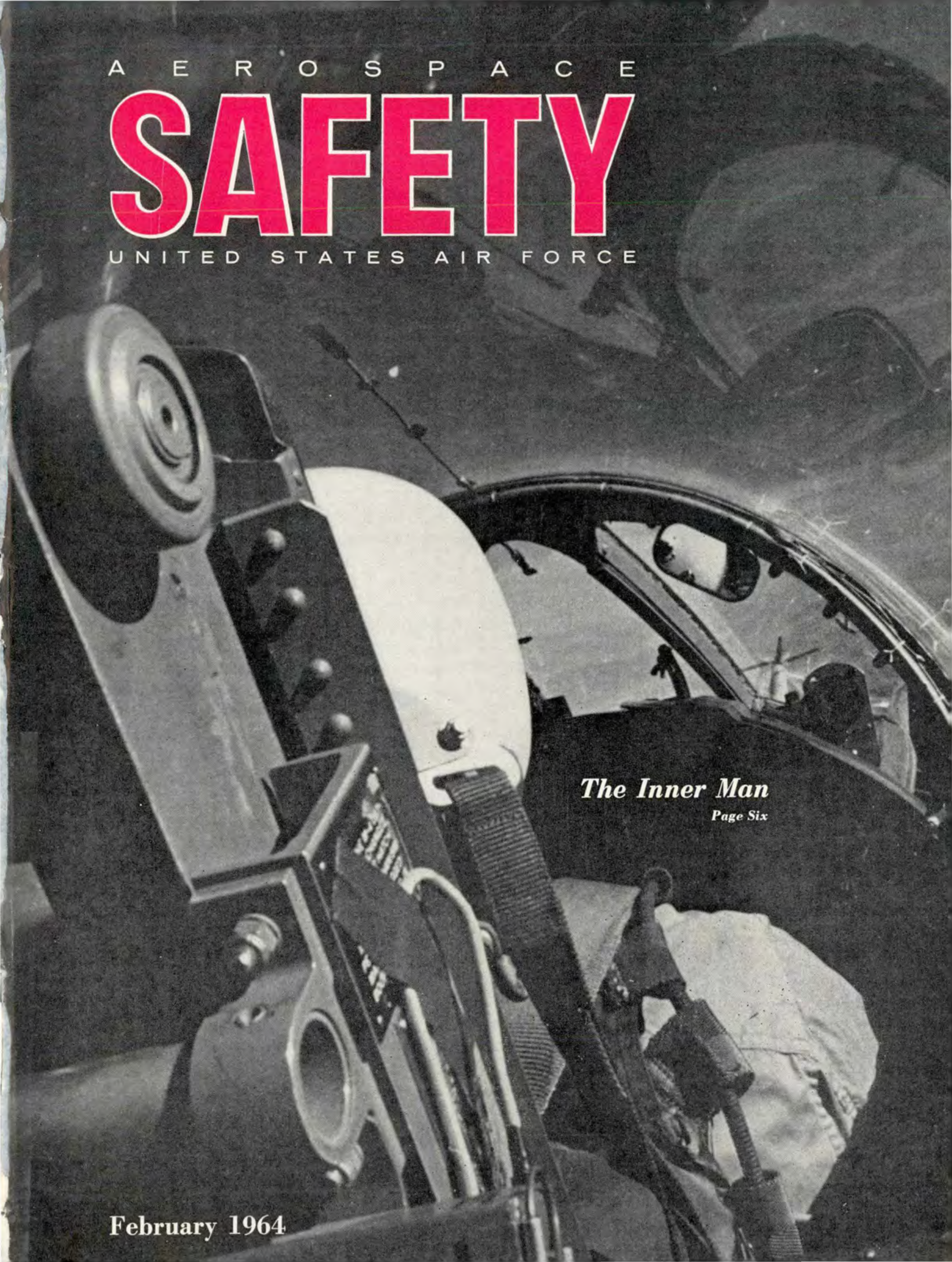
A E R O S P A C E

SAFETY

UNITED STATES AIR FORCE



The Inner Man

Page Six

February 1964

EDITORIAL

Seven Million Dollar Switch

When Center called, the pilot in the right seat responded by pressing what he thought was the mike button on the yoke. Immediately the cockpit was flooded with white light. Quickly he raised his left thumb. The light went out. He pressed with his right thumb; the familiar click of the transmitter opening came through the headset and he answered Center's call. He was an aircraft commander who did most of his flying from the left seat. The mike button on the left wheel is on the left side, and just the opposite on the right wheel.

