# FLYING SAFETY

UNITED STATES AIR FORCE

AUGUST 1955


## Big League Catcher

Page 14

# FLYING SAFETY

VOLUME ELEVEN NUMBER SEVEN

• Have an article on approach lighting this month that's chock full of info. The gent who wrote it knows whereof he speaks too; lays the reasons why we still have 12 separate systems on the line. Sort of shakes a man up at that.

• Our centerspread, starting on page 14, spells out the results of the latest runway barrier tests made by WADC.

• AWS has contributed an interesting story on the higher altitudes; Flight Service makes a pitch concerning never popular delays, and the high Mach boys get the word on the sonic boom in this issue.

• Next month, provided our roving editors don't get their feet wet, we'll have a report on the 18th Air Force's massive "Operation Gyroscope", featuring C-124s. It will be something a little different than anything we have ever done before.

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USAF PERIODICAL 62-1


## LETTERS TO THE EDITOR

### Intake Duct Accidents

The engine air intake ducts of jet engine aircraft during ground operation are potentially dangerous to maintenance personnel. This is specially true when you consider that it has been approximately seven years since the first 200 plus pound human "object" was drawn into the intake duct of the XF-86A, and incidents of this type continue to occur.

Technical instructions have been disseminated, signs have been painted, decals affixed and placards prominently displayed to warn personnel of the danger of jet aircraft intake ducts during engine run-up.

Precautions cited in AF Reg 32-3, Subject: "Ground Safety Jet Aircraft Air Intake Hazards," dated 2 November 1948, and T.O. 1-1-309, Subject: "Aircraft Ground Safety," dated 3 October 1952, are applicable to all personnel engaged in physical maintenance of jet aircraft. However, on 18 April 1955, a maintenance employee walked into the intake area of an F-86A aircraft, and was drawn head first into the engine accessory section. The victim was being observed by another employee stationed near the left wing of the aircraft.

It is suggested that this incident be used as a subject matter in forthcoming publication of *Flying Safety Magazine* to again stress the necessity of compliance with established Air Force Regulations and technical publications relative to ground safety in the proximity of ground operation of jet aircraft.

**Col. Clare W. Bunch**
**Actg. Chief, R&A Div.**
**D/Maint. Engineering, AMC.**

*We certainly agree whole-heartedly with the Colonel. In fact, recently we saw a mechanic walk a few feet in front of an F-86 that was being run up. How he avoided taking a one-way trip into the intake is beyond comprehension.*

*The May issue of the AIRCRAFT ACCIDENT AND MAINTENANCE REVIEW contains a fine article on this subject, and we plan to keep hitting the field on the subject in the future via additional articles, posters and accident briefs.*

*In the meantime, be sure all your people, especially the "new boys," are aware of the dangers involved in standing in front of an intake duct.*

### Approved Airspace

I am the Air Force Member on one of the four regional airspace subcommittees in the ZI.

It is very obvious that many operations personnel are not familiar with the coordination required for the approval of certain activities in operations within the Air Force.

The following item may be more appropriate for the Operations Brief; however, if some publicity were given this matter in a forthcoming edition of Flying Safety Magazine, then certainly many readers would be enlightened.

"Operations Planner, have you ever been confronted with the situation of wanting some airspace for a gunnery range (you just can't hardly get that anymore!), to change your instrument approach, to move a navigational aid facilities (?), or wondering why THEY let them build that blankety blank TV antenna or water tower so near your base? I have.

"Seriously, who is this THEY person or persons? AFR 55-103 explains the Air Force's responsibility concerning airspace matters with other government and civilian agencies much better than I can here.

"It behooves all personnel involved in operations planning and day-to-day operations to familiarize themselves with the above reg.

"Some time ago a particular AFB in the ZI installed an ILAS, worked out a letdown and all the details that go with installing a navigational aid facility. Today that system is not being used because the installation is in conflict with other navigable airspace.

"Proper coordination under the above mentioned regulation would have precluded this embarrassing situation, not to mention the cost to the Air Force.

Don't let this happen to you, Operations Planner."

**Maj. Thomas E. Yarbrough**
**AF Member, 2d Regional Airspace Subcommittee, Ft. Worth, Tex.**

### Chart Holder

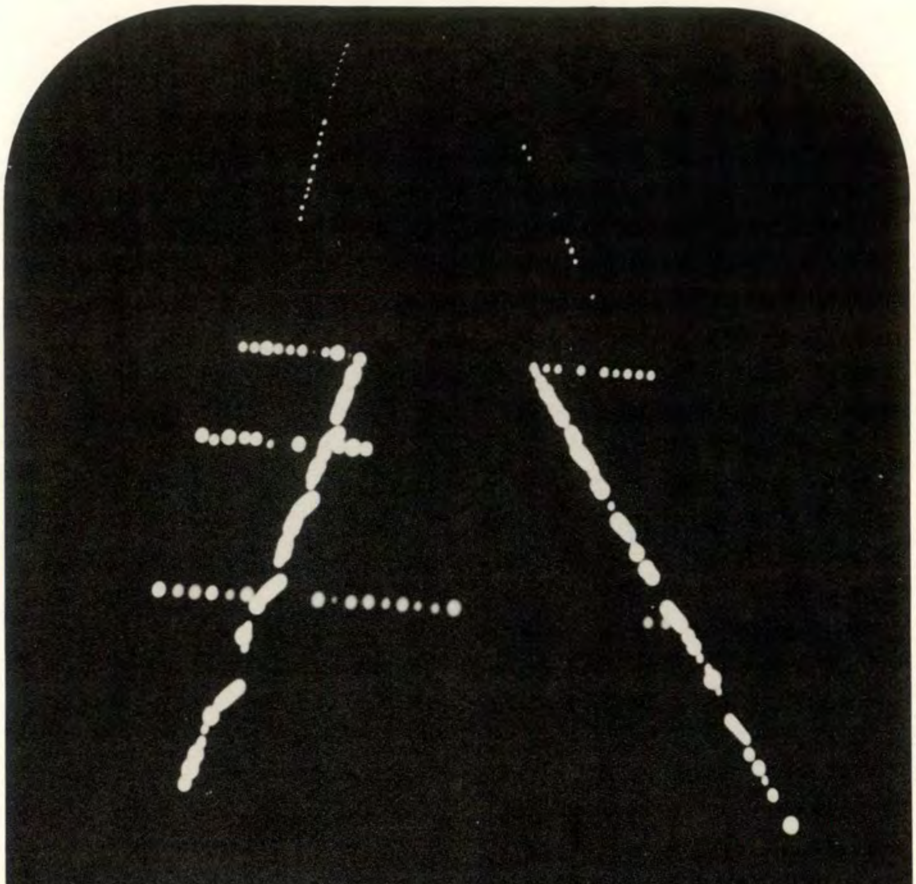
The suggestion of a jet letdown chart holder (Crossfeed, FLYING SAFETY, June 1955 was a good one but the material to be used is not of the proper type. After manufacturing a holder as per instructions, it was noted that it caused the standby compass to deviate eight to ten degrees from normal. This deviation could be hazardous in the event of an electrical failure while on the gages, or if the standby compass was being used as the sole source of navigation.

To eliminate this hazard, it is suggested that the holder be manufactured from brass (brazing rod is available in most welding shops), as it is nonmagnetic and will not cause compass deviation.

The above conditions were noted by Mr. George W. Small (Civilian inspector at this base) in a T-33A which has the standby compass adjacent to the holder location as shown in your picture.

**Capt. Barry F. James**
**FSO, 2347th ARFC**
**Long Beach Mnpl. Arpt.**

*And there you are! But the original holder idea is still a good one. Just do as the man suggests and make it out of brass or some other non-magnetic material.*



Sometimes a pilot wonders if approach lighting systems are . . .

# *Hazards or Aids?*

G. M. Kevern, Chief, Lighting Section
Directorate of Laboratories, Wright Air Development Center

*Have you ever heard a pilot say, "I checked and they have approach lights, so there's no sweat"? You may say to yourself, "Now there is a guy who considers everything during his preflight planning." But does he?*

*Ten to one says that if you ask him about the specific type of approach lighting system at his destination, you will get an answer something like, "Who cares, lights are lights, aren't they?"*

*If he reads the following article, in all probability he will think twice about leaping off on his next night cross-country without first checking to see what type of system he will encounter at his destination. It is important. In fact, being familiar with the system is just as important as knowing if there are any lights installed there at all.*

*If you are going to take the time to see if lights are available, it doesn't take a minute longer to notice the physical layout of the system. Knowing it may keep you from setting your bird down someplace other than on that nice, hard runway.*

DURING A NIGHT landing, have you ever asked yourself, "Am I looking at a row of street lights, runway lights, centerline approach lights or the left hand row of approach lights?" The large variety of approach lighting systems in use in the United States, when combined with inadequate pilot briefing, can cause pilot confusion which sometimes converts a valuable low visibility approach aid into a good-weather landing hazard.

Recently, at the end of a long flight, a pilot was attempting to make a normal VFR landing. He made an approach over what he assumed was a centerline approach lighting system. Unfortunately, the row of white lights turned out to be a left hand row approach lighting system, and the pilot barely managed to pull up in time to avoid landing in the mud alongside the runway.

In another case, a pilot made a good VFR landing between two rows of white lights. Unfortunately, they were slopeline approach lights, not runway lights, and had been installed since the pilot's last visit to the airport. The aircraft bounced across a field, over a highway, through a fence and, finally, up on the runway.

Many similar reports of accidents and near accidents prove the importance of approach lighting standardization and pilot briefing. Adequate pilot briefing is the only immediate solution, as a 10-year construction program will be required to convert all existing approach lighting systems at U. S. airports to any standard which might be adopted.

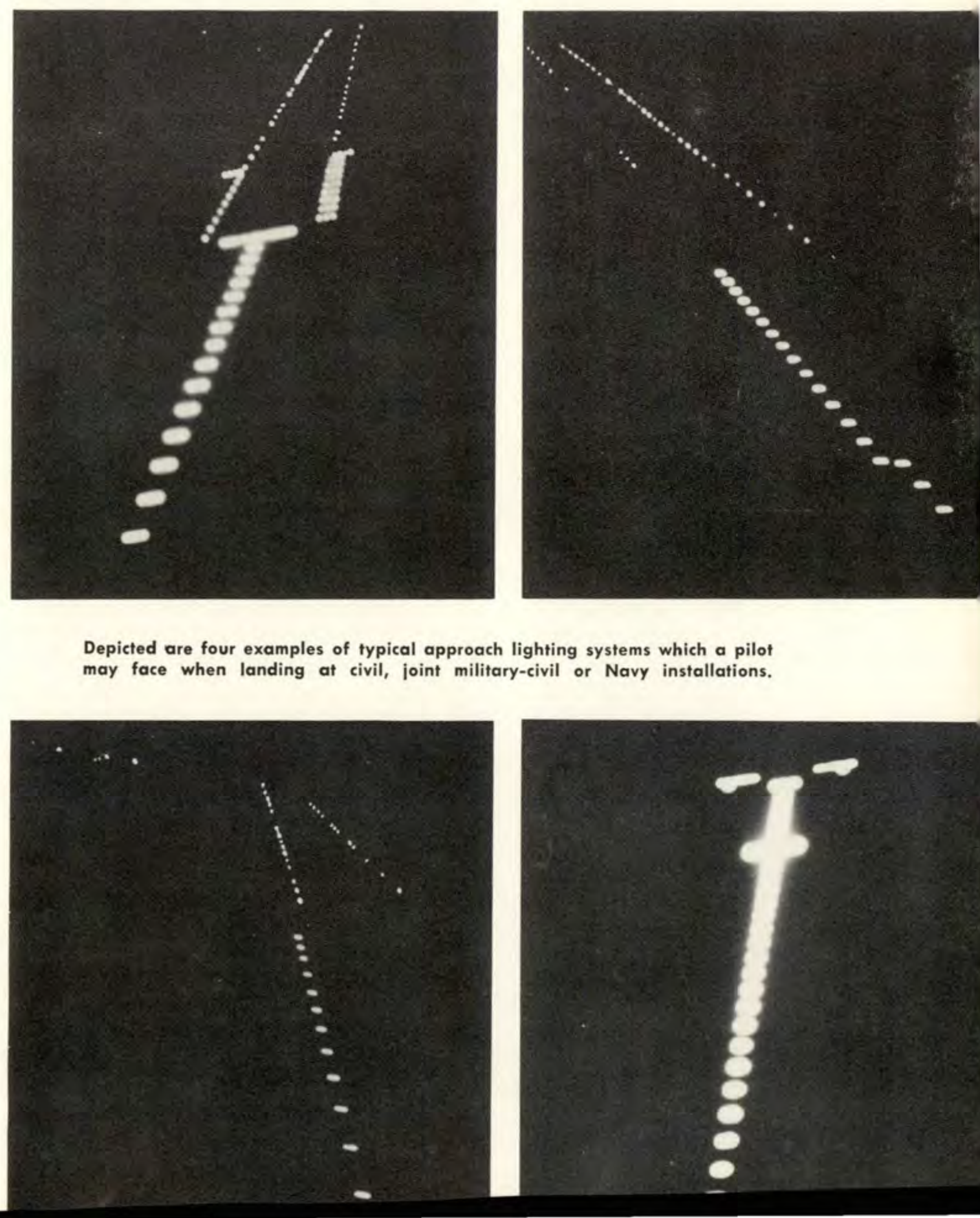
If USAF pilots could confine their landings to Air Force bases, no confusion would exist. Except for a limited number of experimental installations, all approach lighting systems installed at these bases are similar in appearance and use red lights. However, Air Force pilots frequently must land at civil, joint military-civil and Navy fields, and they may encounter, within the continental U. S. alone 12 different approach lighting systems, with great differences in color and appearance. For a safe landing, under either good or low visibility conditions, the pilot should determine in advance the approach lighting system which he will encounter at his destination.

Approach lights are those lights which are installed in an area extending from the runway threshold out into the approach zone for a distance of 1000 to 3000 feet. These lights constitute the pilot's first visual contact with the ground during a low visibility approach, and therefore should provide final alignment and ground reference information.

The minimum visibilities and ceilings described by present regulations are such that approach lighting systems seldom, if ever, perform the function for which they were designed. With the present minima, many other lights are seen in addition to the approach lights. Under these conditions, approach lights merely help to identify the runway and distinguish it from adjacent lighted streets.

Pilot familiarity with approach lighting systems is probably more important than any other factor. Any approach lighting system, whether good or bad, can be of considerable assistance during both good and bad weather if the pilot is familiar with the system. On the other hand, a good system with which the pilot is not familiar can be hazardous.

The brightness of all high intensity approach and runway lighting systems can be controlled from the control tower. Whenever the brightness is considered unsatisfactory, pilots should request that the control tower operator change the brightness setting. If traffic is not too heavy the pilot may request that the approach lights be turned off momentarily. This procedure will serve to positive-



**Depicted are four examples of typical approach lighting systems which a pilot may face when landing at civil, joint military-civil or Navy installations.**

ly identify an approach lighting system, in the event that the pilot is not sure if he is looking at approach lights or street lights. It should be remembered that excessive brightness will cause loss of darkness adaption, and thereby make instrument reading difficult, if it becomes necessary to pull up and make the transition to instrument flight.

### Basic Requirements

At the present time and for many years to come, the only safe solution to low visibility landings will be a properly coordinated system of electronic and visual aids. The electronic aids such as GCA are required to bring a pilot down to the approved minimum, approach lights are required for final alignment with the runway, and runway lights are required to complete the landing.

The function of the approach lights is to provide alignment information immediately and without confusion. During a low visibility landing, the approach lights will be visible for approximately 12 seconds. Furthermore, approach lights must have "wide" in lieu of "narrow" beams so that they will be visible when the pilot is to the left or right of the centerline. This is accomplished by adding suitable horizontal and vertical tolerances to the ideal path established by the ILS or GCA electronic aids. These tolerances are based upon results obtained during actual low visibility approaches. Under these conditions, pilots are under considerable nervous strain and the resulting tolerances are appreciably larger than those obtained when one pilot is under a hood, and a safety pilot has unrestricted visibility.

