper air wind field to the area having the weakest wind aloft. This process enables him to predict with reasonable accuracy severe thunderstorm areas. The effects of the wind shear zone and strong wind belts in the development and maintenance of severe thunderstorms cannot be over emphasized. These zones and belts tend to accelerate this vertical motion within the thunderstorm and increase its intensity. Their individual functions in the development are dissimilar and produce different effects. Suffice to say, however, their presence is important.

The wind belt provides direction of motion, and storms will move at approximately 40 per cent of the wind velocity at the 500 millibar level *(approximately 18,000 feet)*. The wind shear zone is very important because in this zone the strongest vertical motions occur, which produce and assist the development of tornadoes and large hail. Limitations imposed by the loss or non-availability of upper wind data make it difficult at times to identify potential areas accurately. Additionally, the low density of reporting stations precludes precise pinpointing of potential severe weather areas.

The third consideration, "triggering mechanism," is the most important factor for severe thunderstorm development. It is the means that releases the energy of the atmosphere, which, coupled with the energy derived from the wind belt and wind shear zone, results in severe thunderstorms. Triggering mechanisms may be divided into two general types:

- The persistent triggering mechanism type, such as fronts and major troughs associated with strong cold air advection.
- The non-persistent type, such as squall lines, instability lines, instability areas and minor troughs within the general wind pattern. These are the most difficult to forecast and are associated with the most severe thunderstorms. These triggering mechanisms develop in favored areas within general air masses or in discontinuity areas between air masses of different characteristics. Frontal systems may or may not be associated.

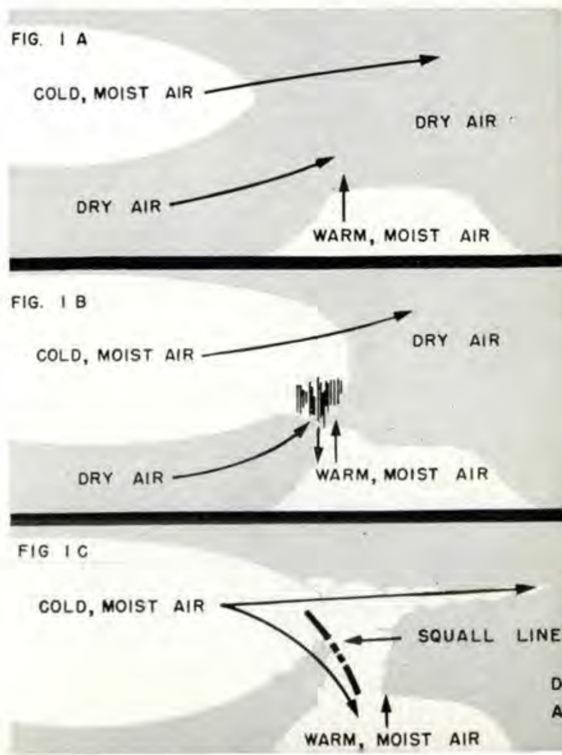
Figure 1 depicts a generalized, vertical cross section of the formation of the formidable Great Plains type squall line or of an instability line not associated with a fast moving cold front. The basic requirement for this type of formation is evaporative cooling of dry air as a result of high altitude precipitation.

Additionally, it is required that surface heating be of sufficient intensity to cause thermal currents to transport moisture from lower to higher levels.

Formation of this type squall line or instability line requires the following conditions to be fulfilled:

- Cold, moist air advection, usually at 14,000 feet msl or higher, but based lower than 20,000 feet msl. *(Figure 1 a.)*
- Cooling of the layers below the advection levels by evaporation of rain or cloud particles. *(Figure 1 b.)*
- An increase of surface temperature, usually by insolation, to the point that will cause convective currents to reach the condensation level.
- Increase in moisture, or sufficient moisture present, at all levels, to cause cloud formation.
- Low level wind convergence to increase updrafts. *(Figure 1 c.)*

Figure 4 depicts the formation of a general area of thunderstorms in association with a warm front or quasi-stationary front. The lower layers upwind are generally well saturated and forced upward over the frontal surface. Along the core of the low



level maximum wind *(usually at 4000-6000 feet)*, projected over the frontal surface, an instability line will develop. Motion of the instability line through the thunderstorm area will be with the 500 millibar winds and at approximately 40 per cent of their speed.

Previously, it was stated that the geographical forecasting of severe thunderstorms is made by means of forecasting the upper wind field. Reference was made to a strong wind belt, and to horizontal and vertical wind shear.

The following hypothesis forms the basis for forecasting the location of severe thunderstorm areas. Our research has shown that a portion of severe thunderstorm occurrences is in association with major storm systems. There are many cases, however, which are not. These occur when there is a general lack of frontal systems, and such formations are generally attributed to air mass potential for severe weather.

As the weather produced in all thunderstorm occurrences is generally similar, it soon became evident that "favored" criteria existed in each case. Research pointed directly to the wind field patterns, and thus, our hypothesis was formulated. *Look for severe thunderstorms in the zone of wind shear*—primarily shear resulting from change in wind speed in the upper levels and change in both speed and direction in the lower levels.

Figure 3 depicts an analysis of the wind speed field perpendicular to the maximum speed belt and in the critical zone as dictated by stability analysis. The isotachs *(constant speed lines)* depict west winds blowing away from the reader. The maximum speed shear is indicated in the vicinity of station C.

Since our available upper wind data are considered sparse because of 75-to 100-mile spaces between upper air sounding stations, it is impossible to ascertain the exact location of this zone. The selected axis of severe thunderstorm activity would be to the north of station C and parallel with the wind direction of the maximum wind belt, usually found at 14-16,000 feet msl. As the shear zone is not exactly smooth but is conjectured actually to exist in a frontal wave form, the hypothesis further states that this type of configuration results in severe thunderstorms in the area where the vertical and horizontal wind shears increase in magnitude as a result of the influences created by the maximum wind belt.

Generally, this would be at the crest of a frontal wave formation such as is indicated by the wave-form configuration of Figure 4. Sufficient density of upper wind data would permit a more positive determination of the location of this type configuration and consequent improvement in identification of areas of severe storm potential.

To the complexity of motion resulting from the interaction of winds of different speeds and direction must be added the vertical motion derived from the stability characteristics of the air column produced by insolation and forced lifting releasing the latent heat of condensation.

Figure 4 is an enlarged picture of the severe thunderstorm action as it concerns the individual cells at the wave crest. It indicates the resulting severe thunderstorm occurrence at the apex of the wave crest. Cell "A" moving faster than Cell "B" overtakes Cell "B," causing near spontaneous acceleration of vertical motion at the juncture of the two cells. An unbalanced state results which is reflected by tornado development, severe windstorms and other damaging phenomena of the severe storm.

Values derived from computation of the stability factor will determine forecast elements at the surface and/or aloft. If sufficient quantities of moisture are available for transport to the upper area of the thunderstorm, the speed of vertical motion within the thunderstorm will determine the size of hail development. This statement does have some modification. Given a fixed quantity of moisture, the hailstone size will be determined by the speed of the vertical motion; the slower the speed, the smaller the hail. The faster the speed, the larger the hail.

Generally, vertical velocities of 40, 56, 79, 104 and 128 knots are required to produce and sustain hailstones of one-half, one, two, three and four inches in diameter, respectively. These velocity values represent the speed attained at the altitude of the -5°C level of the environment air column. They are the values currently utilized by the SWWC for forecast of hail size. Variations from forecast hail size will result from fluctuation of available moisture and from greater or lower vertical velocities being attained. *(Verification and assistance in research on the hail problem is derived from AF Form 1228 submitted by Air Force pilots. We encourage the submission of these forms and any narrative information considered by the pilot to be important.)*

The degree of turbulence will be related to the speed of vertical motion and of the adjacent wind flow pattern in inverse proportion to the distance between them. In other words, the

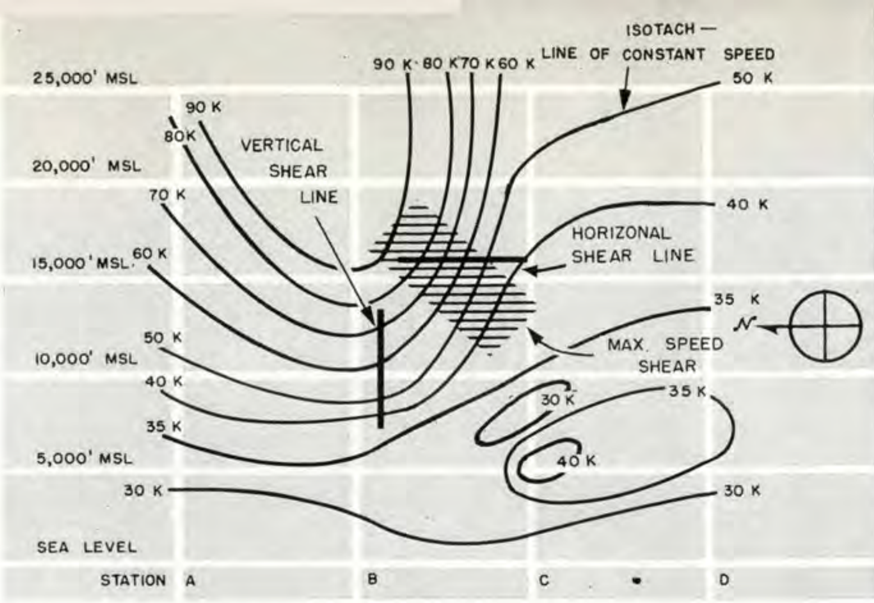
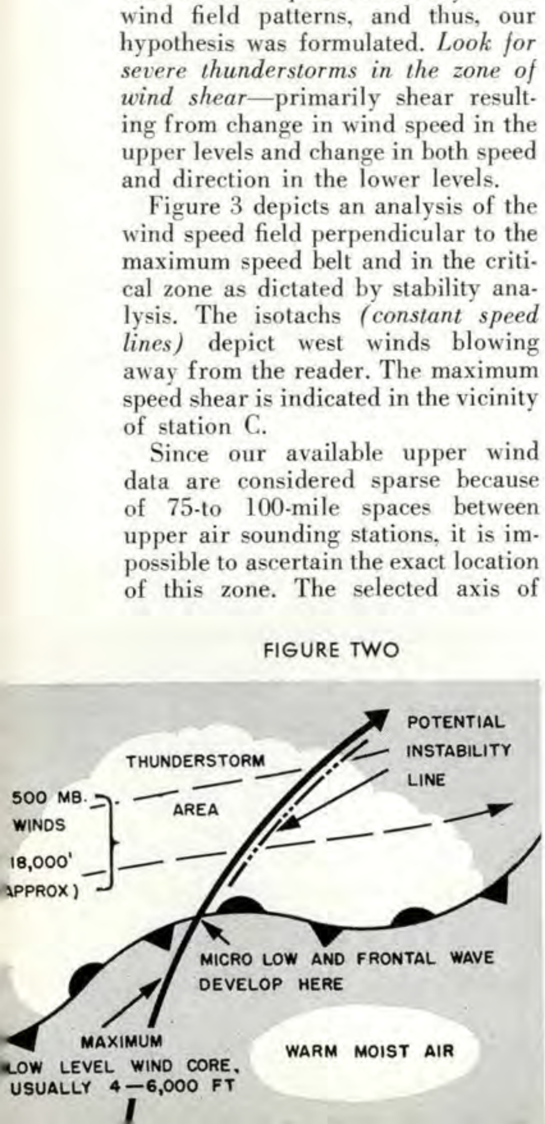


FIGURE THREE. Vertical cross section of potential instability line.

