APRIL 1959

FLYING SAFETY

UNITED STATES AIR FORCE

SPEED, ALTITUDE AND THE MAN

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CONTENTS

Could the F-104 accidently pop into orbit around planet Earth? Read what test pilot Lou Schalk thinks of this possibility in "The Link?"

Sometimes you may feel that we in the Directorate of Flight Safety Research are far removed from the real-life problems of military flying. Here in a building crowded with computers and IBM cards, accident statistic charts and Forms 14, the procedures may seem very cold and impersonal.

We are not so far removed from it all as you may think. Among the accident reports, so systematically numbered and methodically analyzed here, there are now two new ones bearing the names of some of our own associates: Colonel Harry G. Moseley, Major Thomas W. Greenwood, Jr., and Major Vernon R. Stutts.

Colonel Moseley, Chief of the Aero Medical Safety Division of this Directorate, and Major Greenwood, Investigation and Field Operations Division, were returning on 10 February from the School of Aviation Medicine, Randolph AFB, where they had attended a symposium on space medicine. The T-33 they were traveling in was reported missing and, as this goes to press, no further word has been received. Major Ray Stutts, Editor of *Flying Safety* since 1956, was fatally injured in a T-33 accident at Wright-Patterson AFB on the 14th of February. He had been on a trip to the East Coast gathering material for this magazine.

Each of these officers was "in line of duty" at the time, studying, working, gathering information to pass on to you in the interest of your safety.

Here—surrounded in this building by the finest collection of accident-prevention material in the world—what can we do? Just one thing. Whether the accident involves our friends and associates or yours, we can only strive to learn what went wrong and why, then do everything humanly possible to see that it never happens again. ▲

CROSSFEED

LETTERS TO THE EDITOR

Atkins Light—Yes!

This is in reference to the story entitled "Frantic Firefly" in the February issue. The pilots of this ANG Base have observed the Atkins Light on commercial aircraft flying in and out of Kellogg Field (North Central Airlines).

It is the concensus that the Atkins Light is the greatest invention since the "wheel."

Capt. Howard C. Strand
Michigan ANG
Base Det. Commander
Kellogg Field, Battle Creek.

★ ★ ★

Atkins Light—No!

I said it before (Aviation Week, 15 May 58) and I'll say it again. Your article, "Frantic Firefly" in the February issue does little to convince me.

The Atkins Light makes a dangerous assumption and also fosters unacceptable complacency, in that the collision zone is defined as an area within, roughly, a 60-degree radius of the forward longitudinal axis. I can see the troops now—sitting on clouds—twanging their respective harps at the 80 and 40 rate per minute, while attempting a belated accident analysis. The tune will be "Do Not O'ertake Me—Oh, My Darling."

Occasionally, one must push aside the flowering trivia and firmly grasp the root below. When will the slipstick types recognize the fact that you must positively identify *three* things in order to determine course, direction and closure rate? They are: wing, fuselage and tail. I, personally, have had no trouble with the relationship since the empennage retreated to its logical position (Circa 1910?). The birds are big and they are there! Illuminate them—

The light properties of plastic are such that inlaid strips to form the leading edge of the vertical stabilizer (the most important reference) would be visible from almost any angle, or even light the tail with some tired car headlights. The same is true of the wing and fuselage. Flashing lights? We have had those for years and know they indicate a blob somewhere that is going someplace.

In the article you admit that it took 15 seconds to determine travel directions. In another article in the same issue, entitled appropriately enough, "The Slow Speed Demon," you mathematically prove the dangers of the closure rates in terms of .5 to a minimum of 2.0 seconds until vehicle flight path deviation. Come now!

Maj. John J. McElroy
1611th Ops Sq (MATS)
McGuire AFB, N. J.

You had your tune, now mine must be. "Do Not Mistake Me—Oh, My Major." FLYING SAFETY *is not selling the Atkins Light. We merely reported a new development in the battle against mid-air collisions, and have asked pilots to observe the Atkins Light and give us their opinions of its effectiveness. We do thank you for writing. Perhaps the Directorate of Flight and All Weather Testing at WADC might be interested in your suggestion as to the use of plastic.*

★ ★ ★

Survival Kit

I have a problem. Perhaps you can move this letter around until someone can give me the answers. I am the Operations Officer and FSO of the 109th FIS, Minnesota Air National Guard, based at the Minneapolis-St. Paul International Airport. We operate F-89H aircraft and have an Air Defense mission.

Recently we were supplied with B-5-15 back-pack parachutes which made all crewmembers very happy. Last week, the Personal Equipment people began putting the MD-1 Survival Container in the aircraft and when we had a briefing on its use, some doubt was expressed regarding its adaptation to our mission and locale. This is the problem.

There is a period of from four to six weeks in the Fall and also in the Spring when the lakes are not frozen solid enough to support a man, but the water temperature is so near to freezing that a man could only live in it a very short time (estimates run from one to 20 minutes).

The MD-1 weighs somewhere around 33 pounds. It would be an obvious liability in the water and would have to be released as soon as possible after hitting the water. It is cumbersome and looks as though it would lessen a person's chances in an extremely low altitude ejection. With the B-5-15 chute fitted properly and the MD-1 hooked up, the subject is kept in a sitting position with no chance to assume the proper position for a parachute landing. It appears that this sitting position plus the added weight of the MD-1 would greatly increase the subject's chances for serious back and leg injuries.

In a situation where all the items in the MD-1 would be needed for survival, it is obvious that the above "assumed risks" would not overshadow the need for the kit. Alaska operations—or, for that matter, a point-to-point cross-country from our own base in the winter, should certainly require carrying such a kit. But what about our local flying? GCI has our position pretty well plotted at all times. Level terrain does not pose the usual hazards for helicopters and ground search parties. While we do have some rugged winter storms, they are usually well forecast, and if they are extremely severe we are below minimums and are not flying anyway.

One solution might be to leave the MD-1 at home and make certain that each crewmember has a knife, match container with compass, and concentrated food tablets in his flying suit pockets. It is our policy to have our Unit Clearance Officer check each crewmember to see that he is dressed for a walk in the woods and not for an airconditioned cockpit. Perhaps with the above, plus intelligent use of the parachute for survival, we would be better off than risking a landing injury or drowning or unsuccessful ejection with the MD-1. Also, in case it is necessary to leave the aircraft in a hurry—while it is still on the ground—the MD-1 is not exactly a helium-filled balloon!

Perhaps the answer is to start wearing the kit after the lakes are well frozen over and put it away when they start to thaw, thus lessening the drowning problem while having the kit for the most severe portion of the winter. All this may seem like making a mountain out of a molehill to you, but I'm sure that you realize that when a pilot has some doubt or reservation about a piece of personal equipment, its usefulness becomes questionable even if only from a psychological standpoint.

Are we completely off base in our guesses regarding the ejection and landing hazards of the MD-1? Do you have some statistics or incidents to prove or disprove our thinking? Is there a better kit available, or soon to be available, to wear with the B-5-15? Are there modifications for the MD-1 with quick releases or lanyards which will remove some of the undesirability? What do you think of our idea of making a makeshift kit of our flying suit?

Please let us know your thinking. We'd like some factual information which you people are in a position to have.

Capt. Charles F. Timberg, Jr.
Minn. ANG

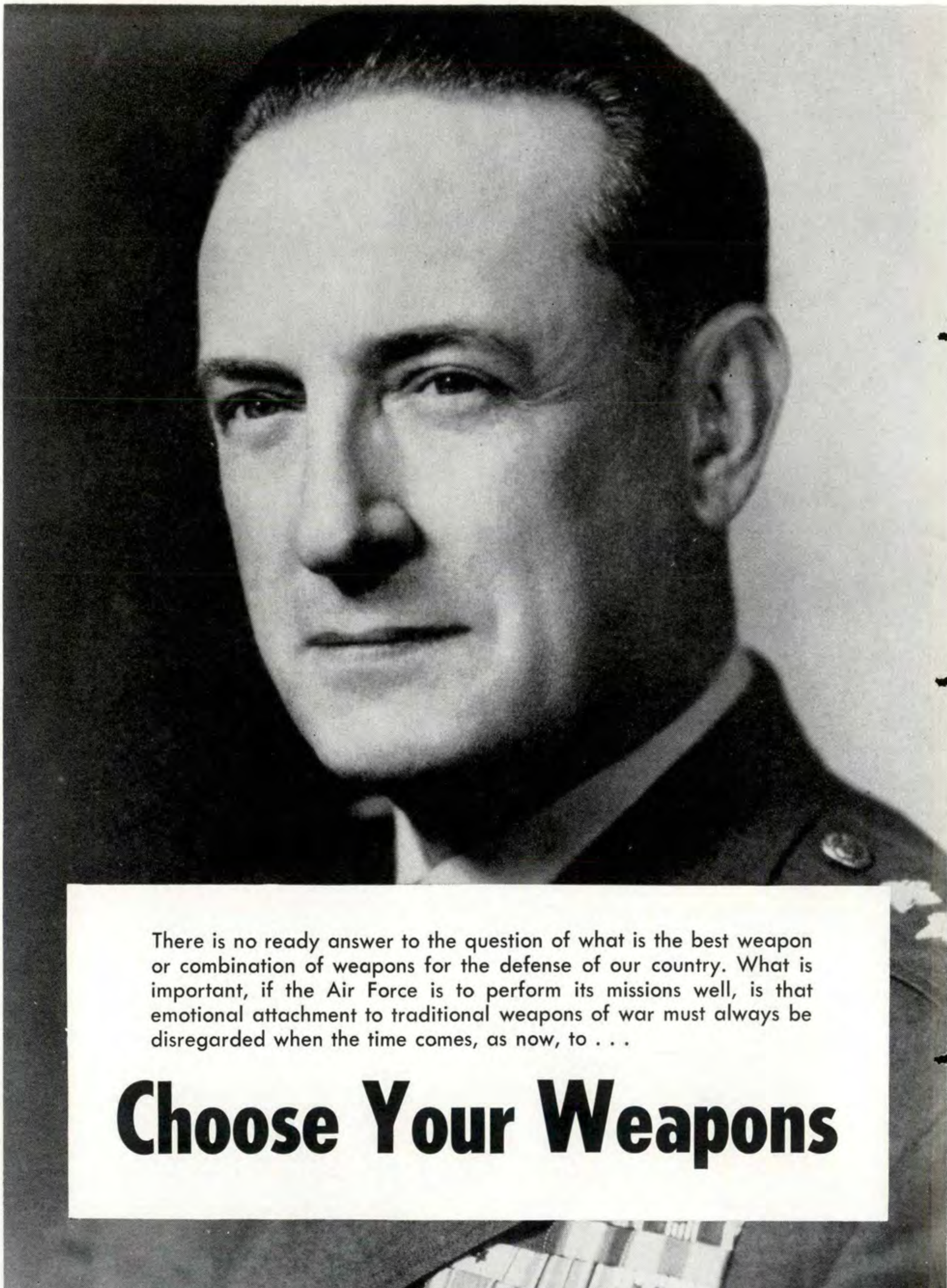
We have no statistics in the Aero Medical Safety Division, DFSR, to support a statement one way or the other, but so far there have been no reported injuries or accidents during ejection or landing attributable to the MD-1 kit.

A lanyard release incorporated in the unit accomplishes the following: pulls the zipper open, drops and inflates dinghy, suspending it 15 feet below jumper, with the accessory bag 10 feet below that. Thus, the anticipated hazard of a water landing is minimized. Tech Orders disclose no quick release device for the whole unit, except unhooking the D-rings.

As for deplaning in an emergency, you know what a shot of adrenalin does to the body; you could win the 100-yard dash with three MD-1s strapped to you.

Do-it-yourself emergency tackle stowed about the person is an excellent idea. Hope for the best, prepare for the worst—this is WISDOM.

"I'm sure we could have gotten clearance for a higher altitude if you hadn't been so impatient, Gridley!"



There is no ready answer to the question of what is the best weapon or combination of weapons for the defense of our country. What is important, if the Air Force is to perform its missions well, is that emotional attachment to traditional weapons of war must always be disregarded when the time comes, as now, to . . .

Choose Your Weapons

General Thomas D. White, Chief of Staff, United States Air Force

I doubt that any of us will ever forget the event which took place on the 4th of October 1957. It was one the whole world could observe—Sputnik I. In retrospect, what followed was another growth phase in our national maturity—but some of the growing pains were serious. There were charges and countercharges. There was again talk of the "ultimate weapon" and articles were written to the effect that the flying Air Force was finished. There were stories that we needed more scientists and still more opinions that the scientists we had were incapable of scientific leadership. Fortunately, many dedicated and intelligent people in science, industry and the government refused to be intimidated by "emotional probabilities" and continued about their work. So, since that time, considerable progress has been made. The Army, Navy and Air Force have all placed satellites in orbit, and the Air Force has made great strides toward the development of military capabilities which will assure extension of our air superiority into space.

Basic to the development of future Air Force capabilities is the definition and selection of weapon systems. If the Air Force is to perform its missions well, we must invariably choose the best weapons systems, regardless of any emotional relationship to the traditional weapons of war.

There is always a great temptation to lean heavily on tradition. You will recall that when the aircraft was first invented, very few men recognized its military potential. Those who did were partially stymied by traditional thinking and the usefulness of the aircraft as a weapon was not fully exploited. Thus when World War I began, the United States was far behind other nations in aircraft and engine performance.

Today, the Air Force's traditional weapon—the aircraft—is being challenged by unmanned vehicles. But with us in the Air Force, mission performance is the answer. If the unmanned vehicle can do the job better, it will be used. If the manned vehicle can do the job better, it will be employed.

Thus far, examination of the various possibilities before us indicates that Air Force weapon systems of the future will be mixed, that is, we will need a force of both manned and unmanned vehicles. By exploiting the best features of both systems we feel we can increase the rate of application of firepower.