Approach lights must not constitute a hazard to aircraft which may under—or overshoot. As a result of statistical studies of all Air Force accidents and because the majority of flights are made in good weather, it is believed that cleared overrun areas at each end of the runway are even more important than good approach lighting systems. This attitude prevented the Air Force from utilizing the slopeline system when it was temporarily adopted as the U. S. Standard, and now prevents the Air Force from adopting the unmodified centerline system advocated by the Airline Pilots Association.

Approach lighting systems must also be designed to provide guidance for fighter aircraft which have severe cockpit visibility limitations. A pure centerline system is completely unsatisfactory for low visibility approaches by aircraft of this type. During visibilities of $\frac{1}{4}$ mile or less no portion of a pure centerline system would be seen if the aircraft flies straight in along the approach centerline. Lights less than 2000 feet ahead of the aircraft would be blanked out by the gunsight or nose of the aircraft, and lights beyond 2000 feet would be blanked out because of the visibility restrictions.

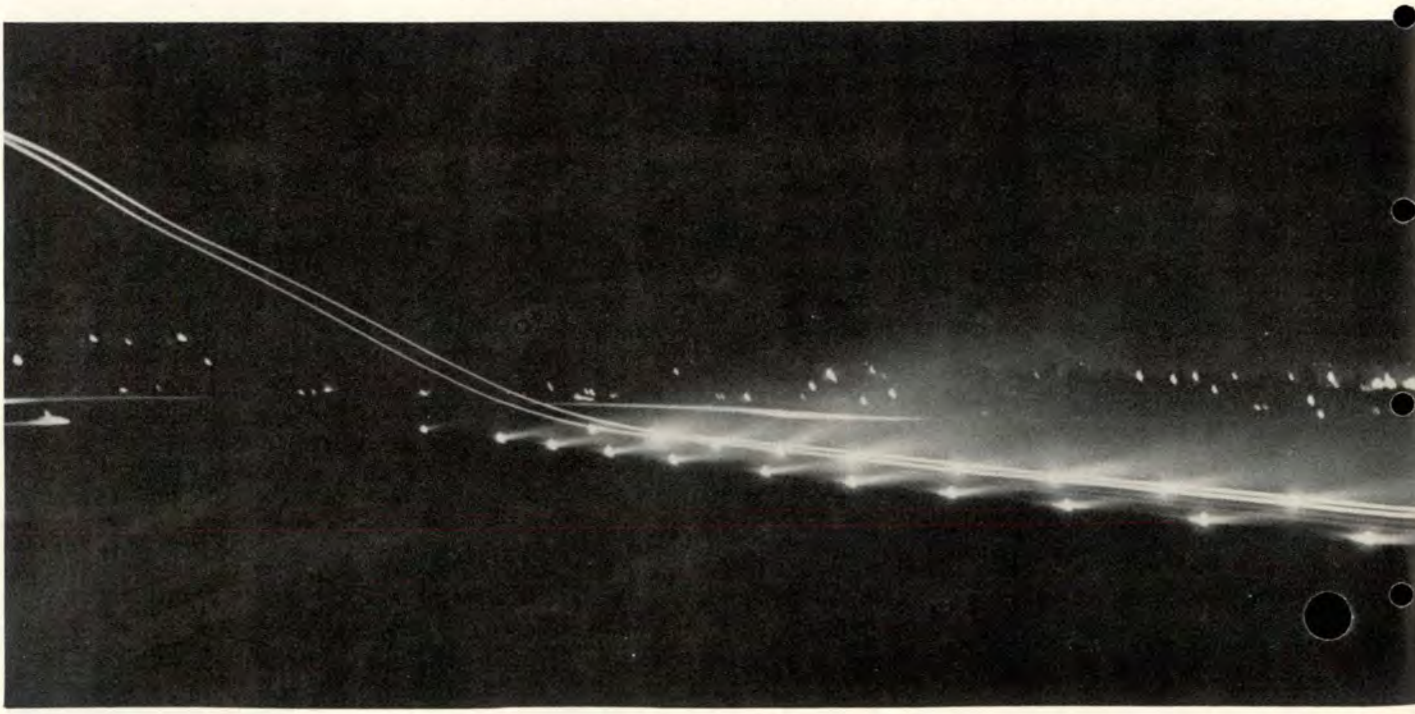
Taking all these factors into consideration has' resulted in concentrating on the development and utilization of an approach lighting system that does not introduce hazards into the overrun area.

During 1946 a joint Air Force, Navy, CAA test program was conducted at Arcata, California, to test the effectiveness of the various approach lighting systems. This location was chosen because of the high number of local fog occurrences. Several hundred actual low visibility landings were made and eleven different lighting systems were put to actual test.

### Neon Ladder

Before World War II, the neon ladder type of approach lights was used widely on U. S. commercial

This time exposure is an excellent example of the way that approach lighting systems are tested.



airports. This system consists of a series of neon tubes placed 100 feet apart, forming a 1000 to 1500-foot extension of the left row of runway lights. (See Figure 1.) Each tube is perpendicular to the centerline of the active runway.

With this system a pilot can readily distinguish a lighted runway from the multitude of city lights. The system also clearly distinguishes the approach area from the runway, thus eliminating the possibility of landing in the overrun. During VFR conditions this system proved adequate, however, the low illumination qualities of neon tubes is of little value during a low visibility, instrument approach.

### Two Parallel Row

All during World War II, both the Air Force and the Navy used the two parallel row of approach lighting system. These approach lights are merely 2400-foot extensions of each row of runway lights. (See Figure 2.) The runway, approach and threshold lights are distinguishable by different colors. Each light is of 200 watts, and is used without filters for the runway, with green filters for the threshold and with red filters for the approach area.


This type of lighting proved extremely effective in the Aleutian area of operations, even during visibilities down to $\frac{1}{8}$ of a mile at night and $\frac{1}{4}$ of a mile during daylight. Still, widespread use revealed that certain improvements were needed.

In the first place, pilot confusion resulted from the fact that both right and left approach light rows were identical. When visibilities were so poor that the pilot only saw one row, he did not know if he was looking at the right or the left row of approach lights.

Also, the distance between the two rows was too great. When a pilot is on the centerline, this is not important. But under actual bad weather flying conditions, equipment limitations, rough air and pilot strain combine to produce actual flight paths which often depart appreciably from the runway centerline.

### Funnel System

The funnel system is composed of 5000-watt lights which give excellent coverage of the entire approach area. (See Figure 3.) It was installed on seven Berlin Airlift bases and was of considerable assistance to that program. The system was considered excellent the first year of Arcata tests, but was found unsatisfactory the second year when four-engine aircraft were used. The larger aircraft could not make the six-degree turn required when the pilot saw and followed only one row.

### Slopeline System

This is the highly publicized system invented by Cory Pearson and Jerry Sweet, of the Civil Aeronautics Administration. Figure 4 is a plan view of their system; Figure 5 is an elevation view of a single pair of slopeline lights, and Figure 6 shows how the system appears to an observer on the ideal flight path. This system appears confusing when first seen, but a pilot thoroughly familiar with the system can obtain more accurate horizontal and vertical guidance than can be obtained with any other system.

As a result of Arcata recommendations, the Slopeline system was the nominal U. S. Standard from 1949 until 1953, but few installations were made. The system was considered confusing by commercial pilots. Virtually no Air Force installations were made as this system violates the requirement for no obstructions in the overrun area.

### Centerline System

This system cannot be definitely described, as the Airline Pilots Association has suggested many different systems, all designed as "Centerline" systems. The term has been used to designate any system which includes approach lights installed on the extended centerline of the runway. The system currently proposed by the ALPA (as installed at Newark) is superior to the one tested and found inadequate at Arcata because crossbars similar to those of the Calvert System have been added. This Centerline system is not satisfactory for Air Force use because it introduces obstructions in the overrun area and because it is of little value to pilots looking out of the left side of fighters which have restricted visibility straight ahead.

### Calvert System

The British (Calvert) System is illustrated in Figure 7. It consists essentially of a centerline with coded crossbars. This system is widely used in Europe, and is one of the systems permitted by the International Standard. The crossbar idea was found so satisfactory during Arcata tests that some crossbars were added to both the slopeline and centerline systems.

### Overrun System

This system was specifically developed to meet Air Force requirements (clear overrun area and visibility from fighter cockpits), and to eliminate the deficiencies of previous systems exposed during Arcata tests.

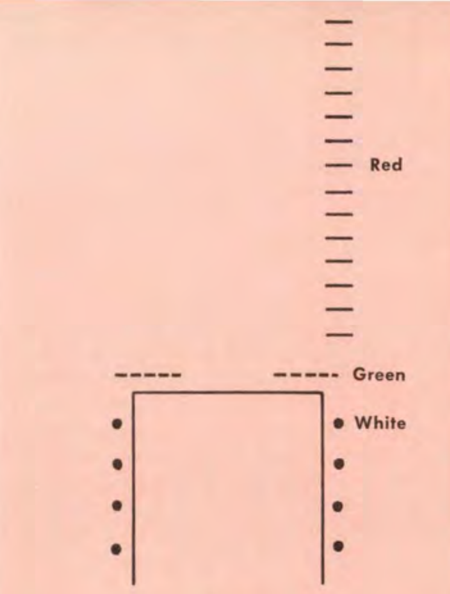



Fig. 1
Neon ladder

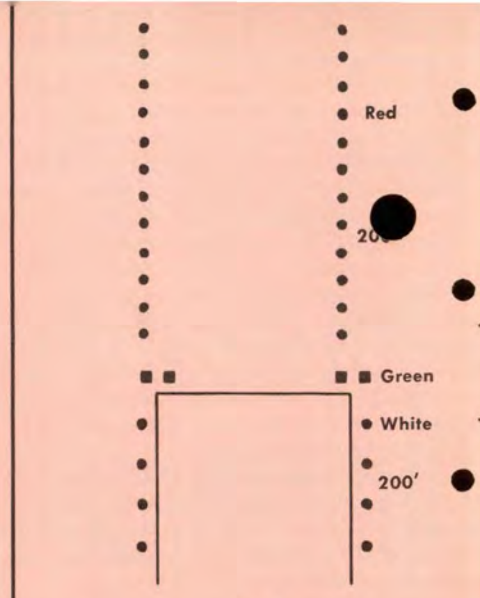



Fig. 2
Two parallel row (AN Standard WW II)

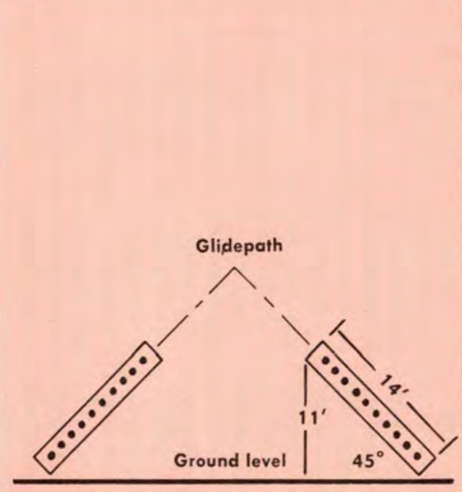



Fig. 5
Pair of slopeline fixtures

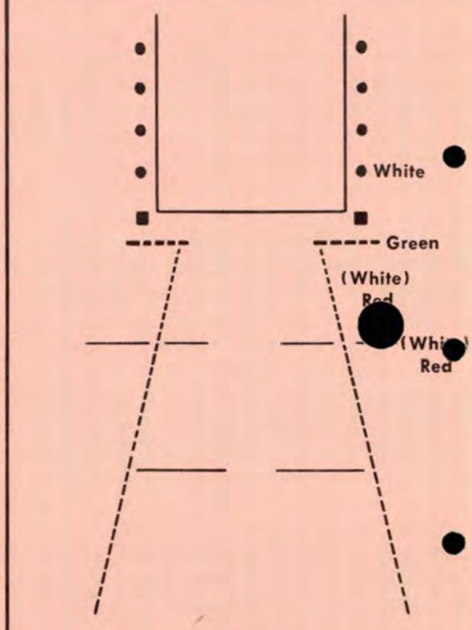
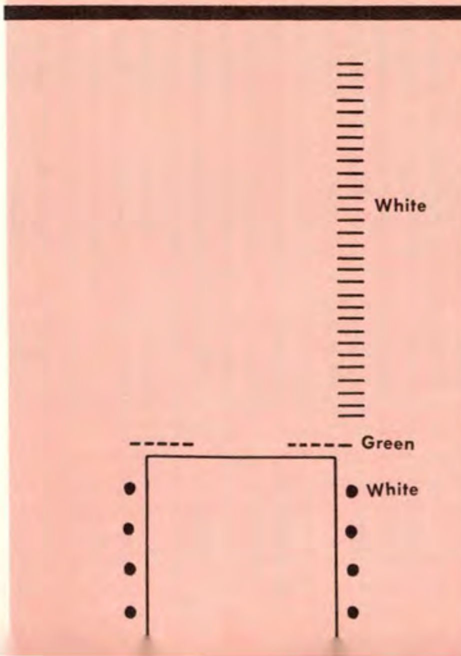
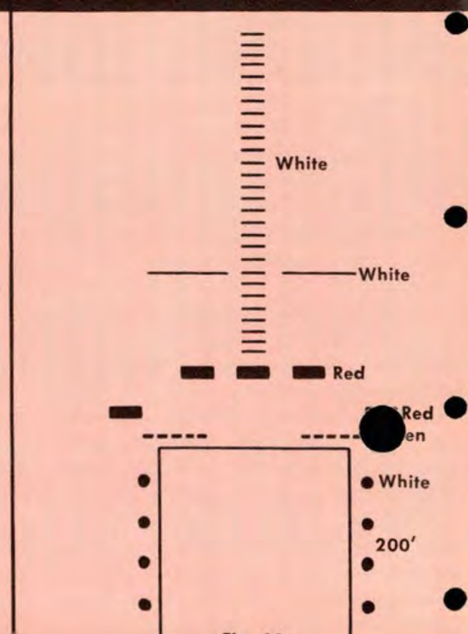



Fig. 6
Slopeline (viewed from glidepath)



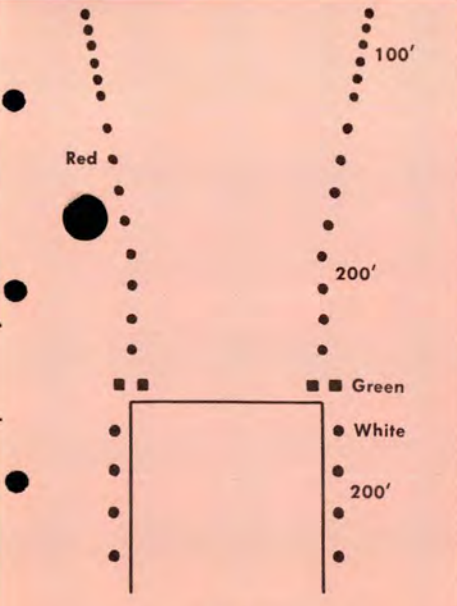



Fig. 3
Funnel system

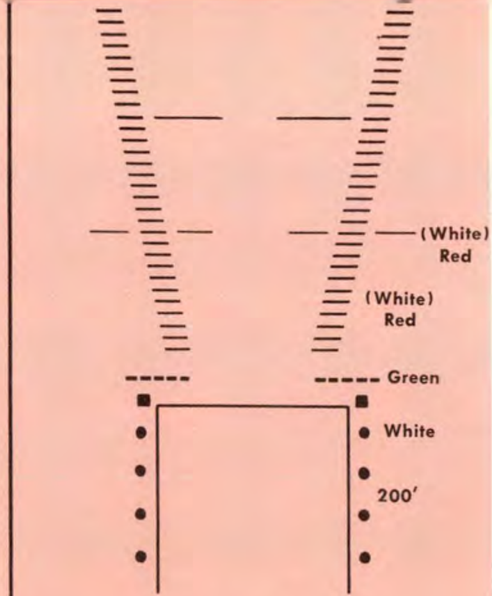



Fig. 4
Slopeline (Plan view)

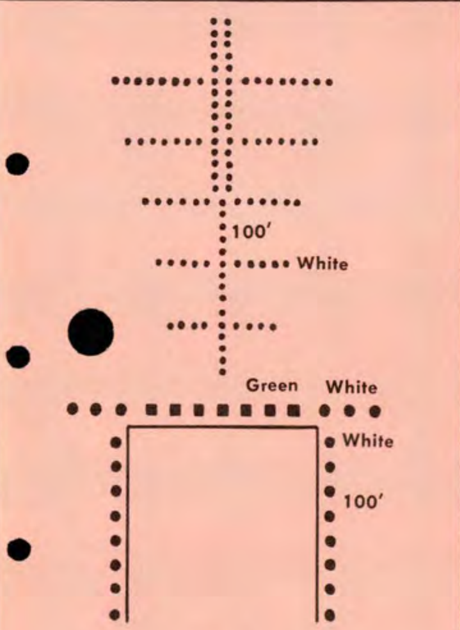



Fig. 7
Calvert system (British)

