A E R O S P A C E

SAFETY

UNITED STATES AIR FORCE

1947 1960

13 YEARS OF EDUCATION

SEPTEMBER 1960

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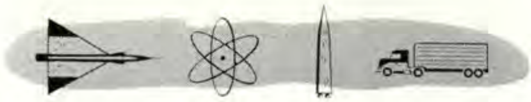
IN THIS ISSUE

THIRTEENTH ANNIVERSARY

Rex Riley, as a junior Major, appeared on the scene as an aircraft accident investigator in September, 1947. Created by the then Captain Richard Grant, Rex soon came to be accepted by many U.S. Air Force pilots as an expert in all flying safety matters. Believing in the simple direct approach, he spotlighted through the panels of the poster most of the accident problem areas of the Air Force in the ensuing years. Accompanied by a succession of good looking secretaries he roamed airbases throughout the world to analyze accident causes and point up suggested solutions.

In 1948, Rex's travels came under the able direction of then SSgt Steven A. Hotch. Since that time the posters have improved greatly in artistic quality and in general acceptance while both Rex and Steve got some well deserved promotions. Today, it's Lt. Col. Rex Riley and SMSgt Steve Hotch, and they ask that their readers continue their welcome letters and suggestions for even further improvement in passing the safety word through the person of Lt. Col. Riley. In the next poster, now on Steve Hotch's drawing board, Rex gets into the missile business with an overall discussion and comparison of flying and missile safety problems. Aerospace Safety Magazine salutes Rex and his creator. fdh

SAFETY — FROM THE GROUND UP



Air Force Safety efforts are being carried on in four main areas: flight, missile, nuclear, and ground. In the past, the Directorate of Flight and Missile Safety Research at Norton AFB has been responsible for directing the safety efforts in the first two fields. The Office of the Assistant for Ground Safety has been performing its functions separately under the overall direction of DCS/Personnel in Hq USAF. The Nuclear Weapon System Safety Group was functioning at Kirtland AFB, New Mexico. It became evident to the Air Staff that the aerospace age had brought about an overlapping of functions in the four basic safety areas with the resultant problems of duplication, coordination, jurisdiction, reporting, manning, and administration. It also became apparent in 1958, as missiles with warheads began reaching the operational inventory in larger numbers, that stringent controls already in effect would have to be made even tighter in these two areas if an accidental disaster of the first magnitude was to be avoided.

There was widespread official concern over the possible domestic or international effects of such an incident and General LeMay directed that an ad hoc committee study the overall safety problem and make recommendations. As a result of the findings, General LeMay, on 2 April 1959, ordered the establishment of a new office under The Inspector General, designated as the Deputy Inspector General for Safety. After one year of operation under this new organization it was decided to gather in yet another safety functional area, that of explosives safety. Therefore, it was directed that this function be transferred from Hq AMC to The Deputy Inspector General for Safety.

Early this year it was decided that there should be closer physical integration of the various safety functions. Therefore, the Office of DIG/Safety and Ground Safety personnel were assigned to Norton AFB to join the Flight and Missile Directorate already in place. For obvious reasons personnel of the Directorate of Nuclear Safety remained at Kirtland, but some service functions for this Directorate will fall to Norton personnel. Closer liaison is of course now possible between the nuclear function at Kirtland and the DIG Safety at Norton, and a liaison force in the Office of The Inspector General also gives the directors at Norton and Kirtland a faster channel to the Air Staff.

The transfer of the DIG for Safety Office, the Asst. for Ground Safety and certain Nuclear Safety service functions to Norton AFB has made possible an absorption of the Air Force's recent austerity cut. Efforts have been consolidated in the fields of safety education, training, statistics, reporting, medical services, programming and administration. As for reporting, it is intended that all duplicate reports or those which lose their purpose or function under the reorganization will be eliminated. Assistance and suggestions from the field for improvement or refinement of existing regulations and reports will be welcome.

In August of this year the physical move of personnel and files to Norton was accomplished. The integrated safety program under this reorganization is designed to give us better ways and means of continuing to reduce the various accident and fatality rates in the Air Force. For clarity, perhaps a short recapitulation of the new organization of DIG for Safety should be made. The Inspector General's office, of course, remains in Washington D.C. His Deputy Inspector General for Safety now has his headquarters at Norton AFB and with him at this station are the Directors of Flight & Missile Safety Research, and the Assistant for Ground Safety. The Nuclear Safety Research Directorate remains at Kirtland with close liaison existing between there and Norton. Therefore, the word now, here at Norton, is Safety From The Ground Up. **fdh**

THE THREE M'S THE BIG FIVE AND YOU

Dave Holladay, Lecturer, Aviation Safety Division, University of Southern California

The science of aerospace accident prevention introduces a challenge. Meeting this challenge requires immediate attention to the quality and quantity of knowledge necessary to achieve the primary objective of mission accomplishment. Therefore, we must have Flight, Missile, Nuclear and Ground Safety Education. Nothing less than total effectiveness will be acceptable in this educational effort.

Education for Aerospace Safety Officers. At The University of Southern California, where Safety Officers of the Air Force receive their training, the concepts of education for accident prevention are being shaped to fit the patterns required by aerospace. Intensive study in Psychology and Physiology provides the Flying Safety Officer with knowledge of human capability and limitations.

Aeronautical Engineering provides knowledge of the aircraft, and flight operational experience fills the requirement of knowledge in flight and ground environment. In addition to these, the study of Educational Techniques and Methods provides the knowledge necessary to the FSO which plays such a vital part in his areas of responsibility. It is through him that correctly applied educational techniques achieve the transfer of accident prevention knowledge to members of the Air Force team. Educating a well-rounded qualified professional Safety Officer is no small task. To do this we must have a definition of requirements.

First, let's look at the "3 Ms." They are MAN, MACHINE, and MEDIA. These relationships are used to demonstrate the accident prevention complex and the educational requirements which it generates. Cause factors in accidents can be traced directly to them.

"M" the Man. The Safety Officer must be educated in human factors. Knowledge of his limitations and those of others is important to his understanding of many critically important relationships between man and machine and the media in which they operate. He must know and understand the physiological factors which affect your physical well-being and capability to respond to the psychological stimuli and react correctly.

The area of Man is all important. The long history of accidents is related to human factors where man, for reasons within and beyond his control, has failed to function correctly in his relationship with machine and media. These failures which caused, or contributed to the causes of, accidents have involved a variety of physiological and psychological conditions. Much is understood and much remains to be learned. The educational contribution of the Safety Officer to accident prevention in this area is largely through the Flight Surgeon. Together they can accomplish much to increase your understanding of those human factors which directly affect you. The educational contribution here is most important since man stands behind all the phases of the aerospace endeavor, from the drawing board to operational readiness.

"M" the Machine. In order to be of educational value to his organization the Safety Officer must know and understand mission equipment, its development and operation. To get maximum performance from the machine, all parameters of performance affecting mission accomplishment must be understood.

In aerospace development we have come a long, long way in a very short period of time. From the first military acceptance tests of aircraft in 1908 to the edge of "Man-In-Space" in 1960 is no small accomplishment. None of this would have been possible without education and the development of knowledge necessary to support technical advancement.

But with technical advancement and this era of specialization have come increased demands for diverse and specialized knowledge on the part of the operators. Your Safety Officer must have some understanding of all specialties and know how to impart accident prevention knowledge concerning them through the use of educational materials.

Designing, manufacturing, managing and operating the complex and extremely costly weapons of today's Air Force leaves no room for mistakes caused by lack of knowledge. A knowledge of engineering principles, with orientation in structures, metalurgy and related aerospace engineering subjects will provide the Safety Officer with knowledge necessary to accident prevention.

"M" the Media. Knowledge of the ground, air and space environments is an educational requirement for all personnel. You and your Safety Officer must possess a knowledge of your environmental relationship to both Man and Machine. Regardless of the mission type, you will be affected to some degree by the media in which you function. Whether you operate from a launching pad or a runway, from a blockhouse or a cockpit, there is always the environmental situation. Environmental phenomena may involve ground support facilities or meteorology. It may involve climate, terrain or geography. Knowledge of the media and your environmental conditions affects you, your ability to get the job done, and the capability of your organization to complete its mission. Knowledge of the environment is largely one of experience through vast association such as that possessed by the pilot in knowledge of inflight weather, or that possessed by the mechanic in knowledge of toxic hazards in his work. The radarman must possess knowledge of the stresses of his environment, and understand how fatigue as a human factor is affected by these stresses.

The knowledge of the Safety Officer acquired through his past experience is an important factor which should be considered by the Commander in selecting the best officer material for the job. The Safety Officer must be carefully selected to insure that his qualifications meet not only the minimum requirements spelled out by regulations, but also the advanced requirements which will enable him to be more effective in his job.

In any discussion of the Man-Machine-Media complex and its relationship to accidents, many inter-relationships between the three become apparent immediately. All accidents will to some extent involve each of the three. The conclusion is inescapable.

The educational program for the Safety Officer must be so designed that immediate recognition of accident cause factors becomes ingrained in his mental attitude. He must be able to:

- Anticipate these factors.
- Learn more of them as required.
- Analyze their full implication in the mission.
- Recommend the proper corrective action.
- Maintain surveillance to prevent recurrences.

He must be able to do these things in each of the "3 Ms," to explain and educate why they are factors, always justifying his corrective action in the light of mission effectiveness. It is his responsibility to advise and recommend in the management of the accident prevention program *for* his Commander. It is no coincidence that the first letters of the key words in the paragraph above create the word A-L-A-R-M, for it is the job of the Safety Officer to *Alarm* when accidents are about to cause a permanent subtraction from mission effectiveness and accomplishment. It is his task to *Alarm* before the accident. It is too late to *Alarm* when the crash occurs. Accident prevention education is a product of the proper application of A-L-A-R-M.

The Commander is the most important individual in the accident prevention program and is therefore paramount to the success of any educational activites engaged in by the Safety Officer. Statements of USAF policy describe accident prevention as "an inherent function of command," as the Commander's area of "personal responsibility." These are functions which he cannot delegate. He should assign responsibility for the management of the accident prevention program and its educational requirements to the Safety Officer. Then the Commander applies the aerospace accident prevention program, using the professionally trained Safety Officer as his special staff advisor, in the implementation of educational activities for accident prevention. One of the prime responsibilities of the Safety Officer is the application of his knowledge in the Man-Machine-Media complex, and the vehicle for the transfer of this knowledge is educational principles and techniques.

The "Big 5." There are five main areas of educational effort where aggressive activity by the Safety Officer will produce results. In the educational phase of the accident prevention program they are the *Big Five*.

First, through the training program and its various parts, and in cooperation with the training officer, the Safety Officer can provide information about accident cause factors and accident producing situations. These accident producing situations used as illustrations in the various sections of the organization demonstrate how the performance of the individual directly affects the accident prevention program. For instance, an accident producing situation involving the aircrew should be used in flight or aircrew training sessions, while an accident producing situation involving aircraft maintenance or installations should be used in these sections to clearly illustrate their very important relationship to the prevention of accidents. In all of these illustrations the emphasis should be placed *not* on the accident itself, but on the methods of effective accident prevention and at the same time increase the unit's operational readiness.

One of the most important educational activities of the Safety Officer is the safety publications program. From Headquarters USAF, through major commands and their local units, a variety of publications are provided.

The Assistant for Safety Education and Training, Deputy Inspector General for Safety, prepares and distributes many publications designed to support aerospace accident prevention and education in specialized accident prevention subjects.

At the major command level, there are also many outstanding publications for safety education aimed at the particular aircraft or weapon systems in use.

At the local level, a variety of eye-catching and interesting safety newsletters and bulletins are published by progressive and imaginative safety officers in support of aggressive accident prevention efforts. But one thing we must always remember: these publications, as vital as they are to our accident prevention education efforts, are only as good as the use made of them.

Publications cost money and to get the maximum educational return from our dollars, the safety officer must insure that they reach the hands of the reader when they are needed and where they are needed. Usually displayed in reading rooms, briefing rooms, on bulletin boards and in alert rooms, these safety education publications do a needed educational job for you. Have you seen the latest issue of your Command's safety magazine?

Third in our safety education program of five items is advertising. The Madison Avenue approach is nothing new in the safety education business. Just as the motivation researchers on Madison Avenue ply their trades of determining why blondes buy more perfume on even Fridays of odd months at pink tinted showcases, the safety education researchers are busy determining what type of poster message in what color stirs the pilot, the mechanic or the personal equipment specialist.

The advertising program of the safety officer is sup-

Students from USC's Safety Officer's Course examine wreckage of an F-86D at Norton AFB, San Bernardino, California. From examination and analysis, student officers try to determine the cause of crash.

ported by DIG for Safety. A variety of posters covering subjects of direct importance to accident prevention are distributed. Never underestimate the power of the appeal for accident prevention which can be generated through the educational medium of advertising.

The potential for public relations activities in aerospace accident prevention exists for all Safety Officers. Much remains to be done in this very sensitive area. There is always the demand for a good community relations program which will, if properly organized and supported, produce many benefits for all personnel of a base or unit. A bad press, radio or television presentation can damage not only the USAF in general but also the esprit de corps, the morale, the general community acceptance and make the accomplishment of the mission much more difficult.

Installations supporting military aerospace activities have become untenable because of misunderstandings generated by poor public relations or the complete lack thereof. The time for your accident prevention public relations program to start is long before the accident. Educate the community by explaining and if necessary demonstrating the functions of your aircraft accident prevention program.

There is no secret about the accident prevention efforts of the Air Force. What you do in your daily tasks as Commander, Safety Officer, Operations Officer, Civil Engineer or Aircraft Maintenance Officer to preven' accidents is not only interesting, it is important to John Q. Public. After all, he pays the bill. Remember, what is old hat and day-in-day-out operational procedure to you, is interesting and quite enlightening to those who wonder about all those vapor trails in the sky, or those sonic booms that shake up the local populace. They deserve to know, and if you fail to educate in accident prevention procedures, the next sonic boom may be that of public opinion.

