APRIL 1955

# FLYING SAFETY

UNITED STATES AIR FORCE

in this issue

- What's the Percentage?
- Situations Unlimited

# FLYING SAFETY

VOLUME ELEVEN NUMBER FOUR

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★ ★ ★

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USAF PERIODICAL 62-1

# *Brigadier General Richard J. O'Keefe*

Director, Flight Safety Research

Brigadier General Richard J. O'Keefe will leave the Directorate of Flight Safety Research, Norton Air Force Base, on April 20, 1955, for reassignment to the Pentagon, Washington, D. C.

Prior to receiving his assignment to Flight Safety Research, General O'Keefe held a number of important assignments including tours in the Canal Zone, Africa and Saudi Arabia. It was while in Arabia that he distinguished himself as Commander of Dhahran Air Field and later as Chief of the U. S. Joint Survey Group.

On March 17, 1951, General O'Keefe was appointed as Director of Flight Safety Research, Office of The Inspector General, USAF. Since then there has been developed the most effective aircraft accident prevention program in the history of the Air Force, as evidenced by a steady decline in the frequency of Air Force aircraft accidents as related to flying hours.

General O'Keefe is a command pilot and technical observer. His knowledge as an aeronautical engineer along with his keen devotion to duty have contributed greatly toward the overall Air Force effort of reducing aircraft accidents.

FLYING SAFETY salutes General O'Keefe, and with a hearty thanks for a job well done, wishes him . . . *Bon Voyage!*


LETTERS TO THE EDITOR

### One Each Air Instructor

My present classification is "One each Air Instructor." My assignment to the 136th Fighter Interceptor Squadron of the 107th F-I Wing, New York ANG, Niagara Falls, N. Y. ($2.00 tours can be arranged to see the Falls.)

A few words on the reason and motivating forces behind this letter. As you can readily detect, it's my first one to you. My duties are to advise and assist the unit in every way that I can. Primarily to assist in the Flying Training Phase.

The 136th FIS served on active duty during the Korean emergency. When the unit was relieved from active duty, only a handful of the pilots came back with it, most remained in the active Air Force. So the task has been to rebuild the unit from paper and scratch. Our pilots are a rare mixture to say the least – former bomber boys, training commandos, cargo, MATS, civilian air lines, crop dusters—you name it. We have every type of driver there is.

Most naturally one of the major problems is accident prevention. The pilots are not under direct supervision as an active duty pilot is. They are all together only four days a month. The only means left to keep them current is through written directives and magazines such as FLYING SAFETY.

In order to assure ourselves whether the pilots are reading the material, and equally important, whether they are getting anything out of it, Captain Michael Svisco, Operations Officer, and I experimented with a test. The August issue of FLYING SAFETY was issued to each pilot on the 2nd and 3rd of October 1954, with instructions to read it.

On the 16th of October 1954, all the pilots were given the test. Results were as follows: Out of 12 questions and nine pilots participating, one pilot got 10 correct, one pilot got nine correct, four pilots got eight correct, and one pilot seven, six and five each, in that order. It shook and rattled them into realizing that they had been passing over some very good and important material.

This has been done before I'm sure, but thought you might be interested to know that our angle on accident prevention is to use the approach of flying education. This is only one of our ideas and steps that we are using or plan to use.

**Major Nile C. Greer**
**Air Instructor**
**107th F-I Wg, NY ANG.**

★ ★ ★

### One Ear Receiver

If the following suggestion has not been made before I would like to suggest that the Air Force get rid of its present type headset and adopt a small one-ear crystal receiver. I have used one for approximately a year and find it very satisfactory from two standpoints.

First of all, it leaves one ear free to hear what your copilot is trying to say to you. Using the old headset, when the copilot wishes to speak to you, and the interphone is busy, both the copilot and the aircraft commander must reach up and remove their headsets. With one ear remaining free, this is not necessary.

Also, I find it more comfortable than the two-ear headset. The old type headset had a tendency to cut off the circulation in my head, causing a headache. This one-ear crystal set eliminates this trouble.

I have suggested this one-ear crystal headset to other aircraft commanders and pilots and not one has been dissatisfied with the idea, after giving it a good trial run.

For those who would like to try the idea, you can pick up a good crystal receiver for $1.50, take it to the radio shop and have them put a plug on it, and you're in business. To me the $1.50 expenditure is more than worth it in the comfort received.

**Lt. Col. Bernard J. Bushue**
**372d Bombardment Sq.**
**APO 239**

*Sounds good to us. FLYING SAFETY would appreciate getting more ideas like this from the field to pass on to the troops.*

★ ★ ★

### Carburetor Trouble

We would like to point out a misconception in the November issue in the article "Beginning of the N." On page 16 the article states "Determining if the N has a Holly or a Bendix type carburetor is a good trick." The writer evidently has never seen a "Bendix N." The carburetor air intakes are shaped very much like the intakes on the reliable old "Gooney," considerably different from the Holley installations. A glance at the front of a B-25 will tell you if it has either Bendix or Holley carburetors.

We would also like to point out that the Bendix installation on the B-25 would seem to ice up more easily than the Holley does.

We read, avidly, every issue and think it's doing an excellent job.

**Capt. Leallen French**
**1st Lt. Richard P. Schumann**
**1st Lt. Charles E. Phelps**
**Ralph W. DuMont**
**Flight Test Station**
**3575th M&S Gp, Vance AFB.**

*Men, you are so right. No "N" with the Bendix was available here for inspection. WADC required they be placarded when the new carb was installed so it was assumed that it was somewhat difficult to identify.*

*This month we are taking a bit of editorial license in order to call your attention to "Looking at the Maching Bird" which starts on page 4. This is no ordinary run-of-the-mill yarn. On the contrary, it presents some very solid facts concerning a relatively unknown phase of this flying business - - supersonic flight.*

*When we first started playing footsie with A bombs and other nuclear devices, few people realized how the little monster would grow until it was the tail that wagged the dog. Now it seems as though our designers are dragging us into aerial skyrockets that not only outstrip sound but will soon outstrip man's ability to cope with the beasts. It is conceivable that we well may be entering the final phases of manned flight as far as aircraft in warfare are concerned. The supersonic airplanes that we dreamed of yesterday are here today; and mañana will be here before we realize it.*

*One of the earliest to crack the sound barrier was Tony LeVier. His thoughts on supersonic flight are reflected in "Looking at the Maching Bird" and to Tony and the men of his profession we render a sincere salute. They are the ones who are pioneering the way for things to come. New concepts in speed are the order of the day.*

# *...the FUTURE is HERE!*

*Back in the days of stick and wire airplanes, a young fellow named Tony LeVier got the bug to fly. As a matter of interest it may be noted that he checked out in an airplane long before it became necessary for him to master the techniques involving a safety razor.*

*Tony was suffering growing pains right along with the aviation industry and in a sense, they grew together. For more than 25 years he has been fooling around with a bit of everything that flies and today, as Chief Pilot for the Engineering Test Flight Section of Lockheed Aircraft Corporation, he probably has as great a share of aviation know-how as any man in the business.*

*THIS ARTICLE is based on a lecture delivered by Tony LeVier recently to the Los Angeles Chapter of the Institute of Aeronautical Sciences.*

★ ★ ★

. . . then the "one minute flag" goes up. One minute away; sixty seconds from the start of this race. I tell you, you've never been so excited in your life. You sit there in the tiny cockpit and can see all around. The whole field, maybe the whole world is vibrating with excitement. The men on the wingtips and the man at the tail, holding you down as you rev up the engine (you don't have chocks or brakes), fight the prop blast and the tugging. You can feel the plane straining as though it were a thing completely alive. You're a part of it too, and you want to be unleashed. You want to go — leap aloft — be free of these restraining influences.

It isn't going to be an easy take-off. Those little 10-inch wheels are hardly more than skids. The field is just a sod plot of ground and you know it's full of pot holes and ruts. You remember the last race. It was a short one too, but you had to put some gas in the tank back of the seat and it raised hob with the C.G. Now you've got gasoline in there again, only this time the tank is full. Where's the center of gravity? Maybe clear back by the tail post.

You didn't want all of that fuel but this race is just a bit more than important. This is it! 300 miles. A rectangular course around and around four pylons. This is the money race. You make it on this one or your name is mud. You've got to make it on this one or you'll be a has-been. Okay, the rear tank is full. Enough fuel to make the race. 45 lousy gallons.

The flag comes down. As the starter's arm descends, you open the throttle. There's no jar — no jolt. You just sit there with the little prop making an invisible blur, and the engine screams. Finally you feel the tiny racer begin to waddle forward. It's just that. A waddle. Earle Ortman is

# Looking at the Maching Birds

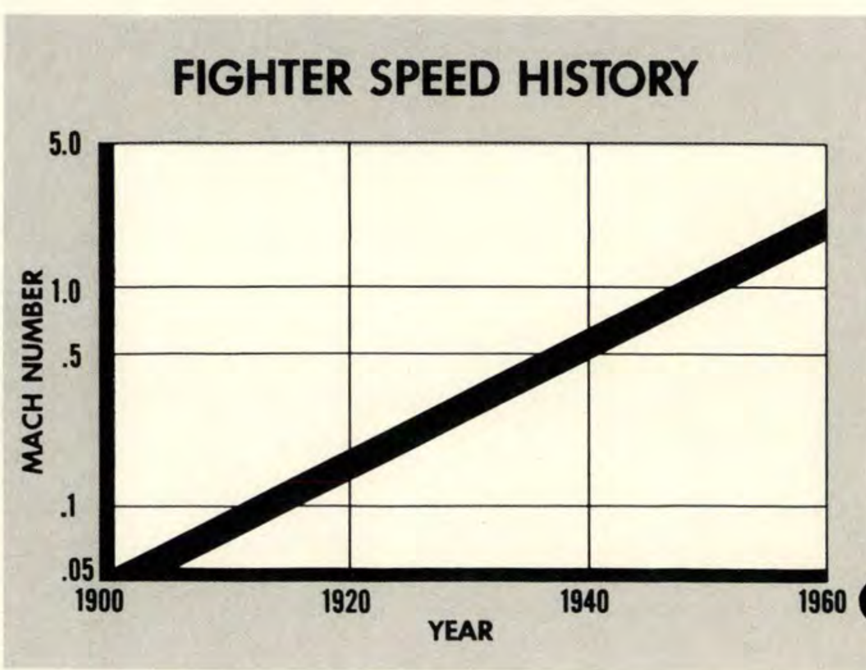



Figure 1

crowding you on one wing and Roscoe Turner is hunkered down on the other side. They're always the fastest starters and there you sit between them with nothing much for control, no acceleration and that horribly dry feeling in your mouth.

In a sense, you know you're lucky. You have a wonderful little airplane, but it's necessary to carry full nose down trim. That weight in the rear is going to cause some trouble. On the last race with only a little in the tank, only 15 gallons back there, the plane was hard to handle.

Half way down the field the stick is right up against the forward gas tank. You can feel the cold metal on your knuckles. Then you hit the first bad rut. There's no second throttle to straighten the plane. No brakes. Then the nose bounces up and the attitude is suddenly very steep but the tail skid is still dragging on the grass. You can feel the acceleration now and the end of the field is coming up fast. If you chop it . . . well, there's a thousand people milling around. You haven't got the guts to chop it. You've got to fly.

Okay, you do fly. Not the way you've been taught. Not the way you know an airplane should fly. This isn't a normal climb in any sense of the word. Talk about a homesick angel, this baby can qualify! The stick is still jammed full forward as you clear the crowd and suddenly the altimeter begins to wind around the dial like mad. At a thousand feet you begin to have a little play in the stick. You can get your knuckles clear of the forward gas tank and ease off a bit on that arm-killing pressure.

It's turbulent up here and the baby racer is bouncing like a chip. You can't control any of that with the stick though, and then you see the starting pylon and suddenly think of what a crazy business you're in and wonder if you shouldn't abandon the whole affair. The rest of the planes are disappearing in the haze up ahead and you make with the mental slide rule fast. "Let's see, 300 miles to go and maybe we've covered a half of a mile with the blind staggers. You shift tanks. Let's burn that lousy gas out of the rear. Then the first turn is coming up and you've got to make it, but there isn't any back pressure used in this turn. It's full ahead on the stick, and even then you almost stall the thing out.

Well, you make that first turn and finally complete the first lap, and then each time around the circuit gets a bit easier. Every trip around the pylons accounts for an additional couple of gallons of fuel, and by and by the CG begins to slide forward and in due time you have good control of the little monster.

So you're lucky, or maybe you're good. In any event, you're just a little luckier than the rest of the guys and you finally grind in ahead of 'em by a few whiskers and pick up the big dough. Of course you don't feel too elated until after you pop that galloping kite onto the ground. You're sure that old Roscoe slipped under you once and that meant he had lapped you around the course. You never considered the possibility of anyone but you having troubles. But you were wrong, everybody was having troubles that day and you were lucky to squeeze out a second place win.

Okay, briefly I've tried to put you in the seat of a midget airplane and fly a big-money race, for I feel now that maybe I can show you how we dreamed and designed and built and raced and sometimes didn't quite make the grade.

To begin with, we took a tiny airplane and greatly extended the purpose for which it was designed. In other words, we took a midget and tried to compete with the big boys. Actually, it was mostly luck that we were successful. We packed in a tremendous amount of fuel and (this is important) we didn't do it right. This whole business could have turned out exactly opposite to the way we intended. Old Lady Luck was along and there isn't any other explanation. However, from such silly tricks as these we began to develop some know-how in the flying business. Weight and balance started to mean something, and our design people took every lesson to heart and later made them all work for us.

**Very Thin Airfoils...**
**Some Sharp Leading Edges**

Back in 1941 I joined the Engineering Department of Lockheed. After years of barnstorming and racing I knew all the answers, and of course I really was a sizzling stone. It wasn't long until I could do impossible things with P-38s, and then one day when I least expected it, I got into compressibility. I was looking up at some trees when I got out of that dive, and it suddenly occured to me that maybe there were still a few unknowns in this flying business.

