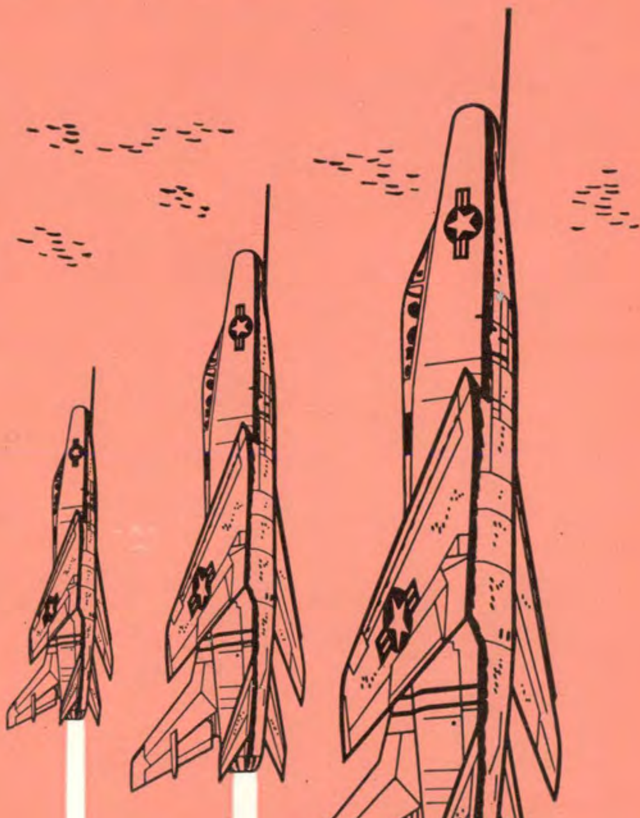
FLYING SAFETY

UNITED STATES AIR FORCE

FEBRUARY 1956



• **Parade of the Centuries**

page four

• **Down Boy, Down**

gear down landings · page sixteen

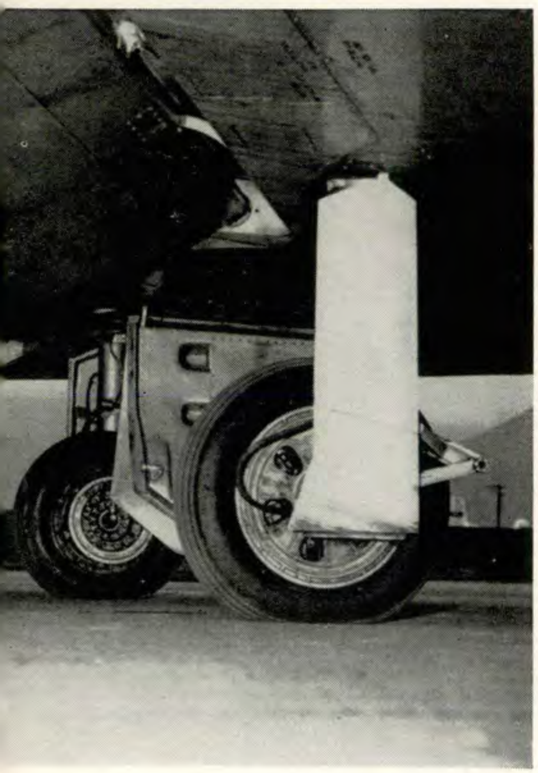
FLYING SAFETY

VOL. TWELVE NO. TWO

- In the months to come, you'll be getting the low-down on the high-ups, namely, the Century series aircraft. Page 4 features some flying characteristics of the first century, the F-100.

- If you want to keep up with the latest fashions in wearing apparel, you'll enjoy "Fashioned for High Living," on page 24.

- If you are flying a jet fighter and ever have to set her down on any unprepared ground, let the gear absorb the shock for you. See page 16 for details.



CONTENTS

	Page
Crossfeed	2
Parade of the Centuries	4
Keep Current	14
Down, Boy, Down!	16
Well Done	21
Rex Says	22
Fashioned for High Living	24

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USAF PERIODICAL 62-1

LOOK BEFORE YOU LEAP!

● Would you roar off in this T-33 the way it stands here? Take a good, long look and see how many items this pilot missed on his walk-around inspection. Accidents can be caused by such carelessness. Turn to page 14 and check your answers with the labeled photo.

LETTERS TO THE EDITOR

OMNI Tips

Here is some additional information on OMNI angles that may be of interest to your readers. You can fly a direct flight off airways to save time and fuel or maybe just to go around some seat-belt weather. This procedure is written for you folks who fly aircraft equipped with the AN/ARN-14. As far as equipment goes, you need an ID-249 Course Indicator, while a RMI (Remote Magnetic Indicator) is handy, but not necessary.

Plot your course on a map similar to the jet navigation type (JN) that has the OMNI stations plotted. Remember to pick an altitude high enough to receive OMNI stations that are off your wingtip or intended line of flight, as listed on page 4 of the Radio Facility Charts.

Now let's go on a simulated cross-country. Refer to accompanying diagram. We take off and climb to altitude on our intended heading and make our usual rough guess on ETA and MH at point One on the chart. Prior to reaching point One, we set our OMNI receiver to station A and put a course of 110 degrees in our ID 249 selector window.

Measure the distance from departure to point One as 75 NM. When your ID 249 vertical needle centers, note the time in minutes and seconds. Change the course in the ID 249 window to 120 degrees for a 10-degree bearing change (or 20 degrees if close to station). While you are waiting for your vertical needle to center again, find the groundspeed from departure to the radial of 110 degrees or, let's say, 270 knots.

When our vertical needle centers at 120 degrees we note our time again and apply our formula of 60 divided by 10 degrees, which equals six. Take six times the amount it took for the bearing change from 110 degrees to 120 degrees, say two minutes. That puts us 12 minutes out from station A. Then put the GS on the E6B and look at 12 minutes and it tells us we were exactly 54 NM from station A on a magnetic radial of 110 degrees.

Plot it on your map and readjust your heading, if necessary, for drift from intended line of flight and compute ETA for point Two.

Prior to reaching point Two, set the OMNI set to station B and the course window to 290 degrees and do it all over again.

This procedure requires minimum equipment. A clock, compass, OMNI receiver and indicator, an ID 249, map, pencil, computer and a straight edge or Weems plotter. If you have a map or Facility Chart that doesn't have a compass rose plotted around the station then a Weems plotter becomes necessary. Of course, if you have a DME instrument on board the formula is not necessary.

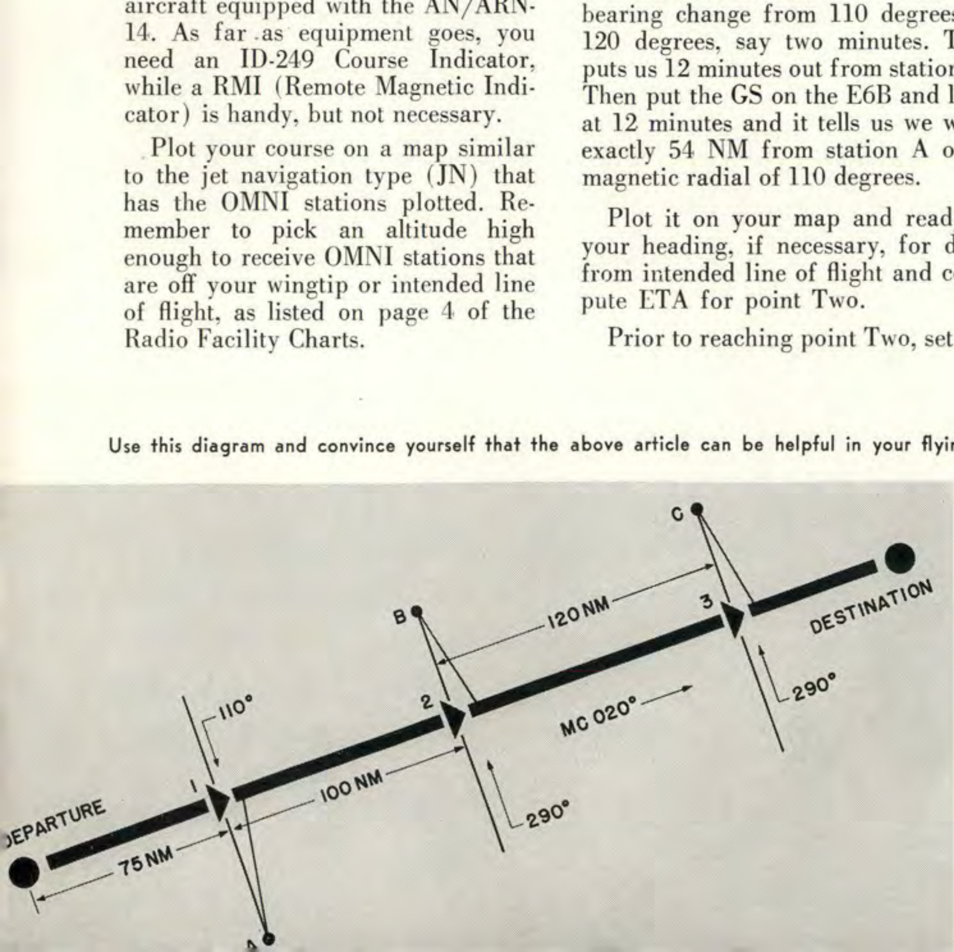
Next time you're out on a flight, try it. It works like a charm.

Capt. Joseph A. Buebe
C-118 Instructor
1741st AT MTTU Sq
Palm Beach AFB, Fla.

Class dismissed.

★ ★ ★

Use this diagram and convince yourself that the above article can be helpful in your flying.



Dynamite Cap Maybe

While reading the November issue of FLYING SAFETY, I had an idea that I believe has some merit.

I was reading the column, "Rex Says," and specifically the article about the pitot cover being left on, and how the pilot tried to burn it off by turning the pitot heat toggle switch ON. This, of course, failed, but couldn't the pitot covers be made of an inflammable material with a highly inflammable spot or cap that could be ignited by the heat furnished by the pitot heater?

M/Sgt Leonard G. Stamets, Jr.
Tyndall AFB, Florida

This idea has been kicked around; however, the majority feels that the best way to get the pitot cover off is to do it by hand before takeoff.

★ ★ ★

Well Done Awards

". . . For quite some time now we have enjoyed reading about some guy or guys featured as "Well Done" award winners in Flying Safety magazine. We look forward to this page. Just recently while talking over a "Well Done," one of the boys wondered out loud 'what becomes of the recommendations the Award Committee passes over'—so we've decided to write and ask."

M/Sgt Alan Adams, USAF
520th Maint Sq, APO 10

FLYING SAFETY is aware of some outstanding reports that must of necessity go unrecognized, and has been considering a suggestion that we run some of them as items in the REX SAYS column. Perhaps this means of recognition would be acceptable to those crewmembers who do not receive the award, though they were nominated as candidates. Anybody else have any thoughts on the idea?

Just like a catcher's mitt, this bull's eye serves as a possible target for troubled jets.

★ ★ ★

For Low and Slow

I am stationed at Hondo Air Base, a primary contract school, near San Antonio. There are numerous Air Force bases in this vicinity and it is interesting to notice the planes that circle our base trying to tell which one they are over. It is well to say that they should learn to read maps. use radio aids, and so on, but from a safety viewpoint as well as economy (fuel and time), why not paint the name of the Air Force base on a runway, ramp or hangar in large letters at each base? If this saved one plane, it would more than pay for the paint.

Capt. Dale H. Baker
Hondo Air Base, Tex.

We did considerable cross-checking on this idea. It's fine for the slower, low-flying types of aircraft but not too suitable for jets. During night time operations it would mean incorporating a system of lighting that might be confusing. Anyone care to offer a comment?

★ ★ ★

It's a Bull's-Eye!

Here's a photo that you bull's-eye artists will get a charge out of.

Our runway is equipped with a barrier on the takeoff end of 32. Every pilot here has seen the nylon webbing that is strung across the runway and also the large red bull's-eye that is held aloft by this webbing. When the decision is made to use this barrier, we say, "Hit it in the center. That's what the bull's-eye is for. Remember the barrier is a big league catcher, so use it like a big leaguer would."

This barrier is 300 feet long and has never been needed since it was installed. Do you have any information of engagements by barriers of this length?

Flying Safety Officer
Craig AFB, Alabama

Any Robin Hoods? Believe this gimmick is one of the best that has crossed our desk in many a moon. It is important to hit the center of the barrier. We have on record only one engagement of a 300-foot barrier. At Eglin AFB, an F-84F, traveling at 15 knots, stopped successfully.

★ ★ ★

Is Rex Real?

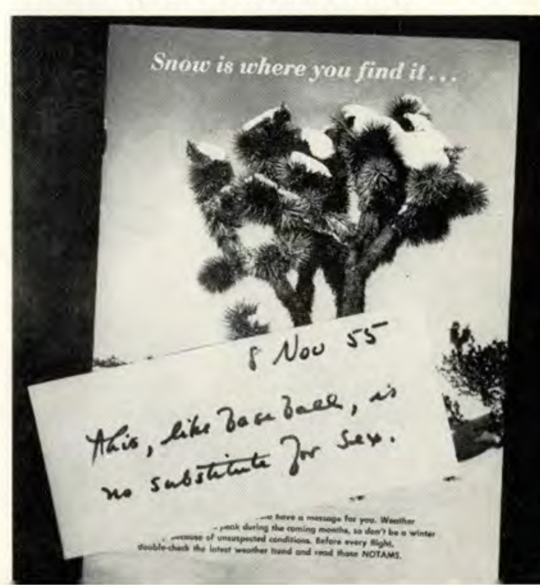
I am writing in hopes you can settle an argument for me. A friend and I were discussing your magazine when a question came up concerning the articles under the name of Major Rex Riley. I maintain that the Major is a real person, who is an accident investigator and writes articles for your magazine on such accidents.

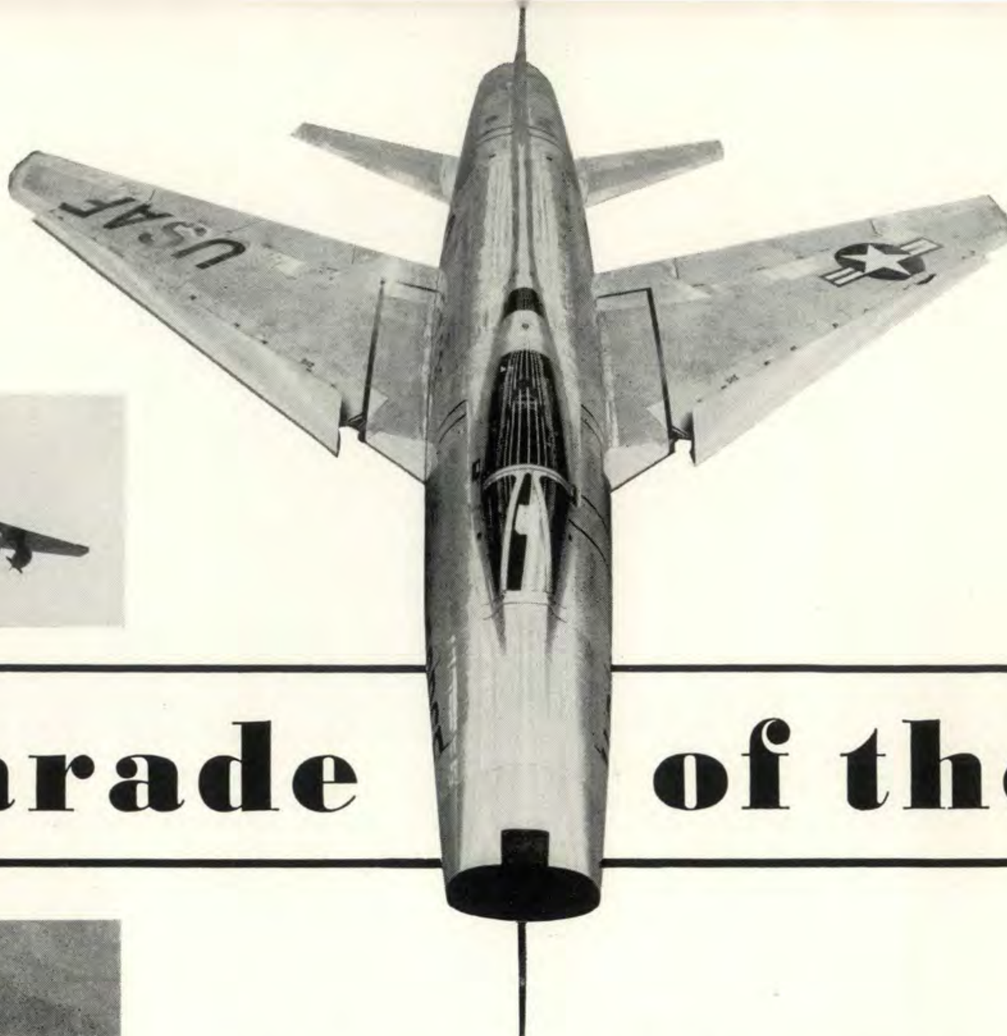
My friend argues that he is fictitious and is only a name used in the illustration of accidents reviewed by FLYING SAFETY.