The task was an operational check of a tail hook modification. One mechanic was seated in the cockpit. Upon instructions that he actuate the tail hook down switch he inadvertently actuated the wing tank release switch. Both external fuel tank jettison systems were actuated. The tanks fell to the floor, ruptured, and a major fire resulted. By the time the fire was out two first line Century Series fighters had been destroyed.

SEVEN MILLION DOLLARS!

Why?

In each case a perfectly normal human reaction resulted in actuation of wrong switches. In one a cockpit was momentarily bathed in white light; in the other the result was a seven million dollar fire. The reason is well known under the common human behavior pattern dubbed "Murphy's Law." The frequency with which the law is exhibited is somewhat in direct proportion to the ease with which it can be accomplished. (Most inadvertent gear retractions after touchdown occur in aircraft with gear and flap handles of like shape and in close proximity.) Another Murphyism goes something like this—make it possible to do it wrong, no matter how difficult, and someday, someway, someone will do it wrong.

The blame? Everyone has been blamed, from the man who actuates the switch to some unidentifiable individual way back who designed the system.

But blame only irritates those accused; it doesn't prevent accidents.

The real accident prevention objective is to effect a cure.

The cure?

It's pretty obvious by now that not much will ever be accomplished in the way of remodeling man. He's probably going to continue to inadvertently actuate wrong switches as long as he can reach them. It should be just as obvious that mere knowledge of the Murphyism trait will not help—certainly the defeatist attitude "this sort of thing happens every once in a while, you've got to expect it," won't do the trick either.

One thing that will help is to make the wrong act more improbable: by changing size and shape of actuators, use of guards, safety wires, physical locations distant from other actuators that can be disastrously confused (bathing the cockpit in white light at night is probably more annoying than dangerous). Pointing the finger at the designer won't do it.

A genuine team effort will help. Everyone, from the designer on, must consider this hazard. There are a lot of mods, many of local nature, that bear watching. Anyone who ever sits in an airplane cockpit and actuates any controls must understand what he is doing, and the hazards inherent in actuation of other controls. Whenever operations personnel discover a potential of this nature they must brief all their potential "Murphys" and inform higher headquarters through operational hazard reports or other communications media established for such purposes. Inadvertent drag chute jettisonings were good examples—the normal human physiological action of turning the arm as it is drawn toward the body was the cause.

Modern weapon systems combined with human beings make this "inadvertent action" cause factor a real challenge. But every once in a while because of look-alike, feel-alike, work-alike controls, an accident occurs, like the seven million dollar fire, that makes everyone's effort worthwhile. ☆

IN THIS ISSUE

FALLOUT

HEADQUARTERS
AIR FORCE FLIGHT TEST CENTER
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
EDWARDS AIR FORCE BASE, CALIFORNIA 93523

REPLY TO ATTN OF: FTFOF

SUBJECT: Aerospace Safety Magazine, December 1963 — 29 Nov 1963

TO: Aerospace Safety Magazine
Major Thomas J. Slaybaugh, Editor
Norton AFB Calif 92409

1. We hope that accident boards operating under your auspices have a clearer picture of accident causes than is indicated by your Rex Riley cartoon in the December 1963 edition. In your drawing, the accident board determined the accident cause to be; pilot failing to maintain listening watch on guard channel and failing to take proper action after the "no contact" time expired.

2. In our combined opinion, one of the most unsafe practices continued within the Air Force is allowing GCA to require pilots to make frequency changes after an approach is started. Had this not been required of the B-57 pilot in your cartoon you would not have had a subject for the cartoon.

TEST PILOTS AT EDWARDS AFB

DECEMBER COVER

The cover picture for December was furnished by the San Bernardino Sun-Telegram Company. This courtesy is greatly appreciated, and delay in acknowledgment is regretted.