None of us like unknown factors. We're always a bit afraid of anything we don't understand, and so by trial and error we gradually learn the whys and wherefores of each problem as it appears and then after we know, we try to pass on the answers.

### Jet Age

We thought we had most of the problems of flying licked after crowding every ounce of performance into reciprocating aircraft. Then along came the first jets. They really upset the applecart. Maximum performance for a piston driven plane suddenly became almost minimum performance for a jet, and as these speeds increased we ran up against something else . . . the sound barrier!

Starting with the experimental airplane, built by Bell, followed almost immediately by the F-80, the transition from reciprocating power to jet power was almost an overnight affair. The jet age was with us, and we were pretty much unprepared. Our thinking and our planning had to be altered radically. Even those of us who were in this new industry little realized where these blow-torches were leading us. We had a tiger by the tail, and it took a lot of doing to tame him.

In those early days, the combination of a jet airplane and a jet engine was considered to be the answer to almost every problem. I remember in particular a group of engineers waiting for me to make a test flight. One of the design men from an engine company said, "You know, our problems are over. The jet engine is so simple that we'll no longer have any great amount of trouble."

How wrong can a guy be?

### The New Look

Then came 1949 and we entered the speed-nutty age. This business of cracking the sound barrier became a must for everybody in the business. If you hadn't cracked through, man, you hadn't lived!

I remember the first time I went through. Of course in those days you were on your own. We were all building aircraft with the same goal in mind, but at first nobody was passing out any free advice. Fortunately I had a good machine. It was well de-

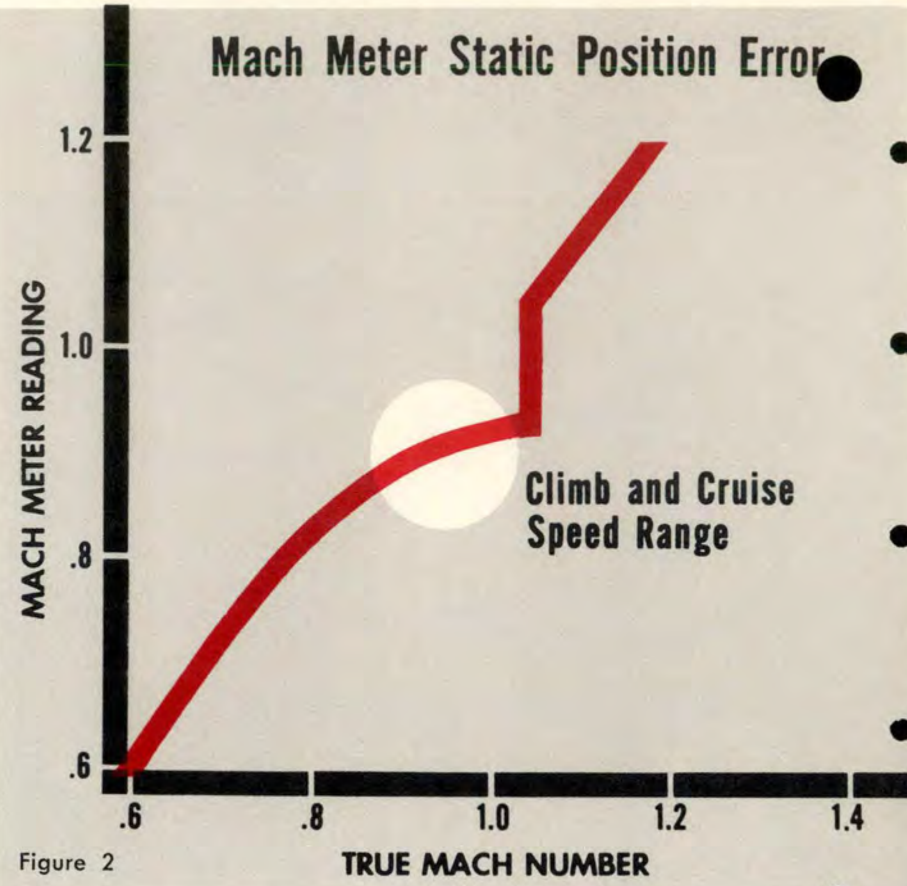
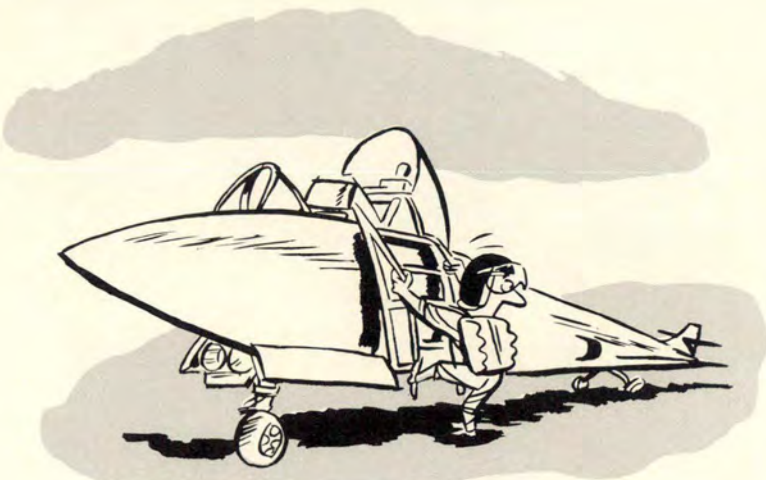



Figure 2

High or Low Horizontal Empennage Surfaces...None in Between



Longer Compared to Span ....

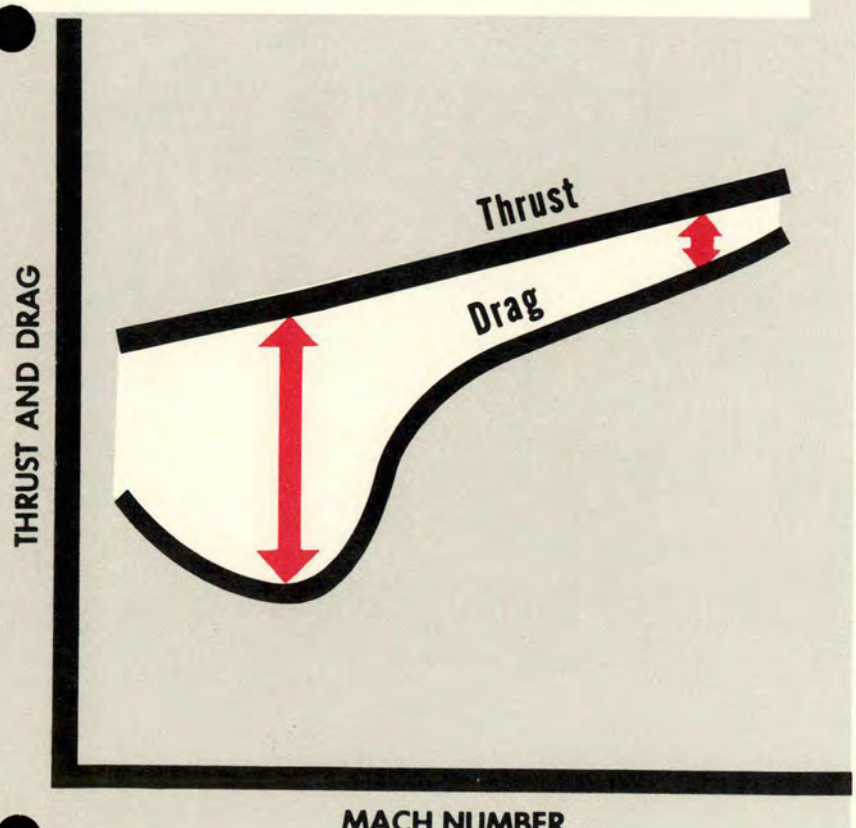



Figure 3

signed and well built. I didn't tear the wings or the tail off, and the plane and I both survived our first trip through the speed of sound. Now we've entered another new era. I call it *The New Look!* We've licked our old problems of sub-sonic speeds, only to be faced with new ones as we crowd across Mach. Our fighter planes have jumped into the 100 series, and the race is on again.

Airplanes today have a brand new appearance. You've seen most of them and once again you're asking, which configuration is best? We have deltas and swept wings and straight wings and some with almost no wings. If you'll look at Figure 1 you'll see what tremendous advances have been made in this speed business.

Back in 1903, the Wright Brothers' first airplane flew at 40 to 45 miles an hour. That's about .05 - .06 Mach. Now, if you'll follow the speed line on the graph, you'll see that we've doubled our speed every eight to ten years. By 1950 we had reached the sound barrier and were pressing against it in level flight. Then a peculiar thing happened. In the past two years we doubled the speed of sound and have gone through one barrier only to encounter another. We've accomplished as much, speedwise, in two years as we had accomplished previously by slow steps over a 50-year period, and the end is not yet in sight.

By 1960 we're going to be traveling awfully fast, and we've got to accelerate our thinking and planning once again to stay abreast of our advance into *The New Look.*

Now, let's take today. Right now, 1955. If you, as a pilot, should visit an Air Force test center, you'd find many different airplanes and a lot of strange and different configurations.

Every manufacturer is shooting toward more speed and better stability and control. Probably the outstanding difference in outward appearance of many new aircraft over the old, is the horizontal stabilizers. One may be extremely low. Another extremely high. In these super-sonic airplanes one may well wonder where it should be, but it probably won't be where it used to be, otherwise it would have been — and there you are!

Fuselage design too has changed a great deal. It used to be that the normal fuselage was about two thirds of the span of the wing. Now we find that most fuselages are twice the wing span and apparently still growing.

Our wing designs are changing radically too. Regardless of configuration, delta, swept or straight, each must be of low aspect ratio if they're to do the job. They've got to be razor sharp and razor thin. We have to forget such airfoil designs as the Clark Y and the Davis. They did a job, and a good one too, for slow airplanes, but today's wing in profile just doesn't resemble anything we've ever seen before.

Cockpit layout remains virtually unchanged in the supersonic airplane. Maybe it is improved a bit, but I feel that there is still room for refinement. One feature that is changing fast, however, is power over weight. Even though these new airplanes get bigger and heavier with every design change, the engine manufacturers are crowding ahead and making greater power available. This means, of course, that takeoff performance becomes increasingly better all the time.

As in all jets, altitude means miles when balanced against pounds of fuel consumed. To get that altitude we must climb on an exacting schedule, and right now it looks as though the best way to derive maximum climb performance is by utilizing the Mach meter as the gage, rather than the airspeed indicator.

Unfortunately, even the current Mach meter has certain limitations. This is known as static position error. Inasmuch as our newest aircraft climb and normally cruise in the subsonic range, it is unfortunate that this position error occurs right where we need it most. In reality, we're flying faster than the meter indicates and as speed increases, so too do drag and fuel consumption. Combat-wise, these new planes are critical as far as fuel is concerned. That is why I say we climb, cruise and let down on a definite schedule. As in any airplane, it'll do the job if the pilot is alert and careful. It's the careless lad who gets into trouble. That applies to any airplane ever invented.

### A New Barrier

Another problem that faces us today is discovering the most economical power settings to insure maximum performance. This is a case of taking thrust and drag and working the two against a given Mach number for the greatest efficiency.

In the older jets, we found that the thrust line and the drag line usually met in the sub-sonic level and that, mind you, was with everything open. Throttle at 100 per cent and afterburner on. In these new birds, however, we find a different condition. We have low drag and high thrust — tremendous thrust. When we chart the performance, we find that the drag line rises quite sharply as we approach Mach, and then after passing through the barrier the drag line and the thrust line start to parallel each other and apparently continue on into infinity (see Figure 3).

As I noted previously, we're up against a new barrier now. It is the heat barrier. Call it thermal, if you prefer. Here our engines are running against a restriction of temperature, and eventually we may have to fly by a temperature gage when we get into the higher speeds. Okay, that's just another problem. We'll lick this one just as we've licked all of the other impossible problems in the past.

**High Thrust to Weight Ratio...Rapid Acceleration**

**...Dives Get Real Hairy**

We have to recognize today, more than ever before, that speed is energy. You store it up. The faster you go, the more energy is available and you can do a lot of things with it.

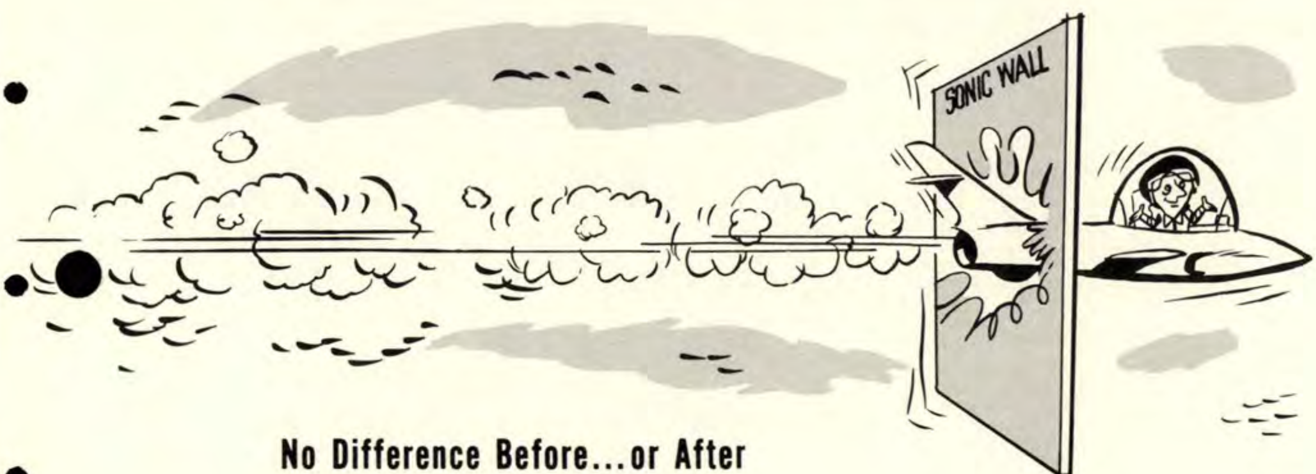
At altitude, indicated speeds may be low. Don't ever let that fool you because the true airspeed is high. And, you can use that speed in these supersonic jobs to a far greater advantage than you've ever imagined.