FIGURE TWO



greater the vertical wind shear zone, the more severe the turbulence. Therefore, the greater the state of turbulence computed, the more severe will be the forecast hail values.

The severe weather advisories are designed to provide as much information as possible regarding thunderstorm development by indicating when and where they are likely to develop, and their intensity, direction and speed of movement.

These advisories are an attempt to inform using agencies of expected conditions, so that the user is in a better position to cope with the situation.

Avoidance of severe thunderstorms which may be so intense as to be described as dangerous, is of primary concern to aviation. Radar equipped aircraft are naturally in a better position to circumnavigate thunderstorms than are non-radar equipped aircraft. However, positive means of identification of the severe storm by radar is still a matter under investigation. Final results of this research will provide valuable assistance for radar storm identification.

Of continued concern to the weather forecaster are the non-radar equipped aircraft. How can they avoid severe thunderstorms? An obvious answer is to fly wide of possible thunderstorm areas. This approach, however, is not always possible, as the severe thunderstorm most likely is imbedded within a general mass of clouds and therefore obscured. It is difficult to suggest a yardstick for guidance, since many factors are involved. The basic guide is the location of the horizontal and vertical wind shear zones as indicated in Figure 3. Shear areas are usually found daily, and sometimes are reported as clear air turbulence when of sufficient magnitude.

Being aware of the turbulence produced by wind shear will assist the pilot in recognizing that the area is "favorable for severe thunderstorms." The more intense the shear effect, the more severe any thunderstorms imbedded therein will be. Any alignment of thunderstorms which tower over others in the area would be indicative of thunderstorms produced in part by wind shear. Therefore, ascertainment of the wind pattern and of the orientation of any wind shear zone is recommended prior to flight. If a shear zone is encountered, knowledge of its orientation will assist in circumnavigation of the area.

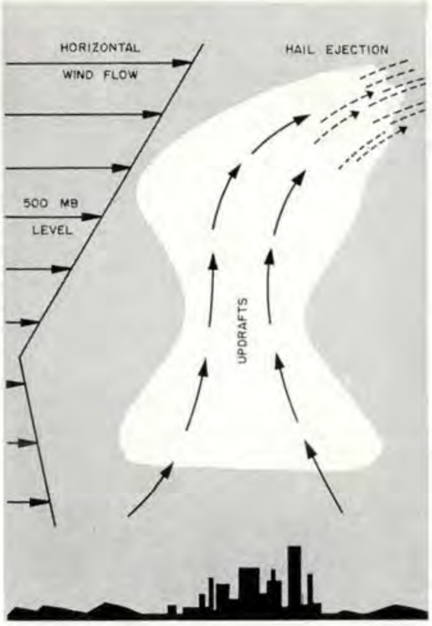


FIGURE FIVE

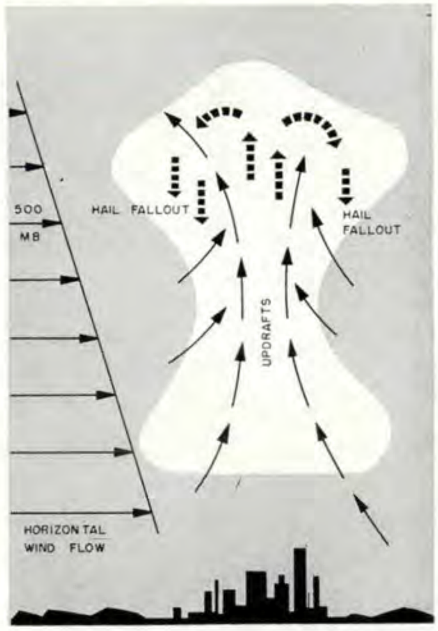


FIGURE SIX

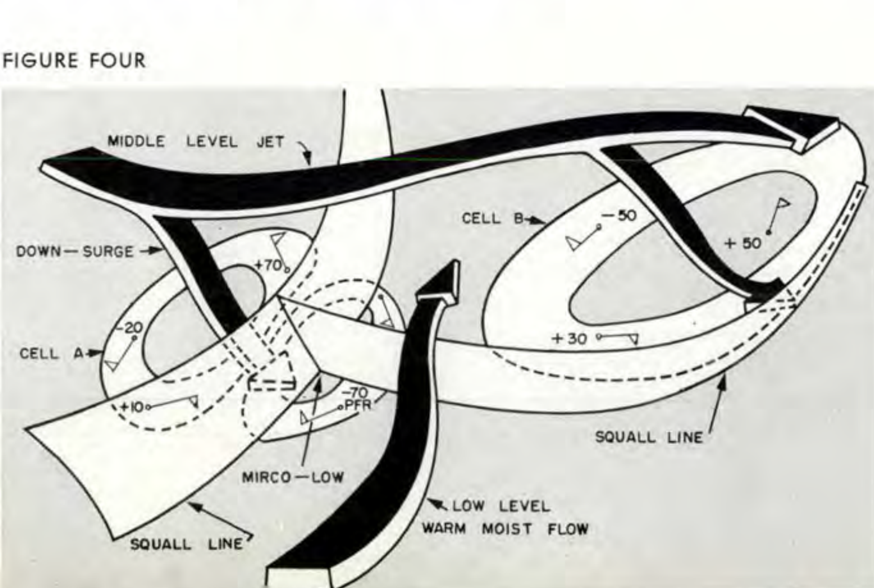
Other criteria used for forecasting severe thunderstorms would not be easily detectable in flight. Cloud configuration may offer some clues. However, unless the actual thunderstorm is sighted, general criteria would be useless. Hail fallout from the thunderstorm will most likely occur downwind from the altitude at which ejected.

Ejection is computed to be at the altitude where the horizontal flow overcomes the force of vertical motion *(Figure 5)*. The direction of the wind flow above the 500 millibar level in conjunction with the location of the shear zone may help identify the side where the hail fallout occurs. Thunderstorms with few or no cloud decks projecting forward from the parent storm indicate that the vertical currents are much stronger than the horizontal flow. The vertical currents in such thunderstorms are of sufficient strength to block the force of the horizontal wind *(Figure 6)*. Therefore, it can be expected that these thunderstorms will eject hail through the tops and fallout will be back down through the thunderstorm.

The ultimate objective of the Severe Weather Warning Center is to forecast accurately the intensity of thunderstorms, pinpointed to the smallest practical areas and as specific in time as possible and far enough in advance to be operationally useful.

As in many phases of forecasting, SWWC is still far from the ideal. The "smallest practical areas" remain, in most cases, large as compared with the impact areas of an individual thunderstorm. However, progress is being made and it is hoped that we will eventually reach the limits imposed by the statistical nature of meterological data and by the existing state of meterological theory. For the present, we will continue to do the best we can to serve you. ▲

FIGURE FOUR



Well Done

KNOWLEDGE • TRAINING • ABILITY

★

1st LT. JACK A. GIGLIO

514th FIS, 86th FI Wg USAFE

When the engine is noisily grinding up its insides and the tailpipe is pouring smoke like a nickel cigar, it's time to either get out or get it on the ground in a hurry. Lt. Giglio elected to get it on the ground—if he could!

It was a crisp fall day in 1958 and the Lieutenant had just finished a successful radar intercept near Kaiserslautern, Germany. He broke off and headed for the stable, pleased that his F-86D had again performed in its customary dependable fashion. Then his eyes fastened on the tachometer. It was unwinding to ZERO. Although his tailpipe temperature and fuel pressure were in the green, he decided to execute a precautionary landing and radioed GCI of his intentions. As he turned to the homeplate vector given him, the oil pressure dropped to a dangerous low. He knew then that engine failure was just a matter of moments and declared an emergency. He was still at 21,000 feet, 25 miles from the home drome.

And then it happened! A loud grinding noise filled the cockpit and vibrations shook the aircraft. The wingman reported black smoke pouring from the tailpipe. Lt. Giglio, realizing that the engine was about to disintegrate, stopcocked the throttle and began a 375-knot letdown for Ramstein Air Base. Carefully playing his altitude and airspeed while analyzing the control response of the hydraulic flight control system, Lt. Giglio arrived over high key point at 4000 feet indicating 250 knots and engaged his emergency flight control system. He traded speed for altitude, rolling out on downwind still holding 4000 feet at 200 knots.

The turn to base was made 1500 feet above the terrain and carefully planned to anticipate an eight-knot surface crosswind. He lowered full flaps and rolled out on final holding 180 knots. As he saw that his careful use of the remaining altitude had assured a successful landing approach, he lowered the landing gear about one third of a mile out from touchdown point and began his flare. As the '86 rounded out, he deployed the drag chute for a perfect touchdown within the first quarter of the runway. As his speed slowed, Lt. Giglio, with his aircraft fully under control, turned off on a sod runway shoulder to clear the strip for a minimum fuel aircraft reported in the pattern.

Inspection of the engine revealed that internal failure of the engine driven oil lubricating pump had resulted in the drive shaft shearing off with subsequent oil starvation of the main engine bearings. After cooling off, the turbine shaft froze in its bearings.

Lt. Giglio's performance in this emergency reflected a high degree of training, thorough knowledge of his aircraft, and exceptional piloting ability. Well Done! Lt. Giglio. ▲

☆ ☆ ☆

1st LT. WM. F. MARSHALL

3553d Flying Tng Sq Moody AFB, Ga.

Lt. Marshall is not likely to forget the 5th of September, 1958. As a student pilot, he was scheduled for a radar intercept training flight in an F-86L. The aircraft was still new to him; 16 or so hours in a bird hardly qualifies one as a veteran. Shortly after takeoff, the yaw damper was turned on at about 3000 feet. The after-takeoff check showed everything shipshape, so the autopilot was put to work at 5000 feet. Under its sure touch, the '86 climbed to

19,000 where the GCI controller directed a turn onto the attack vector. Lt. Marshall turned off the autopilot with the release switch on the control stick—and wished he hadn't!

The aircraft immediately entered a violent, uncontrolled maneuver. The buffeting was so severe that Lt. Marshall could not maintain his grasp on the control stick and his helmet pounded against the canopy. Before he could even begin to regain command of the situation, the plane entered a spin. This, at least, was something more orthodox than its first outlandish gyrations, though Lt. Marshall still could not regain control. As he sat in the plummeting, spinning aircraft, he calmly and rapidly analyzed the situation. He concluded that the difficulty had to be in the yaw damper. With great effort he was finally able to reach the yaw damper switch and turn it off. Recovery was quickly made, and the airplane pulled out of its headlong plunge at 8000 feet. He returned to the field and landed without injury to himself or his machine.