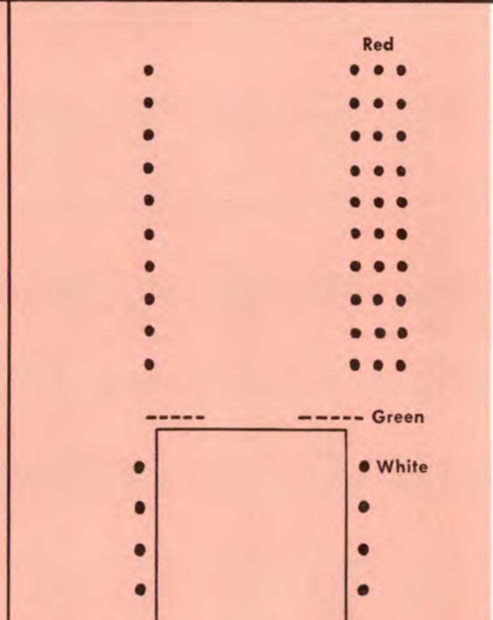
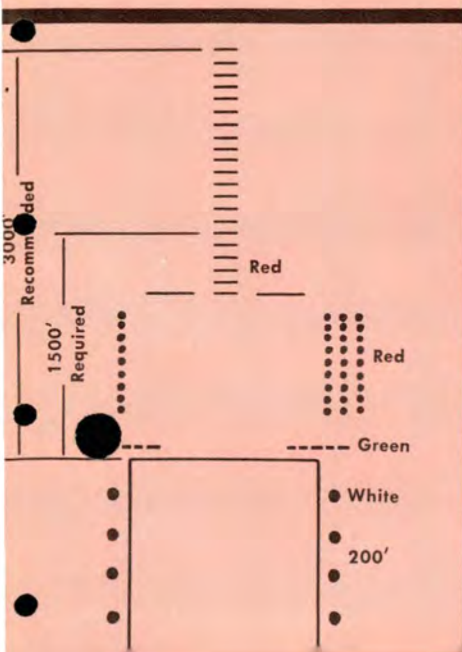
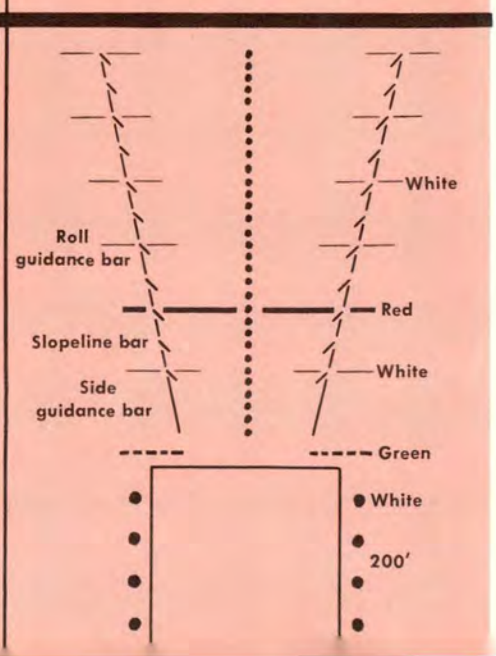



Fig. 8
Air Force overrun lighting system




It is essentially a two parallel row system of red lights 1000 feet long, except that the left row consists of triple lights, and the right row consists of single lights. (See Figure 8.)

### High Intensity Single Row

Consisting essentially of slopeline bars laid flat on the ground, this system incorporates an extension of the left row of runway lights, as shown in Figure 9. The majority of systems were composed of white lights, but a few installations used red lights throughout. When the ALPA refused to accept the slopeline, the CAA installed a number of these single row systems which were proposed as a compromise between the slopeline and centerline systems.

### U. S. Standard-A

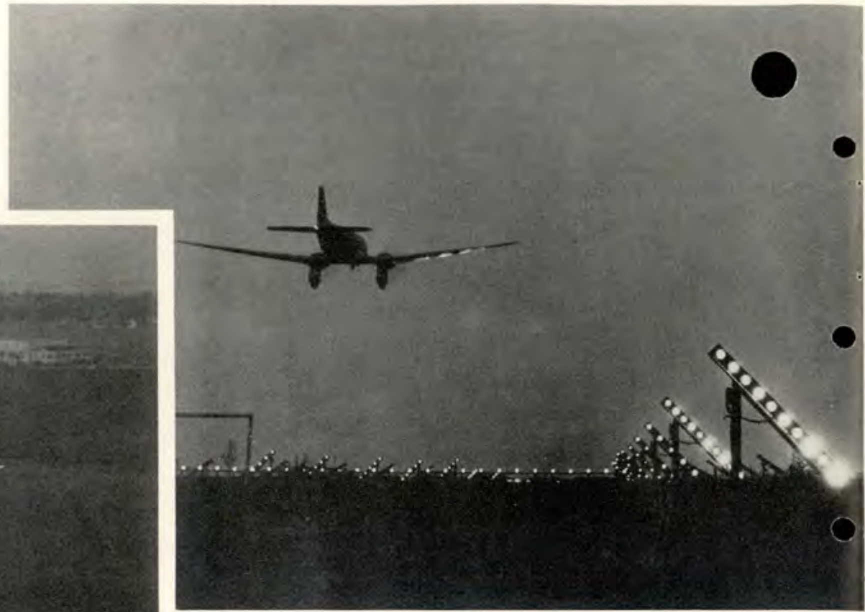
This is the system which the CAA proposes to install on U. S. civil airports. It is the only system currently acceptable to the ALPA. As shown in Figure 10 this system consists of white slopeline bars laid flat on the ground as an extension of the runway centerline, plus red terminating bars. This system does not meet the fighter visibility requirements of either the Air Force or the Navy and obstructs the overrun area.

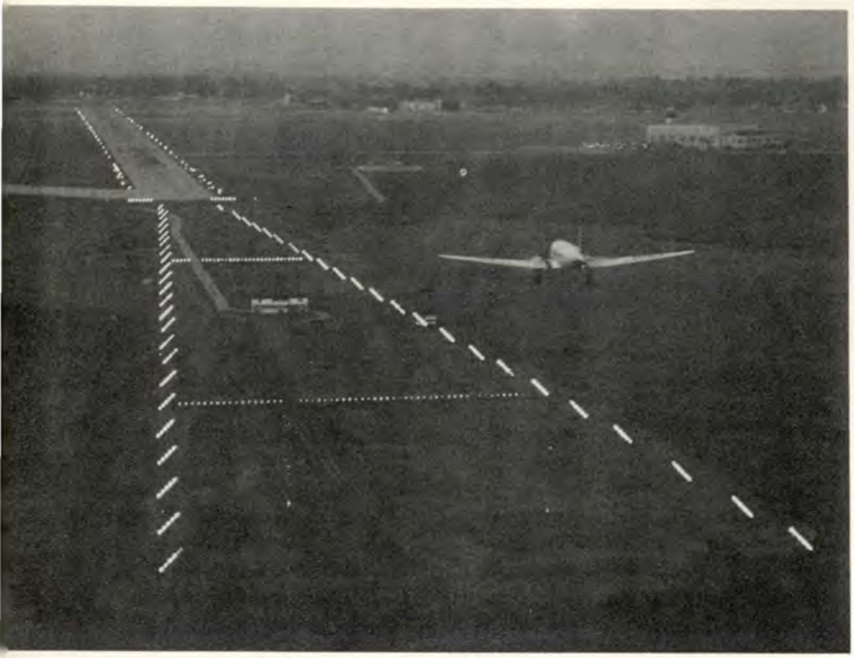
### U. S. Standard-B

This system, shown in Figure 11, was included in the standard at the request of the Air Force. The addition of the centerline extension to the overrun system makes it acceptable under the International Standard and results in an increased overall length which definitely improves the utility of the system. This system meets all AF requirements, as follows:

- Provides final alignment information and defines the ground plane.
- Outlines edges of overrun pavement or compacted ground.
- Presents no obstruction within the overrun area and minimum obstructions on the edges of the overrun area. Overrun lights are essentially 500-watt wide beam runway lights, equipped with red filters.
- The red color makes the system readily distinguishable from runway lights and street lights.
- Positive distinction is provided by the fact that the left row consists of triple lights and the right row consists of single lights.

A pilot thoroughly familiar with the Slopeline system can obtain accurate horizontal and vertical guidance. However, few Air Force installations have the system as the equipment forms an obstruction on the overrun.





• Provides ample light on the off runway side for pilots on the downwind leg and while making the turn for the final approach.

• Provides visual guidance to pilots of fighter aircraft from which pure centerline systems would be invisible during low visibility approaches, because of forward cockpit visibility restrictions.

### U. S. Standard-C

This system, shown on Figure 12, was included in the Standard at the request of the Navy. This system is a combination of the Slopeline, Centerline, Calvert and Funnel systems. This system is not acceptable to the Air Force because it is considered confusing and does not provide a clear overrun area.

### Existing Systems

Approach lighting systems are permanent facilities, with a service life of from 10 to 29 years. Once installed, an approach lighting system is normally not changed until necessitated by other construction work, such as extension of the runway pavement. The funds for approach lighting, especially civil installations, are definitely limited. As a result, all approach lighting systems which have ever been standard within any agency in the U. S. are still in use at one or more airports. A summary of 403 airports listed in the Pilot Handbook shows that 12 approach-lighting systems are currently in use in the United States. The quantities listed below are conservative, as it is known that there are many approach lighting systems in existence which are not indicated in the Pilot's Handbook.

- No approach lights ..................288
- Neon ladder .............................. 55
- Overrun ..................................... 22
- Left single row (17 white and 2 red systems) ..................... 19
- Two parallel row ..................... 14
- Slopeline ..................................... 4
- Miscellaneous (one each of four different types) ............ 4
- U. S. Standard, Figure A ...... 1
- U. S. Standard, Figure B ...... 1
- U. S. Standard, Figure C ...... 1

### International Standards

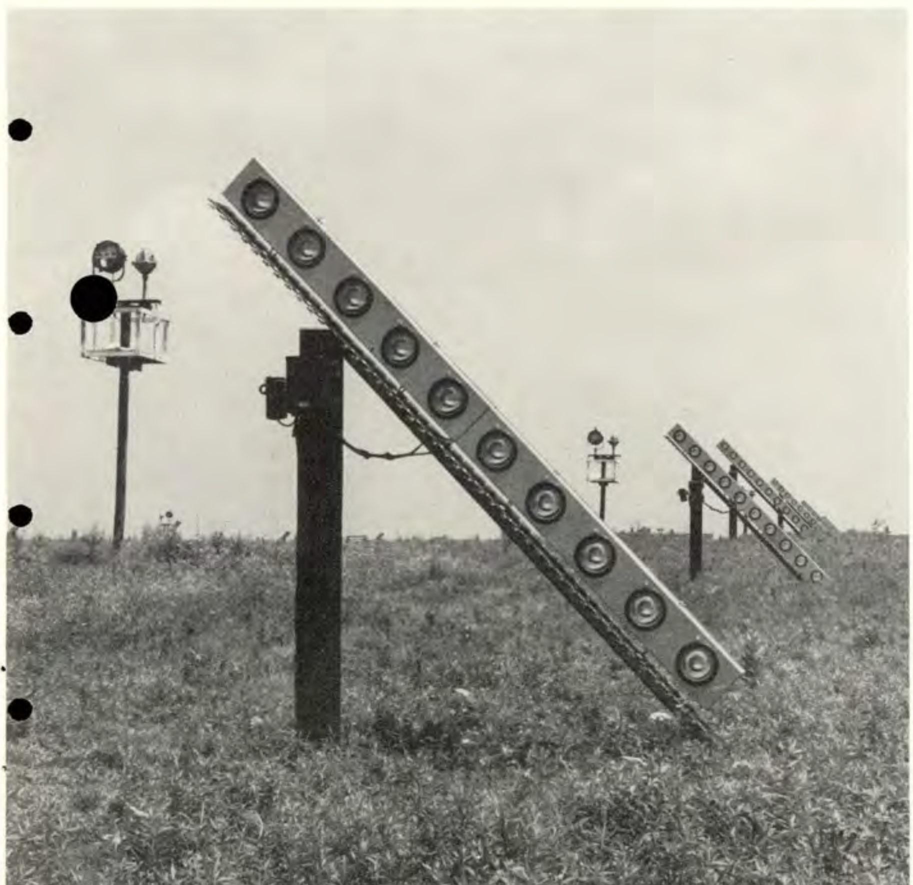
Both U. S. and International Standards are issued primarily to govern civil airports. Once approved, however, all U. S. agencies, both civil and military, must comply with the standards. Special military requirements are ordinarily included as exceptions before the standard is issued, provided that the requesting military agency can submit sufficient justification.

The International Civil Aviation Organization has agreed upon a standard which has been ratified by the U. S. and 59 other member nations. Compliance is therefore mandatory within the United States. The agreement was purposely worded very loosely in order to permit either the Calvert or ALPA Centerline systems. It could be so interpreted as to permit almost any approach lighting system which includes some centerline lights. The U. S. National Standard on approach lighting (No. AGA-NS1) was approved on 4 August 1953, and compliance is mandatory upon all U. S. agencies. Unfortunately this is not a single standard, but contains figures showing three different systems.

### Air Force Standards

With the exception of a small number of experimental installations, the Air Force has only three types of approach lighting systems,

Above, tire marks are mute evidence of what happens when a pilot gets confused by approach lights.
Below, the Slopeline unit has ten sealed beam lights which form a straight line to the end of runway.



both within the United States and overseas. The three Air Force systems are all compatible. Prior to 1950 the Standard was the Two Parallel Row. From 1950 to 1953, the Standard was the overrun lighting system, which is a Two Parallel Row System in which the left row is composed of triple lights in order to distinguish the left row from the right. The new Standard Air Force system (Figure 11 of the U. S. Standard) is an overrun lighting system with at least 500 feet of centerline lights added to the outer end. This new standard meets all Air Force requirements, and Headquarters USAF has directed that all Air Force bases initiate action to comply with the new standard by 1960, provided that Congress appropriates the necessary funds.

The primary cause of complaints by Air Force pilots is the fact that civil approach lighting systems are usually installed at joint use airports. Although the pavement and lighting extensions are paid for by Air Force funds, civil rather than Air Force lighting standards are used.

As previously stated there are now at least 12 different approach lighting systems in use in the United States. Because of the time and money required to change permanent facilities of this type, several years will be required to appreciably reduce the number of different types of systems, regardless of what standardization action is taken. Implementation of the new U. S. Standard should result in reducing the number of types in use in the United States from 12 to three in approximately 10 years.

Although standardization has been maintained effectively on Air Force bases, such is not the case on civil or joint AF-civil airports. In your flight planning, check the Pilot's Handbook to see which of the 12 existing systems is installed. If the book doesn't indicate an approach lighting system, give Flight Service a call for the latest information. Remember a familiar system is helpful . . an unfamiliar one hazardous. ●

# the Soft Touch

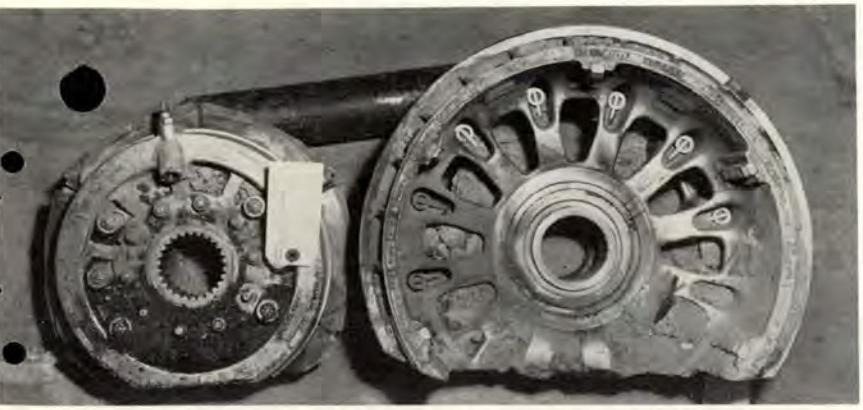
E. L. Martin, North American Aviation, Inc.