Before-the-accident education, through public relations, can provide a cushion, a bank account of goodwill to help absorb the public relations shock of the next accident which we hope will never occur. Yes, education in accident prevention through public relations is best of all, and the majority of it is *free!* What have you done about that tape recorded interview with the pilot who got the bird down safely after an emergency? Have you asked the Information Services Officer about using it on a local radio show?

Last, and Number Five on the list, is Safety Meetings. Let's face it! There's nothing simple or easy about putting together a good, dynamic, informative safety meeting. I'm sure there are many of us who consider these meetings as an evil, necessary or otherwise. Who likes a captive audience? Who likes an hour of dull, dry, unprepared, perhaps poorly read "briefing?" Who likes to attend safety meetings during off-duty time? These are the things that will normally doom any safety meeting to dismal failure.

Face facts! They don't have to be this way. To begin with, safety is not only important, it can be made very interesting. What you learn in an informative safety meeting can make your job easier, your environment safer, and your career more productive. The captive audience factor can be reduced if not entirely eliminated. Safety meetings can be scheduled during duty hours, and good planning dictates this policy since to do otherwise separates safety from its place of importance as an integral part of the mission.

Accident prevention is an inherent function of command, a part of operational readiness and a direct contributor to mission effectiveness. Monthly safety meetings of all personnel are a valid means of education in accident prevention. Interesting meetings, properly planned with imagination and variety will produce results in accident prevention.

So, have at it! Through a well organized educational program in accident prevention, the Aerospace Safety Officer can touch all personnel of the organization. Reaching *all* the personnel is no small chore for he must face competition, and even more important, he must make use of it. There is competition of various forms of entertainment, radio, television, sports, newspapers, advertising and even hobbies. The professional Aerospace Safety Officer uses any or all of these to direct attention to knowledge necessary to generate greater effectiveness and reduce accidents.

YOU—before the fact! When the Aerospace Safety Officer conducts an accident prevention survey, convenes a Safety Council, solicits an Operational Hazard Report, calls a Monthly Safety Meeting, or evaluates the results of a Product Improvement Program, he is investigating and collecting information for the Before-The-Fact portion of the accident prevention program, information which he can put to use in the form of education. It may be in the newspaper, in a safety newsletter, or in a special report designed to promote rapid corrective action. In any case he is working for the Commander, for your organization, for you and for your safety. Most important of all—and never forget—he is working because of you, because you are the most important part of his program. He relies upon you for the "Safety Consciousness" which produced the Operational Hazard Report or the telephone call about the accident potential you discovered. He *must* have your participation and your cooperation.

YOU—after the facts! When the Aerospace Safety Officer conducts the investigation of an accident, calls a meeting of the accident investigation board, completes an accident or incident report, or prepares letters of transmittal and indorsements, he is collecting information for the After-The-Fact portion of his accident prevention program. This part of his job responsibility is what he, his Commander, and you hope to avoid, for this is the worst thing that can happen—to have an accident. An accident, a mark of ineffectiveness, reflects upon everyone: the Commander, the Safety Officer and upon you. The professional Safety Officer knows that a thorough meticulous investigation of accidents will yield valid information, which can be used for education. He's still working for your Commander, for your organization and for your safety, working to find out what caused it and why, so that there will be no recurrence. Yes, he's working because of you, because his educational program for accident prevention may not have reached you, or because, perhaps, you failed to grasp the full significance of the information and its meaning in the performance of your job.

Whether Before- or After-The-Fact, the Aerospace Safety Officer is applying educational techniques which can be learned through professional education at the University of Southern California, applying them for the Commander to aid and to assist in the generation of effectiveness, to recommend corrective action, to prevent accidents, and to accelerate mission accomplishment! ▲

a MEN

★ **Capt. William C. Berry**
Richards-Gebaur AFB, Mo. ADC

★ **Capt. Ronald A. Horn**
Moody AFB, Ga. ATC

★ **Capt. Charles K. Rose III**
Altus AFB, Okla. SAC

★ **S/L C. W. White**
DFS/AFHQ Ontario, Canada

★ **Capt. Robert H. Dixon**
Travis AFB, Calif. MATS

★ **Capt. James K. Fox**
Williams AFB, Ariz. TAC

★ **Capt. Donald Thomas**
Castle AFB, Calif. ADC

★ **Maj. John W. Brunson**
Luke AFB, Ariz. TAC

★ **Capt. William W. M. Deale**
Ellington AFB, Tex. CAP

★ **Maj. Vernon W. Garrison**
Barksdale AFB, La. SAC

★ **Capt. Theodore R. Naumann**
Springfield, Ill. ANG

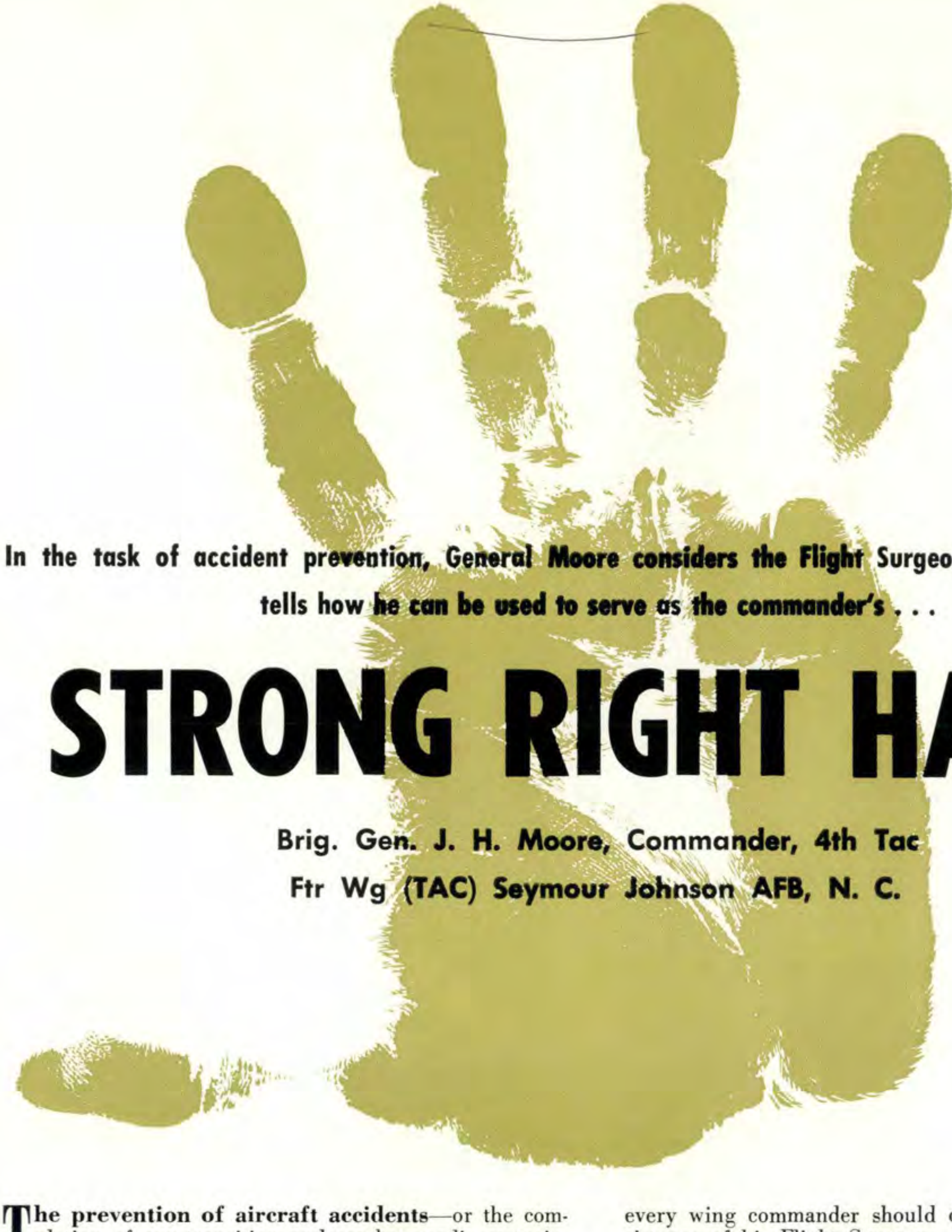
★ **Capt. Donald E. Post**
Sheppard AFB, Tex. ATC

★ **Lt. Col. William L. Reynolds**
Blytheville AFB, Ark. SAC

★ **Capt. William H. Beardsley**
Minot AFB, No. Dak. ADC

★ **Capt. Arthur C. Harmon**
Hill AFB, Utah. ADC

Aerospace Safety Magazine again salutes the officers who graduated from the aircraft accident prevention course at USC (Classes 36 thru 39) with a straight A average. Such attention to duty is sure to carry over into their FSO jobs at their respective home bases and result in topnotch aircraft accident prevention programs. Congratulations! ▲



In the task of accident prevention, General Moore considers the Flight Surgeon indispensable and tells how he can be used to serve as the commander's . . .

STRONG RIGHT HAND

Brig. Gen. J. H. Moore, Commander, 4th Tac Ftr Wg (TAC) Seymour Johnson AFB, N. C.

The prevention of aircraft accidents—or the completion of our transition and combat readiness training with safety and *without* aircraft accidents—is of primary concern to me as Commander of the 4th Tactical Fighter Wing. In addition to all the actions on the subject which I outlined in my article "Four Points for the 4th," I consider that a wing commander should depend upon his Flight Surgeon to play an important and indispensable role in accident prevention.

In our constant drive to reduce aircraft accidents the Air Force as a whole has been quite successful. It is gratifying to note that the accident rate continues to decrease. We have practically eliminated the "unknown" as a cause factor, and mechanical and materiel failure have been steadily decreasing. The most significant primary causative factor in today's aircraft accidents is human failure—pilot error. It is within this area that every wing commander should depend most on the assistance of his Flight Surgeon.

Ideally, the Flight Surgeon should spend all his time with the rated personnel in a tactical squadron. Unfortunately, the shortage of medical officers in our hospitals prevents this ideal method of conducting the Flight Surgeon's primary duties. The immense load placed on our understaffed hospitals has required most directors of medical services to use their Flight Surgeons in the hospitals as regular physicians, doing Flight Surgeon's duties "in addition to," so to speak.

How can the Flight Surgeon assist the wing commander in accident prevention to the greatest extent possible? To insure expert views on this question, I have enlisted the assistance of Lieutenant Colonel Edward J. Shea, Commander of the 4th Tactical Hospital, and Captain Joseph A. Lucarella, our Chief Flight Surgeon, in preparation of the following remarks.

The medical aspects of flying safety are many and varied. In addition to good medical care, close observation, and the proper execution of the periodic physical examination, the most critical problems are those related to the protection of the flyer against the stresses of flight. These stresses are not only physiological, but also psychological. The latter have become more important than ever before because of the tremendous scientific and engineering advancements made in aviation in recent years.

A thorough discussion of the many hazards and stresses of flight is beyond the scope of this paper. However, it seems appropriate to discuss the human factor as the most common primary cause of aircraft accidents. Perhaps, in this way, the wing commander's requirements for Flight Surgeon assistance can best be brought to light.

A preliminary analysis of the human factors responsible for aircraft accidents shows that they can be divided into three general classes: physical, physiological, and psychological factors. The primary mission of the Flight Surgeon is to minimize these factors in carrying out the aircrew effectiveness program. Likewise—and this is most important—it is the duty of the wing commander to make certain that the Flight Surgeon has every opportunity to perform this mission. This marks the first and most imperative requirement, namely, energetic Flight Surgeon participation in *all* wing activities. As will be pointed out later in this discussion, this is unfortunately not always possible because of the acute shortage of physicians throughout the Air Force.

Getting back to the previously mentioned general classes of human factors, the first of these is physical defects. By this is meant actual physical illnesses, past and present, that could cause a bodily impairment to the extent that normal human function at altitude is seriously affected. Discovering these physical impairments is the main purpose of the mandatory annual physical examination.

More important, however, is the necessity for rated personnel to report promptly to the Flight Surgeon any symptoms suggestive of illness. For instance, an ordinary common cold, which may be of little significance to the average person, can cause serious organic damage to the ear, sinuses, and equilibrium mechanism in the flyer. Individuals who persistently fail to report symptoms are dangerous. As wing commander, I expect my Flight Surgeon to keep me informed of such individuals. In order to do this, as will be pointed out later, he must be well acquainted with the men in the squadron to which he is assigned.

In short, certain physical defects are responsible for some aircraft accidents. A flyer possessing such a defect has no business in control of an aircraft. Thus, this is the first general area where Flight Surgeon assistance is required in the prevention of aircraft accidents.

A second class of human factors with which great concern must exist in the prevention of aircraft accidents is the physiological. Physiological factors are those concerning the normal responses of the body to the flying situation. The Flight Surgeon's constributions to this area are many.

Hypoxia, or oxygen lack, is well known to all flying personnel as a potential cause of disaster. Most cases of hypoxia are the result of malfunctioning or improperly used equipment. Flying personnel receive, from the beginning of their training, voluminous information regarding the oxygen equipment which they will be using. They are told to examine this equipment routinely to detect any malfunctioning or deteriorating parts.

Nevertheless, it is still the responsibility of the Physiological Training Officer and the Flight Surgeon, working together, to insure that this equipment is safe. Flying personnel need refresher training regarding oxygen, oxygen equipment, and hypoxia from time to time. The Flight Surgeon can provide this information so that a better understanding of the body needs will exist. In return, pilots will have a more complete appreciation for the necessity of properly functioning and properly utilized equipment.