T/Sgt William Rodak, Jr.
33d Fld. Maint. Sq.
Otis AFB, Mass.

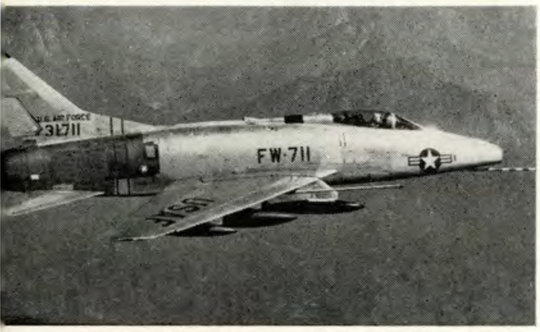
We have tried to make Rex as close to a real-life character as possible. The tipoff is in his name which could be spelled W-R-E-C-K-S. However, you're not in the minority, as we get quite a bit of correspondence addressed to the good major. Also, hope that we're not costing you any money.

An anonymous reader sent this little gem which is pasted over the inside back cover of the November issue of FLYING SAFETY. Like the original, it speaks for itself.





Parade of the



To keep you up-to-date, FLYING SAFETY will take you through the Century series aircraft. Articles on specific flying characteristics of the F-101 and F-102 will appear in future issues. Here are three features on the F-100 prepared by North American Aviation test pilots. They cover flying with external stores, flameout landings and some interesting information on the yaw and pitch damper installation on the first operational Century.

External Stores

Al White, Engineering Test Pilot

YOUR FIRST THOUGHT when you see the sleek, new F-100C is that here is a real fighter airplane, one of the fastest in the world. However, it is also a fighter bomber and is able to carry a variety of stores. Its six pylon stations give it a tremendous load-carrying potential. It has been tested at supersonic speeds carrying more than twice the bomb load of a World War II heavy bomber.

Still, being saddled with a load of stores is not the most desirable flight condition. It's like taking your future mother-in-law along on a date with your one-and-only. It slows you down, reduces your maneuverability and makes your approaches more difficult. Combat aircraft are merely platforms for their ordnance. This fact compensates for any objections that may be raised about the general deterioration of performance and flight handling characteristics when stores are being carried.

What it boils down to is that you *must* carry stores. Therefore, you should know the handling characteristics under these conditions.

Longitudinal Stability

First, let's find out how carrying stores affects longitudinal stability. Consider a clean F-100C trimmed in straight and level flight at a given airspeed and altitude. Now, suppose a gust load pitches the nose of the airplane up, causing an increase in angle

F-100 Centuries

of attack. Since lift varies with angle of attack, the lift forces on the tail and the wing will both increase; however, the increase in tail lift force acting on a relatively long lever arm provides a larger pitching moment than the pitching moment from the wing (wing lift times its lever arm). The resultant unbalanced pitching moment then tends to return the airplane to the original angle of attack. This is known as positive longitudinal stability. For this specific case, the amount of unbalanced pitching moment created by the tail for a given change in angle of attack determines stability. In general, longitudinal stability is a measure of the unbalanced pitching moment for a given change in lift. (See Figure 1.)

Now, let's exchange the clean airplane for one with stores under the wings. It is flying at the same speed and altitude and encounters a similar gust which causes the same change in angle of attack. This time, the lift force at the tail is less because of the effects of the change in the downwash angle and the turbulent wake behind the stores, together with forces on the store which are forward of the airplane center of gravity. Consequently, for a given change in angle of attack, the unbalanced pitching moment is less than in the case of the clean airplane. (See Figure 2.) The longitudinal stability is slightly decreased. This does not mean that the airplane is not stable.

You will notice this slightly decreased stability as a sluggishness of the airplane in returning to the trim condition when disturbed. Your normal reaction is to move the controls to help the airplane to return to a trim condition, and this means that you are working slightly harder than normal at flying the airplane. This is one reason why it is more difficult to handle an airplane with stores than a clean airplane.

Directional Stability

The effect that the installation of stores has on directional stability depends largely on where the stores are mounted. Stores mounted so that the greatest portion or all of the lateral flat plate area is forward of the center of gravity are de-stabilizing. (The lateral flat plate area is the area that is seen when the airplane is viewed in profile.)

The airplane gains directional stability from the vertical stabilizer in much the same manner as it gains longitudinal stability from the horizontal stabilizer. This directional stability is a function of the area of the vertical stabilizer. When stores are mounted forward of the center of gravity of the airplane, the lateral flat plate area of these stores cancels some of the effect of the vertical stabilizer. Therefore, the airplane has less directional stability.

You will be aware of this decrease in stability as a loss in some of the directional stiffness of the airplane. The airplane is more easily disturbed directionally, and it returns to the trim condition at a slower rate than

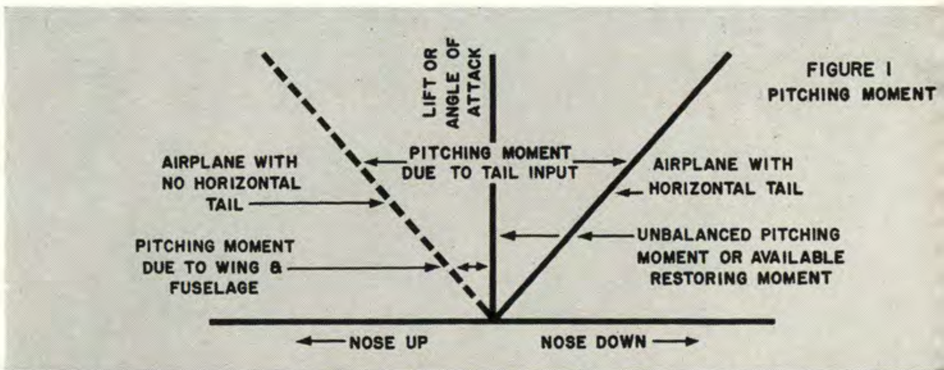


FIGURE 1
PITCHING MOMENT

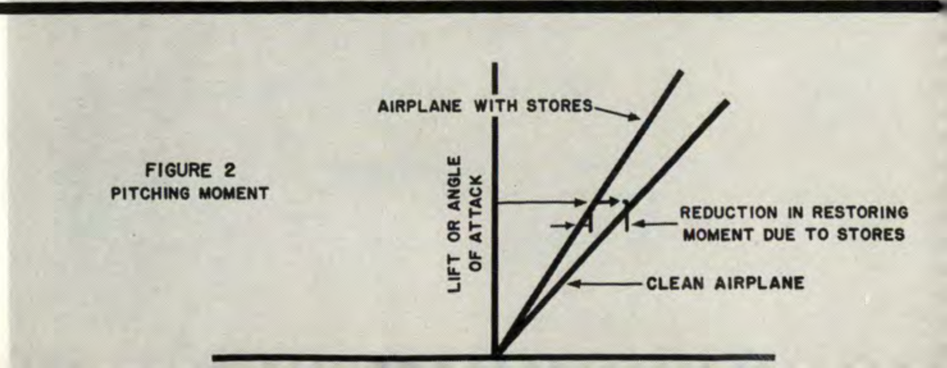


FIGURE 2
PITCHING MOMENT

Al White is a graduate of the University of California, where he received his Bachelor of Science degree in mechanical engineering. During World War II, he flew F-51s and from 1948 to 1954 served as an engineering test pilot at Edwards AFB, California. Since 1954, he has been a test pilot at North American Aviation, principally testing F-100 airplanes.

a clean airplane. If you help the airplane maintain zero yaw with the rudder pedals, you will find that the airplane is easier to overcontrol directionally. Because of the lack of directional stiffness, it takes less rudder to push out against the effect of the vertical stabilizer. Directional stability has deteriorated slightly. This again must not be construed to mean that the airplane does not have directional stability. It is just slightly less stable than the clean airplane.

Lateral Stability

The installation of stores on the F-100C has little effect on lateral stability and reduces aileron effectiveness only slightly. Nevertheless, you will experience a slight reduction in lateral controllability. This is because of the inertia effects of the stores.

The maximum roll rate obtained at any given aileron deflection will be approximately the same with or without stores, but it will take longer to reach this roll rate with stores because of the mass that has to be set into motion. Similarly, it is more difficult to roll the airplane to a desired bank angle and then to stop exactly on this bank angle.

As an example of this effect, imagine that you are rolling a table on large casters across a smooth floor and you desire to stop the table on an exact spot. Normally, this is very easily done. Now place a heavy weight on the table. The table is more difficult to set into motion and more difficult to stop on an exact spot. This is much the same effect that you will encounter in trying to roll the airplane with heavy stores on the wings. The accuracy of your lateral control has been slightly decreased.

Unsymmetrical Store Loading

Up to this point, we have assumed that the stores were mounted symmetrically on the airplane. However, a general discussion of handling characteristics on the F-100C with stores installed would not be complete without some explanation of the characteristics encountered with unsymmetrical store loading.

Let's consider handling characteristics with one store mounted under the left wing of the airplane and nothing under the right wing. It is obvious that right aileron will be required to balance the load of the store hanging under the left wing. The amount of aileron required depends on airspeed, store weight, aerodynamic effect of the store, and to some extent aileron efficiency, which is decreased. The aerodynamic yawing moment of this deflected aileron varies with Mach number as does the yawing caused by the drag of the store.

The curves in Figure 3 show these yawing moments due to deflected ailerons and the drag of the store under the left wing.

The yawing moments of the store and the aileron (Figure 3) are equal (and of opposite sign) at three points in the normal speed range of the airplane. This means that at these three points no unbalanced yawing moments exist. Consequently, zero trim is required to hold zero yaw.

Figure 4 shows the rudder required to maintain zero yaw as plotted against Mach number, and corresponds to the rudder necessary to correct for the unbalanced yawing moments shown in Figure 3. There are three points within the speed range of the airplane where zero rudder is required. They correspond to the three points where the yawing moment of the store and aileron are equal.

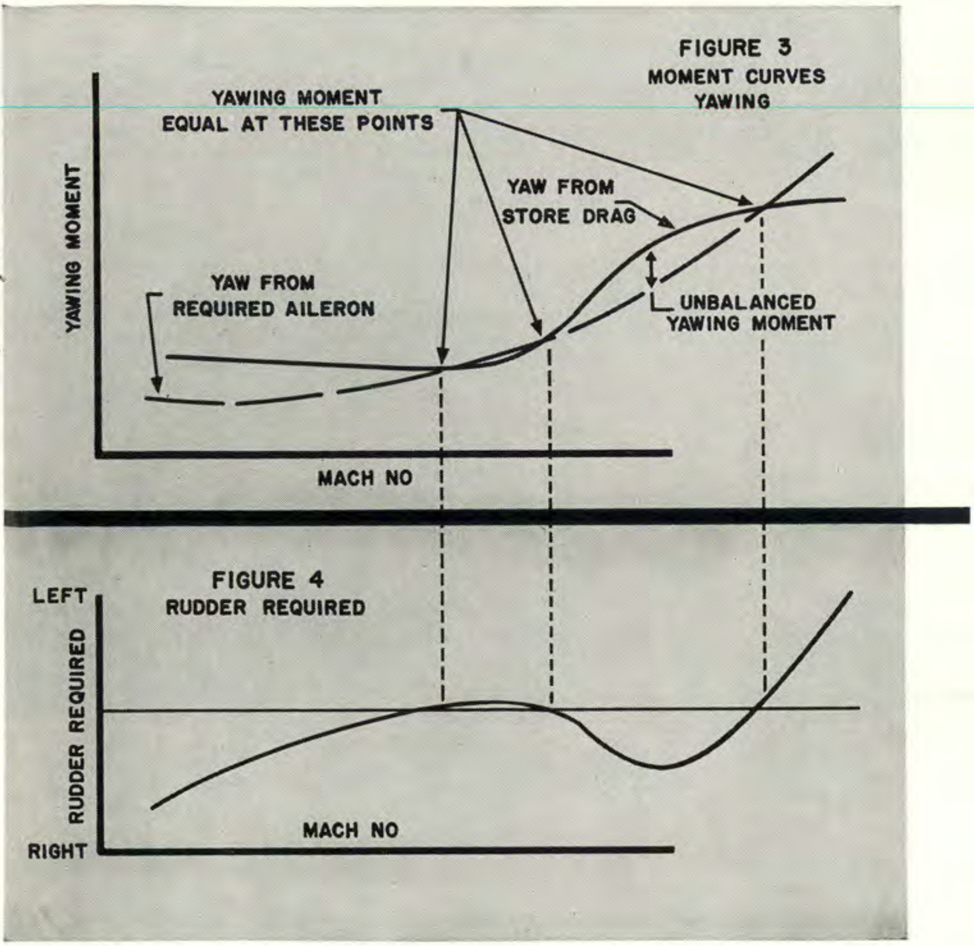
In the center of the curve in Figure 4, there is one small speed range within which the yawing moment from the deflected aileron is greater than that due to the drag on the store. In this speed range, left rudder is required to maintain zero yaw with the store hanging under the left wing. At very high Mach numbers, the yawing moment from the aileron again is greater than that of the store, and again left rudder is required.

In flying with an unsymmetrical store loading, the amount of rudder available is of utmost importance. The actual amount of rudder available is dependent upon the indicated airspeed at which you are flying.

For example, rudder available at 15,000 feet is less than that available at 35,000 feet. Therefore, although zero yaw cannot be maintained at Mach numbers slightly above .96 Mach at 15,000 feet, supersonic speeds at 30,000 feet and above are possible without yaw.

It would be possible to dive from a high altitude at maximum power

The six pylon stations on the supersonic F-100 give it a tremendous load-carrying potential.



course, the runway pressure altitude, runway temperature and airplane gross weight.

Afterburner and Speed Brake

Lighting the afterburner with stores under the wings causes the airplane to pitch nose-down slightly. This occurs because the vertical position of the center of gravity is lower than the axis of thrust. The sudden surge of power on an axis above the center of gravity causes a slight nose-down pitching moment.

Similarly, a slight pitch-up is encountered when coming out of afterburner. This phenomenon is particularly noticeable at low altitudes where the afterburner gives a greater increase in thrust.