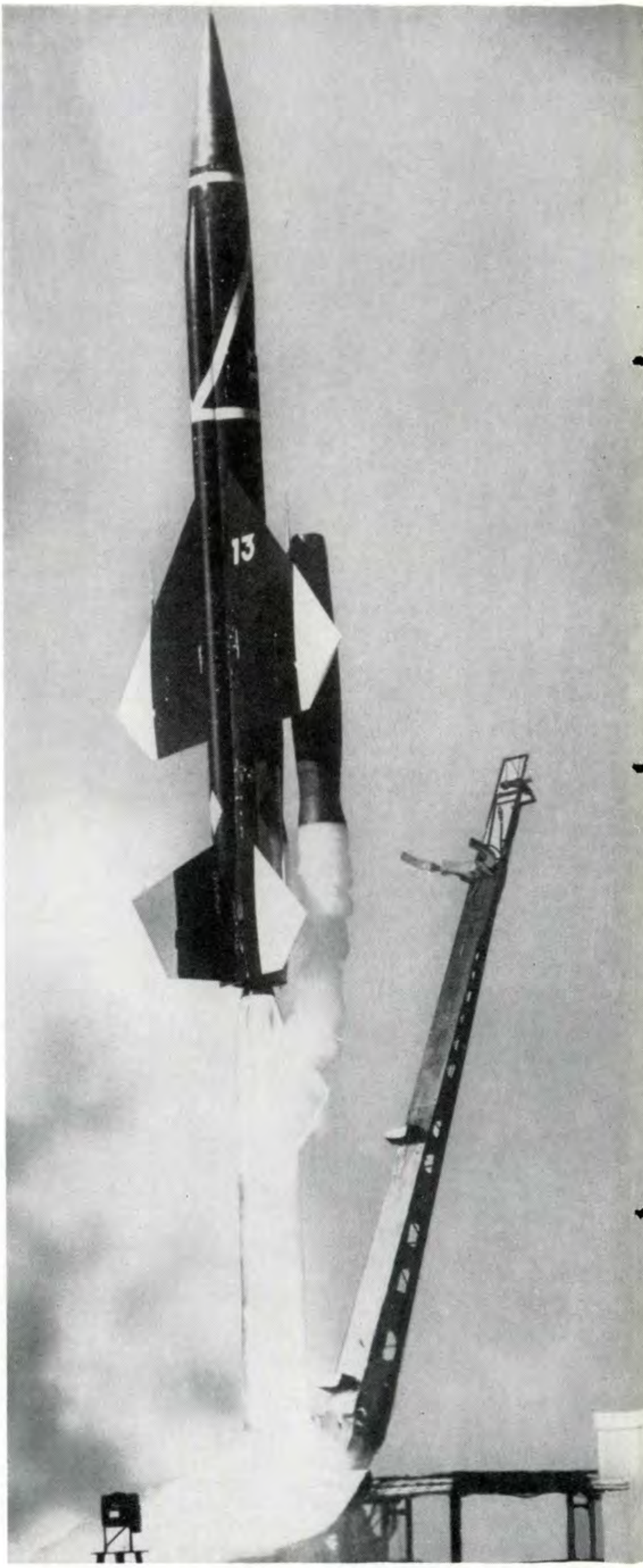
First, let's take a look at the defensive side of the picture. The Air Force is designing and developing an air defense system in depth. We want to attack the enemy strike force as far away from its designated target area as possible. We also want to subject the enemy strike force to continual attack. To do these things in the defensive role requires these elements and in this order: Early warning—identification—control—and attack. This has long been the Air Force concept of defense. It is the reason for the Air Force's continued development and improvement of its long range early warning system, the SAGE, semi-automatic ground environment system, improved fighter interceptors and the BOMARC surface-to-air missile. These systems in conjunction with the Army's Nike-Ajax and Nike-Hercules point defense weapons, should provide an effective defense in depth against the enemy jet bomber and air breathing missile threats which, without a doubt, are the major threats facing us today and for the next few years.

It would be ideal if we could develop a jam proof long range family of air defense missiles which could perform the entire active air defense mission. But, the present state of the art is not that far advanced. However, the BOMARC is a good start in this direction as far as the air breathing threat is concerned. The early model of the BOMARC, which will be operational late next year, has a range on the order of 200 miles. The later model will have a range of approximately 400 miles. This missile has performed well in many tests. One of the more recent, was its successful attack against a 1000 mph target drone flying at 48,000 feet more than 75 miles off the coast of Florida. This intercept, incidentally, was directed and controlled by a SAGE computer located in New York, a further demonstration of the effectiveness of SAGE.

As far as the fighter interceptors are concerned, the aircraft machine gun and the cannon are dropping by the

wayside in favor of air-to-air missiles. We now have the MB-1 air-to-air nuclear rockets, the Falcon radar controlled and heat seeking missiles and the Sidewinder, which was developed by the Navy and was so successfully employed in actual combat by the Chinese Nationalists. Such weapons give our fighter interceptors a higher kill probability. I am sure you are aware that more and more "Century" type interceptors are being received into our inventory: F-101s, F-102s, F-104s and F-106s. We also have the F-108 under development. This interceptor, with a speed in excess of Mach 3.0 and the ability to range at long distances from its base, will provide quick response to initial warning given by outlying early warning stations. These aircraft will be equipped with their own high powered radar and will be directed into radar contact by the early warning stations. They will have the built-in capability to press the attack on their own with air-to-air missiles.

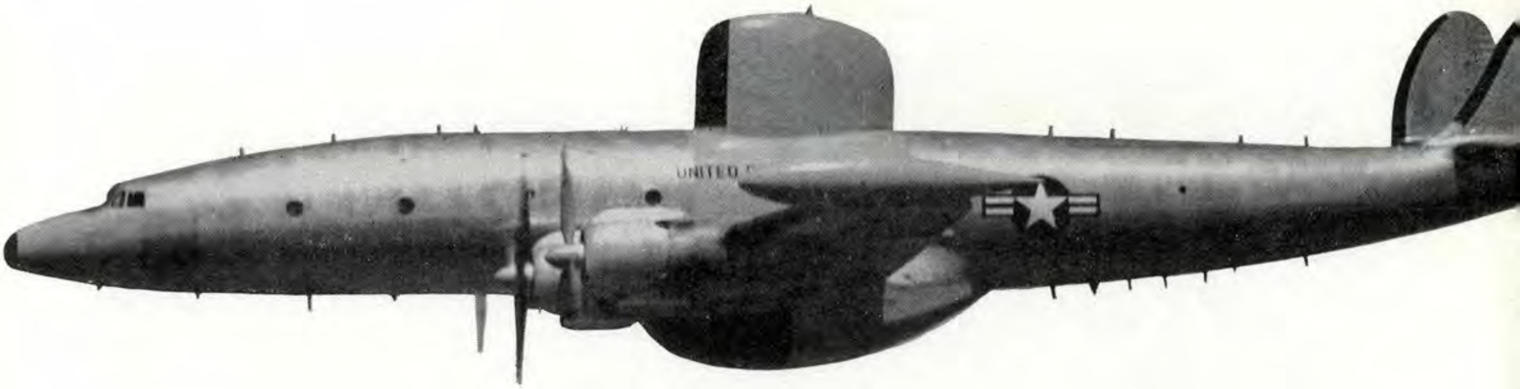
The advent of intercontinental ballistic missiles with nuclear warheads poses a whole new order of defense requirements. The Air Force is constructing long range radar sites capable of detecting such missiles, but as yet



The vertical launcher falls away as USAF's Bomarc gets its rocket boost for the first stage. Ramjets furnish power after launch.

there is no active defense available for use against such weapons. The configuration of future defensive weapons designed to counter ballistic missiles, spacecraft, and other vehicles operating outside the atmosphere, is not quite so clear at this time. Surface-to-air missiles seem to be the most logical answer. I cannot predict what the role of the manned vehicle will be in these operations. I hesitate to suggest that manned vehicles will not be used even though I am unable to describe the specific configurations of the vehicle to be utilized. However, I don't think man in space in a defensive role can be cancelled out as a possibility. Until we can achieve a surface-to-air missile/ground environment combination which can identify and destroy at great distances from their targets all types of enemy forces —whether they be subsonic, supersonic or hypersonic, I feel man will be in the picture.

It is in the field of offensive operations that the future usefulness of manned vehicles in air and space seems to be more clear. Recent significant successes in our ballistic missile programs are indicative of the results we can expect in the future. Although they are large and com-



plicated, the current generation of ballistic missiles are destined for acceptance as real military weapons rather than noble experiments. Here again we are interested in long range, but to achieve this range we must accept penalties in warhead weight. The tremendous weight lifting capability of a heavy bomber can't be matched by these first ballistic missiles. Intercontinental ballistic missiles also have other limitations. For instance, precise geographical relationship is required between the missile's launch site and the target location. Furthermore, once a ballistic missile is launched, it cannot be recalled nor can it be diverted from one target to another while in flight. A manned aircraft, on the other hand, does not require a precise geographical relationship between its takeoff point and the target. In addition, it can be recalled or diverted and it can vary its tactics. So for the next few years, at least, we can expect to see the manned bomber and the ballistic missile performing complementary roles. Since each has different points of advantage a combination of the two systems will add greatly to our offensive power.

Just over the horizon is another factor which shows great promise as far as offensive operations are concerned. This is the merging of the bomber and the missile into a common weapon system—a bomber which would launch air-to-surface missiles. One of the developments in this area has been the pioneering Rascal, which is now being followed by the Hound Dog to be carried by the B-52s. The Hound Dog will have a greatly extended range thereby enabling the bomber to avoid many enemy defenses and yet be in a position to launch its missiles against heavily defended targets from hundreds of miles distant. (I might add here, that in this type of weapon lies one of the reasons for the Air Force's basic concern about a defense in depth and long ranges in our air defensive weapons. The possibility that a bomber force will not have to penetrate all the way to the target makes it imperative that our air defense forces be in a position to attack this force at long distances from potential targets.) Further improvement of such missiles and the development of long range aircraft such as the nuclear bomber would enable us to conduct constant patrols over the seas or friendly territory and to launch a retaliatory attack on a moment's notice deep within an enemy country. Fur-

. . . CHOOSE YOUR WEAPONS

thermore, such attacks could be launched from totally unpredictable locations.

Man's future in space is confronted with many unknowns and one cannot establish a definite time table for achievement. The X-1 and X-2 were initial steps on the road to manned space flight. The X-15 and the Dyna-soar project are additional steps on our learning curve. Further measures are a matter of serious study in many fields. Back of these efforts is the realization that man's true conquest of space will depend on his ability to employ reasoning power and judgment to control his movements in space. He cannot be a mere passenger on a rocket ride from point to point.

When we talk of space and man in space, the factor of safety always enters the picture. Safety not only for ourselves, but for all who use the air space. "What goes up must come down," may not be true of today's satellites, but it will always be true of man because he will want to come back—and come back safely.

All of us associated with the aircraft industry are vitally concerned with safety—in the air and some day in space. There is no need for me to go into why all of us are concerned. Professional aircraft pilots as a group are not only the most concerned about air safety, but the most capable to work out solutions.

It has become very apparent to me that as aircraft performance and capabilities increase three associated factors also increase. These are:

- Cost
- Air Space Saturation
- Penalty for Human Error.

When I talk cost in this context, I am not referring to the cost of the airborne vehicles themselves. I am referring to the cost in an improved ground environment system which will provide adequate navigation aids and control. We have and are spending considerable money to increase aircraft performance and capabilities. We must be prepared to spend a comparable amount on the ground environment system—the system that supports the airborne vehicles.

Twenty-five years ago it seemed improbable that we would ever be overly concerned about air traffic saturation. The airspace was vast. No one concerned himself especially with the possibility of collision. Now, we must be aware of this problem every moment of flight. Increased aircraft performance and an ever growing volume of air traffic have compressed the air space into a relatively crowded area. To operate with greater safety we need comprehensive management of air traffic, better organization of the airspace, and a greatly modernized air traffic control supporting system. We cannot rationalize the problem by wishful thinking that the current situation will improve of its own accord. Use of the airspace will continue to increase. The problem of safety must be approached from the standpoint of accommodating all users through effective management and control rather than through operating restrictions.

As aircraft performance increases, the penalty for human error also increases. This goes all the way up and down the line—pilot, air traffic controller, engineer, mechanic, communications expert and production man. To compensate for human error, everyone should constantly bear in mind alternate courses of action in case of errors by others. The fact that we all may err is a burden we share together.

In this brief discussion of the overall safety problem affecting the future of air travel I have not presumed to provide specific answers. I certainly don't have them. Feasible solutions will no doubt result. I am convinced that good answers lie within overall recognition of the generalities that I have mentioned. Ways must be found to provide adequate ground support and control; we must accommodate, not restrict, and we must find ways to reduce the possibility of human error.

Let me re-emphasize a word of caution. We must not handcuff ourselves by tradition. We must accept new ideas—new configurations—and attack all problems with open-mindedness. That has always been the airman's approach. When I hear people say that aeronautics has come of age, I am concerned lest we become complacent. Aeronautics and astronautics are closely allied sciences. I don't think we've even touched on the infinite number of possibilities that exist. New and challenging horizons of achievements are there if we will reach out for them. ▲

• TIPS FOR T-BIRD DRIVERS

Major Wallace W. Dawson
Fighter Branch, Flight Safety Research

Inadvertent (a good word meaning many things) canopy jettison incidents in the T-33 aircraft continue to happen, despite our best efforts to date. Now there are several good reasons why you should not release this canopy in flight. First, the helmet without its chinstrap fastened might also take off, and this will muss up the hair. Second, the canopy might just hit the tail section and render the bird unmanageable. Third, the noise of the charge going off might scare you. Fourth, canopies cost a rather large hunk of the long green, and finally, it's going to be chilly without the lid on.

Unless you might think that blown canopy incidents are unusual and not worthy of concern, please be advised that 16 greenhouses have been prematurely opened in the past few months. If this trend is allowed to go on unchecked, there will be just two classes of pilots in the T-33: those who have blown a canopy in error and those who are going to do so. Since it is plainly undesirable to classify our pilots in this manner, it behooves us to keep harping on the subject, hoping the word will permeate some skulls so far impenetrable.

Seven of these recent canopy fluffs occurred when the pilot or passenger was trying to adjust the seat; four while removing seat pins; three while removing stowed equipment, and one each fell to a glove and a pin streamer. A good passenger briefing prior to entering the cockpit will eliminate many of these incidents forthwith. A little self-re-education by all T-33 pilots will be sure to prevent the rest. Keep in mind that you are dealing with a loaded gun—which it is—and act accordingly. Just like a hunting accident, it can be fatal as well as embarrassing.