In the new fighter craft, you should remember that energy goes up by the square with increasing velocity, and from an altitude of 30,000 feet one may well zoom up to 60 or 70 thousand feet, if need be. Then, too, this be anywhere between 50,000 and 100,000 feet per minute! And, if that doesn't pop your eardrums a bit, I'll put in with you.

Back in the old P-38 days we used to have a Dutch Roll problem. This was the roll-yaw ratio deal, but fortunately the period was quite protracted and we could cope with it okay. Then came the jets and this oscillatory dynamic characteristic got a lot shorter, and finally came this new breed of cats and now the condition is about as short as a pilot can think. We know that our designers and engineers can dream up an airplane that will eliminate this oscillation factor,

Above all, any fighter airplane must have a great deal of basic stability. If, under certain conditions or within certain speed ranges, oscillatory factors are induced that upset this gun platform or weapons system, then we must have stability augmentors or rate dampers or other gadgets to prevent such oscillations, especially at critical moments.

You'll note that I use the word "gadget" when applied to rate dampers. Actually, that's what certain engineers call them, but if that terminology is correct, then I'll settle for calling fuel controls gadgets too, and you won't get off the ground today




**No Difference Before...or After**

stored up energy can be put to good use combat-wise, such as making complete turns without stalling instead of the usual 90-degree blind staggers that you've come to expect.

I'd like to inject a word of caution at this point, and I'm aiming it especially at you younger pilots. Take that tremendous amount of energy that you've stored up at 40,000 feet. It's great stuff and you can use it wisely or foolishly. Maybe you decide to drop down to the deck and shake up the troops. So, you split-S out. Well, in all probability that will be your last maneuver because your rate of closure with terra firma will

or dynamic characteristic, and like the rest of our problems, it eventually will be licked too. I bring this point out only to show you that *The New Look* is progressing steadily but a lot of spadework still remains.

Now as you all know, we speak of military aircraft as gun platforms. At least, we used to speak of all fighter planes that way. But today we call them weapons systems. Of course, I don't care what you call 'em as long as we remember that we're carrying guns to shoot down an enemy, and as such we have to consider the airplane as a part of the gun or guns.

without a good fuel control system. By the same token, a good airplane, a good fighter plane, must have stability augmentors if we are to depend on it under all conditions of flight.

### Radius of Action

Now let's consider another problem with our supersonic fighters. Maybe I'm using the word "problem" too often. Actually we have no more obstacles to think out and overcome in these new airplanes than in the old OX-5 Wacos. But this one concerns a basic radius of action problem. You're going to take your plane out

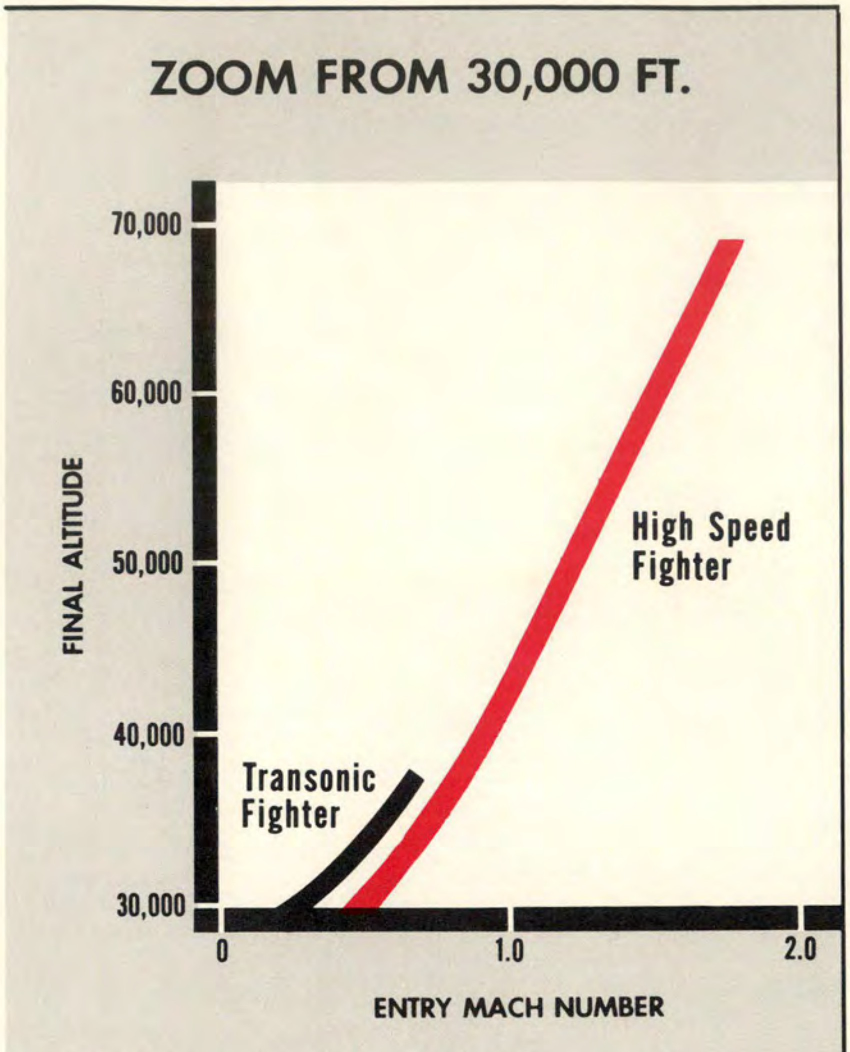
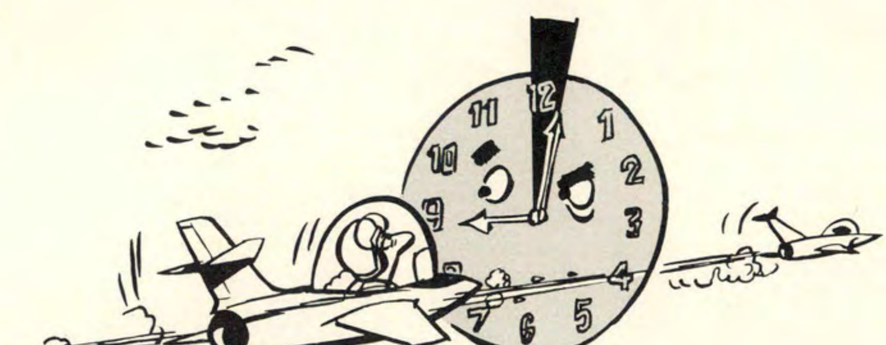



Figure 4



**Two Minutes More Combat Than Planned... Can't Get Home**

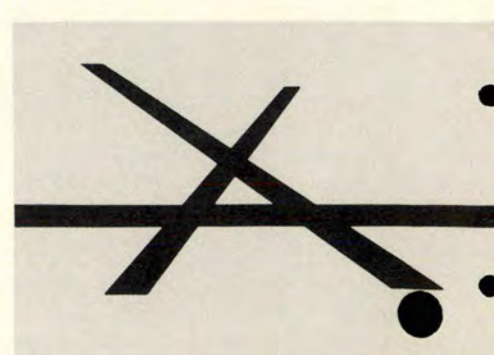
on a normal combat mission, possibly 250 miles from base, fight for five minutes at full bore and then return home. Of course procedures may vary a bit to suit conditions. Weather, tail-winds, cross-winds or other variables, but basically it's a routine chore.

Okay, you leap off, rendezvous with the rest of the flight upstairs and head on out. Somewhere out beyond the bomb line you tangle with the bogies. This is where you start figuring performance by a clock. You've got to know within a matter of seconds how long you can stay in the combat area, when you've got to break off and exactly how you'll fly the mission home.

Possibly you'll have time for just one pass on a target. Maybe you'll have time for several. Remember though, you're flying at supersonic speeds now. I don't know how you pick up your targets. I imagine that the radar scope will assist. Then you lock-on to your objective. It's a head-on pass. You both miss (well, it can happen, you know), and you might as well figure that you won't see him again for at least two months.

Of course, there's always the chap who decides to turn and give chase. Bear in mind that I'm not belittling the merits of individual combat, but I know that the lone pilot who forgets the clock and bores away deep into enemy territory for five minutes or so after a fleeing adversary, just isn't going to make it back home.

We had the same problem in World War II and to a certain extent in the first war. The only basic difference today is the time element. We've got a lot less of that particular commodity now. Take three or four minutes of extra combat and you're going to use up 10 to 20 times as much fuel as in normal cruise. That's the ratio even though it's only rule-of-



thumb. Just stick around too long and forget the clock and you'll be entering the traffic pattern on fumes instead of JP, if you're lucky enough to get that far.

### Approach Technique

I've had a lot of people ask me about landing these new airplanes. They feel that anything that flies at supersonic speed must be a scarey brute to plunk onto the deck. 'Taint so. Actually they're easy to land if you know the rudiments of flying and reduce the handbooks to facts. You should talk with people who know the ropes and get to know every system of the plane before you leap off.

I sincerely believe that any 400 to 500-hour military pilot who has grown up with jets can fly these new craft safely and efficiently. You've got to be led properly and taught properly and clued-in on the few factors that must be watched. Like the old railroad slogan, you've got to stop, look and listen before you can start. Do that, and you've got it made.

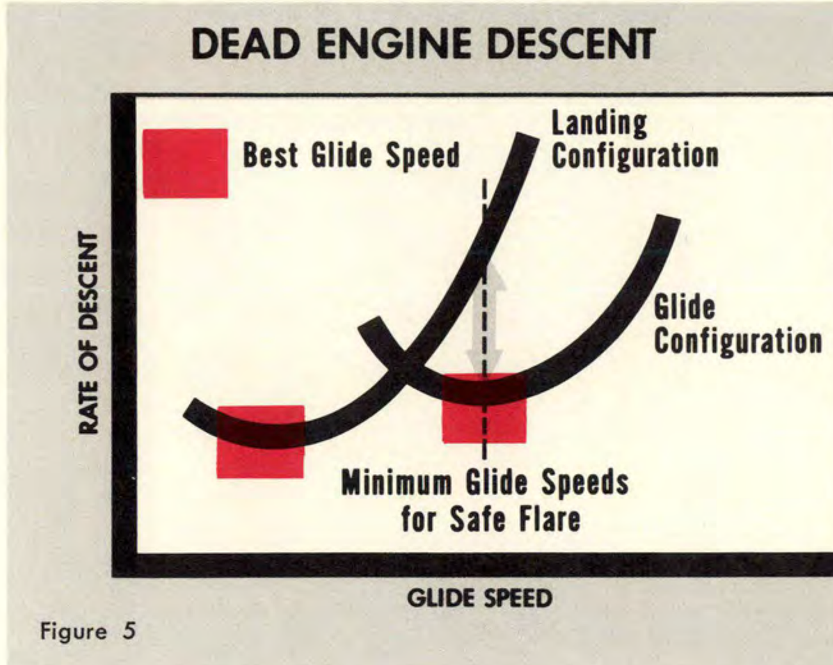


Figure 5

Years ago when I flew my first jet I recognized the fact that here was no ordinary airplane. I tried to convey my beliefs into the original handbooks that I helped to write. Even the best of pilots have failed to recognize some of the jet shortcomings, at first. When you were coming in for a landing and suddenly realized that an undershoot was becoming a reality, you poured on the coal and got exactly nothing. Engine acceleration time was anywhere from 15 to even 20 seconds. A few times I've had a lousy fuel control hang me up for as long as a minute. Things have changed a lot since then, but we must not forget the early lessons.

Fuel controls are much better today and the engines are better, but believe me they're still not good enough to come in on a normal ap-