Whenever stores are installed on the pylons at the two inboard stations, lowering the speed brake causes the airplane to pitch up. The speed brake is lowered in a channel between these pylons, and the air is somewhat restricted from passing around the sides of the brake. More air is forced down, and since the speed brake is forward of the center of gravity, the resultant force on the airplane is nose up. The intensity of the pitch-up increases with indicated airspeed.

If only one pylon (with or without store) is installed and the speed brake is lowered, the airplane yaws toward this pylon. The air passing around the side of the brake strikes against the pylon, and since this pylon is ahead of the center of gravity, the airplane naturally yaws in the direction of the pylon.

If this maneuver is accomplished with the controls free, the airplane pitches up very slightly and yaws and rolls toward the pylon. However, the roll is due to the yaw. The predominant trim change is yaw, and again the intensity depends on the indicated airspeed.

The shapes of stores are improving and as a result will not detract from the performance and stability of high-speed airplanes as much as some of the present-day low-speed stores.

Our purpose in this article is to give you a better understanding of the F-100C characteristics, believing you will be more tolerant of the handicaps imposed by the installation of stores and better prepared to use the airplane to the utmost of its flying capabilities. ●

and arrive at a lower altitude (such as 15,000 feet) at a supersonic speed where the yawing moments from the aileron and store were well enough balanced to allow directional control. However, in this type of maneuver, the airplane cannot maintain its speed at 15,000 feet after the pullout is made. It would decelerate through the range where the rudder required to maintain zero yaw is greater than the rudder available. As a result, the airplane would yaw in spite of full rudder application against it, but large yaw angles would not be encountered.

When the airplane is dived from high altitudes, the dive should be accomplished at reduced power, and Mach restrictions for the particular configuration being flown should be observed. Adequate control is available as long as the Mach restrictions are observed.

With a symmetrical load, the takeoff characteristics are the same as those of the clean airplane, except that more runway and a higher lift-off speed are required. However, unsymmetrical external loading requires a slightly different technique. The added friction due to increased load on one main landing gear, together with the aerodynamic drag on the store, causes the airplane to yaw toward the heavier side.

Rudder power alone is not sufficient to maintain zero yaw below 130 knots. Therefore, nosewheel steering should be used to a minimum of 130 knots. When nosewheel steering is disengaged, you should be prepared to apply three-fourths to full rudder, immediately. This technique keeps the airplane straight on the runway.

Nosewheel lift-off should be accomplished at a maximum of 150 knots, regardless of airplane lift-off speed, in order to avoid excessive vibration. Handbook performance charts always should be consulted for takeoff distances and recommended lift-off speeds, taking into account, of

Emergency Landings

Bob Baker, Chief Engineering Test Pilot

Bob Baker began his flying career in 1939 while studying Aeronautical Engineering at Rensselaer Polytechnic Institute in New York. After graduation, he flew engineering test flights for Curtiss-Wright and the National Advisory Committee for Aeronautics. He is currently chief engineering test pilot for North American Aviation and is actively engaged in testing the F-100A and C aircraft.

★

ONE THING IS SURE—just about two minutes after you pass through the high key altitude in your F-100, you'll be on the deck. Just where on the deck depends on you; your knowledge of your aircraft's handling qualities, whether you have a plan and how much you have practiced. The plan for a forced landing is shown in Figure 5. Arriving at this plan wasn't simple, and to make it work requires knowledge of its derivations and limitations, and then plenty of practice.

An emergency landing to the casual reader of the Flight Handbook is a simple operation when depicted on paper. However, as every pilot knows, the actual procedure is not quite as simple as it looks. The figures and patterns shown on the illustration have a lot of hidden meaning and require considerable practice before they are useful to an F-100 pilot.

Glide Speed

Of primary interest in the F-100A and C forced landing pattern is the manner in which the glide speed of 220 knots IAS was selected. Both airplanes are equipped with irreversible hydraulically actuated controls which power the flying tail, ailerons and rudder. Power to the controls is being supplied by two engine-driven pumps. A ram-air turbine is provided to supply hydraulic power to one of the control systems for use during forced landing when the engine is windmilling and the pumps' output is low, or in an extreme case, when the engine is "frozen" rendering the normal hydraulic pumps inoperative.

The hydraulic power available from this source increases as the speed of the airplane increases. At the minimum touchdown speed of the airplane, pump output is decreased, while the amount of hydraulic power required for control movement at this speed is increased. Since the flight controls demand hydraulic power from the single available supply, it is wise to limit unnecessary control movement as much as possible during the approach. This will ensure that hydraulic power will be at a maximum for control movement needed during the flareout and touchdown. As a result of actual simulated forced landings and a study of their requirements, 220 knots IAS was selected as the best approach speed. It provides satisfactory airplane handling char-

acteristics and at the same time provides a good supply of hydraulic pressure and flow.

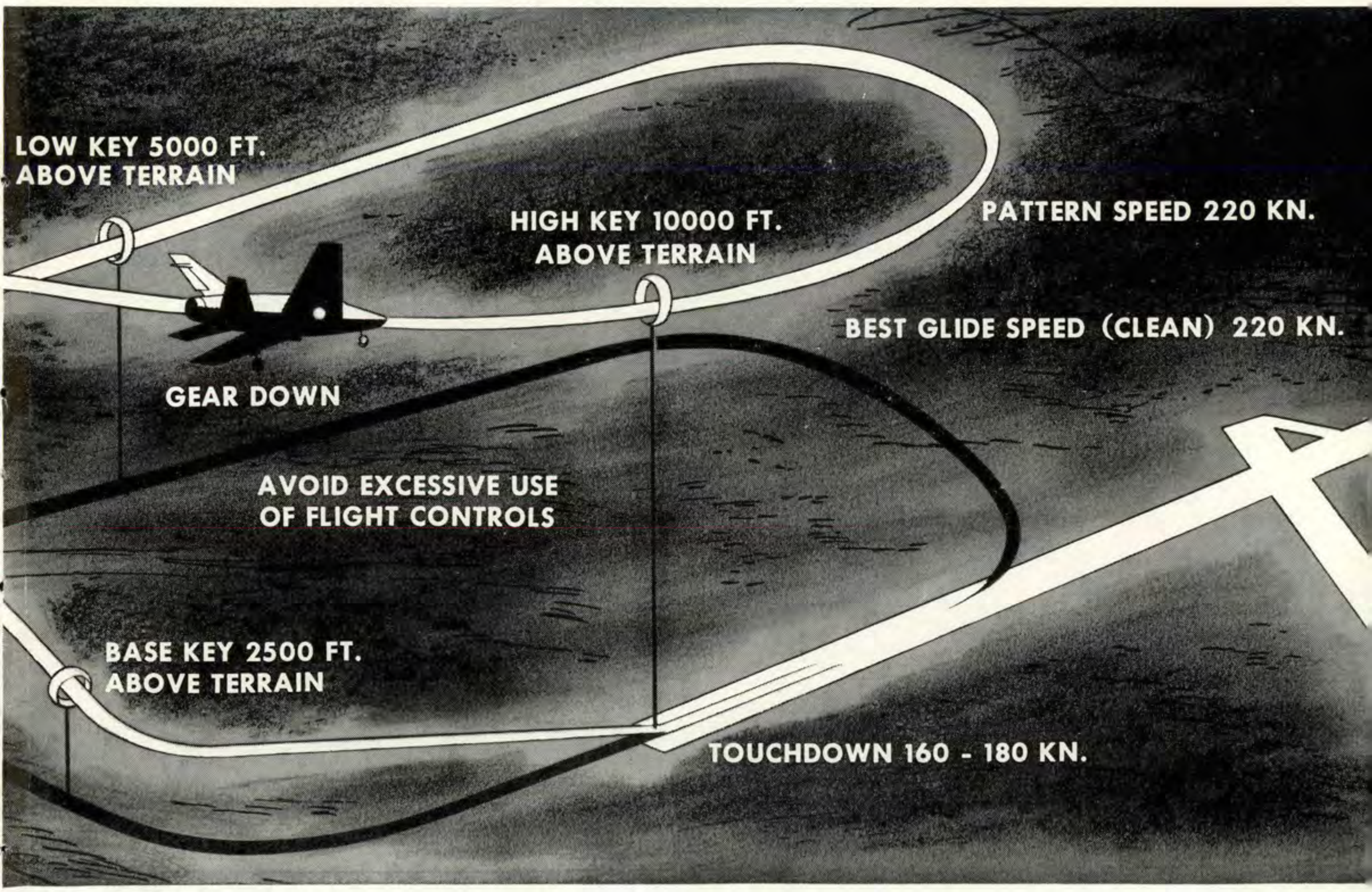
Referring to Figure 5 again, we have now established a glide at 220 knots and maintain this airspeed until after the turn on final. Completing the final turn, we find that less control movement is required and that we can safely drop our speed to 200 knots on final approach. Touchdown speeds are listed as below 180 knots because that is the maximum design speed for the drag parachute. Although touchdown at speeds as low as 150 knots can be made successfully, rough air or cross-wind conditions could require more than normal use of the ailerons. This might reduce the available supply of fluid and limit control movement at this critical time. To be on the safe side, keep your touchdown speed above the 160 knot minimum.

The purpose of the key altitudes shown in the illustration is to give you a reference to shoot for and also an idea of how well your pattern is coming. The high key is over the landing line and just to the right of the runway before the first 180-degree turn on the downwind. Low key is ON downwind and opposite the landing spot before the 90-degree turn onto the base leg. Base key is a term coined here to replace the longer phrase "altitude at base leg" and is just before turning 90 degrees onto the final. If you are fortunate enough to be able to start at the high key altitude, you can tell when approaching the low key altitude whether your pattern is too tight or too wide. If you are higher than you should be at low key point, you know that you are underestimating the ability of the airplane to glide a given distance, and must extend your downwind leg. If you are low at the low key point, you know you must cut your pattern short in order to make the runway. Two check points are provided in the low key and base key from a high key entry; however, if you do not have sufficient altitude to enter the pattern at the high key, you enter at the highest key altitude available to you. This may be low key or even base key, if you are caught at low altitude. Leaving the landing gear up until a key altitude has been attained increases the distance available. Conversely, if over the field above high key, the landing gear may be lowered at any time desired.

The forced landing diagram shows the landing gear down at the high key. Actually, the landing gear can be extended at any time the airplane is over the field. It is suggested that the landing gear be down at the high key so that the glide path can be well established and other variables will not be introduced at some point in the pattern, causing higher drag and resulting in miscalculation of the touchdown point. The cleaner the airplane, the farther it will glide; therefore, speed brakes are retracted throughout the pattern.

The speed brake operates from the utility hydraulic pressure system, which also supplies power to the wheel brakes. Any use of the speed brake reduces reserve power for wheel

Fig. 5. Key altitudes will give you a reference to shoot at and a good idea of your pattern.



". . . just about two minutes after you pass through the high key, you'll be on the deck."

This explanation is most obvious at night when the runway has contact marker lights. As you approach the runway and the contact lights appear to hold the same position relative to each other, you are coming in at a constant angle and will make the runway. If the runway contact lights begin to get farther and farther apart, it means the glide is high and you will fly over the runway. The lights, of course, will reach the maximum distance apart when you are directly over them. If the lights come closer together approaching a point, the glide is getting too low and you know you will undershoot. During daylight operations, you can pick up runway length, buildings and many other objects to give you a clue as to whether your approach will be long, short or just right.

brakes. This does not mean the speed brake cannot be used, because a windmilling engine will provide a continuous, although lower than normal, hydraulic pressure supply. Actually, the use of the speed brake is not too desirable from an aerodynamic standpoint. The rate of descent of the airplane with gear down and speed brake in requires a glide speed of 190 to 200 knots IAS to provide sufficient energy to flare the airplane (allowing a slight margin for error in starting the flare).

Flare Speed

Flare speed would dictate approach speeds if the hydraulic requirements had not been slightly higher. The higher rates of descent from speed brake extension would reduce glide distance, increase difficulty of flare judgment, and put larger demands on the ram-air turbine hydraulic supply. When the flare has progressed to where a landing is ensured, the speed brake could be extended to reduce speed and glide distance; however, there is still the possibility of reducing wheel brake pressure. Wheel brake pressure will mean more in reducing the landing roll than opening the speed brake at that low airspeed.

Your perception as to where you will actually contact the runway is not possible until you are on the staight-away final approach. As you accumulate more F-100 flying experience, you'll find that you can judge more accurately your point of touchdown. Actually, there is an explanation for this increased proficiency.

Simulated Flameout

Practice forced landings can be made if you set up the glide angle you will encounter in an emergency landing. Flight tests have shown that a windmilling engine with speed brake in, produces the same drag on an airplane as an engine running at approximately 80 per cent with the speed brake out. Practice forced landings should be made, keeping as many variables as constant as possible. The key altitudes given here are the minimum altitudes at which it would be desirable to attempt the pattern. You should practice emergency landings by gliding at 220 knots IAS in the pattern, slowing to 200 on the final approach and to 180 during the flare at the end of the runway, aiming for

Touchdown speeds are listed as below 180 knots because that is maximum design for drag chute.

the first third point of the runway. Use the same key altitudes, 10,000 feet for the high key, 5000 feet at the low key and 2500 feet at the base key added to your field elevation. Pick round numbers. If your field is 2410 feet, fly your base at 5000, indicated. Vary your actual path over the ground so as to correct for any deviation from these key altitudes. As every landing is apt to have different wind conditions, you must make your turns closer to the field and farther upwind as the wind increases.

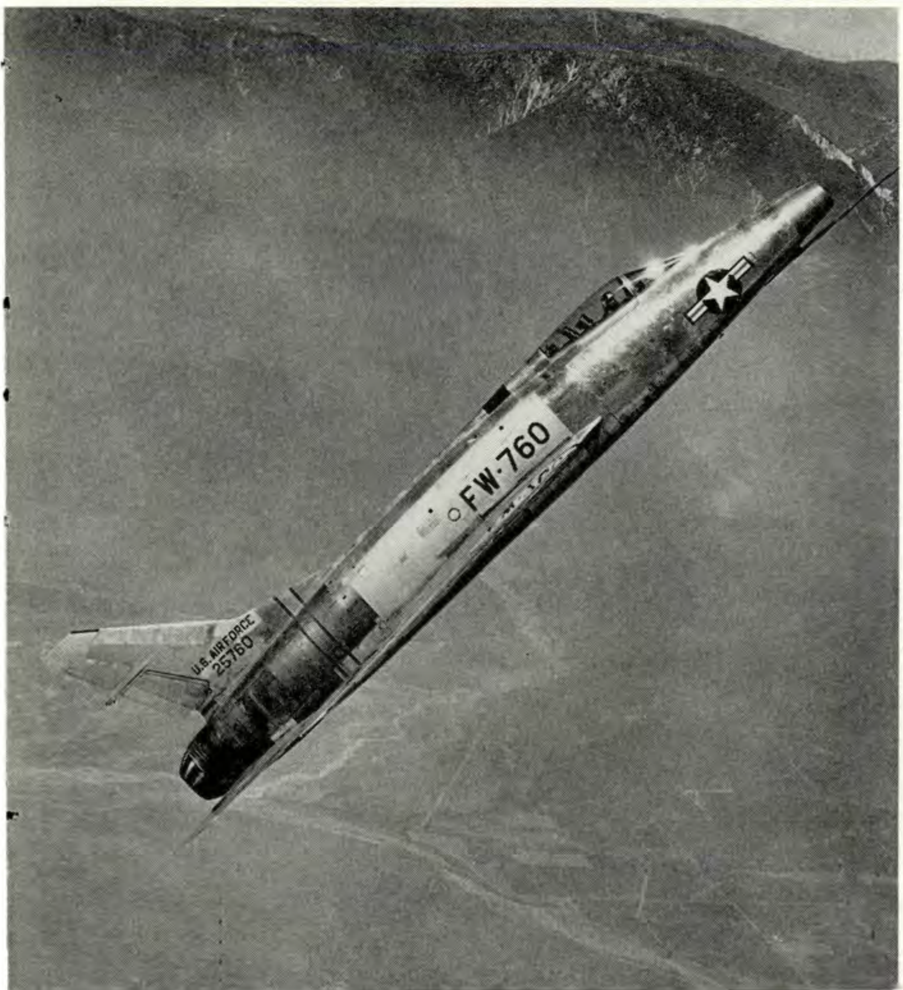
During the approach for an emergency landing, you should monitor flight control hydraulic system number one, as the emergency ram-air turbine is on this system. If the speed brake is used on final approach to slow speed to make contact with the first third of the runway, you must remember that utility pressure is being taken away that would have been available for brakes. Upon contact with the ground, you should switch to the utility pressure system so that you will have an idea of how much braking power is available. As long as the utility pressure stays above 1000 psi, you can apply brakes in the normal manner. If pressure drops below 1000 psi, you should use brakes with extreme caution, as you will soon be going onto the emergency accumulators.* In this case, you should apply a slow and steady pressure in an attempt to provide braking without skidding the wheels and blowing a tire. When utility hydraulic pressure fails, the nose-wheel steering fails and emergency gear retraction is not possible. Avoid excessive use of controls, especially ailerons, in order to conserve the available hydraulic flow on the ram-air turbine.