Noxious gases are, at times, a cause of another kind of hypoxia and the Flight Surgeon can be helpful in making flying personnel continually aware of this particular danger. In most cases, a closed breathing system of 100% oxygen is readily available to the endangered individual and will solve the immediate problem, but only if the individual's index of suspicion is aroused so that the danger is realized.

Spatial disorientation in flight—more commonly referred to as vertigo—has been the cause of numerous aircraft accidents throughout the years. The fact that it can happen to all of us, regardless of experience or age, makes it a matter of much concern, especially to those individuals in direct control of an aircraft during flight. Almost all flying personnel have experienced vertigo as a normal response to the varying attitudes of flight. The Flight Surgeon contributes to pilot understanding of this important matter primarily by providing information concerning the medical basis for vertigo and emphasizing the solution to the problem in flight.

Hyperventilation not uncommonly causes aircraft accidents. In many cases this is related to impending or actual hypoxia where the person begins to breathe faster. Persistence in this increased rate of breathing will eventually lead to incapacitation. The problem exists on occasion where a person becomes excited or frightened and unconsciously breathes too rapidly. The Flight Surgeon can be helpful in this matter by explaining the reasons for this phenomenon and stressing the fact that these harmful effects can and do occur. Every pilot should be constantly reminded of this possible danger and should be taught how to combat it.

Body gases and their effects at altitude are another area of concern which can be of sufficient severity to result in aircraft accidents. Bends, a familiar problem to deep sea divers, is now also familiar to flying personnel. Bends occur more frequently in older, obese men and in individuals who are physically more active during flight. The altitude chambers tend to detect these individuals who are seemingly more prone to have bends, but the problem still exists in some individuals actively engaged in flying. The Flight Surgeon can contribute to the understanding of bends and point out ways to decrease their incidence, or suggest ways to improve the situation if it occurs.

The Flight Surgeon's contribution to the recognition of the normal responses of the body to the flying situation is therefore primarily one of suggesting means whereby these situations can be dealt with properly and intelligently through understanding. This, in turn, aids in the prevention of aircraft accidents.

...the primary purpose of the Flight Surgeon is to know his pilots—and know them intimately.

Another significant contribution that I feel the Flight Surgeon can make in the way of aircraft accident prevention is in the realm of psychological support of the pilot. The key which will allow the Flight Surgeon to be most effective in this area is his ability to attain the complete confidence of the flying personnel. This confidence must be actively sought and deserved by the Flight Surgeon. This is especially true today in peacetime, when the rapid turnover of Flight Surgeons obviates any long-term relationship between them and the pilots. Once this confidence exists, the Flight Surgeon can give freely of his skills as a physician, and may render the very much needed emotional support which every pilot requires at one time or another during his career.

I feel that there should exist between my Flight Surgeon and the pilots of my organization an intimate first-name relationship. The Flight Surgeon, to be effective in my organization, must have a good working knowledge of each pilot's family and personal background, his personality traits, his interests, his weaknesses, and his strengths. I would like to emphasize that the type of relationship of which I am speaking cannot be attained by the Flight Surgeon who remains in the base hospital, isolated from the rated personnel.

It should be obvious that the Flight Surgeon cannot attain this relationship unless there is a reasonable limit to the number of personnel for whom he is responsible. In my experience, one Flight Surgeon cannot care for more than 60 flying personnel and still retain this close relationship. I believe, certainly, that the Flight Surgeon cannot completely divorce himself from the general clinical practice of medicine and still retain the professional contacts and medical perspective necessary for him to be effective in his primary specialty of aviation medicine. The informal consultations between the Flight Surgeon and his colleagues at the base hospital certainly can do nothing but benefit members of my command where their medical problems are concerned.

However, I am concerned with the current trend on the part of the medical service to utilize the Flight Surgeon in the base hospital in routine care of dependents and nonflying personnel to such an extent that it is not possible for him to come to know his pilots, their problems, or indeed, the problems concerned with aircraft accident prevention. This, to say the least, is a deplorable trend, and in terms of flying safety, a dangerous trend.

Along these same lines, I believe that one of the greatest services the Flight Surgeon can render is the early recognition and treatment of minor emotional problems which sometimes occur in pilots during their flying careers. Certainly the relatively young TAC pilots will tend to have few and infrequent serious medical problems. It is not unreasonable, however, to point out that occasionally the younger flying officer and, at times, even the older experienced pilot, will experience psychological stresses—in part as a result of the extreme physiological stresses mentioned above—in his personal and military life which may precipitate emotional problems. These may have a bearing on his efficiency.

The young pilot who does not have the maturity and wealth of flying experience of his older colleague is especially benefited by the emotional support which the observant and skilled Flight Surgeon is able to render to him. More serious emotional difficulties may be precluded and perhaps an aircraft accident prevented by prompt attention to the mental status of the flying personnel. The Flight Surgeon is most helpful to me when he is able to know his men so intimately that any incipient emotional, personal or aeromedical problem can be recognized early. In that way, with the Flight Surgeon's advice, I can take effective corrective action.

Again, in the realm of psychological factors in the prevention of aircraft accidents, one must include the factor of proper pilot motivation. The Flight Surgeon is vital to me in emphasizing to my men the need for strictly observing flying safety procedures. The pilot who has been well briefed on problems such as oxygen discipline and thoroughly understands the dire consequences of a break in procedure is one who is unlikely to get into difficulty.

The Flight Surgeon should constantly strive to positively motivate all personnel toward flying safety by his own example, as well as by frequent informal talks and educational lectures in flying safety meetings. He cannot do this by running a sick call at the hospital where he is isolated from the pilots and their problems. Informal contacts through squadron meetings and social get-togethers are entirely necessary, and it is my policy to encourage these contacts. A Flight Surgeon should have no sense of guilt because he is frequently absent from the hospital if he is spending time with members of his squadron.

Along the psychological approach to flying safety through aircraft accident prevention, a word should be said about the responsibility of the Flight Surgeon for briefing the wing commander concerning group reaction and attitudes toward his policies or toward special events affecting flying personnel such as prolonged TDY's or unusual or stressful missions. An alert Flight Surgeon is often one of the first to know of a morale problem in the ranks. He can be extremely helpful in suggesting remedies, particularly if aeromedical problems are the basis for pilot dissatisfaction. Dissatisfaction or lack of confidence on the part of the pilot in either his equipment or his mission are obviously not conducive to the best effort and may well become the "unknown factor" in an aircraft accident. Prompt and efficient liaison between the Flight Surgeon and the Commander is essential.

In summary, we have attempted to point out in general terms the principal human factors that contribute to the causes of aircraft accidents. In doing so, the more important requirements for Flight Surgeon assistance have been emphasized. In the areas of physical, physiological, and psychological support, the Flight Surgeon can and must exert tremendous influence in the prevention of aircraft accidents.

If it is possible to condense all of the foregoing words into a conclusion, then let it be said that the primary responsibility of the Flight Surgeon is to know his pilots —and know them intimately. With this knowledge he can play a vital role in the accident prevention program. He will not only recognize factors that contribute to accidents caused by pilot error, but he will be able to initiate action to correct the trouble before accidents occur. ▲

C-NOTES

Lt. Col. Waring W. Wilson, Fighter Branch, DFSR

Fuel Tanks— It's amazing how some habits can lead a person to perform nonhabit-forming actions, like turning on external fuel tanks in F-100s. If you fly all the time with 450s aboard and full, you will soon get in the habit of turning on fuel at the 5000-foot check or at some other convenient time. Of course, if you are carrying 275s all the time, it's "maks nix."

Recently, two F-100 pilots apparently made the fatal mistake of failing to check the internal fuel prior to a takeoff which was preceded by several hours on the ground with full internal and empty 450s. The flight manual tells us about this problem and it is hard to conceive of anyone starting an aircraft without checking his fuel quantity. In these cases the fuel had leaked from the internal fuel system to the empty 450-gallon tanks in amounts large enough to drastically affect the CG of the aircraft when the nose was raised for takeoff. In both instances the nose kept coming up until the aircraft stalled and crashed. We're not writing this for the pilots who always check everything prior to takeoff, but if you are one of those who sometimes, either deliberately or inadvertently, misses part of the pre-takeoff checks, or if you are one of those few individuals who doesn't know everything in the flight manual, suggest you stop and think before you take off with 450s on board, be they full, empty or in between. It will pump out at 25 gallons per minute per tank if you turn on the tank selector and the internals are not full.

• • • •

Tires— Pilot skill must sometimes compensate for a materiel deficiency. Tires on Century Series fighters are designed for a given gross weight and are adequate for original specifications. But mission requirements change and fighters must assume the burden with new configurations almost always involving much added weight. This results in uses that approach and sometimes surpass even originally generous built-in safety factors. Until the new tires can be designed to carry the loads with safety, about all the pilot can do is be prepared for the emergency that may occur if he has a tire that's ready to go. Here are some things to think about: Is the aircraft taking off at high gross weight? Did you have to taxi a long distance? Is it a hot day? And did you forget to carefully and slowly turn all corners? If most of these conditions exist, your chances of a failure on takeoff are relatively high. So, be prepared and have a decision already made concerning what you are going to do, considering speed and runway remaining. If you decide to abort, chances are a barrier engagement will be coming. Start early to get rid of the tanks. This will increase your chances to keep it going straight, get a good engagement and keep the fire behind instead of all around you! If you decide to fly, also make getting rid of the tanks "Step Number One." It is well to remember that the F-100 optimum takeoff speed clean is 157 knots and it can be pulled off slightly lower. The other side of the coin also applies. With the nose too high she may get airborne but settle slowly back as the drag gets the best of the available thrust. It's hard to win — but losing is sometimes fatal.

A host of problems face us as we probe for the stars. It will take more than a sandwich, a moon suit, and a heated cabin to assure . . .

man's safety ☆☆☆ in space

Terrestrial dwellers, though in the outer reaches of space, are still earthmen. They will retain most of their customary habits.

Man's thirst for knowledge and exploration, his curiosity and his military needs are leading him toward manned space flight. Before such flight is realized, however, careful and deliberate consideration must be given to man's safety in his space venture. Safety must be reflected in the selection of the man, and in the equipment he will use to make his journey. Man's physical and mental health must be such that his mission will not be placed in jeopardy and his equipment must provide reasonable assurance of safe flight.

Unfortunately, a discussion of space travel today consists more of a look at the problems and questions facing us than it is a listing of solutions.

Some solutions have been found, true. Man still has to breathe in a space ship. Good, we'll get him some air. And he has to eat. Fine, fix him a sandwich. At about this point, solutions seem further and further out in space itself.

Albert H. Hicks, Service News Staff Aero-Space Div, Boeing Airplane Co.

Delighting in the knowledge of what comprehensive and complex arrangements we humans are, it's easy to accept the fact that most safety considerations orbit solely around man.

During the confinement of space travel, a crew will be exposed to physiological, psychological, toxic-chemical and/or mechanical stresses heretofore unexperienced in flight of present-day aircraft. Normal human body behavior under these hazards will depend upon one's ability to adjust successfully to such conditions as the stresses and strains produced by extremely high G forces at takeoff, weightlessness, explosive acoustic effects, light and darkness, continuous or irregular radiation bursts, restricted nutrition, lack of sanitary measures, loneliness, fatigue, confinement, disorientation and frustration.

For example, will it be safe to send up a crew of two men? Like the tales of trappers wintering alone in the cold North, might two men get so tired of the sight of each other over a period of long months that fights would ensue, eventually ending in the death of one or both of them? It's highly possible, say psychologists.

Recent studies have shown that the best minimum team for a space trip would be two men and a woman. Yet potential jealousies and dissension lurk even in this situation.

Ferdinand Werner, M.D., Chief of Boeing's Biophysics Unit, feels that small problems—as viewed by earthlings—may become major in space.

"We aren't sure," said Dr. Werner, "that normally minor injuries might not kill a space traveler. We don't yet know how weightlessness will affect the healing of a wound should a space crewman accidentally cut himself." This problem, obviously, will remain one of the question marks until man can give space travel a try.

Some problems will be anticipated and attempts made to solve them on earth before they arise in space. Crew training is an important approach to this.

A training program for space crews will prepare them for safe flight in their craft, and will condition them to the anticipated environment of space and the planets they will visit. For example, before tomorrow's crewman ever steps aboard his ship, he'll have been whirled countless times in the Johnsville centrifuge. In space, he won't panic when his eyeballs feel like they're leaving him—the sensation will be old hat. He will have stood numerous times near a B-52 during runups with water injection. When his space ship makes a similar sound on blastoff, he'll wear a new hat, built to keep most of the noise out. The use of flight simulators will prepare crewmen for both normal and emergency operation of the spacecraft. Space chambers will be used to duplicate spacecraft chambers in order that crews can practice maintenance under the environment of space, and while wearing space suits. Complete flight profiles can be flown repeatedly in the simulator until it becomes routine for the crew and they become adjusted to a spacelike environment. The routine cockpit procedures of space flight will probably be scheduled to occupy about as much of the crew's time as in today's military aircraft.

In orbit, space travellers must be able to effect repairs. Easy access and inflight maintainability will be built into their vehicles.