Every once in a now and then we run onto little jewels of knowledge which, we are reasonably sure, are not possessed by one and all. We pass these on to you in the hope that being in possession of same will (or maybe might) help you keep yourself from getting between a rock and a hard place.

This tip applies to landing T-33s at Navy bases. Nearly all Navy bases have aircraft arresting gear installed on the runway. This is not—repeat not—the barrier type of decelerator which we know, but cables stretched across the runway six inches high and designed to grab a hook. The Navy reports "numerous instances" of speed brake and wheel well door damage to TV-2 aircraft by inadvertent partial engagement of this cable. It has laid down some ground rules for its own troops in the TV-2 which will apply equally as well to USAF drivers in the T-Bird.

So, if you are landing at a Navy base and expect to run over the arresting gear, suggest you proceed as follows:

- Raise the speed brakes after landing.
- Do not use brakes when passing over the raised cable. Application of brakes while moving can reduce main landing gear door clearance to as little as four and one-half inches.
- Be sure that your tires and struts are properly inflated before you leave home.

Our thanks to the Navy for passing this information on to us. A free exchange of ideas on accident-prevention is certain to benefit pilots in both branches of service. ▲

the DESK JOCKEY

Major Joseph E. Cahill, Headquarters, USAF

"**Air Force eight - seven - five - four,** this is Mitchel tower. I have your ATC clearance. Are you ready to copy?"

Major Steve Gordon completed his pre-takeoff check, then reached for his mike and answered, "This is Air Force eight-seven-five-four. Roger. Ready to copy." He began to copy the details of the clearance on the note pad strapped to his right leg.

"ATC clears eight-seven-five-four to the Atlanta airport via direct Newark, Amber seven to Richmond, Green six to Atlanta. Cruise and maintain eight thousand while on airways and contact Idlewild Departure Control after takeoff for climb instructions. Read back, please."

Steve acknowledged the clearance details and advised that he would be ready for an instrument takeoff in one minute.

While running through the pre-takeoff check, he had become aware of a strange premonition that left him feeling uneasy. True, the weather was down all along the route but this was no new experience for an Air Force pilot with more than 500 hours of weather and 5300 hours total flying time. He realized that he would be on the gages from the second that he lined up for takeoff but then he had made many blind takeoffs in the past 15 years, flying various types of USAF aircraft. Actually, he knew perfectly well the reason for his apprehension — he was losing his confidence. Ordinarily, he had a copilot and an engineer along to help him. Today he was alone.

For the past three years Steve had been assigned to a headquarters desk job. He was getting valuable administrative experience which would broaden his Air Force career. But he had neglected his flying, particularly his instrument flying. Eight or ten hours a month was all the flying he'd managed to do—not nearly enough to stay razor sharp. Still, he couldn't slight his ground duties either.

Steve shook off the uneasy feeling momentarily. As he reached for the mike to call for takeoff clearance, he noticed that the clock read just 1300. The cockpit was practically dark except for the silver glow from the flight instruments.

Steve squeezed the mike button.

"Mitchel tower, this is eight-seven-five-four, ready for takeoff. Over."

"Air Force eight-seven-five-four, clear for takeoff on runway two seven. Your ceiling is one hundred feet. Visibility, one quarter mile."

The voice was deep and monotonous.

Steve watched the gyro-compass swing around as he lined up for the takeoff to the west. Smoothly, he opened the throttles to the takeoff power setting. Almost immediately, the airspeed needle began to rise. He shifted his primary attention to the gyro-compass to hold the runway heading while he cross-checked the other instruments. At 90 miles per hour the controls came alive and he added back pressure on the control wheel to establish a normal climbing attitude. Gradually, the altimeter needle started to rise and the rate-of-climb indicator steadied on 500 feet per minute. As the altimeter needle passed through 300 feet, he moved the landing gear handle to the UP position and adjusted the throttles and prop controls for normal climb.

So far so good. He let his eyes dart from one flight instrument to the next. The takeoff had been uneventful and the tightness in the pit of his stomach relaxed somewhat. Maybe he wasn't so rusty after all. He was passing through 600 feet now on a heading of two-seven-zero and the airspeed had built up to 160 miles per hour.

Steve changed radio frequencies and requested climb instructions. After a moment's pause, he received a reply:

"Air Force eight-seven-five-four, I have you in radar contact. Report over the Newark Radio Range at eight thousand feet. Over."

"Roger," Steve replied, as he tuned in the Newark Range on the radio compass. Through the static, the Newark identification signal E-W-R came through. He noted with satisfaction that the homing needle was pointing dead ahead. "Right on course," he said, half aloud.

Suddenly, his complacency was shattered! A glance at the instruments told him that he was in a spiral to the right. He was losing altitude rapidly and the airspeed was building up. In tuning the radio compass he had neglected the ever important flight instruments!

Abruptly, he rolled the wings level and pulled the control column toward himself. Slowly, the excessive airspeed fell off and the nose moved upward through the horizon. All at once he remembered the first words that his primary flight instructor had ever said to him: "Flying is not inherently dangerous; but like the sea, it is terribly unforgiving." The anxiety felt before takeoff had now returned to him. There was no point in kidding himself. He was rusty and he knew it.

It was just 1310 as Steve reached 8000 feet over the Newark Range and swung to the south on course. If all went well he should be over Atlanta in three hours and ten minutes. He reached for the mike and called Departure Control.

"Idlewild Departure Control, this is Air Force eight-seven-five-four. Newark at one-zero, instrument flight clearance to Atlanta. Estimate Washington Radio Range at fourteen hundred. Over."

"Roger," said the controller, "have a pleasant trip."

Steve made the necessary cruising power adjustments. While shifting his eyes from gage to gage, his mind wandered back over the years. He had graduated from flying school in June of '43. Afterward, he had flown 100 missions in a B-25 in the Pacific. Later, until the Japs surrendered, he had been an instrument instructor. He had been stationed in Germany when the Russians blockaded Berlin and he had been one of the first pilots on the Airlift.

In 1951 he had volunteered to go to Korea where he had flown 50 missions in a B-26, then, for three years he had been a SAC B-47 commander. He prided himself on the fact that he'd yet to put a scratch on an airplane or break so much as a fingernail.

His tour as a desk jockey would be over in three months and he was hoping for an assignment to another cockpit job. Maybe even the B-58 Hustler, if he were lucky. That would suit him just fine.

He checked in over Washington and set a course for Richmond. All at once, a casual glance at the left manifold pressure gage swelled into a wide-eyed stare. He started! The left engine was losing power. Almost instinctively he moved the carburetor heat levers down to the *hot* position. Gradually, the engine resumed power. Steve cursed himself for being so inattentive.

With below-freezing temperature and moisture in the air, he should have anticipated carburetor ice. It was this sort of thing that could kill a pilot—even an experienced one who lets himself get rusty.

As he adjusted the carburetor heat controls he saw his hand tremble. "Got to settle down," he told himself. "Never make it to Atlanta this way."

The next two hours were uneventful. He checked in over Richmond within one minute of his ETA and hit Greensboro and Greenville right on the money. The air had become more turbulent and he had some difficulty holding his altitude and heading constant. The feeling of anxiety persisted, even intensified.

In 15 minutes he would be over his destination. He put the mike to his lips and spoke.

"Atlanta Approach Control, this is Air Force eight-seven-five-four. Five zero miles northeast of your station. Eight thousand feet. Estimate Atlanta Range at one zero past the hour."

"Air Force eight-seven-five-four, Roger your position. Descend to two thousand feet and advise when over the Atlanta Range. Altimeter setting is zero-one-two. Present Atlanta weather ceiling two hundred feet, visibility one half mile."

Steve confirmed the instructions and requested a Ground Controlled Approach. Two hundred feet and half-a-mile visibility were duck soup when he was flying the Airlift. But he wasn't flying the Airlift today. He was a desk jockey who had let his flying proficiency lapse and now he was going to find out just how far he had slipped.

As he finished setting the altimeter, he felt a lurch to the left and countered with a hard right rudder. He had experienced this feeling before; his left engine was going out! His eyes scanned the instrument panel. The left engine's oil pressure had dropped to zero and the oil temp was dangerously high. Without hesitating he pushed the red feathering button.

Steve rolled in enough right rudder trim to relieve the pressure he had been holding. Immediately, he called Approach Control and declared an emergency. He was advised to contact Atlanta GCA on H channel for a radar approach to the field.

GCA came in loud and clear.

"Air Force eight-seven-five-four, remain at two thousand and take up heading two-seven-zero degrees. This will be your downwind leg."

Steve added power to the good engine and turned to a westerly heading. His entire body was trembling as he fought off panic. At his best, this would have been a tight spot. With the ceiling at 200 feet and the visibility at one-half mile, he would have only one pass—no chance for a single-engine go-around after he dropped below 200 feet. He forced himself to move the fingers on his left hand, and he realized he'd been squeezing the wheel in a death-like grip.

GCA was calling again.

"Air Force eight-seven-five-four, perform pre-landing check. Lower gear and flaps at your discretion."

After a few seconds pause, the GCA operator continued.

"Now, turn right to zero degrees. This will be your base leg. You need not acknowledge any further transmissions."

Steve turned North. His heart was pounding now. The climax was about to begin.

"Now steer right to zero-nine-zero degrees for final approach," intoned the GCA operator. "You are five miles from the end of the runway."

Steve decided to put off lowering the landing gear and flaps until he started his descent. He was holding altitude at 120 miles per hour, a bare 15 miles above stalling speed.

"Begin five-hundred-foot per minute descent now," instructed the GCA operator.

Steve moved the landing gear handle to the *down* position. The miniature airplane in the artificial horizon dropped below the bar and the vertical speed indicator settled on 500 feet per minute descent.

"On course and on glidepath," assured the GCA operator. "Very nice job of flying."

For a while, Steve actually thought he was going to make it. And then it happened. *The right engine quit!* Frantically, his eyes searched the cockpit and then he spotted the trouble. He had forgotten to switch fuel tanks. "Got to get it started," screamed Steve as he fumbled for the fuel selector valve. But he might as well have begun to relax the moment the engine quit. It was not going to start again before he ran out of altitude. He was down to 300 feet.

Suddenly Steve felt a shudder. He knew that he was entering a dreaded low altitude stall from which there would be no recovery. The controls went limp and he began to spin like a top. It was all over except for the wait! There was no point in fighting it now. Ironically, he felt only shame and disappointment. The panic was gone. Abruptly, the seat stopped spinning and all was quiet.

As the canopy was slid back, the darkness of the cockpit was flooded with light and the face of Master Sergeant Luther appeared.

"Major Gordon," he said, "it's a good thing you were in a ground instrument trainer. If you'd been in an airplane, your wife would be minus a husband tonight!" ▲

Some people consider an airplane such as the F-104 to be the ultimate in airbreathing aircraft. With space travel near can these be called . . .

The

I was reading a letter the other day that described the F-104 as the final link between flight as we know it in the atmosphere, and flight as we shall know it in space. I've been flying this aircraft in test work since April of 1956 but had never considered it in that awesome aspect. On the contrary, the more experienced I became in the aircraft, the more apparent it became as "being simple to fly." I was convinced that this was a secret worth keeping with other F-104 pilots: To let our public think that one must possess amazing attributes to fly this "missile" rather than expose the fact that it requires no special pilot skill to handle it.

In the National Air Show at Oklahoma City in 1956, I had the pleasure of flying Major Stu Childs' wing, in the '104 demonstration. The attention given this aircraft in her public debut was overwhelming. In fact, we simply reveled in our reserved parking place in front of base operations and the overnight storage inside the hangar reserved exclusively for our F-104s.

Never one to fail to adjust to the situation, Stu remarked to me the second day we were there, "We'll continue to make our break at five hundred knots and go out of sight in the traffic pattern for the rest of the show. I feel they rather expect it and maybe we shouldn't disappoint them."

Now, take the standard VIP observation: "It sure doesn't look like a Second Lieutenant's airplane to me. What're we going to do when it gets out in the operational outfits?"

I did the best I could with that one, but in spite of urging that any Second Lieutenant be promoted as part of the check-out procedure for the F-104, George Air Force Base recently checked out 2d Lt Reg Fisher. And since he made it with flying colors, I assume another of those bubbles has burst.

But let's return to this space flight pitch. We aren't too well acquainted with space flight as yet, but from the present trend of rumors, the man in space will be merely a witness to a show that is pre-planned and automatically set before blast-off. Still, I doubt if the "final link" thought was referring to the F-104's simplicity of operation that does not tax the pilot's skill and cunning.

Seriously, looking at the F-104's flight envelope and by changing "final link" to "present link," I feel that we have a legitimate statement. I don't believe there is anything flying today that can match the '104's performance, but even an advanced version of this aircraft is capable of taking another big stride just as this one did when it first came out.

As some of you probably know, the F-104 is limited in speed because of temperature rise at high speeds, or to use a more descriptive phrase "the thermal thicket." When the F-104 reaches its maximum allowable speed, it still has the excess thrust available to continue accelerating. For this reason, the F-104 can match its world speed record anywhere in a 30,000-foot altitude band from 30,000 to 60,000 feet. It established the world's altitude record by utilizing the principle of energy exchange, i.e., trading this speed for altitude in a zoom.

The most recent feat of capturing all of the "time to climb" world records, including two that had never been set before, was actually the

LINK?

Louis W. Schalk, Jr.
Engineering Test Pilot
Lockheed Aircraft Corporation

truest demonstration of the F-104's performance. Here the flight profiles for the seven records did not involve the thermal thicket, for even the 25,000 meter climb did not have a profile that reached maximum speed. Four and one-half minutes to 85,000 feet or two minutes to 50,000 feet from brake release is somewhat breathtaking. These records were attained by two Lieutenants—Bill Smith and Einar Enevoldson, from Larson AFB, Washington — each with approximately 35 hours in the F-104. In ten flights they set seven records. No other cigarette can make that statement.

How does the F-104's performance link up to space flight? Consider the X-1 and X-2, the two Bell research rocket planes that have helped to write aviation history. These two research vehicles were after speed and altitude. Unlike the jet engine, the rocket engine does not breathe air and, consequently, its thrust output is rather indifferent to altitude. Therefore, for a rule of thumb, the thinner the air the better acceleration in speed.