A check of the yaw damper system disclosed that the power converter had malfunctioned and applied full rudder travel in one direction. The pilot, under difficult and dangerous conditions, had successfully analyzed, and corrected for, this almost unheard of mechanical failure. For this example of cool-headed and resourceful airmanship, Well Done! Lt. Marshall. ▲

2d LT. CHARLES S. GLASS

917th AC&W Sq, Puntzi Mtn, BC Canada

Four civilians in a single-engine, light plane made a night takeoff from Walla Walla, Washington, for a flight to Renton, Washington, by way of Chinook Pass. Unexpected thunderstorms along the way forced the pilot to make frequent changes of course to avoid the severe weather and the looming peaks of the mountainous terrain over which they flew. Finally, the pilot became hopelessly lost and radioed his predicament in an emergency broadcast. His radio homing equipment was inoperative, the LF receiver had been turned off because of strong electrical fumes indicating the possibility of fire, and there were no parachutes aboard. It was almost midnight; the turbulent darkness made it impossible for the pilot or passengers to pick out identifying landmarks. The pilot did the only thing he could: at an altitude of 13,000 feet, he flew a continuous starboard triange, with the coastline to his west and the mountains to his east. Then he and his passengers waited, hoping against hope for a radar pickup and steer that would bring them back out of the night.

At 2350 hours Lt. Glass, standby controller for his unit at Puntzi Mountain, B.C., Canada, was informed of contact with a lost civilian aircraft. The radar scope would not register a blip as the plane was made of plywood and fabric, and DF contact had been negative. On the assumption that the lost plane might still have radio reception, Lt. Glass instructed the pilot to put his navigation lights on steady and turn his landing lights on. Then he requested a scramble from the 409th Fighter Squadron, RCAF, to search the coastline. No contact was made. At 0033, an airman saw lights about 15 miles south of the station. Lt. Glass asked the pilot to blink his lights and positive identification was made. The landing strip was lighted by flares and every available squadron vehicle's lights, and the lost aircraft vectored in. It touched down at 0057 with less than seven gallons of fuel remaining. Four grateful persons alighted safe and sound, thanks to the good judgment of Lt. Glass and the efforts of his men. Well Done! ▲

Follow the FSO

Interviewing the pilot is the best way to get firsthand information about the performance of a T-33 after a test flight.

On these two pages we follow Captain George Jensen, of the 6000th Operations Squadron, on his round of duties at Johnson Air Base, Japan. His routine is typical, not unique, for there is at least one experienced pilot at every base in the Air Force whose primary job is saving lives and equipment. This man is the Flying Safety Officer.

Most of the FSO's busy schedule is filled with routine items such as checkrides, flying safety lectures, inspection of facilities and personal equipment, talking up accident prevention and advising his commander on all matters pertaining to safety or flight. His main concern is, of course, the prevention of aircraft accidents.

When an accident does occur, the Flying Safety Officer is busier than ever. He is vitally concerned with the cause of the mishap; lessons must be learned and the word passed along. If he himself is not the accident investigating officer, he is there to assist in the investigation. His work day may be long and his efforts seemingly not appreciated, but he knows that there are few jobs in the Air Force that offer more opportunity for service and more satisfaction for a job well done. There is no way to measure adequately how much an FSO contributes, but an accident-free record certainly speaks well for him. Give him a hand! ▲

Oxygen masks must be checked periodically. Testing personal equipment such as life preservers, helmets and parachutes is a routine but vital part of the FSO's job.

The instrument panel of a downed aircraft is examined by Capt. McClure for information on final readings. A photographer, S/Sgt Pressley Boudreaux, gets a close-up picture while the officers investigating the accident huddle to compare notes.

A maintenance expert diagrams the operation of a T-33 generator blamed for the accident. Members of the accident investigation board examine the unit. Findings are forwarded to higher headquarters.

End of a busy day. Capt. McClure, FSO for 6041st Air Base Group, returns the salute of Japanese civilian gate guard.

THE CHECK*LIST*

★

✔ Two of the luckiest Air Force men alive qualified for that title recently when they made an instrument letdown below published minimums. According to the pilot, his attention was distracted while conversing at some length with the tower during the jet penetration. He forgot to check the altimeter. The T-33 was allowed to descend until the pilot heard a "moderate crunching-scraping sound," at which time he woke up and pulled up. The gear would not operate normally so the emergency system was used and a landing made. After landing, the pilot found that the travel pod had been rubbed off, the speed brakes and main gear doors had been damaged and one fuselage former had been bent.

★

✔ Major aircraft accidents continue to occur because reciprocating engine aircraft are serviced with jet type fuels. DFSR has recommended to DCS/M that T.O. 36-1-3 be revised to (a) require painting fuel trucks containing jet fuels a distinctive color, other than the standard yellow; (b) require doors, nozzles and hoses of fueling trucks containing recip engine fuels to be painted the same color as the fuel; (c) require hoses and nozzles in fuel storage area and on hydrant refueling systems be painted same color as fuel for recip type fuels or the distinctive color selected for jet refueling units, and (d) require trucks containing anti-detonant fluids be painted white or some appropriate distinctive color other than that used for fuel trucks.

★

✔ Some runways remain wet and slippery or covered with puddles of water for some time after precipitation has ceased. This is especially hazardous to high performance jet aircraft whose landing roll may be increased over 100 per cent by such conditions. To assist in flight planning purposes, commanders are asked to report any of the above conditions by NOTAMS in accordance with AFR 100-52.

★

✔ Electronic computers have taken over major roles in the control of air traffic along the approaches to two of the world's busiest traffic hubs, New York and Washington.

Remington Rand Univac electronic "brains" have been commissioned for daily use at the FAA Air Route Traffic Control Centers at Idlewild International Airport and Washington National Airport. By late summer, according to Mr. E. R. Quesada, additional systems will be installed at the Pittsburg, Cleveland and Boston Air Route Traffic Control Centers, to serve the high density traffic routes in the northeastern areas.

FAA's goal, Mr. Quesada pointed out, is a nationwide network of computers that will, in effect, "talk" to each other, using their own high-speed electronic language to aid in the control of traffic over the FAA's 128,000 miles of airways.

Electronic computers will not replace human air traffic controllers, whose job it is to make the control decisions that keep traffic separated en route and approaching the nation's busy air terminals.

Rather, the computers will be used to relieve controllers of their "bookkeeping chores" and materially lessen the mental stress and fatigue involved in the control of air traffic in the jet age.

★

✔ Investigation of a recent F-100C accident revealed that a pilot can receive a canopy-not-locked warning light without immediate loss of canopy. A local SOP was prepared which outlined procedures for the pilot to observe if the light should come on:

- Reduce cockpit pressure to 2.75 (to relieve upward force but retain any seal pressure which may exist).
- Reduce speed to 250 knots (to reduce friction which would tend to pull an unlocked canopy open).
- Descend below 12,500 feet (cockpit not pressurized below this altitude).
- Land as soon as possible.

Although not a factor in this accident, the F-100C Flight Manual was UR'd to conform to the F-100A, D and F Manuals which require the pilot to hold the canopy switch in the closed position for two or three seconds after the warning light goes out to ensure tight sealing.

★

✔ A review of the successful ejections reported during the period 1955 through June 1958 revealed that 68 per cent of the personnel retained their helmets when the chinstrap was fastened, and 70 per cent lost them when the chinstrap was not fastened. Pulling the visor down, prior to ejection, further helped in retaining the helmet. In fact, reports show that with visor down and chinstrap fastened, 79 per cent of the pilots retained their helmets, while 80 per cent of those who neither fastened the chinstrap nor pulled the visor down, lost their helmets. Protection from head injury (or more serious head injury) was reported by 10 per cent of the pilots who retained their helmets.

★

✔ A B-47 crew, and particularly the copilot, were victims of a brief moment of alarm during a recent celestial mission. Without preliminary warning the aircraft depressurized, the rear seat bottomed, control column stowed, footrests extended, and the alarm bell rang! This was followed by considerable noise and poor interphone communication.

After the crew went to 100 per cent oxygen and checked the aircraft to determine what had happened, the copilot called up to advise that he had inadvertently actuated his right hand ejection hand grip to the mechanical stop. It seems that in order to use the periscopic sextant, the copilot had unbuckled his safety belt and parachute. When the shot was completed, he rebuckled himself into the chute and seat and leaned to the left for his clipboard. This was what precipitated the chain of events.

In addition to temporary damage to everyone's nerves, the emergency depressurization door—when it came off—banged the ring cowl on No. 4 engine and rather severely too. The reason the canopy did not jettison proved to be a malfunction in the forward left canopy hook mechanism. ▲

FIG. ONE, above; FIG. TWO, below.

FIG. THREE, above; FIG. FOUR, below.

If you're punching out in your spring-loaded saddle . . .

Get That Visor Down!

Ronald S. Huey, Aero Medical Laboratory, WADC

Because of an inflight emergency, an experienced pilot made an ejection from an F-100 (altitude 20,000 ft., EAS 250K). Before ejection, he calmly made all checks and arrangements for ejection. All, that is, except one. He did not pull his helmet visor down to the locked position. He positioned himself well back in his seat with his back straight and head back against the headrest. His feet were in the stirrups. He pulled his right armrest up and jettisoned the canopy. Then he pulled the trigger and his seat and body were hurled out into the windblast. Immediately after exit from the aircraft, his P-type helmet, visor UP and acting as a wind scoop, was ripped from his head.

His automatic lap belt opened and the pilot was free of his seat. He made a free fall to 14,000 feet where his chute opened automatically. He looked up at the canopy above his head and was relieved that there were no holes or tears in the orange and white nylon. Other than feeling a little cold, he felt well; he had made a safe ejection. Nothing could go wrong. With his chute open, the big sweat was over . . .

Fourteen hours after his ejection, search parties found the pilot's body. Death was caused by a blow to the head, after contact with the ground, when the pilot was dragged by his chute, face down, into a large boulder at the bottom of a hill. His P-type helmet was found two days later approximately one mile from the body. After the aircraft accident investigation was completed, a UR was prepared and forwarded by the pilot's organization. Part of it read as follows: "P-type helmet was apparently lost immediately after ejection, probably caused by the helmet visor not operating as designed, in that it failed to go to the down-and-locked position upon ejection."

Many Air Force pilots labor under the misconception that visors on the P-4A, P-4B and HGU-2/P helmets operate automatically, that is, drop down and lock in place because of the G force incurred on ejection. Such an automatic feature *is not* and *cannot* be incorporated into these helmet designs, since, first, G forces are encountered during routine missions, when the visor cannot be permitted to drop into the down-and-locked position, and second, such an automatic device would have to be spring-loaded or friction-operated and would require a delicate balance for operation at the proper G load. Consequently, extensive and intensive testing and maintenance would be necessary.

At present, the visors on these helmets must be operated manually prior to ejection. With the helmet visor in the down-and-locked position, the probability of retaining the helmet and oxygen mask is *greatly increased*. The possibility of injury due to ejection, windblast and parachute-landing falls, decreases.

See Figures One through Four for proper procedure to operate P-4A and P-4B visor mechanism.