YOU'RE SITTING in your torch at the end of the strip. All checks have been completed. The familiar voice of the tower operator makes you sole owner of the runway and you automatically ease your left hand forward. The anticipated surge of power is there and the invisible pressure pushing you back in the seat feels real good. At first you are aware of your forward motion. There goes the first intersection. The brilliant yellow of a cruising fuel truck catches your eye. There goes the tower in a slight blurr. As your forward momentum continues to build, the world outside your cockpit narrows down to a centerline, a panel of instruments and the horizon directly ahead. Your plane has just reached the unstick speed as you start to ease back on the stick, NOW STOP!

No, this is not an article on how to abort a takeoff. I don't profess to know too much about that but I do know about aircraft brakes. So, I got you into this mess in order to illustrate the terrific amount of heat potential that you build up for your brakes, with every takeoff you make.

You pilots of the modern, fast military airplanes depend more on good brake performance now than in any previous period of airplane development. The reason for this is the higher wing loading and lower lift coefficient current on the thin-wing and swept-wing configurations. This speed increasing combination has necessitated changes in the brake assemblies which in turn has affected the technique required of the pilot in stopping his rolling stock. A good example of these brake changes may be found in the F-86H.

On the landing approach, the pilot will find that the F-86H differs from the F-86F and D, in that the "H," with the "6-3" leading edge, has a higher approach speed due to heavier weight and the lack of leading-edge slats. The fixed leading edge of the F-86H increases its performance at the high speed range but at landing speed, due allowances must be made for directional control and rate of sink. All of these conditions increase the safe touchdown speed of the airplane, which should be around 135 knots, depending on the landing weight. Excessive landing speeds increase the possibility of tire blowouts or failure of the brakes because of excessive temperature development.



**Above, when brake locked upon touchdown friction burned through tire, ground wheel away. Left, these tires are four examples of the varying degrees of damage caused by skid burns.**

It should be borne in mind that an aircraft brake is a heat reservoir where the kinetic energy of the airplane, because of its weight and landing speed, is converted from foot pounds to BTUs or heat units. Therefore, the basic premise of brake design is resolved by how many BTUs can be absorbed in the brake rotors before the critical temperature is reached.

The amount of heat involved can be explained if you consider the analogy of the airplane accelerating from a standing start to takeoff speed. The forward velocity is attained by virtue of burning fuel in the engine. The fuel represents so much heat in BTUs which is converted into kinetic energy in the airplane. When the airplane is brought to a stop during landing, the reverse of the above takes place and the kinetic energy shows up as heat in the brake. This energy is proportional to the square of the landing speed.

On high performance airplanes such as the F-86H, the landing gear designer has the problem of stowing a wheel that will carry the maximum takeoff load and provide adequate brake capacity. In order to provide a brake that would be adequate for the F-86H and fit within the space available, the Bendix people have developed a new inorganic lining material. It replaced the organic materials used on the F-86F and D. This new brake lining is a cintered cerametallic material. It greatly increases the allowable operating temperatures, thus producing higher braking capacities.

An added advantage of the cerametallic lining is its ability to sustain a constant coefficient of friction throughout the landing run. This eliminates the tendency of the brake to fade at high temperatures.

By necessity, the F-86H brake gained a bit more weight than its predecessors. The brake weighs 80 pounds against 55 pounds for the D series. However, our 80-pound binder is capable of absorbing 9,000,000-foot pounds of energy as compared to 4,900,000-foot pounds for the "D."

Reports from various service activities indicate that there have been numerous failures of the F-86H main landing gear tires. Actually, this tire is larger than that used on the F and D airplanes and has a lower tire pressure. This should normally give longer service. In the majority of cases the tire has been blown shortly after touchdown which indicates that failure may have been caused by one or all of the following:

- Over-braking one wheel to correct for loss of directional control on touchdown. Loss of directional control just prior to touchdown, causes the airplane to yaw and drop one main wheel ahead of the other.
- Too heavy application of brakes.
- Lack of familiarity with the F-86H braking system.

To get the best performance out of the brakes in the H series airplane, follow the normal landing procedures recommended in the Flight Handbook. When the airplane is on the runway, set the nosewheel down quickly and apply the brakes smoothly and steadily to the point just short of locking the wheels; then release and apply brakes intermittently. Hold them on for two or three seconds and off for one second. As the airplane slows down, heavier pedal forces may be applied. If the airplane should yaw during brake application, both brakes should immediately be released and then corrective braking action taken. Here's the reason:

If excessive brake pressure is applied, it is possible for one wheel to lock. The locked wheel will then skid and the tread-rubber in contact with the runway will melt. This reduces ground coefficient of friction and causes the airplane to yaw towards the side OPPOSITE from the locked wheel. The immediate reaction of the pilot is to increase the brake pressure on the locked wheel to correct the yaw. The result will be a tire blowout. Hence also the reason for intermittent braking at high speed; as well as the release of both brakes momentarily should yaw occur. When excessive touchdown speed is avoided and the brakes are used properly in the early stages of the landing roll there is no need for heavy and destructive braking near the end of the runway. Below 90 knots, nosewheel steering is very effective in countering crosswinds. Directional control obtained in this manner helps to reduce brake temperatures.

Remember, an aircraft brake is not designed for continuous operation like an automotive brake. It is designed to stop the airplane safely under the most severe condition, which is an abortive takeoff. Under this condition, the brake absorbs its maximum kinetic energy and attains its critical temperature. If an abort is made, about 30 or 45 minutes should be allowed for brake cooling before attempting another takeoff.

When making repeated landings at short intervals, especially if there are long taxi-backs to the point of takeoff, have the crew chief check your brakes for overheating. A hot brake retracted into the wheelwell is out of the slipstream cooling. The heat absorbed by the brake will radiate to the tire and may cause the tire to burst. Attendant damage to the airplane structure may result or possibly hydraulic lines may be ruptured.

In conclusion I would like to say that you have a good airplane with an excellent set of brakes. Brakes designed solely for your aircraft's individual configurations. Just like any other piece of mechanical equipment that is new to you, you must learn to use them properly and respect their limitations. They'll stop you every time if you use *a soft touch.* ●

Flight Service weather forecasters check the route weather, and brief pilots over the drop-line communications system.

Things can get rather rushed at Flight Service Centers when traffic is heavy, so you may have to . . .

# . . . stand-by

THE OLD ROUTINE of being able to simply "get the nod and leave the sod" has become a thing of the past; tactical pilots on a scramble, of course, excluded. Today the pilot making a routine point-to-point flight must take advantage of facilities and personnel available to help him preplan while on the ground.

Once in the air the pilot will be practically on his own, except for air traffic control instructions and he is likely to be as busy as the proverbial one-armed paper hanger just flying, making required position reports, and such. The importance of being thoroughly briefed on weather and NOTAMS, knowing applicable flying regulations and directives, and properly preplanning a flight has increased by leaps and bounds. Aircraft are becoming hotter to handle and safety and security restrictions impose a number of requirements on routine every day flying. Let's face it, if we don't know the routine answers before we get into a plane, there's going to be mighty little time or chance to get them until we land again.

Getting briefed for a flight that originates from your own little base operations is one thing. But it's those flights from fields where there are no operations personnel that often leads to trouble, through the "improper flight planning" route. There is no compromise for good, adequate flight planning and that is why Flight Service has assumed base operations functions at civil airports.

A Flight Service Center is basically a centralized operations office for a designated geographical area. It includes operations officers, weather forecasters and operations airmen. Since these centers are fixed installations on seven Air Force bases, most of their business must be conducted by some means of land-line communications. There are three primary means of doing this:

- The Flight Service interphone party-line type communications system connects the centers with all military flying installations and some heavily used civil airports.
- Civil airports which have CAA Interstate Airways Communications Stations (INSACS) are connected to Flight Service Centers by teletype.
- If neither of the above is available, then a regular long distance collect telephone call may be made to the nearest Flight Service Center.

All information as to availability of the Flight Service interphone and CAA teletype facilities and Flight Service Center area boundaries and their telephone numbers are included in the center pages of the Radio Facility Charts.

Regulations now require Air Force pilots to complete a DD Form 175, including the weather section, when departing on a cross-country from a non-military air field. This form provides a good weather briefing check-list and, when filled out, a pil[ot] has a good idea of what to expe[ct].

Now let's see what happens when a pilot wants to file a flight plan, get a weather briefing and be cleared, using the Flight Service interphone. Depending upon the situation, he will do one of two things: either get a weather briefing and then submit his flight plan, or submit his flight plan and then get his weather briefing. Either will be copied by an airman in the Flight Service Center. The request for weather goes to a weather forecaster. The flight plan goes to an operations officer who reviews it and then passes it to a forecaster who prepares and delivers the weather briefing. The operations officer monitors the briefing and checks for NOTAMs which pertain to the proposed flight. If all is well, the operations officer gives the pilot any applicable NOTAMs, special information and approves his flight. Upon completion of the briefings by the forecaster and operations officer their respective initials should be entered in the appropriate places on the Form 175.

This procedure is simple, both i[n] theory and in practice, however, t[he] occasional delays experienced by pilots are aggravating and difficult to

Flight Service personnel appraise every flight plan prior to Operations Officers' approval and clearance.

# one

Major Gayle C. Wolfe
Hqs Flight Service, Orlando AFB, Fla.

understand. After all you say Flight Service is there to provide the service requested, so what happened? Simply this. Unless you are filing a flight plan between the hours of 2200 and 0500 you will probably have to wait in line somewhere along the procedure for the forecaster and the operations officer. Normally there will be pilots ahead of you, filing from the same station as yourself. There may be another station for which Flight Service clears on the same line. In the Flight Service Center, incoming calls are handled by a number of airmen who may be compared to telephone switchboard operators. Here your message is typed out and passed to either a forecaster or operations officer as applicable. At this point a further delay may be experienced since two or three forecasters and an equal number of operations officers may be briefing and clearing pilots from four or five other bases on the same interphone system in addition to handling teletype and long distance telephone requests.

Flight Service Centers, like any base operations section, will be especially busy at certain times of the day and certain days of the week. Personnel can be scheduled to meet these added requirements, but mechanical facilities must be programmed to give adequate service commensurate with cost. Facilities such as communications equipment must be programmed well in advance, with the need definitely established, and cannot be economically cut off and on for short periods.

Flight Service interphone lines are leased from the American Telephone and Telegraph Company whose technicians recently completed an extensive and detailed traffic analysis of the entire system. Recommendations for immediate circuit realignment based on the best customer service for the dollar have been accepted and will be in effect for the busy summer period. Further analysis is being made of the data collected with the goal of developing the ultimate in an operations communications system.

One of the hardest places to prevent delay in a Flight Service Center is at the weather forecasting positions. This is certainly no reflection on the capabilities of these technicians. Flight in modern high performance aircraft requires more extensive weather information for briefings and naturally this takes more forecaster time to prepare and deliver. For instance, takeoff roll must be computed for each USAF jet aircraft departure. Since this is determined by pressure altitude and temperature, these elements have to be forecast for ETD and included in briefings. Forecasters who work in a Flight Service Center are restricted much of the time to the immediate vicinity of their desks where the interphones and telephones are located. Current forecasting tools are brought to them and they are under almost constant pressure during busy hours.

What is being done to speed you on your way so that you aren't flying on the end of a telephone? Flight Service is expanding its facilities and personnel structure. Air Weather Service is adding forecasters during especially busy periods and is streamlining its operations in the Flight Service Centers. But you too, can be a big help in speeding things up. When you request a weather briefing the forecaster must know your proposed route of flight, altitude, estimated time of departure and estimated time en route. It takes a forecaster longer to develop a briefing than it does to give it, so state what you want to know in as much detail as necessary. A call back to get additional information takes both the forecaster's time and the interphone line time. The proper sequence and information required when filing a flight plan with Flight Service is in the Facility Chart.

The most logical time for pilots to get a clear picture of the weather situation as well as operational information is when he is on the ground with ready access to this information. Flight Service exists for but one purpose, that of providing the best possible service to the military pilot for the safe completion of his flight, regardless of conditions. So, take your time, plan a good flight and fly a good plan. ●

Proper engagement results in only minor damage to this F-84F gear faring.

**The information in this article is based on the latest barrier test data compiled by WADC.**

# Big League Catcher

Test at 30 mph with 450-gallon tanks resulted in unsuccessful engagement.


Test at 45 mph resulted in the cable overriding 450-gallon tanks on F-84F.

LET'S TAKE AN imaginary fighter jockey, buckle him into a hypothetical jet fighter and stick him smack-dab in the center of a thoroughly unpleasant situation. We'll have him charging down the runway at full bore, reaching takeoff speed and then losing his power. One minute everything was going fine and the next our hero finds himself in sort of a tough spot since he is traveling too fast to get stopped before running fresh out of strip.

We seem to have things arranged so that this boy has hardships he can't possibly use. But wait a minute, maybe they aren't as rough as they seemed at first glance. At the far end of the strip, awaiting our guy's onslaught, is a large nylon net, or runway barrier. And this barrier was designed specifically to do the job of catching jets that otherwise would run off into the boondocks.

Okay, so all this boy has to do is guide the fighter into the center of the net and come to a screeching halt. A little gear fairing may get torn up but that should be about all. Let's follow the engagement.

The airplane's nosewheel hits the nylon straps, the cable raises up . . . and plane, pilot and all go right on through, roll off the overrun and end up in a ditch. Our fictional pilot scrambles out uninjured, but you can scrub one jet aircraft.

But what happened; why didn't this imaginary incident end happily for all concerned? Remember, we said that this was a hypothetical case? We didn't say what kind of a fighter our pilot was flying. If it was a T-33, an F-80, an F-94 or any F-84A through G, he might have forgotten to retract the speed brakes. If it was an F-86 with 200-gallon pylons, an F-94C with 250-gallon pylons or an F-100A with 450-gallon pylons, perhaps he failed to jettison the tanks prior to hitting the barrier. One thing is fairly certain; when he failed to get a successful engagement of the barrier, it was because of lack of knowledge. That is, our imaginary pilot didn't know exactly what to do to insure a safe catch.

Recently, WADC completed a series of tests on barrier catches and came up with some interesting recommendations and information on operating characteristics and installation changes. This data will be incorporated into revisions of T. O. 35E8-2-2-1 but the sooner it is disseminated to the field, the better.


Above, in a clean configuration, this F-84F hits the barrier successfully at 150 mph. Left, another successful stop with 450-gallon inboard pylons. Engagement at 98 mph.

Below, with 120-gallon pylon tanks, the minimum engagement speed was 45-50 mph.

Below, in the clean configuration, barrier can be engaged as low as 20 mph in F-86A.

Side view of the F-86A shows how arresting cable overrode 120-gallon pylons at 50 mph.

Before getting into the meat of the information there is one important point that should be emphasized. While WADC recommends that certain aircraft retain their pylons during barrier engagement because it presents less of a hazard than dropping them on the runway, this doesn't mean that pylons can't be dropped. It is recommended that in any case where an emergency occurs in flight and the possibility exists that a barrier will be used, that external stores be jettisoned before landing. In all fighter aircraft, there will be a higher degree of reliability during engagement when they are in a clean configuration. So, if it looks as if you will need to use the barrier, get rid of those stores before landing.

Operations and installations people will be interested in how the barrier equipment fared during the tests.