In trying for speed these planes first had to climb and then level off, for it was desirable to get up in the thinner air where a level acceleration could be more sensational.

The optimum altitude for the X-1 and the X-2 to accelerate for top speed was around 70,000 feet. This altitude was a compromise due to the limited burning time of the engine with its available fuel supply and its launch altitude from the mother ship at approximately 30,000 feet.

Just prior to launch the fuel tanks were topped off. Upon being launched the rocket plane was pulled up on the stall burble to a steep climbing attitude constantly accelerating in speed. A pushover was initiated to level off and continue to accelerate until burnout. The phase of the powered flight lasted only about five minutes and the pilot was in a race with time to complete the optimum profile. After burnout it was basically a problem of dead-sticking on the lake bed from a high key altitude of 70,000 feet.

One must certainly get a feeling for burnout by shutting the afterburner off at Mach 2.0 at 35,000 feet. It's like shaking hands with a stonewall. Considering the rocket plane's profile from launch to 70,000 feet, a parallel with the F-104 is found in rotating to the subsonic climbing attitude after takeoff. Here, attainment of the climb schedule should be anticipated to arrive at the proper climb attitude and climb speed at the same time. Also in leveling off, a gentle pushover should be initiated programming the aircraft to be level at the desired altitude.

To climb supersonic from 35,000 feet to 45,000 feet draws the closest parallel. The F-104 leaves 35,000 in its high supersonic speed envelope as if it had discovered a brand new lease on life. At 45,000 feet the rate of climb is still around 10,000 feet per minute. An over-ambitious rotation will inject a little zoom into a straight-away climb that is not picked up too readily and it will up the rate of climb even more. The pushover for level off must be anticipated. In supersonic flight, the sluggishness of the altimeter requires the pilot to play it by ear. The altimeter falls behind, thereby encouraging the pilot to overshoot in altitude. With a little practice, proper anticipation allows for this. By becoming familiar with

these techniques in the F-104, the 'go for broke' runs in a rocket plane should become less difficult to perform.

In trying for altitude the F-104 has even more value as a trainer. The "X" planes had the same initial profile for altitude as for speed. The speed pushover was eliminated in the altitude run and burnout occurred while in the climbing attitude. Even high speeds were attained in this climb (the "thinner" the air the faster you accelerate) and on burnout, as was the case in the X-2, the plane would "glide" on up for another 40,000 to 50,000 feet following a ballistic trajectory while trading speed for altitude, just as the F-104 does in its zoom.

Coming downhill was no picnic either as the plane tried to match its maximum speed in powered flight. The steeper the zoom the steeper the descent angle. With steep descent angles the gravity component could be analyzed as a strong thrust vector. Some pilots thought the worst was over after going over the top until they saw the Machmeter winding up on the way down. They described the sensation of trying to pull out and the gradual return of control response for leveling off. They hadn't planned to hit such a speed on the way down, but even if they were to try it again, they doubted if it could be avoided.

Our zoom experience has revealed that the energy for just the rotation is very important. On the altitude, Major Scrappy Johnson rotated the F-104 below its ceiling in order to use thrust to help hold his speed.

The max effort zoom in the F-104 can feel just like a rocket.

On the build-up flights it seemed that the steeper the attitude, the higher she would go. Loss of the afterburner around 70,000 feet and sometimes engine stall could parallel the burnout of the rocket engine. Going over the top in the F-104 or X-2 could be described as similar sensations. There is no experience of a loss of control, but since the aircraft seems to be doing all right by itself, the need to control it does not establish itself, nor is it really obvious that it could be controlled, should the pilot wish.

Looking at speeds of 80 to 90 knots over the top in an F-104 can only be explained by the fact that the angle of attack cannot be critical as long as the aircraft maintains less than 1G flight, which is exactly what it does. As the aircraft "falls through" it produces normal accelerations as low as .2G which means that airspeeds below the stalling speed can be encountered without reaching an angle of attack that produces stall. Now if there is any unpleasant thought when considering a zoom, it is a tail-first descent from 90,000 feet. The attitude demanded by a maximum effort zoom tends to generate just such a feeling. Naturally the healthy approach is to build up from the low side. The nose first descent is the popular thing. Then, on the way down as Mach 1.9 or 1.8 is clocked when passing through 70,000 feet, one can only wish he had had that Mach at 70,000 feet on the way up. Then, the maximum altitude reached really could have been something! Yes, the maximum effort zoom in the F-104 can duplicate the feeling of an altitude run in a rocket plane as we know it right now.

Wait just a minute—the F-104 didn't help the X-1 or X-2 a bit. It was the other way 'round. The "X" airplanes led the way in laying out the basis for the flying techniques and in gathering aerodynamic data on supersonic flights. But, should we say that it won't be valuable for the next step? No, it's just like taking a bite, chewing it for a while, swallowing it, and taking the next bite. Thoroughly digested, this information led to the F-104 and other Century fighters.

The F-80 and the F-86 may not fly like the X-1; but Colonel Yeager, who flew the '80 and the '86, experienced at least a portion of the route there as a preview and he helped relieve the extent of the apprehension that is generated by moving on out into the unknown.

The thoroughly digested info gained from the X-1 and X-2 led to the development of F-104.

Similarly, it was true with the F-100 and the X-2. Colonel Everest was able to shake hands with supersonic flight in the F-100 well enough to be able to expect a similar sensation in the X-2. He also had even a better friend in the X-1.

This brings us up to the present—the X-15. Quickly look at it. There's the shape of the F-104 with a low tail, made so in order to fit it into the bomb bay of a B-52 (there, I said it). But apart from its appearance, look at its flight profile. It will be launched from Utah with its destination Roger's Dry Lake at Edwards Air Force Base. There's quite a departure from taking off from Edwards, climbing out to the edge of the valley, turning around and dropping the X-1 or X-2, heading toward the lake. Their powered flight took place over the lake with the optimum profile always ending on the other side of the lake within gliding distance of that 17-mile long runway.

There are numerous specialists who collaborate on a flight profile. They expend a great deal of effort to accurately predict the rocket plane's performance in order to let the pilot know how he has to fly the aircraft. In the past, if something went amiss, the lake bed was always within gliding distance, even at launch.

The route from Utah to Edwards is a pretty fair cross-country and the relative runway length of the target (Roger's Dry Lake) becomes proportionately insignificant. If things do not occur as predicted, one of three things could happen:

- One could undershoot.
- One could even overshoot.
- And, in this space age, can we say that one might even accidentally pop into orbit? (There's no way, but the copy room will love it.)

The F-104 should and is easing into the picture rather comfortably. The X-1 is still flashing through the sky occasionally, but there is a lot involved in getting off a flight in a rocket plane. The F-104 has comparable performance to the X-1 and is much more simple and economical to fly. Zooms could be rehearsed in the F-104 to the extent that when the engineers call for a 42° pitch angle on the climb, the pilot can have the familiar feeling to identify this angle from experience as well as with instruments. The greater the precision in the execution of the X-15's flight plan, the easier the dead-stick pattern from Las Vegas. For it must be easier if the starting point is where it is planned to be. This is pretty important when the glide ratio of an anvil has to be considered.

Just what is involved in the dead-stick pattern of the X-15 is of specific interest, since all landings will be in that class. Research prior to flight produces some pretty firm figures on aircraft these days. On a high speed vehicle such as the X-15, it is fairly obvious to anyone, even without figures, that the rate of descent with a dead engine should be almost as startling as the rate of climb under power. Here again, the F-104 is a fine guinea pig. Its stubby, razor wings (low aspect ratio and small percentage thickness to the scientists) foster startling glide ratios too, as well as low supersonic drag. By holding the gear extension until the flare in the dead engine landing pattern, the rate of descent during approach remains in an acceptable ball park. By varying the configuration a little, a simulated flameout pattern can be tailored to the predicted X-15 characteristics and the technique established before it flys.

The N.A.S.A. developed a flight simulator with reaction controls. Jets of air were piped out to desired locations. When programmed properly the jets would alter the attitude of the simulator. The X-15 will be out in the areas where insufficient air exists to permit the conventional controls to exert the desired influence on attitude, hence the need for a simulator was established to allow the pilot to practice with this unconventional method of control.

The initial success of the simulator prompted the next step—the installation of the reaction controls on an F-104. Why the F-104? It is not expected that the X-15 will handle like the F-104, but the '104 offers the greatest flight envelope of any aircraft today. Although the reaction controls could go on any aircraft, it is logical to choose the F-104 to get as close as possible to the area of interest. The higher one can get to test the controls, the more realistic the results become.

The X-15 is a research vehicle designed to pave the way for future manned aircraft that will take big strides in both altitude and speed. It really does not appear that the X-15 will ever hurtle into orbit and become stylishly accustomed to space flight. However, that will come along too, no doubt about it. It really takes more imagination for me to try and realize how it could be possible for anyone to dream fifty years ago that aviation could be where it is today. The F-104 is a link all right, but it is in a chain that has its end link yet to be forged. ▲

By varying configuration a simulated pattern can be flown to predict characteristics of the X-15.

WELL DONE

The mission assigned to this pilot in the C-124 Globemaster was to accomplish his annual instrument flight examination. The station was Hill Air Force Base, Utah. As part of the exam, he had been given a two-engine "go-around" by his flight examiner. During the execution of this maneuver the No. 1 propeller failed and went into reverse pitch. The C-124 was then flying at 300 feet above the terrain.

Captain Cragin was unable to maintain control and the Globemaster assumed a steep left bank and continued to lose both airspeed and altitude. The aircraft veered sharply from the runway heading and Captain Cragin made the immediate decision to retard all power. With maximum control application he brought the C-124 to a wings-level attitude, but of course was committed to an immediate landing.

The landing was made in the rough terrain immediately adjacent to the runway. The landing gear, which was already down, was left in that position. Captain Cragin allowed the aircraft to roll to a stop without application of brakes and thereby avoided possible collapse of the gear on the uneven surface. Under similar circumstances, brake application had caused failure of the undercarriage.

By his completely professional approach in the face of an extreme emergency this pilot was able to avoid what might have been a disastrous accident with subsequent loss of lives and property. Well Done, Capt. Cragin! ▲

Captain

ERNESTO A. CRAGIN

28th Logistic Support Sq., Hill AFB, Utah

Captain

LLOYD M. CLORE

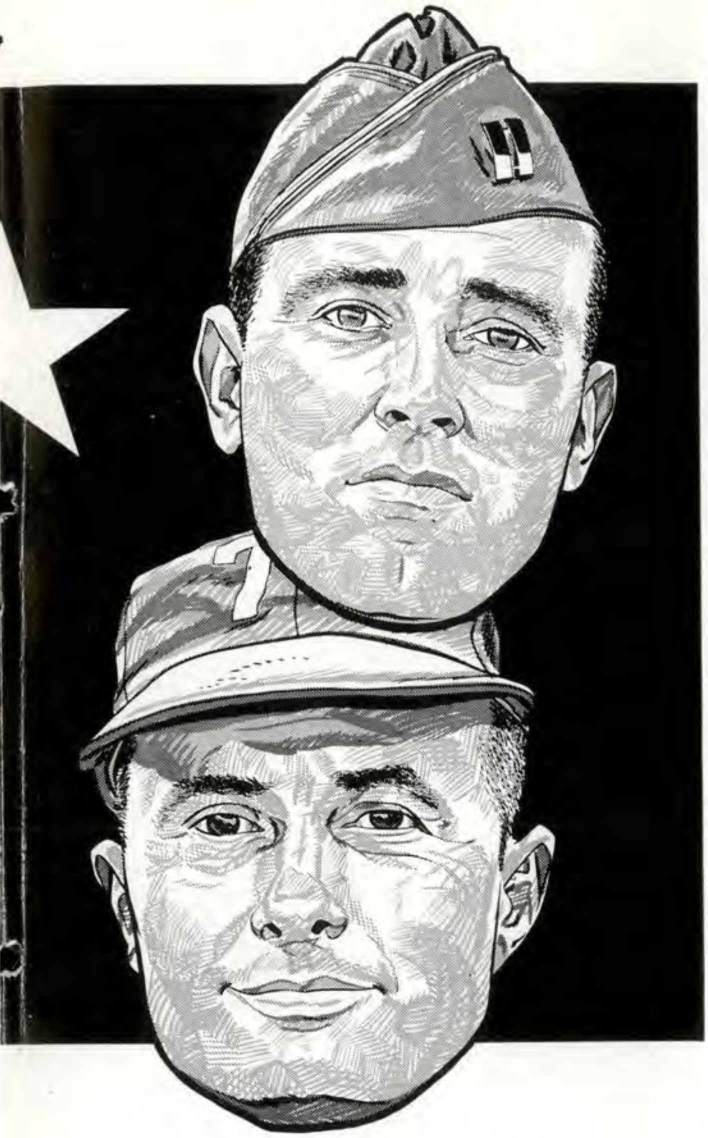
First Lieutenant

BALTASAR LUNA

73rd Troop Carrier Squadro

This reserve C-119 crew was flying a night training mission when, immediately after takeoff, the elevator controls jammed as the landing gear was retracted. By using the elevator trim the aircraft was maneuvered to an altitude of 6000 feet where attempts were made to free the elevator control. The gear handle was placed in the down position and the main gear lowered. Elevator control was regained but the crew found the nose gear was cocked and binding on the nose gear door. The tire had been binding the elevator control bell crank.

Three hours were spent in attempts to free the nose gear. Finally, it was determined that the door rod must be manually disengaged if the nose wheel was to be lowered. The flight mechanic, Sergeant Beauchamp, entered the nose gear compartment without a para-



Captain

DEWEY H. FERREL JR.

Staff Sergeant

WILLIS J. BEAUCHAMP

n, Medium, Air Force Reserve

chute, but secured by tiedown straps held by two crewmembers. The nose gear was also secured in the up position by tiedown chains while the Sergeant worked so that when the binding force was released, the gear would not swing down and leave Beauchamp hanging in space.