The visor should be operated by grasping the yoke, as seen in Figures One and Two, and giving the visor a vigorous downward tug to make sure the locking device is properly engaged. If the visor is operated by using the locking device for a lever, as seen in Figures Three and Four, it is possible to cant the locking device so that it will not properly engage in the slot at the bottom of the slide. ▲

The proverb "An ounce of prevention's worth a pound of cure," was never truer than when applied to aircraft accidents. Their staggering cost can be reduced by measures within the capability of every base commander. Here is the prescription for that . . .

OUNCE OF PREVENTION

Lt. Col. Thomas L. Murphy, Bomber Branch, DFSR

Let's see now, what did he say?

"Sir, we are a team of specialists from the Directorate of Flight Safety Research. The purpose of our visit to your base is to assist you in your accident prevention program by revealing areas of accident potential and making recommendations for their elimination. Our report will be left here with you and will not require indorsement to higher headquarters. Only those individual items which may affect similar bases or require higher echelon assistance will be forwarded for action by the responsible major command, or Headquarters USAF."

I must be hearing things. He said assist, not inspect. My hearing aid must need fixin'. He called it an Operations Safety Survey.

I've been plagued with every kind of inspection from A to Z. In fact, if each inspection team popped me with a stamp upon departure, I would be covered from head to foot. And before the ink was dry, I'd be ready for the next stamp.

As a commander, have thoughts such as these been running through your mind? Maybe they have. But let's go back to the thought in the first paragraph: "An Operations Safety Survey is conducted for the purpose of assisting the commander in preventing aircraft accidents."

Why so much emphasis in this area? Simply because the lack of that ounce of prevention is costing us a staggering one million two hundred thousand dollars per day, in broken hardware alone—to say nothing of the cost in lives, training and experience.

Many checklists have been published on how to conduct your own surveys. They are all good; they give the commander an idea of what he can do to eliminate accident potentials on his own base. However, because checklists in themselves are somewhat dry, they may appear meaningless. Here are some of the more interesting items observed during the past few years while conducting surveys on various USAF bases.

• At one base it was pointed out that a fairly large mound of dirt located alongside the main runway constituted a definite hazard to aircraft operation. Its immediate removal was recommended, but the base was short of funds for such work. (Six good airmen—or pilots—could have removed the dirt in a few hours, with minimum expenditure of funds.) Several weeks later an aircraft ran off the runway and collided with the mound of dirt, causing considerable damage to the aircraft. Now the base did have a problem: remove the broken hardware, the mound of dirt, and chalk up another accident.

• Here's one from the other side of the ledger. A commander was notified that the fill around several concrete base runway lights had been washed away and could cause real damage, should an aircraft leave the runway. Immediate action was taken to fill in and smooth out the terrain around these lights. The payoff was almost immediate. A very expensive experimental bomber ran off the side of the runway, across the area that had been filled and fortunately came to rest, with no damage to the gear. Chalk up a save!

• Two years ago a disastrous fire occurred while technicians were changing a booster pump in an aircraft fuel tank. All available fire-fighting equipment appeared on the scene to fight the fire and save adjacent aircraft. While fighting this fire, their attention was diverted to a point almost a mile down the ramp where another fire was belching from a ramp drain which ran under parking spots for other aircraft. Raw fuel from ruptured fuel tanks of the first aircraft had run down the water drainage culverts under the ramp, where it became ignited and threatened to engulf other aircraft. Only quick action by cool-headed airmen prevented further disaster.

Although this incident was well publicized, the lesson did not "take" throughout the Air Force. A year later, during a safety survey, another base was visited and aircraft were found to be parked along a ramp drainage system, inviting just such another disaster. It took three hours for the responsible installation engineers to go through all the charts and determine that 50 per cent of the parking ramp drainage system funneled into this one drain. (The commander took immediate action to revamp his aircraft parking arrangement.)

Have you looked at your "ramp drainage vs. aircraft parking" arrangement lately? Could this disaster happen to your base?

When was the last time a check was made, comparing training records, Forms 5, and proficiency check forms in your unit? Safety Survey Teams have pointed out that at almost every unit they visited, flagrant violations of the word, intent and spirit of Air Force and major command directives are occurring.

Here are some findings which a crosscheck of the records revealed:

- Some pilots are receiving annual proficiency checks in as little as 10 minutes flying time.
- Some pilots are accomplishing only one landing or no landing at all.
- Some are completing proficiency and instrument checks on one flight in T-33 aircraft.
- Some are fulfilling the requirements of an annual instrument check and a proficiency check in as little as 30 minutes flying time.

Only direct supervision and control will minimize this problem area. These "quickie" checks do a disservice to the pilot receiving the check, to the commander and to the Air Force. Yet they occur despite the fact that pilot factor, in some degree, is cause factor for a major portion of aircraft accidents.

Emergency procedures examinations have been given to hundreds of pilots operating aircraft in almost every category in the inventory. Questions for such tests were taken directly from the red-bordered section of the Pilot's Flight Manual. Grades have ranged from a low of 30 per cent to a high of 100 per cent. The average grade has been considerably lower than desired.

Do you *think* you know how well your pilots could handle an emergency situation, or do you *know?* A simple 10-question emergency procedures examination given periodically would help to generate interest and provide the answer.

The Survey Team visited a large base where several different tactical and cargo-type aircraft were in operation. Each unit was assigned its own tactical radio frequency. When an inflight emergency occurred, the first call was always made to the tactical operations section for advice, or to let them know what was going on. This was fine except for one very important factor: the last ones to find out that an emergency situation existed or was developing were the control tower operators and the crash and rescue personnel. These people should be among the *first* to know, in case additional chemicals are required for foaming runways as well as for fighting a possible fire. Also, additional ambulances may have to be dispatched from the hospital to accommodate the number of crew or passengers aboard the aircraft, or inbound aircraft may have to be diverted to alternate bases.

It seems that as long as we have prepared runways to launch and retrieve aircraft, the problem of runway "lips" will plague us. This one problem area has been given more publicity than a Marilyn Monroe extravaganza. Despite this, the first third of the runway gets cluttered up with broken hardware because the pilot landed his aircraft six inches short and sheared off the gear on a three-inch exposed runway lip. You say short landings are not made any more since designating the first 1000 feet as "overruns?" Have your AO check the first 500 feet back along the approach end of the runway. Better yet, take a look—periodically—for yourself! Those deep tire imprints were not made by a "Vertol" aircraft.

Probably you've noticed that much of this article concerns correctible items associated with operations and facilities on and around the airfield itself. There is a reason for this. Approximately 70 per cent of all major accidents occur in this area, not out in the wild blue yonder. Correctible items such as those listed in the accompanying box were found to exist at almost every base visited by the Safety Survey Team. **Can you afford to wait?** ▲

Accident potential items found at USAF bases:

- Runway barrier nonstandard.
- Maintenance Safety of Flight inspections "scheduled" instead of the "without-warning" type.
- Charts not posted in operations showing ramp and field hazards.
- Runway distance markers not installed (ATL 5041A); others not illuminated in accordance with National Interim Standard for Runway Distance Markers, dated 6 August 1958.
- Airfield rotating beacon not modified for high altitude recognition in accordance with T.O. 35F-54-2-501.
- Outdated flight information publications carried in unit aircraft.
- Excessive vehicular traffic crossing active runways.
- Aircraft Performance Data training inadequate.
- Detailed procedures for formation flying not published.
- Excessive numbers of instructor and instrument examiner pilots on orders.
- Lack of proper supervision and guidance.
- Seat pack parachutes not being repacked in seat box, required by T.O. 1401-2-101d.
- Attempts to "control" local traffic by using GCA search radar.

Tips for -Bird Drivers

"Aircraft on the runway, clear to the right side. It looks like another aircraft is landing in the opposite direction!"

These words from a western tower cut the night air like a knife not so long ago. Hairy? Boy, you know it. But peanuts compared to the crash and explosion that followed almost immediately.

Two T-33s head-on, on the runway? This is hard to believe, real hard to believe. With all of our controls, rules, regulations, supervision and so on, how could this have happened? What could have gone wrong with our procedures that would even *allow* such an accident as this to begin to happen?

Let's trace it from the start and see. But why trace it? One reason alone, so that you will have the word on it. Why the word? So that you will take heed and say to yourself, "This'll never happen to me." So it won't.

Who would ever have thought that the two pilots in T-Bird Number One (because they landed first) could get into any trouble on this particular flight? Only 265 miles to go, so no sweat on fuel. Sure, the weather doesn't look so hot at destination but only 40 miles away is a 10,000 plus runway that's forecast to be "loud and clear." So, as usual, "the flight progressed normally." Destination fix was reached, weather reported as obscuration, one mile visibility in haze on approach with two miles on the runway. Dark. A penetration was started and completed. A GCA run was made, a good one. No sweat—on the runway talking to ground control. Turn right at the next intersection and a "Follow Me" will be there? Okay. Yes, tower, I'd say the visibility on the runway is 2½ to 3 miles. Spotty.

"Aircraft on the runway clear to the right side, it looks like another aircraft is landing in the opposite direction!"

Who would ever have thought that the pilot of T-Bird Number Two (because he landed second), could get into any trouble on this particular flight? Only 360 miles to go, so no sweat on fuel. Sure, the weather doesn't look so hot at destination but only 30 miles away is a 10,000 plus runway that's forecast to be "loud and clear." So, as usual, the "flight progressed normally." Destination fix was reached, weather reported thin obscuration ¾ mile visibility in haze. Dark.

A penetration was started and completed. Under RAPCON now, being positioned for a handoff to GCA at destination; *not* the same destination, incidentally, as T-Bird Number One. Cranking along, should get handed off soon, yep, there it is, switch to GCA channel, thanks RAPCON. Hello GCA. Reading you loud and clear, how me? Good, oh you say you've lost radar contact with me and to execute missed approach. Okay, but I have the field in sight. Oh, you've got me again? Good. Sure, I'll continue my approach. What! You've lost me again? Well, I do have the field, it's okay. I'll land visually from a 360-degree overhead. Yeah, I'll go to tower for clearance. Thanks GCA. Hello tower, request clearance to land at your base from a 360-degree overhead. I can see the runway plain as day. Turning final, gear in the green, pressure up.

Then the tower cut in, urgently, sharply—"Aircraft on the runway, clear to the right side. It looks like another aircraft is landing in the opposite direction."

Incredible! Fantastic! Unbelievable! Boy, you ain't heard nothin' yet. There was an 80-degree difference between the heading of the runway that T-Bird Number Two landed on and the one he *thought* he was landing on.

So, where do we go from here? What can we do with what we've got? What can we do to keep it from happening again?

This was a pure case of mistaken identity—taking one airfield for another. After all, it was night and IFR. Both places reporting this obscuration and restricted visibility in haze. True, the base the pilot picked in error had a lot better visibility than the one where he intended to land. So let's do a little Monday morning quarterbacking.

We'll easily dispose of aircraft Number One because he was right all the way, no mistakes. Now aircraft Number Two: The first hint of trouble came when GCA lost him on its scope, the first time, shortly after handoff.