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Volume Twenty Number Two — USAF Recurring Publication 62-1

THERE'S TIME TO THI*

More than a few accidents and near accidents point up the fact that action is being taken more on the basis of instinct than methodical thought. And, when this is the case, a livable emergency can become less so. To wit:

On a routine transocean flight one of the engines of a four-engine transport failed. During the course of the engine failure checklist the engineer inadvertently pulled the firewall shutoff control on one of the other engines. This wasn't discovered until that engine began running rough. By the time this mistake was discovered the engine had failed and it too had to be shut down. Instead of a routine three-engine flight to a suitable field a harrowing two-engine flight of nearly 1000 miles resulted.

In the article "Two Minutes to Disaster," which appeared in this magazine in July, primary cause of the major accident of a twin-engine transport was attributed to "Inadvertent application of full carburetor heat on operating engine resulting in loss of power and ground impact." This occurred during performance of engine failure procedures after an engine had been shut down shortly after takeoff.

Then there were the U-3 troops who lost an engine and quickly ran through the "Engine Failure, Flight procedure—so quickly that almost before they knew it they had feathered the prop on the good engine. Their opposites might have been the U-3 crew who watched their fuel supply dwindle and dwindle and dwindle as they flew along above the overcast until finally the little engines experienced fuel starvation symptoms during the penetration.

To get back to the sergeants who engineer the beasts, here's one of the more recent TWX'd accounts: During climbout, at 2500 feet, the engineer reported oil quantity was dropping on Nr 2 engine. Oil quantity continued to drop to approximately nine gallons with oil pressure below minimum. The pilot instructed the copilot to feather. Fuel dumping was initiated. During engine shutdown and cleanup procedure the engineer inadvertently retarded the mixture on Nr 3 engine. He reported his error to the pilot and attempted to restart the engine. The aircraft began to lose altitude at the rate of 500 feet per minute, even though maximum power was used on Nr 1 and 4 engines. Successive attempts to return Nr 3 mixture to autorich resulted in severe engine backfiring. Loss of airspeed and altitude continued and full external wing tanks were jettisoned to reduce gross weight. The flight engineer reduced the throttle setting and RPM on Nr 3 and subsequently obtained normal operation of Nr 3 but not until the aircraft had descended to 200 feet. With power on Nr 3, a climb was established and a normal three engine landing culminated the flight.

In the don't-think-before-you-speak category was the case of the pilot of the twin-jet job who experienced a dual flameout at altitude. When he reported his dilemma to the ground controller he was given the classic, "Stand By." This is a case wherein the aircraft exerted the pilot's emergency authority and down he came. It's not fair to our readers to leave this one in mid air so we will add that, at lower altitude, he was able to get relights.

In another case the crew converted their troop transport into an unintentional cotton picker by running it to a final stop in a field after loss of an engine during a low level mission. They never got around to completing that portion of the checklist that stipulates, "Cowl flaps, inoperative engine, Closed." Landing was made with cowl flaps full open.

Pilots of a jet trainer, low on fuel, made low go's because of traffic. Finally they ejected—fuel exhaustion. A parallel runway, suitable for emergency landings, remained unused.

Of course, inadvertent gear retractions are legend. They have occurred with sporadic regularity on all types of aircraft ever since the state of the art "progressed" from fixed gear. The crutch used to explain these was, for a long time, the proximity and similarity of gear and flap controls. Something new has been added—the drag chute. Here are some "for examples:"

NK

The F-105 touchdown was rated excellent—1200 feet from the end at 170 knots. After rolling 1300 feet the pilot inadvertently raised the gear handle (round knob that actuates in a vertical direction) in lieu of pulling the drag chute handle (a handle marked "drag chute" that operates in a horizontal direction.)

The student pilot in the TF-102 had difficulty locating the drag chute handle by feel after touchdown and inadvertently pulled the gear up instead. An extremely rough runway got credit for an assist on this one since it allowed the landing gear safety switch to become deactivated.

Here's one who was almost quick enough to avert that "awful scraping sound."

An F-101 jock, after pulling the gear handle instead of the drag chute handle, reacted by slamming the throttle forward and the gear handle back to the down position. The bird became airborne and the left gear returned to the down and locked position. The right gear started down, but was prevented from falling into position and locking because the right wing was too low. The right wing began dragging, the aircraft settled, veered to the right and finally stopped.