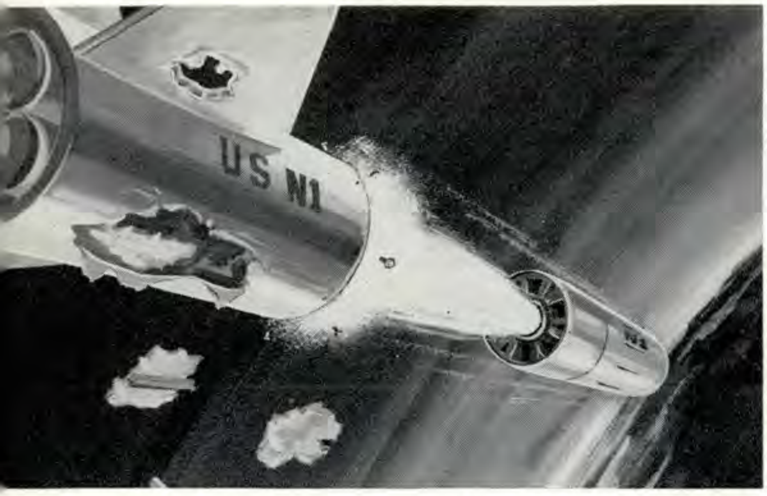
Space navigation is an intricate process requiring a multitude of electronic equipment. Spacecraft may require large expenditures of energy to alter their orbital trajectories even slightly, and energy management must be considered in the total relationship of space flight mechanics to determine if destinations will be reached.

Flight trajectories between such planets as Mars, Venus, and Jupiter will be controlled orbits about the Sun, and will have to be followed closely in order to arrive at the desired destinations. If the orbit is not precise, the spacecraft may continue to drift in its orbit about the Sun indefinitely.

Just as today's aircraft are committed to flight at some point along the runway, so will a spacecraft similarly be committed to a flight trajectory at some point in its final boost phase. At velocities less than the committal point the flight can be aborted and a normal recovery made; at velocities greater than the committal point the flight must be continued and an attempt made to reach the desired destination. Rescue craft could not be utilized because they couldn't capture the spacecraft at this time. Also, escape capsules do not offer the controls, navigation equipment, supplies and so on, which are necessary for safe arrival at the desired destination or for return on the orbit to earth.

During flight, the space crew will naturally desire continuous information concerning their safety, and will want to effect control as necessary to sustain that safety. Such crew-quarters environmental variables as temperature, pressure, humidity, atmospheric gas content, micro-organism content and radiation will be controlled automatically, with display lights and emergency controls provided for the crew.

The environmental status also can be telemetered to a ground station, and alternate emergency commands could be sent to the crew through a data link. Where critical operating equipment is located in remote areas, such as engine and fuel control compartments, closed circuit television cameras could be used to permit visual observation of the equipment at all times.



Escape capsules within the space ship will be a must, in case of accident or disablement. When normal recovery means are not available, rescue craft could be dispatched, maneuvered alongside.

There was earlier reference to giving a man some air and a sandwich. For short space flights, the problems are relatively simple. On extended journeys, they are multiplied greatly.

Various experiments being conducted by Boeing are seeking ways to supply man with both air and food from one system. One experiment has algae growing on water and purified human waste, with fish living on the algae and on the oxygen produced by it. In a closed ecological system *(Ed. Note: Ecology—biology dealing with the mutual relations between organisms and their environment.)* of this sort, man would breathe the leftover oxygen and eat the fish for necessary protein.

Romney H. Lowry, M.D., head of Boeing's biosciences group, sums up the purpose of these experiments:

"On earth, nature takes about a year to carry out a complete cycle, beginning with the harvest of food and running through its consumption, breakdown, excretion and conversion into plants or animals, and finally, terminating in the harvest of the next year. We are attempting to develop an ecological system which will run through a complete cycle in a matter of days."

However, should such a system in feeding man prove workable, further health hazards appear.

"For one thing," asks Dr. Lowry, "what would happen if the intense cosmic radiation of space—or a nuclear engine—should cause a gigantic mutation of a normally harmless bacterium which in turn would produce a strain of disease-producing bacteria that would not respond to any known medication?"

Also, periodic checks will be required for decomposition of the spacecraft's materials from radiation, high temperature and low pressure. The loss of gases and moisture from leakage and through airlock exits or other seals will be critical and must be limited both in flight and at the destination.

To some degree, today's manned aircraft equipment can be adjusted and/or repaired in flight. So, too, will the space crew provide maintenance for their vehicles. The space crew may find not only their mission but also their lives in jeopardy if equipment malfunctions cannot be corrected. Capability of inflight maintenance will give higher assurance of a successful flight. For example, the Strategic Air Command's high proficiency of performance and low abort rate is attributable in part to inflight maintenance and the use of alternate systems. Although great advances are being made to insure higher reliability of future equipment, greater amounts of it will be necessary. It may be possible, however, to have the bulk of the equipment readily accessible for fault isolation and replacement. Also, test provisions may be integrated into the equipment with a minimum of additional bulk and complexity.

The spacecraft and its supporting equipment should provide at least the same assurance of a safe recovery as do today's operational aircraft. To accomplish this, the design of recovery devices and techniques of operation require imaginative ideas and equipment substantially different from that which we have today. The problems, and their solutions, for recovery from earth-orbital flight are entirely different from those of recovery within the earth's atmosphere. The space crew could not survive in space using the escape seats and capsules found in today's aircraft.

Escape capsules within the space ship will be a *must*. They will require propulsion of some sort to blast the capsule back into earth's atmosphere. Once re-entered, slowing devices would be used. Parachutes could bring the capsule to a comparatively soft landing on land or sea. Signalling equipment would be operated by the crewmen to direct rescue parties to the capsule.

However, when normal recovery means are not available, it is possible that rescue craft could be dispatched, placed in proper orbit, and maneuvered alongside a distressed spacecraft. Suitable airlocks and entry equipment could then be utilized to recover the crew and/or allow for the required maintenance to be performed on the disabled vehicle. Other ideas for crew recovery will undoubtedly be proposed.

Man's safety in space is only one of several major factors influencing the advent of manned space flight. It should be understood that such space flight is not without risk, and that a risk must be borne if man is to cross the threshold of outer space.

The entry of man into outer space will climax one of the greatest efforts of history. Although the problems are enormous, the knowledge gained from such a venture could undoubtedly produce an era as exciting and rewarding as the present nuclear age introduced by the atomic bomb. ▲

THE LOOK OF THE HAWK

Captain R. M. Mooney, Chaplain, Holloman AFB, New Mexico

Photo courtesy of Walt Disney Productions.

In past weeks, television sportscasters have been remarking: "The Hawk flies again." They were referring, of course, to Ben Hogan, an outstanding golfer with a worldwide reputation, a competitor who is still feared by men half his age.

Hogan rapidly won the nickname of "The Hawk" years ago because of his unswerving dedication to all the fine points of the game, his intense concentration, and his unrelenting will to win. Whether he is practicing or playing, he actually has the look of a hawk about to plummet accurately and decisively on its prey. Hogan has stated that since turning pro he has never picked up a golf club without first determining what shot he wanted and how to accomplish it. In other words, he has never permitted himself to pick up a golf club in a casual manner. To him it becomes an implement immediately demanding his undivided attention and the application of fierce concentration and all the resources of skill garnered during years of practice and competition. In attitude as well as appearance, Hogan merits his nickname, "The Hawk."

Some civilians tend to visualize Air Force pilots as hawk-like invididuals, somewhat like Ben Hogan in his almost savage pursuit of perfection. These same civilians are perhaps a little disappointed when they find that most Air Force pilots look little different from the average run of American male. Still, they look for something of a hawk-like quality in him. From his point of view, the civilian sees the Service Pilot as one frequently risking his life in flight maneuvers that demand both daring and a high degree of technical competence. It comes as a shock to many inside as well as outside the Air Force when some pilots and some crewmembers evidently take an offhand approach to their flying duties.

That familiarity breeds carelessness is so true. Rated personnel so often stare death in the face that some fellows find it a trifle boring, hence their negligent attitude. The keen concern that all of us have for the skills and knowledge that safeguard our lives and those of our subordinates has been dulled in these few by familiarity with danger. They overlook the God-given obligation and the divinely implanted instinct to preserve their own lives and those of their crew. Their back-log of experience may carry them through for some time.

On the other hand, most of us are sharply aware of life's value and the precarious hold that we have on it. That is why civilians and military personnel too expect to see something of the hawk in every Air Force pilot. They believe that in his interest in his own life and all the full meaning that it holds for him and for his loved ones, an Air Force crewmember should manifest a fierce concern with his own flying proficiency. They believe that when a pilot looks down the long end of the runway, eases the throttle forward and releases the brakes, he should be relaxed, yet vigilant, alert, ready and confident so that he can call into play as needed a rich store of information, practice and experience that will make his flight safe and his mission successful.

Since we are in the service of our country, we cannot discount the opinions of its citizens. They think that Air Force pilots should be hawk-like in their concentration on all that is conducive to proficient flying. I am sure that many pilots conform to this popular and thoroughly justified concept. Yet, you and I know that all of them do not. There is the apathetic fellow who almost has to be spoon fed the educational information and the skills that he needs for proficiency. Then, there is the foolhardy type who is bold and daring but without good judgment. Both are threats to USAF mission achievement, property, and, above all, to human life.

The former does not work at acquiring the ability necessary to match the requirement of a difficult job. The latter makes a difficult job even riskier than can be handled by well qualified ability.

The unsurpassed splendor of man is that he is a living, intelligent being. By that fact we are set apart and above all the rest of God's visible creation. We are his Masterpiece in the physical universe. With this honor goes the correlative obligation to cherish this unsurpassed gift of life. It takes but one thing: Professionalism, such as:

- Unswerving dedication to the fine points of flying.
- Intense concentration that stems from self-mastery.
- Unrelenting will to achieve proficiency through standardization.

These are the hallmarks of one who really prizes the splendor of God's gift of life. These are the characteristics that to civilian outsiders will give you—the Air Force pilot—what they expect to see: the look of the hawk. ▲

CHECKLIST

Recent experiments conducted by Wright Air Development Division (ARDC) demonstrated that it is possible for such everyday devices as portable radio receivers and electric shavers to seriously interfere with an aircraft's communication and navigation equipment.

The investigation was launched following a report by a C-54 pilot who said a passenger-operated portable radio interfered with the plane's communication system. This report led to the disclosure that the FAA had similar complaints.

In one FAA-reported case, a passenger's foreign-made portable receiver upset the instruments to such an extent that a 25° left turn was indicated even though the plane was in level flight.

Following the tests, WADD made these recommendations:

- Prohibit the use of all-wave portable radio receivers on any frequency band higher than the standard broadcast band (540-1600 kc).
- Restrict the use of portable radio receivers covering the standard broadcast band to the passenger cabins, and not in close proximity to equipment racks and associated wiring.
- Prohibit the use of portable radio receivers covering standard broadcast band on any flight using the Loran system of radio navigation.
- Prohibit the use of all electrical and electronic devices, except hearing aids, during all terminal flight phases.
- Prohibit the use of electric razors. Consideration should be given to equipping MATS aircraft with interference-free electric razor and power outlets.
- Restrict the use of battery-operated portable recorders only if transient interference is detected.

Air Force News Service.

Early in July, the Air Route Traffic Control Centers of FAA began using nearly 300 new radio frequency assignments primarily for traffic flying under en route traffic control. This is the first major step in implementing FAA's frequency deployment plan for assigning additional radio frequencies to control air traffic. The additional frequencies will assist controllers in handling communications within the presently crowded radio band to direct Instrument Flight Rules (IFR) traffic.

Sometime in October, approximately 200 more frequency assignments will be added over and above the initial 300 new ones effective in July. There has been no increase in the Very High Frequency (VHF) radio frequencies assigned to air traffic control communications since October 1946, despite a record increase in air traffic. FAA's frequency deployment plan—by using five additional megacycles between 126.825 and 128.825 mc, and 132.025 and 135.0 mc—will partially relieve congestion on present frequency channels.

Assignments of the additional radio frequencies and their locations have been published in the Special Notices Section of the FAA Airman's Guide. The listing was first published April 12, 1960, and repeated in all editions through June 21, 1960.

FAA News Release.

Information received via Headquarters channels indicates a recent increase in Operational Hazard Reports concerning the misuse of guard channel by military pilots, AACS, and FAA air traffic control facilities, and Headquarters urgently recommends that corrective action be taken by all commands. All of us know that this channel is an emergency frequency and any misuse thereof can create a flight hazard to many airspace users. On pages 26 and 27 of the March issue of this magazine, this topic was covered thoroughly by LCdr H. E. Johns, USN Liaison Officer with the 5th US Coast Guard District. As a follow-up, look for the poster which is being prepared for inclusion in the FSO Special Study Kit. This should reach the field in the very near future. Meantime, all pilots and controller personnel, Get Off Guard—except for emergency use!

From Wright Air Development Division comes the following information about the Flight Crew Check List Quick Change Program:

"In order to maintain the currency of Flight Crew Check Lists, particularly in relation to Safety of Flight Supplement generated changes in procedures, it has been necessary to develop a program that will permit rapid changes to the check lists. Basically, the program consists of the Flight Manual Manager providing the contractor with advance information relative to the issuance of a Safety of Flight Supplement that affects the check list. The contractor will then take expedited action to prepare an immediate change to the check list which will be printed and distributed without delay.

"Operating commands must establish base procedures that will assure that proper check list quantities are reflected in the Publications Requirement Tables (0-3-1) and that check lists are rapidly disseminated to flight crews. In accordance with AFR 62-2, the flight crew is required to use this check list when operating the subject aircraft. The check list is identified by a Tech Order number that is identical to that of the applicable Flight Manual except for the addition of the letters 'CL' and a suffix number indicating the crewmember to whom it applies. Remember that this check list does not replace the amplified version of the procedures in the Flight Manual.

"To fly the airplane safely and efficiently, you must read and thoroughly understand why each step is performed and why it occurs in a certain sequence. As changes are made to the amplified check lists in the Flight Manual, concurrent changes will be made to this check list so that both will agree. However, a change to the Flight Manual may not affect the amplified procedures, therefore the Flight Manual date may not be the same as that of the check list.

