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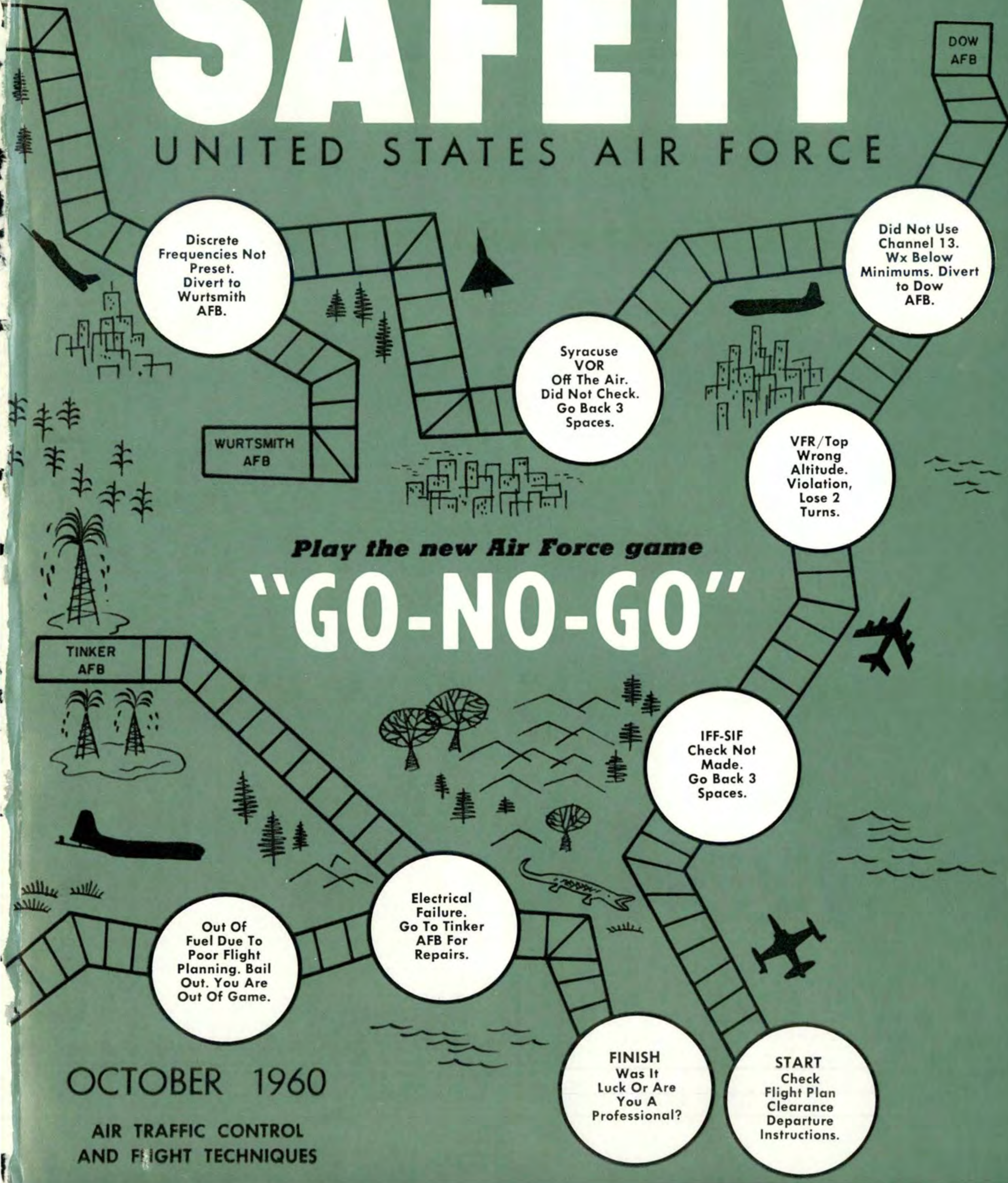
UNITED STATES AIR FORCE



Play the new Air Force game

"GO-NO-GO"

OCTOBER 1960

AIR TRAFFIC CONTROL AND FLIGHT TECHNIQUES

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IN THIS ISSUE

LETTERS TO THE EDITORS

Hope you've noticed that in addition to our old pet, "flying," we now include the fields of ground, missile and nuclear safety. How about some ideas and suggestions for promoting safety in these areas? R.S.V.P.

One for Lt. Col. Rex Riley

In your role as Aircraft Accident Investigator, your "word" to the fly troops has been effective and this pleases us indeed. Now, however, you have added another line of problems, since "Flying Safety"—oops! Pardon, please, I can't get used to that new name—I mean "Aerospace Safety" Magazine has taken on a new field, "Ground Safety." There's more work ahead for you, Colonel. I read a news item recently about the C-47 that crashed after takeoff from Moody AFB. It states: "The only injury was to a civilian ground safety expert who broke his arm when he landed."

Guess you know by now that you and Steve Hotch had better get with it and print a few "Dos" and "Don'ts" for the benefit of the ground troops, like you've done for us fly types. Make it soon, please, because it looks like we'll be having more ground troops as passengers on future flights.

Good luck and thanks many times over for all the fine help.

A Fly-Safe Reader

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Why Don't They?

All two of our pilots are senior birdmen, though relatively new at driving T-Birds. We've read tips for T-Bird drivers in every edition of *Flying Safety* and would like to ask three "Why Don't Theys."

• Why can't the airstart ignition be incorporated with the emergency fuel switch, or be relocated next to it? Presently it is so well hidden that valuable time might be lost in a panic type search during a low altitude airstart.

• Why can't an additional warning light be installed that would glow whenever all locks on both gun bay doors are not properly fastened? On an instrument takeoff this could be more dangerous than an unlocked canopy—which has a warning light.

• Why can't the deice switch be relocated next to the deice warning light for easier operation and prevention of dumping cabin pressure?

Capt. John S. Wright
Capt. Joseph F. Smith
Hq Medical Service School, USAF (ATC)
Gunter Air Force Base, Alabama

Your ideas have real merit and are right along the thinking line of other T-33 pilots. First, airstart tests were conducted at Edwards in which all fuel switches were gangloaded, alcohol deice switch activated for 30 seconds, battery override switch turned ON, fuel system placed in EMERGENCY, and airstart ignition provided with a single action of a gangload bar. Over 300 airstarts were made in flight, and observers were sufficiently impressed to favor modifying all T-Birds. We hope for formal evaluation soon. Next, the gun bay door warning light would entail six microswitches, one for each latch plus the warning light in the cockpit. This change has been considered by SMAMA but the cost of modifying all T-Birds would be too great. The deice switch could be relocated inexpensively. Since ATC is the primary using command the proper course of action is a formal recommendation for this change through channels, for action by the Modification Review Board.

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AFR 30-21

I appreciated Dr. Beil's article, "Passenger Care," in the August issue. While my suggestion may not contribute to flying safety, but is a part of flight discipline (and they are closely related), I would add that AFR 30-21 be remembered. It is the most frequently violated regulation in the book and it merely says that personnel "operating, acting as crewmember or traveling in aircraft" will wear identification tags.

Brig. Gen. C. H. Morhouse, USAF, MC
Headquarters Fifth Air Force

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Eielson AFB's Flying Safety Officer, Major John Gahn, uses a fertile imagination for promoting the flying safety program. At each meeting a goofer-of-the-month is duly recognized. At one meeting, for example, a pilot who goofed his descending T-Bird checklist was presented with a "do it yourself suicide kit." He got the point.

Above, designed to highlight "hot" items and stir the curiosity of crewmembers, a bright red cloth serves as a background for a large cutout of the KC-135. Aluminum foil and painted details do the rest. Below, news bulletins and Rex posters on separate display.

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Oklahoma Hospitality

We agree that the safety checklist from Laredo, published in the July issue, is a winner, especially since the idea originated here at Vance AFB, Oklahoma, in 1959, and was displayed at the 1960 ATC Flight Safety Conference, 18-20 May 1960. There's more to the checklist, however. Laredo borrowed only half of it. Here is the card which we hand to the pilot upon his arrival at Vance AFB.

WELCOME TO VANCE AIR FORCE BASE

Your aircraft will receive Duncan & Heinz approved care by the Transient Alert Section, 3575th M&S Group. For your convenience, the Line Snack Bar is located just north of base ops. A list of telephone numbers which you may need appear on the reverse side of this card. For further information, contact your Alert Crewman. We hope to make your stay at Vance an enjoyable one. If you RON at Vance, your before-dinner drink at the Club is on the house. Ask your Alert Crewman for a ticket.

Transient Alert Section.

In case you're wondering, those telephone numbers are for Base Ops, Transportation, Transient Alert, Maintenance, the FSO, BOQ, the Officers Club, the OD and the Weather Section.

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Cleared for a One Eighty

The other day I overheard a remark on the radio by an F-86L pilot awaiting clearance, and thought it worth repeating. The pilot was told to crank up as his clearance was coming in. He cranked up, started taxiing, and then received a long involved climbout procedure exactly 180° from his planned destination heading. He waited a moment and then asked if he could have letdown instructions at the same base he was departing, since he would be out of fuel if he accepted the departure as given.

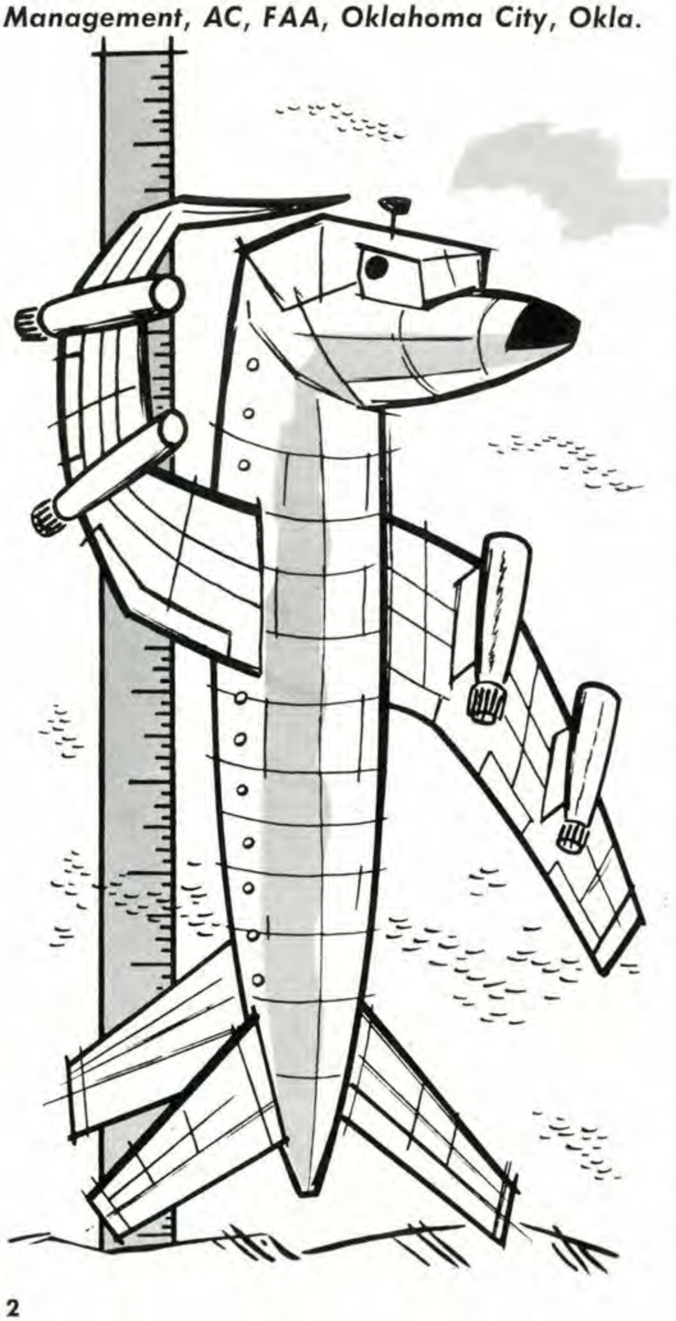
Maj. Warren F. Arey
Hq 14 AF, Robins AFB, Ga.

With the air route traffic control structure bursting its seams, no wonder we've got . . .

GROWING PAINS

• • •

Mr. Charles Kite, Instructor, Air Traffic Management, AC, FAA, Oklahoma City, Okla.



The sky has nearly always been thought of as a boundless expanse of space where the free-wheeling airmen could frolic in complete solitude. But this is just not true in 1960. With the steady increase in traffic over the last 10 years, the sky has become a crowded place. Disaster headlines and near miss reports are testimonial to this fact. As aircraft manufacturers feed a steady production of several thousand new airplanes into the airways system each year, the burden upon the air traffic control system—and the controllers—becomes increasingly more formidable. Even now, during peak periods daily and seasonably, the air route traffic control structure almost bursts at the seams.

In the face of this fantastic crowding of the formerly boundless "wild blue yonder," older pilots and flight personnel look back over the years with a feeling of nostalgia for the good old days. The pilot, swashbuckler that he was, reigned king of his trackless domain and shared its solitude with none but the eagle. Now he's hemmed in on every side, if not by other aircraft, then certainly by regulation and restriction, and usually by both.

Simplicity has given way to complexity, individuality to regimentation, and all in the name of safety. For today, control of the overcrowded skies is critically necessary if the nation's military and commercial aviation systems are to progress.

The problem is, how to handle this volume of traffic safely and still keep delays and involved clearances to a minimum. Some mighty dedicated people are working on this problem, you can be sure. One thing that still baffles solution seekers: how to keep these proliferating numbers of aircraft safely apart? Radar, of course, is part of the answer.

Since military flying comprises about 32% of total air traffic, the words "traffic control" are no strangers to service pilots. In fact, one has only to overhear a typical post-flight coffee break conversation to realize that the military flyer has many phrases that are far from lyrical to describe the civilian and military controllers he's had to cope with. However, as our manual states, "The primary objective of Air Traffic Control service shall be to promote the safe, orderly, and expeditious movement of Air Traffic." That's just what the controllers try to do, and their job is a challenging one.

Let's get down to some figures and see just how incredibly the volume of air traffic has grown. In 1941, Washington National Airport had a total of 43,060 operations, 657 of which were military. In 1958, the total was 281, 686, with the military making up 11,088 of this figure.

The number of passengers arriving or departing from Washington National rose from 344,257 in 1941, to 4,-533,623 in 1958. This is a truly staggering increase, and has been repeated all over the country in nearly the same proportions. This mushrooming of traffic has multiplied controller problems and workloads almost beyond belief. "Growing pains" is a very apt way to describe one of the maladies of air traffic control.

Communications difficulties, for example, are a part of the price we've paid for expanded air travel. Communication channels are now full, though their numbers have increased to the point where it is now common to have as many as 17 separate receivers and transmitters available to controllers. This, of course, is not so strange when you consider that the needs of all three branches of the air traffic system must be met, namely, the military, civil, and air carrier. But this beanstalk growth in the

A class in control tower operation works with a model of Will Rogers Field. Right, Air Traffic Control along the airways is seen in this training Control Center. Conditions simulate actual operations.

number of communication channels has demanded increased skill on the part of the controllers in handling frequency selections, message exchanges, and question answering. They have to know their jobs thoroughly. And they do, thanks to their rigorous training and demanding supervision. For no new controller can handle traffic until he is ready to cope with the multitudinous problems that will face him.

For one thing the time available for controller decision has been reduced in nearly the same proportion as the speed of aircraft has increased. Every moment of his time is taken up with keeping his decks cleared so that when a decision must be made, he can give it his fullest concentration. This is no easy task when one considers the number of clerical duties to be performed, the congested communications frequencies to be coped with, and the hectic scramble to keep up with control problems caused by the huge volume of traffic. These things make full pilot cooperation mandatory if the controller's job is to be expedited.