Share the plight of this crew. At 600 feet, after takeoff, an explosion shook the aircraft and fire enveloped the Nr 2 and 3 engine nacelles. The copilot reported, "visible fire and flame on engines 3 and 4." The pilot retarded Nrs 4 and 5 to what he thought was "Idle Stop." Instead, he went to "Cutoff." The pilot said he could see no fire on Nrs 4 and 5, but the tower and the copilot still reported fire. The pilot then noticed fire in Nrs 2 and 3. He shut these down. An attempt to restart Nrs 4 and 5 was unsuccessful. Altitude was being lost on the two-engine powered aircraft. The "prepare to bailout" order was given. As the aircraft stalled the crew ejected.

Sometimes, just sitting on the ramp, quick actions can cause trouble. The copilot, holding the checklist on his lap and using a flashlight to read by, read, "emergency power switch." He reacted by reaching for and actuating the "emergency gear switch." The aircraft settled on its fuselage. There was conjecture in this case that adherence to proper procedures, i.e., pins installed, might have averted this one.

There are at least two or three other examples, older, but probably worthy of repetition because they are so unusual.

A transport crew, bothered by the sound of the gear warning horn and the glare of the red light in the gear handle while making an approach, solved these two annoyances by, respectively, turning off the horn switch and placing a paper cup over the gear handle. End result—a short runout and lowered profile cost the Air Force quite a few dollars and use of a transport for several days.

In another case, this too a transport, the pilot is alleged to have looked across at his morose copilot during takeoff roll and suggested, "Cheer up." He got "Gear Up."

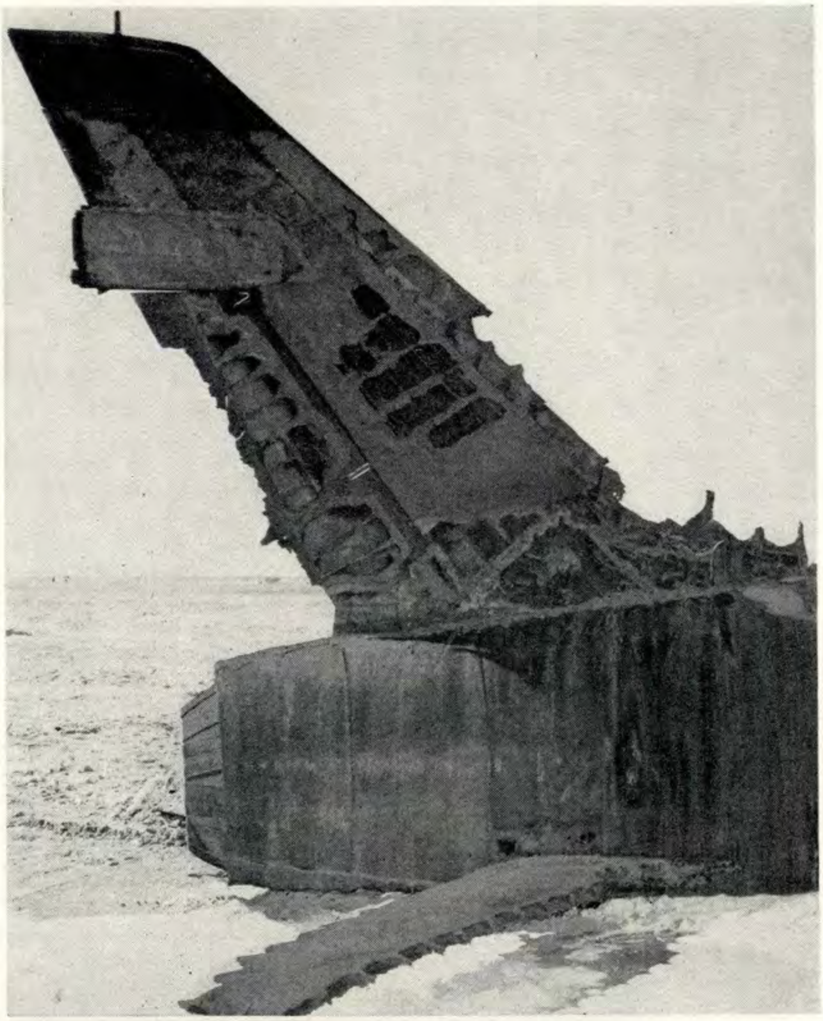
One more. The new owner of U-3 type equipment flared for landing, heard a horn, reacted to that quick fear of a gear up landing by initiating his go-around procedure. He got as far as advancing power and pulling the gear handle up, then remembered—the stall warning horn. Of course! He relaxed, retarded the throttle and DID land gear up.