This wouldn't have happened *if* GCA had been equipped to give IFF service. It is so equipped now. After GCA lost him on the scope, he was told to execute missed approach procedures, which turned him in the direction of the wrong (for him) field. He had this field in sight and chances are he kept it in sight, even after he went back to GCA. So when they lost him the second time he had his ace in the hole. He could see the runway "plain as day." He requested a VFR approach. This was in violation of AFR 60-16, Par 53 (C) (2). Be sure when you look it up, that the Reg you have is dated 29 Oct 57. Tower personnel were wrong in this respect, too. They cleared the pilot to land VFR when the base was definitely IFR. *If* he hadn't; *if* they hadn't; *if* the weather, *if, if, if*.

What does it all add up to? Certainly not lack of guidance; the Reg is crystal. Lack of proficiency? No, these people all knew their jobs, they were "first team." What then? There has to be an answer and there is. The people involved just didn't make sure.

Do you always make *sure?*

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The following brief of a T-33 major accident involving fuel system icing should be brought to the attention of all T-Bird drivers.

The pilot was on an IFR, 1000/on-top navigation flight. After 43 minutes of flight at a 32,000-foot altitude, he noticed that the engine RPM had increased from 91 to 94 per cent. It was then reduced to 91 per cent and the pilot observed a fluctuation of one-half to one per cent, plus fuel pressure fluctuation of two to three psi. Flight was continued.

Approaching his destination, the pilot was cleared to descend to 26,000 feet. After reaching the LF beacon at 26,000, the pilot was cleared again for letdown. The proper setting was 78 per cent. After making a turn, the pilot noticed that the power had fallen to 73 - 74 per cent. He advanced the throttle but had no indication of an increase in RPM. He advanced the throttle full forward and experienced what he considered to be an aft section explosion. The aircraft then flamed out. The pilot decided to stopcock and not attempt an airstart. At no time did the fire or overheat warning lights illuminate. The de-ice warning light did not illuminate.

Unable to reach an airfield and with a 3200-foot overcast, the pilot subsequently landed gear-up on an unprepared surface. He was not injured. The engine was removed to a test stand, started, and operated on normal and emergency systems.

Although numerous symptoms of fuel system icing downstream of the low pressure filter were present prior to the flameout (fluctuating RPM, RPM increase-decrease, loss of throttle control, inability to obtain higher RPM), the de-ice system was not used during the flight.

Use of alcohol periodically during prolonged flight at high altitude is recommended in the T-33 Flight Manual. The Flight Manual also contains de-ice instructions when symptoms of fuel system icing occur. Why not review your Flight Manual today? A good thing to remember, too, is that fuel system icing can occur at altitude on a CAVU day in June just as easily as it can while flying through an overcast in December.

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Rarely, rarely does a month become history but what we have had one or more porpoise-type accidents in the T-33 aircraft. Porpoising, as you no doubt know, and I hope not from experience, is that condition wherein the aircraft bounces back and forth between nosegear and main gear during the initial phase of ground contact in landing. This embarrassing situation is caused by allowing (or causing) the nosewheel to touch the ground before the main gear. This ridiculous attitude of flight is usually caused by the pilot's attempt to "spike" the aircraft on the runway before the bird is ready to quit flying. So; if you do get in a porpoise all is not lost. In fact, recovery is really simple. The following paragraph is from Section II of the Handbook, by the way, and I do quote:

"If porpoising should develop, position the control stick in neutral or slightly aft of neutral and hold it there, while simultaneously advancing the throttle to 100 per cent rpm. (Do not attempt to counteract the bounce with opposite stick movement, since the combined reaction time of pilot and aircraft is such that control movement aggravates the porpoising.) The object of this first step is to damp out the oscillation as soon as it begins by restricting control movement and by getting the aircraft completely airborne again, where further bouncing on the landing gear is impossible."

There you have it. Land her on the main gear and don't try to force her to land while she's still flying. If she does get out of hand, follow the quote above.

By the Numbers

Tony LeVier, Director of Flying Operations, Lockheed Aircraft Corp.

This article on thrust in relation to temperature and elevation was first published in September 1955. Since then, a new generation of pilots has taken to the air with birds of incredible speed and power. They have humbled the once-mighty sonic barrier to the status of a numeral on the machmeter. But whether jet, rocket, or plain old piston-powered, today's eye-popping performers must still obey the rules for takeoff distance and speed observed by the Wright Brothers at Kitty Hawk. Briefly, when temperature and/or field elevation is UP, thrust is DOWN. When thrust is DOWN, takeoff roll must be LONGER.

This familiar principle is being neglected by some of our aeronauts. Before spring is fair into summer, the birds are beginning to pile up because of miscalculated takeoff rolls. Just last week at a Colorado base an experienced pilot, forgetful of the devitalizing effect of altitude and temperature on thrust, put a perfectly good jet aircraft in the boneyard—and almost went with it. It was a hot day at an elevated field. He didn't realize he'd have to roll 25 per cent farther to accelerate to takeoff speed under these "non-standard" conditions and tried to wrestle the jet into the air as he saw the runway disappearing. He got behind the power curve and ran out of thrust.

So this article, with a few dates changed, is as timely as ever. To fly, thrust is a must. Tony knows this and doesn't leave it to chance. He plans it by the numbers.

In this modern jet age I have always said that summer weather brings on three things: vacations, sunburns and, if you're flying jet aircraft, long takeoff runs.

As soon as hot summer weather sets in, there's always an upsurge in takeoff accidents. It's really funny to hear all the various reasons why one guy went through the fence after an aborted takeoff, another blew out a set of tires and wrecked both wheels, gear was retracted on another, and so on.

The pattern is the same regardless of who you are or what language you speak—*hot weather busted aircraft!*

Okay, what's the reason? Simple. Matter of fact, you know good and well what causes it. Some jockeys say, "Cripes, I had a loss of power," or "I racked back on the stick but she was glued to the ground." So, it's blamed on the engine and rightfully so, but not for the right reason.

Let's go back a few years and sort of review the problem of *hot weather* or, to the intellectual type of person, "*high ambient air temperature*," and its effect on aircraft takeoff performance. Matter of fact, let's go back to the year 1903 when I believe a couple of brothers named Wright designed and built a flimsy sort of contraption called an aeroplane. For those not fully acquainted with this early age of flying, they happened to be the first to do so, and recognized then the fact that hot weather had a marked influence on takeoff performance; that is, a *bad* influence.

In those days they couldn't shove the throttle further forward to increase the manifold pressure, or hit the JATO button, light off the afterburner or use the water alcohol. They were lucky to even have what they had. Know what they did to solve the problem? They took advantage of the cool sea breeze at a place called Kitty Hawk, and later on used such scientific methods as taking off on the down slopes of hills, or flying early in the morning and late in the afternoon. In marginal conditions they would use a fish scale to measure thrust. If it pulled 60 pounds, okay!

I know you are fully aware of the fact that hot weather affects the power of our engines and the lift of our wings. You should know; you've had the finest aviation training that money can buy, and this was part of it. 1903, '23, '43, '53 or now, 1959—it's all the same—temperature still has the same effect on aircraft takeoff performance, *except* we have it a lot better than the old timers on almost every count. That is, all except when we have a crash resulting from a failure to become airborne.

My early flying experience taught me to respect hot weather, and when confronted with a takeoff on a short strip, I learned to head into the wind, if any. I also learned to use all the runway available, *and to allow the aircraft to accelerate to takeoff speed before attempting to lift off, in spite of any feelings for doing it sooner.* Of course, this was not a very scientific method, but then, we didn't have handbooks of instruction in those days with takeoff performance charts. In plain English, it was by guess and by gosh, and cut and try. If you didn't make it, well, a busted airplane in those days only cost a few hundred bucks and generally, no one got hurt except the pilot's feelings.

But today, we are more scientific. Proof of that is the modern aircraft. It is complicated to operate, extremely costly to buy and maintain and usually requires a large crew to man the larger types. And the fighters continue to get more complicated. Therefore, they too are a very costly article. Not all air bases have runways of adequate length for jets, and at times, these craft are found to have a marginal takeoff performance in hot weather. At this point I might mention that my introduction to the jet age—some 15 or 16 odd years ago—was during the beginning of the summer months when the ambient air temperature at ground level in the shade was often above 100°F. I remember one time when we flew (if you can call it flying) when the mercury hit 115°F. I believe this incident stands out in my mind above all others.

It was a test flight and the elevation was approximately 2300 feet. I didn't have a runway, thank God for that, but instead I had 3½ miles of dry lake bed. I knew that I was going to use plenty of run because I had rolled some 10,000 feet on a previous takeoff with lower outside air temperature.

To make a long story short and not to bore you with my problems, it took 15,000 feet to become airborne, and then I wasn't sure if it would stay that way. During the ensuing few seconds it took to make up my mind what course of action to take, it was too late to do anything but pull the gear up, hold her steady and straight, and hope! Had I chopped the throttles and aborted, it's anyone's guess what the outcome would have been. Finally, after several minutes of straight flight, I had gathered enough speed and altitude to assure myself of being out of any immediate trouble. To give you an idea what a terrific effect this high outside air temperature had, in addition to the takeoff, I flew 30 miles in level flight accelerating to best climb speed.

This little incident (if you can call it little) took place at Edwards. I was test flying Lockheed's penetration fighter, the XF-90, a twin-jet aircraft of monstrous proportions and underpowered, to say the least. We were not as yet blessed with afterburners and JATO equipment, a fact which nearly put us out of business. There was one guy who was more impressed than all of the others and I was that guy!

In the experimental test flying business, one can write off some of these so-called goof-ups by the nature of our profession, and it is generally done even when an aircraft is washed out. *He is an unwise pilot, however, who doesn't figure his chance pretty close when things look marginal, like when there's high ambient air temperature for takeoffs.*

Let's take a look at the conditions that I was flying under, on this typical Mojave Desert summer day, and see what the "numbers racket" brings out.

First off, to get you warmed up to my clatter, we must understand that the loss in jet thrust due to high ambient air temperature is four to five times greater for a jet engine than for a piston-type engine. This fact is not generally known except by engineers, and then only to those dealing with aircaft and power plant design. I was fortunate enough to be working with engineers fully aware of the importance of temperature.

When the temperature is high, the thrust is low, but how much? For each 10°F above the so-called sea level standard temperature of 60°F, the thrust of a jet engine is reduced by four to five per cent. It is very seldom that we are favored with the so-called standard temperature in the summer time. All normal performance figures are based on these phoney standard sea level conditions which, of course, when quoted make performance of aircraft look good. Throw in a few extra degrees of temperature and your performance is shot. Then, too, when we talk about the jet engine alone and its *rated thrust*, we must realize that this rating is for the engine running at sea level in 60°F air, *not installed in the aircraft*. Installation takes another toll in thrust, depending on the type of aircraft we are talking about. What's left to push the aircraft in many cases would astonish even the pilots who consider themselves to be "tigers."

Okay. Ready? The XF-90 penetration jet fighter was powered by two Westinghouse axial flow J-34 turbojet engines. The original design and performance of the aircraft was based on engines each producing 4000 pounds of static thrust, down 25 per cent thrust to begin with. Now, install the engines in the aircraft and we drop another 200 pounds from engine installation loss and end up with 5600 pounds of total static thrust. Static thrust is what is

Hot Weather Rules For Everyday Flying.