Military pilots, however, have always been uniquely cooperative with controllers, and respond fully and enthusiastically to every request made of them. They are indeed professional in every respect, as are most of the pilots in the airways today.

But no matter how cooperative and professional pilots may be, there is little they themselves can do to alleviate traffic congestion, particularly during peak periods. The sheer rise in the volume of aircraft to be handled during these periods make for delays that have no apparent cause or reason. Sometimes, it must be admitted, controllers bottle up a portion of the sky by their very efficiency. They do this by using a minimum separation that will not permit a climb on course but which necessitates an unusual departure procedure to provide safe and proper separation between arrivals and en route traffic overhead.

Sometimes a delay is not the result of any immediate cause, but the aftermath of something that may have happened several hours ago and perhaps many hundreds or even thousands of miles away. We are often hard put to find out just where it all began, and why. A delay which has you fuming in Albuquerque may have found its origin in Chicago, Phoenix, Denver, or San Francisco—which admittedly sounds ridiculous until you understand the cumulative effect of a snarl-up on the complicated route structure and scheduling procedures. Trying to explain all this to a layman who has acquired his aviation knowledge flying the left front seat in the passenger compartment is a difficult task.

Here is an example of the ballooning effect of a delay on the whole system. An unusual approach procedure that departs significantly from the normal will, at almost any terminal, exact a delay penalty that can last for hours. This kind of thing has grown so critical for jet operations that anticipated delays must be NOTAMized so that flight planners can take the extra time and fuel into account when figuring jet routing.

The jets gulp fuel in such prodigious quantities, particularly at lower altitudes, that the minimum fuel state

Growing Pains (Cont.)

quickly becomes highly critical. Pilots must advise tower and other control personnel the instant they suspect fuel may become a problem. In this way, with advance warning, the controller has time to plan for a possible emergency. As management experts say, preliminary planning reduces immediate planning. And it has become vital that Air Traffic Control personnel plan as far ahead as possible.

Another strong limiting factor that affects smooth traffic flow is the airport itself. If it is old, poorly planned, or improperly laid out, its acceptance rate will likely be low. Also, if it is too close to another field, there will be interference in the efficient use of space and radio aids. Overcoming the built-in features of poor planning is almost impossible after the concrete dries and the contractor has left. Even today, aware as we are of the need for airports designed to handle a high volume of traffic, we can hardly make airport consultants listen. It sometimes seems to escape them that the most beautiful airport in the world, landscaped to perfection and with the terminal facilities a decorator's dream, stands in utter defeat if Air Traffic Control cannot move traffic with speed and efficiency.

Now let's take a few minutes to discuss some of the fundamentals of Air Traffic Management. This is not in lieu of visiting a center; on the contrary, controller personnel are strongly in favor of having flying crews visit control centers. Surprisingly enough, very few of the people directly concerned with Air Traffic Mangement ever do visit an Air Route Traffic Control Center. There the visitor would see these fundamentals put into action in the control of traffic, something we're all vitally interested in.

Basically, control of IFR traffic involves four types of conflicts between flights:

- First, aircraft overtaking on the same course.
- Second, crossing paths.
- Third, opposite direction traffic on the same course.
- Fourth, crossing paths on a climb or descent.

The amount of separation necessary between aircraft is determined and prescribed by a joint committee of Army, Navy, Air Force, and FAA personnel. All users are well represented. The committee's decisions, once made, become our laws for applied IFR control techniques. Separation standards are an example; once they are decided upon they must be adhered to by pilots and controllers. It makes no difference if the weather is clear or if the flight is for training only. No compromise is permitted. Safety comes first.

When the sheer volume of air traffic is considered, it becomes plain that neither deviation nor compromise can ever be allowed in either VFR or IFR traffic management rules. Naturally, circumstances will sometimes dictate that a certain latitude be taken, under controlled conditions, to meet emergency situations. But these must be considered in a class by themselves. Ordinarily, the mixtures of speeds, pilot experience, aircraft limitations, weather situations, airport proximities, and such, mean that controllers must adhere to their standards and rules. But there may sometimes be unusual sounding clearances given because of the press of time and limited airspace. With the help of all parties in understanding the problems, their effects will be minimized.

We have said that growing pains are among some of the maladies besetting air traffic control. But growing pains make for color and variety and interest. This business is never dull. Everyone has views, it seems, on just how Air Traffic Management should be exercised—and views are intense. It is true that Air Traffic Management plays a part in nearly every single phase of flight operation. For that reason Air Traffic Management's view of flying is, perhaps with few exceptions, one that encompasses the whole field of flying.

It is possible, for instance, to spend years of flying in the military and never meet a cowboy from Wyoming after his landing in a new Twin; or a potato grower from Idaho in his Cessna 180. But Air Traffic Management knows them all, the civil, airline, and military flight crews, and knows their everyday flying habits. We must know them too, for here is where we have to coordinate all the diverse skills, varieties of equipment, and types of aircraft into one smooth-flying network of traffic. There are problems, of course, and not all of them can be solved by Air Traffic Management alone. Rather we shall find solutions when there is an established channel of communication for all of us users of airspace to employ, when we can exchange thinking, planning ideas, and other considerations for mutual analysis and decision.

Bold planning and thinking are necessary if we are ever to solve the problems stemming from our growing pains; if delays and congestions are ever to become history instead of current vexations. But it is one thing to find solutions, and quite another to apply them where the lives of passengers and crews are involved. Automatic equipment, however, shows promise of coming to our rescue, though it is still in the experimental stage. One thing is certain: it will free the controller from many of his routine clerical duties.

Here are some of the ways by which we shall resolve many of our current en route conflicts and help to relieve the congestion of our airways:

- IFF and fancier radar to afford hard "pictures" for the controller.
- Segregation and classification according to speed. This will have to wait, however, until the airways structure will accept one-way routes.
- High speed turnoffs at all major terminals. This will double our present runway traffic acceptance rate.
- Automatic position reports and automatic recording of flight data. This may be the greatest single asset to pilots and controllers alike. For one thing, it will free the controller to devote his entire attention to pilot needs and considerations. For the pilot, this feature will cut down on routine communications conversation and enable him to concentrate more fully on his aircraft. Voice would be used only when the "routine" had to be suspended in case of emergency or danger.

Waiting for improvements is always difficult, especially when the immediate effects of changes are slow to make themselves evident. But changes are coming; they're far beyond the planning stage in Air Traffic Management.

Flying and Air Traffic Management are something like love and marriage—a matter of give and take. To remain compatible, we must understand each other and settle our differences amicably. We must remember that air traffic will double very shortly. We have no time for dissension and dispute—only for hard work, willing hands and understanding! There's a lot we must do together. ▲

"GUNSLINGERS"

Major General Perry B. Griffith, Deputy Inspector General for Safety, USAF

OF the accidents with which my office deals, perhaps the most tragic and futile are those caused by accidental shooting. When a report crosses my desk telling of the death by shooting of a 21-year-old airman at the hands of a friend, I am dismayed by the waste and tragedy. Two young airmen, laughing, joking, in the full vigor of life, practicing fast draws on each other—with guns they "didn't think were loaded"—and then, BLAM! A man lies dead. Here is a life taken, not in combat, or in defense of country or home and family, but foolishly, needlessly.

The gun is designed to kill. With a loaded weapon in your hand, you are a potential killer. The gun itself, with all its safeguards, is actually safe enough; it is the common sense and good judgment of the man handling it we must question. Fortunately, most Air Force personnel who handle firearms do so intelligently, following the regulations of the Provost Marshal and the Air Force. It is the careless few, here as in other spheres of activity, who magnify a problem out of all proportion to its statistical significance.

There were 2369 accidental gun deaths in the United States in 1957, the last year for which we have accurate comparative figures. Although accidental gun deaths do not account for a largely significant part of the accidental deaths, among either civilians or the military, had there been only one, obviously futile, and so easily avoided, it would have been one too many. For example: an airman on a coffee break from guard duty crept up on a fellow airman at his guard post, thinking to scare him. He drew his .45 caliber pistol, cocked it back, and stepped up to his friend, shouting, "Bang, you're dead." The .45 went off and shot his buddy in the chest, killing him on the spot.

Another case: an airman on guard duty drew and cocked his weapon to execute a challenge. After the challenge he replaced his weapon and strolled to a nearby post where he began to fast draw with another guard (a violation of general orders). He had forgotten, however, to unload his cocked weapon after the earlier challenge. After completing a fast draw, he aimed his weapon at his mock opponent and pulled the trigger, killing him instantly.

In both of these cases the young men involved were violating the most fundamental rules of handling firearms. A gun ought never to be pointed at another individual without the intention of killing. Most of us have a natural abhorrence of taking the life of a fellow man. But the gun is a weapon designed fundamentally to kill. For that reason, loaded or unloaded, it should never be pointed at another, even in jest.

Now, these airmen were disregarding their standing orders not to engage in horseplay with guns. And in neither case was the safety lock in position, or the guns wouldn't have fired. Finally, these men ignored the basic rule of considering every weapon loaded until proved otherwise.

Let me cite a few more examples of this tragic carelessness and folly. You will readily see the pattern as it emerges; the violations of regulations, and the neglect of ordinary common sense. One example involves a 21-year-old airman working in an on-base gasoline station. He was briefed by his NCOIC not to fool with the weapon placed in the station and located in its holster by the cash register. As with a child who has been told not to light any matches, after his Noncom left, the airman cleared the weapon and began dry firing and practicing fast draws. When a fellow airman reminded him of established policy on weapon handling, the fastdraw artist only laughed. Finally, he inserted a clip of ammunition, operated the slide action, held the gun to his temple and pulled the trigger. Sure enough, the gun fired, right through his sideburns and his flat top. The bullet tore his head off. He didn't live to realize that he had placed a round in the chamber.

My final example did not end quite so tragically, but still illustrates what I shall call "the fallacy of the empty gun." A 19-year-old airman, returning from highway patrol, removed the clip from his weapon and started practicing fast draws with a friend in the patrol office. He had failed, however, to clear his weapon properly, and overlooked the fact that there was a round in the chamber. After a few minutes of practice draws he pulled the trigger and wounded his companion in the chest.

In all cases I have cited, the persons involved failed to observe the most elementary rules pertaining to weapons safety. In some cases supervision was at fault. But no matter where the error lay, the thought remains: these calamitous accidents were preventable. Had the individuals involved been more carefully trained, more closely supervised, and more discriminatingly chosen for the tremendous responsibility of using loaded weapons, these deaths probably would not have occurred.

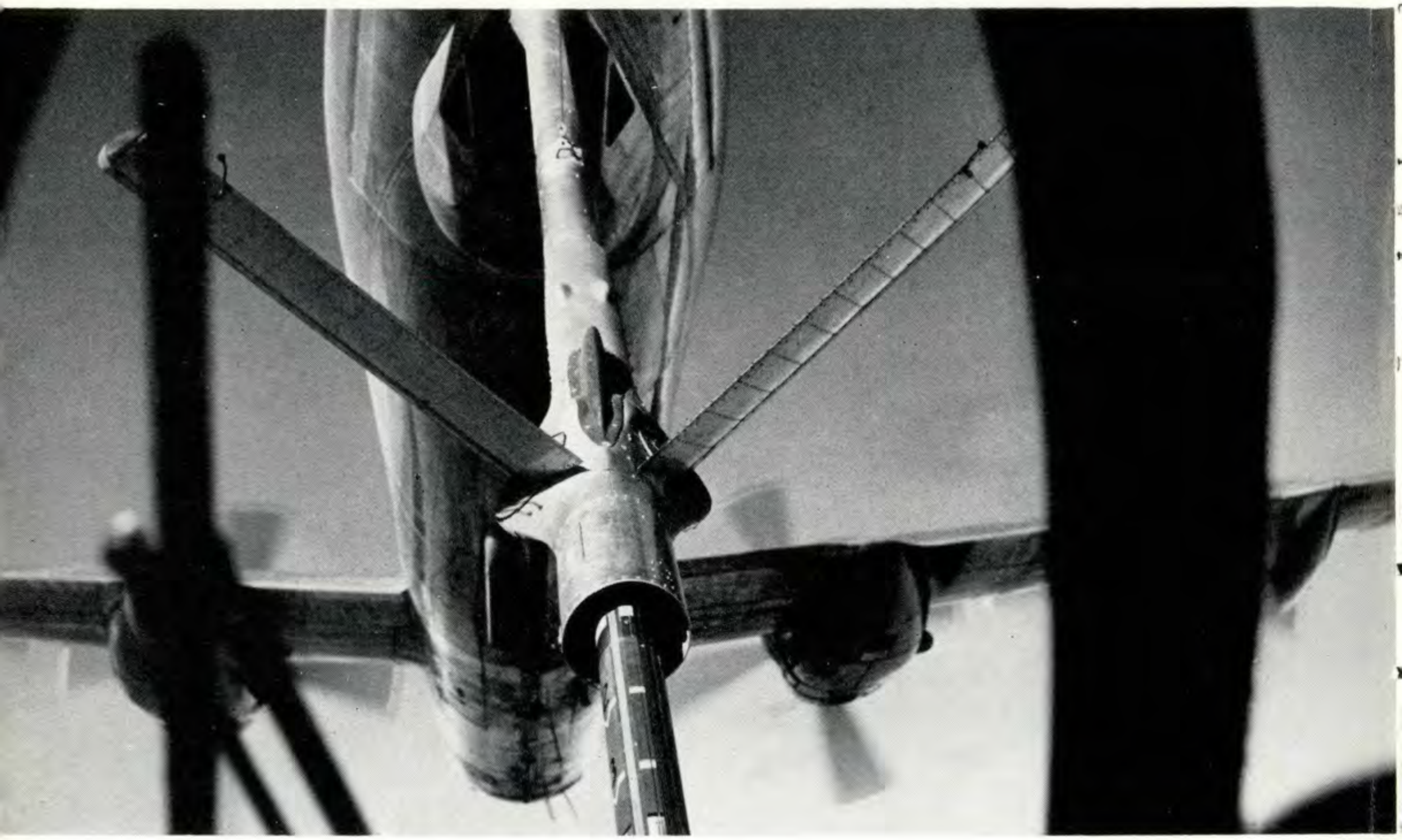
Monday-morning-quarterbacking will not undo the damage that has been done, but perhaps if you will give the matter some careful thought and attention, like tragedies may be avoided. If charged with supervising those who handle loaded weapons, make sure the men are trained, competent, and mature-minded. Do the very best you can to see that the proper safeguards are employed in issuing and returning weapons; that guns are properly cleared; that the individuals carrying them know their responsibilities; and, finally, that there is no time or occasion for horseplay.

I recall, as a lieutenant, a man accidentally discharged his pistol while cleaning it in the barracks. He was tried by court martial the next day. Another time the O.D. was inspecting the guard and as he started to take the sentry's pistol the slide flew forward and the man squeezed the trigger. The weapon went off and put a hole in the lieutenant's hat. This man also was promptly tried. Perhaps our toughness in those days paid off.

I would like to sum up my appeal for firearms safety with the following suggestion. Forget the hotshots in the movies and on TV. Follow the rules laid down by the training manuals and your supervisors and you will probably never get in trouble from an accident with a gun. I'll bet a lot of your celluloid heroes never shot a live round, but at least they have their lives to show they didn't play Russian Roulette, even with blanks, between takes. ▲

The tanker pilot must maintain a stable platform if a smooth, continuous transfer of fuel is to be made. This is the hardest test of his skill when it's time for . . .

BOOMS AWAY!



Capt. Dillard D. Bolls, 376th Air Refueling Sq (M), Barksdale AFB, Louisiana

The KC-97 tanker fleet of the Strategic Air Command is still one of the major links in the manned-bomber strategic concept. This aging Boeing Strato-Cruiser has provided SAC its capability of inflight refueling, thus assuring the bomber force an extended range to any global target. Even now, with the KC-135 jet tanker in use, the old piston-engine workhorse still has a part in the play and even at its age it remains a safe airplane. The problems of wear and tear are being solved by improved maintenance management and a great storehouse of crew experience.