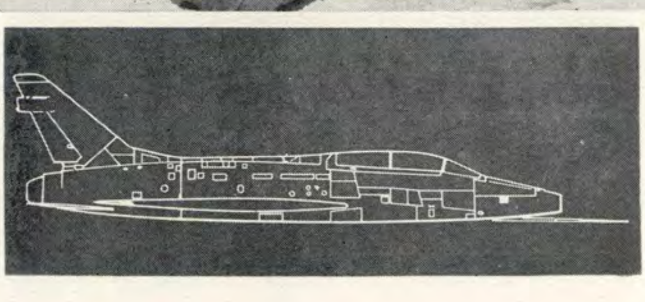
Were there any simple, clear cut solution to accidents of this sort it would surely have been applied long ago. Suggestions provided the writer during an impromptu poll of IPs and project officers during preparation of this article fell primarily into these categories:

- Think
- Use checklists
- Know your aircraft and aircraft systems
- Practice, practice and practice until proficient.

One thing stands out in many accidents of this type—action taken by a crewmember *aggravated* the seriousness of the emergency, or turned a routine situation into an emergency situation. The emergency in which instinctive reaction must be taken, even before there is time for thought, is rare indeed—if it exists at all. ☆

Find the Fault





During the first six months of 1963, 12 major accidents occurred in the F-100 fleet which were characterized by loss of aircraft control. In 11 of those accidents the pilots were killed and had made no transmissions prior to impact. Investigations were failing to identify the causes for the accidents, although possible or most probable causes were determined to be pilot error, pilot incapacitation, spatial disorientation, or malfunctions in the flight control system. Research into each of the accident reports by the Directorate of Aerospace Safety produced no valid findings upon which to make recommendations for corrective action or fixes.

One day early in August, there were two additional F-100 accidents in which loss of pitch control was experienced. One malfunction occurred at altitude and the pilot safely ejected. The other occurred while the aircraft was in formation at 2500 feet, and the pilot was killed.

An assistance team, consisting of personnel from the Directorate of Aerospace Safety, SMAMA, MAAMA and flight control and airframe representatives was dispatched to assist in the investigation of the latter accident. No specific determination could be made because of impact damage and salt water corrosion. But significant operational and maintenance practices that adversely affected aircraft control were discovered.

At the request of the major command, the team evaluated autopilot and flight control maintenance practices at all F-100 bases within the command, for the purpose of deter-

Maj Clarence H. Doyle, Jr.,
Directorate of Aerospace Safety

mining whether these practices might, in some way, be influencing or inducing situations where lack of aircraft control is suddenly experienced. The team then visited F-100 bases in other major commands, looking specifically into autopilot/flight control maintenance and operational practices. Findings and recommendations are being published in a report to be disseminated to all F-100 using commands. Some of the general interest findings are as follows:

Pilots were not ground checking yaw damper and autopilot systems in accordance with Flight Handbook instructions. In most cases, pilots were not provided with checklists to perform this check and were not familiar with correct procedures. The Flight Handbook abbreviated checklist does not contain this check because instructions and procedures are contained in Section IV and not in Section II.

The autopilot function of the Automatic Flight Control System (AFCS) was infrequently used at nearly all bases due to lack of mission or training requirement. Wings committed to long overwater flights did attempt to peak up the AFCS prior to deployment. At all bases visited pilots generally expressed a lack of confidence in the reliability of the system and indicated little mission requirement existed for its use.

Pilots were generally vague on what constituted an autopilot discrepancy and were unfamiliar with tolerances in heading and altitude modes, oscillation limits in pitch and roll, etc. Their writeups were not concise or accurate, resulting in maintenance personnel not being able to effectively clear the discrepancy. In most instances, pilots were not afforded a maintenance debriefing by an autopilot specialist.