## Chase Instead of Dogfight for 5 Minute Combat Time ... Can't Get Home

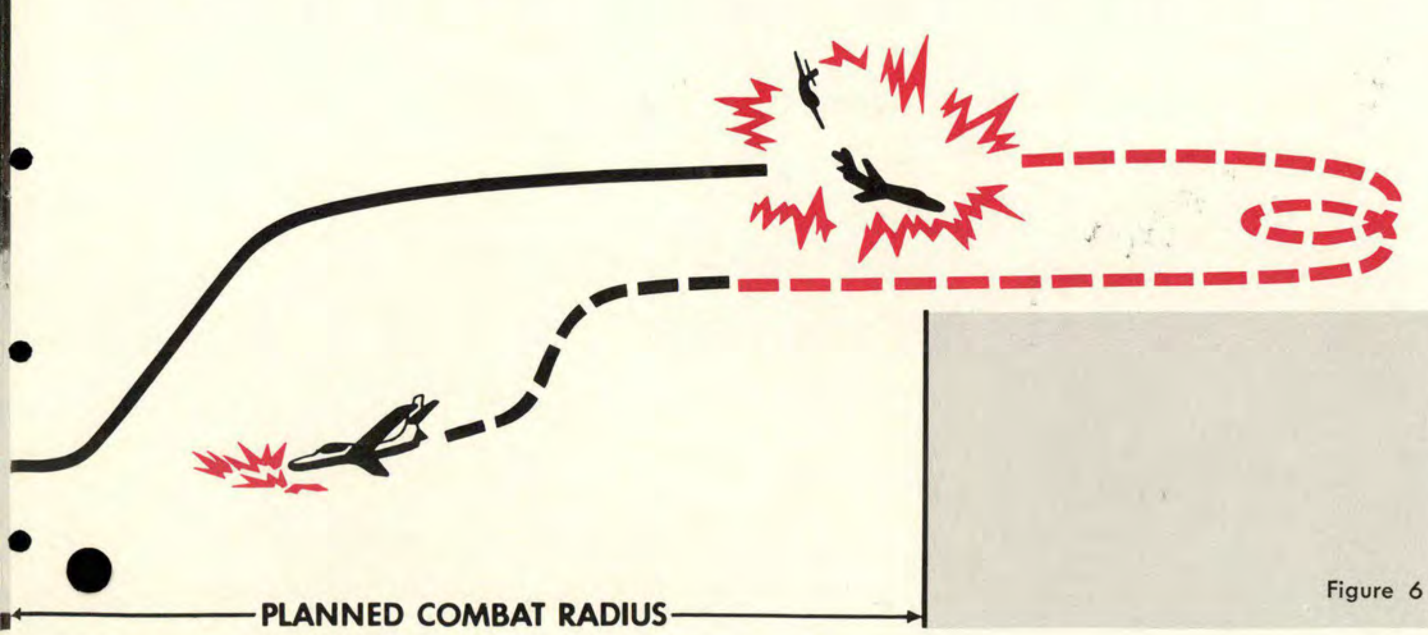
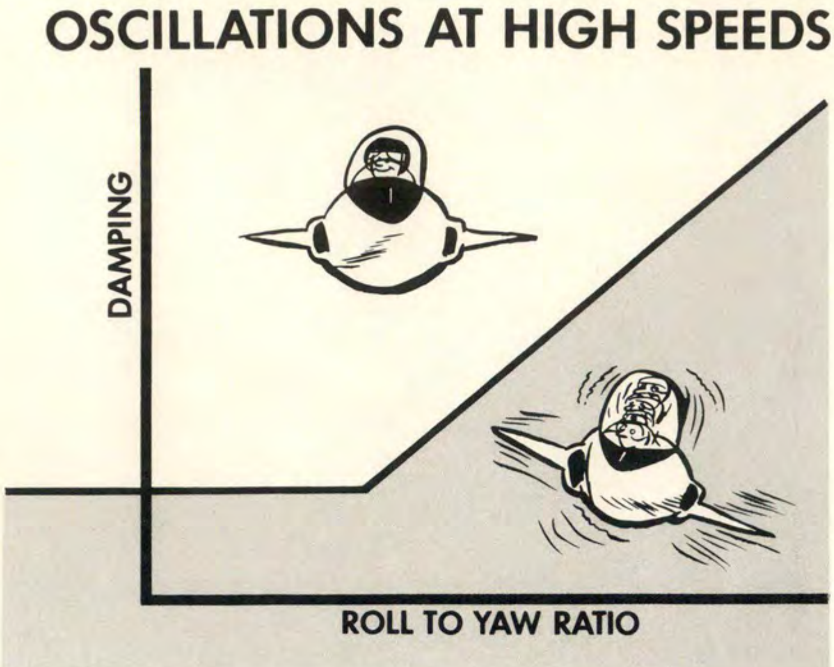


Figure 6




proach, chop the throttle and still have instantaneous power, if you suddenly need it.

Just for the sake of discussion, let's say that you have been out on a two-hour combat mission. You come back intact, arrive over the base with 800 pounds of fuel, maybe 400 pounds, but no matter. If you've enough fuel remaining for one minute, you have it hacked. That's all your approach will take. Just one minute. Then at this point you get a little careless. You figure that you'll chop the throttle and save as much fuel as possible. You say to yourself, "I've got to make this approach with the throttle in idle because the engine might flame out."

Well, maybe it will, but it kept grinding along while you were deep in enemy territory and it brought you home and there's still a few pounds of fuel left, so the odds are that it'll keep on running until you're in.

What I'm really getting at is this. Take a good look at Figure 7. You chop that throttle all the way back in your supersonic fighter and, brother, you probably won't make it. In a nutshell, you'll prang short. Note that I say prang, not land. If on the other hand you carry a wee bit of power and then see you're not going to make the runway, chances are against your making it even if you do slam it into full bore. Know why? Your reaction time is about 17 jumps behind the airplane. But if you carry plenty of power for the particular configuration and make a standard power-on approach, then you'll have it made with no sweat.

Still discussing our newest airplanes, there are certain factors that are different from any of our previous models and types. As noted before, every supersonic plane is, of necessity, one of low aspect ratio and when you get an aircraft of this type down in the lower speed ranges, such as are necessary for approaches and landings, there is a tremendous amount of drag evidenced, even if the gear and flaps are not down. Now, if we lose an engine because of combat damage or other factors, then we have to be thoroughly conversant with dead engine descent procedures. Right now, that's where we come into the picture.

If you'll study Figure 5, you will see two curves. In essence they do appear similar but there is one out-

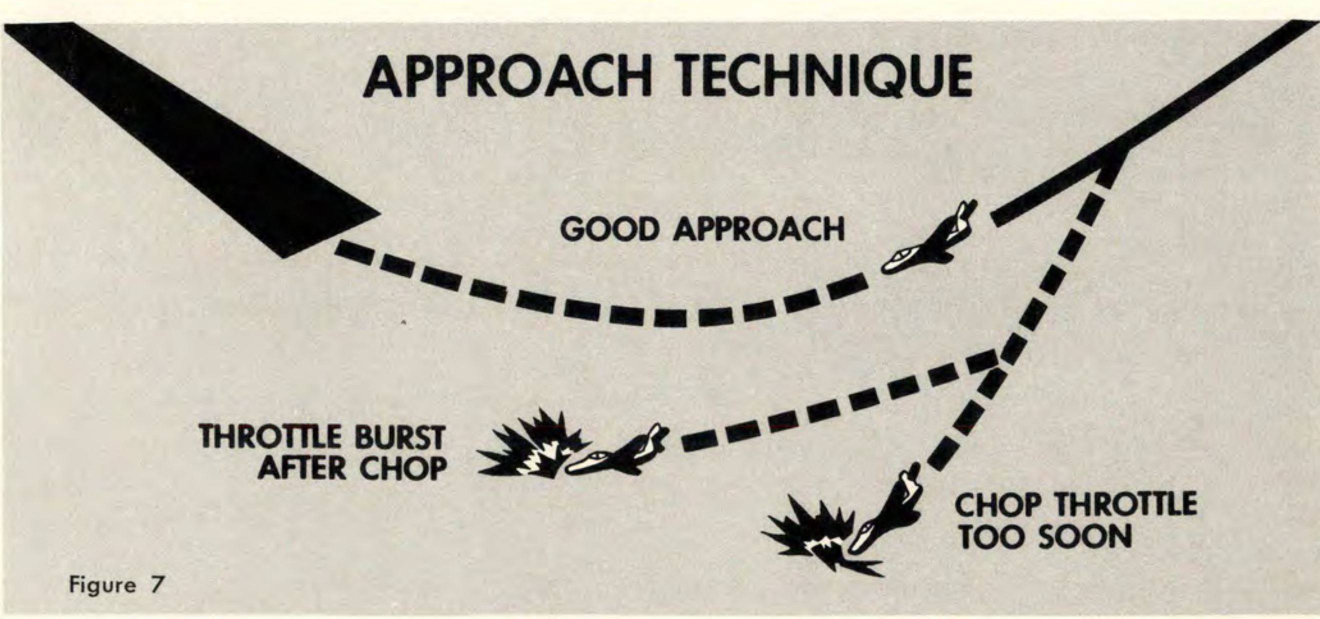



Figure 7

standing difference. The one on the left is plotted for landing configuration while that on the right is for a clean airplane.

In plotting these things, our engineers have to consider two factors: rate of descent and glide speed. What we're trying to find is a minimum speed for the least amount of sink. In other words, it's a case of lift over drag (L/D). Such curves as these are accurate. I know, for I've flown 'em all. However, this particular one on the left would curl your hair and after I'd fooled with it for entirely too long, I decided I'd best get with the slide rule boys and try some brand new tactics.

As an individual I like speed. The longer I flew these plotted glide curves, the more certain I became that if we moved back up the left curve a bit, we'd be better off. In essence, more speed spelled better control to me. Although the engineers had figured these curves for optimum efficiency, i.e., lowest sink for minimum maneuvering speed, the fact still remained that this didn't feel good. There was nothing left to play with. No surplus speed, or kinetic energy to juggle when flight conditions were not completely static. So, I elected to give more glide speed a bit of a whirl.

Somehow that didn't work out either. It gets extremely disconcerting when one looks out through the top of the canopy and sees the landing strip and that rate of sink was out of this world. I've seen bricks fall slower. I wonder who called all this a glide? Anyway I finally decided the curve on the right might be the answer if we could just solve a few small problems.

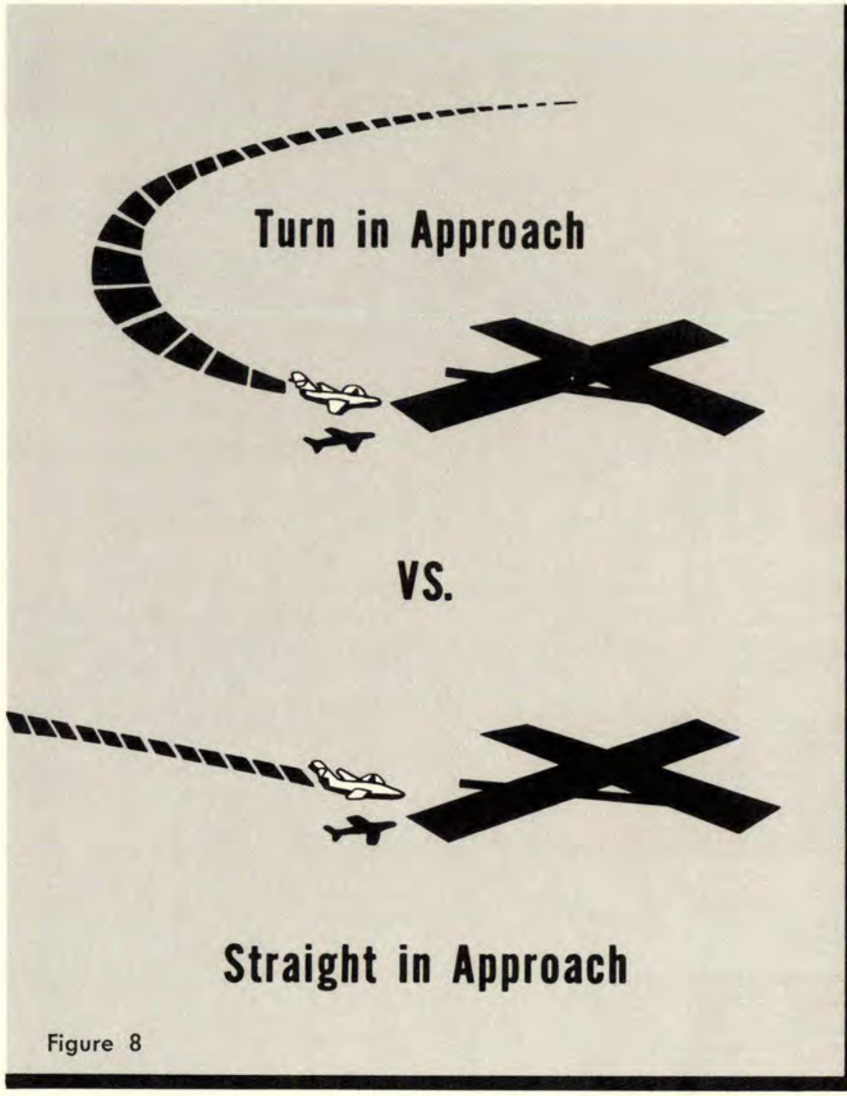


Figure 8

First was the matter of flaring out properly. Possibly 1500 feet would be a bit too high and then too, 500 feet could well be too low. This was a hard one to solve (remember, I don't have any greater error margin allotted to me than you have) and then the thought occurred that if we could design a quick, free-fall gear, possibly our second problem (gear not down) would automatically solve the first problem too.

Somewhere along the line there's always a solution to these things. Now we have to acknowledge that speed means better control. We need speed for our approach, for starting the flare, for whatever little bit of jockeying is necessary and for good control on the touchdown. So, somewhere in here we've got to get the gear down but not so soon as to build up a lot of drag and louse up that L/D factor prematurely.

Another bet that has been overlooked by some quarters is the possibility of establishing some optimum flap settings. There's no reason why we have to put flaps down and leave them there. Just as easily we could work out varying flap settings for various configurations that could be applied as needed at different points along the glide path and still take advantage of every bit of energy to derive maximum efficiency from our plane. These are factors that weren't worked out overnight. We don't have a magic wand but like the rest of our problems from years past, we're slowly building up our know-how.

I am firmly convinced that we're going to have to revise our flameout patterns for the supersonic jobs. The tried and true high and low key positions just won't work out in the new babies. With a dead mill, rolling into a gliding turn increases the rate of sink all out of proportion to anything you've ever experienced. We're going to have to establish aiming points for a straight-in approach, practice for proper flaring and plan a good many miles ahead of the airplane. Actually, it won't be any more difficult than our present flameout patterns, after one gets the hang of it.

Well, there you have it. Maybe I've rambled about a bit. We're entering the supersonic age though and sometimes we have to look back a little in order to see ahead. ●

# round trip

THE SETTING is on the flight line of a southern base on a typical day in mid-November. The temperature is in the mid-60s. Under the wing of one of our sleek bombers, we find the crew preparing for a 15-hour mission. The trio is meticulous in its actions as last minute preparations are made for the flight. Their final action before boarding the aircraft is to dress for the occasion. This takes from five to eight minutes. Although the amount of clothing is somewhat more than that required for other types of flying, it must be remembered that climatic equipment cannot be put on under emergency conditions but must be ready for immediate use in the event of such emergency.

The innermost garment is a partial pressure suit which is available in case the pressurized cabins become damaged. This suit operates on the principle of applying counter pressure in amounts equal to the breathing pressure. There is a seal at the neck and oxygen in the helmet or in the mask, depending upon which type of helmet is used.

The suit is provided with both an aneroid release, set to go into operation at a predetermined altitude and a manual mechanism for inflation in the event of aneroid failure. The development of the pressure suit has cost approximately $1,500,000, and is estimated to have saved over $15,000,000 worth of aircraft.