Sergeant Beauchamp managed to remove the nose gear door rod, then re-entered the cargo compartment. The nose gear was now lowered normally and the landing made without damage to the aircraft. Through ingenuity, courage and perseverance, this crew prevented damage to the aircraft and prevented injury or possible loss of life. Well Done, Captain Clore and Crew! (Picture was not available for one crewmember, 1st Lt Ben. R. Duffey.) ▲

WELL DONE

Lt. Peterson was instructor pilot aboard a B-25. The mission was transition training for two student pilots. Also aboard was the flight engineer. The specific assignment was practice landings at an auxiliary base and several landings had been made with no trouble.

Immediately after raising the landing gear on a subsequent takeoff, hydraulic fluid began pouring into the student compartment. Lt. Peterson quickly placed the landing gear control in the down position and the gear extended and locked. At this time the right engine began to vibrate and smoke trailed from the nacelle. The turn to downwind was completed as the right engine became dangerously rough with heavy smoke now issuing from the cowl flap section.

Peterson shut down the right engine and feathered the propeller. He then actuated the fire extinguisher in the engine compartment. The gear was not raised because it was likely a re-cycling would not work with the loss of hydraulic fluid.

The B-25 would not maintain altitude in this configuration so a close descending base leg and final was made. The landing was performed without further incident. Post flight inspection showed a cracked hydraulic line in the student compartment and in the nacelle section. The No. 10 cylinder in the right engine had blown off. The quick thinking of this Lieutenant prevented what might have been a serious accident. Well Done, Lieutenant Peterson! ▲

First Lieutenant

ROBERT L. PETERSON

3500th Pilot Trng. Wing, Reese AFB, Texas

SPEED, ALTITUDE

Lieutenant Colonel Kenneth F. Troup
Aero Medical Laboratory, WADC

As man approaches his dreams of flying through space at the speed of light and regular travel between the planets, many complicated problems arise because of the unknown and hostile environment that he will encounter. Even though we are far short of these dreams, many of the same problems are present in today's operational flying. It is the aim of the human factor specialists, aircraft designers and human engineers to make flying in these environments as safe as possible and to eliminate speed and altitude as cause factors in aircraft accidents. It is also the aim of these technicians to reduce ejection fatalities to zero by the design of better escape systems.

A plot of ejections over the past several years showed that the trend for the average speed and altitude for ejection went up until 1957. Then, even though aircraft with greater speed and altitude capabilities were placed in the inventory, the average ejection speed and altitude remained the same or dropped slightly. This encouraging decrease was very likely the result of more widespread use of the automatic lap belt and parachute opening device. These statistics, of course, do not give an indication of the altitude where the difficulty occurred. It may be that crewmembers are waiting until the last possible minute to leave the disabled aircraft.

Statistics indicate that since the introduction of the ejection seat into operational use, 1462 ejections have occurred, 17 per cent of them resulting in fatal injuries to the pilot. During the period from October, 1957, to September, 1958, 276 ejections occurred, with 19.55 per cent of them resulting in fatalities. Ejection was initiated at 2000 feet or lower, 35.9 per cent of the time. During this same period, 45.5 per cent of these low-altitude ejections were fatal.

Even with the present escape equipment available, in emergencies the escape sequence should be started as soon as possible to insure safe and positive escape. If the present trend continues, we can expect the art of the escape system designers to stay abreast of the problems posed by the increased speeds and altitudes of operational aircraft.

There are a number of problem areas concerned with speed and altitude which make safe recovery of the man from these environments very difficult.

The first of these is low altitude. At the present time the Air Force has in use many different configurations of seats and parachutes. Even though this does not give all personnel an equal opportunity to escape, this problem will always be with us because of the logistics problems involved. Owing to the number of different configurations, it is difficult to give an overall figure for safe, low-altitude escape.

A safety of flight supplement has been published for each aircraft which states the safe altitude and speeds for the particular aircraft and the type of equipment used. A general statement can be made setting out parameters for Century Series fighters, with exception of the F-100 and F-104. An upward seat, of course, is a requirement for safe runway escape. These aircraft, when equipped with a B-5 type harness and pack, a C-9 canopy and a zero lanyard connected, have an off-the-deck capability between 140 and 300 knots.

The present zero lanyard hook-up is not the most desirable from an operational standpoint, but it was a "quick fix" method of providing a device that would give safe recovery from much lower altitudes. In the first six months of its use, ten low-altitude ejections were made with the hook-up. Seven were successful. They were from altitudes of less than 500 feet. To insure safe ejection, the pilot should do everything possible at low altitude to put himself in the most advantageous position. Airspeed should be traded for altitude, if possible, and the nose of the aircraft should be pulled up just prior to ejection to give a higher trajectory.

A specific policy should be stated by commanders concerning saving the crews rather than the aircraft. This policy should then be further emphasized by flight surgeons and flying safety officers. If the pilot is fully aware of such policy, the mental and emotional conflict as to "save himself or the aircraft" will be minimized

and  *Man*

and the time of indecision reduced. He can then concentrate on saving the aircraft but will also have his safe escape planned before the minimum altitude has been reached.

The problem of buzzing has been greatly reduced by an educational program and the pilot's respect for his aircraft. Planned and briefed low-level missions also enable the "tigers" to get it out of their systems.

The use of 100 per cent oxygen on all takeoffs and landings continues to be a problem. Here again is a matter on which the commander can set up his own policy, according to AF Regulation 60-16, and then have the flight surgeon, flight safety officer and other supervisory personnel emphasize his policy at briefings and other meeetings.

The main reason for using 100 per cent oxygen is to enable the crewmember to eliminate one step when smoke or other odors are present in the cockpit. If he is already on 100 per cent he can get right to the source of the trouble without having to turn to 100 per cent oxygen, thus saving valuable seconds when they count.

The oxygen systems have been designed to include adequate oxygen for 100 per cent during ground operations. The return to the normal position must be part of the climb checklist. A survey has been made of all aircraft to determine the amount of carbon monoxide that would be present during ground operations. Negative results were found in each test. Smoke and toxic fumes are not considered a problem from the physiological viewpoint. The only substance that could cause toxic effects in short periods of time is carbon monoxide. Any effects which might be present can be eliminated by using 100 per cent oxygen. Smoking does, of course, raise the crewmember's level of carbon monoxide and makes him susceptible to lower concentrations of carbon monoxide.

Night vision in present aircraft is becoming less important with the increased use of radar, both airborne and ground controlled. Current high-speed aircraft make it more difficult to distinguish dark objects on the ground in time to prevent collision with them. Since oxygen increases night vision, 100 per cent should be used from the ground to an altitude of 10,000 feet. At present, there are no Air Force regulations covering this use, therefore it becomes a Command responsibility to impose its requirement. Night vision at 8000 feet is reduced by 25 per cent without supplemental oxygen.

Smoking decreases the ability of the blood to carry oxygen and this also reduces night vision. Night vision may be improved by training in the use of the eyes during hours of darkness, by wearing dark adaptation goggles in all-white, light areas, and by using only red cockpit lighting to retain dark adaptability. The flight surgeon should have periodic discussions with crewmembers to remind them of the problems that might be encountered and offer corrections to improve their night vision.

The philosophy of designing aircrew personal protective equipment on the basis of known physiological principles has made it possible for aircrews to fly at high speeds and very high altitudes with a degree of safety that cannot be matched in everyday transportation on the highways. Despite the recognized efficiency of Air Force protective equipment, accidents do occur and lives are needlessly lost in our aircraft. The obvious conclusion is that no matter how well protective equipment works, it must be properly maintained and used.

The developers of all standard USAF personal protective equipment insure that this equipment is mechanically capable of doing the job for which it was designed. Design deficiencies from an operational standpoint are discovered and corrected during research and development and/or service test, and by the UR program. Production defects in the equipment are eliminated by inspection and quality control. The role of training, however, cannot be over-emphasized. No matter how good the equipment is, it must be properly installed, adequately maintained and correctly used, if it is to serve its purpose. Accidents involving personal equipment can usually be traced to training deficiencies. There is a serious lack of trained maintenance and supervisory personnel in the field. Personal Equipment sections are commonly understaffed and overworked.

The present oxygen mask and helmet give satisfactory service if properly used. The P-4B helmet will give adequate protection against head injuries usually occurring during crash landings and buffeting. It has been necessary in the design of all helmets to make some compromise between comfort and protection. This equipment must be fitted and maintained by trained personnel. The aircrew member must also be instructed in the care and use of the equipment if it is to function to best advantage.

Several items have been developed or are being developed to make the oxygen mask more comfortable. The facelet which cements into the MS22001 mask is in the field and should be used by crewmembers who have

Airspeed should be traded for altitude if possible before ejection.

pressure points caused by the mask. This facelet is a soft plastic material that gives a good seal around the mouth and nose without having to pull the mask tightly into the face. A sponge modification kit is also available for field installation in the mask for persons with irregular facial contours. A new mask with a non-stretch hose, the MBU -3/P is being procured. In use, the hose fitting is coupled to a manifold block connector permanently fastened to the vertical parachute strap just over the chest. Into the connector the pilot also plugs his bailout bottle hose, and the main oxygen supply line coupling.

Future masks of light weight construction will have a single inhalation-exhalation valve. The seal will be an inturned rubber flap to mold around the facial contours. Non-stretch hose will be installed on all new masks to aid in retention during windblasts.

Recent experience with the MC-3A connector shows the unfortunate results when crewmembers do not understand the design characteristics of a new oxygen system component. This connector was developed in response to the requirement for a device which would immediately warn a crewmember of accidental disconnection from his oxygen supply. The MC-3A imposes a noticeable resistance to flow in the mask when disconnected from the oxygen hose but still permits the wearer to breathe without excessive effort.

Soon after the connectors were issued, some of the users decided that during bailout, even from low altitudes, the oxygen flow from the H-2 cylinder would make breathing easier by overcoming the resistance through the open end of the mask hose.

Over a period of time the picture became so distorted that a note was published by a flight surgeon in Aircrew Effectiveness Abstracts for February-March, 1958, stating that the MC-3A connector made it absolutely necessary to use the H-2 cylinder for parachute escape from any altitude to avoid the "lethal chain of events" leading to "death from hypoxic asphyxiation." The writer also said that, as far as he knew, tests had never been conducted to determine how many pounds of pressure were required to breathe against the resistance imposed by the connector. Actually, the resistance in the connector is only five to six inches of water, or just a fraction of the maximum resistance against which a man can breathe successfully, whether conscious or unconscious.

A new mask suspension kit, type MD-1, is in limited field use at present, with a larger quantity to be procured in the near future. The new mask, simple to fasten and release, can be field-fitted to any type helmet. Its windblast retention characteristics have been greatly improved. In sled ejection tests, this kit, when used with a P-4 type helmet, remained on the dummy's head at speeds of Mach. 1.25.

One of the most common causes of loss of helmet and mask, on ejection, is the failure to pull the visor to the "down" position prior to jettisoning the canopy. Failing to fasten the chinstrap is also a major cause factor in helmet and mask loss. From ejection statistics we find that with the visor in the "up" position and the chinstrap unfastened, 83 to 85 per cent of the helmets are lost. However, when properly used, with the chinstrap fastened and the visor down, approximately 85 to 87 per cent of the helmets are retained. A study of accident reports indicates a number of parachute landing injuries have been prevented by proper use and retention of the helmet.

One of the chief factors in good personal equipment maintenance is the assignment at squadron level of well-trained personnel equipment specialists. Since personal equipment is becoming more complicated, its care and instruction in its use are more important. In order to prevent malfunction of this complex equipment, a high caliber of airman must be selected and trained in its maintenance and crewmembers drilled in its proper use. The presence of well-trained personal equipment officers, established in a career field at squadron level, would minimize the problem. During a recent base survey made by members of an ARDC team, this point was vividly brought out. At squadrons where the personal equipment officer assigned was interested and trained in the personal equipment field—though this was extra duty—problems were almost non-existent. Conversely, at units where little interest or training were apparent, tremendous problems existed. The conditions prevailing were reflected in the morale of the entire organization.

The flying safety officer and personal equipment officer should set up a physiological training program at squadron level. This would enable them to review periodically the physiological factors of flight, care and use of personal equipment, survival techniques and latest flying safety information.

Decompression, or loss of pressurization, can be a very serious hazard to flight if it is not properly understood. Two factors can result from decompression: aeroembolism and hypoxia.

Aeroembolism is better known to pilots as the "bends." They can produce pain of such a degree as to incapacitate the crewmember. This is the result of the formation of gas bubbles in the blood and body tissue. Bubbles, primarily nitrogen, form in the bloodstream—like the effervescence in a pop bottle when the cap is removed—when the air pressure surrounding the body is suddenly dissipated through canopy loss or decompression at altitude. This hazard exists even in an unpressurized cabin above 25,000 feet. It can be lethal above 45,000 feet.

When man flies through space, many complicated problems will arise in the unknown and hostile environment.

Two methods are available to reduce incidents of the "bends."

• Cabin pressurization maintained at 24,000 feet or lower, reduces the incidents in all flights to a neglible level.

• De-nitrogenization can also be used to reduce the probability of the "bends." This is accomplished by breathing 100 per cent oxygen for long periods of time. Inflight de-nitrogenization is effective in cabin altitudes up to about 20,000 feet but requires a longer period than at ground level to achieve the same level of effectiveness.

The flight profile using maximum cabin altitude while pressurized, and the flight time to the target area where the risk of decompression is highest, determine whether de-nitrogenization should be carried out entirely at ground level and two hours before flight, or one hour at ground level followed by two hours at cabin altitudes below 20,000, or entirely inflight for four hours below 20,000 feet.

The possibility of a primary failure of any protective equipment component is so remote that hypoxia from this cause may be ruled out. When oxygen equipment is properly maintained, used within its known limitation and in the prescribed manner, hypoxia will not occur.

Hypoxia, or suspected hypoxia, is listed as a cause factor in over 75 per cent of undetermined aircraft accidents. Because of this high rate, it is of great importance to the flying safety officer. Hypoxia is insidious, for only in the very early stages can the pilot recognize his condition and take corrective action. Even mild hypoxia, which reduces the pilot's capability to perform, when combined with the stress of flying high-performance aircraft, makes the pilot more susceptible to becoming an accident statistic. It is his responsibility to make sure his oxygen system is in proper working condition *prior* to flight. He is aided by trained specialists who, through efficient care and maintenance of such equipment, help him to insure its proper operation.