Pilots were generally unaware of the function of the AFCS Hydraulic Engage Switch, and of the added safety factor it provides (High Wire aircraft) in the event of an inflight malfunction.

Trouble shooting techniques to correct autopilot/flight control malfunctions were generally ineffective. This was most evident where the pilot experienced an airborne malfunction that affected aircraft control. A random, uncoordinated approach to clear these discrepancies frequently resulted in the cause for malfunction not being identified. In some cases corrective actions indicated on maintenance forms could not have corrected the malfunction.

Badly deteriorated wiring in non-High Wire aircraft was in evidence at all bases visited, but was more acute in USAFE aircraft. Deteriorated insulation in wire bundles can cause spurious signals and unwanted inputs to be introduced in circuitry affecting aircraft control, i.e., gradient changer, trim, or pitch correction circuits, and inadvertent engagement of portions of the AFCS.

Review of autopilot checkout procedures in periodic inspections and flight line maintenance indicated organizations were not using standard procedures and methods.

Conclusions reached by the team are as follows:

F-100 pilots in all using commands are experiencing inflight incidents and accidents involving the AFCS/flight control system that cannot be readily explained.

The F-100 AFCS/flight control system is a complex integration of electronic, hydraulic and mechanical components and systems that are so interrelated that the entire system must be operated, checked and maintained as an entity.

Since the autopilot is rarely used on local training missions, the autopilot portion of the AFCS is activated infrequently. This results in defective and/or maladjusted components developing without the knowledge of operator or maintenance personnel.

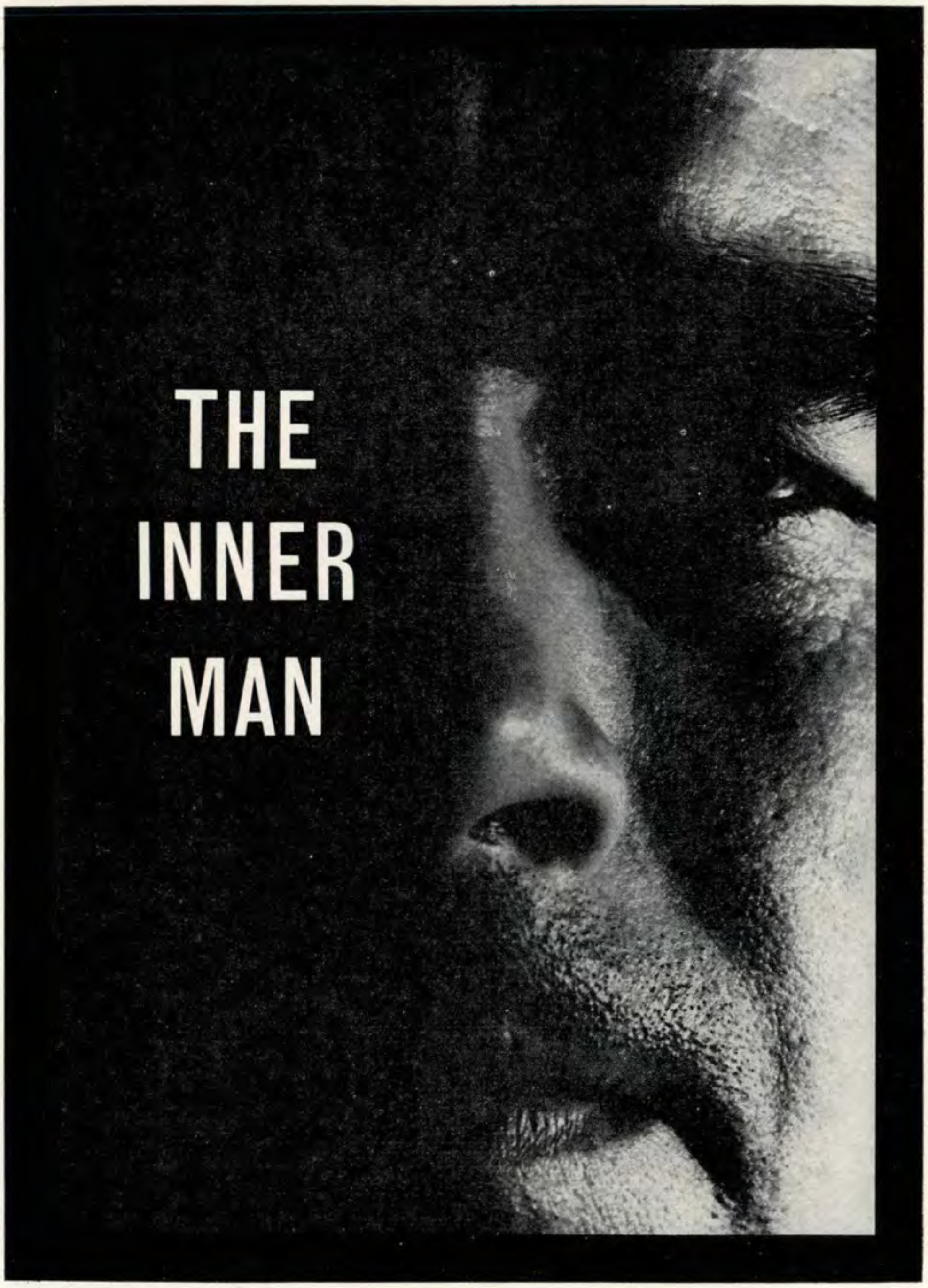
An accumulation of defective parts, components and/or systems out of adjustment which are unexpectedly brought into play by an inflight malfunction can result in unexpected flight control forces which the pilot may not be able to control.