In over 50 engagements made during the tests conducted by WADC, using the standard webbing adapter 54H22130, there was no case in which the webbing adapter failed to function properly. This adapter was tested at speeds as high as 160 mph. The arresting cable installation was made in accordance with T. O. 35E8-2-2-1 to insure proper slack condition. Operations people should be sure that the installation personnel at their base are thoroughly familiar with the T. O., as you can run into

| Aircraft Model | Inboard or Mid-wing Pylons | Dive Brakes | Napalm, Rockets Other Stores | |
|---|---|---|---|---|
| T-33 | N/A | Must be Retracted | N/A | |
| F-80 | N/A | Must be Retracted | N/A | |
| F-86 A thru D | Retain 120 Gal. Tanks<br>Jettison 200 Gal. Tanks | N/A | N/D | Minimum engagement speed 45 to 50 kts. |
| F-94 C | Jettison 250 Gal. Tanks | Must be Retracted | N/D | |
| F-84 A thru G | Retain 230 Gal. Tanks | Must be Retracted | * | Minimum engagement speed 40 kts. |
| F-84 F ** | Retain 230 Gal. Tanks | N/A | N/D | Minimum engagement speed 40 kts. |
| | Retain 450 Gal. Tanks | | | Minimum engagement speed 35 to 40 kts. |
| F-100 A | Jettison 450 Gal. Tanks | N/A | N/D | |

* Successful engagements at minimum speed of 35 knots have been made with inboard pylon 1000 pound bombs attached.
**230-Gal. outboard or underwing tank should be retained.
N/A — Not applicable. N/D — No Data available.

The chart shows engagement limitations for the runway barrier by aircraft type.

serious trouble if the cable is not installed correctly.

Another important point for operations supervisors to check is the revised arresting chain. The Center recommends that the chain be composed of five connected sections or "shots" totaling about 450 feet. The first "shot" is composed of single links of chain, each weighing from 45 to 55 pounds per lineal foot. The other four "shots" are double links that should weigh from 100 to 120 pounds per lineal foot. As an added margin of safety, a new arresting cable has been designated to replace those now in use. This cable, which is 7/8" wire rope and stronger than the old cable, should be requisitioned and installed as soon as possible. The stronger cable and increase in quantity of chain were made to provide for high speed engagements at higher gross weights which will become necessary for new aircraft.

The tests run by WADC resulted in quite a few recommendations for various airplane models. In some cases, additional recommendations were made as a result of experience with similar models although actual tests weren't run.

The tests revealed that the F-86A through D, in a clean configuration, could engage the barrier successfully at speeds as low as 20 mph. However, with 120-gallon pylons on, the minimum engagement speed was between 45 and 50 mph. No tests were run with 200-gallon pylons installed on the F-86 but other test data on large pylon tanks decided WADC to recommend jettisoning the 200-gallon pylons.

On the T-33 and the F-80, minimum engagement was made at 20 mph, and tiptanks may be retained as they present no problem on a catch. However, be sure the speed brakes are retracted as they will force the cable under the main gear.

Minimum engagement speed on the F-94 was 30 mph, and, although tiptanks should be retained, it is recommended that if the aircraft has 250-gallon mid-wing pylon tanks installed, that they be jettisoned. Once again, speed brakes-in.

Tests on the F-84 models A through G revealed that in a clean configuration, minimum engagement speed was 35 mph. Both tiptanks and the 230-gallon mid-wing pylons may be retained, but minimum engagement speed for aircraft equipped with pylon tanks is 40 mph. With inboard pylon 1000-pound bombs attached, minimum speed was 35 mph. Speed brakes must be retracted.

Minimum engagement speed on the F-84F in a clean configuration was 35 to 40 mph. With inboard pylon tanks of 230-gallon capacity, minimum speed was 40 mph; with 450-gallon tanks, minimum speed was between 35 to 40 mph. With 230 gallon outboard underwing tanks the minimum speed was 40 mph.

To date the F-100 has not been tested, however, based on the geometry of the landing gear, it can be assumed that engagement in a clean configuration will be successful. WADC recommends that mid-wing pylons be jettisoned prior to engagement. At present, there is no data available on the F-89, 101 or 102.

The information listed in this article is scheduled for inclusion in each aircraft's Flight Handbook; but until a pilot receives it, check what we have here and be sure you know what to do before you have to use a landing barrier. If you wait until you're rolling down the runway toward it, it's going to be a little late.

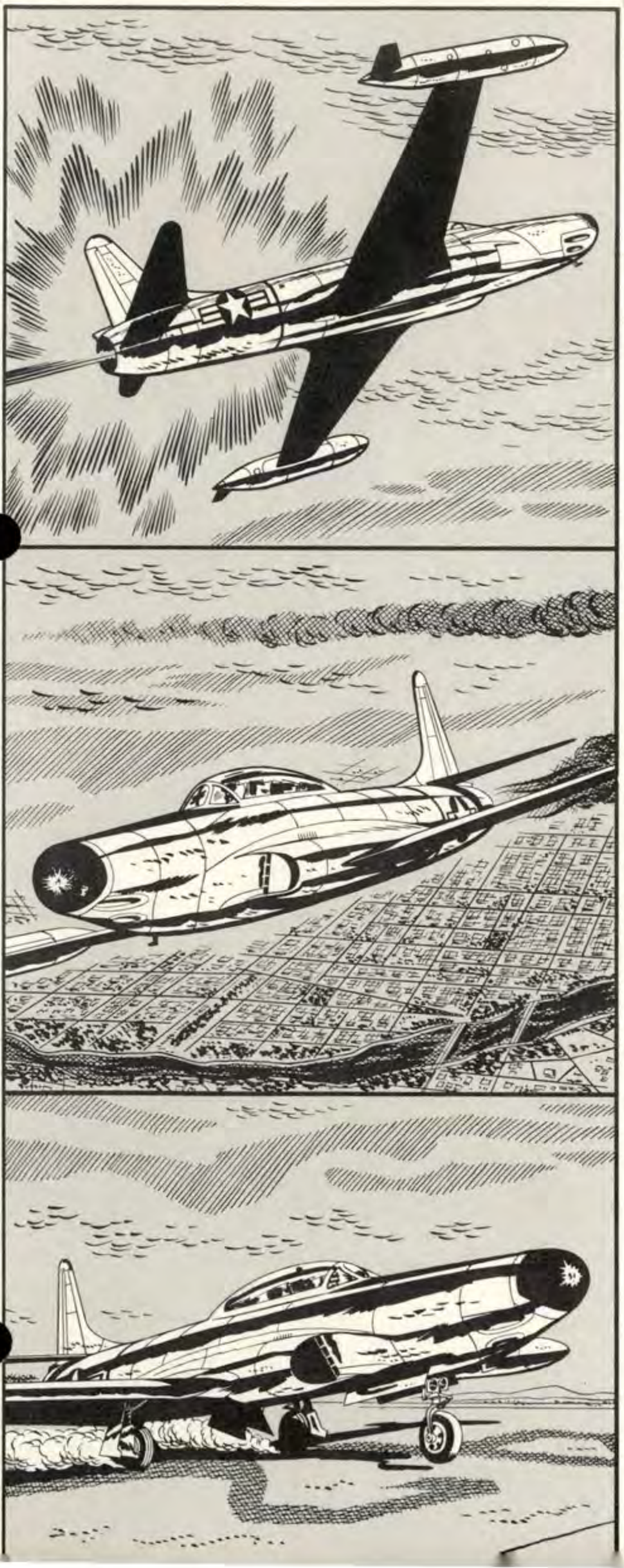
There are several other important procedures that a pilot needs to know to insure a successful engagement.

- Hit the center of the net.
- Brake the plane normally but don't clamp down on the binders so hard that you blow a tire. As you near the barrier use the brakes to steer toward the center of the net. ●

# Col. R. B. Spear

**134th F-I Sq. (ANG)**

# WELL DONE



IMMEDIATELY after takeoff in a specially modified F-94A, Colonel Spear heard a loud explosion just as he was turning off the after-burner. This was followed by an instantaneous power loss, although all engine instruments were giving normal indications. Both the tail section overheat warning light and the plenum chamber fire warning light came on and he noted that smoke was trailing behind the aircraft.

A 120-degree turn back toward the base was made immediately, thereby establishing a downwind leg for the one available runway. He was now at 2000 feet, aircraft apparently on fire, no thrust available and over a densely populated area. It was now or never.

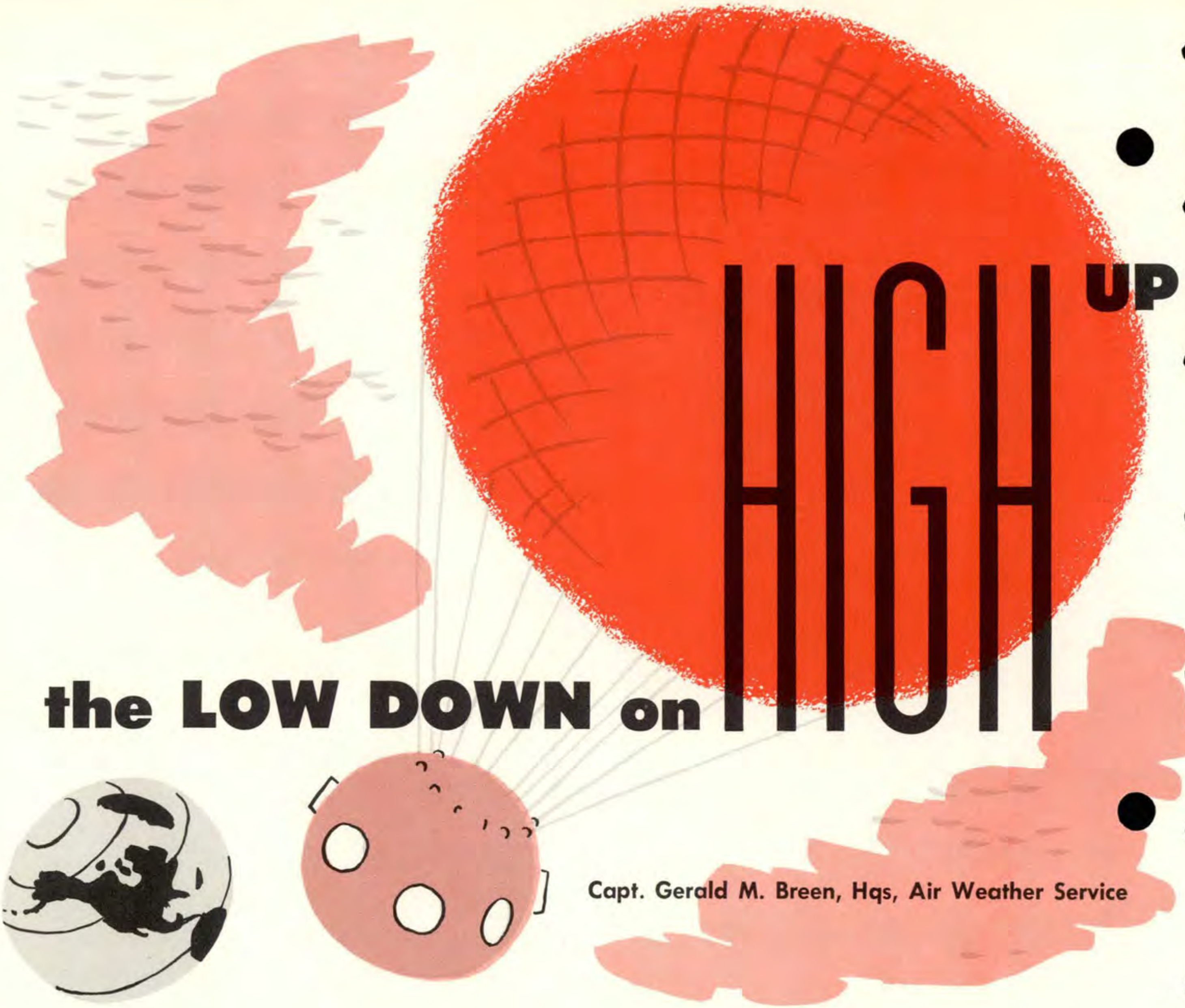
His first thought was an immediate ejection, but he abandoned the idea after a quick glance at the city below. Colonel Spear realized too that he would have to keep the nearly full 230-gallon tiptanks. Jettisoning them would surely result in civilian casualties.

He quickly decided to attempt a landing on the crosswind runway, even though the final approach would have to be made over a deep gulley immediately off the end of the runway. ILAS equipment protruded into the glidepath, making this approach additionally hazardous.

Touchdown was made on the numbers at minimum speed for the load, with not a foot of altitude to spare. Prompt action by the crash crew extinguished the fire and damage to the aircraft was minimized. Few, if any, of the thousands of people below know that one man's skill prevented a tragic accident.

To Colonel Spear a sincere WELL DONE.

# the LOW DOWN on HIGH UP



Capt. Gerald M. Breen, Hqs, Air Weather Service

DURING RECENT years, attention has been focused on the structure of the higher atmosphere, particularly in connection with problems posed by developments in new types of high-flying aircraft, rockets and missiles. Many agencies are currently extending our knowledge and contributing greatly to the scientific fund of research in order to explain climatic processes. The applied climatologist must analyze and interpret many climatic factors that enter into problems of design, specification, planning, location and operations.

In connection with the upper troposphere and lower stratosphere, roughly at heights above 10 miles, the climatologist is often asked: "Where do you get your information? Upon what are the records based? How do you know that such a phenomenon occurs at this height?" Suppose we answer these questions by taking an imaginary trip up through the atmosphere; with a self-imposed ceiling for this ascent being placed at about 40 miles.

Research into the upper atmosphere has moved fast since World War II. Scientists using high altitude rockets have made remarkable progress. Unexpected associations, some still unexplained, have been found to exist between physical conditions in the upper atmosphere and weather conditions in the tropospheric region. The lower atmosphere or troposphere exists between ground level and the tropopause, which is the boundary or zone of transition between troposphere and stratosphere. The troposphere varies in height, depending on the latitude, from about four miles at high latitudes to 11 miles at the Equator.

The stratosphere designates the atmospheric region lying between the tropopause and an upper boundary known as the stratopause. During the ascent on our imaginary flight after reaching the stratopause level, the temperature first begins to increase at a more rapid rate than is characteristic of the lower stratosphere. The level of the stratopause varies between 22 and 31 miles, according to the latitude and time of year.

Unmanned balloons can function at great altitudes, up to 25 miles if carrying only very light instruments, but presently they reach a level where the surrounding air is of about the same density as the hydrogen in the envelope, and so they lose their buoyancy.

Rocket and guided missile research, as well as high altitude aircraft, provide valuable experimental techniques. The first man to enter the stratosphere for certain, and to survive, was the Swiss physicist, Piccard, who ascended to 10 miles in 1931. The last great ascent was by the American helium-filled Explorer II in 1938 where a record height of 14 miles was reached. The greatest height yet reached by an unmanned rocket is reported to be 250 miles.

Of the four principal types of atmospheric soundings — rockets, acoustics, searchlights and radiosondes — only the latter have furnished sufficient information for adequate quantitative analysis. Where radiosonde data are scarce, acoustical soundings have proved valuable.

As we ascend from the earth's surface the pressure and density of the air fall steadily. At 10 miles, near the base of the stratosphere, the atmospheric density is about 1/10 of that at sea level. Atmospheric tenuity does not merely affect men but also machines. Aircraft require the atmosphere for support. There is a limit to the height at which reciprocating engine aircraft can even operate. That limit is between 10 and 15 miles or, roughly speaking, where the air pressure is about 1/20 of its sea-level value. Fortunately our rocket-powered craft is not so affected and we continue on.

### Stratosphere Clouds

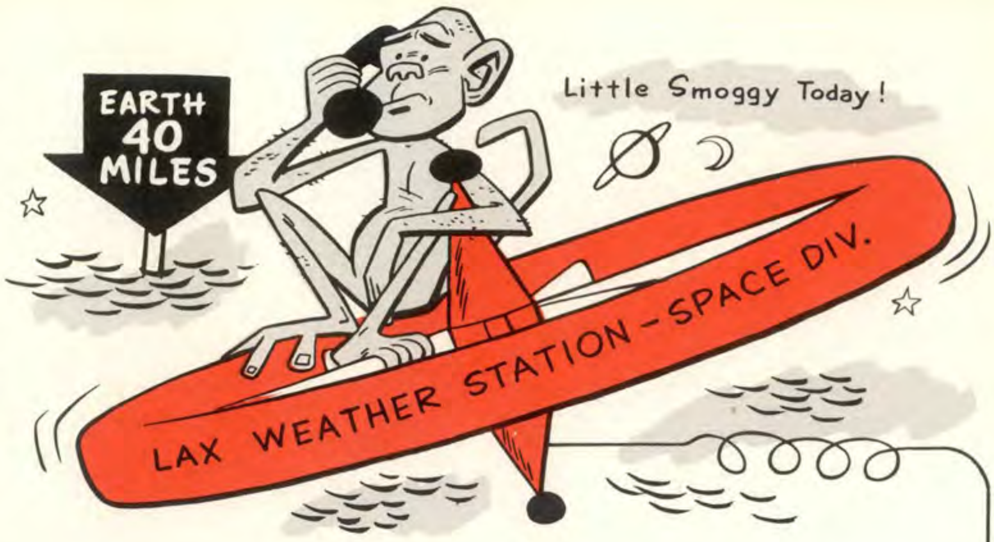
As we journey into the upper atmosphere, some stratospheric clouds are observed. These mother-of-pearl or nacreous clouds, as they are called, generally appear at the 14 to 19-mile level. This seems to indicate a region of cooling at the top of the stratosphere. By analogy with clouds in the troposphere, it is usually assumed that they consist of water droplets or ice particles. The total range of cloud height is remarkably small, being little more than twice the average thickness of the clouds, between 1.2 and 1.9 miles.