- Four to five per cent loss in thrust per 10°F rise in ambient air temperature above sea level standard.
- Two or three percent loss in thrust per 1000 feet elevation.
- The rated thrust of a jet engine is not your net thrust because of the installation loss.
- The static measured installed thrust is not all available to accelerate with.
- Excess thrust is what is available above what is being used at the moment to hold speed.
- Excess thrust is the thrust that takes the big loss due to high ambient air temperature.

Check these figures and you will see that they come close to your takeoff performance charts.

- For each 10°F ambient air temperature above sea level standard of 60°F increase your rolling distance by 10 per cent.
- For each 1000 feet elevation above sea level increase your rolling distance by 10 per cent.
- For clearing obstacles, convert obstacle height in feet to per cent. Add this to the takeoff distance. For example: A 25-foot obstacle increases takeoff distance 25 per cent.
- Finally, use your charts. The specific answers are there.

Lockheed's F-90, twin-jet penetration fighter.

measured when the aircraft is at rest on the ground. Well! So we have only 5600 pounds of thrust. Sure, lots of jet aircraft are flying around with less, but the XF-90 was no ordinary critter. It happened to have grossed out at a hefty 33,000 pounds plus, full up, lugging everything but the kitchen sink. This day, however, we were grossing out at a mere 25,000 pounds for obvious reasons!

I'm ready for takeoff. I have taxied to the extreme north end of Muroc Dry Lake; my tailpipes are almost poked into the boondocks. I move the throttles forward until they are against the stops; the tach is steady at about 101 per cent rpm—all I can get and, boy, I well need it today!

I release the brakes. Does the old girl jump? Negative. She barely waddles forward without any doubt in my mind that this is going to be a distance record for an aircraft takeoff roll. Well, let's see how much actual thrust I had at the start of my roll. We can take 60°F sea level standard and subtract 8°F to get down to the standard day temperature of 52°F at 2300 feet above sea level. Subtract this supposedly standard 52°F from my actual 115°F and we end up with it being 63°F above standard conditions—and all just for me! Now, 63°F divided by 10, multiplied by 4, is about 24 per cent less static thrust. Take another two per cent drop per 1000 feet elevation and, well! I think you are beginning to catch on.

Remember, our installed thrust is 5600 pounds. With a 25 per cent loss because of high ambient temperature and another five per cent for altitude, we now have but 4000 pounds of static thrust, or 1600 pounds less than we would have on that so-called standard day at sea level. Boy, that ain't hay.

Now the trick in figuring this out so that you don't fool yourself is to remember that even this 4000 pounds isn't all available to kick you in the pants. On takeoff there is rolling friction of the wheels and the air drag of the airplane to overcome just to hold speed, let alone accelerate. These factors eat up another 2000 pounds at the average speed during takeoff roll. So-o-, now, if you're still with me, you will see that my fine engine specification kick in the pants of 6000 pounds is down to a measly 2000 pounds! Why I can hardly feel it push at all.

I move ahead slowly; the acceleration is less than one-tenth of a G. It should have been three times as good on a normal day. I roll past the 5000-foot point and my speed is 60 mph V_1. Ordinarily, I would be preparing to hoist the old girl off after rolling this distance at a comfortable 160. The lake bed stretches ahead as though it were endless. The heat waves and mirages have everything floating above the ground and they look to be ages away. I roll on. My speed indicates 130 and I'm past the 10,000-foot marker.

Now I'm sitting erect and my mind is starting to calculate my percentages. The indicator appears to hardly move as I start easing back on the stick at 150 mph, indicated. At this speed the old girl would have lifted off but I knew that I would have settled back and my chances would have been shot. I'm approaching the point of no return—I like to lift off at 165—I lift into the air at 160. I'm skimming the dry lake bed barely inches high. Suddenly I realize my mistake trying to be a hot test pilot getting that test flight off at any cost. I know what it's like to clobber an airplane. My record is far from lily white.

I raise the gear lever and say a silent prayer. Hang on, LeVier, this is going to be a close one. Gear up. Flaps still down— don't dare to raise 'em now. The large expanse of the main test base looms up smack on the nose. I ease into a very gentle left turn to avoid the base and skirt the full length of old Rogers Dry Lake. Gad! What a wonderful place to have. I pass the main base runway at 185 mph, indicated. I'm six miles from start of roll and three miles from lift-off. You figure it out, boy! I'm shaking all over again re-enacting this incident. Needless to say, from that moment on, we all—and I mean all—started to get our heads together a little closer and started using them. The immediate answer was JATO. It solved our problem until afterburners were installed, and we went on with our testing without trouble.

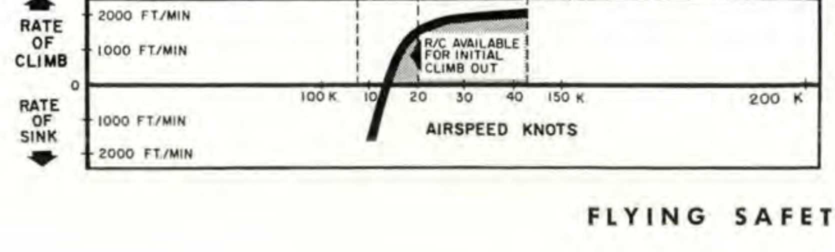
Okay, let's pick up from where I left off on the figuring. The conditions during roll were lousy, but let's look and see how *really* sorry they got at the 15,000-foot marker at 160 mph, indicated, when I started to fly.

Having lifted the old girl into the air, I managed to lose just about all the excess thrust I had, which wasn't very much. Why? Because now I'm airborne with flaps and gear down and a grand old lift-drag ratio of about six. Now a 25,000-pound airplane less all the fuel I had burned at this point and with an L/D of six, has just about 4000 pounds of drag. Just exactly all I had in thrust.

At this point, and I wish to make my greatest impression on whomever may be interested, *I had not one single ounce of thrust left to do a thing with.* All I could do was hold 160 and an altitude of perhaps a foot or two above the lake bed.

The next act—that of raising the landing gear—pulled me out of the hole. I must admit, however, that I had many more advantages than the average jet jockey. I was then and still am in the test flying racket. I had the use of a dry lake bed some 12 miles long. I knew beforehand approximately what the distance would be, but not exactly. I figured it could be made and it was—but for some 10 or 15 seconds, my neck was out a mile!

FIG. ONE. Standard Day



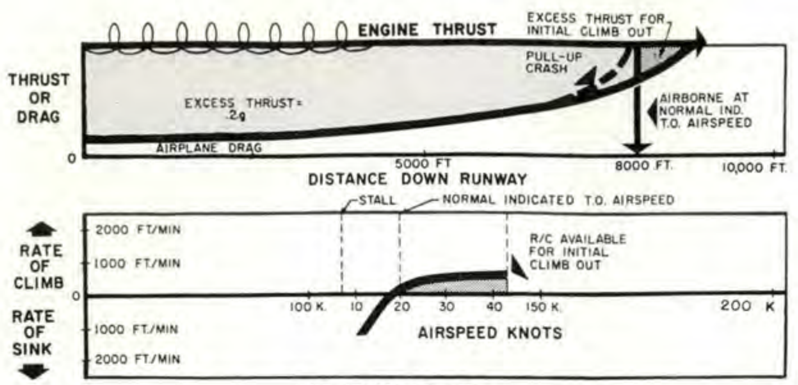


FIG. TWO, Hot Day

Now! Let's cool off and talk about some sensible kind of flying.

So the old XF-90 didn't turn out to do so good when summer weather set in, but neither do a whale of a lot of other jet jobs that I've seen grunting to get off with a full load. Name any one of them and you have a "dog" in hot weather; if coupled with poor takeoff technique and too short a runway, you can spell "busted aircraft." Just remember this: you're planning a cross-country flight. Perhaps it's only from Willy down Phoenix way to Webb AFB in Texas; or from Albuquerque to Oklahoma City. Wherever you are, you're in base ops. It's not too lively, and most of the guys are wishing it was 1700 hours so they could break it off and get a cool one at the club. Some poor guy is sweating out a flight plan at the plotting table, trying to figure how he can get home in one jump. He's sweating but it isn't from the flight. It's warm in there and all the fans and coolers are in high blower.

Boy! Check that old runway temperature! Get a look at the runway length again. Pay a visit to the front desk and ask the guy in charge of the joint for a look at the takeoff performance chart again. Maybe you're flying a T-Bird, an F-86 an '84, or one of the new Centuries. Remember, they all have different takeoff speeds and distances. Some are worse than others, but that doesn't make a bit of difference. They all make it, provided they have enough excess thrust to accelerate to takeoff speed and there is enough runway distance.

You look at the charts, and according to the numbers, you can make it with a thousand feet to spare. You are cleared to take the runway and question yourself again. Did you figure right? Did you use the right column—the one without wind? You were in a hurry at the time and anxious to get airborne and enjoy the cool air from your refrigerator.

You're cleared to roll, 100 per cent rpm, exhaust gas temperature normal, oil pressure normal, fuel flow appears a little lower than it did earlier this morning—Natch! It's hot, boy! Release brakes—the old girl starts rollin'—you pass the intersection of runways 3 and 210, which you noticed before climbing aboard was 3000 feet from the end of your runway. The airspeed indicator reads 90 and isn't moving up too fast—matter of fact, it's awfully slow. You pass the 4000-foot marker and the indicator reads 120. You want to start pulling the nose up but you know that she isn't ready to make like a bird. You haven't even reached the stall speed yet. The 5000-foot marker flashes by and you start to wonder, "What's the matter with this old tub?" At 5500 feet, you ease back on the stick and the nose comes up to a respectable angle as you watch the airspeed indicator read 150. That's my speed, and the old girl becomes airborne. She doesn't seem as perky as she was that morning, but there's a little life left in the old girl, and the 7000-foot marker flashes by.

You make a mental note and raise the gear level. The end of the runway flashes by and then sagebrush and boondocks.

After a while, when you have settled down to the humdrum of your climb, you notice on your knee pad a number "6000+ feet." It was your note on runway distance, and by gosh, it took it, but you did it right and that's why you cleared the sagebrush.

Now let's look at a couple of illustrations that will show your problems for standard and not-so-standard days.

Figure 1 shows how soft your life is when it's cool. With a 10,000-foot runway in front of you and lots of engine thrust over airplane drag, you get a solid .3G acceleration at the start.

As your drag increases down the runway to takeoff speed, the excess thrust gets less. But notice—it's still real, real good, and we have lots of excess thrust for climbout. Now look at your rate of climb shown on the bottom of the chart. See how just above stall you get a good climb and anywhere up to your flap retract speed, things are great. If all days were like this, you'd never have any sweat.

Now, look at Figure 2 for a hot, hot day. The engine thrust is 'way down and your initial acceleration down the same 10,000-foot runway is only .2G. As the distance flashes by, your speed picks up slowly and by the time you're ready to haul her off, you've used up 8000 feet of runway.

The excess thrust for climb is a lot smaller now and everything is a heck of a lot stickier. Looking at your rate of climb shows you haven't got much! And you can lose it all by pulling her up the least bit too steep. So you hang on tight, let your speed increase slowly and don't pull the old nose up too much.