Badly deteriorated wiring in non-High Wire aircraft contributes to the unreliability of the AFCS/flight control system and substantially increases the possibility of the type of malfunction outlined above.

The inadvertent engage circuitry feature of the High Wire modification provides a substantial increase in safety of flight when malfunctions occur.

The AFCS cannot be safely deactivated without degrading the operational capability of the aircraft. Therefore, proper maintenance of the integrated AFCS is essential.

Actions currently being taken by all command levels and appropriate AMAs should result in a much improved and reliable F-100 aircraft. ☆



THE INNER MAN

Anchard F. Zeller, Ph.D.,
Directorate of Aerospace Safety

The sun was shining brightly on fluffy white clouds. Patches of green showed through some 25,000 feet below. Rays from the sun were picked up by scattered distant rain showers and reflected as rainbows, adding to the beauty of the day. It was a great day for living. Three minutes out a fighter pilot routinely contacted approach control and requested an ADF penetration. He was instructed to descend to 20,000 feet. He was next asked if he would accept a VFR descent to 5000 feet and was then instructed to descend to that level and await further instructions. Eight minutes later the pilot reported passing through the 5000-foot level, and when queried one minute later confirmed this altitude. This was the last communication received. Two minutes later a witness saw the aircraft strike the ground.

Scratch one aircraft. Scratch one pilot.

An attractive young woman sipped her drink and stared into space. Her preoccupation was such that she failed to notice the chaplain insignia of the stranger who approached her. A few quietly spoken words, dawning realization—the striking truth—a wife had lost a husband and four children a father.

An accident, with its aftermath of death, destruction, and human sorrow, is an unfortunate thing. Can some good come from even the most tragic? Yes, if lessons are learned and others prevented from falling into the same trap.

An accident board composed of honest, hard-working specialists could find nothing to pin-point the cause. After thorough and painstaking evaluation, the most likely cause became merely a statement of the obvious—the pilot lost control of his aircraft during approach and crashed. Yes, this was the cause—but why?

True the day was beautiful, but was the pilot in a position to appreciate its beauty? It had been almost a year since he and his wife had separated. During that time a new baby, now four months old, had been born. What conflicts tear at the soul and distress the mind when grave personal decisions are at stake? He knew that his wife would be waiting . . . waiting for a show-down. Would she be drinking? Drinking had been one of the problems which had led to the separation. Would any of the children be with her? What of their future? Are incompatible parents better than no parents at all from the child's standpoint? And then, the problem of religion. Had seemingly minor differences in faith at the time of marriage been aggravated to the point of being a factor in incompatibility? Were such considerations in the pilot's thoughts as he approached the forthcoming meeting?