One hundred per cent oxygen is necessary when flying between 35,000 and 40,000 feet. Without oxygen, unconsciousness will result in 15 to 20 seconds. As the cabin altitude rises above 40,000 feet, greater pressure of oxygen must be put into the man's lungs to compensate for the partial pressure at these heights.

In the 40,000- to 50,000-foot range, physiological compromises and adjustments are made by the strong well-trained body to help the man survive an emergency in good shape. This is with the MD Type 1 Regulator in the safety pressure position to supply the needed pressure. Let me emphasize that this is only an emergency condition, and descent below 40,000 feet should be made as soon as possible.

At 50,000 feet, the ambient pressures are so low that even with the maximum feasible breathing pressure (35 to 40 mm.), hypoxia will result. As the cabin altitude rises above 50,000 feet, it is necessary to increase the pressure of the oxygen supplied. Without this increase of oxygen pressure, unconsciousness will result in 12 to 15 seconds.

It is impossible to put higher oxygen pressures into the lungs without giving the body some type of counter pressure to balance the internal pressures. From these facts evolved the pressure suit. This external counter pressure may be applied by two different methods. One, mechanical—as in the capstan partial pressure suits, MC-3 and 4 types; the other, pneumatic—as in the full pressure suit now under development.

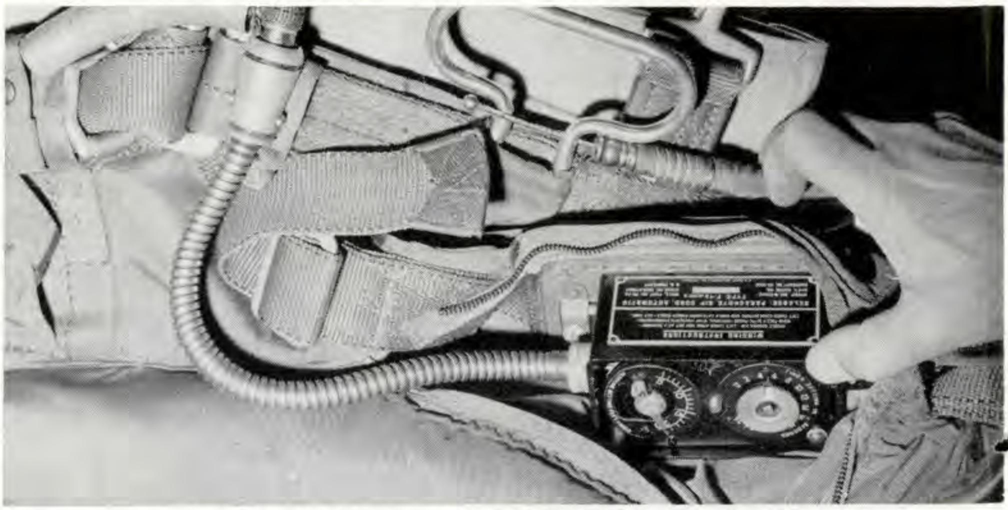
Air Force Regulation 60-16, dated December 1958, says that during all flights above 50,000 feet, pressure suits will be worn. Our present operational pressure suits, MC-3 and 4, are physiologically adequate to protect the pilot to any altitude. The suits, used in operational flying, have been responsible for saving over 500 pilots and aircraft at a savings of many millions of dollars. As in any type of protection we buy, however, we must pay an operational penalty to obtain it. The partial pressure suits are somewhate warm and do reduce the wearer's mobility, but they are being used in operational flying.

Two methods are available in present aircraft to maintain the crewmember in thermal balance. The aircraft air conditioning system is used to supply a constant temperature environment within the cockpit area. Because of the impermeability and bulk of some of our present personal equipment, it has been necessary to add a garment to these assemblies to provide air conditioning directly to the man's body. This is being done by means of the Type MA-2 standard vent garment now in the

About those missileman qualifications, Gridley. We have something quite different in mind.

The moon is in easy reach of ROTI Telescopic Instrument developed for ARDC. This photo was taken during recent evaluation tests of tracking systems at the AF Missile Test Center.

SPEED ALTITUDE and MAN



The automatic parachute ripcord release is one step in the right direction. Another fairly new development being tested is the supine seat with seat bucket for protection and booms for stabilization.

field. This garment, providing regulated air from an external source, removes the hot moisture laden air next to the man's body, and carries it away so as to keep him in thermal balance in all conditions of flight. A short vent suit, Type CMU-1/P, is available for use with the partial pressure suits.

Ejection at high altitude presents several basic problems as far as the mechanics of escape are concerned. Emphasis is necessarily placed on the alleviation of high dynamic forces that are applied to the occupant of an escape system. These forces can generally be attributed to the high drag resulting from the ejected mass being exposed to the windstream. The aerodynamic forces acting on the ejection seat create excessive tumbling rates which make separation difficult. Tumbling after seat separation may be controlled by flailing the arms and legs.

Operationally, few occurrences have been reported of a severe nature. The G forces or opening shock exerted upon the man if he opens the chute at altitude are extremely high, sometimes exceeding the stress limits of the chute harness and human tolerances. For this reason, free-fall to a lower altitude, 12,000 to 14,000 feet, should be attempted where automatic equipment is not used.

The high speeds of present aircraft pose many additional flight problems. Because of the high velocities, only split seconds are available for any decisions that must be made. In many cases there are no split seconds and the decision for correct action is made only by instinct. This instinct to do the right thing at the right time can come only from training and practice. This fact is proved by studying the statistics of pilot factor accidents. By far the greatest number of these accidents are caused by the inexperienced pilots in the 500- to 1000-hour category. Here again, a vigorous training program stressing emergency procedures and outlining the decisions to be made therein would help reduce the rate of these accidents.

Mid-air collisions are a growing problem. The increased number of aircraft flying and their faster closing rate makes some kind of collision warning device essential. A study is now underway to check pilot reaction time to such an instrument. Preliminary data indicate that three seconds are required for the pilot to receive the warning, both audibly and visually, and undertake corrective action. In many cases this is too long. Warning devices must be built that will give the pilot a greater degree of safety. In all cases of decision, less time exists for trial and error. The pilot must make the proper decision the first time. Once again, a good training program would pay off in reducing the number of accidents.

Structural failures at high altitude—40,000 feet and above—are almost non-existent in today's aircraft. The present operational engines do not have enough power to make this a factor. However, in more dense air at lower altitudes, the possibility of reaching structural limits, particularly in turbulence, is always with us. Pilots should be familiar with the stress limits of their weapon and should never exceed them.

High speed does, of course, have a very important role in materiel failures of engines. To obtain maximum speed it is necessary to operate the engine at maximum performance. If this condition is carried to excess the engine is more susceptible to immediate failure or failure at some future time. Knowing these limits and understanding the reasons for them will undoubtedly reduce the number of accidents attributed to this cause.

We've discussed some of the problems connected with high speed and high altitude flying. Let's talk about some solutions. In the low altitude area, better equipment to give greater safety is of paramount importance.

The Air Force has incorporated, on a retrofit basis, automatic lap belts and parachutes into all operational aircraft as applicable. The zero lanyard system is also being incorporated so that the automatic parachute timer is bypassed and the chute deploys immediately upon separation of man and seat. Modifications to the complete system also include:

- Reduction in delay times for initiating lap belt and parachute opening.
- Modification to the parachute pack and canopy combination.
- Increased performance of the ejection catapult within human tolerance.

The Wright-Air Development Center of ARDC has conducted an extensive test and evaluation program of the Martin-Baker automatic ejection seat system as a possible solution to the low altitude escape problem. Generally, the tests were successful, except for failures of the system in the high-speed track tests. Adoption of the Martin-Baker system was not recommended, for the following reasons:

• It was concluded that the Air Force one and zero ground level escape system would provide equivalent low altitude performance, and incorporation into the aircraft could start immediately. A retrofit program for Martin-Baker seats would be prohibitive financially and take too long.

• Extensive modification of the system would be required to conform to USAF requirements for such items as ejection control configuration, seat adjustment, catapult accelerations, accommodation of personal equipment, and standardization of cartridge devices.

• The recovery system failures at high speed would have to be corrected before use could be considered.

These are the areas in which the designers and research and development people are working. What can the flying safety officer and commander do to reduce fatalities in low altitude ejections? As already mentioned, vigorous training programs on the command policies and procedures in this regard and enforcement of rigid air discipline will reduce accidents in all areas.

Improved high altitude protective equipment is under development and should reach the field soon. This will consist of a redesigned helmet and "get down" altitude suit, which will be more comfortable and less restricting than present garments.

Farther in the future we have the escape capsule program underway with an operational date of approximately 18 months. This program will solve escape problems in the high-speed, high-altitude and low level areas. It will also put a little fun back in flying, since the shirt-sleeve concept is being used in capsule design. The environmental protection is removed from the crewmember and built into the capsule.

As more operational experience is gained with the present equipment, it becomes apparent that increased numbers of trained technicians must be used at squadron level to maintain the more complicated life-saving equipment now being issued.

There must also be a closer supervision of airframe and engine maintenance to reduce materiel failure and maintenance as accident cause factors. Proficiency pay and the recent pay increase should induce more trained maintenance personnel to remain in the Air Force and aid in the reduction of these cause factors.

In an effort to provide safe ejection seat escape at excessively high speed, the U. S. Air Force initiated the Industry Crew Escape System Committee (ICESC) seat program. Two methods were attempted to develop a seat that would give adequate protection to the crewmember at air impact forces of 2500 pounds per square foot. One idea, since abandoned, was to deploy a skip-flow generator—a boom protruding from the front of the seat—to act as a windbreak and stability device. The second approach, promising better results, was to rotate the seat to the supine position and use the seat bucket as a windbreak, with booms thrust out for stabilization.

Mechanical aids to actually make decisions for the pilot in high speed flight are under development. Better autopilots with built-in computers to help keep them on course is one approach.

A new instrument panel display to enable the pilot to more quickly check all instruments has been designed and is undergoing flight testing.

Automatic ejection equipment has been considered but this type of system becomes very complicated and eliminates the pilot's decision responsibilities.

Better selection of crew personnel is being attacked from two ways. All weapon systems are evaluated on a time line study to point out all of the duties any given crewmember will be required to perform during a mission profile. Using the time line studies, the Personnel Laboratory is then able to devise tests and testing equipment to determine the proper individual for a given job. This is a new long range approach to the crew selection problem and eliminates the unsatisfactory crewmember before investing large sums of money in his training.

The Training Psychology Personnel are developing ground trainers and simulators so realistic that it may be possible to completely train a crew without having them leave the ground. This should help reduce maintenance costs and accidents to the minimum.

The personal equipment designers are attempting to design equipment that will give adequate environmental protection but still be comfortable and allow the crewmember to perform his inflight function. Keep in mind, too, that man is out of his natural environment. There is usually a certain penalty operating under these conditions.

Let me say here—and this has been said before—that flight safety is everybody's business. Designers, flight surgeons, flying safety officers, training officers and maintenance personnel—all must do their jobs properly to reduce the needless waste of manpower, materiel and money caused by aircraft accidents. ▲

splash department

The pilot of the F-102A was No. 2 in a flight of two on a Profile Training Mission. On a routine ILS landing the pilot reported passing inbound over the outer marker. Twenty seconds later, with no further radio message, he was seen to turn and dive to the right. From the outer marker inbound, No. 2 was observed to lose altitude more rapidly than normal. At an estimated 500-foot altitude, he jettisoned the canopy and turned 45 degrees to the right. He rolled out at about 200 feet, then suddenly dived the aircraft toward the water. The pilot ejected just prior to impact. The aircraft disintegrated immediately upon contact with the water. At no time during the flight had No. 2 notified anyone of inflight difficulties. All automatic escape features functioned, including the lap belt. The parachute was deployed by a two-second timer, but never fully inflated before the pilot struck the water.

The pilot died of multiple, extreme injuries, especially skull fracture and deep cuts on the head. Yet his helmet, found separate from the body, was in an unmarred condition. The chinstrap snapped and unsnapped perfectly. The conclusion of the investigating board was that the pilot had failed to fasten his chinstrap and thus lost his helmet—in this case his single most important element of protection—at the first point of impact, probably on ejection.

Accident analysis disclosed pilot mismanagement of the fuel controls, resulting in a flameout due to fuel starvation. While making a close formation penetration and attempting to set himself up on the localizer, he apparently tried to correct an asymmetrical fuel condition and inadvertently turned his selector from engine position. The fuel quantity indicator later showed 500 pounds of fuel aboard the aircraft.

★ ★ ★

A Training Command T-Bird entered the traffic pattern for a night landing at Randolph with an IP in the front cockpit. A normal pattern was flown and the final approach made at 130 knots. Touchdown was observed to be normal, speed brakes were retracted and the brakes tested. As the brakes were reapplied, the nosewheel cocked to the right. The pilot was unable to keep the aircraft straight by use of both brakes so only the left brake was used to keep the aircraft aligned in the center of the runway. The aircraft's momentum was not appreciably slowed up by the use of one brake on the wet runway, so the pilot stopcocked the throttle, retracted flaps and told the tower he would engage the barrier.

As the aircraft slowed, it veered further right and contacted the main barrier stanchion with the right wing, knocking the barrier down. The nose gear passed over the drag chain, and the right main gear left the runway 60 feet after passing the barrier and continued another 20 feet in the soft ground. The left main gear never completely left the overrun. A tower operator's testimony confirmed that the nosewheel was cocked, as the landing light was shining approximately 90 degrees to the direction of travel.

The present T-Bird Dash One Handbook has this warning note on page 34, Section II:

After taking off from a runway covered with large puddles of water, do not retract the gear for 15 seconds after breaking ground so that the centering cam can position the nose gear for retraction.

A recommendation is being made to include another caution note to alert pilots to the fact that cocking of the nosewheel can also occur when landing on a water-puddled runway. Further investigation will determine if any corrective action can be suggested.