The second garment is a ventilated suit which keeps the man in thermal balance with cockpit temperatures up to 140° F. This suit is designed for connection with the aircraft air conditioning system or for use with a blower-type device. It is a double layer, apron-type garment made of neoprene nylon material and weighs approximately 12 ounces. Future plans are to develop this suit with an individual lead which will provide for individual thermostatic control whether the crews are over the Arctic or over the Tropics.

The next article of clothing is a winter flying suit or liner for the outer exposure suit. The last and outer garment also is impregnated with neoprene and is put on through an extended V-opening or a slant-cut opening, depending upon the model. The important features of these suits are the inner seals at the neck and sleeves which insure waterproof protection. Completing the outfit is a pair of rubber boots, not insulated,

**Designed for the upright support of an unconscious man, the Mark III resembles a pair of water wings.**

# ticket —

**Personal equipment has outgrown the old concept of take it or leave it. It is now actually a detachable part of the plane.**

but designed to be worn over the Air Police or jump type boot that has become organizational equipment for most flying personnel.

Top this all off with the XA-13, a semi-rigid helmet which was designed primarily for long range bomber-type aircraft, and our crew is ready for takeoff. The helmet is form fitting and protects the upper regions of the head. It fits snugly and the sides are cut away around the face to increase the area of visibility.

A few hours after takeoff, the bomber was winging its way North-Northeast, somewhere off the coast of Nova Scotia. Suddenly, what had been an uneventful flight, now becomes a situation of tense concern. An emergency had presented itself which called upon the full resources of each crewmember. The decision was made to abandon the aircraft, but not until a distress message and a position report had been sent.

A few moments later, Jake felt a sudden, reassuring jolt as his chute whipped and then billowed above him. Immediately all of his training and practice flooded his mind. He actually had to restrain himself from over activity, he concentrated on putting first things first.

By pulling a quick release cord, the lift raft which had been packed in the lower half of his contour seat, pan-type Global Survial Kit, inflated and dropped on a lanyard 25 feet below him. He could see the accessory container oscillating on the same lanyard 10 feet above the raft. The oscillation did not last long, however, and Jake soon realized that the string of survival equipment was acting like the tail of a kite, stabilizing his descent.

His next and remaining concern, until he hit the water at least, was his life preserver. As a single thought he remembered the entire briefing on this new piece of personal equipment. The Mark III Split Life Preserver it was called. Its new design provides adequate flotation and has self righting characteristics which allow for the support of an unconscious man in an upright position. It does not restrict body movement and is capable of integration with all types of flying equipment. Jake hoped that all this was true.

The water was coming up fast now. What had they said about judging your distance above it? It didn't seem so tough. For one thing the string of gear, 25 feet below him, gave Jake an excellent reference point.

The brilliant yellow life raft seemed to be suspended momentarily in mid-air, almost as if it were taking a final breath before plunging into the dark, frigid waters of the North Atlantic. In quick succession came the accessory container, the pilot, and last, the billowing 24-foot canopy. All became part of the wind-swept sea.

As Jake's feet touched the water, he instinctively slipped out of his chute harness and inflated his life preserver. He had often wondered how he would react if this time ever came. Here he was, going through procedures as methodically as if he were rehearsing back at the base swimming pool. Even in the face of this crisis, he was unconsciously aware of the strange sensation of mildly cold pressures enveloping his body instead of the freezing, soaking, wetness that his reflexes were mentally prepared for.

With these impressions fleeting through his mind, his next thought was to locate the life raft. Although the sea rose in great swells all about him, the Mark III held his head high and clear of the churning waters, defeating the sea's first line of attack.

It seemed to him as though he was bobbing around in a deep canyon, looking up at huge, green, white-crested mountains that swelled endlessly and diminished on all sides of him. His raft was nowhere in sight but a constant tugging about his middle reminded him that it was somewhere within 25 feet of him and ready for occupancy.

As he hauled on the lanyard that assured him of his flotation gear, Jake realized for the first time that his hands and face were almost numb with cold. The bitter numbing cold that inevitably subdues all struggle for survival. However, this same cold did not penetrate the rest of his body. Exposure, the sea's slower but deadly secondary line of attack was failing. He lashed out for the tugging life raft with a new fury.

As he lay completely exhausted in the raft, Jake became accustomed to the violent pitching and rolling motion caused by the heaving waters. When deep in the valleys, his world of green seemed to completely envelop him. It even seemed to offer warmth and seclusion from the biting wind. When momentarily riding the ridge of his green mountains, he could glimpse the entire span of restless ocean. Mentally he played a game of hide and seek with the other two bright yellow dots. Sometimes he could see them both at once, while at other times one or both were completely out of sight.

While still engaged in his mental gymnastics, Jake suddenly saw a third player in his game. The impact of the new participant hit him all at once! It couldn't be, not this soon, but there it was, a cutter's prow knifing through the mountainous swells and headed directly for them.

He was thankful that time had permitted the sending of a distress message and a position report before they abandoned the aircraft.

Although the foregoing series of events were purely fictional, the equipment worn and utilized by the mythical crew is the real thing. The facts concerning the articles of survival were presented by the Aero-Med briefing team from the Wright Air Development Center. The occasion was a recent program sponsored by the Air Force Operational Test Center at Eglin AFB, Florida.

Just what do the Jakes and Johns who make up an Air Force aircrew need to survive mishaps in this day and age of high altitude and round-the-world flight? This question and many others were answered by the Aero-Meds.

The actual briefings at Eglin AFB were conducted by Captain William C. Kaufman, project engineer for emergency high altitude suits in the Respiration Center, and Lt. Billy J. Mills, project engineer in the Integration Section of the Aero Medical Laboratory, WADC. The briefing covered the present and proposed types of survival equipment which are required in this era when the capability of the Air Force to carry out its mission depends upon the air crews whose capabilities are directly dependent upon their personal, emergency and survival equipment.

This preview of the actual and proposed revisions in survival equipment should reassure each air crewmember that protection in flight has progressed hand in hand with flight. Although the equipment has changed, there is still one determining factor as to its success or failure that has not — *You*. No matter how fool-proof the device may be, it's still up to the crewmember to use it properly.

Records indicate all too many instances where survival would have been assured had the available equipment been used correctly or even used. Personal equipment has outgrown the old concept of take it or leave it. It is now actually a detachable part of the airplane. Although the airplane will fly without these parts, a smart pilot would not. ●

**Eight minutes are required to completely garb today's crewmember for high altitude flight.**

**The XA-13, a semi-rigid helmet, designed primarily for the long-range bomber aircraft.**

As the aircraft passed through 24,000 feet, the canopy blew off and struck the pilot on the head. He slumped forward, unconscious, greatly restricting any movement of the aircraft's controls.

On Lt. Rowley's first landing attempt, the pilot partially regained consciousness and involuntarily pushed the throttle forward. A go-around had to be made because of the excessive airspeed.

# WELL DONE

## 2d Lt. Donald J. Rowley

**Flight Test Maint. Officer, Hq SBAMA, Norton AFB, Calif.**

*LT. DONALD J. ROWLEY was the copilot on a B-45 test flight. He had climbed to 10,000 feet and had flown at this altitude for some time when the pilot instructed him to climb to 25,000. As the aircraft passed through the 24,000-foot level, the canopy blew off, and struck the pilot on the head, rendering him unconscious.*

*Although Lt. Rowley had a total of only three and one-half hours in a B-45 and had never landed the aircraft, he elected to attempt a normal gear down landing from the rear seat. He was confronted with the serious problems of no forward visibility, extreme wind velocity, freezing temperature, no engine instruments and no flaps or brakes. The unconscious pilot had slumped forward, restricting control movement; however, the crew chief was able to crawl aft, pull the pilot away from the controls and lower the landing gear.*

*The first landing attempt was unsuccessful because the pilot partially regained consciousness and involuntarily pushed the throttles forward, but a successful go-around was made. On the next attempt, Lt. Rowley was able to complete the landing by skidding the aircraft from side to side on the final to catch momentary glimpses of the runway, and he stopped the aircraft by use of the emergency brake system.*

*Lt. Rowley's devotion to duty and his exceptional skill and courage are a credit to himself and the U. S. Air Force. Well Done!*

# FELLOW TRAVELERS

Major W. B. Willis, Hdq, Air Weather Service

Some of the very worst flying conditions are encountered in the vicinity of squall lines.

SQUALL LINES and tornadoes occur under similar conditions. Tornadoes may occur at any time within the formative stage of squall lines; or they may form during, in advance or to the rear of a squall line. They also occur frequently when there is no identifiable squall line.

It goes without saying that some of the worst flying conditions are encountered in the vicinity of squall lines. This is true because in their most active stage, during their first few hours of life, they are composed of a continuous line of thunderstorms containing moderate to severe turbulence, heavy rain or hail, almost continuous lightning, gusty winds, brief windshifts, rapid temperature falls and abrupt pressure rises. There is always the possibility of one or more tornadoes in the vicinity of a squall line.

A tornado is a violent circular whirlpool of air, having an average diameter of 250 yards. Within its funnel-shaped cloud there are spiraling winds of terrific speed. Estimates of this speed vary from 200 to 600 mph.

Tornadoes usually move from southwest to northeast at approximately 40 mph but have a tendency to skip about at random along their general course. No one yet knows how high the funnel cloud of the tornado extends above the base of the thunderstorm under which it forms, but tornadic influence has been encountered at nearly 40,000 feet. A funnel-shaped cloud was reported in one instance as extending from the surface of the earth to approximately 35,000 feet where it merged with the cirrus anvil overhanging clouds. Lightning, in a thunderstorm containing a tornado, is the bright continuous sheet type with a lacework effect due to intensely vivid flashes of frequent forked lightning. It appears brighter, more colorful and more vicious than in any other type of storm. Although it is one of the least extensive, a tornado is the most violent of all storms.

The life span of a tornado is exceptionally short, approximately one hour for the average storm. The life span of the squall line is relatively short also, usually 12 hours.

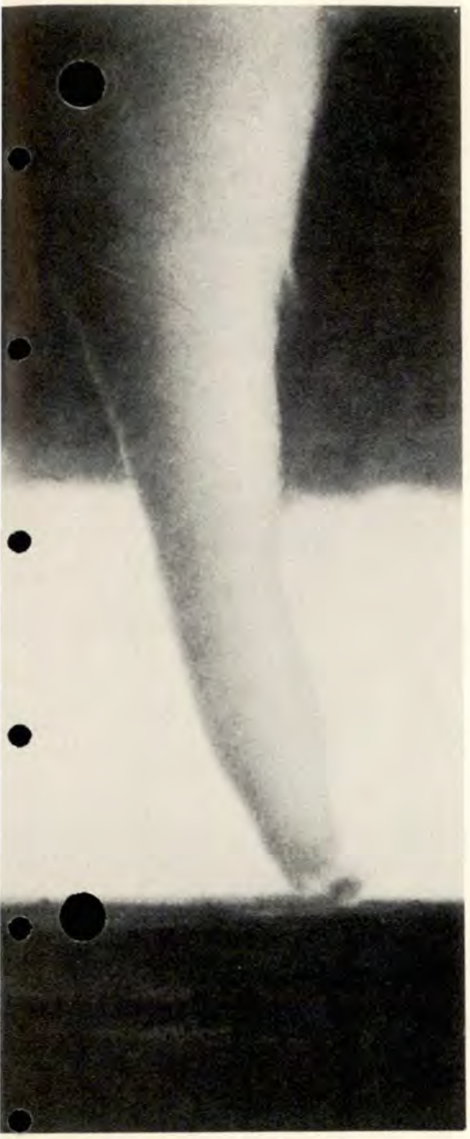
The Severe Weather Warning Center of the Air Weather Service attempts to forecast the geographical areas and times of occurrence of tornadoes, as well as hail, severe turbulence aloft and gusty surface winds in excess of 50 knots associated with severe thunderstorms.

At the present time the geographical area, within which the most intense thunderstorms are expected to occur, is referred to in teletype messages as a "black area." Within this black area there may be forecast areas of tornadoes. These areas will be restricted to 10,000 square miles if possible, but may be larger if the developing weather warrants it. This is an advisory service and the information is sent directly to the station weather officers and flight service centers for further dissemination. At the present time the information furnished by the Severe Weather Warning Center is not available through CAA Radio Range Stations.

Squall lines are rather difficult to forecast by even the most experienced personnel. In some instances they are well past the formative stage before they are identified on map analysis by forecasting personnel and seldom if ever appear on 24 or 36-hour forecast maps. Thus, if a squall line forms over a rather sparsely settled area, it may be in its most active stage before it is identified.

Every pilot who was ever caught in a squall line would probably have given most anything he had to have been warned in advance. Until there is a better understanding of the mechanism of squall lines, the best method of dealing with the problem is to recognize them as soon as pos-

The tornado, a violent whirlpool of air, may often be associated with embryo squall lines.



High, spiraling winds of the tornado often reach velocities of from 200 to 600 mph.

Having an average diameter of 250 yards, tornadoes often extend from the surface of the ground to great heights within the squall line. Their influence has been felt up to 35,000 feet.

sible after they have formed. Almost any cold front situation may be a squall line breeder.

Tornadoes are equally as difficult to forecast. To predict exactly where one will strike, with any degree of accuracy, is virtually impossible. The Severe Weather Warning Advisory has proven to be of valuable service to flights through black areas. Pilots are more cautious and keep a closer watch on weather conditions than they are prone to do normally.

Atmospheric instability is prevalent over most of the United States east of the Rockies, with normally a steady progression of cold fronts and accompanying squall lines from March through June. This is also the period in which to expect a sharp increase in tornado activity, with the area of maximum occurrence, approximately 600 miles in diameter, centered over northwestern Mississippi in March. This area moves northwestward through April and is centered over eastern Kansas in May and June, with the belt of maximum occurrence extending from northern Oklahoma to southern Minnesota.