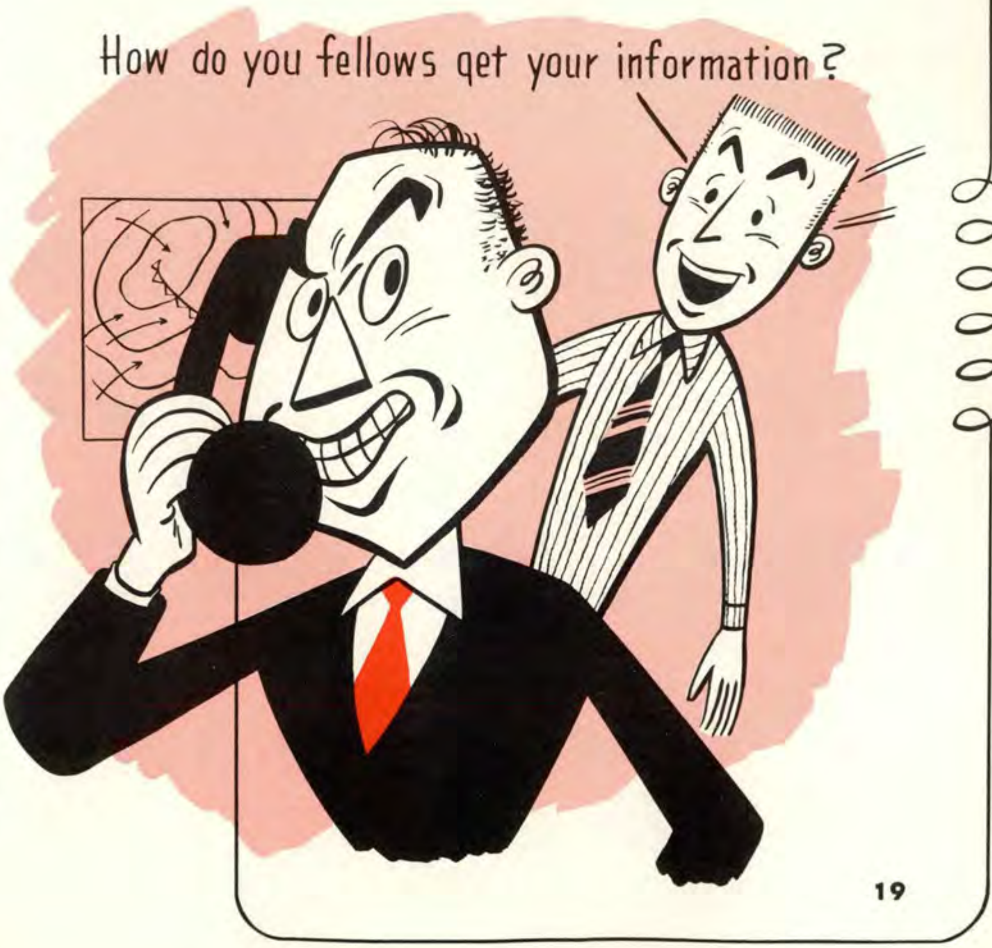
### Temperature Structure

The temperature distribution in the troposphere and the lower stratospheric regions is now well known from direct observations with the help of sounding balloons and smoke shells. The accompanying chart shows the average temperature structure of the atmosphere in temperature latitudes up to 40 miles, together with the sources of information for various height ranges. Available values for upper atmosphere temperatures are derived from a study of radiosonde data, the absorption of solar radiation by ozone, irregularities in the propagation of sound, luminosity and speed of meteors, atmospheric tides, the auroral spectrum and the reflections by radio.

In recent years the vertical temperature structure up to 12 miles has been extensively explored by radiosonde. Since World War II, soundings up to 19 miles have been experienced very frequently.

Starting with an average surface temperature of 20°C., the atmosphere becomes colder with increasing altitude until in the region which divides the troposphere and the stratosphere a temperature of



—55°C. is found. As the ascent continues through the stratosphere, the temperature remains nearly constant until at a height of above 19 miles where it starts to increase and reaches a maximum of over 85° C. at about 36 miles.

Research has shown that there is a definite increase of temperature with height between 19 and 36 miles, with maximum temperatures approximately equal to those at ground level. The rise in the middle atmosphere between 20 and 34 miles is caused by absorption of solar radiation by ozone. Observations on the abnormal propagation of sound waves and study of the heights of appearance and disappearance of meteor flashes confirm this.

**Weather balloons such as the "Moby Dick" are used to provide altitude weather information.**

A small amount of ozone, spread in a very diffuse layer between 12 and 31 miles above the surface of the earth and with its maximum concentration at about 16 miles, protects life on the earth from extinction by solar ultraviolet radiation. Ozone becomes warmer when solar ultraviolet radiation is absorbed; in fact, the ozone layer acts somewhat like an enormous heat reservoir accounting for the temperature maximum at a height of about 36 miles.

### Stratospheric Turbulence

Aircraft flying in the stratosphere sometimes encounter localized patches of "bumpiness." The explanation of this problem is difficult. Large atmospheric eddies take a very long time to weaken. The release of potential energy and the observed turbulent energy may be well separated in space and time. Irregular wind components can be looked upon as manifestations of large-scale turbulence, which is indicated by most of the stratospheric wind observations. However, knowledge of turbulence in the stratosphere is very rudimentary at present.

Wind structure and temperature of the atmosphere are clearly associated. In particular, the effect of mixing upon the composition of the air can appreciably influence atmospheric-temperature-pressure relationships. Although we ride through a bit of clear air turbulence in our imaginary ship, we're still in the dark as far as a solid, conclusive explanation goes.

### North America Winds

Wind systems in the upper atmosphere are complicated and variable. Various techniques are used to study winds, such as high-altitude balloons, smoke shells, compressional wave propagation and distortions of meteor trails. At levels above 19 miles, the following methods provide valuable information: Sound propagation, persistent meteor trails, noctilucent clouds, smoke and vapor trails from V-2 rockets, movement of ionized clouds and theoretical work on atmospheric oscillations and various magnetic disturbances.

While graphical summaries give some indication of the North American circulation pattern, caution should be used in reading such charts since deficiencies inherent in some techniques and the distribution of data may cast doubt upon the accuracy obtained.

Above 10 miles, the chart shows a distinct monsoonal effect over North America, with a strong reversal of direction from summer to winter. Winds are predominantly from the east during summer and from the west during the winter months.

Generally an increase in windspeed can be expected with altitude until the stratosphere is entered, at which point velocities will decrease. At a height of about 12 miles, another increase will occur and average windspeeds of about 130 knots can be expected. During winter, windspeeds increase with increasing latitude, while during the summer they decrease with increasing latitude.

As was previously mentioned, the boundary between the troposphere and stratosphere is called the tropopause. It is an approximately level surface which has discontinuities or interruptions in the belts of strongest winds, called jet streams.

Jet streams appear as tongues or narrow bands of high-speed westerlies; they are meandering belts or "rivers" of fast moving winds passing between much slower winds on both sides. These belts are most intense at elevations of six to seven miles (30,000 to 35,000 feet). Mean charts show jet streams with speeds of about 100 knots circling the globe between 20 degrees and 30 degrees N. latitude in winter; in summer, a speed of about 50 knots is found between 35 degrees and 50 degrees N. latitude. This concentrated high wind system has been studied in detail by researchers at the University of Chicago, who coined the descriptive term "jet stream."

Even a brief description of the complexity of the atmosphere serves to emphasize the need for an abundance of accurate data before a much fuller understanding can be gained. An ideal opportunity for more intensive study of high-altitude winds, for example, is provided by establishing certain years for international cooperation and effort.

Well, this little excursion into the upper regions was over almost before it started and there wasn't a great deal to see. But one of these days we'll get out of the imaginary rocket class and into reality. Then our knowhow will increase by leaps and bounds. ●

# chilled and Chattering

RECENTLY, WE heard of a young fighter pilot who had one of the more positive statements of the year to make after a rather hairy experience. Seems as if he was quoted as saying, "I'll carry a dinghy when I'm crossing the Mojave Desert. I don't care where I am flying, I'm going to have one aboard, believe me."

Now it isn't too hard to think of quite a few places where a dinghy is just excess baggage; but maybe this lad had a point, at that. Plenty of USAF pilots make flights everyday that just possibly could end up over a large body of water. And if a man suddenly had an emergency occur about then, a dinghy would come in real handy.

The author of the above statement furnishes a case in point. His accident had several points of interest; it involved not only a survival problem but also a serious malfunction in the rocket-firing system of his fighter aircraft. In his own words, here is what happened.

"I was lead ship in a flight of two fighters participating in a rocket familiarization ride over Lake Huron. The accident occurred when I lost control of the aircraft as a result of a fire and had to bail out.

"We were briefed on the armament and firing portion of the flight, and on the flying phases as well. The briefings were supervised and no discrepancies were noted.

"After starting the aircraft, we took off and climbed to 5000 feet and proceeded to the range. On the way out we contacted GCI and requested them to track us so we would be sure that we were over the range. Shortly afterward, they confirmed our position as being over the southern portion of the rocket range.

"We then dropped down to about 1300 feet indicated to clear the area and make sure that there were no boats on the range. After we had picked out a good spot, we pulled up and started flying a box pattern to the left. I told the wingman that I would make the first dry run. We pushed over from 4000 feet, at 85 per cent rpm and about 280 knots, and simulated rocket firing at 2000 feet indicated. I then pulled up to 4000 feet, safetied all switches and started another left hand pattern.

"As we turned onto final, I picked out a slick spot on the water to fire at and proceeded to set up the aircraft for the firing run. Screens were extended, switches placed in firing position, with the switch on 'fire 12' and manual position, and all circuit breakers in. I pushed over again, this time at 90 per cent rpm, and at 2000 feet I squeezed the trigger and felt the pod drop and heard the hissing of rockets, but nothing came out.

"My wingman informed me immediately that I had hung rockets which were burning and advised me to get rid of the pod at once. I moved the armament master switch to the emergency jettison position but the pod didn't drop and my wingman called again, telling me to get rid of everything. I then rotated the switch to the jettison ready position and hit the 'panic button'. (This dropped the tips; I should have depressed the salvo button on the stick but things were getting a little tight at this point.)

"As I hit the switch the airplane started to roll to the right and I grabbed the stick and moved it full left. This had no effect on the roll, so I immediately ejected.

"I forgot to pull my visor down and the wind tore my helmet off right away. I tumbled about three times and the wind threw my arms back, but finally I got them around and grabbed the seat belt. The seat left as soon as I hit the belt and after a few seconds I pulled the D ring and opened the chute.

"As soon as I got straightened out in the chute I took inventory — my oxygen hose was still strapped to the chute; I took it off and threw it away. I repositioned the dye marker to where I could get hold of it easier and got set to hit.

"I pulled on my risers as I hit and went under about five feet. I was partially entangled in the shroud lines but I got my knife out and started cutting through the lines. As I was cutting, I noticed that my hands were getting quite cold. I inflated my Mae West and slipped out of the chute harness. Then I spread some dye marker and just waited.

"I held my hands under my chin, gripping the Mae West, but it felt as if the circulation was stopped. I tried sticking my hands in my mouth to warm them. It didn't work. My G suit seemed to help keep circulation going in my legs and my jump boots helped for my feet.

"About 15 minutes after bailout I had lost all feeling in my body and between 25 and 30 minutes after I got out I started shivering uncontrollably and then passed out. I didn't remember anything else until I woke up in the hospital."

This pilot bailed out over one of the Great Lakes near the end of the month of March. The lake was covered by a thin layer of scum ice, and the water was at least 0°C. His statement concerning the need for a dinghy is now obvious. Fortunately for him he was pulled out of the water shortly after he lost consciousness and suffered no after-effects.

His wingman and another wide-awake pilot alternated in buzzing the shore until they were able to raise some boats from shore and direct them to the downed pilot. He was in the water approximately 50 minutes and during this period was unconscious for 20 minutes. His body temperature upon recovery was far below normal, and it is doubtful if he could have survived for much longer.

No wonder this lad is determined to carry a dinghy wherever he goes. He may not need it over the Mojave, but if the occasion arises, he is going to be prepared, just in case. How about you? ●

# REX SAYS

It HELPS TO be strong in this man's Air Force. At least, one of our jet jockeys saved an aircraft for Uncle Sugar by the strength of his good right arm, to say nothing of saving himself.

The pilot in question took off in No. 4 position in a flight of four F-86s. After breaking ground, he placed the gear and flap handles in the UP position. Immediately, he noticed a severe rolling tendency to the left which required full aileron trim to keep the plane upright.

As the airspeed increased, the tendency to roll increased also. By reducing power, holding strong right stick pressure and with full trim in the pilot was able to keep the aircraft under control.

A quick check of the aircraft revealed that the left flap was up and the right flap was full down. He called the flight leader who joined him and confirmed that one flap was down. After gaining a safe altitude, the flap handle was moved back and forth several times, but no flap reaction could be obtained.

The pilot notified the tower that he would remain airborne to use up fuel and lighten the load. By experimentation he found that with the speed brakes out and with the gear down and locked he had better control of the aircraft which stalled at around 143 knots.

He flew around at 150 knots, burning up fuel, and flying with his left hand in anticipation of the strength that would be required on his long, final approach.

He tooled around in a wide pattern, got her turned onto a long, final approach and, with a little sweat and much elbow grease brought it in for a successful landing. We feel this boy showed plenty of good flying ability and more than average level-headed planning to get the plane in with no damage.

***REX SAYS:*** *I certainly concur in that last statement. Your boy did an exceptional job in a tough situation. He deserves plenty of cheers from all of us.*

★

I TOOK OFF the other day in a B-26 with a crew chief for company and after an uneventful climb to 5000 feet, advised airways that I was going to do a bit of range work for an hour. It was a perfectly clear day so before getting under the hood I told my passenger to keep his neck on a swivel. I have a certain aversion to running into solid things like mountains or other aircraft.

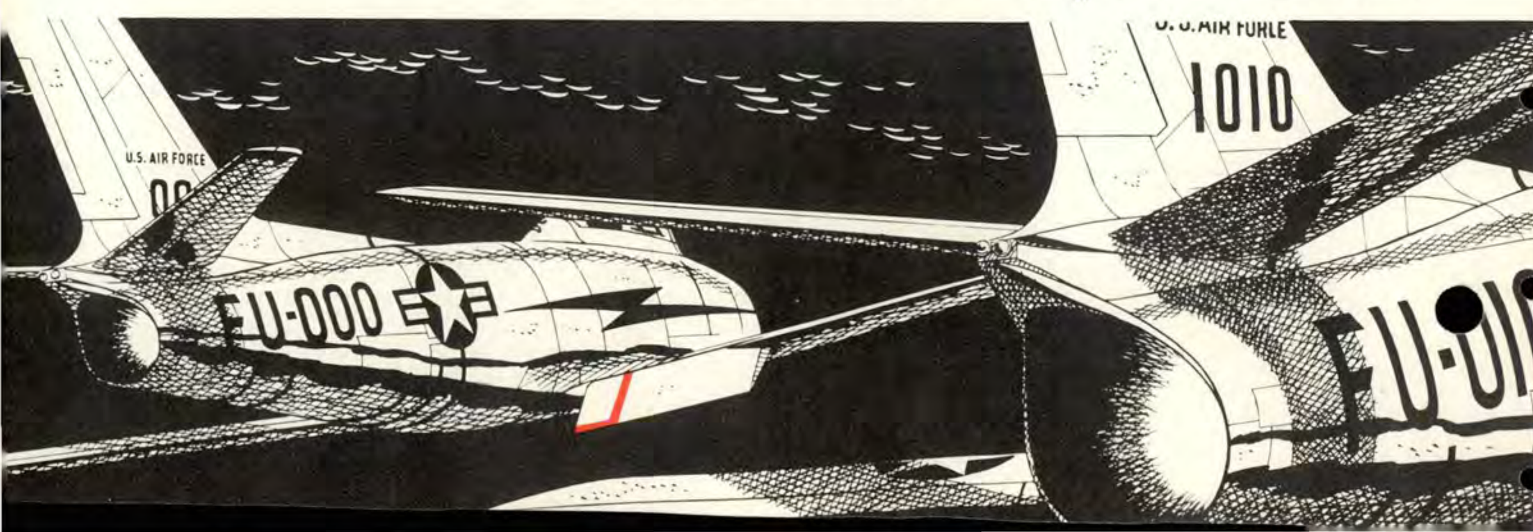
I became quite interested in A's and N's, and odds and ends in the cockpit like needle and ball, airspeed and the horizon. In fact, I became so interested that about 30 minutes had passed before I happened to glance at my "safety pilot." Apparently my gentle flying and the warm rays of the sun had lulled him deep into the arms of Morpheus. To wit, the clobber-head was fast asleep. Unfortunately this shook me up so badly I couldn't concentrate on the gages, so I called off the whole thing before we both made it a really long, permanent sleep.