Look at the difference in the size of those shaded areas of thrust left for climb on the first chart and the one for this hot day. You've hardly got any excess thrust left at all and *it* is only at a narrow speed range.

To wrap this all up, let me sound off about one more thing. If you keep coming back on the stick before she's ready to fly, you're in real trouble. I know it sounds basic, but records show that guys have used up 10,000 feet of runway and 500 feet of sagebrush country without ever getting off. They felt that they should have become airborne someplace 'way back there and kept bringing the nose up higher and higher. Remember that old backside of the power curve?

So get that takeoff distance down pat and don't get all shook and try to haul her into the air until you *know* "by the numbers" that she's ready to fly. ▲

Page 2-62 of the new Dash One (T.O. 1T-33A-1, 15 Jan 59) has an acceleration check speed diagram in the condensed checklist portion.

Could the frenzied, axe-swinging swashbuckler of yore be a military pilot today? Here's a new twist to an old notion of military virtue.

WHO'S MAD?

Lt. Col. Mitchell J. Mulholland, 4050th Air Refueling Wing, Westover AFB, Mass.

In an excellent and penetrating article in the March 1959 issue of FLYING SAFETY, Dr. Thomas F. Staton opened the shutters wide and let some light in on a potent factor in accidents of all kinds: the emotional factor. Like all presentations by the inimitable Doc Staton, this article was a thought provoker. Nail after nail was pounded home, but one big nail, although readied and trued, still awaits the hammer's blow.

"Whom the Gods would destroy they first make mad" quotes the Doc. Ah, yes. Just who makes whom mad? It is well pointed out than anger, depression and other strong emotions have no place in a cockpit. The ideal airplane driver, military or otherwise, is conceived of as being a cool, methodical, unshakeable gent, complete master of his environment and his machine. In spite of the homage paid to our death or glory boys of wars gone by, we in the flying game have always regarded Lindbergh as the real pilot's archetype. Who knows how many of us were inspired to fly by our mental picture of the Lone Eagle and his example of how man can triumph over nature? An Air Force made up of thousands of Lindbergs? A little out of reach, maybe, but we can try!

Unfortunately, there is a gimmick. Military flying has come of age, but in the long perspective of man's history it's still a new way to fight a war. As was to be expected, it started out as a branch of the ground forces, and grew up within a tried and true military framework. It is still within that framework. Despite blue uniforms and new terminologies, the changes that have been made are less than skin-deep. The way of life, the environment, and above all the military virtues that guide the Air Force flyer today are essentially the same as those familiar to combat soldiers since Frederick the Great, and earlier. Of itself this is not a bad thing; after all, we are a combat force organized for a purpose: to close with and destroy the enemy. But, has it allowed us, encouraged us, to live with some sacred cows that may be working at cross-purposes with our mission?

To begin with, the ability to get mad used to be considered a military virtue. I say "used to be" with a touch of irony, because it still is. Watch a bayonet drill at Parris Island if you don't think so. The ground forces need that adrenalin to push them to their peak for physical combat. Look at the old classic examples of glorious military rage: the purple-faced, choleric colonel, the blasphemous mule-skinner, the blistering top sergeant, the "Rebel Yell."

For thousands of years this militant aggressiveness, this unrestrained fury, has been nurtured and abetted as a sine qua non for an effective military force. Soldiers in battle needed the stimulus that an emotional leader could give them. Herein lay a good deal of the success of such leaders as "Old Blood and Guts" Patton, "Howlin' Mad" Smith, Stonewall Jackson and many other greats. A man has to be pretty darned emotional to ram a bayonet through an enemy's stomach, to storm a pillbox, to garrot a sentry, to rush a machine-gun nest, just as he had to be pretty keyed up to come through one of those sword-swinging free-for-alls they used to call battles in the "good old days."

Now just where does an airplane jockey fit in this noisy, gory picture? He doesn't fit in it at all—that's the answer. At one time he had a place in it, in the old kind of dog-fights where he did everything but clobber his opponent over the head with a wrench. But he doesn't do it now, not in the cockpit of a B-52, an F-104 or a C-130. He is completely isolated from physical combat, often even from sight and sound of it. He is controlling a complicated machine in a mission requiring utter precision. In controlling the machine he must, above all, control himself. Under war conditions, if fear or apprehension is there, as well it will be, it must be smothered and disregarded. His job requires complete calm, complete concentration. Anger is the emotion most notably absent from his world. There is nobody there to be mad at anyway.

What then is the military flyer's ideal environment? Wouldn't it seem logical that his place of business should have something of the antiseptic, unemotional quality of the laboratory? That his relationships with his co-workers should be professional, friendly, and free of irritation? That his routine should be unflustered and devoid of pressure or panic? That his home life and work life should not interfere one with the other? Dream on, say you. Okay, so we're just talking about ideals!

Having opened Pandora's Box a small crack, you may see something of what's inside. First, are some of us misinterpreting the "tiger" concept into considering anger to be a desirable attribute in military flying? Have we for so long regarded "force" and "aggressiveness" as military virtues, have we so insisted on rating our people on possession of these qualities, that we build tensions and emotions into our work that should not be there? From cadet school on, have we so encouraged a harsh, aggressive form of personnel relationship that we feel it has to be that way all the time? Have we accepted what James Hilton called "the shrill acerbity of the barrack-square" as a desirable quality on our flight lines?

There was a scene in the movie "Twelve O'Clock High" in which the general, played by Gregory Peck, delivered a chew-job that was a real tour-de-force. He was working over a lieutenant colonel, and the chew-job (so the story went) motivated this character to go on out and fly a bang-up combat tour. Now this was a real chewing out, involving all equipment from incisors to rear molars. It had everything: sarcasm, contempt, venom; it was a classic! Now maybe, just maybe, this kind of rawhiding might make a man become a hero. Actually, I rather think the hapless chewee would have been more likely to prang his B-17 on the first takeoff following his little tete-a-tete with the old man.

Almost nowhere else but in the military is the chew-job considered a commendable performance. Certainly there are few experiences better calculated to stir up the bile in a man's system and make him choking, boiling, red-eyed mad. The effects are both immediate and lasting. I wonder what the results are in the cockpit? But we live with it and think it's good.

Bless us, we started living with this in flight training. I don't know whether this has been improved or not in recent years, but I know of instructors who would get practically apoplectic with rage while eating out some unfortunate cadet in the cockpit or in the air. I have seen junior pilots abort a takeoff for some real or fancied malfunction, then get chewed unmercifully by a maintenance officer, and be sent out to take off again. Whether the pilot was right or wrong, is this the way we send off an aircraft in peacetime?

I know this sort of thing can lead to endless arguments, and well it may. But why should it be considered a kiss of death in an officer's effectiveness report to suggest that he might be a "nice guy"? Why must we be told "you gotta get *mad!*" A man cannot be an icy pillar of self-restraint all the time he's commanding

The grime and gore of the foot soldier's combat today is not much different from what it was when Alexander's armies stormed across the ancient world. But the pilot, programmed into battle with Univacs and computers, must be as imperturbable as the black boxes he commands.

an aircraft, then flip a switch and become a volatile martinet the minute he's on the ground.

Is anger an end in itself or a symptom of something bigger? Have we consciously allowed pressure to become a way of life? With a nervous laugh we refer to the ulcer, that glowing, throbbing symbol of success. We have all heard of the superior who is supposed to have said "I don't have ulcers—I give them!" Good joke, but not funny.

We could go on for days deploring the cult of the ulcer in our offices and shops, but our worry here is safety of flight. The pilot whose ulcer is detected and identified in time for grounding is lucky. Poorer, yes, but lucky. The pathetic part of it is that the ulcer isn't the only thing that threatens his well-being. It's the state of mind and stomach that produced the ulcer to begin with that represents the danger.

A pilot has enough to worry about flying a complicated aircraft on a complicated mission in ugly weather. When this is compounded by career worries, mediocre OERs, a pressure schedule, hot-tempered superiors, conflicting instructions and regulations, plus heaven knows what home worries, we have a fertile breeding ground for ulcers at least, fatal accidents at most.

Laying off the superiors for a moment, let's consider our procedures. We frequently set up and tolerate procedures that couldn't have been better planned to send a pilot aloft madder than the proverbial wet hen. For instance, waiting at the end of a runway for an ATC clearance. Once I waited six hours on a taxi-strip at Kelly. After four hours I watched a colonel start up his B-26 and roar back to the ramp practically livid. He went around one corner like an MG at Watkins Glen. Fortunately, he was giving up, not taking off.

The congestion on our airways and in our control zones gives rise to situations that raise the choler if we don't watch ourselves. Trying to get a word in edgewise on the radio, or getting cut out of a rugged landing pattern by a jet emergency, or being told to hold indefinitely at a nice turbulent altitude. Or, on the ground, what's your mood when you take off two or three hours late at a gas stop because you had to wait interminably for a fuel truck or a starting unit? *(Duncan and Heinz, please note.)*

Many of these things can be cured by better management and better planning; by the realization on the part of support people that a jillion-dollar airplane deserves to be in the hands of a contented pilot. The pilot, of course, can and does realize that not all irritants can be done away with. But this is not the time to chide the pilot; he's been living with this stuff for years.

Yes, as Doc Staton says, it would be most desirable if a pilot could ground himself when he's seeing red. But, admittedly, it would be most difficult, as long as we operate the way we do.

The education the Doc speaks of should reach commanders, and the supervisors up the line, to convince them that at least *they* should not stir up or foment angry situations. We can't control all the factors that may dangerously arouse our pilots, but we can control what *we* do to them. I don't mean mollycoddle them either; they don't want that. Just treat them fairly, justly, as fellow professionals, and as fellow humans. Don't send them into the air hounded by worries, suspense dates, threats and acrimony. Let's not forget, we are supposed to be a force of skilled technicians, not Merrill's Marauders. Our people need drive, yes. The drive for self-improvement, the pride to be perfectionists, the endurance to fly well under difficult conditions. They are not required to bayonet anybody, so why not forget about stressing that aspect of their conditioning?

After years of military training and military thinking, maybe it jars us to be told that our mission does not normally involve combat in the strict sense of the term. But, by George, it doesn't! Our mission is to guide our complex machines to a point in space whence other of our machines can take over, close with the enemy (or his machines) and destroy him. We probably won't even see our enemy; we certainly won't grapple with him. Combat in its broad sense is there, of course, because the enemy will be bringing his machines to bear in an attempt to frustrate our designs. If we do our job well enough, better than he does, we succeed. If not, we fail. The point is, our screaming need is for skill, professionalism, perfectionism, adaptability and the tops in technical proficiency. Not anger, not the "killer instinct," not emotion in any shape or form.

What is going to achieve what we want? What will put the maximum number of Lindberghs in our cockpits? What will do the most to eliminate ulcers and psychological trauma from our busy pilots? Just one old-fashioned commodity that has never gone out of date and never will. That's leadership. The kind of leadership that knows where it's leading. The kind that puts people first and sacred cows last. The kind that leads men to the conquest of space and not simply to a replay of the Charge of the Light Brigade. The kind that knows the limitations of human beings, but also knows their fantastic capabilities. The kind that doesn't demand the impossible right away, but that recognizes man's capability to do the impossible when trained right and treated right.