"To determine the check list applicable to a given Flight Manual issue, take a look at the bottom of the Flight Manual 'A' page under 'Current Flight Crew Check List.' For purposes of determining the concurrency between the Flight Manual and this check list, the latest date of a Safety of Flight Supplement affecting this check list will be considered to represent the latest change date of the Flight Manual. Whenever you receive a supplement affecting your check list, write in the appropriate information. Printed, replacement check list pages will be made available to you as quickly as possible through the 'quick change' check list program. Whenever you receive a normal change or a revision to your check list, check to see that it contains all outstanding Safety of Flight Supplements which affect the check list. If it does not, add in the required information by hand. Any comments and questions should be directed through your Command Headquarters to Wright Air Development Division, Wright-Patterson AFB, Ohio, attn: WWZPH."

In looking through the records of the Directorate, one item seems interesting. It pertains to USAF aircraft accidents resulting from collision with suspended cables or wires. During the four-year period, 1956-1959, there were nine such accidents. While this number is not great enough to draw positive conclusions, it appears that this type of collision presents a greater hazard to rotary wing aircraft than to fixed wing models. Three of the nine accidents involved helicopters and in each instance the aircraft was destroyed and its crew members were killed.

The Air Force has announced an order for five Lockheed JetStars for use by the Airways and Air Communications Service in making inflight inspections of worldwide military navigational aids. In its new military safety role, the JetStar will be able to duplicate the various flightpaths and approaches of modern high performance aircraft to any terminal control area. Such versatility will enable the military to keep a continuing check on the accuracy and reliability of navigational, radio, and traffic aids so vital to safety and operational readiness.

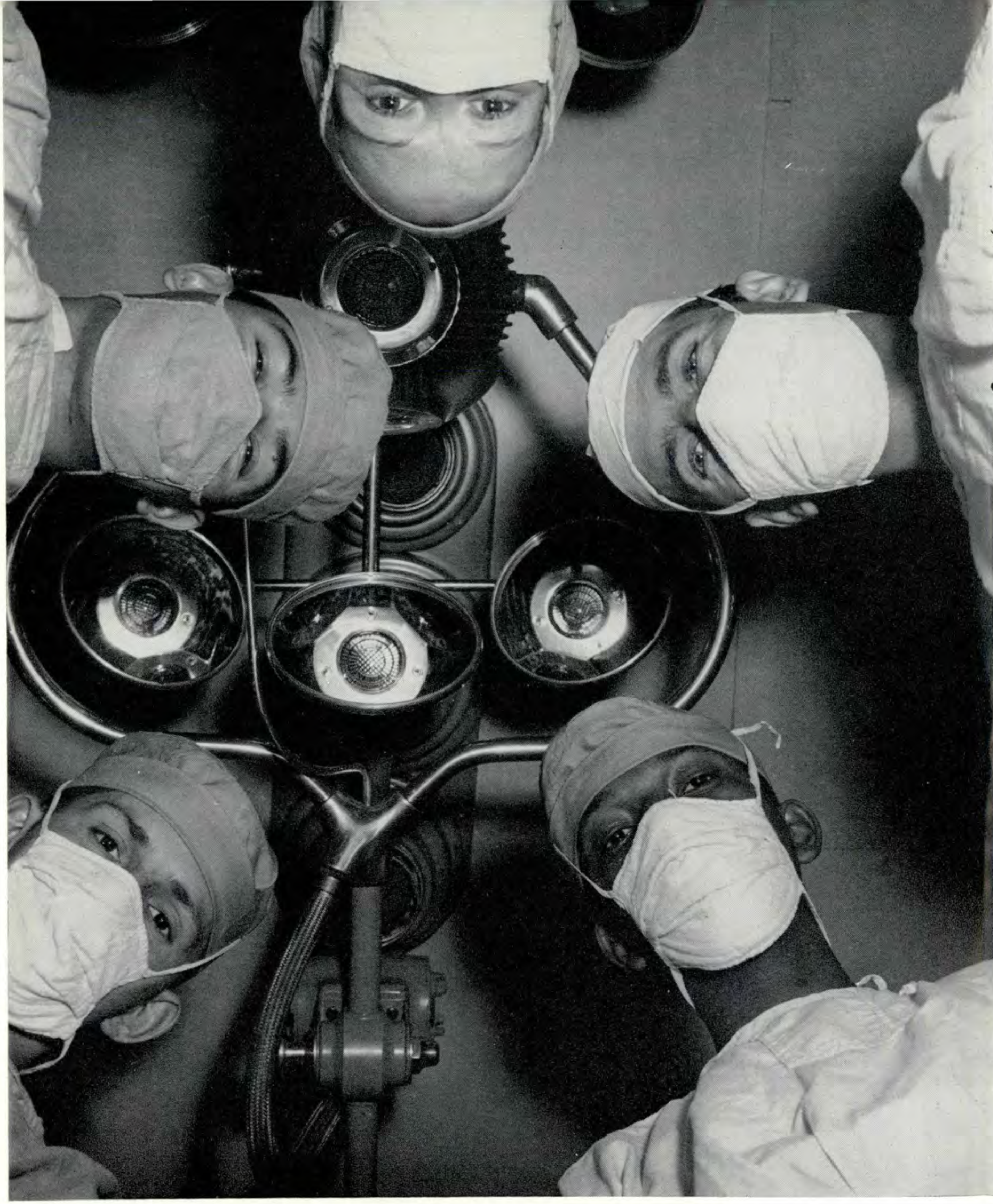
The Federal Aviation Agency is preparing to implement positive control of upper-altitude traffic (civil, military and private) on an area basis rather than a route basis. The aim of the project, which will be started by October 15, is to provide complete separation of all aircraft from 24,000 to 35,000 feet in the Chicago-Indianapolis area. The program will cover a nine-state area with the range of the 125-mile radar sets at the Chicago and Indianapolis ARTC Centers and at London, Ohio. All VFR traffic will be barred in the area, and all flights must operate under IFR rules and must have instrument qualified pilots in planes equipped with radar beacon transponders and prescribed ATC radio.

Air Transport Advisory.

TWO POINTS OF VIEW

"After my usual detailed briefing . . ."

"What he really said was, 'Kick the tires, light the fire, the first one off the ground is the leader and we'll brief on guard.' "



From this position, traffic safety does seem important. The Air Force loses more lives in private motor vehicle accidents than in air accidents. In fact, the wheels actually took 120 more lives in 1959 than the winged vehicles claimed.

THE WHEELS TAKE MORE

• • •

Major Grover G. Morgan, Jr., Education and Training Staff Officer, Assistant for Ground Safety

Photo courtesy of Airman Magazine

Beginning with this issue, another field of safety activities is given some space: Ground Safety Research. Airplane drivers may question the importance of this subject and regard it lightly. The picture of the surgeons and their assistants may be a familiar sight to some of our readers. From this position, ground traffic safety does seem important! The U. S. Air Force loses more personnel in private motor vehicle accidents than it does in aircraft accidents. In fact, the wheels actually took 120 more Air Force lives in 1959 than the winged vehicles claimed during that same year.

Look at your watch. Before it ticks away the next two hours one member of the Air Force team will, if he is conscious, be staring up at a group of masked men who look like this. One airman or officer sustains a disabling injury every two hours and one dies every 18 hours in a private motor vehicle accident.

This young man who is going to die within the next 18 hours is a happy, healthy person right now, unaware of the danger that threatens him. When the red signal of pain flashes across his nervous system it will be too late to prevent the accident. And yet the Air Force can predict with reasonable mathematical certainty most of the facts and circumstances surrounding his accidental death—before he dies!

It's easy to predict what *will happen*, as all we have to do is look at what *has happened*. For the past 10 years the Air Force has coded on IBM cards 80 different items of information on every single ground accident reported. By using a simple system of "poker mathematics" we can tell you that the next Air Force victim of a fatal ground accident will die in an auto crash. Anybody who can count can make this prediction. The figure is arrived at by using the simple system of counting the reports that cross the desk of W. L. Tubbs, Colonel, USAF (Ret.), the Assistant for Ground Safety Research: five out of six fatal ground accident reports involve wheels. And the chances are seven out of ten that the next victim will be under the age of 25. Using this same system we can also predict that this young man will die as a result of driving too fast for conditions on a highway, turnpike, or "thruway" in a rural area between the hours of 2000 and 0300. He will lose control of his car, swerve off the highway and roll over or collide, surprisingly enough, not with another car, but with a fixed object such as a tree or bridge abutment.

Another item of information that may surprise some people is that at the time of the accident the weather will be clear and dry and he will have no one to blame but himself. Chances are he will be driving while fatigued and he may have had a few beers, but the percentage of "had been drinking" auto accidents among Air Force people is no greater than that of civilians. He will probably die in Texas, California, Florida, South Carolina, Arizona, New Mexico, Ohio, Illinois, Missouri, Louisiana or Oklahoma. Sixty per cent of the ZI Air Force fatal traffic accidents occur in those 11 states.

Yes, all of these facts are known about the next Air Force traffic accident victim; the pattern is set and the die is cast. Unfortunately, we don't know his name or serial number (by the way, his grade will probably be airman first, second or third class). Perhaps he is already in his car and on his way. The headlines will read: "Airman Dies in Car Crash." And that's what makes it bad for the Air Force. When a civilian is killed, he is not usually identified with an organization. We never see headlines reading: "Member of Lions Club Dies in Highway Accident," or "Presbyterian Killed," but invariably the military man is immediately identified with the service.

These headlines give the services a black eye. Because of this unfavorable publicity, numerous magazine articles, newspaper stories, and editorials have been written about "G.I. Killers on the Highway." Although our experience in fatal auto accidents is bad, it is no worse—and is actually slightly better—than comparable age groups in civilian life. For instance, approximately 65% of all Air Force private motor vehicle accidents involve military males under 25. This is not surprising because about 50% of our military are in this age group. But our airmen in the younger age groups actually have a better record than their civilian counterparts!

For the past five years an average of 80 out of every 100,000 male civilians in the 20-24 age bracket have died each year as result of private motor vehicle accidents. This compares with an average of 78 out of every 100,000 male airmen and officers who have died in private car accidents in this age group each year for the past five years. This is certainly not enough difference to brag about but it proves that publicity about "G.I. Killers on the Highway" is not warranted. We stand falsely accused in the public eye.

Actually, one would expect Air Force people to have more instead of fewer vehicle accidents than comparable age groups in civilian life because we face not only all of the problems that confront the civilian, we have an additional set of situations that does not concern civilians to the same extent as it does the military: The Air Force puts the city fellow in the country and the country fellow in the city, subjecting each to new driving conditions. Before the young fellow entered the service his driving was probably confined, for the most part, to one geographical area. But being in the Air Force, great distances are placed between him and his home and we can not blame him for wanting to get home as often as possible. Therefore he has more opportunities to have accidents than his civilian counterpart because he drives more.

These conditions also increase his driving in the open highway (as compared to city driving). Because of the higher speeds involved, it is on the open highway, turnpike or freeway that most fatal accidents occur. As he motors through the 50 states, he runs into 50 different sets of laws as to what is right and wrong on the highway. Every time he crosses a state line he is confronted with new legal concepts of traffic control. He faces real traffic problems overseas; in one country he drives on the right side of the street and in another on the left.

Another angle is the psychological one which the long haired types call "conception of self." It would be interesting to know what changes are made in one's conception of himself when he puts on the uniform. We are told that from early childhood we associate the uniform with the adventuresome, carefree, "tomorrow we may die," "soldier of fortune" attitude. This may influence a person's behavior both in and out of a car.

The influence of the home, the school, the family and the church—all instruments of social control—have been lessened or removed. The young airman achieves a certain anonymity and does not behave in his new environment as he did back home. Mother and father are replaced by a commander and first sergeant who go home at 1700 hours. He is on his own and these factors may influence his behavior while he's behind the wheel.

These are *not* excuses. They are clear-cut reasons why we in the Air Force have to be better drivers and use more caution than others. We have to compensate for these problems by being more cautious than the average driver.

During a recent graduation ceremony at a small high school there was one boy in the class who stood out head and shoulders above his classmates. President of his class and valedictorian, he was voted "the most likely to succeed." He graduated at 4 p.m. one afternoon in May. By 5 o'clock that same afternoon there was nothing left of him but a pile of flesh and blood and bones on a cold slab in a morgue. He was supposedly prepared for life but he met death on the highway the afternoon of his graduation. His high school, in his general science classes, had taught him how long it takes a ray of light to travel from a given star to the earth, but nobody had convinced him that it takes 295 feet to stop a car traveling at 70 mph. This youngster is typical of the young airman; there is a gap in his development which could cost him his life.

In an effort to fill this gap, the Air Force has a 10-hour driver improvement course for all airmen under the age of 25 on a mandatory basis. Since this course was introduced, along with other safety training and promotional programs, tremendous strides have been made in reducing Air Force traffic accidents. During the five-year period, 1955 to 1959, private motor vehicle fatalities to Air Force personnel were reduced 25% and injuries were cut by 36%. These reductions are significant and they indicate that we are gradually achieving our goal of turning back to society a safer driver and hence a better citizen than we received when he enlisted.

How do you avoid traffic accidents? Well, just look at the facts predicted for the next Air Force traffic accident victim and make sure you don't fall into the same web of circumstances that typify most Air Force traffic fatalities. Let's review those circumstances:

- Who? Airman first, second or third class under 25.
- Where? On a highway, turnpike or thruway in a rural area.
- When? Between the hours of 2000 and 0300 on weekends.
- How? Combination of factors: drinking, driving while fatigued; driving too fast for conditions. Resulting in loss of control of car and swerving off highway; rolling over or striking a fixed object, such as a tree or bridge abutment.
- Why? Because somebody didn't heed the warnings in this article or figured he was safe if he didn't fit into the pattern described above.