**REX SAYS:** *As the Good Book says in the 23rd Psalm, "Thou art with me." AFR 60-4 calls for a "qualified observer." This sleeping beauty could hardly qualify. Amen.*

★

IT IS ALL well and good to observe the limitations as to minimum altitudes and airspeed, especially in single engine operation of a twin-engined aircraft, but circumstances certainly do alter cases. Possibly I have had more aversion than most to flying over metropolitan areas, characterized by solidly built structures, having done most of my flying in the wide open spaces.

A quick check by the wingman revealed that the left flap was up and the right one, full down.



Just a few months before my pending retirement, after 35 years in the Air Force, I was taking off from a base in a nice, plush, Cocoa four seven, to return to my duty station. Both engines checked out perfectly, and the takeoff was routine until the aircraft was about 15 or 20 feet in the air and well committed to flight. Suddenly I had the startling realization that the aircraft wanted to slow-roll to the left. It felt as though the left engine had suddenly given up the ghost and quit.

I had a couple of hands full of airplane while trying to pick up that left wing. My trusty copilot manipulated the throttle controls and obtained full power from the right engine, but the left propeller refused to respond to all feathering attempts. Even the prop control had no effect on the smoothly windmilling brake that had been the left fan.

After the boundary was cleared and we had passed over the surrounding roof tops by what seemed like inches, I was able to climb to nearly 150 feet, but the last 50 were soon lost when power had to be reduced because of the high engine temperature.

I couldn't turn right because of obstructions so we started a slow left turn to get back to the field. The entire flight from then on was made at between 90 and 100 mph, dodging water towers and sundry buildings which loomed above us. We got the gear down just as we crossed the boundary and finally landed.

Strangely enough there was not a thing wrong with the engine, the prop was the villian all the time.

This was about the shortest flight I have ever been on, but I certainly did not suffer from boredom.

There were a couple of things that aided in preventing a major catastrophe. In the first place, the radio compass had been set on the local homer prior to takeoff. At the altitude we were flying it would have been impossible to locate the field without it.

Next, the copilot did a bang-up job in assuring maximum results from the right engine.

I suggest that each copilot keep a constant check on RPM during takeoff. Chances are if that prop is going to act up it will start its shenanigans before you become airborne.

**REX SAYS:** *Glad you made it. This little episode makes me think back to the required engine check-out recommended in the C-47. If you remember, it does not require a full power check during runup. However, it states that during the takeoff run a check of the RPM must be made to see that the governors are functioning. If they work okay then, chances are they will probably stay with you.*

★

The lightning strike was accompanied by a loud artillery-like explosion.

YOU HEAR A lot about pilots getting bounced by a large jolt of lightning but mostly you don't figure it will ever happen to you. Well it can; it happened to me.

I was flying a C-47 and was in the process of executing a missed approach procedure at an Air Force base, when the plane caught a bolt of lightning right on the nose. At the time, we were climbing up through a layer of strata-cu and were encountering moderate to heavy snow, moderate turbulence and some light rime icing. Outside air temperature was about -3°C.

Apparently the charge distributed itself rather evenly over the wings and fuselage and was discharged from the static eliminators on both ailerons and the vertical stabilizer. The strike was accompanied by a very loud explosion which sounded like a heavy artillery piece being discharged outside the window. When hit, the aircraft shuddered momentarily but normal flight control response returned immediately.

After landing, a thorough inspection revealed burn damage to the outboard aileron static eliminators and damage to the low frequency radio antenna. Also, a small hole the size of a thumb tack was found in the rudder trim tab.

***REX SAYS:*** *I don't imagine this experience was exactly pleasant, but think what it could have been. Fortunately, these lightning strike incidents are fairly infrequent or we would all need built-in grounds on the flying suit.*

# Keep Current

NEWS AND VIEWS

**Survival Diet** — Last month, one hundred volunteer airmen participated in tests to aid in the development of improved global survival rations.

The airmen, recruited from Lackland and Chanute AFBs, subsisted on diets ranging from starvation to normal while living under field conditions.

Half the men exercised heavily, half lightly. A further breakdown in conditions was made in the drinking water given both units of men. Some were allowed unlimited amounts of water, some only controlled amounts to determine the effects of water on an airman's well being. In all, 20 different feeding situations were studied; varying in caloric content and nutrient mixture in terms of fats, proteins and carbohydrates.

The tests, made to determine the most efficient diet that will keep a downed airman alive under all circumstances, will cover a total of six weeks.

Basically, the 100 airmen were divided into four groups.

- Group I was given unlimited amounts of water, received only light exercise and was given a pre-determined ration of food daily, ranging from no food for some and up to 3000 calories for others.
- Group II received the same rations of food and water as Group I but was required to exercise heavily.
- Group III received similar rations of food, exercised lightly, but was permitted only limited amounts of water.
- Group IV received food and water quantities similar to Group III, but exercised heavily.

The best method of exercise was determined to be hiking as the caloric expenditure of each individual could be controlled, and the men walked specific distances each day. In addition, the volunteers were required to shelter and care for themselves using equipment available in standard USAF survival kits.

This installation was devised to reduce sound during the preflight operation of the F-100. Here the tailpipe juts through opening in the silencer. The unit features a sound reducing asbestos collar.

F-89Ds are being equipped with a new fire-control device.


**Fire Control Help** — F-89D aircraft are being fitted with a device designed to insure accurate alignment of the 104 rocket fire control system. A 28-volt electric fan directs an airflow of approximately 160 knots over the airplane's angle of attack detector probe, allowing quick calibration and alignment of the attack sensor system. The units are being shipped to all Air Force bases where the '89Ds are stationed, for installation.

**Big Time Saver** — Pilots using the new DME (Distance Measuring Equipment) will soon be able to make straight-in approaches to many airports instead of going through time-consuming maneuvers.

Present regulations require that a pilot make certain turns and maneuvers to ascertain his position with certainty before descending at most airports. In about 60 days, after criteria have been established and procedures published, pilots using DME will be permitted under Civil Aeronautics Administration regulations to proceed straight-in.

The saving in aircraft operating cost can be substantial. An estimate of the time saved by a straight-in approach normally is between eight and ten minutes.

This announcement was made by the Office of Aviation Safety and is a result of the high degree of accuracy demonstrated by DME. The DME provides a pilot with a direct reading of his distance from a range or an airport where the ground transmitting equipment is installed.

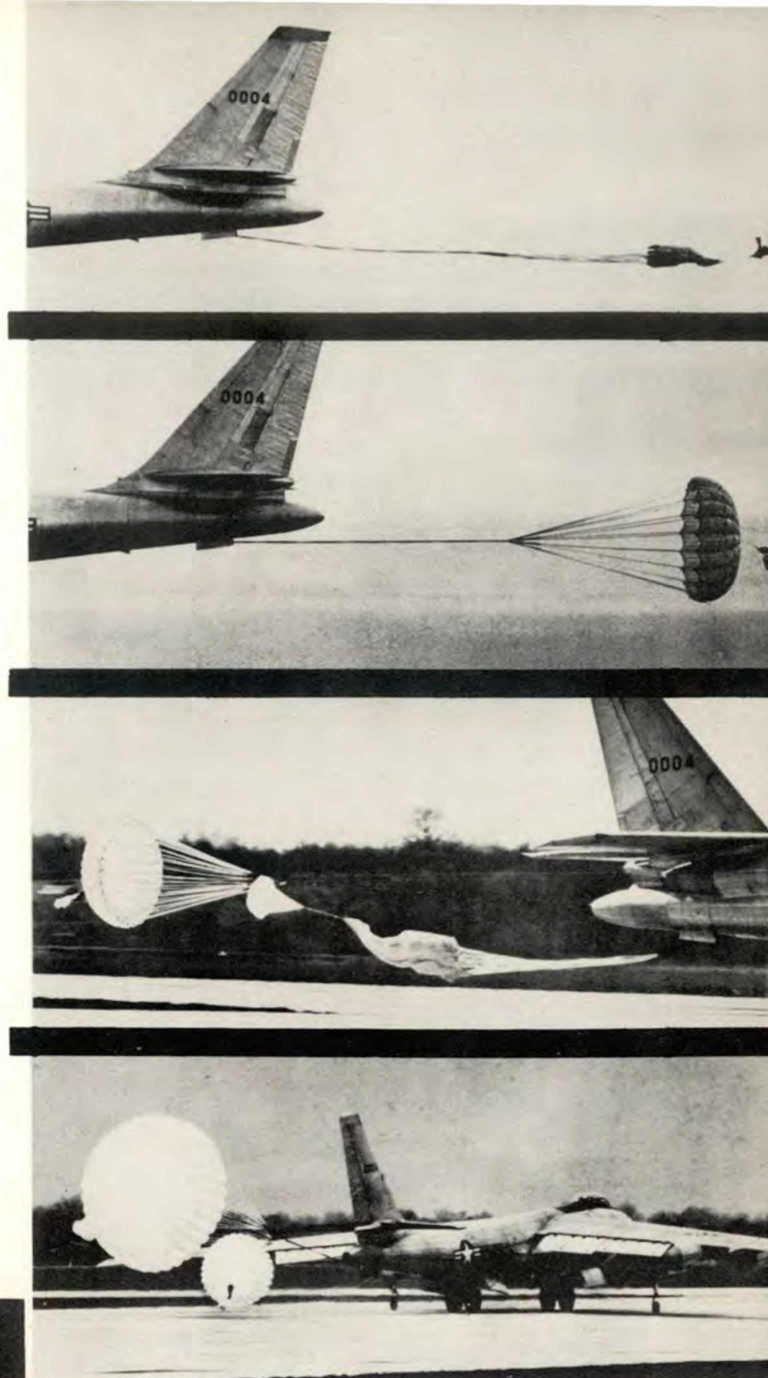
**Approach Chute** — The landing speed of the B-47 jet bomber has been considerably reduced through the use of an approach drag chute. Use of the chute now makes the landing roll of the B-47 comparable to that of a propeller-driven airplane of equivalent size.

The '47 has used a parachute for braking purposes for six years. The new parachute will not take the place of the 32-foot landing deceleration chute, but will be additional equipment, deployed in the air to permit a steeper descent for the landing approach.

The new parachute is approximately 16 feet in diameter and, although too large to be used as an approach chute for a fighter, it can be used as a brake parachute on the F-94, F-86, F-100, F-101 and F-102.

Using this approach control device facilitates landing on shorter runways and results in less braking action and tire wear. It also makes for better control on landing approaches and spin recovery on test aircraft.

The parachute drag device weighs approximately one-third less than other deceleration devices, thereby saving overall aircraft weight. The use of parachutes permits pilots to maintain engine power during landing, thus assuring engine response in the event of go-arounds.




The two top pictures show the deceleration approach drag parachute opening and streaming out behind the B-47. The parachute was designed for slowing down while in flight. Just before landing, the approach chute can be seen fully opened. The regular "brake" parachute starts to open and fully deploys for use in slowing down after the landing.


Left, the C-123B was recently assigned to the new transport group at Ardmore, Okla. It will perform assault-troop operations.

# the Thundering Heard

Aeronautical Research Laboratory, WADC
Fred L. Daum

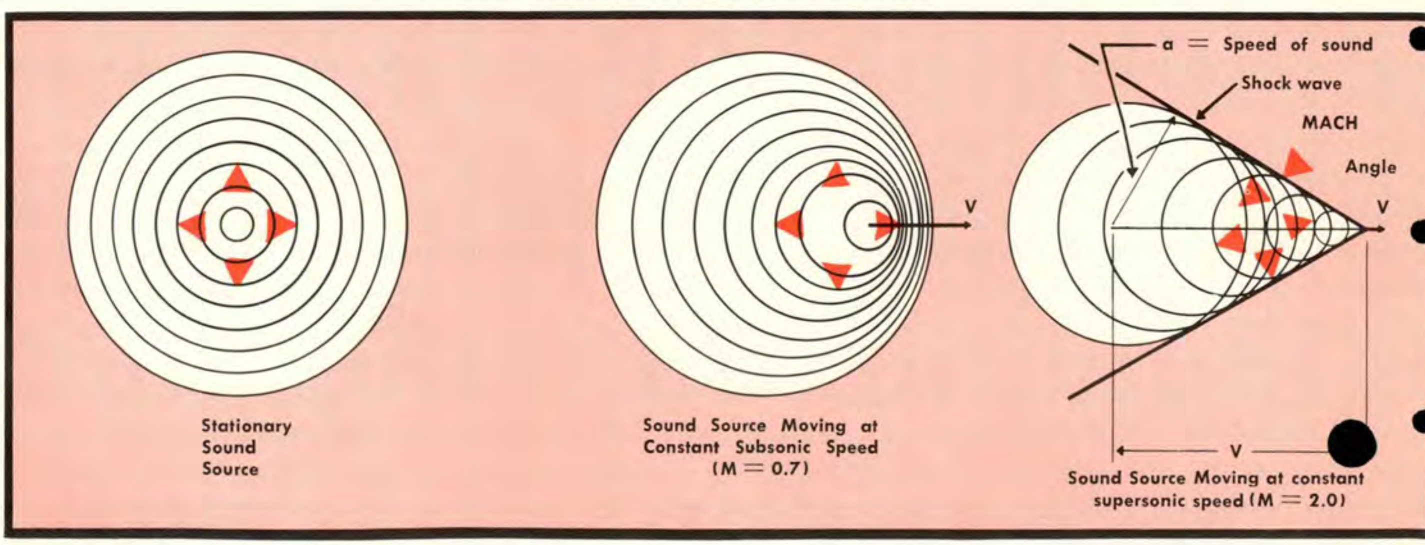
PILOTS OF NEW supersonic aircraft would do well to take a lesson from speedboaters, who quickly learn either to give other boats a wide berth when traveling at high speed or to lower their speed when passing near other boats. Speedboaters who don't learn this lesson soon find themselves unpopular among fishermen, canoeists and others whose boats they may rock or nearly upset, and sometimes find themselves on the losing side of an argument with the law.