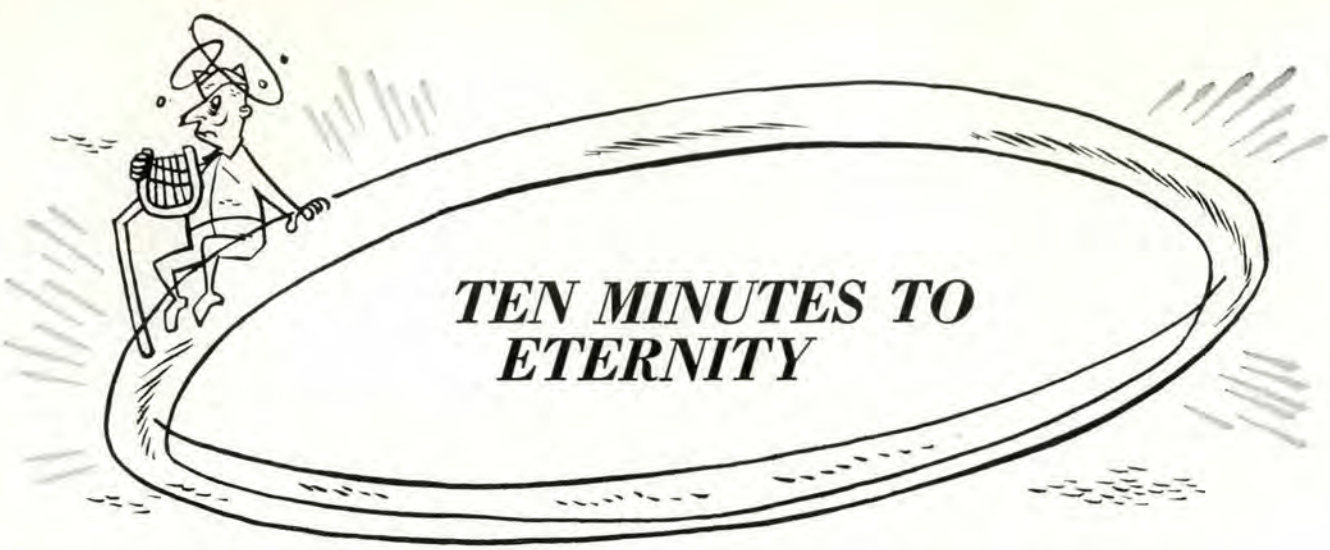
An Air Force pilot is a tremendous guy. In only 50 years he has gone from the parade ground at Fort Myer to the threshold of space. Every year for the last 20 years we have sobbed that he has reached the limits of human performance, and the next year he goes off the chart. He has done the impossible so often it has become commonplace. We demand more and more, and still he delivers.

Now we're ready to put him in orbit. And he'll do it. So what do we do to him? We put him on alert. We make him Airdrome Officer, Flight Planning and Briefing Officer, Staff Duty Officer and Tower Officer. We crowd him into expensive and inadequate housing. We move him all over creation, split up his family, send him to Formosa, Thule, Antarctica. We pay him one-third what his airline contemporary gets. We rack him back, chew him out, make him stand parades and inspections. We swamp him in a morass of paper and get extremely emotional at him over trivia that don't matter a tinker's damn. But we want him calm in the cockpit.

Thanks for waking us up, Doc Staton. To quote somebody in ADC a few years ago, "Let's get off the pilot's back!" ▲

About the Cover

The Editors have attempted to portray most of the boo-boos that cause accidents to men and planes around an airdrome. If we've neglected to include any persons in our cover picture, we're sorry. If those who have been left out feel slighted, they may feel free to point out our omissions. We can all learn from the errors of others.



TEN MINUTES TO ETERNITY

Major Roy J. Broughton, Jr., Headquarters Air Training Command, Randolph AFB, Texas.

This is a novelty! You'd never quite guess the trouble I had writing this or delivering it. I finally convinced the "Boss" that my story was important, not to me but the others, the people still flying tin birds through the lower levels of the sky.

My tale begins one afternoon, when the ops officer scheduled me for a cross-country flight. It all seemed proper and routine, except for the near-sunset takeoff. Looking back now, I wonder if I should have flown that night, but at the time the thought never occurred to me. The flight planning was routine except for a momentary setback when I got my aircraft assignment—no omni.

The weather guesser was a helpful type; he erased any qualms I might have had. His route forecast was the best—nothing but a bit of scattered cirrus. His terminal forecast would look good to anyone, clear and 60! With weather such as that, I even considered forgetting about the bird dog altogether.

My flight plan was reasonable, it seemed to me. Plenty of fuel, a good preflight and a well briefed crew. From all appearances, this should have been the most routine of flights. Even now I can think of nothing more I could have done at that time, nothing forgotten that could have precipitated the events to come.

The first clue that all was not as routine as it seemed, was noticed about 200 miles out. I remember monitoring the weather broadcasts and finding out that the good forecast was not panning out. Since there would be mountainous terrain along the rest of my route, I decided on an IFR clearance and got one through an FAA communications station. This put me above 10,000 without oxygen, but that was always a routine procedure at my base anyway. At any rate, the clue wasn't understood and I continued on course.

Another hour and I heard reports of thunderstorms, which, of course, were of much concern to me. After another check of the weather, I made a gross error in judgment, but a rather common error, I think. The knowledge of my forecast, the lack of a severe weather warning, and the indication that the thunderstorms were scattered, led me to continue my flight. Actually, my estimate of the weather was bad, and as I proceeded west, the lightning became more and more frequent.

A little farther—the airway made an abrupt 90-degree turn—and I remember now a little point of professionalism forgotten then. When I computed my ETA I failed to consider that the crosswind I had en route would switch to a 20-knot tailwind. I forgot to adjust my groundspeed, and that set up my fate. As I approached the next fix, the lightning was really flashing, and I couldn't prove a thing on those low frequency radios. I see—now that it is too late—that I overflew the fix and when I turned at my ETA, I was actually several miles off.

The finishing act came next.

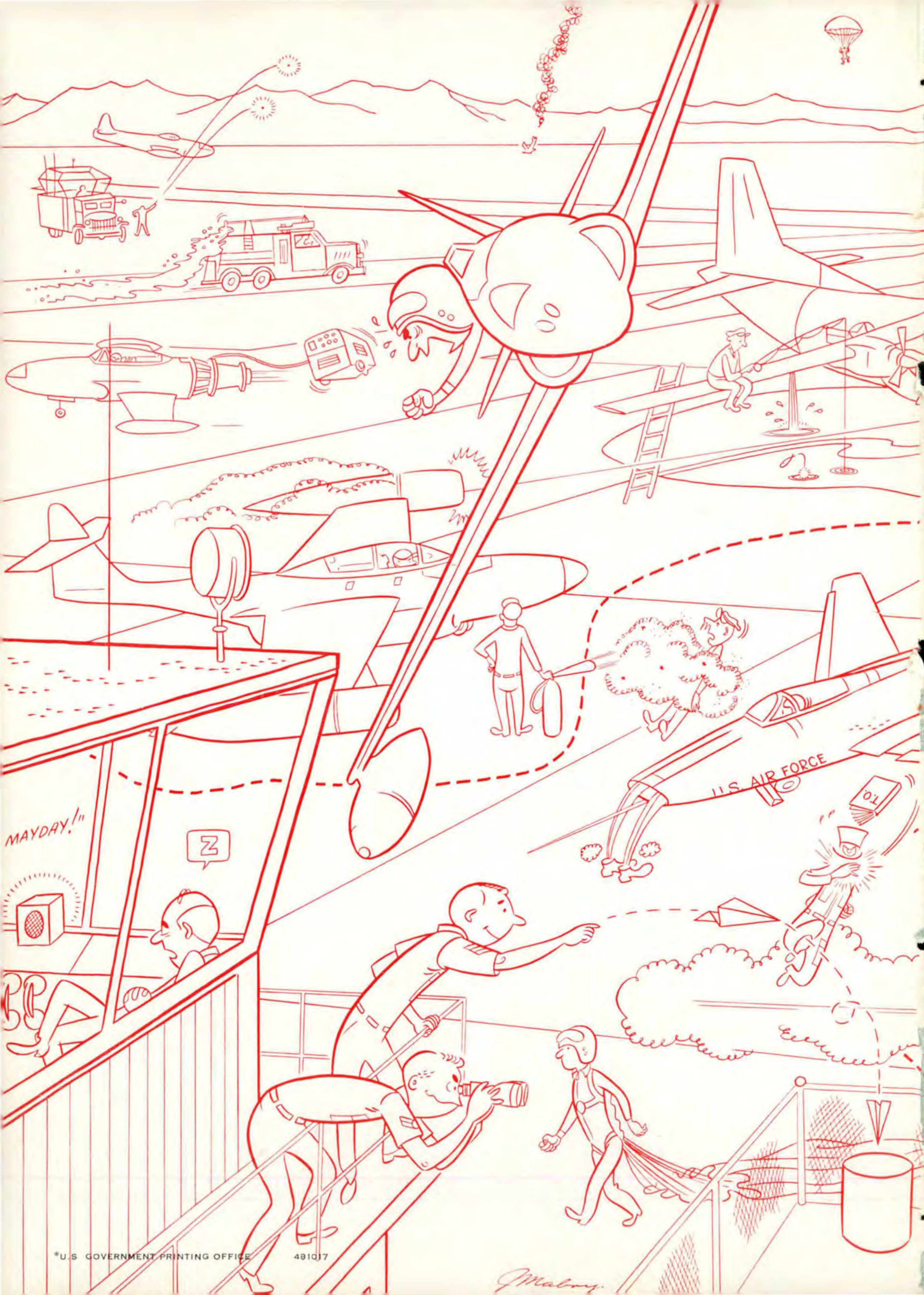
When I computed my next ETA, I made a fatal mistake if you'll pardon my reference. Somehow, I added 10 minutes to my estimate for the station, which doubled my time en route. This wasn't a new or novel error, but the results were spectacular—to say the least! My bird dog was still homesick and while I waited for it to settle down as I neared the station, I flew out my ETA. Very nearly made it, too! Only one minute to go when it happened.

Actually, I didn't see anything. It was more of an intuitive feeling of impending danger. Then, a flash and it was over. The airplane was a mass of smoldering wreckage against the side of a mountain. A once-proud bird and four people ended their careers that night—thanks to a 10-minute mistake, 10 minutes to eternity!

I came back just to tell my story, and now it is told. Perhaps in some small way it will encourage those still living to greater effort and I don't really ask for much. In fact, I have only five requests.

- That pilots, at long last, believe the rules about oxygen and high altitude flights at night.
- That the hazards inherent in low frequency radios be understood at last.
- That weather forecasters continue to strive for accuracy, but whenever they are wrong, they admit it—and say so loud and clear.
- That ops and airdrome officers finally become fully alert to their responsibilities and pass their superior knowledge on to those in flight.
- That pilots, regardless of the type aircraft they fly, never relent in their striving toward professional proficiency, for that state of ability, coupled with judgment, can cope with *all* the problems of flight.

If these requests are granted, I may not have died in vain. ▲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