Will that somebody be you? ▲

Captain Tracy B. Mathewson, III

Headquarters ARDC, Andrews AFB

After preflight checking his F-104D, Captain Tracy Mathewson made an afterburner takeoff to the west from Kirtland Air Force Base, New Mexico, on a maintenance test flight. About 30 seconds after brake release while making after-takeoff checks, he retarded the throttle from full afterburner to 100%, or military power. Suddenly there was a series of violent compressor stalls. The EGT fluctuated from about 715°C. to 500°C. and RPM dropped off rapidly. Captain Mathewson retarded the throttle to OFF momentarily, then pushed it back to full military power. He also activated the airstart switches, and got an immediate airstart.

The flameout occurred at 300 KIAS, 2700 feet above the ground. Although the aircraft was heavily loaded with fuel, the Captain retained the tiptanks to prevent injury to civilian personnel in the residential and industrial building area under him.

He called Kirtland tower on guard channel, declared an emergency, and requested an immediate landing on the same runway he had departed. After being cleared to land, he established himself on the downwind. Then another series of compressor stalls occurred, and another flameout. Captain Mathewson actuated the inlet guide vane switch to the manual position and got another airstart. By this time he was clear of the populated area and jettisoned the tiptanks. With the aircraft in a clean configuration he found he could maintain 280 KIAS at 2700 feet.

Approximately 30 seconds after the second flameout, another series of compressor stalls along with a third flameout occurred. Captain Mathewson made another airstart and managed to keep the RPM at 97%. As he turned onto base, lowering the wing flaps to takeoff position, the compressor stalled and the engine flamed out again. The Captain made another airstart, turned onto a higher-than-normal final approach, lowered the gear, and landed without a bounce.

Subsequent maintenance checks revealed compressor damage from foreign objects. The compressor would stall at 89%, followed by engine flameout.

Captain Mathewson's outstanding knowledge of his aircraft, his professionalism, and his laudable concern for the lives and property of endangered civilians below reflect the highest standards of Air Force leadership, airmanship, and ability.

The Captain's Form 781 entry read: "Duration of flight: 5 minutes; discrepancies: 4 low-altitude flameouts."

Aerospace Safety would like to add: Well Done, Captain Mathewson. ▲

Whether Jennies, Starfighters, or missiles, we're still plagued by ...

THE SAME OLD BUGS

Archie D. Caldwell, Records & Statistics Div., DFSR

The missile weapon systems which currently comprise the Air Force Missile Inventory are being limited in employment today by a factor which has plagued the operation and maintenance of heavier-than-air vehicles ever since the first U. S. patent was applied for by the Wright Brothers back in 1903. This factor, which was present in the nation's first fatal military plane crash some 52 years ago, is still an underlying cause for far too many launch and mission failures of SM-65s, IM-99s and GAM-72s. This factor is design deficiency and it's as effective in reducing the missile research and operational capabilities of the Air Force as would be a bomb hit on a launch complex.

With the exception of certain missile and research vehicles that are launched and then recovered for further flight, the primary function of the missile is a one-way trip, culmination being the fulfillment of test objectives or impact within the Circular Error Probable (CEP). However, there are too many instances wherein this ultimate objective is not achieved, too many because of design deficiencies passed from one generation of missiles to the next which should have been identified and corrected in the earliest conceptual phases of design and never allowed in follow-on systems. Those of you who have been in the aircraft end of the business for a while can surely remember an instance of receiving a new series of an aircraft model, and after only a few weeks, hearing this statement: "It just looks different; it's got the same bugs as the old ones."

Several respresentative design deficiencies worthy of dissemination have been noted during surveys or missile investigations. At first glance they do not appear to be of a magnitude suitable for mention, yet they are a part of the weapon system and their failure or malfunction can and often does effect the behavior and success of the more impressive part of the system, the missile itself. For example: A ballistic missile base was found to have six pumps and generators in the power plant and pumphouse dependent upon a *single* air compressor for starting pressure. One failure here could have been compounded, if time were critical.

At the same installation an IRBM launch proceeded with a normal countdown. The missile made a good liftoff and initiated a stable, nearly vertical trajectory for approximately 105 seconds when loss of roll and pitch programming occurred. The missile was *destructed* by the safety officer when it became apparent that control was lost. Inspection of the launcher revealed a broken retaining spring which caused failure of the liftoff switch actuator pin which in turn actuates the flight programmer. Subsequent investigation revealed that other launchers at this base were equipped with faulty or broken springs. This spring—costing less than five dollars—cost us a ballistic missile.

Design for safety and reliability must be considered concurrently with the first stroke of the designers pen or the first word establishing the weapon requirement. It

The terminal count begins as the top of the semihard shelter rolls back and Atlas rises out of its pod—unless one of those same old bugs interferes. Right, missile maintenance technicians change a cluster of rise-off disconnect couplings, which must function perfectly if Atlas flies.

must encompass all phases of operation and handling. A case in point occurred upon completion of ballistic missile shelter retraction in Phase II. The missile began normal erection. The launch control officer imposed a STOP, but the STOP switch had no effect and the missile continued to erect to the full vertical position. (Normal sequence: there is no provision for halting the erection sequence after shelter retracts closing limit switches.) The only means by which the erection could be stopped would have been to turn off the 440 volt main circuit breaker at the hydraulic pumping unit. Missile weight would then have caused the erector to come back down as soon as the pumping unit stopped.

A similar mishap occurred when an erector motor did not go into creep at 87° as programmed. Although the EMERGENCY STOP was activated immediately, inertia carried the boom and missile past the vertical to approximately 93°. The boom-to-launcher pins failed in Quadrants III and IV and the booster fittings failed in Quadrants I and II.

Ballistic missiles are by no means more susceptible to design deficiencies than are other missile types. One "Air-Breather" missile which was flown prior to 1950 had evidenced a design deficiency from the start: the missile broke up during the terminal dive phase of flight. It was not until that one missile impacted in an area which permitted recovery that examination of the wreckage could reveal that breakup was induced by failure of the tail section. Structural beef-up of the tail section was accomplished and a greater degree of mission accomplishment subsequently achieved.

During a survey of an operational base possessing

Thirteen technicians occupy this launch control center when a firing is imminent. Many pieces of launch control equipment are duplicated, assuring 100% back up capability in the event of a console malfunction. Visible are diagrams of various Atlas systems, all of which are monitored for countdown. The standby status panels to the left of the TV screens reflect the status of a sentry missile.

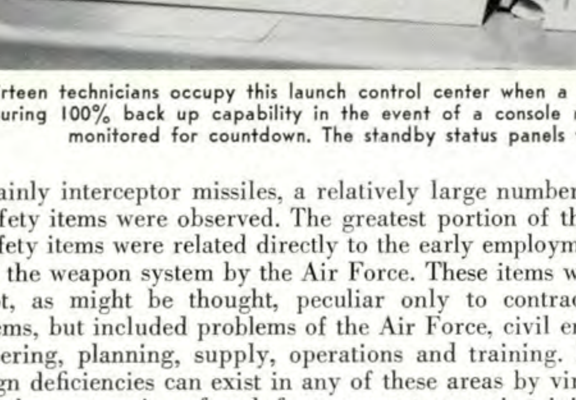
mainly interceptor missiles, a relatively large number of safety items were observed. The greatest portion of these safety items were related directly to the early employment of the weapon system by the Air Force. These items were not, as might be thought, peculiar only to contractor items, but included problems of the Air Force, civil engineering, planning, supply, operations and training. Design deficiencies can exist in any of these areas by virtue of the progression of each from concept or project initiation, through employment or completion.

Facilities used for storage and handling of toxic propellants and explosives were being operated without the benefit of published technical guidance. Construction of asphalt areas adjacent to LOX facilities was permitted without regard to their incompatibility. Delivery of test equipment required for critical missile system checks had not occurred or was not concurrent with delivery of missiles.

The listing of each item, directly or indirectly related to system design could go on indefinitely. It would cover virtually all equipment from miniaturized electronic components which are not capable of withstanding vast environmental changes, or rubber grommets around the buttons of a launch console (which cause controls to stick in the closed position) to the very large items of ground handling and support equipment such as launchers and erectors, and finally even the complex or base itself.

The manufacturer can go only so far in eliminating these problems. He can base new designs or redesigns only on known inadequacies of present materiel. Users' requests for correction will fall on unsympathetic ears if a request for correction or modification is made without justification and the necessary details required for support. It is incumbent upon the Air Force that in all phases of missile operation, from concept to impact, each detail be evaluated and planned for in order to achieve the optimum in missile safety and reliability. There is no such thing as a random failure. Each malfunction is the result of a definite deficiency, whether it be materiel, human, or procedural.

The obligation the Air Force has to the nation makes this identification and resolution of weapon system deficiencies mandatory—especially if the progress in missile development and operation evidenced in the past is to continue in the future. Without the effort of all personnel in achieving the ultimate in design and employment to support this obligation, there may be no real missile future. ▲



"Oh, I'm the new man in Missile Safety!"

 PEEK-A-BOO 

The American has been conditioned to respect the human rights and liberties of his fellow man. Even so, certain phases and facets of man's life are considered more sacred than others. For instance, the American male considers his home and home workshop a holy place, not to be tread upon or in, without his express approval. The American female, by the same token, demands that all respect the privacy and sanctity of her purse and kitchen, in that order.

The American pilot, strange and aloof character that he is, considers the cockpit his personal and private domain. ("So my airspeed is a little high, no one will ever know. Besides, there's lotsa runway ahead and I have a drag chute and good brakes. I think!") Sure, our worthy pilot knows the Dash One speed for his aircraft weight and configuration and he uses these speeds for computing his personal, final approach speed.

Exempli Gratia: The Dash One recommended approach speed for weight and configuration of aircraft is 160 knots; add 5 for spastic pilot, 5 for the wife, 5 for son John, and 5 more for daughter Mary. New approach speed: 180 knots.

Results: Long landings, blown tires, worn brakes, lost drag chutes, busted barriers and messed up real estate. Such situations invariably do weird things to our bright, shiny, expensive birds and quite frequently alter the anatomical geography of the practitioner.

At the other end of the scale (and runway) is the pilot who rides the stall point in order to make use of the first inch of the runway, then lands on the overrun and slides down the runway sans landing gear.

To nullify the havoc created by the "stall 'em short" and "bang 'em into the barrier" artists, Uncle Samuel has added much to the dividends of the stockholders of a couple of cement companies to provide sufficient runway for our high-performance aircraft. Our elongated cement ribbons have grown to such lengths that clear zones criteria are becoming difficult to adhere to at many of our air bases. Moreover, 1000-foot overruns are also being added to runways in an attempt to save pilots and aircraft. In spite of such precautionary measures, however, the careless pilot can ever defeat the longest of runways.

The runway lengthening program has brought about a question of paradoxical asininity that requires an equally asinine answer: "Which end of the runway to lengthen?" The pilot who busted a bird while landing short would state that the approach end of the runway certainly should be lengthened, for this would have prevented his mishap. The "through the barrier" artist could pose an equally strong argument for an addition to the far end of the runway.

This sort of reasoning, if followed, would certainly extend runways to infinity—at least from coast to coast and from the Gulf to Canada. (Perhaps this wouldn't be such a bad idea. We could then land upon encountering instrument weather and taxi to our destination. No, on second thought I guess this isn't the solution either. I've just had eerie thoughts of a collision at the only intersection of the north-south and east-west runways.) The intent of the above statements is to make clear the point that the solution to preventing long and/or short landings must lie in an area other than through lengthening runways.

It is common knowledge that the acceleration characteristics of jets are such that long runways are required for takeoffs; however, the landing roll, using correct touchdown speeds, drag chutes and proper braking techniques, never exceeds the distance required for takeoff. In fact, the contrary is true. The landing roll is normally much shorter than the takeoff roll.

A review of the records shows that the causes are all too familiar: High touchdown speeds, long landings, deployment of drag chutes at speeds which destroy them, hard brake application too soon after touchdown (when the aircraft is too light for good brake effectiveness), and delays in slowing the aircraft after touchdown. The short, landing, however, is usually explained in much simpler terms: Pilot Factor. ("Pilot misjudged approach and touched down short," it usually reads.) It has often been said—and it bears repeating here—that good, safe landings are made in the pattern and approach. Proper planning and execution of patterns, approaches, and landing rolls will prevent most of the accidents in this category.

A while back I had occasion to witness a demonstration of radar checking of touchdown speeds of landing aircraft utilizing police radar of the type that has trapped many a motorist in his blistering speedway run down the boulevards. A similar radar may one day peek into the cockpit to "eagle-eye" speeds with the same regularity and monotonous accuracy of the farsighted mother-in-law in the back seat of the family sedan.

If this sort of peek-a-boo supervision has the same influence as the mother-in-law, it is a foregone conclusion that the black tire marks will certainly begin grouping at the first third of the runway rather than extending the full length of the runways.

Radar monitoring of aircraft landing speeds would be of great value at bases where there is training traffic of like aircraft or at bomber bases for linespeed checks. Such equipment would have a psychological effect on pilots and would encourage pilots to adopt precision flying habits for approaches and landings. The days of pilot individuality must fall victim to the progress of air science if our accident rate is to continue its downward trend.

So come on fellows. If we can't beat 'em, let's join 'em, and start pegging that correct approach airspeed and touchdown speed. Let's set 'er down on the first portion of the runway. Be sure, however, to put the bird down *on* the runway and not on the overrun. This way the runway will be in a position to do us the most good, *under* and *in front* of us. ▲

Maj. Jesse C. Wilkins, Missiles Br, DMSR.

REX Says

The file of Operational Hazard Reports, incident reports and safety tips has become rather lean here lately and we hope this means that there are fewer "close ones" to report and you're not just forgetting about us. Incidentally, now that USAF safety efforts are being extended over into missile, nuclear and ground areas, the Editors and I are counting on you for reports of activities and suggestions in those fields, as well as fly safe items. So how about it? Signatures are not required!