Records from 1916 through 1954 indicate that half of the reported tornadoes occurred between 1400 and 2000 local time, and that approximately 80 per cent of the total occurred between noon and midnight. They have been reported at all hours of the day and night throughout every month of the year.

Studies of squall lines and flights through them, indicate no apparent preferred level for penetrating a given severe squall line. Severe turbulence has been reported at all levels flown and from 4000 feet up; there seems to be no one level worse than another. More severe turbulence reports were received between 2000 and 4000 feet than for any of the other levels, but it is thought that this was due to the belief of many pilots that they were less likely to encounter severe turbulence in the lower levels.

Radar is an excellent aid in determining the location of squall lines. However, it only indicates areas of precipitation and many pilots have had the mistaken idea that if they can avoid these areas they will be clear of all severe turbulence. This is only partially true because a radar echo does not in itself indicate turbulence and there have been numerous occurrences of turbulence outside of cloud and rain areas.

Very few people have flown into a tornado and lived to tell of their experience. (See *Flying Safety Magazine*, July 1954). It is the opinion of those who have flown through one that it is impossible for any pilot, regardless of experience level, to fly safely through tornado areas without being subjected to extremely hazardous conditions.

There is really no comfortable level for penetrating violent thunderstorm activity, such as is encountered in severe squall lines, with the types of airplanes being flown today.

On many different occasions experienced pilots, with thousands of flying hours to their credit, have been unable to get their aircraft successfully through a squall line area. This is true for both commercial and military pilots.

It is absolutely true that most thunderstorms in their dissipating stage can be flown through with only light or moderate turbulence being encountered. Obviously, it is foolish to fly deliberately through squall lines or well-developed thunderstorms that appear to be in their most active stage.

Air Weather Service personnel are available to give you the latest actual and forecast weather conditions for your proposed flight. They, in turn, would appreciate your report of any unusual activity or deviation from forecast weather. Call the nearest radio facility and give them the information as soon as possible, and at your first stop give the local weather forecaster a thorough briefing. Your information might mean a lot to another pilot who will be flying along the same route. ●

# YOU - SAFE CO-OP


**Above, approved checklists and emergency procedures were lumped into a usable package.**

**Presented here is a new approach to a command-wide, Flying Safety program anchored by Headquarters at one end and operational personnel at the other.**

*The following article outlines the efforts of Headquarters United States Air Forces in Europe toward the aircraft accident prevention problem. It serves to stress the fact that major commands realize their responsibilities in accident prevention, and that they don't expect the pilot to "go it alone." Their program reflects the attitude that USAFE pilots can shoot holes in the accident rate only if provided with the ammunition.*

"DRASTICALLY Reduce the Aircraft Accident Rate." That is the USAFE battle cry. True, the cry is an old one . . but the approach isn't.

The new approach, originated in early 1954, and has proved to be a definite step in the right direction. It was based on the logical formula of integrating the operation and inspection functions into a homogeneous effort. The program was built upon a command-wide organization anchored at one end by staff specialists in Headquarters and at the other end by the men in the operational units.

The foundation of the organization was standardization and education. With these tenets in mind, reorganization was accomplished at USAFE level to include Flight Safety as a Directorate of the Inspector General and a Standardization Board under the Deputy Chief of Staff for Operations. This structure enabled Flight Safety to assimilate inspection data and to scrutinize the efforts on all staff functions with impunity. The Standardization Board centered its activities around achieving maximum utilization, efficiency and combat capability of command resources.

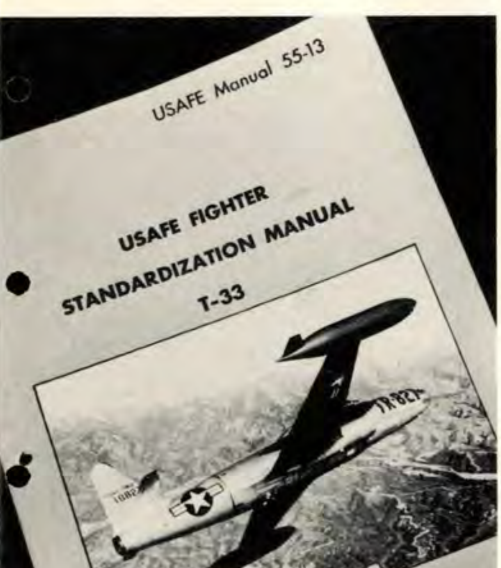
At the same time, Standardization Officers were appointed at operating levels to work in close cooperation with the unit Flight Safety Officers. Headquarters USAFE issued directives to these levels establishing methods of operation.

The Standardization Board's first efforts were directed toward focusing attention on standardization in such a manner that it was no longer the result of individual efforts but an overall command contribution. Standardization was based on proven practices, procedures and techniques, not on the deep rooted dogma of "Here is the way I've always done it." These approved standards were lumped into usable packages in the form of manuals on standard operating procedures, emergency procedures, checklists and standard aircrew flight check criteria for every aircraft.

As new aircraft are programmed for the command, standardization board personnel are placed on stateside TDY to gain operational experience and data so that maximum assistance may be furnished tactical units during the conversion period. This assistance is furnished through personal supervision as well as through the aforementioned publications.

Standardization Board members at all echelons are handpicked, highly qualified rated personnel. They all collect and evaluate the latest flying techniques and procedures and work closely with each other in establishing a standardized practice. All data are correlated through personnel con-

**Standardization, based on proven practices, is presented in manuals for every aircraft.**




**Officers in the Directorate of Flight Safety and specialists from the Standardization Board participate jointly in formulating command policies and procedures for USAFE-wide dissemination.**

ferences, staff visits and integrated staff action at headquarters level before being issued as a command policy. At the present time the transports, fighters, bombers, observers and flight engineers all have their representatives on the USAFE board.

The Flight Safety Directorate has a three-fold responsibility:

- Implementation of a current program.
- Analyzing incidents and accidents with a view to revealing cause factors for future remedial action.
- Providing statistical data to point out accident trends and problem areas for subsequent staff action.

The educational program is very extensive and includes a monthly briefing that enables the Commander in Chief, USAFE and staff to keep informed on the command accident status. In addition, all commanders attend a quarterly commanders conference similar to CINCUSAFE briefings, and a quarterly meeting is conducted for unit Flying Safety Officers where they exchange accident prevention ideas.

To illustrate the scope and effectiveness of the Flight Safety-Standardization Board team concept, the following are typical areas where joint effort produced best results:

Investigation — Officers in the Directorate of Flight Safety and specialists from the Standardization Board participate jointly in selected aircraft accident investigations. Their special reports receive personal perusal from the Commander in Chief and are forwarded to the appropriate agency separately or with AF Forms 14 for the corrective action.

In keeping with this concept, Flight Safety surveys are conducted by numbered Air Forces at all bases under their jurisdiction. The reports include such things as inadequate airfield lighting, nav-aids, overruns and so on. These reports are studied at Headquarters level for necessary corrective action. The Directorate of Flight Safety maintains a discrepancy file on all bases for use by headquarters in making staff visits.

Incentive Program — This program is carried out at base level and instills *esprit de corps* between units through a competitive spirit. A system has been developed to judge outstanding units for awards.

Accident Analysis — Personal letters are required by the Air Force commanders when an aircraft accident occurs in one of their units. These letters are studied with a view toward taking immediate action to preclude future similar accidents. This procedure permits rapid correction which would not be taken normally until the completed Form 14 is received. When the Form 14 does arrive, it is reviewed to ascertain if additional action is required.

Standardization Checks — The Flight Safety and Standardization Board officers again team up during operational readiness tests to inspect and measure the effectiveness of operating units. Aircrew standardization proficiency checks are mandatory biannual requirements for all pilots in the command. These are performed at base level by the unit standardization officers, and these officers in turn are checked by the USAFE Standardization Board.

During operational readiness tests, the Standardization Board observes operational tactics and spot-checks crews while the Flight Safety member evaluates all phases included in the accident prevention program, i.e., installations, maintenance, flight surgeon participation and equipment.

Many USAFE units will be converting to new high performance aircraft, and the command will be receiving rotational units from the ZI. This challenge will be met through the concerted command team effort. We predict that these efforts will be rewarded. ●

# Situations Unlimited

Above, interior view of F-89D jet flight simulator showing the actual simulator in the foreground. The pilot occupies the cockpit on the right with the radar operator seated directly behind him.

**Once inside the cockpits of these simulators, the pilot and radar operator both cease to pretend.**

T. E. Mulford, Link Aviation, Inc.

THE STRATOJET pilot and copilot were just completing a routine training flight in a Link B-47B simulator. As they turned from base to final approach for the landing, the console operator decided to play a practical joke on them. By merely flicking a few switches, he cut out all three engines on the same side.

The pilot cussed at the simulator, cussed at the operator and fumbled desperately with his controls, but to no avail — he didn't make it.

Everyone thought it was a pretty good joke . . . everyone, that is, except the dismayed pilot. He was thinking about what would have happened to him and his crew if that malfunction had occurred over the landing strip in a real Stratojet, and his thoughts weren't too pleasant.

He persuaded the instructor to give him another go at that landing, and another, and still another until finally he figured out the proper change of trim and throttle to bring his plane in for a safe landing.

About a month later this same pilot and copilot were coming in for another landing, only this time they were in the air over an air base, and not in a Link simulator. And when it happened, no one thought it was a good joke. Because of a fuel system failure, all three engines on one side flamed out.

This was a case where practice really paid off royally. Following the same procedures that he had worked out in the simulator, the pilot made a successful landing. Admittedly he did a bit of perspiring before completing the touchdown but the fact remains that he greased the B-47 in without a scratch.

This incident actually happened. It doesn't prove that practical jokes save lives, but rather it lends credence to the old adage, practice makes perfect.

By this we are not implying that the simulator can ever take the place of actual practice in an airplane. We've all had enough time in the old "blue boxes" to know that somehow things don't always work out just the same when we actually get in the sky. However, the flight simulator does fill a very definite need in our training program. One can make any mistake in the book while flying one of them and still be around to keep trying again and again.

Two simulators now in use by the Air Force are the B-47B and the F-89D, Link's latest contribution to the field of flight simulation. Another simulator, for the Convair F-102 supersonic fighter plane, has recently been completed by Link and soon will be in use by Air Force pilots.

Once inside the cockpit of any of these simulators, you can't tell it from the real plane. Controls, instruments and accessories are carbon copies of those in the plane, and the instruments not only look the same, they react the same.

The C-11B is a trainer rather than a simulator because its cockpit configuration and flight performance do not duplicate any specific aircraft, but rather a general type of aircraft. Basically it resembles in appearance and flight characteristics the F-80 series of fighters.

In most other respects, the C-11B has the same general facilities and characteristics of the larger simulators. It provides training in single-engine jet flight procedures, communications and navigation.

These electronic trainers and simulators, while based on the same principles and patents, bear but slight physical resemblance to their predecessor, the old blue box of World War II fame.

It was found late in the '40s that greater flight realism and flight simulation could be obtained by electronic means rather than by the standard mechanical and pneumatic methods employed in previous trainers.

Link has developed a special electronic analog computer, capable of interpreting flight data in terms of dynamic response, and has since used this computer principle in all of its trainers and simulators.

Contrasted with the comparatively simple and limited early trainers, a modern simulator may utilize over 1635 electronic tubes, 93 servo motor-generator sets, 400 computer assemblies, 275 amplifiers and 1950 gears.

In the short time since the flight simulator became a reality, ground trainers and simulators have become an integral and very important part of the flight training programs of America's air arm. It is now a part of Air Force policy to contract for a new trainer or simulator each time a significantly different model of aircraft is adopted for use.

**Minus its top cover, the B-47B Flight Simulator provides a tandem cockpit for pilot and copilot. A full complement of instruments and a duplicate set of controls are available to the instructor.**

There's hardly a jet pilot in the sky today who hasn't logged some time in a Link . . . and not without good reason.

Figures published recently by the Air Training Command indicate that use of flight trainers and simulators in Air Force training programs has resulted in tremendous savings of time, money, men and materials.

But material savings are not the only benefits derived from the use of these electronic devices. Pilots flying a trainer or simulator get realistic training from the pre-takeoff inspection right through to an instrument landing, and in between the two they can learn to cope with countless emergency or combat conditions.

Included among these are target interception, engine failures or malfunctions, overspeeding engines, loss of engines, flameout, engine fire, icing of engine intakes, hydraulic failure, electrical system failure including inverter failure, over-voltage on generators, alternator failure, circuit breaker failures and hydraulic brake failure.

The value of these emergency training provisions can hardly be overestimated. A coordinated response to unforeseen emergencies is one human capability that cannot be developed in the class room or from books. A speeding jet is a tough place for any man to have to stop and think things out, especially when time is such a vital factor.

Instinctive response, not just general intelligence or reasoning power, is what often pulls a pilot through an emergency situation. Time in the blue is the best place for practice that leads to instinctive responses. The simulator lays the foundation for actual in-flight proficiency.

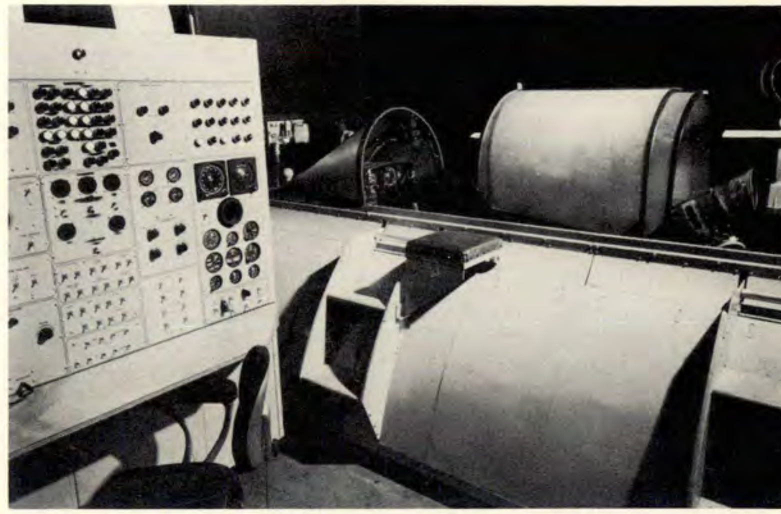
An F-89D pilot of the Alaskan Air Command learned this the easy way. He had just taken off on an intercept alert recently when a warning light indicated a fire in his right engine. This was a new experience to him, and with limited altitude he had to act fast.