Power-off landings aren't easy, but F-100 pilots have made successful dead-stick landings. My helmet goes off to those pilots because they have developed that touch that makes a man a part of his airplane. That pilot touch comes from having a plan and practicing to make it perfect. ●

**F-100C airplanes AF54-1915 and subsequent have an added feature in the brake system which allows you to use brake pedals to pump up and apply pressure manually after the emergency accumulator pressure has been depleted. Braking action then will depend on the amount of pressure that you can apply manually to the brake pedals.*

★ ★ ★

Yaw and Pitch Dampers



Bob Baker
Chief Engineering Test Pilot

A GOOD AIRPLANE should have dynamic and static stability. This means that with a constant power setting and the airplane trimmed for level flight, the controls can be momentarily disturbed and the airplane will regain its original attitude.

Kicking the rudder causes a directional oscillation which gradually decreases in magnitude, and the airplane returns to its trimmed position. How quickly the oscillations diminish is the measure of aerodynamic directional damping. The amount of damping depends largely on air density and air-speed. To supplement aerodynamic damping, particularly under high-altitude conditions, the yaw damper is used on the F-100 series.

The yaw damper system uses a gyro to sense yaw rate and create signals which are amplified, varied in intensity according to altitude, and used to control the position of the yaw damper hydraulic actuator. This actuator operates the control valve of the rudder hydraulic actuator to deflect the rudder and automatically correct the directional oscillations of the airplane nose. It should be noted that only changes in yaw rate affect the system. All steady rate signals, such as encountered in a normal turn, are washed out by the system amplifier.

The yaw damper does not increase the static directional stability of the airplane but does supplement the aerodynamic damping of directional oscillations.

We made flight tests at North American to determine how much rudder displacement was required from a given electrical signal received from the gyro. The entire speed range and altitude capabilities of the airplane were checked for yaw damping, and signal inputs made to vary with altitude. From these tests we selected the requirements used for flight checking production airplanes before delivery. Air Force pilots can flight test their airplanes in the same manner. Here's how it goes:

With the airplane trimmed for straight-and-level flight in military power at 35,000 feet, sideslip the airplane, keeping turn needle centered and the ball one ball-width out of center. Release controls abruptly and count the number of times the turn needle passes through zero rate of turn. With the yaw damper switch in STANDBY, the needle will pass through center five to 10 times before its motion is so small that it cannot be counted. Each time the needle passes through center, one-half cycle has been completed. In other words, five counts would be $2\frac{1}{2}$ cycles.

Now, with the airplane still trimmed for straight-and-level flight, the yaw damper switch is turned to ON. There should be no change in trim due to the yaw damper being on. Repeat the side-slip, keeping the turn needle centered and the ball one ball-width out of center. Release controls abruptly and observe the turn needle. If the yaw damper is set properly, the turn needle will pass through center not more than four times (following the initial deflection), indicating that damping is completed in two cycles or less.

Yaw dampers installed in production airplanes have three gain settings (high, nominal and low) which control the amount of damping action. These settings are adjustable only from the ground. If the gain setting is too high, needle action is sluggish and does not pass through center even once. If you happen to be "sitting on the perch" for a high side pass at a target and the gain setting is too high, as soon as you use aileron to start your pass, the nose will hang up and the airplane will be felt to slip in the direction of the turn. Perhaps you're making shallow turns to clear an area and notice the nose tends to yaw away from the direction of the desired turn. This also is an indication of high gain setting. If the gain setting is too low, the needle will oscillate from five to 10 times before damping. In either case, the yaw damper should be rechecked with ground measurements, in accordance with applicable tech orders to give the proper damping action. This is important.

Since the yaw damper serves no useful purpose during takeoff and landing and may cause objectionable heading changes under crosswind conditions, the yaw damper should be turned to STANDBY for all takeoffs and landings. Whenever terrain clearance is less than 3000 feet the yaw damper should be set to STANDBY. The natural aerodynamic damping of the airplane itself is very good at lower altitudes.

The yaw damper has fail-safety features which cause automatic shutoff to prevent malfunctions in the system from causing dangerous attitude changes of the airplane. Occasionally, however, malfunctions which are not dangerous but which prevent proper yaw damper performance may occur. In this case, place the system to STANDBY and have the ground crew check-out the yaw damper after landing. If the yaw damper should lock out because of a temporary inverter malfunction or loss of electrical power, it can be reset about $1\frac{1}{4}$ minutes after the malfunction has cleared by placing the yaw damper switch at STANDBY and then returning it to the ON position.

Having checked out the damper in your airplane, make a pass at an air target with the damper off and then turn it on and repeat the pass. Try this on a ground target in rough air. You can do a lot better job with a lot less work using the yaw damper. Watch those scores go up!

Pitch Damper

When flying in high, thin air, an aircraft loses some of the advantages of a denser atmosphere. One of these is natural aerodynamic damping. You have probably noticed the effects of reduced aerodynamic damping under certain flight conditions as a pitch oscillation when recovering from a

With constant power setting and trimmed for level flight, the F-100 has excellent stability.

turn or when pulling up to a target. While this oscillation is small in the F-100, it is noticeable enough to require your attention for satisfactory air-to-air tracking. This pitch oscillation also is too fast for a pilot to apply corrective pressure in the proper direction at the right time to damp the oscillation.

To solve this problem, North American Aviation came up with a pitch damper system. This system automatically corrects for oscillations much faster and more accurately than the pilot and helps provide an improved gun platform at high altitudes and high Mach numbers. Basically, it consists of a gyro that senses pitch motion and feeds this information to an amplifier. The amplifier controls a hydraulic actuator which is connected to the stabilizer control system. Only changes in pitch rates are transmitted as a signal to the pitch damper. Steady pitch rates as encountered in normal turning maneuvers are not transmitted.

The natural aerodynamic damping of the airplane is good at low altitudes. Use of the pitch damper is, therefore, not recommended for takeoffs and landings as it could cause objectionable airplane attitude changes. The damper switch should be depressed to the STANDBY position at all times when the airplane is less than 3000 feet above the terrain.

Since an aircraft loses some of its natural aerodynamic damping at high altitudes and has good damping in the denser air at low altitudes, the amount of automatic correction required from the pitch damper decreases with decreasing altitude. This is necessary to avoid overcorrection at low altitude. The pitch damper incorporates an automatic means for preventing overcorrection from occurring.

Here's the way we flight test the pitch damper system at North American Aviation:

Trim airplane for straight-and-level flight at 35,000 feet and military power. Pull up 500 feet, and then push over in a 10-degree dive. Make a 2 to 3G pull-up, raising the nose slightly above horizon; then release controls abruptly. With the pitch damper switch depressed to the STANDBY position, about three to five pitch oscillation cycles occur before the airplane damps to the trim attitude. In other words, the airplane's nose will cross a horizontal reference six to 10 times. With the pitch damper switch on, the airplane pitches down,

Watch those scores go up when you use the yaw damper. A better job with a lot less work.

overshooting the trim attitude once, and then comes back to rest at the original trim attitude. The purpose of the climb and dive is to ensure that airspeed is the trim airspeed, because straight pull-up would cause the airspeed to bleed off.

Another check of the pitch damper for satisfactory operation is simply depressing the damper switch to the STANDBY position and then pulling it back out. There should be no change in trim in either case.

We have turned the pitch damper on in level flight and in turns pulling 2 to 3G, with no transient oscillations noted. We have kept the pitch damper on during all sorts of maneuvers, rolls, loops, Immelmanns and simulated combat without encountering any unsatisfactory or dangerous G conditions whatsoever.

There is a safety circuit in the pitch damper which limits deflection response to prevent unsatisfactory G conditions. If this safety circuit does not function correctly, the pitch damper is automatically shut off.

Occasionally, malfunctions which are not dangerous but which prevent proper pitch damper performance may occur. In this case, place the system in STANDBY and have it checked by the ground crew after landing.

If the pitch damper should lock out because of a temporary inverter malfunction or some other temporary electrical power failure, it can be reset about 1¼ minutes after the malfunction has cleared by depressing the pitch damper switch to the STANDBY position and then pulling the switch back out.

The pitch damper thus supplements the aerodynamic damping qualities of the F-100C, giving you a better gun platform and better tracking potential at high altitudes and airspeeds. ●

Keep Current

NEWS AND VIEWS

Fokker Jet Trainer—Due to start on a demonstration tour is the new Dutch-developed Fokker S-14 jet trainer. In the 450 miles per hour class, it has a wingspan of 39 feet and overall length of 44 feet. Its centrifugal flow gas turbine engine is rated at 3470 pounds of thrust and the aircraft takes off over a 50-foot obstacle in about 3300 feet and climbs at 3000 feet per minute. At 25,000 feet altitude, the plane has a maximum range of 600 miles without tiptanks. Fairchild holds manufacturing rights. ●

The Fokker jet trainer will make its debut shortly.

Here are the answers to the photo on page 1. Did you catch them?

Calling All Cars—The development of an improved, miniature, lightweight emergency radio which permits a stranded airman to direct his own rescue has been announced recently by Hqs ARDC. The new radio weighs only 15 ounces.

This combination transmitter and receiver will be included in the standard survival kits for aircrews. Because of its size, it will be especially adaptable for fighter pilots.

Containing sub-miniature tubes and cell batteries, this radio will transmit from 50 to 100 miles. Following a forced landing or bailout, the pilot need only push the transmitter button and broadcast information regarding the crash and his location. If he wishes, he can set the radio to broadcast a continuous tone signal which rescue aircraft can use to "fix" his position.

Two-way conversation may be carried on between the stranded airman and the rescue aircraft. The UHF voice and tone signals are broadcast on an established emergency frequency. ●

★ ★ ★

Making its first powered flight recently is the X-2 rocket plane.

Flying Research Lab—The first powered flight of the X-2 rocket plane has been made at Edwards AFB, California. It was flown to "transonic speed" by Lt. Col. Frank Everest, chief test pilot.

Designed specifically to probe the so-called thermal barrier, the X-2 will be used solely as a flying research laboratory. It incorporates many innovations, among them the use of stainless steel and K-monel in the fuselage and wings. Both these metals have a much higher melting point than aluminum which softens and loses much of its strength at high temperatures.

It is powered by a rocket engine capable of developing power almost equal to that which is developed by a modern Navy cruiser.

The cabin is heavily insulated, pressurized and detachable. Should a pilot have to leave the X-2 at high altitudes, explosive charges would separate the entire cabin from the rest of the airplane. A ribbon type parachute would carry the capsule to a low altitude where the pilot could then parachute to the ground.

The windshield is made of highly tempered glass capable of withstanding almost 1000 degrees Fahrenheit. It also will resist infra-red rays. This is a necessity, for at the altitudes that the X-2 is designed to reach there are no dust particles to cut down the intensity of the sun's powerful rays.

A B-50 bomber has been adapted to carry the X-2 to altitude from which it begins its flight. ●

★ ★ ★

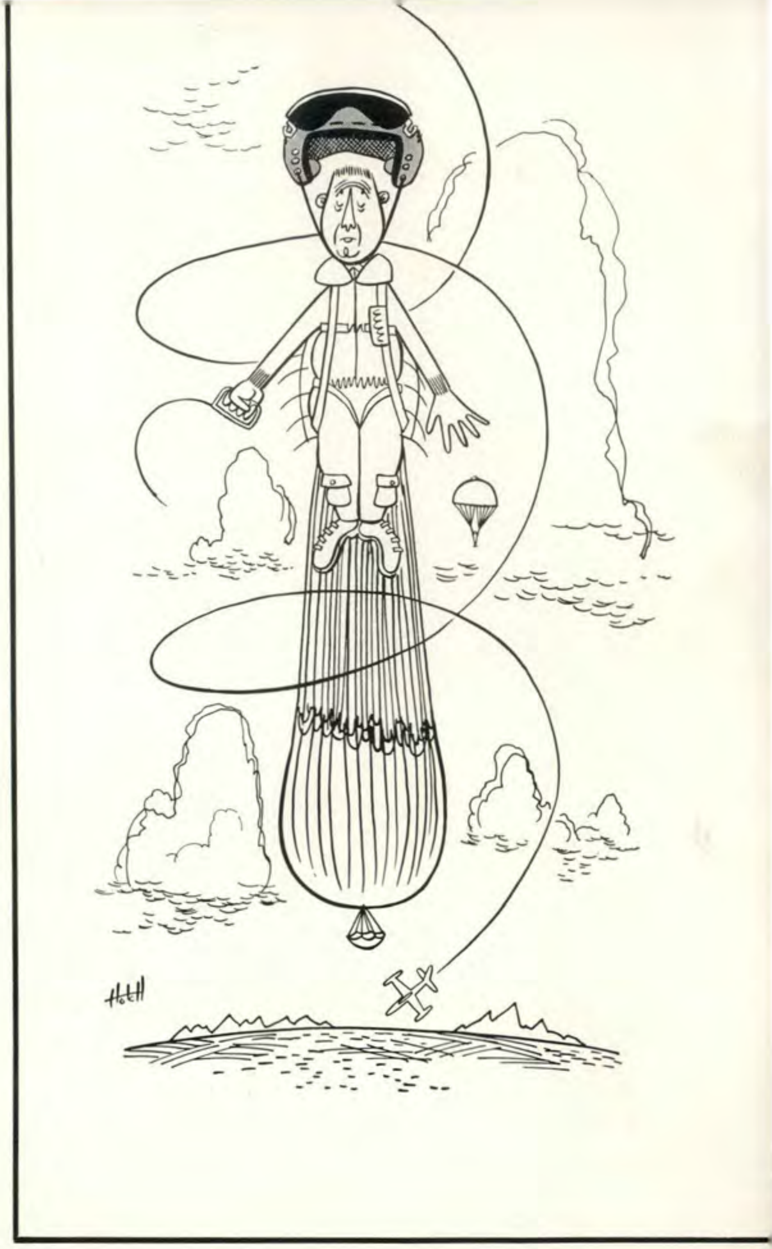
Sixteen Tons—The world's largest turbine-powered transport helicopter—the 40 passenger Piasecki YH-16A "Turbo Transporter" made its public debut recently.

The YH-16A is powered by two YT-38 gas turbine engines whose power is harnessed to turn the two giant, powerful rotors.