Here's one from a not-so-happy pilot:

Recently I cleared out of an Air Force base in the Midwest to one in the East and, being a student of complete flight planning as the cure-all for most pilot factor mishaps (as expressed in FLYING SAFETY), I checked the NOTAMS thoroughly for my destination. I was amazed to find only two in the file, and I expected to find both of these as a matter of routine. One was a musty, dog-eared NOTAM signed by a G. Washington, stating to stay clear of the Delaware River Danger Area, dates obscured; and the other was a current one stating QUACKUM, meaning, according to the dispatcher, TACAN Inoperational.

I suspected something wrong when there wasn't a one stating: *"Ofl Bus Only; No Qtrs Avail; No JP Fuel; Work in Progress all Runways, use CAUTION;* and *No Transient Maintenance Avail."* But the dispatcher said the file was OK. So I roared off into the murk and did fairly well until over the final fix for destination. After the usual "fencing" period, I convinced the FAA controller my bird wasn't equipped with the wildcat approach frequency he initially suggested (primary for BOAC at Capetown, South Africa). Finally, we established contact on Navy Common, 243.0.

Then came instructions to let down this way and that way, only vaguely resembling the instructions in my week-old letdown plate. Having read in Major Ross Beckham's article in the March issue that any pilot who accepts a nonpublished letdown is at fault, I challenged this gentleman on the ground: "How come this nonstandard letdown, and was he accepting responsibility for my navigation, and all that?"

He allowed as how the letdown he was giving me *wasn't* nonstandard; that he wasn't accepting *any responsibility for anything*, and then he asked what my intentions were! Finally, he convinced me that my brand new letdown had been NOTAMMED off the books some weeks ago, and that his procedure was the *new one via NOTAM*. To get even with me for doubting him, he wouldn't admit radar contact with me until I threatened to call MAYDAY. And, finally, after running me all over the East Coast, he lined me up perfectly with the runway and turned me over for an excellent GCA and uneventful landing.

A check with the AO revealed his letdown plates to be the same as mine, so we joined forces to blast the Approach Controller via the hot line. He casually suggested that we check NOTAM number so and so for the base. It turned out there were two NOTAMS—both of 'em nearly a month old—revising the local letdown ADF and Omni procedures. Somehow the base had neglected to change its own books after submitting the NOTAM change.

I made my OHR to the FSO who replied as follows on a DD Form 95: "I checked with our dispatch here and it seems that pilots frequently steal the NOTAMS from the file. I'm going to bring this up locally and advise pilots that loss of life and aircraft could result from denying NOTAM info to other aircrews. Also, that severe disciplinary action can result. Might be a good idea to bring this up in Aerospace Safety Magazine." He says, in effect, that hurried pilots "steal" complicated NOTAMS rather than digest or copy them. Apparently the dispatch sections have no efficient method to check their NOTAM status.

I suspect the FSO's answer to my Operational Hazard Report is correct. However, it does seem that there should be a more concrete method of checking NOTAMS for validity and adequacy when you run through the file. Maybe Flight Service should monitor them every 12 hours or maybe some base education is necessary. If a piece of paper is more than two lines long, it isn't a NOTAM; it's a publication.

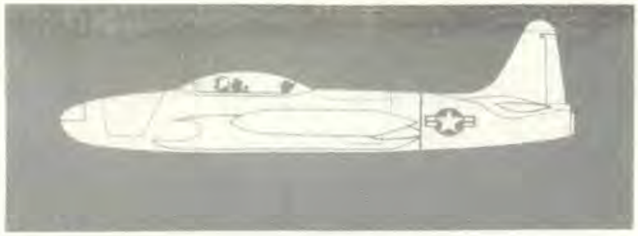
The NOTAM system was not designed to publish complete new letdowns; nor was it effected to notify transient pilots that there are no quarters available, nor for complicated danger area geographical zones, coordinates, effective dates, altitudes, and so on. And if a NOTAM describing a hazard does *not* specify to use CAUTION, is it all right not to?"

Rex Says: *Our unhappy friend isn't the only person who has NOTAM problems; all of us who fly have had them at some time or other. I won't say we have the greatest NOTAM system in the world, perhaps it could stand some overhauling. What I do say is this: If people, namely base ops personnel, would handle and take care of the NOTAMS just as though a life or an airplane depended on each notice, we would have a far better system than we now have. Also, it would help a good bit if airplane drivers would stop making NOTAMS their personal property. As for accountability, there is an adequate system in effect. The trouble here is that a lack of understanding or compliance with existing instructions. The accountability system is described in Hq USAF letter (AFOAC-S/CP), dated 31 October 1957, subject: "Air Force CONUS NOTAM Accountability System." Inasmuch as that letter is about three years old it is very possible that some bases have lost, misplaced or destroyed it. Maybe some of them have never received it. This same letter does state that the procedures and responsibilities of inclosing will be reflected in a forthcoming revision of AFR 100-52, "Notices to Airmen (NOTAMS)." So far the regulation hasn't been revised and it sure would be nice to tie up all the loose ends in a single package. Take a check, you troops who are responsible for NOTAMS; if you aren't complying with the instructions of inclosure 1 to the letter and using AF Form 1035 (inclosure 2), you could be setting up an aircrew for some rough treatment.*

• • •

With two pilots in the T-Bird it wasn't too difficult to spot the siphoning left wingtanks during the first turn after takeoff. The front seat pilot advised the tower of the difficulty and advised he would remain VFR in the local area until the tiptank fuel was gone. As they circled the air base to the left at 2500 feet, the rear seat troop commented that the "slaved gyro needed to be fast slaved." While somewhat preoccupied with avoiding local traffic, the pilot in the front cockpit *pressed the tiptank salvo button, mistaking it for the gyro fast slave button.*

Rex Says: *Sure enough, both tips left the bird in real good shape and fortunately didn't clobber any folks on the ground or go through a house, a car or a herd of milk cows. Two points we want to bring out and they are pretty obvious: First, how do you mistake the salvo button for the fast slave? It isn't easy. It's only fair for your subconscious mind to let your conscious mind in the act when you go about moving, pushing and pulling controls. Second, how about the loose fuelcaps that started the whole thing? The incident report didn't mention the reasons for the fuel siphoning. Would you like to bet that the caps hadn't been checked? Or, if they were checked, that the chains were between the cap and the filler neck?*



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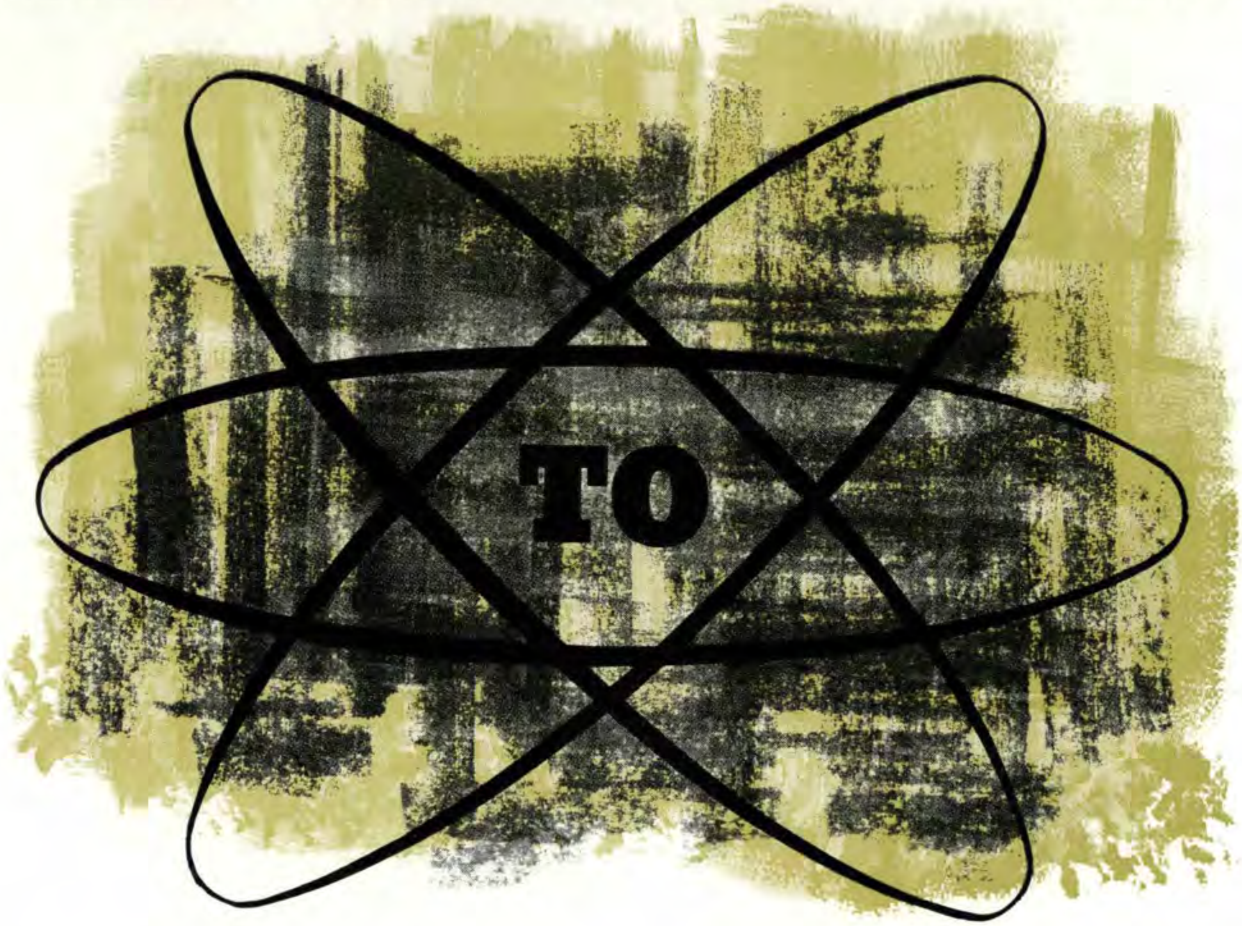
Six crewmen, 16 passengers and a C-47 were in real trouble. The left engine was inoperative and the aircraft was short on altitude. The pilot managed to get to a field but was too high for anything but a panic landing. The runway had been laid out in a valley, was built on filled land and ended in a 40-foot drop-off after a 150-foot overrun. After the fourth or fifth bounce the airplane ran out of runway and overrun and began a series of post landing gyrations which a C-47 was not built to stand. Scratch one Gooney Bird. The passengers and crew took a beating but not so much from the crash itself as from the rain of loose objects in the plane. Only a 250 pound hydraulic jack, tightly lashed down, remained in place. A crew chief's tool box in the tool compartment came open and shot tools throughout the fuselage at 60 mph. Baggage became 30-50 pound missiles and cans from flight lunches whistled through the interior. Control locks and the ladder headed towards the forward bulkhead. One of the passengers stated "we took a severe beating from large and small objects hurtled through the air with unexpected force."

Rex Says: *This same story would probably be repeated in 9 out of 10 passenger type flights. Take a look around the next time you climb aboard and count the number of loose objects. During the flight take another look. Anything as big or as heavy as a 25c magazine, if not secured, will become a potent missile during a crash landing. Another point—have you ever ridden through a thunderstorm in an airplane full of flying objects?* ▲

SIX MILESTONES



NUCLEAR SAFETY

The Directorate of Nuclear Safety Research, Kirtland AFB, New Mexico

The Department of Defense guidance to the services on certain very vital aspects of nuclear safety has been reduced to writing and is now published as DOD Directive Number 5030.15, dated 10 June 1960, subject: "Safety Studies and Reviews of Atomic Weapons." Each military department was directed to forward its own implementing regulation to the Assistant to the Secretary of Defense (Atomic Energy) within 60 days of the publication date. The Air Force, however, had been employing most of the procedures set forth in the DOD directive for several years; in fact at the time of publication of the directive, the USAF implementing regulation was being routed through the Air Staff for final approval and comment just prior to publication. This regulation will be known as "Air Force Regulation 122-2, and the proposed title is *Nuclear Weapon System Safety*."

The Directive provides guidance to each military service for:

- Conducting appropriate safety studies and reviews of the various atomic weapon systems.
- The development of safety rules.
- The application of certain safety standards.

AF Regulation 122-2 will set forth procedures for conducting safety studies and reviews and for developing and attaining the safety standards of the DOD directive. For approximately $2\frac{1}{2}$ years the Air Force has been organized to implement certain aspects of this new DOD directive. In August, 1959, the Air Force safety reorganization established the Directorate of Nuclear Safety Research which has been and is responsible for directing the accomplishment of the same policies which are contained in DOD Directive Number 5030.15. That directive states that each service will conduct appropriate safety studies and reviews, and develop appropriate safety rules for all atomic weapon systems for which it has developmental or operational responsibilities.

The underlying purpose of these activities is to detect and correct unsafe design and unsafe procedures, and to set forth safety rules governing the peacetime operational use of atomic weapons.

In effect, the directive describes five milestones of nuclear safety. The Air Force has added a sixth. These milestones are described below:

• *Initial Safety Study*. An Air Force safety study group called the Nuclear Weapon System Safety Group (NWSSG) examines all available information about the new nuclear weapon system against the requisites of safety—safety against accidents; safety against deliberately unauthorized operations; safety against inadvertent improper operations; and effective security. This group is chaired and supervised by the Directorate of Nuclear Safety Research (DNSR). Its members are representatives of each major Air Force command having nuclear weapon responsibility, the Defense Atomic Support Agency (DASA), and the Atomic Energy Commission (AEC). Technical input into the studies considered by the NWSSG is provided by the Air Force Special Weapons Center (AFSWC).

• *Pre-operational Safety Study*. The NWSSG conducts a second study of the new weapon system shortly before the system becomes operational. At the time of this study the weapon design is definitive and the Air Force's concept of operations is clearly defined.