Instinctively, he closed the throttle on the dead engine, turned off the right engine generator, turned on the crossfeed, notified the tower of his emergency, blew his canopy clear and proceeded to make a normal landing.

Although this was the first time he had ever experienced such an inflight emergency, he proceeded flawlessly and instinctively just as if he were going through a routine maneuver. He was able to do this for one primary reason . . . he had practiced that procedure several times before, both in his aircraft and in the simulator.

Ground trainers and simulators are not limited to just standard transition type or advanced crew training. Since their instruments can accurately simulate almost any flight or engine condition possible with the actual plane, the training potential of the simulator or trainer is practically unlimited. Add to this the flight recording mechanisms on the instructor's console, and you have a device which insures sound teaching and training practices.

Up in the area of our Northeast Air Command, where most flying is done under instrument conditions, many pilots practice difficult missions ahead of time in their C-11B trainers. If the flight recorder on the instructor's console indicates that a pilot failed to hit his destination, then he practices again and irons out errors until the practice mission is successful.



**Above, external view of F-89D Flight Simulator. When in flight, cockpits are canopy covered. Jump seats, center, are provided outside of each cockpit and facilitate instructor observation.**

**The F-89D Simulator in operation shows pilot, concentrating on his instrument panel, with radar instructor, upper left, and flight instructor checking and controlling the entire flight problem.**

**The C-11B, jet flight trainer, was first all jet simulator to be produced in quantity.**

This realistic briefing process illustrates just one of the many extra-curricular activities performed by ground trainers and simulators, and it illustrates too the tremendous training potential which these wingless wonders have to offer.

The Directorate of Flight Safety Research has long been on record as advocating the development of new simulators to keep pace with our latest jet aircraft. As we all know, these earth-bound trainers can never take the place of actual flight time but their value in teaching procedures should never be underestimated. Sound procedures are the basis for ultimate development of inflight proficiency.

Our growing all-jet, all-weather Air Force requires greater proficiency on the part of pilots. The very complexity of a modern jet fighter has taken the pilot out of the glamour-boy class and made him a serious, hard working individual. His is a rough row to hoe by any standards. He needs all the help and guidance that science can develop. We believe that the flight simulator, for a particular airplane, is one answer in our quest for the best.

# On Course—with 60-16

AIR FORCE regulation 60-16, officially known as "Air Traffic, Clearance, and General Flight Regulations" has often been referred to as the pilot's GOOD BOOK. It is the one reg that pilots have to live with, yet the one most often violated.

That a pilot knows this regulation is important, *I mean real important.* Even in this uncertain era of ours, by complying with 60-16 you can rest assured that you will never be the No. 1 boy on a flying violation rap. What is even more important you considerably enhance the possibility of living long enough to see that grandson of yours check out in the F-1002.

Maybe you know 60-16; if so, you are the exception. I don't think anybody will be too startled if I say that most pilots know less about it than they do about the telephone directory. Just why this is true can well be considered the mystery of the century because, as previously stated, know it and keep out of trouble; ignore it and, brother, you don't know what hardships are.

Granted, it may be a little hard to keep up with the changes. That's one of the reasons for this article; you must expend a little additional effort to keep up with the latest 60-16.

For example, one of the most recent changes requires that pilots accomplish a Form 175 when clearing out of a strictly commercial airport. You are required to carry a supply of forms (175) at all times. If you do go into a non-military field that uses the CAA clearance form only, you must make out a 175, leave the original, then turn in the carbon copy at your destination.

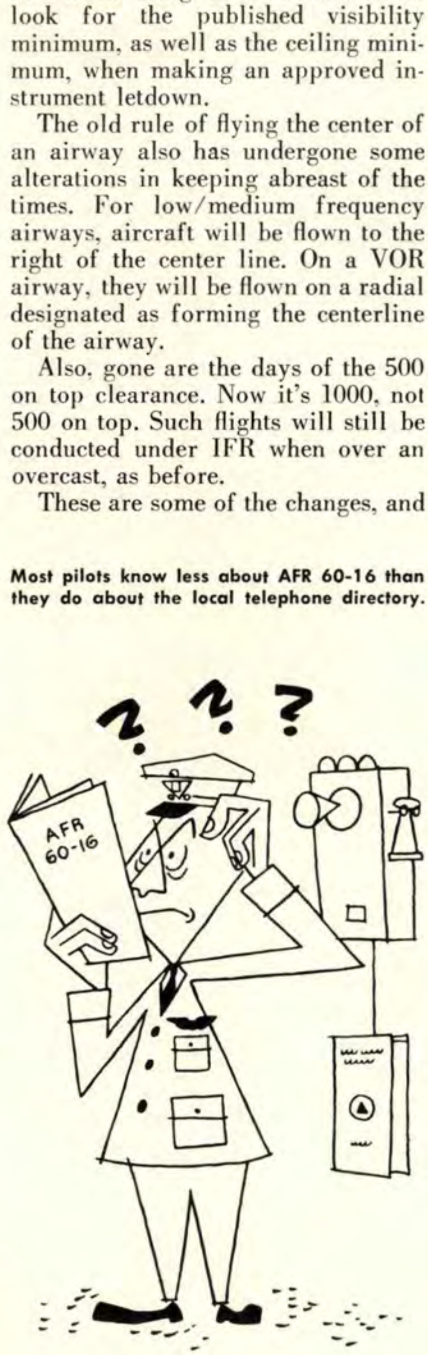
Another change is that landing visibility minimums for Green and White card holders are being published in the current revisions of the instrument approach charts. On the charts not yet revised, minimums will be one mile by day and two by night. The main thing to remember is to look for the published visibility minimum, as well as the ceiling minimum, when making an approved instrument letdown.

The old rule of flying the center of an airway also has undergone some alterations in keeping abreast of the times. For low/medium frequency airways, aircraft will be flown to the right of the center line. On a VOR airway, they will be flown on a radial designated as forming the centerline of the airway.

Also, gone are the days of the 500 on top clearance. Now it's 1000, not 500 on top. Such flights will still be conducted under IFR when over an overcast, as before.

These are some of the changes, and they are mentioned just to prove our point . . . . that unless you keep right on top of revisions to the pilot's GOOD BOOK, you are not in the know. And remember, whether you violate this regulation through ignorance or intent, the results are the same . . . . bad!

**Most pilots know less about AFR 60-16 than they do about the local telephone directory.**




Along the same line of thinking, it might be well to insert a few remarks concerning deviation from your flight plan while under IFR on airways. We all know that situations can arise necessitating some sort of change in either course or altitude. Maybe ice or turbulence requires a new altitude or maybe you want to circumnavigate a storm center. In either case, get ARTC approval first. Changing to a different altitude because of turbulence or ice, without clearance, could be compared to the old "out of the frying pan into the fire" limerick. You might make the change to get a smoother ride, only to run smack dab into the path of another aircraft.

The important thing to remember is ARTC controls IFR traffic in controlled areas. Don't make a flight plan change without their approval.

In the event of an emergency things are a little different. If you cannot maintain your assigned altitude and for some reason cannot get clearance to descend, declare an emergency and have at it. Nobody, including ARTC, can keep you from going through 9000 if your airplane can't maintain ten. But remember, make every attempt to notify ARTC. Also, in the event of an emergency, you'd better get familiar with paragraph 48 of 60-16. It is entitled "authorized deviations."

Well, that should just about wrap up this little dissertation on AFR 60-16. In case you haven't gotten the gist or if you are the type of guy who doesn't want to take the time, "see you in court." ●

# *what's the percentage?*

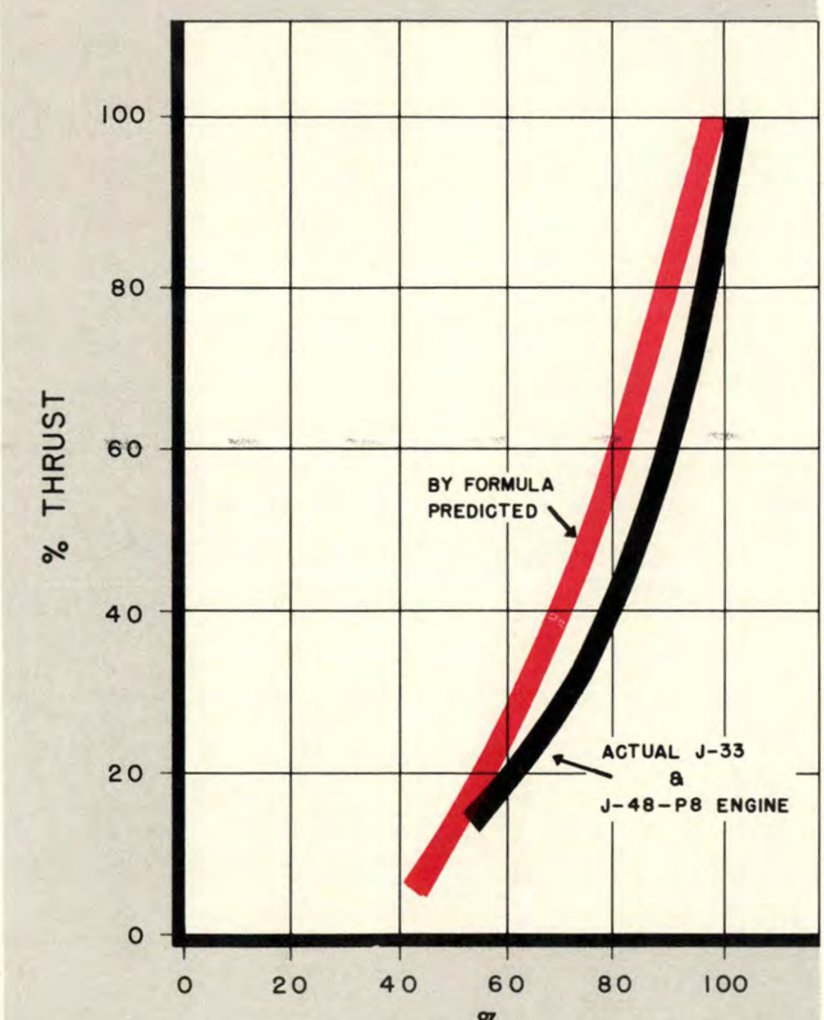


Figure 1

IN this day of measuring fuel in pounds, oxygen in litres and power settings in per cent of RPM, somebody recently came up with a logical question. The fuel in pounds we understand, the oxygen (liquid type) in litres, well, I guess we understand that too, but what about the relationship between the per cent of RPM and the amount of actual thrust? It is confusing when you stop to think that an aircraft with a reciprocating power plant that calls for 43 in. Hq. for takeoff gets off okay, pulling only 35. Yet, try to take an F-84F off sometime, pulling only 80 per cent or even 90.

Now there is a very logical mathematical formula put together by the engineers that we could go into, but by the time we finished printing it most of us still would be in the dark on the subject. So let the figure experts juggle the complicated equations and square roots. I'm sure we can get at the subject in a "hangar-talk" sort of way. Don't let the simple equation series presented here shake you up. They merely mean that there is a direct relationship between the per cent of RPM indicated on your instrument dial and the actual amount of thrust being blown out the hot pipe.

It may or may not come as a surprise when we say that when you reduce the RPM from 100 to 90 per cent the engine thrust is reduced to 75 per cent. Yes, in taking off 10 per cent of RPM you actually lose 25 per cent of thrust. To carry it even farther, reduce the power setting to 80 per cent RPM and the thrust is cut down to 50 per cent.

You stove pipe jockeys should remember that the relationship of these figures to each other is not affected by any of the standard considerations such as are usually injected into casual pilot's lounge discussions of this problem. By that we mean don't start throwing around terms like thrust, air density, altitude, ram effect or droop —they don't enter into it at all. This proposition refers to any given altitude, and to that altitude only.

Remember, we are speaking of percentages of total thrust available in any given situation, as opposed to your Pilot's Handbook which deals with the problem on the basis of actual pounds of thrust.

Just in case a few of you happen to be mathematically-minded slipstick artists, let's state the proposition technically. Now, don't you other types go wandering off shaking your heads ruefully just because we throw a few figures your way. You're a cinch to understand these basic equations and even if you don't, "this is only the beginning."

Thrust varies directly with $RPM^{3.5}$ which for all practical purposes may be re-stated as: Trust varies directly with RPM, cubed. Use of this proposition is illustrated by the following.

$$\frac{T @ 90\% \text{ rpm}}{T @ 100\% \text{ rpm}} = \frac{90\% \text{ rpm}^3}{100\% \text{ rpm}}$$

By transposing and rearranging we get:

$$T @ 90\% \text{ rpm} = T @ 100\% \text{ rpm} \times .9^3$$

or

$$T @ 90\% \text{ rpm} = .73 \times T @ 100\% \text{ rpm}$$

or

$$T @ 90\% \text{ rpm} = 73\% \text{ of } T @ 100\% \text{ rpm}.$$

Now that wasn't too bad, was it? It just shows you that 90 per cent of RPM gives you approximately 73 per cent of thrust. However, a word of caution on using the proposition as outlined above: As expressed, it describes the Thrust vs. RPM curve fairly accurately only in the upper limits of the curve. (See Figure 1 which illustrates the engine curves for the J-33 and J-48 engines.) The proposition is not valid for those RPM's which are below 70 per cent. A pilot must check the thrust curves in the appropriate handbook or consult the engine manufacturer's tech representative to obtain available thrust percentages at the lower RPM settings. But the main thing we wanted to bring out was the large actual thrust loss that occurs when you reduce the RPM from 100 per cent to 90 and 80 per cent.