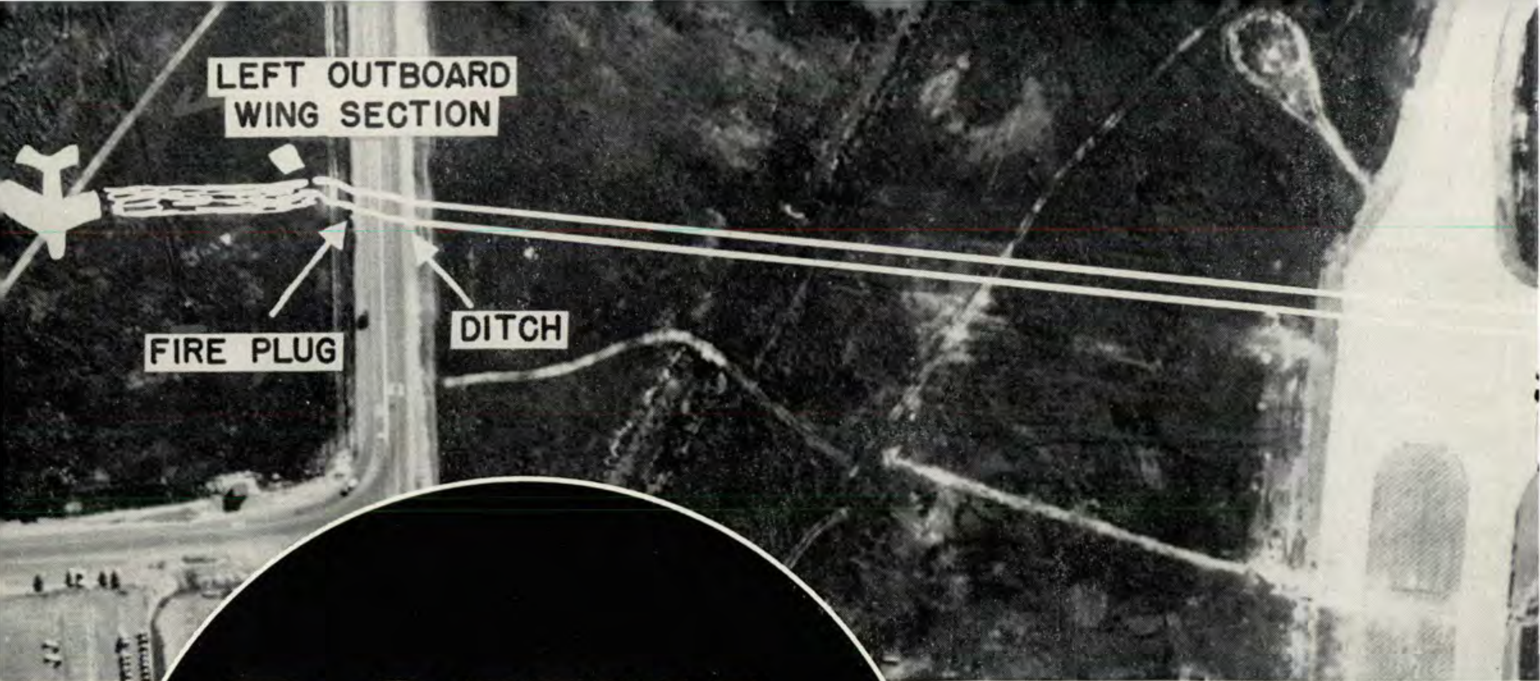
This helicopter weighs over 16 tons and has a top speed of approximately 150 miles per hour. Its fuselage is 77½ feet long and each of the three-blade tandem rotors measures 82 feet in diameter.

During flight tests, the aircraft demonstrated its ability to fly and maintain altitude, carrying a normal load with only one engine operating. In addition, its autorotative flight with both engines shut off is another advancement in flying safety.

The use of gas turbine engines in helicopters offers several important advantages over standard reciprocating engines. They are smaller and lighter, yet have the same power. They operate at optimum fuel consumption in the higher power ranges. They are easier to service and maintain. No ground warm-up time is required and the vibration and noise level is markedly lower. ●



Hovering effortlessly is the new YH-16A turbo transport helicopter.



Through brush, across an irrigation ditch, over a highway, into a fire plug, but still the pilot was uninjured. The gear was down.

DOWN, BOY, DOWN

Should you land gear-up or gear-down on an unprepared surface? Regardless of the type of aircraft that you fly, you should know the answer to this question. This article has the answer.

IF YOU ARE a jet fighter jockey, this story is for you. If you aren't a fighter type, I'd suggest you read it anyway. I think you'll be surprised!

The Dash One says, "If sufficient altitude is available, it is recommended that the crewmembers bail out in preference to ditching or crash landing, even if over open, flat country ——." But what happens when you are involved in a situation where you are too low or for some other reason have no option but to land?

To tell you that you are less susceptible to injury when you land a jet fighter with the gear down on an unprepared surface is one thing. To have you believe this new concept is another and, incidentally, the purpose of this article.

I was rather skeptical about this recommendation even after reading the study on it. However, I think that once you are familiar with the whys and wherefores, you will agree that emergency landings on unprepared surfaces should be accomplished gear down. As a result of this study, all fighter Flight Handbooks, excluding the one on the F-89,* are now being revised.

The study was made primarily because of the increasing frequency of spinal injuries sustained by pilots during wheels-up landings of modern jet fighter aircraft.

Originally (July, 1954), a committee headed by Dr. E. J. Baldes, of the Scientific Advisory Board, USAF, probed into the problem, and came up with some recommendations. One of them was that "serious consideration be given to the operational procedures for all aircraft with high angle of attack that emergency landings be made whenever possible in the wheels-down configuration to insure greater protection to the pilot."

Spinal Injuries

Vertebral compression fracture is the term used on the Form 14 to describe the spinal injury suffered by many pilots who have crash landed.

Even though the spinal column is an extremely flexible, anatomical engineering marvel, it has its weaknesses. When a "slap" load is placed upon it, the edges of each vertebra compress together and splinter or break. The little cushion disks between the vertebra also are mashed and the pilot often times suffers a severe, painful injury.

There are several significant rea-

Structural damage, top photo, resulted when F-86 hit fire plug. Aircraft came to rest at a 90-degree angle to runway direction.

In another F-86 accident the gear absorbed the landing shock. Top photo shows the second impact with the ground when pilot undershot. The F-86 bounced 300 feet from point of first impact, skidded approximately 400 feet then veered to right.

sons for a greater number of injuries during crash landings with gear retracted. When landing gear is up, impact forces are transmitted directly to the aircraft and crew. Also, landing in this configuration usually results in either an increased airspeed at touchdown or an increased nose-high attitude. A nose-high attitude causes the aircraft to literally "slap" the ground on impact, subjecting the crew to spinal injury.

During landing with gear extended there is a greater tendency to maintain appropriate landing speeds. Also, the increased drag created by the gear reduces the nose-high approach attitude and lessens the probability of nose "slap", following impact. Probably the most significant factor is that the extended landing gear absorbs initial impact, reducing forces imposed on the fuselage area and on crewmembers. Fracture the landing gear instead of your back.

Unprepared Surfaces

One of the first things I wanted to know as I went further into this subject was a definition of an unprepared surface and some examples of same.

Generally, an unprepared surface is any landing surface which is not a runway or a leveled and smooth overrun. (Overruns were considered only if there was construction, ditches or runway lips involved. This study did not consider forced landings on open water surfaces.)

Examples of some unprepared surfaces classified as rough, level terrain are ditches, ridges, rocks, sand dunes, plowed fields, swamps, desert, trees and tundra.

Rough, rolling terrain consists of trees, rocks, ridges, river beds, roads and hillsides. Smooth, rolling terrain includes hilly country, desert, roads and fields. And smooth, level terrain consists of lake beds, fields, roadways and beaches.

Next, I wanted to know about the comparison of damage done to an airplane with the gear up versus the gear down configuration.

Comparative Damage

Of 108 landings on unprepared surfaces, 70 per cent of the wheels-up landings resulted in destroyed aircraft. This compared to only 45 per cent that landed in a wheels-down configuration.

How about gear up versus gear down damage in undershoot and overshoot accidents? In 239 undershoot accidents, 75 per cent of the wheels-up landings resulted in destroyed aircraft, while only 21 per cent were destroyed that landed in the wheels-down configuration.

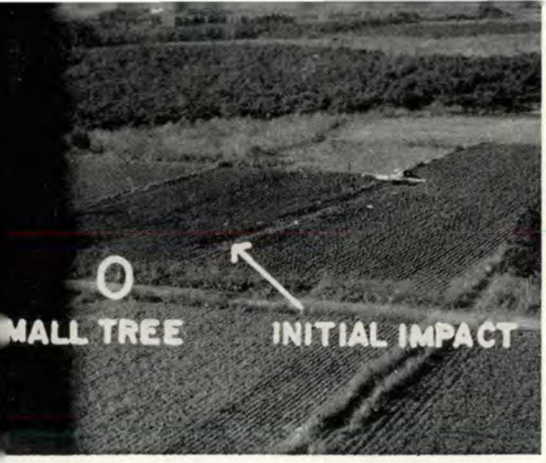
In the overshoot category, 45 per cent of the wheels-up landings resulted in destroyed aircraft in contrast to only 15 per cent with the wheels-down configuration.

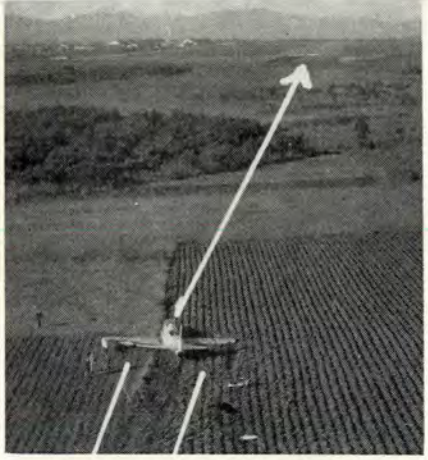
I read these statistics. They looked good, but what actually happened on some of these crash landings? Let's look at a few.

• On a night flight, a pilot of a T-33 suffered hypoxia at altitude and regained consciousness at about 5000 feet. The pilot could hardly see the instruments and could not eject. During the landing attempt, the aircraft hit 1650 feet short of the runway in rough desert terrain consisting of soft sand dunes and mesquite brush.

The landing gear sheared, absorbing the initial impact forces and the aircraft slid 345 feet. The aircraft was destroyed and the pilot was injured. The item of importance in this serious accident, of course, is that the pilot survived.

This T-33 went through fence and drainage ditch. Entire nose section was torn free. Pilot was uninjured. Gear absorbed shock.






The aircraft contacted soft ground of a turnip patch at minimum flying speed, coming to a stop after skidding 216 feet. Leaving the gear down allowed the pilot to land in a normal attitude.

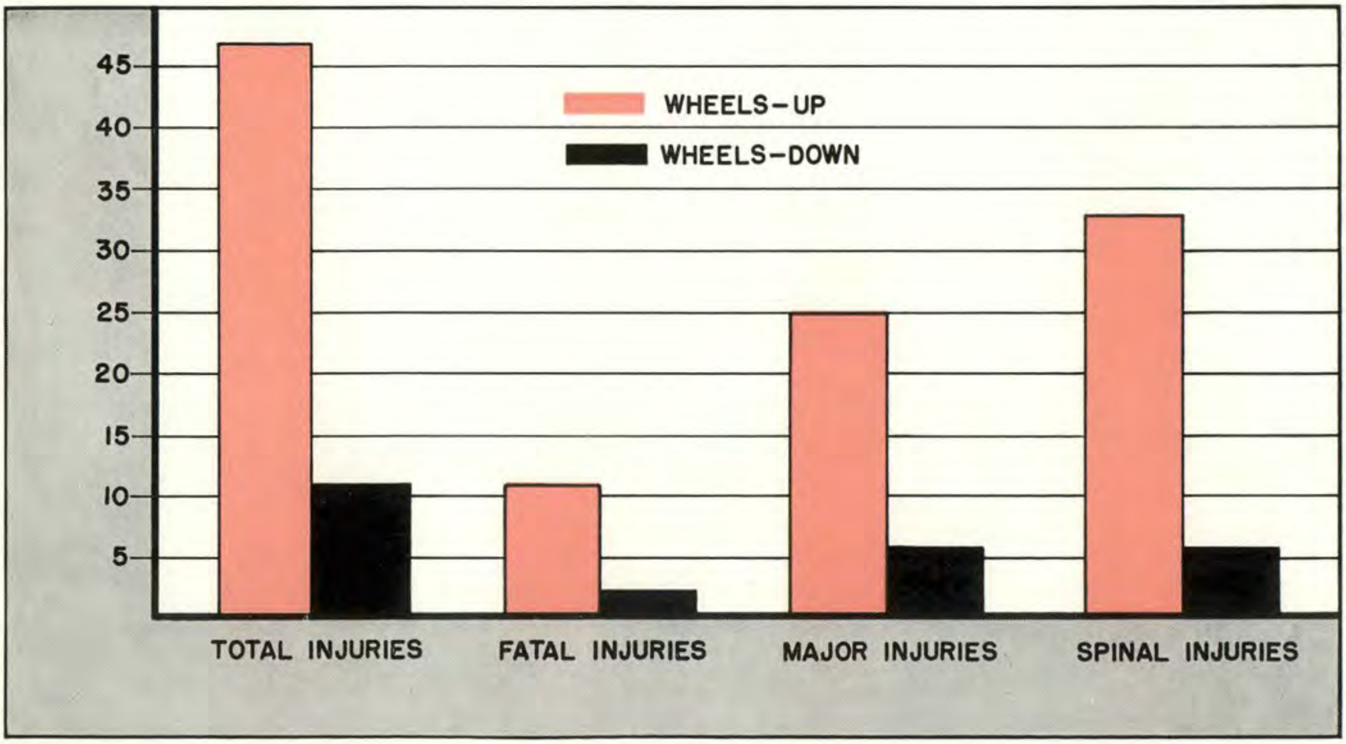
• An F-94C was landed in a nose-high attitude in a plowed field, wheels-down. The nose gear sheared upon striking an irrigation ditch. The aircraft continued, sliding on its nose section and main gear for 600 feet in the plowed field. The aircraft received substantial damage but the pilot was not injured.

• A pilot of an F-86F inadvertently left his gear down as he made a power-on approach for an emergency landing with minimum fuel. The landing area he had chosen was crisscrossed with seven ditches eight feet wide and five feet long. Weeds covered the ditches making the strip look smooth. Touchdown was normal and the aircraft slid 1800 feet over all seven ditches, shearing the landing gear and flaps. The aircraft was destroyed; however, the fuselage was intact. Although injured, the pilot got out of the aircraft and walked away.

• An F-84F made a wheels-down landing on a roadway. A normal approach was made to a 15-foot wide macadam road, which had shallow ditches on both sides. Culverts running underneath the road stuck out on both sides of the narrow road. After touchdown, the nose gear collapsed and the wing fuel tanks were torn off during the 3000-foot landing roll. Protruding ends of several of the culverts were struck during the ground roll, and the aircraft received substantial damage. The pilot, however, was not injured.

I continued to read down through the accident briefs in the study. I saw that they all pertained to landings on

Chart shows comparison of injuries when pilots have landed with wheels up and wheels down.



The landing gear will withstand a terrific impact. This F-84 touched down short of the runway; the tire exploded and the aircraft slid on the wheel hub for 4500 feet.

different types of unprepared surfaces. I think that the following report which I read summed up clearly what the entire study advocates.