The experience level of the average tanker crew (pilot, engineer, inflight boom operator) is probably five years on a combat crew and 1500 hours of flying time in the KC-97 aircraft. The faster turnover of copilots and navigators, however, would lower the crew experience level somewhat. The safety record that has been attained is the direct product of SAC's demand for safety in the operation and maintenance of the KC-97.

The problems of refueling are many; however, exacting procedures have been established to be followed in cases of particular malfunctions. The inflight refueling electrical and hydraulic system is a mass of possible troubles. The current flight handbook outlines procedures for effecting fuel transfer even with an engine failed and feathered on the tanker aircraft. The techniques for flying the refueling platform are relatively simple but "caution" is the byword while in contact with a 200,000-pound B-47 or a 400,000-pound B-52 receiver.

Rendezvous is the first problem of the tanker and and the receiver aircraft. Since the primary job of the KC-97 crew is obviously the successful transfer of fuel, the rendezvous must be made under any and all conditions. At first glance this may sound like a "piece of

Above, TSgt F. C. Jones, boom operator, working in the boom pod. (In posed photo, no chute is worn.) Below, left to right: Capt D. D. Bolls, pilot; 1st Lt D. L. Williams, copilot; 1st Lt N. H. Valor, navigator; TSgt R. T. Boehler, engineer; TSgt F. C. Jones, boomer.

cake." But consider it from a viewpoint of guiding together two rapidly moving aircraft, starting from 150 miles out, down to 1/2 mile, with as little radio contact as possible, day or night, fair or foul weather, and many problems present themselves.

Briefly, the task consists of orbiting an assigned point while making contact over the UHF radio with a bomber at his initial point or entry into the refueling area, then meeting it over the pre-assigned control point. This must be done with as little deviation as possible from the track and altitude. Two methods are:

- The APN 12/76, wherein the tanker navigator receives range and general bearing information on a radar scope.
- The APN-69 beacon method, wherein the receiver navigator picks up the tanker's radar beacon on his search radar and directs his aircraft to intercept the tanker.

The latter is the primary method as it can be accomplished under radio silent conditions, requiring only pre-takeoff coordination. The advantage of this APN-69 rendezvous under a war condition should be obvious.

The rendezvous portion of a typical training mission might go like this:

We're at cruising altitude, maintaining hemispheric separation on a VFR-on-top flight plan, approaching the coordinated orbit point. The tanker navigator is busy making sure the aircraft is to arrive at the orbit point at the correct time. The pilot is transmitting on the briefed UHF frequency making the initial radio call while the rest of the crew are preparing for the refueling. When UHF contact has been established and the tanker has received any adjustments of the ETA to the air refueling control point—plus the descent range of the receiver, since the bomber is cruising at, say, 35,000 feet—and the formation airspeed, the two navigators (tanker and receiver) go into the rendezvous procedure. We depart orbit to make good the latest ETA of the receiver to the control point, and increase airspeed to approximately 230 knots true airspeed.

The actual rendezvous has been going on all this time with either tanker or receiver navigator making the necessary course corrections and range calls, depending on the type of equipment being used. When the receiver is 12 miles from our "flying gas station" the pilot and the flight engineer adjust power, accelerating to the agreed airspeed. Shortly, the receiver makes visual contact and comes into the observation position.

By this time the boom operator is cleared to the UHF radio and the boom is lowered. Then, if necessary, he further directs the receiver into the contact envelope. The envelope limits of the flying boom for contacts are 17° left or right azimuth, between minus 25 and 45° elevation. The inner limit is 6.1 feet with an outer limit of 18.3 feet. The boom operator then extends the telescoping boom to 10 feet, waits for the receiver's receptacle to line up, and then extends the nozzle into the receptacle. When the boom is in "contact made," the flight engineer closely monitors the boom-receiver progress and actuates the lever to operate the fuel transfer (A-1) pumps to transfer the fuel into the tanks of the receiver. The pilot must maintain a stable platform if a smooth, continuous transfer is to be made. This is probably the hardest test of the tanker pilot's skill.

When the required amount of fuel has been transferred the boom is disconnected from the receptacle and raised to the stowed position. The receiver backs off and we make a 45° left turn to clear the bomber's track. And, contrary to the stories that you may have heard, the boom operator *does not* slide down the boom and clean the bomber's windshield.

A refueling report is usually given to the receiver, to include pounds of fuel transferred and the number and type of contacts made. The latest navigational fix and other information required for accomplishing training reports are also relayed. This, then, is our job, just one of the many in SAC, and seemingly not too difficult.

However, we would like to discuss some of the techniques and problems in the paragraphs to follow.

During a peacetime training mission the KC-97 aircraft will arrive over an orbit point at an altitude that is normally between 13,000 and 20,000 feet. This altitude is maintained (if under VFR-on-top rules) until refueling is completed. This procedure is established in the interest of safety to allow the maintenance of hemispheric altitude during orbit, tail chase, and refueling. When high performance receiver airplanes like the B-47 are refueled or when for some reason, like a feathered propeller on the tanker, the desired airspeed is difficult to obtain, a constant descent provides higher airspeeds without impeding the air refueling boom contact. These descents, however, do not usually exceed 150 to 300 feet per minute. We don't like them much faster.

Prior to contact, the flight crews of each aircraft have agreed upon the desired initial and final airspeeds and the approximate duration of the boom contact. With this information the tanker pilot can increase airspeed with ample accuracy by varying the rate of descent. He must not exceed 250 mph IAS though, since the control of the boom is critical above this speed. This procedure cannot be used if the tanker aircraft is cleared on a VFR-on-top flight plan because a constant altitude must be maintained for separation. The descent procedure should only be used when the flight plan is an altitude reservation type with a pad of 500 to 1000 feet built in on the lower side of the airspace reservation.

If it is on the reserved airspace flight plan, the KC-97 accelerates to the agreed formating airspeed by descending 500 feet and increasing power when the bomber has approached within 12 miles. The bomber's speed advantage enables it to close in for contact. The receiver levels out 500 feet below the refueling altitude and decelerates to 50 knots IAS above the tanker's speed. At the end of approximately two minutes deceleration the KC-97 should be only two miles ahead of the bomber. The bomber then moves in slowly for the contact.

Since the tanker is essentially a platform for the flying boom, the tanker pilot must fly the airplane in such a manner as to provide a stable platform. After contact is established the tanker pilot should maintain a stable attitude and, in particular, refrain from excessive rudder and elevator control. During the contact the copilot controls the engine power settings and scans the area for other aircraft while the pilot is primarily flying instruments.

Platform flying is relatively simple in smooth air; however, smooth air rarely occurs and mild turbulence will generally be the condition. As the receiver aircraft approaches the position for contact, a bow wave will tend to raise the KC-97, followed by making the airplane noseheavy. This occurs when the bomber is within 15 feet of the boom contact. Prior to this, when the boom is lowered, the KC-97 will slow down 5 knots due to the drag of the boom in the slipstream. The airplane should then be retrimmed. It is important that the tanker pilot make no power changes as the bomber moves the last few feet for contact. The airspeed at this time will be about 250 knots; this is customary at the start of a KC-97 heavy refueling. Once contact is made, adjustments of power by the tanker copilot should be limited to ½ inch Hg manifold pressure per engine.

As the fuel is offloaded from the KC-97, the tanker airspeed will slowly increase. This is advantageous because the tanker, having begun refueling at a high gross weight, is easier to hold at the desired airspeed, platform stability becomes easier, and engine cooling is improved. And, also, the receiver aircraft is assisted in maintaining a comfortable margin above stalling speed as its gross weight is increasing.

Moderate turns for navigational purposes can be made while in contact. The maximum angle of bank should never exceed 10°. There will normally be slight pitching in turns even in smooth air. During these turns it is important that the KC-97 pilot remember to hold as steady an attitude as possible for safety and to prevent disconnects. During rough weather, pitching, yawing or rolling due to moderate gusts will be ignored unless a return to the original attitude does not occur. This is because the gust effect on each aircraft in close formation is approximately the same. Momentary changes in airspeed due to light turbulence are disregarded.

If, during a constant altitude refueling (as is required on a VFR-on-top flight plan) the altitude goes beyond plus or minus 200 feet, the pilot will edge back to the original altitude by a power change. If this occurs at the maximum power setting, which is quite often the case in heavyweight refueling, and the altitude drops 200 feet low, the tanker pilot must require a disconnect, because the airspeed cannot be maintained during an upward pitch correction. This is the particular bind the KC-97 pi-

Left. This boom, jammed by a B-52, had its right ruddervator forced broadside to the airstream, rupturing the hydraulic system. The boom could then be neither hoisted nor flown up to the stowed position. Right, Sgt Jones in tail cone with the boom latching hook cable assembly.

lots very often find themselves in, and it is a dilemma that cannot be solved with the current airspace clearance restrictions.

The refueling tactical doctrine is predicated on the idea that the refueling operation to be conducted will be in the time of the retaliatory launch and that the airspace restrictions will be only those imposed by the military on its aircraft in the air. With the ever increasing air traffic and the limitation of altitude changes imposed by this traffic and AFR 60-16, the practice of refueling procedures in peacetime is a serious problem of safety. These are the major factors that make the tanker refueling business a really difficult job. For the tanker pilot, while hooked up, is not as free to make corrections as other pilots. This is because all elevator-control movements of his aircraft, especially changes in course and altitude, are most critical while in refueling contact.

The most dangerous position to be in when the boom is in contact and refueling a B-47 bomber is at or near the lower limit mentioned previously, minus 45° elevation. Because of the angle the boom makes with the receiver receptacle beyond this limit, during disconnect the nozzle may bind and will not easily clear the bomber's receptacle. Boom damage can be expected if the B-47 continues through the lower limit.

Below, 1st Lt N. H. Valor, navigator, at his duty station. Next, pilot's eye view as he pulls up to the pump. Lower, TSgt R. T. Boehler, flight engineer, checks the gage maze on his panel.

In the case of the B-52 receiver, the more critical position is the inner limit of the boom envelope, with elevation and azimuth in the green.

The boom of the KC-97 is raised, after fuel transfer has been completed, by flying the boom to a position near the chock by the aerodynamic force over the "ruddervators" and hoisting it into the latched position by a hydraulic hoist motor. The boom is held in this chock by a hook that is cable-connected to a latching lever operated by the inflight refueling technician (boom operator). If these systems fail, the crew has a problem because if the boom is allowed to drag on landing, boom damage is imminent. Our crew has experienced several malfunctions of these systems and has found that in cases where no other method works, the cargo hoist may be employed to raise the boom by depressurizing the aircraft and hooking the hoist to the boom cable in the tail cone of the aircraft and raising it to a position as high as possible to prevent it from striking the runway on landing.

The use of the cargo hoist in cases of a boom-down emergency is not included in the technical order. We feel that thought should be given to establishing a procedure to be used in these rare cases.

We direct this next comment to crews operating the KC-97 aircraft. If you operate the aircraft with an air refueling system leak or loss of engine driven hydraulic pumps or pump gearboxes, continuing your flight in order to complete scheduled flying time or scheduled training requirements could seriously affect the airplane's air refueling systems. According to the Flight Handbook, and as borne out by the experience of crews, a flight should be terminated as soon as possible when a hydraulic pressure failure in the air refueling hydraulic system is encountered. This will avoid damage to the engine driven hydraulic pumps and the entire system. If pumps are allowed to fail because of either loss of all fluid or because of closing the shutoff valve and continuing to operate that engine for an extended period of time, the entire system can become contaminated with metal particles. This invariably leads to extended maintenance and safety problems. Another good reason for flight termination is possible leakage of hydraulic fluid into the heater cavity located in the rear of these engines. As the Handbook states, this constitutes a serious safety hazard if wing anti-icing heaters should be required, especially since the KC-97 operates in the far north the year 'round.

A couple of years ago our unit was behind the flying time curve due to the installation of the 34G60 propeller and the Solar APU. Aircraft, after experiencing pump failure, were flown contrary to the above instructions for the purpose of extending flight times and completing training requirements. We finally ran out of pumps replacing them at seven times the current SAC rate. These malfunctions continued in the form of loss of pumps, valves and seals. Common sense alone seems to bear out the Handbook, especially with the older equipment now in use. Units using the KC-97 can profit from our experience. *Follow the Handbook.*

I can think of nothing worse than climbing with a good flying airplane to meet a bomber on a retaliatory mission and then losing the air refueling hydraulic system and being unable to offload the fuel. Without the boom system we might as well stay at home. ▲

Editor's Note: Captain Bolls and his crew were twice cited this year for their masterly professional handling of inflight boom emergencies.

It Sees...It Remembers

. . .

Mr. G. W. Goodrum, Ryan Electronics, Div. of Ryan Aeronautical Co., San Diego, Calif.

Any time you sit in on a bull session that includes more than one oldtimer, they'll eventually bring the conversation around to the days when pilots got from one point to another by following the railroad tracks. This was the age when a pilot's qualifications were two hours of dual and more guts than discretion.

Subtract the inevitable coloring that the stories have gained in the aging process, and the early days of flying still sound like one of the greatest adventure periods in history—because they truly were. And more than a few innocent bystanders got the pants scared off them when a cross-country pilot tried to resolve his confusion by flying low over a railway station to read the name of the town painted on the depot.

In an era not too far removed from the crawling pace of the horse and buggy, it was okay to navigate by the rail method. But rails had a habit of disappearing under fog or low clouds. Too, the pilot, being as green at railroading as flying, sometimes got switched onto the wrong track.

Even though the more serious-minded second generation of flyers has made aviation one of the safest means of travel, accurate aerial navigation remained a complicated procedure until the advent of the continuous-wave (CW) Doppler technique—one of the last steps in man's long quest for superiority over the birds. Man could fly higher, farther, and faster, but the bird still held the edge in the field of navigation until science turned the Doppler principle into a completely self-contained automatic device that provides highly accurate navigational information in any kind of weather, day or night, anywhere over the earth's surface without benefit of ground stations, wind estimates, or true airspeed data.

Such a significant achievement was not accomplished overnight. Christian Doppler, an Austrian physicist, first formalized the principle of frequency shift, now known as the Doppler effect, in 1842. The initial research for application of the phenomenon to aerial navigation was begun in 1933 by the Naval Research Laboratory, Washington, D. C. Ryan Electronics has developed it to the present state of the art—a whole family of Doppler radar navigation sets providing accurate, instantaneous navigational information that is ideal for almost any type of aircraft or mission.

The extreme accuracy of Doppler navigation is perhaps its biggest contribution to aviation safety. These sets, for instance, have demonstrated accuracy to better than ½ of 1% of the distance traveled. They maintain that accuracy through a wide range of aircraft attitudes, and from 0 to 70,000 feet, automatically and continuously providing groundspeed and drift angle information as well as other vital navigational data to the pilot. Continuous-wave Doppler, as opposed to pulse or other modulation techniques, starts operating while the aircraft is still on the runway and continues to function throughout the flight, even including the extreme attitudes of terminal maneuvers, until the plane is back on the runway again.

Continuous-wave radar systems can transmit and receive energy simultaneously and continuously. However, the pulse-type radars cannot. The latter must transmit radar energy in short "bursts," then stop to "hear" the returning echoes; while the CW systems receive data 100% of the time, contributing to highest accuracy.

No small safety feature of the Doppler navigator is the fact that it eliminates the need for many of the instruments now used in conventional navigation, and being completely automatic it leaves the pilot and navigator free to concentrate on other problems. Doppler sets are extremely simple to operate. As any pilot knows, the more duties he has in the cockpit the more chances he has to make mistakes.