About now it should be obvious that some of the more steaming stones




**Using the rule of thumb, the power settings of 100, 90 and 80% of rpm, actually give only 100, 75 and 50% of available thrust.**

should re-group and give our rule-of-thumb yardstick some deep thought. The proposition, as outlined above, stating that thrust varies directly with RPM cubed can be most revealing. It can be applied to several phases of everyday jet operations.

For instance, there's the boy who comes screaming in on initial and makes a high-speed break. It goes without saying that this familiar character never bothered to find out what his actual thrust is after he has reduced the power setting and cranked around into the pattern. After coming back on the throttle, he throws out the speed brake, shakes around into a wide mushing turn onto a shuddery final, and sets his long-suffering bird down in the toolies, well short of the runway. And chances are he sits there in his battered war machine wondering just what happened. Can't get it through his head that he acted in defiance of the facts that we have outlined, in brief, above.

Now you couple this terrific thrust loss with the inherently poor acceleration qualities of jet engines and you come up with the same answer — into the toolies again.

A case in point is the pilot who likes to fly his pattern at high speed until he screeches around on to final. At this point he whacks the throttle back to IDLE and pops his speed brakes to get down to "all-garbage-out" speed.

This driver kills off speed and winds into final with a complacent air, hoping the boys on the ground notice that a real sizzler is in their midst. He realizes he is settling a little too fast and pours on the coal, but, of course . . . he also ends up slightly short of the strip. He hasn't considered that when you chop things to IDLE it takes time to wind up to an RPM that will give you anything in the way of a boost. The old bugaboo of engine lag teamed up with what we were just talking about to plunk this guy down short.

Someone should have told these two types that it's okay to live it up a little on the ground but when you get into a jet, it's best to know what you are doing. Paying attention to the following rule-of-thumb figures can mean the difference between setting down in the boondocks and laying your aircraft onto the runway for another good landing. Remember:

| | | |
|---|---|---|
| 100% rpm | = | 100% Thrust |
| 90% rpm | = | 75% Thrust |
| 80% rpm | = | 50% Thrust |

Those figures mean just one thing to all jet pilots. Keep chopping that throttle way back, boy, and you're a likely candidate for the statistical column entitled: Landed Short of Runway. Cause: Pilot Error. ●


Capt. James M. Neale, Holloman Air Development Center.

WE RECEIVED a very interesting letter recently from Brigadier General L. I. Davis, Commander, Holloman Air Development Center, in which he pointed out some of the dangers of flying across D/209. If that doesn't ring a bell, may we suggest that you refresh your mind by reading the current Radio Facility Chart.

The Holloman-White Sands Range (D/209) is one of the larger, extremely active, land mass ranges used primarily for testing and developing unmanned airborne vehicles. In view of the location and size, it is a matter of quite some concern that aircraft occasionally are flown across D/209, rather than circumnavigate it, in order to save fuel and time. Even if we do not consider the aspects of a violation, careless flying across this or any other danger area may well result in an aborted journey.

Although it may be hard to believe, there are several cases on record of fearless drivers who have deliberately flown through danger areas just to save a few miles and possibly just to unnerve the guided missile troops.

Take that little dog-leg on Amber 3 for example. Between El Paso and Albuquerque the airway jogs to the west at Truth or Consequences. Not much of a jog, mind you, but enough to clear D/209. Ironically enough, straying off airways here may lead to something like the aforementioned name of the city, so best one make the jog or take the consequences.

Of course you are asking for trouble if you stray into or across *any* danger area, but the following bit of verse by Captain James M. Neale lays it right on the line as far as Holloman is concerned:

*Once upon a noontime sunny*
*A B-17 that was a honey*
*While cruising 'cross our danger range*
*Got clobbered by a missile strange.*

The verse happens to be true and describes the demise of a B-17 drone, but it can happen to you in your shining suit of jet armor unless you avoid Holloman-White Sands.

Naturally, the people down there don't want to scare any brave young airmen or disillusion you into thinking that every aircraft that crosses a danger area is going to be blasted out of the wild blue yonder. Actually, your chances of successfully sneaking across any danger area, without proper clearance, are probably pretty good if you're the lucky type. If you're not, or if by chance you happen to be the poor sad sack who is fresh out of luck at the wrong time, then you'd better steer clear.

If you get caught in one of those "don't-fly-in-here areas" that may be saturated with Mach-busting missiles and other ill-willed objects flashing through the heavens, you have no one to blame but yourself if you get hit. As a matter of fact, you won't be around to meet an F.E.B. or the equivalent anyway.

Guided missiles are still a rarity around the Air Force and as such are restricted to doing their stuff inside designated boundary areas. It just so happens that the Holloman-White Sands Range is about the busiest base that one may imagine and certainly is no place to be flying.

When planning a flight that will be in the vicinity of danger areas, restricted areas or warning areas, take a good look in the back of the Radio Facility Chart. There you'll find at least six pages devoted to airspace restricted areas. The number that is assigned to each is the same number that appears on the planning chart. In addition, the effective altitude and time used is given for each area.

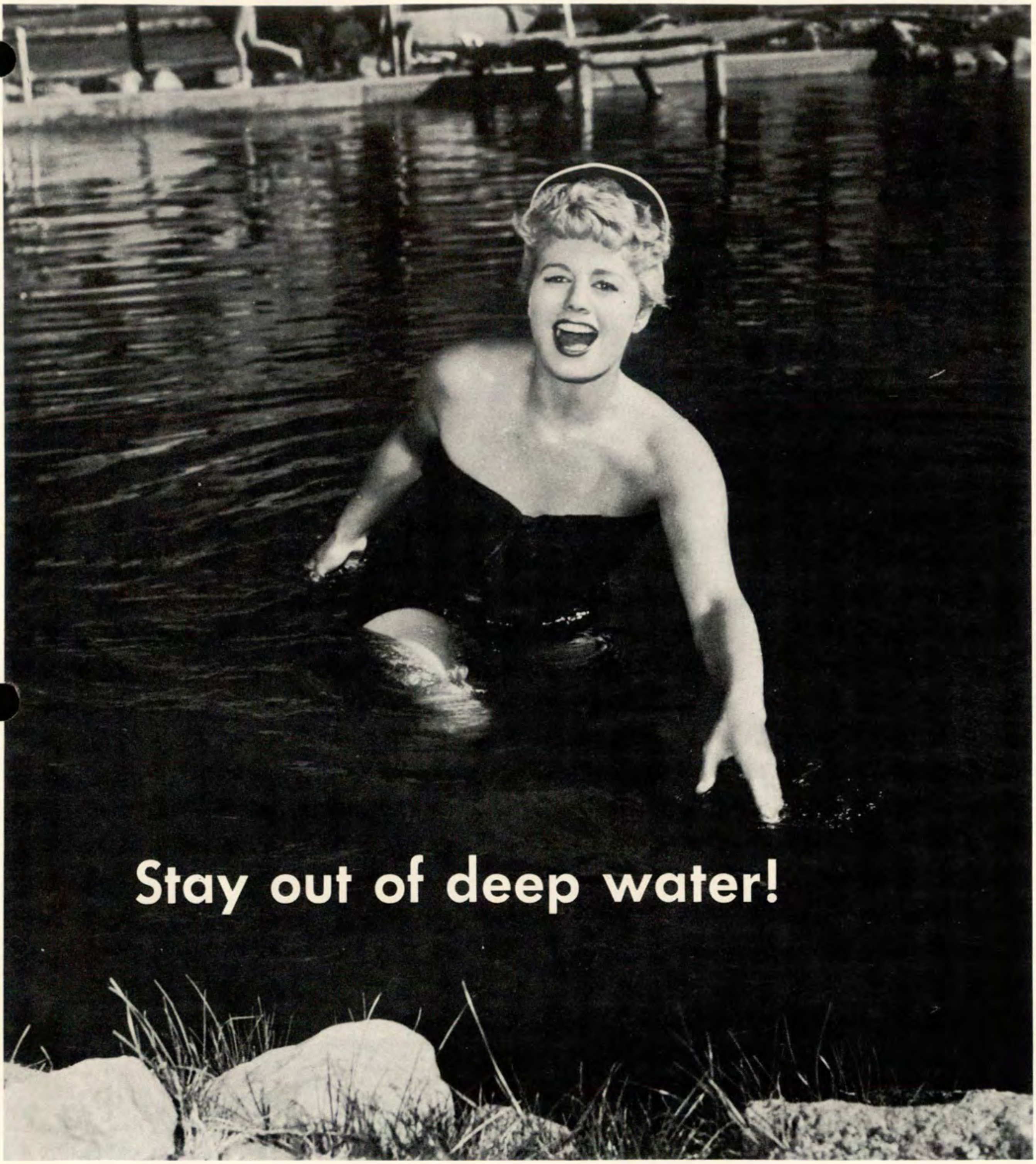
If you should note that your projected flight path would be near a danger area wherein the effective altitude was listed as 30,000 feet and time in use as unlimited, then it would be strictly a game of Russian roulette to barge through that area at 25,000 feet, whether day or night.

A few years ago, a careless flight leader went steaming across one of our southern danger areas. It was a perfectly clear day. The flight was strung out loosely in trail at about 3000 feet. Apparently someone was using comic books rather than charts for navigation purposes. Then, all you-know-what broke out. The air was suddenly full of slugs, and they all meant business.

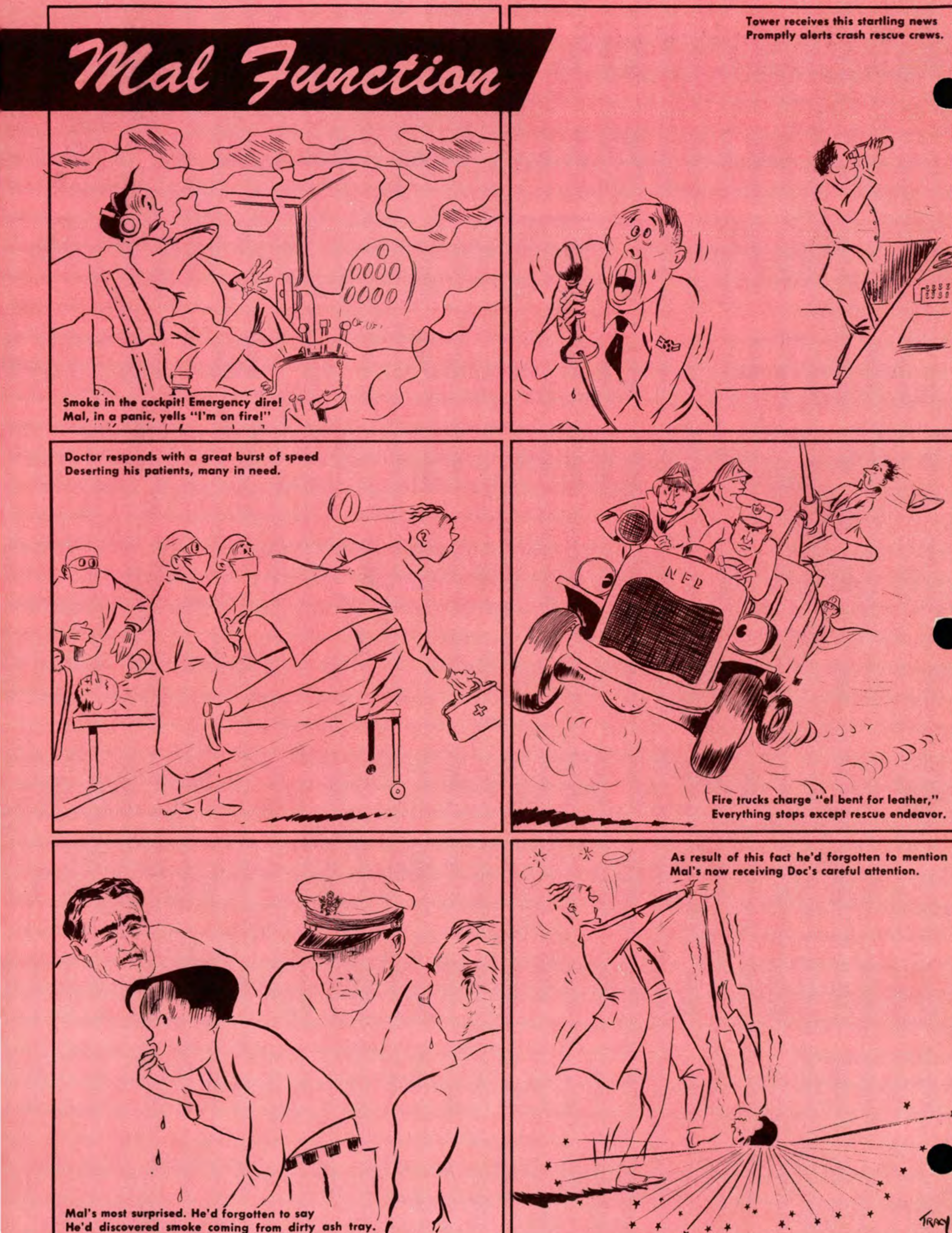
Fortunately, none of the personnel was struck by wandering bullets, but all of the planes suffered damage of varying degrees. You may well ask, why didn't the gunnery crews hold their fire? Well, it just happened in this case that the armament being tested was of the remote control variety. A lot of ammunition was expended before anyone got around to shutting the mechanical monster down.

Some of the gadgets that we have today will not only hunt you down in the sky, but if they miss, will turn around and take another whack at you.

Perhaps the day is not too far off when these blasted guided missiles will do us all out of our flying time. To date though, only a few monkeys have ridden them aloft and returned intact. However, we suggest you leave the pilotage of such vehicles to the simian family and for your part (and mine) let's stay as far away from every danger area as possible. ●




*If Confucius were still around, he might come up with something like, "He who doesn't heed 60-16 may find himself in deep water." The article entitled "On Course with 60-16," on page 25 of this issue, should make good reading for all of us who are interested in flying . . . flying right, that is!*

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