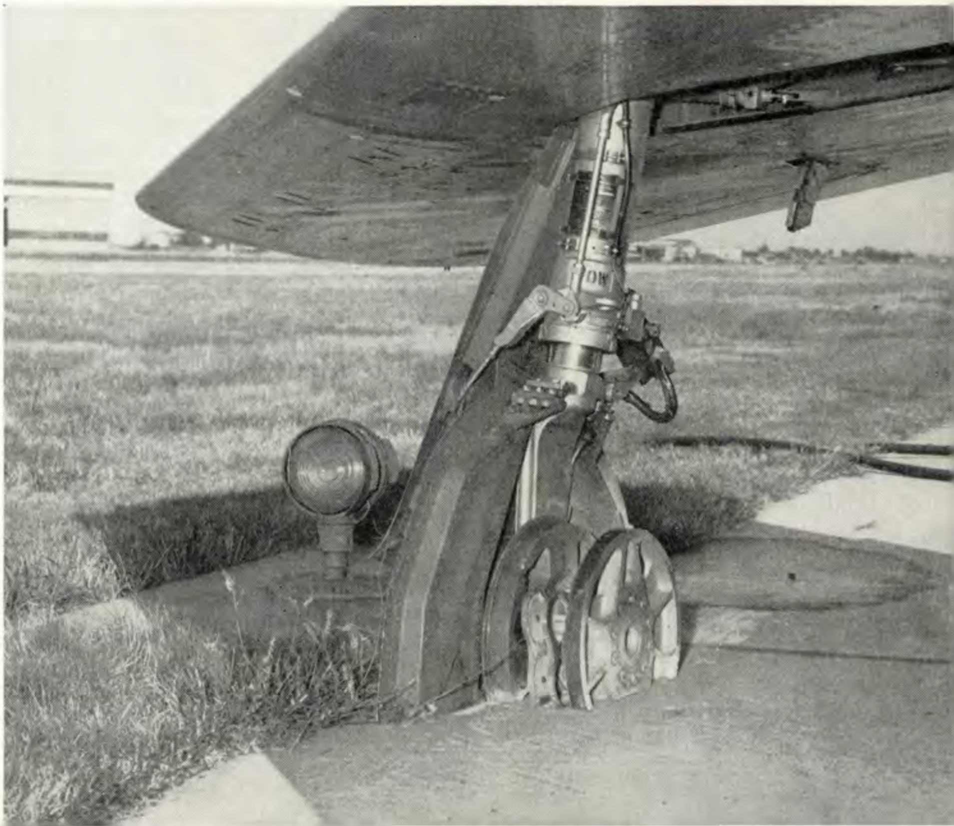
• An F-86F went off the end of the runway and into a swamp containing tree stumps. The nose gear and wing tanks were torn off soon after entering the swamp and the aircraft slid through mud and tree stumps for 300 feet with the main gear intact. The aircraft was destroyed, but the pilot was not injured.

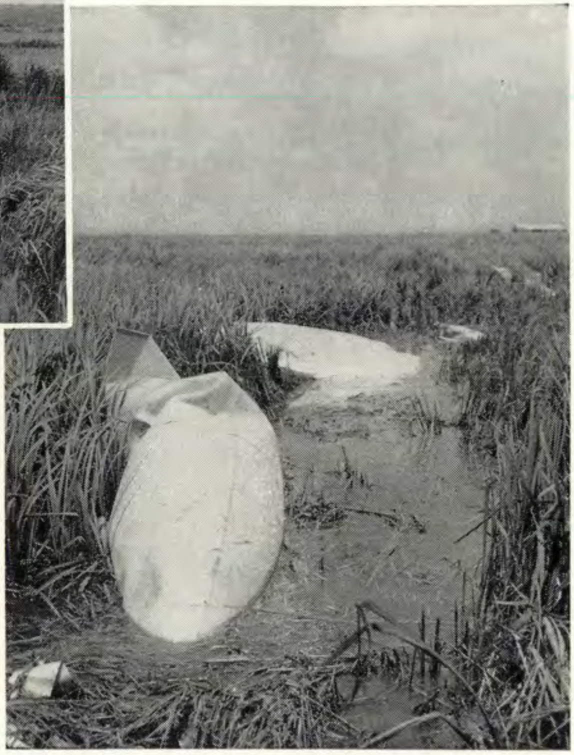
The pilot's comments concerning this accident are very significant. ". . . I might be criticized because I left everything down. But something seemed to occur to me. I have been thinking about our runway arresting barriers. It seemed to me that it might be better to leave my gear down and use the swamp just like a barrier. It worked. I just rolled off into the swamp and decelerated to a fast stop. I think the extended gear kept me from tumbling. . . ."

The term "tumbling" used by this pilot started me to thinking. To me, it had a psychological connotation. One of my first mental recollections of flying was of an airplane skidding on its nose and then tumbling over on its back.

This thought has stayed with me. I guess newspaper photos, eye witness accounts and other informational sources continually have influenced me. I had come to regard tumbling or flipping as a foregone conclusion if you crash landed gear-down or if the nose gear or main gear struck any sort of obstruction.

But listen to this. . . . There were no cases recorded where a jet fighter aircraft flipped or tumbled after landing gear-down. There were 86 accidents where, although the nose gear





The pilot undershot the runway and hit a rice field. The wing tiptank broke off as the plane struck several small dikes. There was no fire or explosion.

collapsed or sheared, the aircraft slid through various types of terrain without flipping over or tumbling.

What then is the explanation of these photos that show an airplane resting on its canopy or back with the gear pointing skyward?

Close investigation of these inverted type accidents disclose that the aircraft, in its ground travel, usually starts a side roll to the right or left. When this happens, any number of gyrations can result. Of 458 accidents there were eight wherein aircraft ended inverted after rolling over.

So the chances of flipping over or tumbling when accomplishing a forced landing with the gear down on an unprepared surface are comparatively nil.

Another thought came up. What do other fighter pilots think of this gear-down recommendation? I've talked with a lot of them, from all types of fighter outfits, too. They reacted to the topic like a cage full of tigers. They mauled it over, good. But the revealing thing about their conclusions was that once they saw how comprehensive the study was, how accident after accident report indicated that lives were saved, injuries lessened and damage to aircraft reduced, they were for it.

They were for it to this extent. If a guy had to make a choice of landing with the gear down or up, it would be with gear down. They emphasized and I'll reiterate, if sufficient altitude permits, your best bet is to use the nylon letdown.

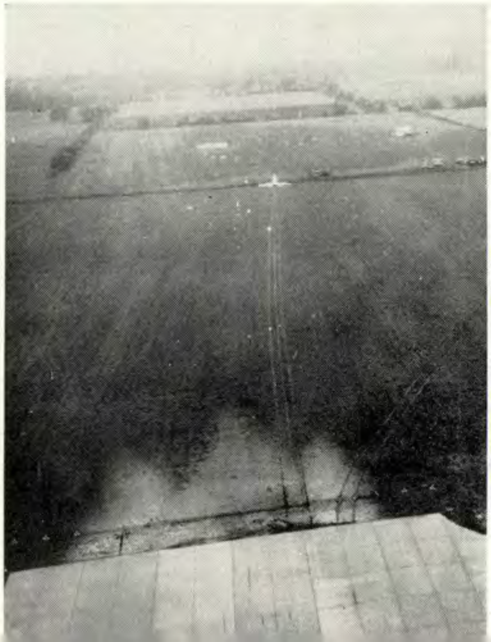
If you are wondering about what to do with your external stores, do as the flight handbook says for the type of aircraft you are flying.

Further research projects have been initiated to see whether the same recommendation can be made for forced landings on bombers, transports and trainers. Also, a project is now under way to see what can be recommended when the gear is only partially extended. There will be more on this particular subject later.

Right now, however, there is one thing that you can count on. Your survival chances are better if you leave the gear down and locked to land on unprepared surfaces. ●

**At the present time, this gear-down recommendation does not apply to the F-89. A modification or redesign of the nose gear assembly will have to be made. When this is done, then this gear-down for crash landing recommendation will apply.*

Pilot aborted and a drainage ditch stopped this F-86. No injury to pilot. No fire.



WELL DONE

KNOWLEDGE . TRAINING

★ **Captain** ★

Albert T. Keeler

764th Bombardment Squadron, 461st Bombardment Wing (L), Hill Air Force Base, Utah

★

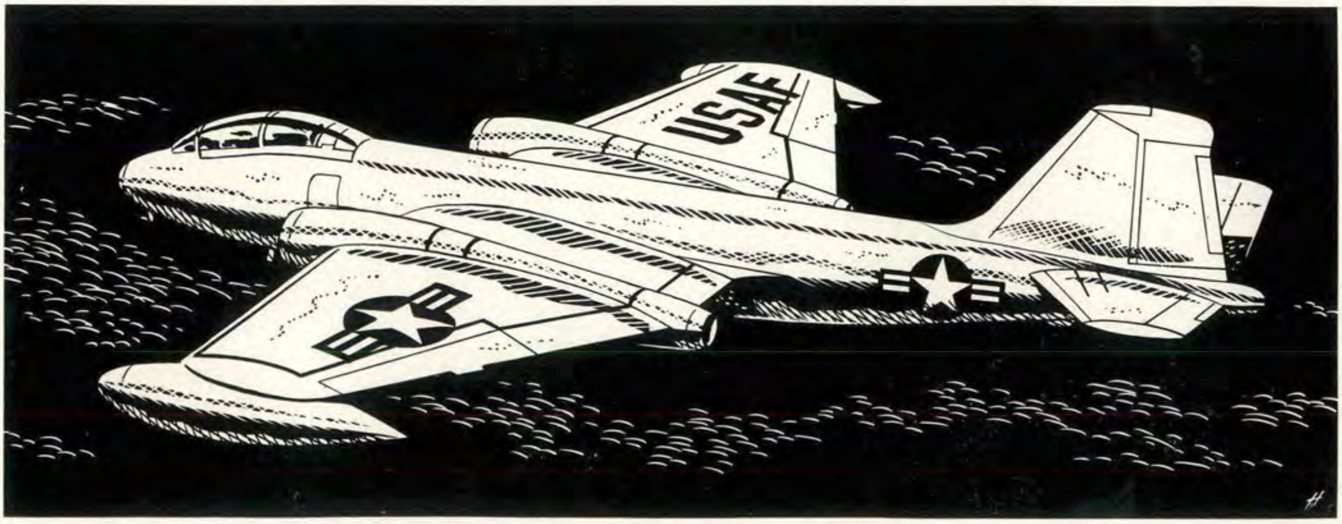
CAPTAIN ALBERT T. KEELER was on a cross-country flight out of Washington, D. C., when the left engine of his B-57 flamed out. He descended to 20,000 feet immediately, made a successful airstart and climbed back to 40,000. All engine instruments were indicating normal; however, he noticed that the fuel consumption was excessive. All fields in the area were below minimums, so he continued his flight and declared minimum fuel.

Over St. Louis radio, both engines flamed out, and during the descent, Captain Keeler turned off the inverters. The navigator handled all radio calls, leaving Captain Keeler free to attempt airstarts. At 15,000 feet the right engine was restarted but flamed out again. At 2500 feet the right engine was restarted once more and an emergency declared. At 1500 feet the left engine was restarted. Captain Keeler was below all clouds so he headed for the nearest Air Force base.

Setting up his landing pattern, he extended the gear but both engines flamed out. He turned immediately to the nearest runway which was 5000 feet long. The flaps would not operate and an overshoot seemed imminent. However, he spiked the B-57 on the runway as the first third point flashed by, and stopped with no damage to the plane.

A fuel check, after landing, revealed no usable fuel remaining. A defective "O" ring gasket had caused it to be pumped overboard. A total of nine airstarts had been made, four successful, five unsuccessful.

The cool judgment and excellent technique displayed by Captain Keeler is an outstanding example of professional airmanship. Well Done!



REX SAYS

I WAS BROWSING through our squadron flying safety reading file the other day when I came across as unusual and eerie a tale about flying as I ever expect to read. I thought old Rex would appreciate hearing about it.

The C-46 had been airborne about an hour, cruising over the dense Amazon jungle at 18,000 feet. Idly watching the thick, matted forest unfold was Ross Allen, the famous Floridian reptile expert, and a movie photographer, Dan Carley. Allen was worried about the cargo stowed aft.

He nudged the photographer, pointed over his shoulder and disappeared through the cabin door. A few seconds later, he came back.

"Hey," he whispered excitedly, "an anaconda's loose."

The photographer scrambled off the small jump seat. The two men bounded through the door and Allen paused long enough to snatch up a heavy burlap bag. They peered through the dimly lighted cargo section.

"There he is," Allen said tensely. He pointed toward the rear of the plane. They could barely make out the form of the 17-foot, 180-pound anaconda, which is capable of swallowing a pig or deer, as it slid over the blanket-covered cargo.

In the manner of a matador working a bull, Allen held the bag before him and cautiously approached the huge reptile's head.

"Get ready to grab his tail," Allen commanded. "And for heaven's sake, don't let him constrict. He'll kill both of us!"

The other man nodded and inched his way toward the rear of the cabin.

Now it was the anaconda's turn to sense danger. Its beady eyes watched Allen; its tongue flicked in and out, and its head wove back and forth. Suddenly, it struck.

Snake catching was old stuff to Allen. Deftly, he side-stepped. The ugly, tooth-laden mouth that was intended for Allen's arm clamped shut on the burlap bag instead. Allen seized the snake behind the head.

"Grab him!" Allen shouted. And both men hurled themselves on the thrashing reptile.

"Stretch him!" "Don't let him coil!" Allen yelled.

In the frantic moments that followed, they worked the reptile into the bag. Allen quickly bound and tied it with a stout cord. Stowing the sack away, they covered it with a blanket.

Both men were wet with perspiration. They knew the C-46's altitude had been on their side, for the cold temperature had slowed the anaconda's reactions. Quickly, they checked the rest of the cargo. Everything was in perfect order.

The rest of the cargo? A total of 3000 pounds of snakes—38 more anacondas, five powerful boa constrictors, two vicious spring tooth snakes, one deadly seven-foot bushmaster and a few ill-tempered, highly poisonous fer-de-lances.