These and other features of Doppler navigation provide a degree of safety in aviation that formerly was achieved only through an elaborate, expensive network of ground radio transmitters and beacons. Such a network obviously cannot be built to cover the entire globe. Outside of the networks, the flyer must resort to dead reckoning and celestial methods, which at best can tell him only approximately where he was when he began his computations. This might have sufficed in the slow-moving aircraft of WW II vintage, but is hardly adequate for modern high performance aircraft rapidly moving toward the Mach 3 range of operation.

Too, the cold war has made the aviation world acutely aware of the vulnerability of ground stations to jamming. In the event of war, these facilities undoubtedly would be silenced—in friendly as well as enemy countries. With the completely self-contained system of automatic, instantaneous navigation which Doppler provides, these problems are eliminated. A self-contained system is impervious to jamming.

When transports begin to operate at Mach 3, the pilot not only will have to know his precise position at all times in order to stay in the proper air lane, but he will have to know exactly where his plane will be at any given moment in the future of the flight, or America's air transport system could become a national tragedy instead of a source of pride. With the Doppler technique, the problem is solved before it arises.

Doppler, of course, was developed for military applications and, because of its long term accuracy, has been especially beneficial to far-ranging bombers. But a couple of side benefits were discovered after its development: because Doppler eliminates the requirement for wind information, dangerous straight and level wind runs preceding the bombing run no longer are necessary. And when Doppler is tied into a bomb directing set, it permits the pilot to take evasive action right up to the target because the navigational information needed for bombing computations is instantaneous and automatic. The pilot is left free to protect his aircraft and the bombardier-navigator is free to concentrate on the bombing problem.

Now let's talk about helicopters.

In helicopters, the CW Doppler is providing the first capability for safe operations at night and in low visibility weather, greatly extending the usefulness of an already versatile aircraft. When Doppler is tied in with automatic stabilization equipment and an altimeter, the helicopter pilot can command a fully automatic maneuver from normal cruise conditions through transitions in both speed and altitude to a hover.

The very nature of the helicopter makes this a factor for increased safety in almost any type of mission, and especially in rescue work where precision hovering may be the key to saving a life. Ryan engineers say their automatic helicopter sets provide more precise, sustained hovering control than the best pilot can accomplish manually under the most ideal conditions.

In helicopters, as well as in fixed-wing aircraft, Doppler sets with computer tie-in can "remember" a course just flown and use the information to permit the aircraft to automatically retrace its route. Almost any experienced pilot can recall situations in which he would have swapped all his knowledge of navigation for just such a device.

Measurement of the frequency shift of microwave energy is the basic principle of Doppler navigation. The energy generated by the set is concentrated into two or more narrow beams and directed by an antenna in the aircraft toward the terrain below. The aircraft's motion causes a difference in the frequencies of the transmitted energy and the energy which the terrain reflects back to the antenna. The difference is directly proportional to the speed of the aircraft.

With one microwave beam, only one component of the aircraft's speed can be measured. But with two beams of radiation and barometric altitude rate data, it is possible to compute the aircraft's heading speed, drift speed, ground speed, and drift angle. Additional beams can be included to meet the special requirements of helicopters and airships. Doppler sets which provide navigation without reference to wind data actually can automatically compute and display wind speed and direction by combining groundspeed and true airspeed information.

The ground velocity data obtained with the Doppler set is the basic output from which other vital navigational data is generated. It can be directly integrated to provide ground miles, or it may be used in a navigational computer, along with true heading information, to determine the north-south and east-west components of the aircraft's velocity.

This velocity data can be automatically integrated to obtain north-south and east-west distances traveled, which in turn can be converted to latitude and longitude coordinates. Knowing the present position and the desired destination, the best course and shortest distance to that destination can be automatically computed and displayed.

Obviously, CW Doppler offers a big advantage over conventional navigation techniques whenever complete and continuous position information may mean the difference between success or failure of a mission and the safe return of the aircraft and its crew. ▲

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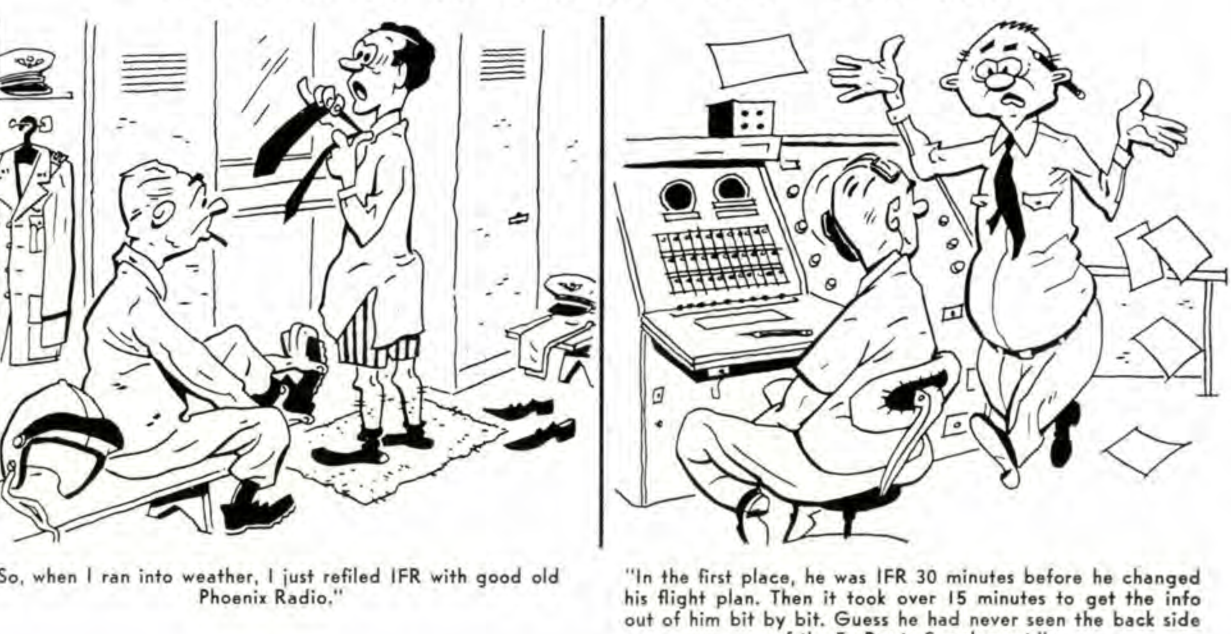
· TWO POINTS OF VIEW ·



"So, when I ran into weather, I just refiled IFR with good old Phoenix Radio."

"In the first place, he was IFR 30 minutes before he changed his flight plan. Then it took over 15 minutes to get the info out of him bit by bit. Guess he had never seen the back side of the En Route Supplement."

A unique look at the polar ice cap. The huge pieces of ice shown in this photograph illustrate the Arctic Ocean in its summer dress. During winter months the ice pack is almost completely unbroken.

Ice—in and out of highballs—is here to stay, say the troops from "Kef." They invite you to learn more about it. So, let's go . . .

Sledding With The Black Knights

If you've been flying Uncle Sam's iron for any length of time, you're familiar with Mother Nature's formidable foe of flyers: *ice*. A compilation of the mountains of words previously written on this subject would resemble a resumé of a Congressional filbuster. To date, however, no one has come up with a comprehensive solution that would eliminate the many problems resulting from the incompatibility of ice and aviation. Let's face it: Ice—in and out of highballs—is here to stay!

This article isn't intended to solve this permanent problem. Nor is it our intention to present a scientific discourse regarding icing phenomena. The purpose is to acquaint you lucky jocks who have thus far escaped a far northern assignment with some of the problems created by the cold stuff in northern climes.

The "Black Knights" of the 57th Fighter Interceptor Squadron, shivering through a tour of Keflavik, Iceland, will unanimously agree that this old patch gets its share of every icing problem known to birdmen. Located just a snowball's throw south of the Arctic Circle, the "Kef" area is besieged by ground as well as aircraft icing headaches.

Although the temperature range at Keflavik is mild (winter mean temperature is 32°), this northern location produces a weird phenomenon. In winter months, the ground in Iceland will frequently freeze despite an outside air temperature as high as 42°. Don't ask us why. This isn't a scientific report, remember? Take our word for it, or better yet, y'all come on up for a demonstration. Anyway, with an outside temperature of 30 to 40°, an average of approximately 5 inches of precipitation per winter month, and freezing ground, even a back seat radar type will admit that a possibility of clear ground ice exists.

We're not going to launch a whole lot of iron with a thick layer of clear ice on the ground and a 40-knot wind whistling across the ramp. Thus, when old man winter blows his blustery breath at Keflavik, he disturbs more than just the birdmen. Our experienced groundkeepers grit their teeth, tighten up their parkas, and go to it.

Since there isn't any known method of preventing ground ice at Keflavik, the groundkeeper's problem is narrowed to two possible solutions: Create a traction surface on the ice, or get rid of the darn stuff. Removing many miles of clear ice has long since been determined to be an unpopular pastime. The Keflavik troops have tried to remove ground ice through the use of tanks and even flamethrowers. (Courtesy of the U. S. Army.) What joy to pound, scrape, or melt a nice wide path only to have cool, clear ice reappear almost immediately. In their attempts to create a traction surface on the ice, the Keflavik troops had many a futile experience with the unfortunate combination of wind and sand. The two just ain't compatible, and braking action remains just as nil after sanding as before. Necessity demanded a better solution; the "Black Knights" were tiring of the thrilling slide across the lava beds in their sleds of lead.

Experiments with sand application methods eventually led to the answer: An effective water sanding technique. In a nutshell, this method involves spreading water over the terrain. Just as the water starts to freeze, sand is spread. This creates a sandpaper-like surface and gives the "Black Knights" half a chance.

Okay, the terra firma is finally passable and the knights scamper out to their aged iron. Alas, arriving at ye ancient steeds, our young lads are confronted with yards and yards of ice-covered airfoil. After so many years in northern climes you'd think that the '89 and ice would learn to get along. T'aint so. They get attached to each other, but they remain as discordant as they were the day the first Scorpion was tested. (Yep, they had ice 'way back in those days.) Much weeping and gnashing of teeth at length produces a deicer truck: that's a mobile tank of deicing and defrosting alcohol, equipped with an elevator type platform and a spray nozzle. Many gallons of alky later, our knights are finally ready to enter their soggy beasts.

The icing problem now shifts to the upright knight in the cockpit. This young lad has long since learned to rely on prevention rather than removal. Flight commanders in the 57th emphasize the problem and the resultant pilot awareness of inflight icing probability has paid big dividends. Icing incidents have become infrequent despite humidity and temperature conditions at Keflavik which are highly conducive to fuel system and structural icing.

Alcohol and water, as every true knight well knows, mix well after duty hours in a cozy atmosphere. But, homogenize the two during duty hours in an aerial environment and our warrior is in deep trouble; consequently, it doesn't take long for a pilot to get serious about personally preflighting the various deicing facilities of his bird. Our stalwart knight visually checks the alcohol level in the tank . . . this stuff is specially denatured and fit only for consumption by our fire breathing steeds.

During the taxi-out, our knight assures his guest in the back seat that the loadmeter indication would lead one to believe that the alcohol pumps are working just like they were meant to. For skeptical '89 drivers, it is indeed possible. Just turn off two generators before hitting the alky switch. Before the brakes are released for takeoff our guest in the back seat is foolish if he doesn't query the staid driver as to the latest position of the pitot heat and engine heat switches.

At long last we're finally airborne. The book says to recycle gear, flaps and boards. Our knight gets with this recycling routine just like he knew what he was doing—which, of course, he does. Cheers, all is going well. All will probably continue to go well if our pilots remember to use the not-so-conveniently located alcohol deice switch. Use of this switch as per tech order instructions will do much to prevent that ice cube from forming in the low pressure fuel filter. In fact, this will even prevent its forming downstream from the filter. Should our brave knight forget that little doo-wa-ditty of a switch, he's likely to start pumping adrenalin at an alarming rate. A windmilling engine over "rough and mountainous arctic terrain and water" will make a believer out of the real skeptic.

All right, we'll admit that occasionally even the best and most thorough preventive measures will not keep the cool cube from disrupting the normal flow of fluid. Still no reason for a heck of a lot of sweat! Our pilot has read and digested all the deicing data contained in a folder designed exclusively for this subject. This folder, compiled by the local Flying Safety Officer, contains all the deicing information offered in the tech order plus whatever miscellaneous data base ops can get hold of. If your outfit doesn't have such a folder, we highly recommend that you make one up, regardless of where you are stationed. You're as likely to run into an icing problem over Texas as you are over Keflavik. Our folder contains all the tidbits you're reading here, plus the all-important airstart procedures.

Oops, I almot forget to mention structural icing. For you who think we can't sound intellectual, dig this:

"The Island of Iceland lies in the path of a vigorously active storm track pattern. The storms are typical of those associated with warm and occluded fronts. The moisture in this frontal activity is characteristically in the form of very large water droplets. The very large size of these water droplets is due to the impregnation of small water droplets by the oceanic environment. . ."

How's that for an intellectual dissertation?

For those of you who're still with us, take our word for it. This water is wet! As you've probably guessed by now, the chances for structural icing under this condition are quite good. This is especially true in the 0 to −8°C. range.

Again, the "Black Knights" rely on prevention. In the '89 we've got a tremendous hot air deicing system. (Now you know what all those holes are for.) There isn't much sense or future in tempting fate, however, so we avoid altitudes carrying the critical temps as much as possible. Going through these altitudes, both up and down, we do so pronto! 'Tis sheer nonsense to stick around to see how heavy you can get. It ain't healthy. It has something to do with lift, stall speeds, and all that jazz.

Well, there you have it—a capsule view of the consternation caused by the cool stuff in this northern clime. Perhaps personnel has given you the word since you've scanned these pages; if so, welcome aboard, you specially selected jocks! We've come a long way to coexisting with the ice in Iceland. However, on that long ride up this way, we suggest a session with the pertinent sections of your tech order. You'll become a believer after your first sight of this barren namesake of the formidable foe of flyers. ▲

Capt. Alan J. Grill, 1st Lt. Cornelius J. O'Keefe
57th Fighter Interceptor Squadron, APO 81, N.Y.

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"Colonel, here's a safety equipment salesman to see you."

Some Cross-Country Notes By Rex Riley

During the summer months, Rex did a good bit of traveling around the U. S. His observations of conditions at some bases rate from bad manners to dangerous practices. Most of the unsatisfactory practices can be corrected by individuals or supervisors. No attempt has been made to identify a base, an individual or even the command.

We can do without:

• *The Lazy Airdrome Officer*. At a western base we saw a Major stomp in from his airplane with both arms full of baggage. His aircraft was parked two blocks from base ops. The Alert Crew had parked him, left a vehicleless Alert man to get refueling and maintenance data. After waiting 10 minutes in 112° temperature for some wheels, the pilot walked in. All this time the AO sat contentedly in an airconditioned building paring his nails.

• *Sweatbox VOQs*. Rex spent two nights recently in a WW II VOQ; it wasn't the first time and it won't be the last. But, by golly it was the hottest he's been for a long time. One small window was the extent of ventilation, and at 2 o'clock in the morning it was just about as hot as it had been at noon the day before. The perspiration poured off. At getting-up time, Rex felt as if he had had no sleep at all. It is realized that not every base can aircondition the barracks, VOQs, BOQs, and so on, but it is also known that oscillating fans are available for issue. This particular base was beautiful: green lawns, buildings painted, two swimming pools, some new permanent buildings and the hottest VOQs in the nation.

• *Kick-the-Tire and Light-the-Fire Pilots*. During the hot hot summers and cold cold winters, it's perspiring or freezing work to pull a good preflight. But if you don't, you're going to bash an airplane or at the least be very embarrassed. For example, take those transient T-Bird pilots who didn't check their fuel caps at one of the desert bases. They were taxiing out before they found that *all* the fuel caps were loose. They hadn't checked them and the Alert Crew had purposely left them loose because of the heat and expanding fuel. Many other bases where the temperatures run high, alert crews are leaving the caps loose after servicing. And how is your preflight these days?