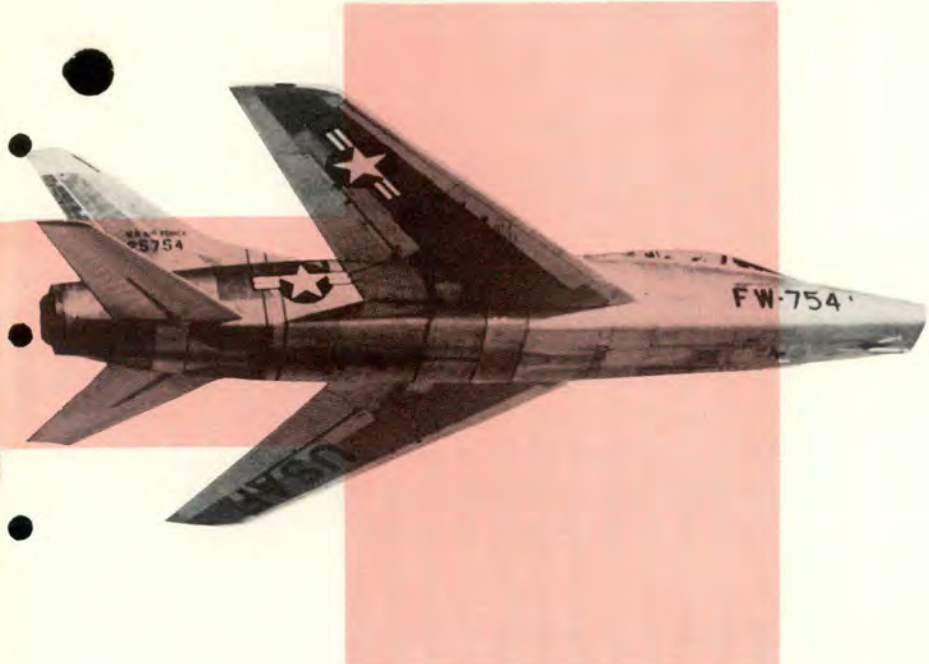
Some pilots have found that the indignation of a few boating enthusiasts is tame indeed compared to the wrath which the shock wave from a supersonic airplane can arouse over an area of several hundred square miles. Sometimes people complain merely about a loud boom; sometimes they report broken windows or other damage to ground structures, and in one case a report even got into circulation (apparently the combined product of someone's overactive imagination plus some misunderstanding) that a boom from a diving F-86 had spread the rails of a railroad track enough to have caused derailment of a train.

This phenomenon, extensively reported in the press and by word of mouth as the "sonic boom," has been misunderstood widely and its effects greatly exaggerated, and various explanations for it have been offered. At first even the experts didn't understand it too well; now, however, as a result of investigations by the Wright Air Development Center's Aeronautical Research Laboratory and by others, the explanation seems so simple that one wonders why there was ever any mystery. Very briefly, the answer is that booms are heard whenever the shock waves generated by an airplane during supersonic flight reach someone's ears. The number of booms heard is the same as the number of shock waves reaching the person.

These shock waves are the pressure waves that are set up in the air when an airplane flies so fast that a given particle of air in front of the airplane doesn't know the airplane is

This illustration shows the propagation of disturbance.






coming until it gets there. In subsonic flight, the airplane gives warning of its approach by very small changes in pressure that reach out ahead of the airplane and cause the particles of air to start moving aside. These warning signals are transmitted at the speed of sound. But, if the airplane is flying faster than sound, then it gets there before the warning signals and the particles of air are jostled aside so roughly that a pressure wave is set up, a cone-shaped wave in the air which in many ways resembles the v-shaped wave from the bow of a speeding boat.

Like the wave from a passing speedboat, this cone-shaped pressure wave may extend out a considerable distance in all directions from the airplane's flightpath and can be pictured as moving along with the airplane. Like the wave from the boat, it can be detected as it passes by an observer; but because it's a pressure wave in air instead of a visible wave on the surface of the water, the means by which we observe its passing is different. The main sensing element with which a human being detects pressure waves is the ear — in other words, pressure waves are simply sound waves, which we can hear if they're within the audible frequency range. A single very rapid change in pressure is heard by the ear as a boom, and this is what happens as a shock wave goes by. The shock waves generally heard are bow and tail waves, that is, the waves from the front and rear ends of the body, and these give two booms. In some areas the booms have been dubbed the "Double Whammy" because of this characteristic. Straight and level supersonic flight will give the "Double Whammy" and a supersonic dive starting from subsonic speed will give at least two, generally three, and sometimes four booms. However, the first two, about a tenth of a second apart, are usually much louder than the later ones, which apparently result from a transonic shock wave which drops behind the airplane as it goes through Mach 1.

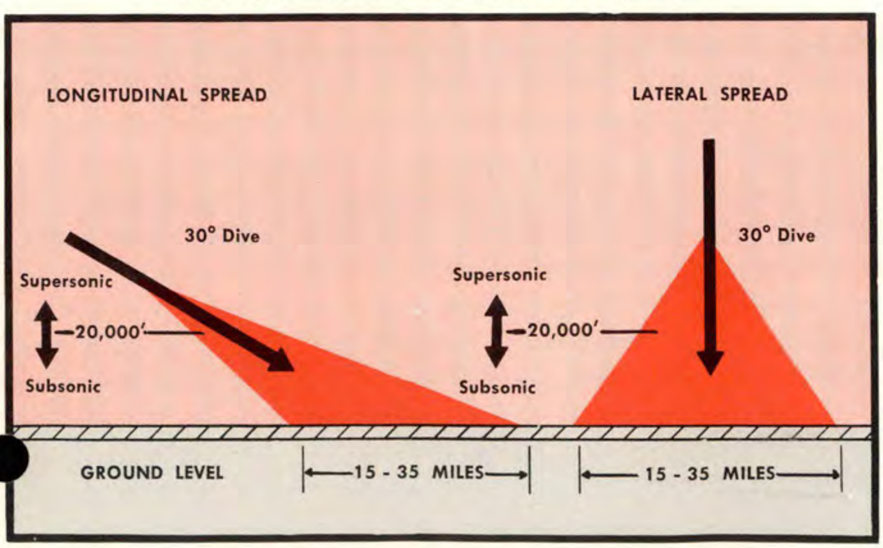
Under some flight and atmospheric conditions these shock waves may be so weak when they reach the ground that they are not heard at all. On the other hand, if an F-100 makes a supersonic pass 200 feet off the deck, an observer on the ground just below will experience a pressure jump of about a quarter of a pound per square inch.

Such sudden pressure jumps are more than enough to break windows, as has been demonstrated many times. Complaints aren't confined to broken windows, damaged structures, and interrupted sleep either. Farmers have reported that chickens, frightened by booms, panic and smother each other; cows refuse to give milk, and mink kill their young.

Sonic booms may be created in straight and level flight or in a dive. In the straight and level case, the shock waves and the airplane move through the air together, as a system, and the waves extend from the airplane to the ground. Here, a continuous trail of booms is left on the ground below the airplane's flightpath. This is something like what happens when a boat runs parallel to the shoreline, with the waves extending to the beach where they make a continuous splash as they move along the beach.

However, this simple situation isn't what has caused most of the booms. Most of them have been associated with high altitude steep dives in which supersonic speed was achieved for only a few seconds. During this short period of super-

**Rough experimental observation of spread of sonic boom.**



sonic flight, shock waves are formed, but as the airplane slows to subsonic speed these waves continue on ahead of the airplane until they reach the ground and are heard as booms. If we return again to our boat analogy, it's as if the boat were headed toward the beach at high speed and then either slowed up or turned around. The waves already formed would continue on, growing weaker all the time, but would still hit the beach.

In theory, a pilot can deliberately boom a given area on the ground by diving toward that area at supersonic speed then slowing to subsonic speed and pulling out. Actually, the pilot can't be quite sure where the boom will hit because of temperature, pressure and wind gradients in the atmosphere. In a standard atmosphere and with the same wind at all altitudes, the boom will generally be loudest somewhat beyond the aiming point, but may be heard in an area extending five to 20 miles in all directions from that point. Temperature inversions will move the point of maximum intensity closer to the airplane. When diving at supersonic speed, the pilot can be sure that some area will be boomed, but he can't be sure of which area.

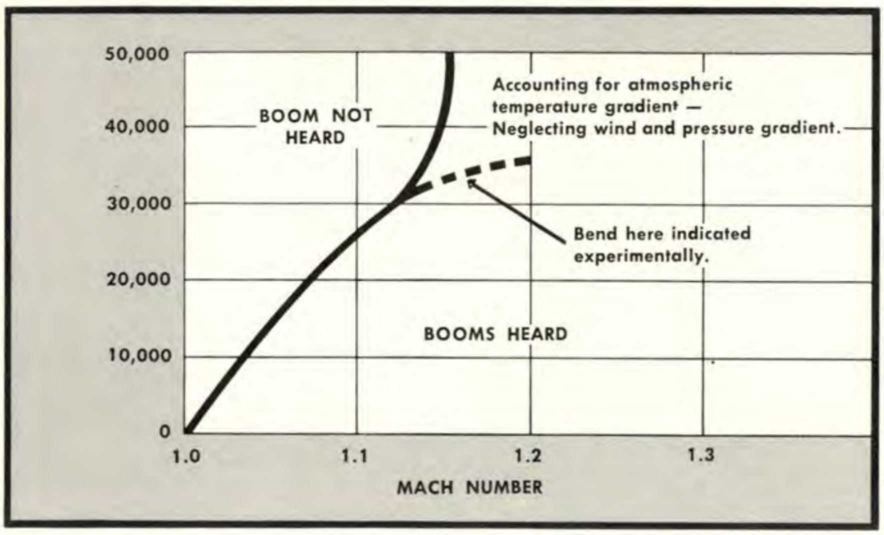
The net result of all this is that Joe Jetjockey had better think twice before trying to boom his girl friend's house. If atmospheric irregularities foul up his aim he may boom his CO's house instead; and even if he does hit his target on the nose, the boom covers a lot of territory and his CO's house may still get a good jolt, which Joe will undoubtedly feel when he lands.

Headquarters USAF has issued instructions to the field to avoid creating sonic booms in areas where relations between the Air Force and the public would be adversely affected, and one may expect that severe disciplinary action will be taken against those who intentionally indulge in this practice. How can our friend Joe be sure of not offending? This is a difficult question to answer because there are so many variables. A number of different local regulations have been issued prohibiting supersonic flight below certain altitudes and over certain areas. These regulations are designed to minimize public annoyance from booms and should, of course, be observed. However, because there's a lot that isn't known yet about this subject, we can't be sure that the restrictions locally imposed will actually keep us out of trouble in all cases. In the absence of more specific local directives, and until such time as Headquarters USAF can provide better guidance, it is suggested that the following rules be observed:

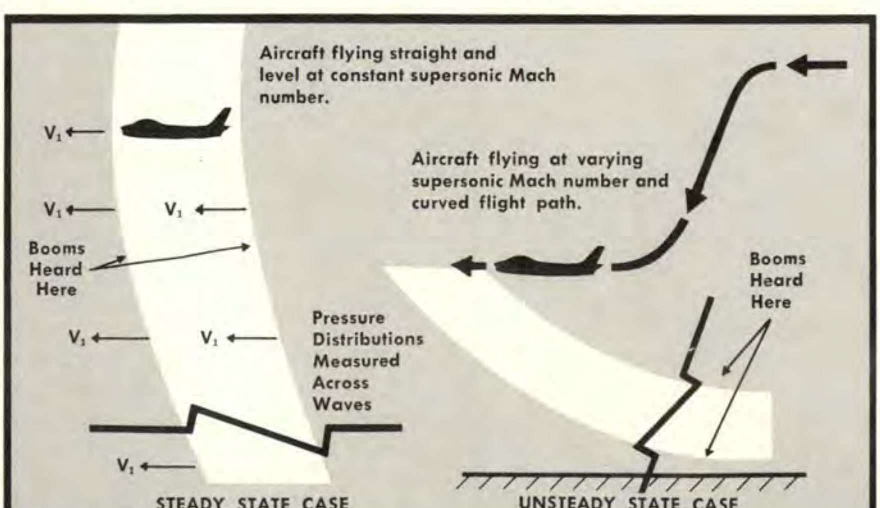
- Avoid supersonic flight within 30 miles of populated areas, especially if you're losing altitude, and are heading toward the area.
- Avoid supersonic flight below 40,000 feet. If supersonic dives are necessary, slow to subsonic speed before reaching 20,000 feet. You'll still set off a pretty loud boom, but probably won't break any windows.
- Avoid supersonic flight within 5000 feet of other aircraft.
- Familiarize yourself with the errors in the Mach meter on the airplane you're flying. In many aircraft the Mach meter reads low near Mach 1. You're actually supersonic a little before you get the jump on the meter.

These rules don't guarantee avoidance of booms but if the rules are followed, any booms which are heard should be mild (except those from dives) and there should be no significant damage. The problem is still being studied and further tests will be conducted to determine with greater certainty just what restrictions must be placed on today's aircraft and those of the future. ●

Altitude — Mach number limits for creating boom in level flight.

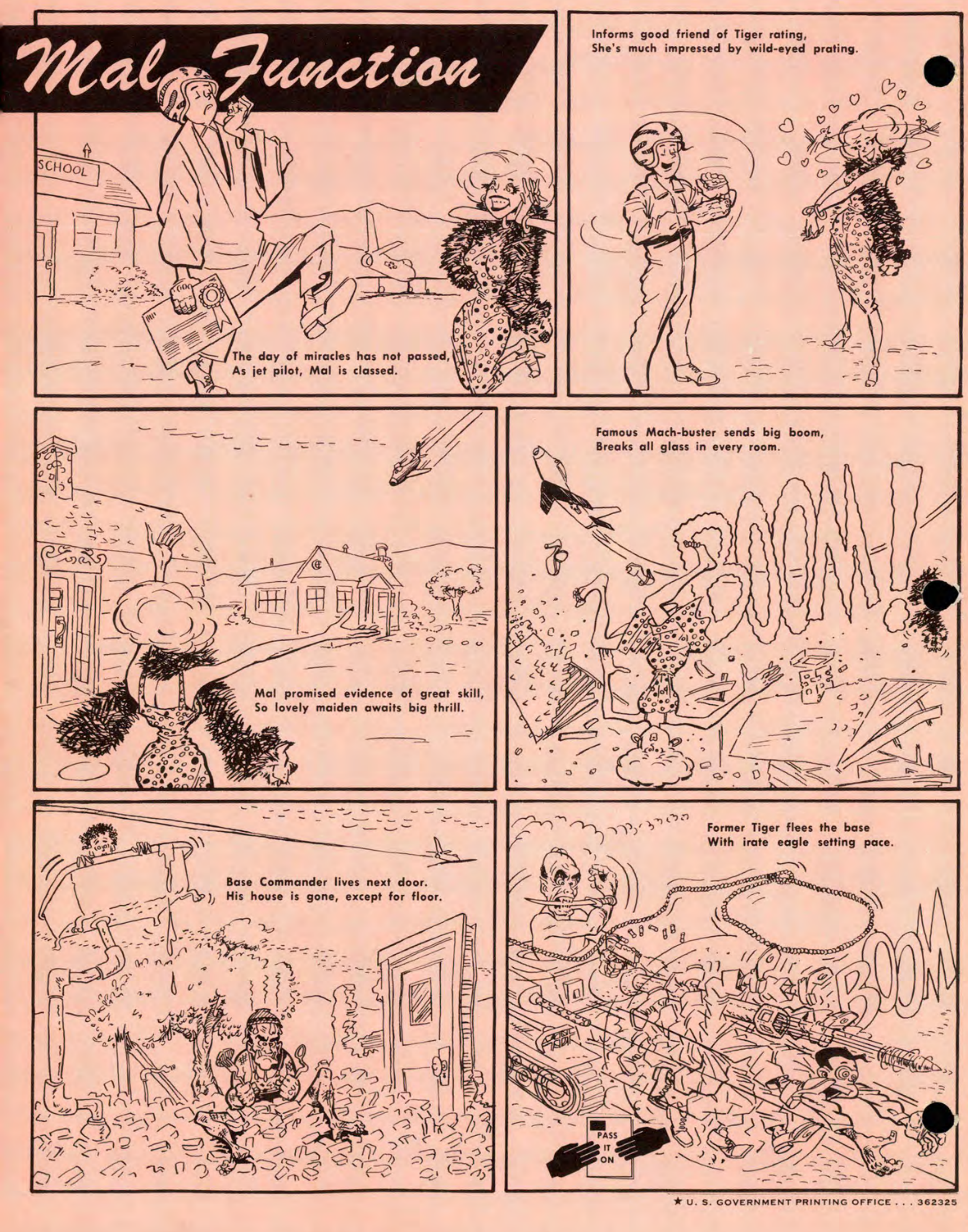



Shock wave patterns in steady state and transient phenomenon.



# *Hold that line...*

There are all kinds of proposals and this little lass apparently has something pretty interesting on the line right now. But, from the flyboy's point of view, just about the most important proposal is the one he telephones in to a Flight Service Center when he's trying to leap off from a civilian field. Maybe you didn't realize it, but **you** can expedite such flight plan proposals if you'll follow a few simple rules. Just look over the article that starts on page 12 of this issue and mayhap you'll find where you have been slowing yourself down.

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