***REX SAYS**—Credos to Mr. Allen. I have heard many a yarn about passenger trouble but this one wins the furlined pitot cover.*

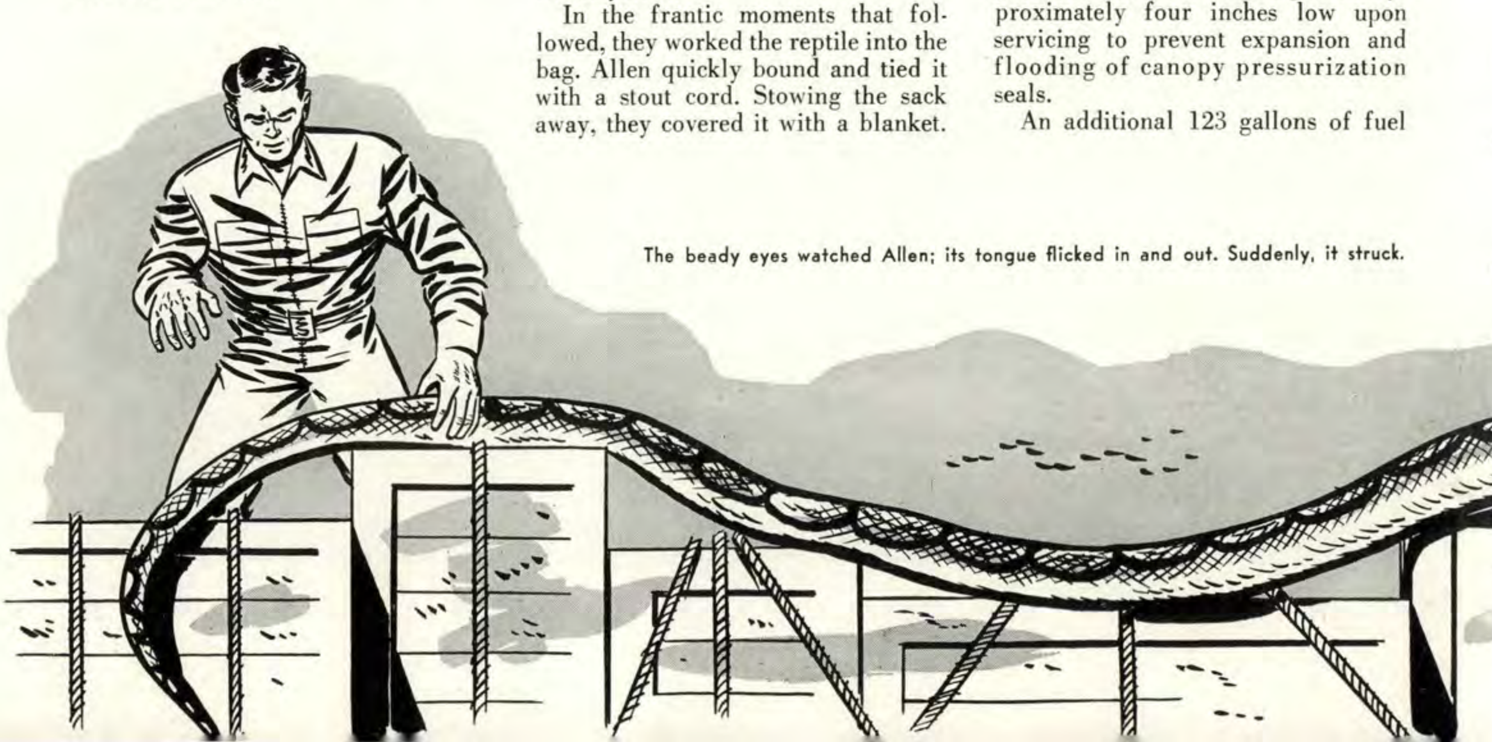
★ ★ ★

I LANDED AT an Air Force base about 2030 hours and requested full service for departure the next morning. During my preflight check of the aircraft I found that the fuel in the tiptanks was about four inches below the filler neck in each tank. Further investigation revealed that this was noted in the Form 781.

The alert man went back to the alert shack to request more fuel and was advised that it was local standard procedure to leave T-33 tiptanks approximately four inches low upon servicing to prevent expansion and flooding of canopy pressurization seals.

An additional 123 gallons of fuel

The beady eyes watched Allen; its tongue flicked in and out. Suddenly, it struck.



were required to fill the tiptanks completely in this instance. The shortage of this much fuel in a T-33 aircraft could have placed me in a very serious situation had I not removed the caps and visually checked the tiptanks prior to takeoff.

This command prevents expansion and flooding by leaving tiptank caps loose and requiring pilots to tighten them prior to takeoff.

***REX SAYS**—Just goes to show the trouble you can save yourself with a good preflight of your aircraft. When the difference is 123 gallons of go-juice, it could cause you some exciting moments about the time you get close to your destination.*

★ ★ ★

I WAS PULLING AO duty. I glanced at the clock and it said 2145 hours. I asked the weather man what he was reporting and he told me, "Eighteen hundred broken, 10 miles."

The squawk box blared, "Ops, this is the tower. There's a T-33 on the runway. He just up and landed without making a call at all. You got anything on him?"

Well, I took my feet off the desk and hustled out to the ramp. And believe you me, what had transpired to get this T-Bird on the runway at my base when he should have landed at a field some 20 miles away, is something hard to believe.

This bewildered lad first filed an IFR flight plan to my base which does not have a published jet letdown procedure. En route he was advised of this and changed his flight plan for the other base which was approximately 20 miles away.

So he tooled merrily on his way until he was over what he thought was the proper range station to start a penetration. Only this dude forgot the cardinal rule about tuning in a radio compass. What? Why, that properly identifying the range station is a must.

RAPCON enters the episode now. They located a target making knots toward some clouds that happened to have a lot of hard centers in them, like, maybe, mountains.

They contacted this aircraft and advised the pilot to turn to a heading which took him away from the mountain range. Shortly thereafter, the RAPCON boys sighed with relief when the blip scooted out of danger.

Next, they advised him of his present position. He replied they were wrong as he had the field in sight. RAPCON then requested the pilot to ask for a DF steer. But, by this time, the pilot had startled the wits out of our tower operators by landing here, at my base.

After looking at his Form 175 and getting RAPCON on the horn, he was more than slightly convinced that he had made a boo-boo.

***REX SAYS**—Yes, sir, and friend, this type of operation can make a guy a long time dead.*

★ ★ ★

IF YOU HAVE some extra space in the Rex Says column, I'd like to spell out for the troops a little episode that I witnessed in a Danger Area recently.

The missiles that I carry underneath my airplane are unerring in their trajectory to a target. There's a swoosh, some smoke and blooey!

This one day, I "locked on" a target and was counting off the seconds to missile release time. Sixty, fifty nine, fifty eight and so on. This target didn't have a ghost of a chance of escaping destruction.

Then it came. Within 40 seconds of missile release time, it was determined that this was the wrong target. What had happened?

Some numbskull, who evidently had gotten away with violating restricted areas before, had crossed over into our airspace where we were doing some serious business.

I imagine by now he's heard about this violation. However, I thought that all fly types ought to take a second gander at the location of these restricted areas on navigational charts and the Fac Charts. You're liable to be "locked on" if you're not careful.

***REX SAYS** — Another instance of some joker who doesn't believe in planning a flight carefully. The information is available, so use it. This cat was using up his nine lives at a rapid rate, believe me.*

★ ★ ★

WHILE ON a routine flight last summer, an Air Force C-47 landed at an overseas, foreign, commercial airport and refueled.

Shortly after the aircraft had been refueled, the plane was struck by lightning. The bolt passed through the aircraft and grounded through an airman standing under the wing. The pilot took immediate resuscitating action and saved the airman's life.

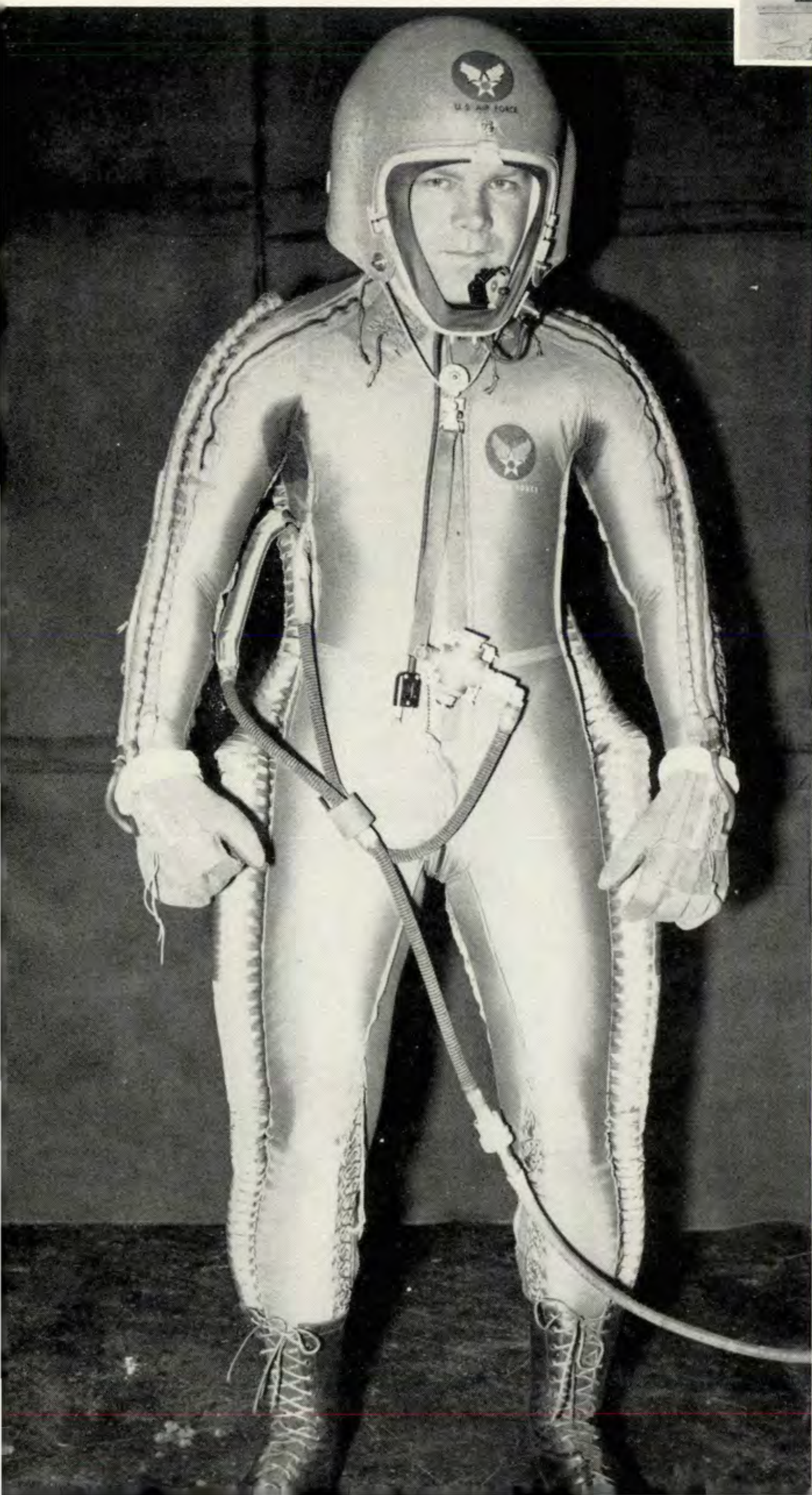
The moral of the story is that commercial airports might not always ground aircraft adequately, when servicing. The probable cause of lightning striking in this case was a high concentration of static electricity in the aircraft as a result of improper grounding. Also, crewmembers and other personnel should never stand under the wing of an aircraft during a thunderstorm.

Crew chiefs and pilots should make sure that the aircraft is grounded properly during servicing.

***REX SAYS**—Sound advice. It would be interesting to know if the grounding wire at the tailwheel was touching the ramp. That should be a part of the preflight inspection just for this very same reason.*

You've got to dress for the occasion when you fly at extreme altitudes. Check these styles.

Fashioned for HIGH



High flying requires adequate protection. The inflated partial pressure suit is a must.

THE JET CAME charging down the runway. As it neared two men standing nearby, its great speed became more and more evident.

Suddenly, it was overhead, still silent and still traveling fast. An instant later, a whooshing roar beat down, hammering at the two men and revealing at last the terrible power of its jet engine. As fast as it came, just so fast it left; its tailpipe roaring out a whine that grew fainter and fainter as it fought for altitude.

"Man! That's too fast for me," one exclaimed in awe. "An airplane that can go like that just isn't safe. Give me the good old prop jobs of the big war. Now, there were safe planes."

The colonel, who was his companion, chuckled quietly. "Yes, that's a pretty fast airplane, but you haven't seen anything yet! Most of our jets have to dive to break the sound barrier, but coming off the assembly lines are several airplanes that cross the sonic barrier in level flight. They're really fast."

"That's just what I mean," exclaimed the other officer. "They're just too danged fast to be safe. It's taken the romance out of flying."

Advance in Speed

"If by 'taking the romance out of flying' you mean fear and danger have been injected, you are probably half right," the colonel answered. "It's true that higher speeds and higher altitudes are more dangerous than the 100 and 200 mile-an-hour clip of old planes. It's also true that pilots today are busier and have to be more alert than in the old days.

"But is that any different than

Living . . . .

C. Carroll High, Jr.
Hqs ARDC

ground transportation? Don't our automobiles move faster today than they did a couple of decades ago? Yet, we think nothing about it.

"As you know, aviation medicine is my field and I would not presume to speak for the aircraft designers or the engineers and scientists who design and develop the equipment that goes in an airplane. But I can tell you of some of the advances made in the way of personal equipment to protect our high-flying pilots in this day of faster-than-sound travel.

G Force

"For instance, one hazard introduced by speed is G force. In a jet airplane these forces can get pretty terrific. Under positive G force, your blood tends to pool in your legs and abdomen and with loss of blood in your brain, you will black out.

"Aero medical research has developed an answer to this problem. A suit, designated the MB-2 anti-G coverall, was devised at the Air Research and Development Command's Wright Air Development Center. It operates on a bladder system so that pressure is applied to the flier's legs and abdomen when needed.

"Whenever the plane makes a turn that sets up a G force on the pilot, a valve opens, letting in air supplied by the aircraft's compressor. The higher the G force the more the valve opens. The bladders tighten and prevent the blood from pooling. This suit, made of 50 per cent nylon and 50 per cent cotton, is now standard throughout the Air Force."

"It sounds pretty uncomfortable," his companion broke in.

"Not at all," the colonel answered. It is no more confining than an ordinary pair of flight coveralls, and it is reassuring to know that any maneuver you could make would break up the airplane sooner than it would black you out."

Pressure Suit

"Now take this altitude thing," the colonel continued. "You have been around airplanes enough to know that the higher you go, the thinner the air. Designers have pressurized cockpits so that a pilot traveling at 40,000 feet, for instance, can enjoy the equivalent of the relatively safe altitude of 15,000 to 20,000 feet.

"But the Air Force is flying combat planes and anything can happen—in combat or out. A canopy cracked or smashed by gunfire at 50,000 feet could result in the death of the pilot from lack of oxygen. An oxygen mask would help at this altitude, if he descends immediately, but suppose the plane was higher—say, 63,000 feet.

"An unprotected man at that altitude would be subjected to a number of stresses, any one of which could cause his death. Besides the lack of life-sustaining oxygen, his body tissues and gases would expand, endangering his internal organs.

"A great deal of research into this problem has been carried on by scientists in WADC's Aero Medical Laboratory. They have developed a workable emergency suit, but the goal is a suit to give protection over a much longer period of time.

"In use now is the T-1 partial pressure suit. This garment encases a pilot snugly from neck to ankles. Along the arms, sides and legs are capstans, which are hollow tubes. When inflated, they tighten laces, which in turn tighten the cloth around the arms, legs and body.

"Normally this suit is worn inflated along with a pressure helmet, either the MB-5 or the K-1, into which oxygen is introduced. If the cockpit should suddenly lose pressure, oxygen is forced into the helmet under pressure and also into the capstans on his suit. The oxygen thus forced into his blood during breathing permits him to retain consciousness, and counter-pressure from the suit tends to keep his blood flowing in a normal fashion.

"Since this is only an emergency suit, a pilot is expected to bring his airplane down to a safe altitude as quickly as he can. Tentatively standardized is an advanced version of the T-1 suit, designated the MC-1. This is the suit that undoubtedly will be a standard item of clothing for the high-flying pilot of the future."

"That sounds awfully warm to me," the old veteran ventured. "First an anti-G suit and now a T-1 suit."