• *The Can't-wait Pilot*. The throttle bender who insists on *immediate* refueling, oil, oxygen and maybe maintenance. He fusses if told he'll have a half hour's wait. So the Alert Crew goes all out to service his bird—only to find out the pilot has decided to RON.

• *Poor Reasons for Inadequate Clothing*. Last winter Rex landed at a midwestern AF base to find the temperature about 10 below zero, drifting snow, and winds about 30K, in fact a real "blue darter." During the preflight he noticed the Alert Crewmen in white overalls, wool stocking caps and a conglomeration of underclothes. Obviously they were just about to freeze their feathers. When one of the Alert men was asked why they didn't have adequate winter clothing, the reply was, "Our supply tried, but we're in the wrong zone." Another stop was made in the same climate zone, and *all* the line personnel had real fine winter clothing. Something is wrong somewhere, and it sure promotes bad working conditions which, in turn, leads to poor safety on the flight line.

So much for the aches and pains department.

And now for some "bouquets" to the troops in the field. Places and names of bases have been mentioned inasmuch as the remarks are complimentary.

• *Stag Rooms*. At Nellis AFB Officers Club there's a secluded, separate and attractive "stag room." It's for men only and aircrewmembers in flying suits are more than welcome. You can eat breakfast, lunch or dinner from 0600 to 2100. If you are a tired and hungry transient pilot you don't have to go to the VOQ to change clothes before you eat. You can go to the stag room, drink a coke, cool off and eat—still in flying clothes. If you are leaving the next morning you can eat breakfast in your flying suit, then go right to the flight line. Base pilots who fly the morning and afternoon periods don't have to go through the rigamarole of changing from flying suits to uniform, to flying suits to uniform. Nellis also has a VOQ that is as nice as we've seen anywhere.

• *Good Transient Maintenance*. Recently Rex's T-Bird broke down at Laughlin AFB, Texas. The transient maintenance people did a real fine, expeditious job of getting us on the road again. The trouble was analyzed correctly, parts obtained and fabricated and we were on our way with a minimum of lost time.

• *Airborne Advisories*. While going into Tinker AFB, Oklahoma, the Ft. Worth Center advised Rex of a C-130 climbing VFR on a reciprocal course to flight level 285. Rex was letting down from 38,000 and sure enough the C-130 came churning along on a collision course. Had it not been for the advisory, a midair collision *could* have occurred. The El Paso and San Antonio Centers also hand out numerous traffic advisories while some of the other Centers are real quiet.

Bet you've seen some good and bad ones in your travels. How about letting us in on them so we can pass them along? Maybe you can help to make cross-country traveling safer and a little more savory. ▲

MISSILANEA

Your unit should now have Air Force Regulation 58-9, published 20 June 1960, titled "Responsibilities for Reporting Missile Hazards." This regulation gives every missile man, regardless of level, the opportunity and responsibility of reporting potential hazards in missile activities.

If you see a dangerous condition or a situation that looks as if it might cause an accident, report it immediately. A simple handwritten note will do. Give it to your immediate supervisor, the missile safety officer, or to your unit commander.

If *you* do this, corrective action can be taken. The remedy will then be passed on to other interested agencies. Your initiative in making a report may save some other missileman from accident and injury.

Look for a film, soon to be released, showing the complete cycle of events from the time an MHR (missile hazard report) is submitted until the time a fix is made. The film will be shot at Norton AFB, San Bernardino, California, by the 1352d Photographic Squadron (Air Photographic and Charting Service), from Lookout Mountain Air Force Station, Los Angeles, Calif.

A substantial portion of the equipment in most missiles is comprised of the various electrical or electronic units. Many missile malfunctions can be traced to the complicated electrical or electronic systems. However, this does not mean that all of the malfunctions must be within the many complicated black boxes. The wiring, plugs and switches that connect or are associated with the black boxes can be a likely source of trouble and should not be overlooked by the investigator.

Electrical plugs can be an especially fruitful area for the missile accident investigator. Here are some examples of what to look for when examining plugs:

- Moisture and/or corrosion in the various parts of the plug.
- Foreign particles in the plug, like solder drops, pieces of loose wire, or metal chips.
- Frayed or uninsulated wires within or leading into the plug.
- Broken, sprung, bent, and missing pins or sockets.
- Wires which have become disconnected or which may never have been connected to the plug.
- Cold soldered or incorrectly soldered connections.

Although a thorough examination of plugs and wiring in the wreckage from a missile accident may disclose the cause, it should be emphasized and re-emphasized that this same type of thorough inspection before the missile is launched may prevent the accident.

A 10-minute film now on the shooting schedule will cover this subject thoroughly. Watch for it.

Plans are underway for the Third Air Force-Industry Missile Safety Conference to be held in Southern California sometime in December of this year. Attention will be focused on ground safety equipment. Like the visible part of an iceberg, which represents about one-ninth of its mass, the missiles are the most conspicuous parts of the new weapon systems. Underlying and supporting the missile, however, is a vast web of machinery and support equipment, all of which must function just as reliably as the missile itself if launch success is to be achieved.

The Directorate of Missile Safety Research is inviting ground support equipment specialists from the Air Force Ballistic Missile Division (AFBMD), AMC, and from Industry to join Directorate experts in examining deficiencies of design and installation in support equipment. In this way the possibility of repeating errors in follow-on and new equipment will be minimized.

Lt. Gen. Joseph F. Carroll, The Inspector General, has expressed the deepest interest in the Conference. He is particularly concerned that safety devices be incorporated into missile weapon systems in the earliest stages of design and development. To this end, the General encourages the closest possible cooperation between the Air Force and Industry.

Industrial representation at the Second Missile Safety Conference held in June exceeded that of any previous get-together. If that serves as any indication of the number who will turn out for the next one, it should be the most successful to date.

With the use of atomic and nuclear missile weapons becoming more widespread, the possibility of accidents in their handling and storage becomes increasingly likely. Accidents, however, do not mean explosions, for the hazard of nuclear detonation is virtually nonexistent.

A Department of Defense message states: "Accidental detonation of A-weapons is almost impossible. Infinitesimal is the word to describe the possibility of accidental detonation of a nuclear weapon, according to experts who point to a perfect 14-year safety record to emphasize the point in a recent Department of Defense briefing."

As proof of this, the Air Force can point to the several accidents which have occurred involving "broken arrow," the formerly classified code name for accidents with nuclear weapons. In none of these accidents has there been a nuclear explosion, nor has there been a significant amount of contamination. In all cases the Air Force's disaster-control team soon had the situation under control.

The most recent accident involving a nuclear weapon was the explosion and burning of a Bomarc missile, IM-99, at McGuire Air Force Base, New Jersey, on 7 June. Although there was no nuclear detonation or any damaging degree of contamination, many of the firefighting personnel—under orders—evacuated the area instead of fighting the fire. They mistakenly feared a nuclear explosion.

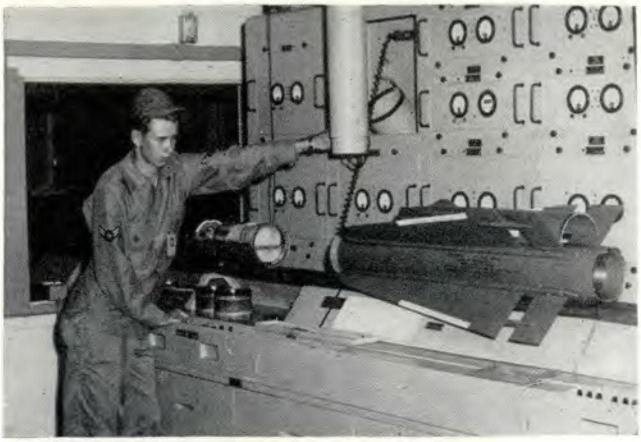
It is critically important that personnel involved with nuclear weapons or installations understand that there is almost no possibility of nuclear explosion, despite the kind of accident that may occur. Regular emergency procedures must be followed through as, for example, in the case of firefighting. ▲

The missile technicians and armament men of 414th Ftr Gp, Oxnard AFB, Calif., proudly proclaim . . .

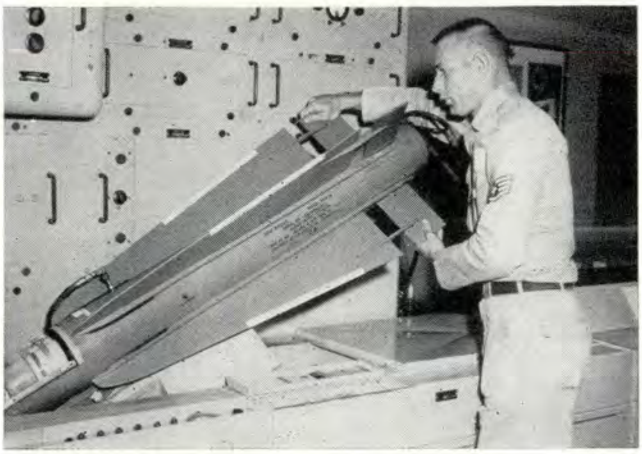
"WE PUT THE 'DO' IN VOODOO"

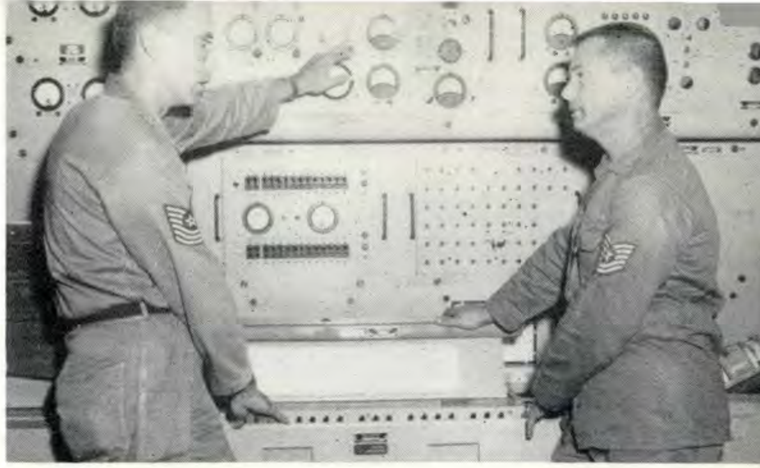
Above. When Armament gets a call for a missile, the long, meticulous checkout procedure begins. Here the missile is removed from storage. Below, A2C Marvin Winterfeldt and SSgt Harold E. Johnson show how carefully the GAR-2A is packed in its metallic container.

Above. The Falcon, securely nestled in its cradle, is absolutely safe in storage. It will not be armed until after the checkout cycle is completed. Below, an overall view of the MA-1 checkout console, and overhead track, where the Falcon takes its physical.



Above, A2C John E. Probst performing continuity checks on the missile at checkout station A on the MA-1 console. Note the warheads, by Probst's right hand, removed from the missile before check. Below, SSgt Leonard insures that flippers are properly locked for test.





Above, MSgt William H. Whitfield, NCOIC of the Missile Section, explains the missile checkout procedure to TSgt Louis N. Lagala. He in turn supervises the work (below) of guidance system mechanic Sgt Johnson. All work is performed with the aid of the checklist.

One of the men who helps put the "do" in Voodoo is 1st Lt Ken V. Peterson, Air Weapons Officer of the 414th. "Our outfit has a head start on anyone else," he says, "because in Col Lee R. Lambert we have one of the finest base commanders anywhere. Safety is a byword with him."

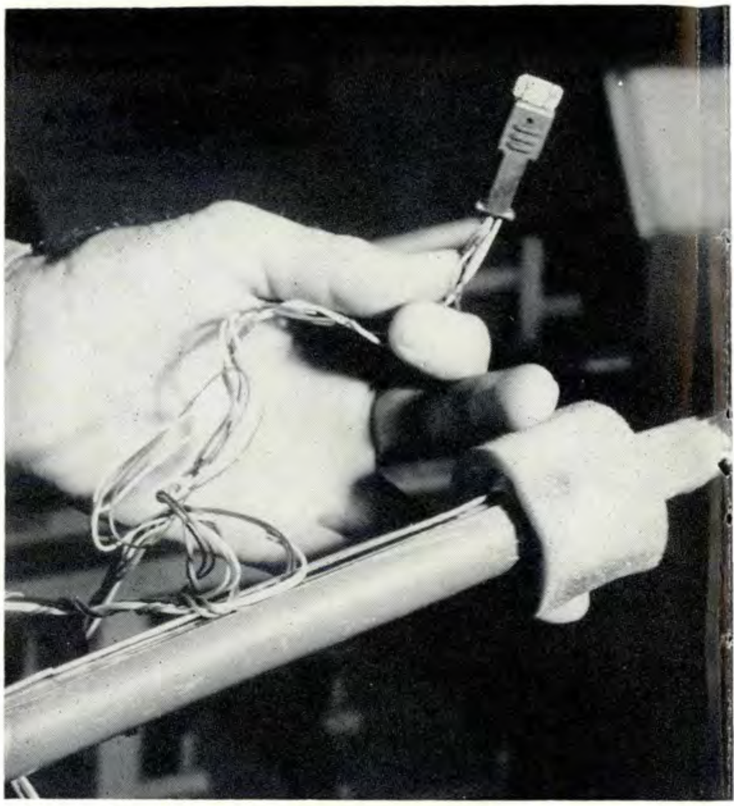
The high degree of readiness and efficiency that helped the 414th win the Western Air Defense Force "A" flag is apparent in their safety operations. "To us, safety is not a textbook term but a daily practice," says Lt Peterson. "With the help of my chief honchos CWO Clem Pine, CWO Buck Buckley, SMSgt C. J. Moore, MSgt Bob Courson, MSgt Bill Whitfield, and TSgt Pop Karnecki, these are the things I try to make sure we do:

"First, we ramp-check everyone's job every day. We make sure that checklists are being used and that no short-cuts have crept in. We give pop quizzes, either written or verbal, any time we detect complacency. These reveal shortcomings double quick. Then, during loading alerts, I ride around in my truck and spotcheck the loading of all aircraft and the safety practices of all loading crews, from warehouse to flightline.

"Although we have monthly meetings where safety procedures are reviewed in detail, any observed lapses in safety technique are dealt with immediately. Safety first has helped make us first. We've got that "A" flag to prove it." *(Photos: A2C C. P. von Rennen, Oxnard AFB Photographer.)* ▲

Below, SSgt G. W. Thomas, a missile guidance technician, runs a continuity check on the igniter circuit with the help of Mr. John E. Bunk, a Hughes tech rep. Note again the ever-present checklist.

Above, Sgt Thomas removes the igniter from its container. Right, note the installation of a shorting clip across the pins of the igniter. This prevents accidental ignition from stray radio frequency energy. Below, Thomas inserts the igniter with a T-handle.



Above, TSgt Daniel B. Valenzuela, armament supervisor, checks the tiedown straps as the readied missile leaves for the line. Below, TSgt Richard Karnicke, master armorer, supervises the unloading.

Above, SSgt F. L. Johnson, Sgt Karnicke, and SSgt Paul Drake load the Falcon on the missile launcher rail. Below, they make a stray voltage check to see that no voltage is leaking through the system.