★ ★ ★

No one could say the L-20 pilot wasn't current. In the previous seven weeks he had made 596 takeoffs and landings as a passenger carrier. He knew his airplane well—perhaps too well! For a routine takeoff, fortunately without passengers, he simply kicked the tires, flipped the mag switch and rattled off into the blue . . . sitting on his checklist. One hundred feet up, the engine gasped

into silence. The driver turned right and came down against a reef in one foot of water. No, he didn't drown, but he certainly bent up the bird. It took the accident investigators just one minute to find the immediate cause of the accident: The plane had run out of gas.

Most people, and many pilots, are aware that internal combustion engines require fuel for proper operation. Airplanes guzzle the stuff. If they don't get it, they won't fly, at least for long. This one flew just long enough to pile itself up on a reef.

★ ★ ★

Two F-89D pilots were delivering aircraft for rocketry training. The wingman experienced difficulty with his right pylon fuel system, but recomputed his requirements and elected to continue the flight. In the New York area, he found the right outboard fuel tank was not feeding, and declared an emergency. To compound his troubles, his airspeed indicator was not working properly. While being vectored by Air Defense Command radar into Mitchel Air Force Base, he saw Idlewild and decided to land there. A close-in approach was made because of poor visibility. On the flareout the pilot stalled the plane and crashed into the runway.

Medical examiners reported the pilot was preoccupied with thoughts of his absent wife who was suffering from poor health. Moreover, he was flying an aircraft he did not trust. He used poor judgment in entering a landing pattern without an accurate airspeed indicator to rely upon. A pace aircraft could have been dispatched to his assistance, had he so requested.

REX SPECIAL

Our own mistakes cause enough grief without being the victims of someone else's errors. Remember, just as you can goof, thy brother can goof also. Protect yourself by vigilance. A recent case in point is that of an aircraft commander who had the foresight to check the letdown for an alternate he thought he might have to use. The chart was missing from his Terminal Flight Information (High Altitude) Handbook.

A further examination showed that pages 51 through 66, and 187 through 202 were not included. Pages 67 through 82 and 171 through 186 were simply duplicated, thus filling out the Handbook to its regular size. A survey of all Handbooks on that base was undertaken which, while incomplete, turned up another three that were deficient.

Go ahead, get clanky. You know you didn't check the charts for your possible alternates last time you filed India Foxtrot Romeo. A word to the wise: Better make this a regular part of your flight planning ritual even if the book is nicely bound and all the charts "are supposed to be in there." Proof readers, like printers, like pilots, sometimes overlook an important item.

★ ★ ★

Checking the Form One, now the 781, has long been accepted as the first thing to do when the time comes to ready a bird for flight. It makes sense for several reasons, not the least of which is saving yourself the embarrassment felt when, after completing the external check, you find that a large red cross reposes in the appropriate box.

Some time ago a Major was making this check of the Form 781. He was just about to put the form into its holder inside the cockpit, when he did a doubletake on the aircraft number on the form. The aircraft number on the T-33 and the aircraft number on the form didn't match up.

His howls of anguish brought the line chief on the double. A quick ramp conference confirmed the fact that, sure enough, the crew chief had pulled a "switcho-chango" in the maintenance shack and brought back the wrong form. But where was the form for this T-Bird? Could it be flying in another Tee? Thirty minutes of frantic search along the ramp convinced the line chief that such must be the case. The next hour was spent sweating out the other aircraft. When it finally landed, the pilot of that one joined the crew chief and line chief in a silent prayer that everything had gone all right in spite of the mix-up. The airplane might have taken off on a red cross. *Could it happen at your base?*

The only irreducible accident rate is zero. We will have losses as long as we fail to take every action to eliminate potential hazards and thus reduce the probability of accidents.

COINCIDENCE OR

Lieutenant Colonel W. W. Wilson,

Ever hear of the Commander who was shot with bad luck? He has the best trained pilots, the most conscientious maintenance people and the best airpatch in the area, but oh, his luck! His airplanes are okay too. Of course, they're pretty new—at least to his outfit. They were just delivered a few months ago and everything would have been fine, except for that Ole Debbil bad luck.

Take that accident of Joe's last week. Who'd have thought that a young, eager, aggressive pilot like Joe would get in a spin and have to leap out? He knew the procedures in the flight manual. Why, just the week before he had answered the questions on the check-out questionnaire perfectly.

And take the accident before that one. Why, if that old revetment hadn't been sticking up out of the boondocks off to the right of the runway, if the utility system hadn't failed or if the aircraft had gone to the left . . . But as luck would have it, the utility system did fail. And the bird did go right . . . And, damned if it didn't shear the gear right off the airplane when it hit that old revetment that's been out there all these years! Or—even the first accident they had with the new airplane. If it hadn't been for losing the drag chute and the anti-skid failure all at the same time, this wouldn't have happened either. Well, would it?

Of course it wouldn't have! But what causes accidents? Is it really bad luck? Or is it, maybe, just plain complacency? Was Joe really pumped full of knowledge about spins? Why was that revetment still there? Nobody ever used it anymore. It was just something left over from the last war. The C.O. and the AIO both had seen it a hundred times. And so had every pilot who'd taken off on runway 35 or landed on 17.

And how about the drag chute and antiskid failures? Was Maintenance keeping records of *all* drag chute malfunctions and spreading the word among crewmembers?

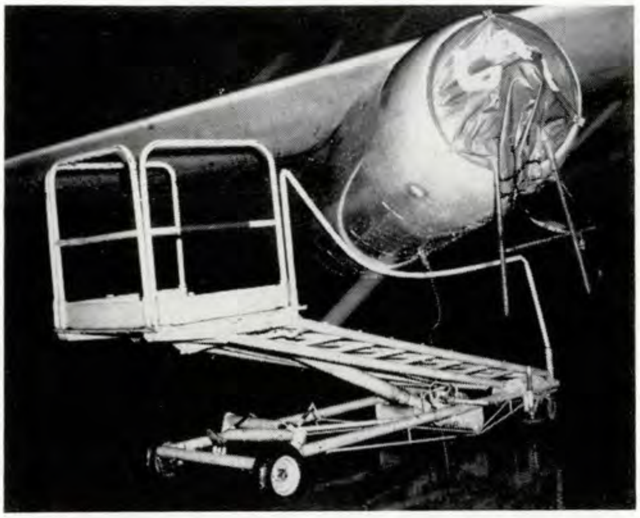
Had anybody checked on the antiskid test equipment lately? It was requisitioned a long time ago. Of course, nobody had followed up on the requisition, but why should they have to do that? And back to the drag chute again. Supply had some kits which would have prevented this trouble, but this aircraft was one they "hadn't had time to modify." Of course, the pilot should have turned off the antiskid. But then you can't expect a young pilot to remember every emergency procedure, can you? You've got to expect losses.

Well, maybe once a long time ago we had to expect losses, but not anymore. The only irreducible accident rate is zero. We will have losses as long as we fail to take every opportunity to eliminate potential hazards and thus reduce the probability of accidents. An accident usually occurs because a number of incidents occur simultaneously. This is the only thing coincidental about an accident: If any one of the incidents can be prevented or postponed the accident can be prevented.

The Operations Safety Survey is designed to remove hazards which, if allowed to remain, may culminate in an accident. *A Safety Survey Can Be Conducted at Any Command Level.* A commander may conduct a survey of his own command or he may ask for a survey to be conducted by the Directorate of Flight Safety Research. Surveys are also conducted annually by DFSR either by direction of the Chief of Staff, the Director, Flight Safety Research or at the request of commanders.

The DFSR Operations Safety Survey teams are composed of specialists in operations, personal equipment, maintenance and supply, and facilities. They make a thorough analysis of a unit and submit recommendations for the removal of hazards and elimination of practices which might be a potential cause of aircraft accidents.

If complacency is allowed to creep in, it will eventually lead to the coincidence of two or more failures which together make an accident.



Was it bad luck that the ditch digger happened to be left right there?

COMPLACENCY?

Fighter Branch, Flight Safety Research

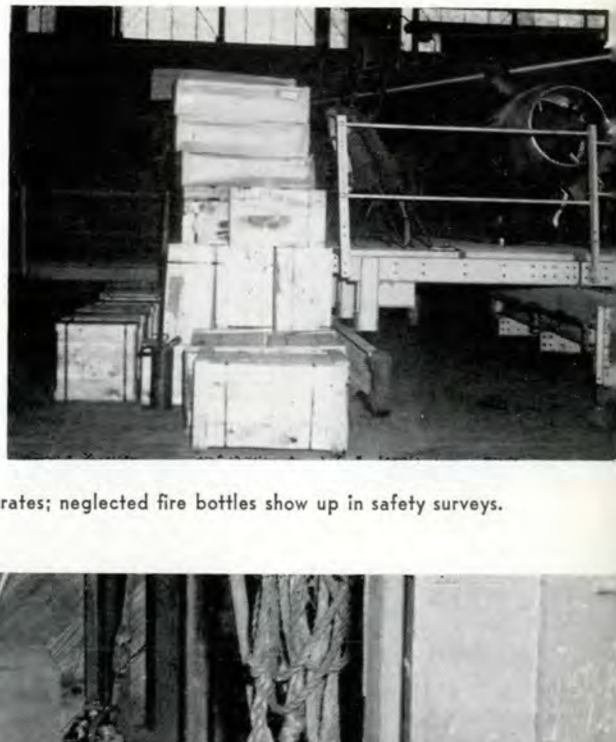
Their recommendations are not mandatory and a reply is not necessary at base level. A report tendered at major command level does require reply, however, compliance with the recommendations is up to the commander.

Looking over the records reveals some good indications about the relationship between command emphasis and the accident rate. Many examples have been found showing that where safety surveys are conducted either by The Office of The Inspector General or at command level, the accident rate for that particular command showed a corresponding decrease. Conversely, those units and commands which are not surveyed during a long period of time have been observed to experience an *increase* in rate, while other commands and units are experiencing a decrease. These increases in rate have occasionally been observed in conjunction with decreases in the numbers of pilots transitioning in a particular aircraft and improvements in the facilities used.

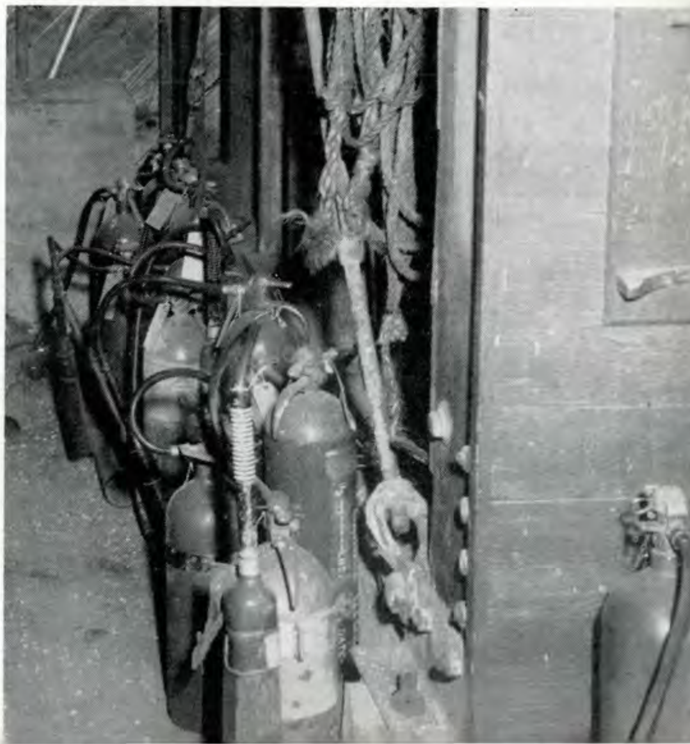
Does an attitude of complacency or a tendency to relax accompany a long period in which a survey is not conducted? There is no definite proof of this, but an increase in accident rate is cause for thought.

Does the absence of a Safety Survey in itself indicate complacency or relaxation? The answer is "obviously not." An alert, aggressive program designed to eliminate accident potential can and has been successful in reducing the accident rate. The point is that any unit can help itself by such action. If complacency is allowed to creep in, it will lead to the coincident occurrence of two or more failures which together make a major accident.

Take a look at your own unit. Has your rate gone up recently? Or, does it appear that it's a little high compared to the overall average? And if it has, or if it does, do you really suppose that this can be, in actual fact, "merely a coincidence?" ▲



Combustible crates; neglected fire bottles show up in safety surveys.



Wherein Captain C. Z. Chumley plays the role of FSO and the Colonel goes back to his nitroglycerin pills. We present C. Z. in . . .

A STEADY HAND AT

Undershoot Air Force Base had been calmer than usual for three weeks. So calm, in fact, that the Club Officer and the Provost Marshal decided that the state of affairs merely meant the famous calm before the storm.

They were so right!

The Air Policeman at the main gate threw a high-ball at a sleek, yellow and black XK-120. The stern-faced, set-jawed, Captain double-clutched, geared down oh, so slightly, returned the high-ball and shot forward amidst the sound of grinding gears and squealing rubber.

Captain Chauncey Z. Chumley, the Air Force's most intrepid aeronaut, had returned from a 21-day leave to find out that he had a new assignment, in the office of, heaven forbid, Flying Safety.

The Jag shuddered to a stop in front of a building marked with a sign that clearly indicated that Chaunce had found his target.

Two of the regular crew chiefs looked up from their work.

"Looks like they got him on another violation!"

"Nope, Sarge, you couldn't be wronger. Captain Chumley was picked to fill in for Captain Mattson, who's away at the Fly Safe school out in California. Personally, I've cashed in all of my Savings Bonds, Sarge, 'cause we are in deep, serious trouble. Hey, where ya' going?"

"Tell the maintenance officer I'll be back in three hours, I'm going to send the wife and kids home for a while. This place should be one gigantic accident, looking for somewhere to happen an' I think Captain Chumley knows how to make it happen!"

Chumley entered the Fly Safe office and slammed the door. Slammed it so hard in fact that the good sergeant in charge of the coffee detail dropped a freshly brewed pot of the lifegiving fluid.

"Top-a-tha-mornin' te ye, Sarge, I suppose the 'Hun' is up in force today?"

The sergeant managed a weak smile as he went to get the mop.

"Morning sir, I was just brewing up some coffee when you startled me. I'll make another pot. Captain Mattson always has a cup while going over the TWX's and the morning mail. I thought that you'd pick right up in the routine of things sir."