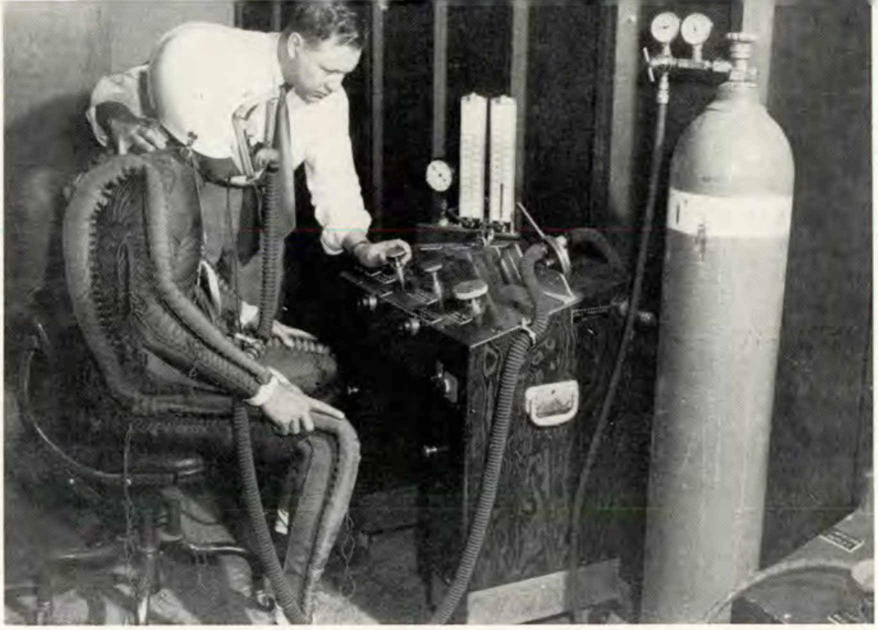
"You are so right. It is warm, but you haven't heard anything yet.

Anti-Exposure Suit

"When it comes to a hot suit, you should see the MD-1 anti-exposure suit. This rubberized nylon garment is designed particularly for drops into water or cold areas and furnishes an air-tight, water-tight covering from the neck to the soles of the feet.

"Attached to this suit are overshoes large enough to be worn over the combat boots normally worn by aircrew members. At present, airmen wear the Mark IV rubber boot, developed jointly by the Air Force and the Navy, but with this type of footgear, it is

This is the coverall type of anti-G suit.



Before wearing the partial pressure suit operationally, a pilot learns pressure breathing.

impossible for the downed airman to shed his anti-exposure suit unless he doesn't mind going barefoot.

"The new anti-exposure suit has a V-closure to keep out water or air and is worn over the XMD-3 liner. In reality the liner is a pair of coveralls, greatly resembling the ordinary flying suit, and can be worn as an outer garment. Both these suits should be standardized within six months. All these layers of cloth would make the pilot really uncomfortable if it weren't for one other piece of clothing.

"This is the MA-1 ventilation garment, which should be standardized about the same time. Realizing that the problem of cooling would come up, the Aero-Med Lab developed this suit which is often called an air-conditioned garment.

"By means of hundreds of tiny holes, air pumped by the aircraft's compressor is forced around the pilot's torso. Larger holes allow the air to escape to the liner and anti-exposure suit. In the latter garment are dump valves at the wrists and ankles where the air must travel to escape. This air evaporates a man's perspiration, thus cooling him. Its principle is the same as the water bags that travelers carry on the front of their cars while crossing a desert."

Ejection Seat

"All of this is very well," the old veteran said, "but if something should go wrong up there, it still looks mighty dangerous to bail out of a high-flying, high-speed jet."

"Yes, there's a certain amount of danger," the colonel admitted, thoughtfully. "But the Aircraft and Equipment Laboratories at WADC are doing all they can to minimize it.

"The Aircraft Lab, for instance, has developed ejection seats that shoot a man out of an airplane either upward or downward. Automatic devices disconnect the lap belt and deploy the parachute some time after the seat falls clear. But more about this later.

"The Equipment Lab, concentrating on parachutes in this case, has developed a guide surface chute that has a lower opening shock and is much more stable than the present one. To illustrate how safe this new equipment is, two of our test jumpers at the Aero-Med Lab ejected successfully from a B-47 at 45,200 feet. There is little likelihood that it will be necessary for pilots to bail out at that altitude for some time to come (they should be able to get lower before leaving the plane), but it's nice to know that they can bail out from that altitude and live.

"At another time, one of these same jumpers ejected from a B-47 traveling at 570 miles an hour (423 knots IAS at 10,000 feet). He suffered no ill effects from the ejection.

"I guess you've convinced me," the old veteran said, "but how does all of this bailout equipment work?"

Automatic Release

"I'm glad you asked that. When a pilot is strapped into his ejection seat—either the upward or downward type—he will wear one of two para-

Left, pilot is wearing anti-exposure suit. Above shows underarm life preservers, back type parachute and the A-1 survival kit.

chutes, the standardized seat-type chute with Class III harness or a back-type chute, also with Class III harness. Although a new back-type chute, utilizing a low-shock canopy, has been standardized, only a few are presently available for testing.

During ejection a lap belt cartridge containing a two-second delay element is triggered. At the end of the two seconds, the main powder charge supplies gas pressure to force open the lap belt latch mechanism, allowing the crewman to separate and fall free of the seat.

"As he falls from the seat, a lanyard with key connecting the lap belt and his parachute's automatic opening timer, pulls the arming handle free, setting the parachute timer into operation. At the end of a two-second interval, the timer then opens the parachute.

"The timer also is pre-set prior to flight to open at 5000 feet above the highest terrain over which the airplane will fly, but in the mill is a plan to have the timer pre-set at the factory to open at 15,000 feet. In high-altitude ejections, the crewman will free-fall until he reaches the pre-set altitude. This altitude setting should be low enough to keep the parachute-opening shock at a minimum. But both the lap belt and parachute can be operated manually at any time by the descending airman if he so desires.

"The new parachute was specially designed by the Equipment Lab. It has small pockets around its edge, called guide surfaces, which permit a more stable descent. The harness is designed with interlacing straps so that it can be easily adjusted with one motion. Designed to hug the pilot's back, the new parachute can be donned like a vest and is 16 per cent lighter than earlier models. Already standardized, this parachute is being purchased now.

"The crewman's job isn't finished when his parachute deploys, however. If his drop is into water, he must inflate his life raft. The modified A-1 global survival kit normally is stowed in a compact package to fit into the ejection seat. When he leaves the seat, the survival kit remains right with him.

"After ejection, the crewman pulls a release, which forces carbon dioxide into the life raft. As the raft expands, it forces open a zipper, running around three sides of the container. When the zipper is fully opened, the container's contents then fall out.

"The raft continues to inflate and hangs suspended from the pilot at the end of a 10-foot line. Attached to the raft is a 15-foot line, at the end of which hangs the accessory kit."

"It seems to me I've seen pictures of that," the old veteran broke in. "But wasn't the raft on the bottom and the accessory kit in the middle?"

"You probably saw a picture like that," the colonel replied. "We have tried it both ways and find little difference in effectiveness. The kits on order now, however, have the raft in the middle. Some of us feel that the accessory kit, by its heavier bulk, gives greater stability during the descent by being on the bottom.

"He also is equipped with the MA-2 underarm life preservers. This preserver consists of two compact units, one fitting beneath each armpit.

"He opens a valve to inflate the two units with carbon dioxide, or, if his drop is over land, he can discard the units. Superior to the Mae West type, this preserver provides better flotation and keeps the wearer more upright in the water. Also standardized, it is being readied for immediate production.

"You can see the set-up now. When the pilot reaches the water, he has his raft and accessory kit attached to him. By drawing the raft to him, he can be out of the water in a matter of seconds. This could mean the difference between life and death under certain circumstances.

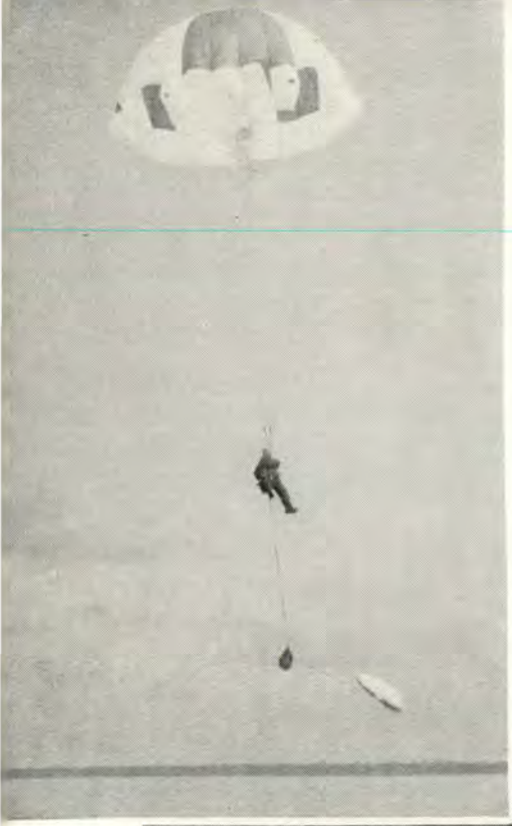
"The new gear also provides for disposal of the parachute, which could drag a man to a watery grave. After the pilot inflates his life preservers and his raft, he can release the canopy quick releases on his harness. As soon as his feet hit the water, he can complete the action by flipping the catches and disposing of the parachute canopy completely. Or, he can release one side and retain the other. This will deflate the canopy and still leave it attached to him for possible later use."

"What do you mean 'later use'?" The colonel's companion asked.

"The canopy parachute is one of the most valuable pieces of survival equipment a pilot has. While on the water, he can use it to protect him from the cold or the sun, and he has a ready-made sail. After reaching land, he can use it for a tent, sleeping bag or hammock and with its red and white panels, is serves as an excellent signaling material.

A-1 Survival Kit

"But to get back to the A-1 survival kit. At present, we are using the C2-A kit with PK-2 raft, which must be inflated after striking the water. With the A-1, a pilot can be in the raft in 10 seconds, while it will take



at least 60 seconds with the PK-2 raft. But the A-1 isn't the last word. Soon to be standardized is the MB-1 container, an improvement on the A-1. It will have a pin and cone closure, ejector snaps for attaching the kit to the harness, and the depth of the seat will be fixed. Otherwise, it is the same as the A-1.

"The A-1 also is known as our global survival kit. The accessory kit contains items that make survival possible in any part of the world—in the Tropics, the Arctic, on land or water.

Life raft and accessory kit stay right with pilot. He can be in the inflated raft within 10 seconds.

Into raft is first step. Note underarm life preservers. Below, man on right shows close-up.

I have a paper here with a list of items in the kit. Listen to this—it sounds a little like a mail order house catalog.

"The bag contains two pairs of socks, a fish net, spoon, compass, ski goggles, a 22-calibre (Hornet) bolt action rifle, sea water de-salter kit and water container, signal flares, candle, salt tablets, razor, matches, pocket knife, sharpening stone, first aid kit, signaling mirror, small stove and heat tablets, emergency rations, sending and receiving radio set, fishing kit and a survival manual.

"Even a man unfamiliar with the kit need only take time to read the manual to learn how to use all of the equipment it contains and to get some helpful survival tips. The Air Force leaves nothing to chance."

"But," interjected the old veteran, "not every pilot flies a global mission. Most flights are made in certain areas—entirely over land, for instance—and a downed pilot might wind up with fish hooks and nets when he could use more emergency rations than the kit calls for. What about this situation?"

The colonel was ready with an answer. "We have just initiated what we call base packaging. Authority has been given to base commanders to vary the contents of the kit to conform to the missions his pilots normally make. For instance, where flights are predominantly over desert country, additional water and emergency rations might be added at the expense of the de-salting kit. The kit as now constituted with base packaging is extremely flexible.

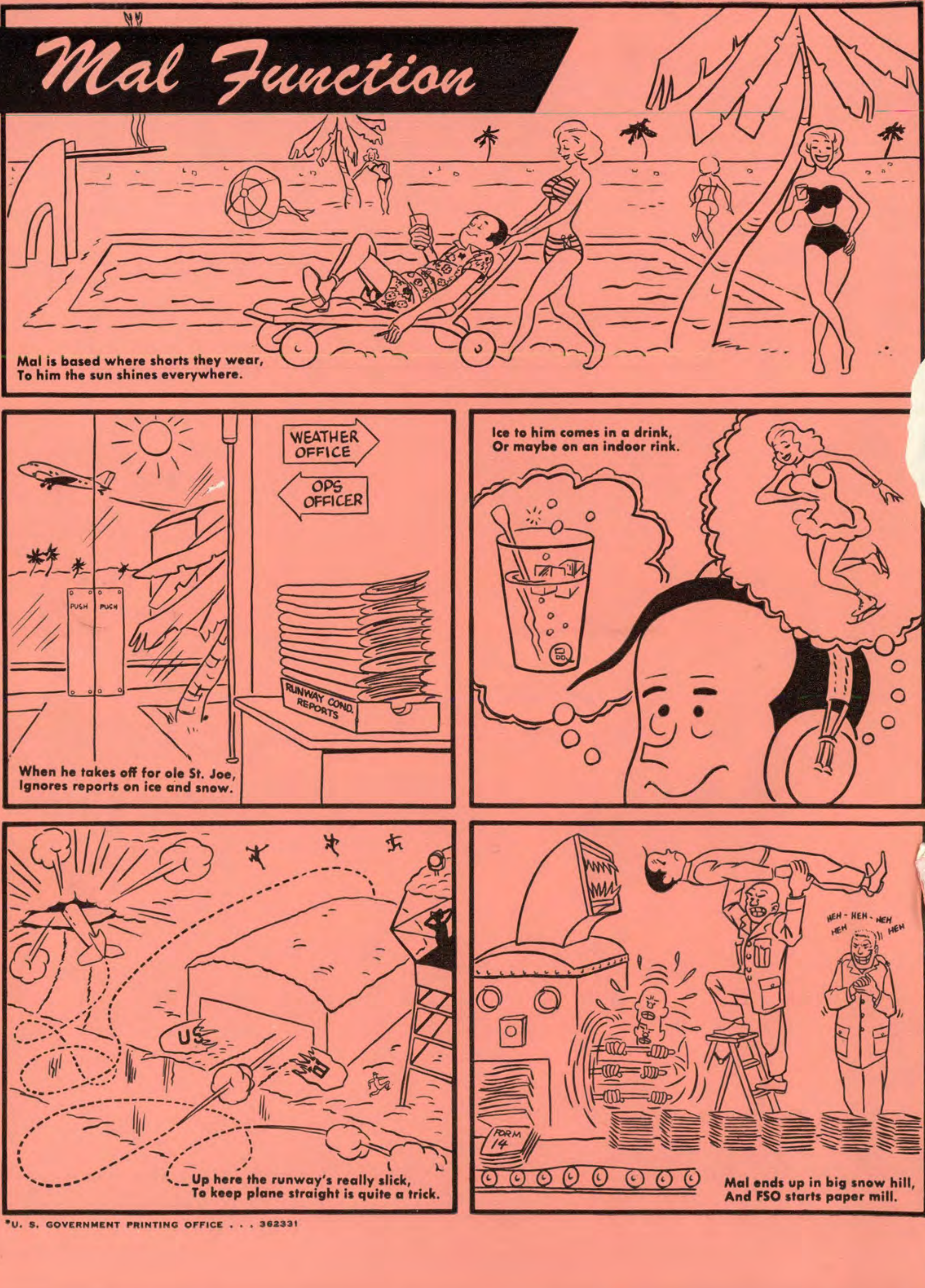
"As you can see," the colonel summed up, "while our planes are flying faster and higher and encountering conditions never dreamed of only a few years ago, the Aero-Med Lab has been fiighting to keep man abreast of, or ahead of, his machine.

"Our first consideration is man's safety. It costs a lot of money to make a good jet jockey and it would be poor business to toss man and machine away indiscriminately — aside from the humanitarian standpoint.

"Our second consideration is a man's comfort. Yes, I said comfort. An uncomfortable pilot or crewman is an inefficient crewman and the speeds and altitudes of present-day military aircraft demand the highest efficiency a man can give. ●

When You Hit the Dirt!

Besides being nice to look at, this little gal is illustrating the latest technique for landing on unprepared surfaces. The whole story is on page 16, "Down, Boy, Down!" Like the lady is demonstrating, there are some mighty interesting angles in the article.



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