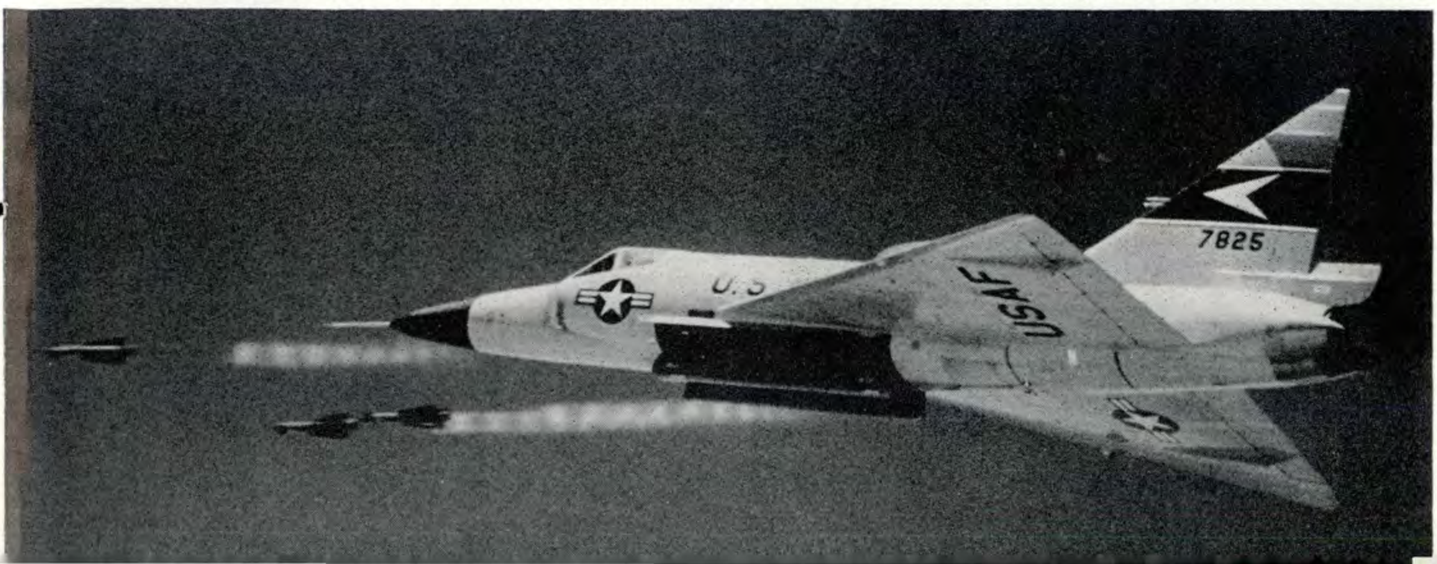
Above, Captain Charles H. Mercer, Voodoo's pilot, checks his cockpit armament switches before proceeding with his preflight.

Captain Mercer, with his checklist, inspects the nosewheel start switch which keeps the missile from firing when gear is extended.

Pilot goes over the Falcon thoroughly, from nose to tail, to make certain it is properly mounted and in shipshape firing condition.

Secure in the knowledge that his aircraft and its armament are ready for any job ahead, Captain Mercer prepares to climb aboard.

Falcons on the way! A salvo of three missiles is shown a moment after launching from an F-102. (Sorry, 414th, no F-101 firing pictures were available.) Using either radar or infrared guidance systems, the missiles will track and destroy an enemy intruder despite evasive maneuvers.



Flight Service, with its specialized aids, can help you complete your flight safely. Their services are . . .

Yours For The Asking

Above, the Maxwell Flight Service Center is a hive of activity. Note the moving belt above the interphone key boxes. Flight plans and messages are passed by boxes mounted on the belt to pertinent positions for servicing. Below, the MATS Air Evacuation Sector Board, manned by A2C Travis W. Kilgore and TSgt Charles T. Fisher.

"**Flight Service**" — to most military pilots — is a familiar term, and the oldtimers can even remember its beginning as Army Flight Service when it was formed in 1943 under Army Flight Control Command. Since that time the functions have changed, but the purpose has remained the same: *to provide specialized services for the safe completion of military point-to-point flights.* These specialized services will be individually covered later in this article, but first a look at a confusion area.

Effective 15 January 1960 the Federal Aviation Agency adopted the name "Flight Service Station" to replace the name Air Traffic Communications Station (ATCS) which used to be Interstate Airway Communications Station (INSACS). Don't confuse FAA's Flight Service Stations with Military Flight Service Centers. The Flight Service mentioned by AF Regulations 60-16, 55-8, 55-4; by AR 95-8, OPNAVINST 3710.7 and the Flight Information Publications are the *military variety*, as we will explain.

Under the provisions of AFR 23-19, Hqs Airways and Air Communications Services (AACS) operates a network of six military Flight Service Centers across the United States for the specific purpose of *service to military flights.* Each Center consists of specialized operations, weather and communications sections and is connected to every active military base in the United States by a series of full period rented interphone circuits. This net serves 372 stations where military flying occurs with multiple drops to base operations, DF stations, control towers, FAA ARC Centers, aircraft plants, and heavily used civil airfields. During an average year Military Flight Service processes over 2,000,000 point-to-point flights by Department of Defense pilots, each requiring an average of three messages for completion. USAF AIROPNET teletype facilities are used for the "long" haul flight plan involving more than one center area or overseas flights.

Let's take a quick look at this processing and the services you get *without asking*, as compared to what you must or should *ask for*.

Every military flight plan filed (DD Form 175) in the ZI is called in by the departure base operations to a Military Flight Service Center *immediately* after departure. If you depart a P type civil airfield, the FAA Flight Service Station is responsible for forwarding a flight plan to Military Flight Service.

If you depart a PC type civil airfield, *you* are responsible for getting the flight plan to Military Flight Service.

Capt. William F. Shepherd, Jr., Chief, Flight Service Br., Hq AACS, Scott AFB, Illinois

Above, at the Sector Board position are, left to right, A1C K. W. Crawford, TSgt L. D. Sims, and A2C C. C. Maurry, Jr. Above, right, TSgt R. W. Manning holds down the Flight Service Forecaster position. The services of these men, and many others, are as near as your telephone.

You can do this by long distance telephone (collect) prior to departure. This is a *must* if you do not have your own clearance authority. Or, you can air file after departure with FAA or the nearest military radio and request relay to Military Flight Service.

After the plan reaches Military Flight Service, a lot takes place.

• The destination base is notified that you are coming and is given your ETA. This base can now take action to divert you to your alternate, or initiate advisory action on NOTAMS, weather, or hazards.

• If your flight is composite VFR/IFR, the FAA's Air Route Traffic Control people are notified that your flight has a scheduled IFR leg and where you'd like to have a clearance. However, this doesn't guarantee that a clearance will be waiting but it does give them advance notice.

• After delivery is complete, your flight plan is screened by qualified operations personnel and posted on visible files where it awaits notification of your safe arrival.

If you have departed a base without an operations office such as a civil field, your flight plan is screened by an operations office and a weather forecaster prior to posting. Deficiencies in flight planning will be brought to your attention.

Now you have filed, departed, everyone has been notified that you're coming and we've settled down to wait for you to arrive.

The next action on your part is to *file an arrival*. If you do not, one hour after your flight planned ETA or at flight planned fuel exhaustion, whichever is earlier, an action known as a Preliminary Communications Search is initiated to *find* you. This consists of a call to every military station along your route, including your departure point and destination, to make a physical ramp check for your aircraft. Additional calls are then made to all en route FAA stations for information on your flight.

If you are *not* located, notification of Search and Rescue agencies for physical search is the next action taken. When you're overdue, your location will be the prime mission of many people until you're located and by the same token if you merely failed to file an arrival or change en route message, the same people will be focused in your direction but for entirely different purposes. *Therefore, you must file arrival notification if you arrive safely to prevent unnecessary emergency action.* Do this by physically turning in the duplicate copy of your DD Form 175 to a military base operations, or by filing a message to Military Flight Service from an FAA Flight Service Station if landing at a civil P field, or by calling long distance collect to Military Flight Service if you have landed at a civil PC field.

Now that you have arrived, let's consider your departure and how to get you briefed and cleared if you need it.

If you are leaving a military base and its operations and weather station is open, there is no question. File, get briefed, give ops a copy and leap! *But*, if ops is closed—and about 60% of them are at one time or another—or if you are departing a civil base, flight planning facilities such as weather information, NOTAMS, clearance authority and so on, are available through Military Flight Service. If you have your own clearance authority, use of these facilities is a matter of choice; if not, you have no choice, but must submit your flight plan for approval.

In either case, use the Military Flight Service interphone if available, or FAA teletype if leaving a P field, or collect long distance telephone if leaving a PC field. Feel free to use long distance telephone any time you desire a briefing and the existing communications are not satisfactory. Telephone numbers, Military Flight

Service areas, and procedures are contained in the En-route Supplement, USAF-USN Flight Information Publication. To toot our horn a bit, the Military Flight Service Centers maintain annually 225 operating agreements with active military bases for clearance and weather support, in addition to full coverage for all civil bases.

During an average year, 350,000 clearances are processed. It has been estimated that approximately 2000 base operations officers and base weather forecasters would be required to keep these bases open 24 hours a day, if the centralized base ops facilities were not available through Military Flight Service sources.

Inflight advisory action by Military Flight Service is initiated *only on request* of competent authority such as you—the pilot—or base operations officers or weather forecasters. Primarily, advisories are designed to apprise you of information important to the safe or expeditious completion of a flight. During an average year 15,000 such messages are processed.

Ever been lost? Given sufficient time and fuel, any pilot is able to orient himself; but at or near the end of a flight, time and fuel are vital factors. Should you find yourself in a situation where the real estate is hard to find, Military Flight Service Centers are in a position to offer immediate assistance by functioning as a coordination and evaluation center for the USAF D/F net. Present operating procedures require any D/F stations hearing a call of distress to pass the word to Military Flight Service who then alert all or a portion of the USAF D/F net. As courses are obtained the net control center plots this information to obtain a cross-plotted fix. Information concerning position, course to a base, emergency airfields, and weather conditions is available, and *practice runs* are solicited.

Use this service by calling any USAF D/F unit on channel 14 or switch to 243.0 (guard) or 121.5 for the full emergency treatment. Approximately 500 aircraft a year are assisted through this service so your call won't be unique or unusual. We have recently installed a series of red lights and gongs in each Military Flight Service Center which fire up each time an emergency type call comes in, to guarantee expeditious handling. Use this service before you get close to running out of fuel, altitude, time, airspeed and/or ideas! Call it a practice if you like, but declare an emergency if you want the full treatment.

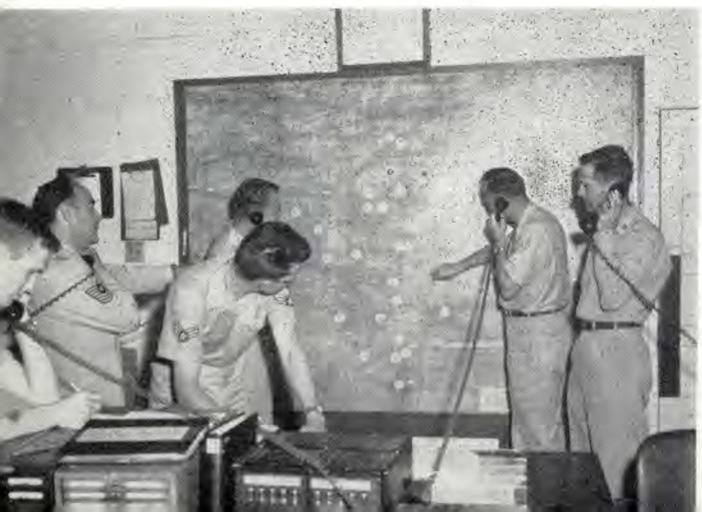
Each year the Atlantic and Gulf of Mexico serve up their quota of big winds—hurricanes with female names. The AACS gets into the act early by preparing the Joint Military Aircraft Hurricane Evacuation Plan (JMAHEP). This plan, for all military services, selects refuge bases for all military aircraft based in the hurricane danger zone—a 100-mile strip along the coast—and provides advance coordination for fuel requirements, parking space, crew and maintenance facilities, should evacuation become necessary. Military Flight Service Centers serve as direct coordination agencies during actual evacuations and keep everyone informed by establishing a numbered hurricane condition for each area along the predicted path of the storm. These centers can designate alternate refuge bases and perform any required coordination activities. Such preplanning permits safe and orderly movement of aircraft when hurricane conditions exist.

The least popular function of a Military Flight Service Center is the handling and processing of flying violations. Centers are responsible for the accurate identification of aircraft and pilot involved with alleged violations filed by military or civil agencies and the routing of these allegations through the appropriate channels for investigation and action. In the case of a USAF pilot, this agency is the commander of the pilot's home station.

For those of you who are Aero Club pilots, we regret that the services that have been described cannot be extended to your full usage, but manning and funding are for military point-to-point flights only and will not stretch to the point that we can accept your requests for briefings or your long distance telephone calls on a collect basis. If you are in a valid bind, however, call us —on a paid basis—and we will do our best.

So there you are: another service performed by AACS for its customers, be they military or civil, Military Flight Service. It belongs to you. Use it. ▲

Below, D/F Emergency Plotting Board tracks a pilot in difficulty. Lending a hand are, left to right, A2C T. W. Farrar, MSgt J. Cornell, A1C R. H. Smith, A2C J. T. Cutright (background), and Captains K. B. Currey and F. A. Hannah. Right, Captains M. L. Saltsman and H. R. Jackson plot the course.



C-NOTES

Lt. Col. Jackson Saunders, Fighter Branch, DFSR, Norton AFB, Calif.

During a recent test flight for rudder actuator and rudder feel-cylinder change, an RF-101A went into a series of uncontrollable yaw oscillations whenever the airspeed went above (approximately) 285 knots. The first indication of trouble occurred on takeoff at about 285 knots, 800 feet over the end of the runway. The aircraft yawed violently to the left and was followed by a series of uncontrollable yaws and tendencies to roll and pitch. Ground observers said that it yawed as much as 80°, enough to present a complete side view of the airplane. At this point the pilot retarded the throttles to idle and raised the nose, and as the airspeed dropped below 270 knots, he regained control.

The pilot initiated a slow climbout away from the base, turned off the yaw dampener, and pulled the autopilot circuit breaker. The aircraft was leveled off at 6000 feet and immediately went into another series of uncontrollable yaws, pitches and half rolls. The pilot advised the tower that he was abandoning the aircraft. Due to G forces, however, he was unable to grasp the ejection handles. He then decided that his best chance to eject would be in a deliberate pitchup so he pulled the nose up sharply, and as the aircraft reached a near vertical position, control was again regained. Once more the aircraft was leveled off and the speed brakes extended. By now the pilot suspected that the airspeed switch had some bearing on the difficulty.

An airspeed of approximately 250 knots was maintained while the pilot made several turns to see if control could be maintained. No control problems were encountered at this speed and the gear and flaps were lowered for a straight-in approach and landing. An uneventful landing was made with 11,000 pounds of fuel remaining. Here's what the postflight investigation revealed:

• With hydraulic and electrical power on the aircraft and an MB-1 pitot static tester installed, it was noted that any time the airspeed reached 287 knots the rudder would immediately go full left. Bleeding off pitot pressure would return the rudder to neutral at 270 knots.