This investigation is extremely detailed. It considers every imaginable facet of the weapon system's life. Handling procedures, testing equipment, security measures, and emergency doctrines are among the areas examined. From this study come refinements for safety and the proposed Safety Rules to be observed during peacetime operations involving this weapon system.

• *Safety Rules*. These proposed rules are given a very extensive and careful review. After agreement by the Nuclear Weapon System Safety Group, the Directorate of Nuclear Safety Research and the rest of the Air Staff, concurrence must be obtained from the Defense Atomic Support Agency and the Joint Chiefs of Staff. This concurrence must be followed by approval by both the Secretary of Defense and the Atomic Energy Commission. When the weapon is to be carried in an aircraft during peacetime, Presidential agreement is also required.

• *Pre-operational Survey*. This safety milestone was added by the Air Force and is not a requirement of the Department of Defense. Shortly before the operational date of the weapon system, the Directorate of Nuclear Safety Research conducts a field survey of a selected unit in its operational environment to ascertain whether or not the Safety Rules for that particular weapon system are adequate, understandable, and usable.

• *Operational Review*. It is evident that a period of operational experience with a particular weapon system may produce ideas or information which might enhance the operational safety. Hence, the Directorate of Nuclear Safety Research of the Air Force makes it a practice to review the weapon system's safety again after it has been operational for awhile. This is just one more step to improve the Safety Rules and operating procedures.

• *Special Safety Reviews and Studies*. Special Safety Reviews and Studies may be conducted whenever circumstances indicate the need for them. They will be conducted by the Directorate of Nuclear Safety Research or by the Nuclear Weapon System Safety Group.

Application of Certain Safety Standards. There are four important problem areas in nuclear safety:

- Accidents and incidents.
- Psychotics or saboteurs.
- Human error.
- Security.

These four basic problem areas led to the establishment by the Department of Defense of certain minimum safety criteria or safety standards designed to overcome these problems. The standards are the "go, no-go" gage of nuclear weapon designers, developers, researchers, manufacturers, and users. Effective implementation of these standards will enable all services to maintain a goal of *maximum safety consistent with operational requirements*. Each of the safety standards is designed to deal with one of the four safety problem areas mentioned above.

The first problem area is accidents. Thus, the first safety standard reads: "There will be positive measures to prevent weapons involved in accidents or jettisoned weapons from producing nuclear yield." This standard must be met by the design people and by the military service before an atomic weapon system can be used. To generalize, the standard considers such features as bomb design, bomb storage, design and procedural use of safety switches, and detailed safety procedures.

The bomb designer must design a bomb that will not trigger a nuclear reaction, that is, no nuclear fission or fusion, even if the high explosive of the bomb has been detonated during a crash, fire or jettison of the weapon.

In storage the atomic bomb must be inert—not capable of electrically triggering its nuclear component. This is usually accomplished by a system of switches. These switches prohibit power from reaching the detonating element of the bomb. They must be thrown in proper sequence by a team of men before power leaves the batteries. They are so located that one man cannot throw all the switches necessary to detonate the weapon. In brief, the weapon is designed so that it requires the efforts of a team of knowledgeable weapons men meticulously going through well defined procedures in order to detonate the weapon.

The detailed safety procedures are simply precautions in the form of a sequence of actions, each of which is a check and double-check, to assure that mechanical devices operate to serve their intended purpose. This is referred to as safety in procedures, or procedural safety.

These are some of the ways of observing the first safety standard. Of course there are others. The important thing is that certain positive measures are provided in the form of safety rules to back up each of these design and procedural schemes.

The second problem area is that of the psychotics or saboteurs, and the second safety standard guards against this problem. It states that: "There will be positive measures to prevent deliberate arming, launching, firing or releasing."

To meet the requirements of this safety standard, safety switches are "buried" in the weapon's interior and two or more persons are required to be present whenever access to the weapon or the weapon system is permitted.

Much of the nuclear safety is dependent upon switches that will prevent electrical energy from reaching the nuclear detonating element of the weapon until the proper time. *These switches must be reliable.* They are designed, built and tested with the greatest possible precision and care to insure reliability. They are often *unique* in design and use—unique in the sense that the switch will operate only under certain conditions or that only certain operators may have the means of operating them. Certain switches cannot be operated by man and will not operate until the weapon senses an environment peculiar to its intended trajectory.

As already mentioned, the switches are controlled. Some are controlled by the mere fact that they are inaccessible. In other instances, it requires two or more persons, working as a team, each person taking independent action to operate the switch.

And, finally, there are *many* switches which must be actuated or caused to actuate before the weapon will detonate. In addition to switches that are directly associated with the weapon itself, there are switches and other physical controls of the complete weapon system.

Procedurally, one way that psychotics and saboteurs are guarded against is the enforcement of a safety rule requiring that no less than two persons—each of whom is capable of detecting improper procedures with respect to the task to be performed—be permitted access to the weapon or weapon system at any one time. The use of skilled technicians working together at all times in or about the weapon or weapon system is essentially a buddy system.

The third problem area is human error, and the third safety standard deals with this problem. It reads: "There will be positive measures to prevent inadvertent arming, firing or release." This is attained by:

- Having the switches locked or sealed in the appropriately titled *safe* position.
- The use of two or more controls.
- Having more than one skilled technician present when anyone has access to the weapon.

The same type devices outlined above to guard against a deliberate arming are used to guard against human error. Locks and seals prevent inadvertent actions. As shown in the illustration, a locking pin is inserted in the control knob which is in the safe position; the chain holds the pin and the seal. This illustration is from a T-249. The use of multiple controls to activate one switch is a double-check against human failing.

The solution to any of these first three problems and attaining the safety standards covering them lead to the design of mechanical safety devices and rigid safety procedures. Many of these devices and procedures "double in brass" and lead to the successful attainment of more than one of the first three standards; however, for maximum safety, considerable effort must be devoted to the fourth problem: security.

Without adequate security, both safe design and safe procedures can easily be overcome. The fourth safety standard states: "There will be positive measures to insure adequate security." There are several factors involved here, such as:

- Physical restraint of the weapon or weapon system.
- Security clearances.
- Restricted access to vital areas.
- Alarm devices .
- Armed guards.

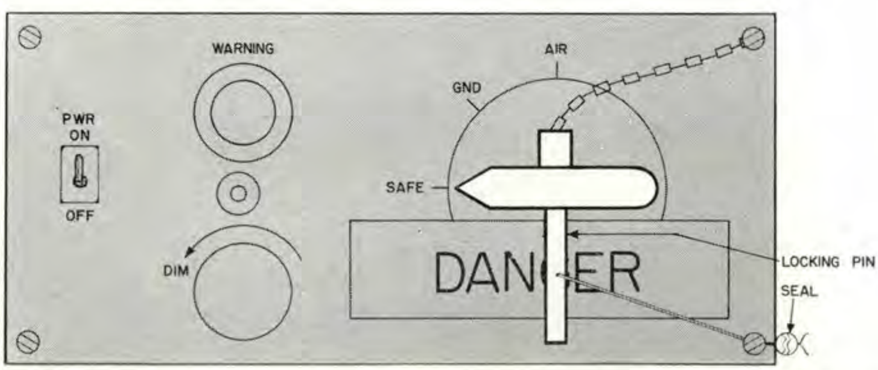
Physical restraint of the weapon is relatively easy to accomplish in the storage area. In the operational area this restraint is mainly the guarding of the aircraft or missile nuclear weapon system, as well as restraint through physical tiedowns and procedural security. As an example: the consent and action of several persons are required before a weapon system can be used. Until then, it is figuratively and in some cases actually *tied* to the ground.

Security clearances are a means by which reliable personnel are selected before they are trained in any phase of the atomic weapon program. This is a continuing process. Security clearances once received can just as easily be taken away. Restricted access to vital areas is authorized to properly cleared persons who have a need-to-be in the area.

Alarm devices are easily adapted to storage areas where control is relatively easy. As the weapon is moved to operational areas, more reliance is placed on armed guards. Guards can do the job as well or better than the most sophisticated anti-intrusion devices but at a larger cost in manpower.

So there we have the six milestones and four safety standards that apply to each atomic weapon. Unless approved positive measures have been incorporated into each weapon system to observe these milestones and attain these standards, the weapon system is not operational. ▲

T-249 Safety Device



CROSS FEED

LETTERS TO THE EDITORS

FSO Course at USC

In last month's magazine, Major Clay O. Keen cast his vote in favor of the Reserves attending the FSO Course at USC. Here is an extract of CONAC's reply to an inquiry in behalf of these officers:

"No training spaces have been allotted for Air Force Reserve Officers to attend subject course, although Hqs USAF has approved, in principle, attendance for those Reserve Officers who occupy Wing FSO positions. In view of limited number of spaces available each year this headquarters has established the following *priorities* for training members of Air Reserve Units:

- Those Air Reserve Technicians performing flying training duties at sites at which there is no active duty unit.
- Those Air Reserve Technicians performing flying training duties at sites at which there is an active duty unit.
- Those Reserve officers who occupy the Wing FSO Position.

In response to Hqs screening for FY 1961 requirements, this headquarters is requesting five spaces for Air Reserve Technicians, such personnel to attend schools in their civil service status."

Interested personnel who are eligible should apply through regular channels.

The Editor

Old Book—New Name

I am disappointed in the new name of our *Flying Safety Magazine*. Maybe I'm being a diehard but I feel that the missile business is a separate subject. The original intent of the publication is still "current" and the need greater than ever since flying has been curtailed in many units. I have enjoyed FLYING SAFETY during most of its seventeen years and sincerely hope to see it continue for many years to come.

Capt. John W. Harris, USAF
Homestead AFB, Florida

Some others feel much as you do, Captain, but since budgetary limitations prohibited a separate missile magazine the next best move seemed to be a changeover to include material pertaining to missile, nuclear, and ground safety research. Take a look at the masthead of the August issue.

Visor Down

Throughout my pilot training and especially during fighter-bomber training at Williams, I was encouraged by my instructors to wear my helmet visor down at all times when flying visually. This would not only afford protection from glare but also from shattering canopies or windblast during ejection.

Since I've been in SAC, however, on two different occasions at two different bases, I've been told by an IP that I should not use the visor except for bailout. On one occasion the IP said he had been told by the flight surgeon that the visors were hard on vision.

Personally, I've never found a comfortable way to wear regulation flying glasses in conjunction with an oxygen mask, especially on long flights. I don't like to think about the harm these glasses would do to my vision if I were ever hit in the face with anything while flying or during bailout.

This is the long way to ask a short question: Is the helmet visor harmful to vision if kept unblemished? Can it be worn without ill effect during all phases of flying where glare exists? Does the benefit gained by crewmembers wearing prescription glasses overbalance the possibility of what might happen if struck in the face while wearing these glasses during an unexpected inflight emergency?

1st Lt. Dennis C. Watson
338th Strat Recon Sq
Forbes AFB, Kansas

Aero Medical Safety's reply to your inquiry is that colored helmet visors or sunglasses have the same general purpose: to cut down glare. Normal use of either will not damage the eyes under any circumstances regardless of light intensity, but be sure they are clean and free of scratches. Of course, neither sunglasses nor colored visors should be used when light intensity is low since this will decrease ability to see. If time permits, lower the visor before ejecting. Do not fear eye damage from a broken visor during parachute descent, but be sure to raise the visor before landing.

Tunable UHF Radios

In the May issue, Captain Borden of the New Jersey ANG had a query about a Tech Order pertaining to tunable UHF radios for T-Birds. The answer is T.O. 1T-33A-573, dated 15 February 1960, "Replacement and Relocation of ARC-27 Command Set Controls for T-33A-5LO and T-33A-10LO." Kit delivery was to begin 31 March and be completed by 1 January 1961. The modification, to be accomplished as scheduled by AMC, allows both 20 preset channels and manual tuning.

Hope this information is of some help.

Captain John S. Lipsit,
Hq 1608th AB Gp, Charleston AFB, S.C.

Thanks for writing. Undoubtedly, this Tech Order has made its way to the New Jersey ANG Base Ops by now.

Sherlock USAF Type

The value of safety must be known and understood by *all* Air Force personnel. I don't separate flying safety from ground safety in any respect. What I can not understand is why would members of the USAF condone the expenditure of such a deluxe tower like the one pictured on pages 14 and 15 of the May issue—the article "A Room With a View"—and completely ignore ground safety. I refer to the wall plug but this is not an isolated case by any means. We should improve planning and look closer at the design of new buildings and facilities.

Your magazine is a Godsend to us all. Thanks for your efforts.

MSgt Robert Miskimen, USAF
Parker, Florida

You're so right about flying and ground safety; one's as important as the other. Thanks for taking the time to write and for the kind words about the magazine.

Frequency Cards for T-Birds

I was very impressed with Captain Ihde's letter concerning UHF Frequency Cards for T-33 aircraft (Crossfeed, March 1960). His comments on arranging the frequencies in numerical order instead of in Channel number are very good. He brings several safety factors to mind which certainly shouldn't be overlooked.

We at Kirtland agree heartily with him, since we have been using this system on all our support and test aircraft for approximately two years. I've been so used to this system I hadn't stopped to actually consider how "unusual" it was. I thought perhaps it was SOP.

A/2C Robert F. Green
4925th Test Gp (Atomic) ARDC
Kirtland AFB, New Mexico


Mal function
Mighty Mal, the Missileer,
Grooms his dart while thousands cheer.
History making hour is nigh,
First time spaceman makes the try.
Generals squirm and watchers gawk.
Mal says, "Just like Sunday walk."
Lo! The blockhouse lights the wick,
Man should orbit super quick.
?
PLOP
Rocket equals Wilbur's flight,
Spaceman makes a sorry sight.
Cause shows clear in small black box,
Mal spliced oil line into LOX.