"Well, me bucko, things are going to change around here during the next sixty days while ole Chumley's at the helm. Neither rain, nor snow, nor gloom of night shall stay this appointed FSO from his appointed tasks."

"That's a mailman, sir."

"It's all devotion to duty, sarge, all devotion to duty." Chaunce pulled a copy of Motor Trends from his pocket and flopped into the chair behind the desk."

"Hey, sarge, clear away all this scrap paper in the IN basket. How can I concentrate on the matters at hand with hours of work staring at me?"

The sergeant emptied all but a thick folder from the basket and started for the door.

"Hey! you forgot something," Chaunce remarked.

"Yes sir, I did it on purpose. That's the latest monthly kit for FSO's. I thought surely you'd want to look at it."

"Throw all that stuff away, laddy buck. I've got my own ideas on how to run this railroad. Why I can remember when I made the only safe thirty-second pattern in an F-82 up at McChord, and wasn't I the first one to—"

Archie D. Caldwell, Research and Analysis Division
Flight Safety Research

THE HELM

And so it went for 55 incredible days while the flying skill of squadron and group pilots kept the record clean. Chumley patted himself on the back more vigorously with each passing day, decreeing that it was *he* who had worked the miracle that caused the advent of true safe flight.

"The Wright boys could have done LABS runs at Kittyhawk safely if I had only been there," Chaunce thought to himself. He *was* in good humor. Only a couple more days 'til the real FSO got back and only 20 minutes before quitting time. In two days he could point with pride to the clean chart on the wall denoting no majors and minors.

The phone interrupted his thoughts of plaudits and honors.

"Flight Safety—Chumley here ole chap. You what? Well he should know that I'm not even current in that bird. All right, all right. I'll be right up there."

"What is it, Captain?"

"We've been cursed with a flameout. Not even in the type bird we have here, some lad from Big Thunder AFB got weathered out and headed here. Quick, get the jeep started."

"Don't you think that you should check the —?"

"Don't bother me with details, fetch me my scarf, there may be photographers."

The USAF jeep wasn't quite as fast as the "XK," yet it arrived at the base of the tower in good time. Chumley's chubby legs carried him quickly up the 124 steps in time to hear the emergency call.

"This is Air Force jet six six one at the high key—airspeed two twenty. Instructions, over."

Chaunce grabbed the mike from the tower officer.

"Okay, my boy, you're in good hands down here, now take it easy and don't panic. No sweat! Your airspeed seems a little fast to me, you might slow up a bit. Nothing to worry about lad. I can remember when I was in P-51s, I ——."

"This is Air Force jet six six one. I can't get my gear down and am turning from the low key, the gear handle is down but the indicators show up. Is crash equipment standing by?"

"You're sure the handle is down? Maybe you didn't get it all the way down. Even so, forget about it. We have you in sight. You look a little high and hot from here."

The Tower Officer saw that the aircraft would hit short. Knowing what was about to happen, he hit the crash alarm. Chumley's groans were drowned out by the screech of metal on concrete and the wail of many sirens. The crash crew was quick and efficient.

"Sir, here's the preliminary report on yesterday's crash."

"Thank you, Chumley, sit down." The Colonel's face

reddened slightly at the first paragraphs and became absolutely livid from there on.

"What in the name of Mother McCree do you mean 'the pilot did not follow instructions' as the primary cause?"

Chaunce shuffled his feet and looked out the window.

"Well, I told him to see if the gear handle was clear down. Besides, the pilot sounded like he didn't have too much experience in the bird and might have been a little shook up. I figured that I could help him cope with the situation."

"What do you mean, you thought you could help him cope with the situation? Fortunately the pilot emerged from the wreck without injury and has stated that because of his limited experience in the aircraft and because it was the first emergency he has been confronted with, that he relied to some great extent on the instructions received from the ground here. After listening to the tape of your conversation with the pilot, the only thing I can say is that he is lucky to be with us."

"Now, Colonel, remember your hypertension, sir, besides I only tried to impart to him some of the vast knowledge and experience I have as not only the world's finest aviator but as an FSO. Unfortunately, I wasn't familiar with the machine he was having trouble in. Now if that had been an F-86 or even a P-51 I could have ——."

"You could have picked up the emergency procedures on that aircraft from your own office where they've been sitting for over a week. They were sent to you, and you were supposed to send them to base ops and to the tower for use in just such an emergency."

"Well, you see, sir, I was just too busy with other things."

"I've done a little checking, Chumley. You've visited the squadrons twice in about six weeks. Your FSO kits are unopened. When the tech reps call, you're always out. You haven't observed a single landing or pattern. You think the AIO is interested only with street lighting.

"I could go on and on about the things you should've been doing and didn't. The checklists in the back of 62-5 that weren't used, the multitude of tasks that make the job important that weren't done.

"In short, you've let me down. As commander here I do not have the means or hours in the day to check on all facets of running the base personally. That is why, while I still have the responsibility of accident prevention, I have to designate a representative to help me. If *all* of my helpers on the base thought that things would run themselves, as you do, I would have been on the 'Outside looking In' a long time ago."

Chaunce bit his lip and a well-rounded tear slid from his eye to the floor. He mentally envisioned himself, tired and dirty, peddling apples on a street corner. The colonel continued.

"Your duties as an FSO are never ending and definitely are not limited to an eight-to-five day, no more than a pilot's knowledge of his aircraft is limited to duty hours only. His motivation is his insurance, 'cause what the pilot doesn't know can hurt him. But, what you as an FSO don't know can hurt everyone on the base."

Chumley started to speak of how nice the record had been until the accident—then he thought better of it. "I guess the old master has a few things to learn, huh, sir?"

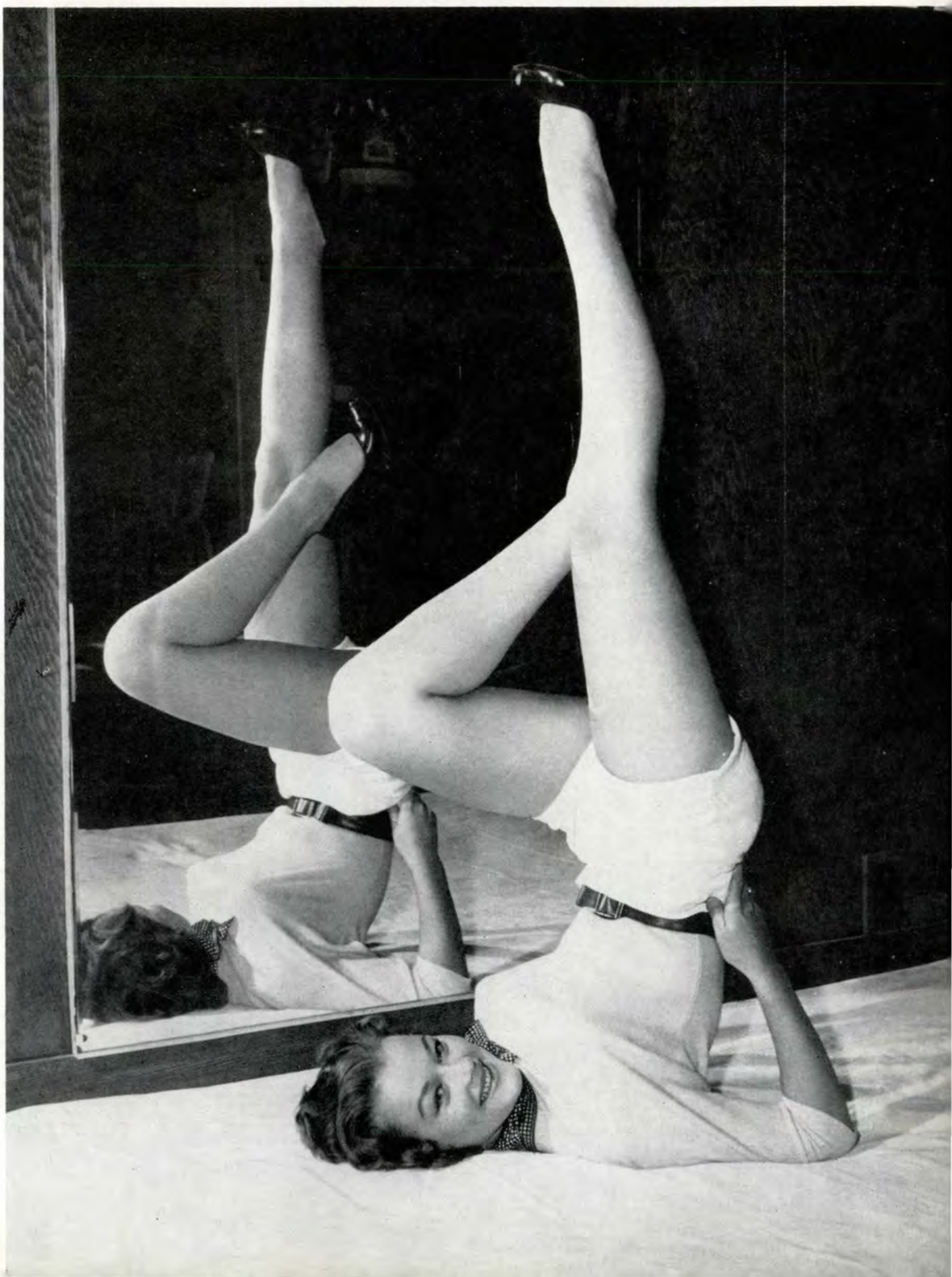
"Chaunce, ole man, there is no one, but no one, in this world who knows everything there is to know on accident prevention, but there are plenty of good Flying Safety Officers and others who are interested enough to keep us out of trouble. I want you to become one of those people, therefore I'm placing you, as of now, on duty as the Assistant FSO for this base. I am giving you another chance . . . why, I don't know."

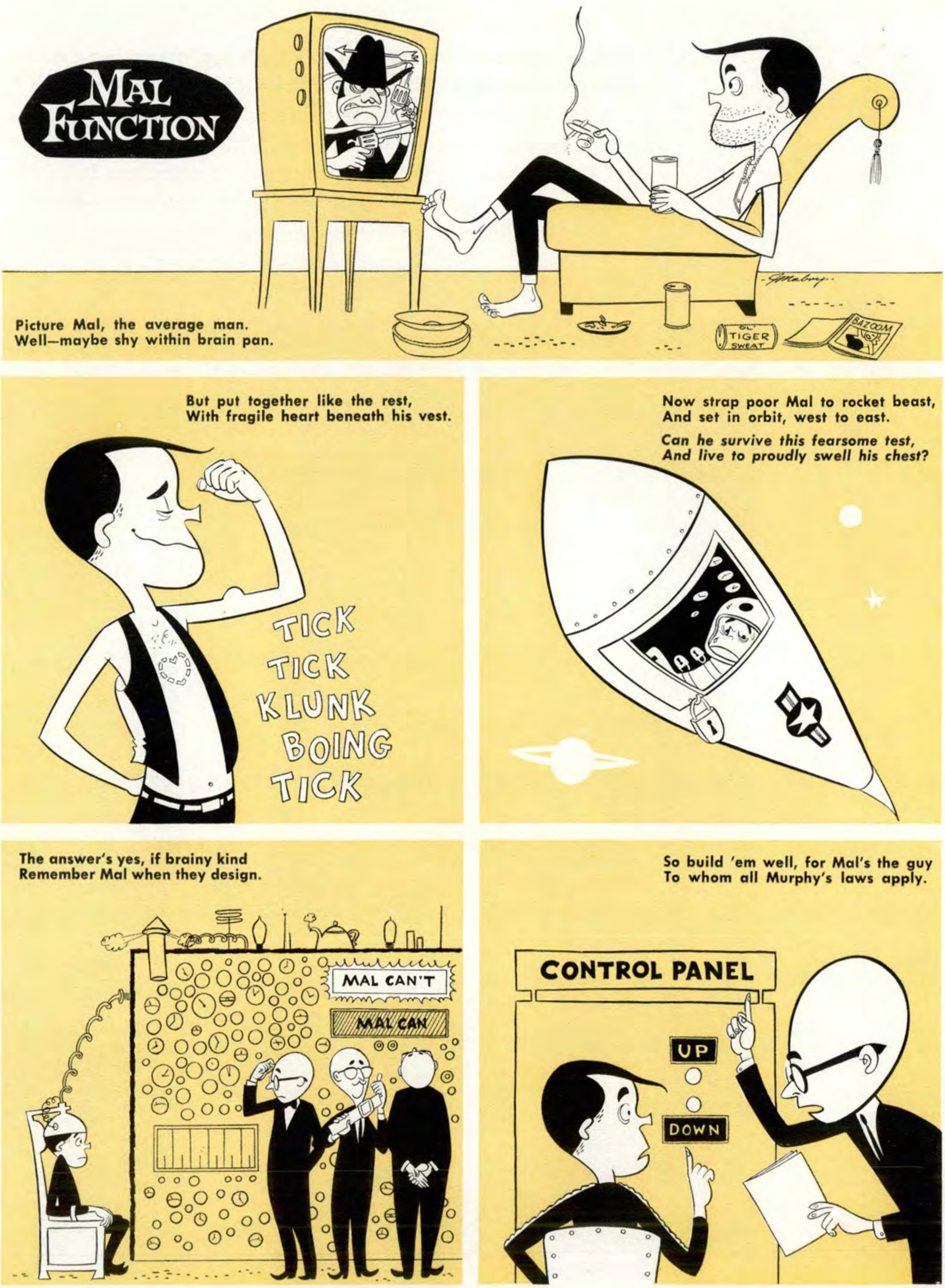
Chumley's voice seemed choked as he mumbled his thanks and backed out of the office. The word had obviously hit home. Chaunce slowly started down the hall, then looked at his watch.

"Five after five! Great Scott—I'll be late for cocktails at the club."

Chaunce hurried outside, leaped into the waiting Jag and laid asphalt for the club. The exhaust drowned out the sobs of the colonel who had been watching from the window above. ▲

The demands made upon pilots by ever-increasing speeds and altitudes require nothing but the best in physical conditioning. Just doesn't make sense to take off in anything less than peak condition, physically and mentally. But "Bet-a-Million Gates" was a piker compared to some throttle benders. He was only betting his money and reputation—they're betting their lives and someone else's money. How about you? Are you keeping in shape?





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