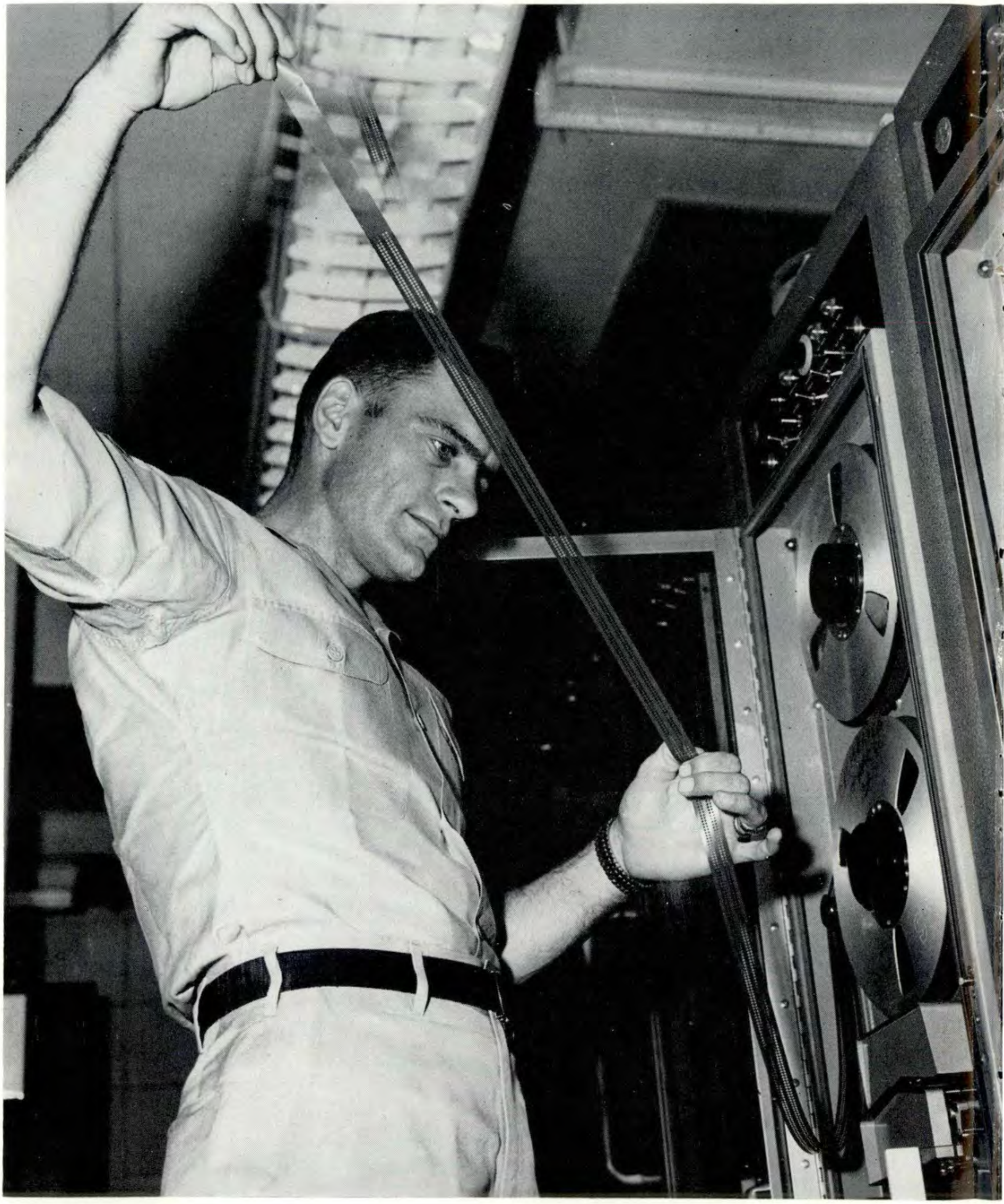
• Further investigation revealed that the rudder feel-cylinder (P/N 20-91390-1) was incorrectly installed—in fact it was upside down. Installed in this position, the cylinder is allowed to extend full travel when the shut-off valve is energized at 290±10 knots. Full extension of the feel cylinder in this manner will actuate the rudder servo to the full left position. With the aircraft in an extreme yaw, pitot pressure will bleed off, allowing the airspeed switch to open, de-energize the shut-off valve, return the feel-cylinder to the low speed condition and the rudder to neutral. This condition, plus attempted recovery control by the pilot, would account for the rapid yaw oscillations.

The rudder feel-cylinder was removed and reinstalled correctly. Subsequent ground operation revealed rudder control and feel-cylinder to be normal. Following a thorough overstress investigation, two recommendations were submitted.

• That a CAUTION note be added to the procedure for Rudder Feel-Cylinder Installation and Adjustment, page 144, Fig. 4-7, T.O. 1F-101(R)A-2-7, emphasizing correct installation.

• That all using activities be advised of the serious consequences resulting from improper installation of the Rudder Feel-Cylinder. ▲

It's hard to beat the machines, at Las Vegas or Itazuke. That's because . . .



They've Got It Taped

A group of pilots based at Itazuke was invited to watch "flight plans produced by an electronic computer"—a demonstration put on by the Statistical Services at the installation. Several mouths dropped open, too, when the computer finished one flight plan, then printed at the bottom, "Do Not Fly." Had a pilot flown this flight plan he might have lost his life because he wouldn't have had enough fuel to complete his mission. Other flight plans followed.

The next day, two F-100 pilots, Capt. Thomas G. Hopkins and 1st Lt. Gene Cassingham, of the 8th Tactical Fighter Wing, flew the first computer flights in their Super Sabres. On a small piece of paper the computer gave them their takeoff roll, refusal speed, magnetic headings, groundspeed, time over each turning point, and fuel remaining all along the line. The flights were completed without incident, much like any other routine mission, except that instead of the pilots taking about an hour to prepare the flight plan, the computer kicked it out in, say, 30 seconds—the result of more than a year's intensive work.

It started in June of '59 as a means of cutting lead time in the event of a national emergency in the Far East, and to provide PACAF pilots with an added degree of built-in flying safety, namely a flight plan checked and double checked for accuracy. Itazuke Air Base was selected as the pilot base for the centralized computer system, the Burroughs 205 "Datatron" electronic computer. Upon completion of the test here, this equipment will be installed at five other bases in the Far East.

In the case of the Itazuke computer, the project started from scratch. The programs to be run had never been designed before, and there were no military "programmers" available who had even seen a Burroughs 205! The manufacturer, however, soon took care of this by sending in its first team, headed by Mr. William J. Roznovak, of La Puente, California. Major Harry F. Pierce, of Spokane, Washington, was assigned as project officer, and on 8 June 1959, a "programmer's" course was started for training military personnel.

Programming was exceedingly difficult and complex. Handpicked NCOs and airmen were assigned to the project. The Itazuke Machine Accounting Officer, Lt. Clarence B. W. Ching, of Honolulu, and Major Pierce, also completed the course, thus becoming the only two officers in the Far East familiar with the Datatron computer.

Major Pierce was assigned a twofold job.

First, he was to develop five operational applications for the Datatron. They included the computer-produced flight plans, automatically updated files of crew and air vehicle data, and several applications which would more clearly indicate our operational capability.

The second requirement was to place the entire base supply account on the computer.

By July, 1959, work was started on both programs. Mr. Joseph C. Berston, the tech representative from Cleveland, Ohio, was especially suited to head up the operations team since he was both a mathematician and an ex-Air Force navigator. Members of his team included Bob Watters, of Denver, a highly experienced Burroughs programmer, and two military men, SSgt Arthur L. Armstrong, Watsonville, California, and A1C William L. Roberts of San Francisco. Both airmen are former radio operators.

With this background in flying, the operations program was a little easier to produce, but was still a brain breaking task which required nearly a year to complete.

In order to adapt the applications to the F-100 aircraft, volumes of information had to be gathered. The flying characteristics of this airplane had to be integrated into the computer program—such things as:

- Takeoff and landing data at various gross weights.
- The effect of external tanks on true airspeed at various altitudes and temperatures.
- The change of airspeed as fuel is consumed.

A method of inputting weather data for the entire area of responsibility had to be devised. Forms had to be designed so that crew data could be introduced, like diversified flying time, operational status, number of takeoffs, landings, GCAs, gunnery scores and so on.

Methods were designed for channeling to the computer such maintenance information as airframe time, engine time, commission status, and parts to be changed at the next inspection period. All of this information and much more was then flow charted, machine coded, fed into the computer, printed out in various reports, and then boiled down so the computer could answer a very basic question, "Can we hack our mission? and if not, why not, and what can we do about it?"

At the outset, it was evident that much technical assistance was needed to develop the program. Lt. Cassingham, of San Jose, Calif., mentioned earlier as one of the F-100 pilots who flew the first computer flights, was made available for this purpose. With the aid of his firsthand experience, the program progressed sufficiently so that by November, last year, certain portions of it were ready for debugging.

Debugging is a long and tedious phase in the evolution of a computer program. It consists of feeding the instructions to the computer one step at a time and analyzing step by step what the computer does with the information. This insures that each of perhaps 1000 instructions is a proper one and in proper sequence. Five was started for training military personnel needed to do the job.

From the beginning, the Itazuke computer installation had all the characteristics of a "crash" program.

Finally, the applications were ready for testing but the computer was not due to be installed until March, 1960. To save as much time as possible, the team and Lt. Cassingham were sent to the manufacturer's plant in California, where they spent 30 days working with the

. . .

Left, SSgt Clinton Jones, a member of the Datatron team at Itazuke Air Base, Japan, feeds a new memory tape into the computer system.

Maj. Gen. Gordon A. Blake, Chief of Staff, PACAF

computer. A demonstration given at the end of this period indicated that the plan was definitely feasible and that the team was on the right track.

The months of revising, reprogramming, and debugging that followed served to strengthen this belief. The computer flights, flown almost a year to the day from the start of the project, produced conclusive evidence.

When range and endurance are involved, it takes a fighter pilot from 45 minutes to an hour to make out a flight plan. This should be done each time he flies the plan because winds and temperatures are constantly changing. This amount of time, multiplied by the number of pilots in a tactical fighter wing, amounts to a considerable expenditure in manpower. The Datatron kicks out a finished flight plan in less than 30 seconds.

The significance of this point is that predetermined routes are stored in the computer. Weather control keeps the routes current by directing weather data into the computer at all times where the two elements are synchronized to produce a corrected profile. This assurance of a valid profile readily obtainable from a wide selection of predetermined routes can be of critical value during an emergency. In effect, it would give a tactical commander the opportunity to send any given number of his aircraft against a target without duplicating the approach angle and arrival time. Decisions could be effected up until time of takeoff. Anti-aircraft defense could thus be minimized while reaction time would be reduced to a single element of movement—start engines and go!

To illustrate the rapidity and accuracy of this system, here is what takes place in detail when performing a computer flight at Itazuke.

First, an input sheet is made up on each conceivable flight that might be flown. This sheet is lined off in blocks in which numbers and letters are inserted. There is a place for the flight plan number. There are also places for the code designation of the takeoff base and the landing base. In other blocks, the geographic coordinates of turning points are inserted, together with a number which designates the type of leg to be flown, that is, a takeoff leg, and so on. Also, there is space to insert code numbers designating points in the area where forecast winds and temperatures are known. The sheet is then delivered to the computer room where the information is punched into an IBM card. The card is then fed into the computer where the information is

1st Lt Gene Cassingham (left), the first pilot to complete a computer flight at Itazuke, views a test problem with Maj Harry Pierce, Air Force project officer for the Datatron system at the base.

stored on magnetic tape as a "no wind" flight plan. It remains in the computer until needed.

Forecast winds for the entire area during the next 12 hours are fed into the computer at periodic intervals. These are also stored on tape and held in readiness. Then, when a flight plan is needed, the console operator pushes a few buttons and in less than half a minute the current flight plan is printed. The winds and temperatures have been integrated with the "no wind" flight plan, and out comes a form almost identical to a regular AF Form 21A "Flight Log," containing all the information the pilot needs to navigate to his destination.

These flights are only the beginning of a rather extensive computer program designed to cut down the time-consuming hours required by pilots in preparing flight plans. One of the most important features of these flight plans is that they are accurate. The computer will only consider valid flight plans, that is, those with the legs in proper sequence, with properly designated takeoff and landing bases, and those for which winds are available on file in the computer. If the input data passes this and other tests of validity, the machine will then compute the flight. If the flight will use more fuel than the airplane can carry with the required 1000 pounds reserve, the computer will indicate this and write "Do Not Fly" at the bottom of the flight plan.

Needless to say, PACAF pilots are really sold on this safety feature. There is little doubt that an electronic computer will increase an activity's operational capability. This is an extremely important feature, but one difficult to weigh in dollars and cents. The supply application will show more tangible savings.

As of last month the computer is used in all requisitions, receipts, issues, and turnins at Itazuke. This means that complete base supply stock record accounts ranging up to 50,000 line items will be carried on the computer. Stock excesses will be identified automatically, releasing large amounts of Air Force money normally tied up in supplies for which there is no immediate forecasted need. This problem of identifying excesses has been a complex one and virtually impossible except on a periodic basis, even though mechanization through punch card machines has been employed.

With the Datatron, this will be changed. Excesses will be detected as they occur, thus enabling redistribution to bases where they are needed. Conversely, the problem of insuring that items are ordered on time to replenish shortages will also be solved through an automatic excess identifying feature. When the reorder point is reached as determined by prefed instructions, a requisition card will be "kicked out" by the computer. The order can be on its way to the depot within minutes after this condition occurs.

The centralized computer is indeed a verastile instrument. Its use will eventually be applied to many facets of military operations, but foremost will be the increased flying safety factor afforded our pilots and the ability of PACAF to provide a more economical and more effective air defense system. Reaction time will be cut, more flexibility can be built into our air units, and pilots can carry out their missions with a higher degree of accuracy and safety than ever before attainable.

In peacetime this difference between present operations and future computer flights could mean the life of a pilot—in a national emergency, the life of our nation. ▲

YOUR WORST ENEMY—YOU

Maj. Norman W. Bernier, Director of Flying Safety, U. S. Air Force Academy

The leader of this "way out" magazine prevailed upon me — that's Emily Posteze for browbeat — to whomp up an article. Before starting, I'd like to clarify two points:

First, although I am a pilot and will be talking about the mistakes that pilots make, this is definitely not a "holier than thou"-type article.

Second, I have been in the fly safe business for many years as a result of the "it takes one to catch one"-type thinking in personnel offices.

My main qualification for the job is the fact that I am an authority on errors, having made more than anyone else and am still around to talk about them.

Many calories ago when I was a small flying safety officer, the glimmer of a theory began to evolve concerning the true but unstated causes of many aircraft accidents and the best ways of preventing them. As a result of investigating between 100 to 150 of them, either as investigating officer or a member of the board, plus innumerable incidents, near misses, war stories and so on, it is my conclusion that USAF pilots' worst enemies are USAF pilots.

Permitting personalities to enter, it is my firm opinion that, while flying, your worst enemy is yourself. In fact, I have attempted with a modicum of success in the past 10 years to base aircraft accident prevention programs on this concept. This is a bitter pill to swallow and a hard product to sell. However, if you will be honest with yourself and with me, I think I can cite enough examples to sell you, or at least start you looking askance at and questioning the validity and integrity of some of your flying decisions.

There is an adage in the advertising business that to sell something you have to believe in it, and I would like to say here that I am a total convert. I am convinced that I am potentially my own worst enemy when flying and the good Lord only knows the number of near misses, narrow escapes, and gray hairs I have to prove it. Seriously, the things that pilots do to themselves are enough to make a grown flying safety officer cry.

Enough of this idle chitchat. Let's get down to some specific examples.

During part of the Korean fracas I was the operations officer in a ZI jet squadron, training pilots for Korea. One particular night the squadron was having a special party—free cocktails for 2 hours, taksan entertainment, plus high hopes. It was to be the best party yet in a unit already noted for its robust parties. The weather on the day of the party was miserable. Locally we had low ceilings, freezing drizzle, and a typical southeast ice storm was developing. Low ceilings and poor visibilities were prevalent along the entire East Coast from Key West to East Port, Maine. Alternates were few, far between and of doubtful duration. Lo and Behold! What came awinging into the midst of this unpalatable mess but one of the squadron den mothers (an IP).

He had taken off from a Midwestern base and by stretching his fuel, luck, and by taking an extremely optimistic view of the weather at his destination and alternate, was able to file. Because of a monumental snarl-up in flight service, however, we did not receive word of his forthcoming arrival until we heard that he was in the area requesting a GCA. Through a benign Providence he got the bird on the ground, covered with enough ice for six cocktail parties and barely enough fuel for taxiing.

We reviewed his flight plan, groundspeeds, fuel consumption, time and fuel to alternate, and so on. The tail winds were considerably less than forecast and prior to arriving at destination the pilot had long since passed the point of no return insofar as going to his alternate was concerned. This pilot had considerable jet experience and I am sure realized that he could never have reached the alternate had our base gone below minimums or zero zero.

When queried as to his reason for embarking on this "hairy do" the pilot—who incidentally had his own clearing authority—stated that he had several classes to instruct in ground school the next day and felt that he should get back if at all possible to take the classes. And he was incensed when someone suggested that there might have been a bit of "party fixation" involved in his decision. Receipt of an RON-WX message from this pilot would have told us that he couldn't get in because of the weather situation and that it would be necessary to find a replacement for him in ground school. This would have posed no problem, and we would have approved his judgment in not attempting the flight.

Exactly one week later this same pilot with the same lecture schedule ahead of him was back in the office with a 30-day leave request clutched firmly in his grubby little fingers. My first question was, "What about your lectures tomorrow and for the next four weeks?" His reply was, "No sweat," and he proceeded to explain how through masterful juggling, swapping, and academic musical chairs, he had it arranged so that other instructors could hold down the fort while he was on leave. The new schedule was accompanied by a 15-minute dissertation on the fact that he was close to nonessential in the squadron and the most likely candidate for a leave.

Although the subject flight did not end in an accident the potential was great, and to me the incident has always been a classic example of rationalization and false sense of mission urgency.

This false sense of mission urgency is an insidious thing. It has been and probably will continue to be the cause of a number of aircraft accidents. How many times have you used it as the outward and expressed justification for making a flight, such as, "I've got to get back to the office." "They need the airplane." "I have to fly again tomorrow." "They told me to get back tonight," etc., etc., etc? Be honest: the true and compelling reason was entirely different and usually strictly personal. For instance, "I can't RON, I only have my flying suit along." "My leave starts tomorrow." "If I write up this discrepancy, I will be stuck here for the weekend." In too many cases the latter examples are the true reasons for attempting questionable or downright unsafe flights, while the first examples are expressed and stated as the reasons for making the flight.

The point I am trying to make, and have you be on guard against, is that we all have the innate ability to give ourselves a masterful snow job. This false sense of mission urgency is a particularly hard snow job to fight because it seems so noble and patriotic. I think there is a subconscious feeling that, even if the flight does go awry, we may be able to slip under the robes of martyrdom for protection. If we can't be honest with ourselves, we are going to continue to talk ourselves into sticking our necks out and taking flights that should not have been made. The odds are that we will get away with it, but the statistics at DIG safety continue to prove that some of us won't make it. If you are a gambler, carry on and good luck! On the other hand, if you are a cool, competent, "crooked-smiled but straight-toothed pilot," be aware of, and on guard against, these self-administered snow jobs.

Another similar cause factor is what I have chosen to call the "save face and lose frame" factor. Pilots belonging to this school of thought attempt to adhere to a very strict code. The main tenets of the code are: Don't go around. Don't abort. Don't change your flight plan. Don't worry about '781 discrepancies.

This factor caused a considerable number of accidents in our Wing in Korea and was the source of great unhappiness to me personally as I was the Wing Flying Safety Officer.

We were on a two-wing base in Korea; our wing was flying F-80s and the wing across the base was flying F-86s. The '86 was a more sophisticated bird than the prosaic '80 and possessed improved aerodynamic devices for slow flying and deceleration in general, such as bigger and better speed brakes and wing slats. The base had a relatively short and very rough runway and as a result you had to plunk the '80s down pretty close to the end of the runway and at just about the right airspeed if you were going to stop with all the tires, wheels and flaps intact. This necessitated some precision pattern flying and a final approach of sufficient length to nail down the proper airspeed and attitude.

During joint bar maneuvers our more sophisticated brethren across the way continually harped on the fact that they could get more airplanes on the ground quicker or stay in Mig Alley a little longer if they didn't have to waste so much time behind us in the traffic pattern. They assured our pilots that if they were really tigers they could rack that '80 in and squeeze their pattern down to where it wouldn't delay the '86s.

They were eminently successful in getting their message across. Our troops reefed the pattern in and gave the boys in the '86 mobile control no cause for complaint. Of course, we did have to close the runway a number of times for F-80s with blown tires, collapsed gears, and overrun problems. I was able to correct the situation by having the Korean War stopped, but for a while there, landing accidents were quite a problem.

Another area where this same "face" factor enters in is the lack-of-proficiency type situation. For instance, the weather is "no bono" at home plate. As a matter of fact, it is just about at minimums. However, there is a good alternate near by and you have plenty of fuel for the proposed flight. It is a good legal flight, 60-16 wise, and you are supposed to have the bird back tonight. You have your own clearing authority. The aircraft is in good condition and there is no apparent reason why you should not make the flight.

You and you alone know that you have just come off a 30-day leave and that prior to that you had not flown weather or night for quite a spell. Do you attempt the flight with a night landing in snow or rain to save face? Or, do you admit to yourself that your proficiency is not high enough at the time to warrant attempting the flight. RON, and try it again next day? If you do, you're insuring preservation of more essential and substantial portions of your makeup than "face."

Sometimes the false sense of mission urgency and saveface factors combine to form a "you've had it" factor, and that's the worst kind. We had a perfect example of this last year right here about 30 miles east of our Dry Prang air patch. A T-Bird took off from Far Off air patch with a VIP passenger scheduled to lecture in the town adjoining Dry Prang. In general, the weather was excellent; however, due to strong headwinds, the pilot could not possibly have completed the flight as planned without gliding the last portion and making a flameout landing.

The pilot maintained fuel consumption figures during the first portion of the flight. Apparently because the fuel consumption figures were so far in excess of his computations he couldn't stand to write them down. He stopped entering fuel consumption figures around the middle of the flight. At this time, three or four Air Force bases were available as refueling stops. The pilot continued to press on with his mission of delivering the VIP to his lecture point. Up to this point I believe the false sense of mission urgency factor was predominant because, in actuality, a stop for fuel at that point would have only delayed the lecturer a short while, but would have insured his eventual safe arrival.

Far later in the flight, with the fuel situation becoming desperate, the pilot did not seem outwardly concerned or alarmed. Here, in my opinion, is where the "save face and lose frame" factor took over. Right at this point, some honest, soul-searching self acceptance of the gravity of the situation and the declaration of an emergency would have resulted in immediate assistance from the ground and pinpointing the location of the aircraft. Instead, the pilot continued on, accepted a lower flight altitude with its attendant increased fuel consumption, and still did not declare an emergency after the aircraft had flamed out from fuel exhaustion. Even after gliding flamed out for a considerable distance, the pilot delayed bailout to the point where the passenger's chute opened just prior to striking the ground. The pilot was killed when he ejected at too low an altitude for his chute to deploy. The VIP was unable to make the lecture due to delays involved in flying in from the crash by helicopter, treatment of minor injuries, and observation at the hospital.

A related facet of this accident prevention potential within ourselves is the self-discipline area. One of the prime targets for self-discipline is our laziness. We as pilots have a propinquity for short cuts. Usually these short cuts are not more efficient but we talk ourselves into believing they are. The basic truth is that the short cut is an easier way to do something and we are lazy. Let me pose some "for instances":

One sad day several years ago, one of our trusty jets ran off the end of the runway after landing and damaged the gear. I happened to be in the area and arrived on the scene as the completely confused pilot evacuated the aircraft. The cause factor, when uncovered, resulted in the Wing Commander punching several fist size holes through the top of his mahogany fighter. The pilot was aware that he should not apply brakes too soon on our 8000-foot rough runway, so he had evolved an easy way to solve this problem. He just looked out of the side of the cockpit and waited until the 3000-foot remaining marker came up to start braking action.

The system worked well for quite a while. It eliminated the need to look out ahead, use judgment and make decisions; it was real easy! The only trouble was that in a sudden and unexpected burst of activity the air installations folks removed a number of the runway distance markers for repainting prior to our hero's return from a cross-country flight. After waiting a considerable period of time for his "cue marker" to come up he got suspicious, looked ahead, and found insufficient runway remaining in which to stop the aircraft.

In the next instance the actual cause of the accident was undetermined. The most probable causes again pointed out an example of a short cut leading to disaster.

This case involved one of our many engined flying machines and a practice aborted takeoff. The abort procedure called for the aircraft commander to chop and reverse the recips, while the pilot handled the jet throttles. The pilot had marked the jet throttle quadrants with a pencil line denoting the desired throttle position.

During the practice aborted takeoff, the aircraft commander chopped and reversed the recips and the pilot reduced the jet engine throttles to the mark on the quadrant. During this period the aircraft commander began losing directional control of the aircraft and it left the runway headed for some parked aircraft. At this point full takeoff power was applied and a takeoff attempted with the aircraft off the runway. The attempt was unsuccessful. The aircraft crashed and burned—with several fatalities and considerable property damage.

The most probable cause of the accident was considered to be a runaway fuel control on one of the jet engines which caused it to go 100% instead of idle when the throttle was retarded, resulting in a king-sized case of assymetrical thrust. Had the actual jet RPM gages been used to set idle RPM instead of a pencil mark on the quadrant, it is possible that the cause for loss of directional control could have been discovered and corrected in time by shutting off the fuel flow to the engine.

Another area where self-discipline can help is in the comfort and convenience area. A good example is the preflight inspection. An aircraft is an inanimate, unfeeling object and doesn't particularly care whether it is 10 below zero or 120° above, or if it's raining or snowing. The preflight is a published checklist with the same number of items to be checked in the same way, day or night, hot or cold, wet or dry, windy or calm. Yet, have you noticed the tendency for the time required for the preflight to shorten in direct proportion to the adversity of the weather? If it's a cold, snowy, windy day when we should actually be checking things more closely, we tend to cut corners, take more things for granted, and perform a quicker and less thorough check on items that we do check.

A healthy dose of self-discipline is the only thing that is going to get any job done properly under adverse conditions. Your leader's black snake will never reach to a cross-country base and the transient alert folks won't force you to preflight properly, although they'll appear at your board meeting and state that you performed a hurried and incomplete preflight.

Another good example in this area of lack of self-discipline is inadequate and/or incomplete flight planning, particularly on flights originating from other than home plate. A small point in this area is general unwillingness to revise ETAs. It just seems to be easier to stretch a minute or two than expend the energy recomputing, revising, and reporting. Probably the laziness factor is compounded by the desire to "save face"—no use blabbing all over the sky that we goofed on our computations if we can help it.

I haven't by any means run out of examples, but we must be running out of space allocation so I am going to call a screeching halt. In conclusion, I would like to re-emphasize several points.

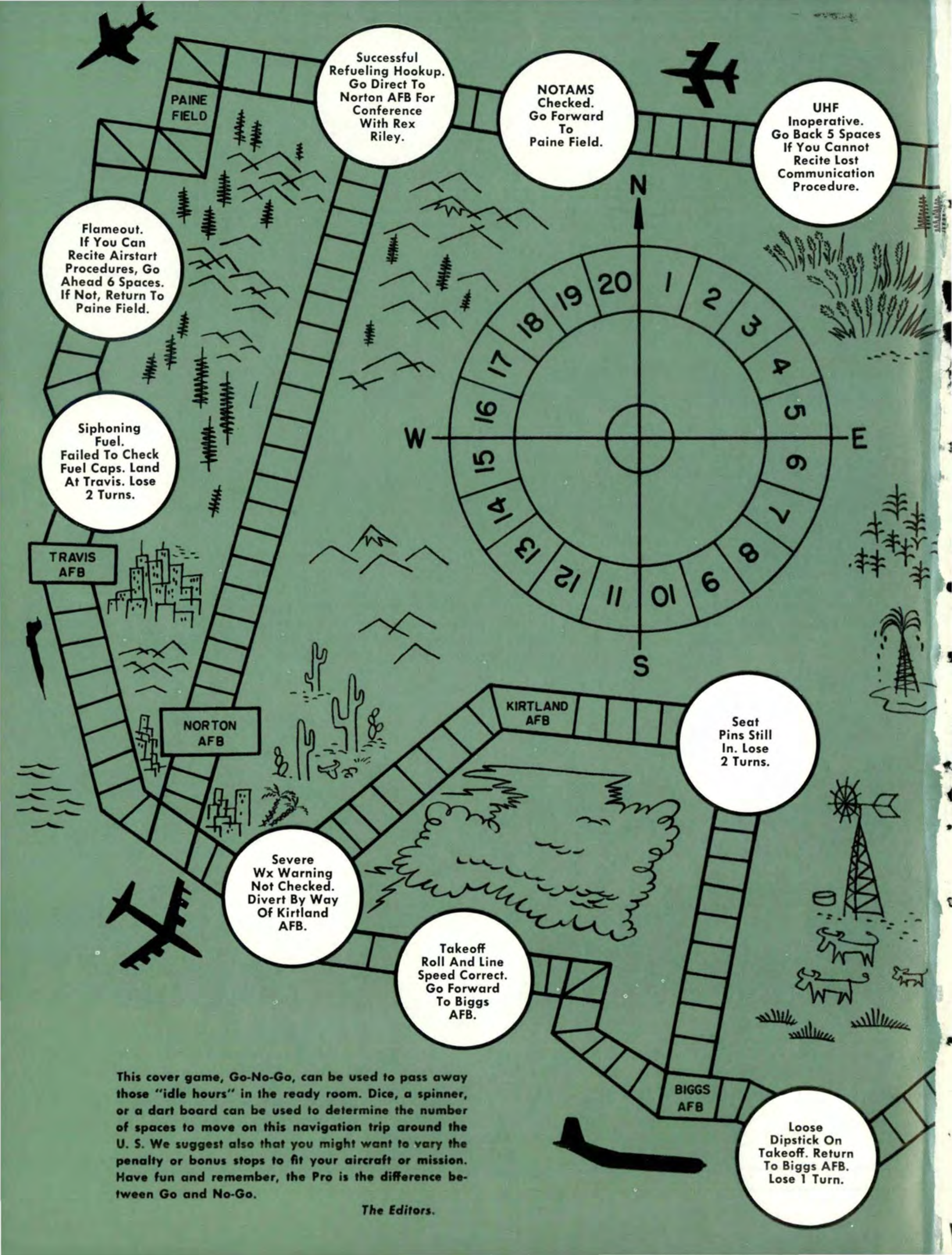
• First, keep an eagle eye on yourself when you are flying and don't snow job yourself into a near miss or accident. Remember pounds per hour, groundspeeds, and en route mileages can be computed to decimal points and a correct decision as to whether or not you can safely make a certain leg or flight is in reality a relatively simple and uncluttered problem. Disregarding adverse weather, aircraft discrepancies and fatigue, minimizing fuel consumption, overestimating groundspeed, and ignoring known delays, are some irrational procedures used by pilots to convince themselves that certain decisions or flights are proper and safe. Don't rationalize yourself into being a knight in shining armor with the defense of the United States resting on your successful accomplishment of a particular flight, when the truth of the matter is that you don't want to miss a scheduled golf game the next morning.

• Second, use self-discipline. Don't use short cuts because you have convinced yourself that they are more efficient when the plain truth is it's just an easier, but not as safe, way of doing something. Don't force yourself to fly when you know in your mind you shouldn't.

• Third, forget "face." Don't attempt flights requiring skill beyond your present state of proficiency and/or training. Admit and correct your mistakes. Don't force yourself to fly them out to their oft-times ignominious conclusions.

The foregoing are factors, germane to your flying, of which *you can* be best judge and analyst. Attempt to weigh and balance them impartially and impersonally when making flying decisions. Each resultant decision is a potential life or death matter. Treat it as such and give yourself a break.

One last thought: Confucious is reported to have said, "He who conquers himself has won the greatest battle." So be it. ▲



This cover game, Go-No-Go, can be used to pass away those "idle hours" in the ready room. Dice, a spinner, or a dart board can be used to determine the number of spaces to move on this navigation trip around the U. S. We suggest also that you might want to vary the penalty or bonus stops to fit your aircraft or mission. Have fun and remember, the Pro is the difference between Go and No-Go.

The Editors.