It cannot be determined that any of these thoughts flitted through the mind of the pilot as he made his routine transmission and prepared for landing. If any did, their effect on an experienced, capable pilot in a routine flight termination can only be surmised. This is an all too familiar story. Only in retrospect can the problems which prey on a man's mind be related by inference to a faulty decision which led to his death.

When a bolt fractures, a line breaks, or a circuit fails, objective tests can often positively determine the difficulty. Once the problem is determined, corrective action can be initiated. Further observation determines the validity of the remedial action. So progress continues. But how does one determine that personal problems cause errors of commission or omission which in turn cause accidents?

It would be much more comforting if such a relationship could not be demonstrated; because, once demonstrated, the uncomfortable necessity of definite corrective action presents itself.

Take another case—a young pilot undergoing transition upgrading training. Takoff was initiated for a routine two-ship formation flight. Two thousand feet down the runway Mobile Control noted that the afterburner had failed to light. This information was transmitted to the pilot but was not acknowledged. The aircraft crossed the overrun still not airborne with the nose high and the tail dragging. Three times the aircraft bounced into the air and returned to the ground. On the fourth bounce the aircraft disintegrated against a tree and burned.

Again a wife was waiting—eight months pregnant in a strange town in a country where the people spoke a foreign tongue. Again the sorrow for a husband lost and a child who never would know its father.

But how does this relate to personal problems? The pilot was known to be anxious concerning his wife's condition. He had arranged to complete his transition in approximately one-third of the required time. He had not only volunteered but had actively initiated efforts to take every flight possible in order to expedite program progress. Was a calculated chance taken in attempting a takeoff without afterburner in order to avoid losing a flight? Not all incidents are so dramatic. Embarrassment—an aircraft damaged—a gear-up landing—one of the most aggravating problems which the Air Force faces. Here's another. As usual, the pilot could offer no good explanation. On turn to final he had reported the gear down and locked. A normal landing was then accomplished; normal except that the gear was up.

Again why blame personal problems? The pilot concerned was known to be having marital difficulties. A short time previously he had experienced an automobile accident, when he had turned left directly in front of an oncoming car. Some time prior to the flight which terminated in the gear-up landing, it had been noted that he appeared confused and his speech disorganized. Were personal problems involved? Who can definitely say? Is there a better explanation? Perhaps. It was the pilot's third approach; possibly he recalled putting his gear down previously. Other pilots, however, land successfully following multiple approaches involving repeated lowering of the gear; so personal problems remain suspect.

More examples? Take the case of. No, . . . this approach has contributed about all it can. How about statistics? Solid numbers lend respectability to any thesis. If assiduously used they can sway even the most skeptical.

Good statistical support requires only three things. First, the number of accidents attributable to human error; second, the number of these in which personal problems played a part; and third, in order to put this number into perspective, a determination of how many pilots who have personal problems do not have accidents.

At first glance a relatively simple task. Well known numbers appear to apply. To begin with, at least half of all accidents and probably as many as two-thirds are the direct result of human frailty.

Now how about the personal problem aspect? Here the problem becomes a little less clear. There are a number of occurrences where the individual experiencing the accident can be shown to also have had personal problems. But how about those who fly accident free? Do they also have problems. Of course they do. The problem now arises of determining whether this group has problems as acute or as frequent. Here the statistician polishes off his formulae, oils the machines, and eagerly

reaches for numbers to turn into a clear answer. Unfortunately, numbers are not forthcoming, so the mathematician washes his hands of the whole affair. What becomes of the problem? It's still there. Should an attempted answer resort to still more examples. No, because no matter how frequent the examples, and there are many, they will never result in conviction unless the individual is emotionally prepared to accept the fact that personal problems can be a factor and act accordingly.

Who can say for sure that a pilot who crashes unaccountably is distracted by marital tensions, financial worries, or philosophic conflicts? Yet each individual who examines his past will almost certainly attest to the fact that such distractions cause faulty behavior, lapses in attention, carelessness to detail, even recklessness. Now, do these cause accidents? Of course they do. So it is assumed as self evident that personal problems contribute to accidents without specifying to what degree this contribution is involved. Does this acceptance mean that a certain number of accidents are inevitable?

This brings into focus the requirement which it was hoped could be avoided. Namely, what can be done to prevent accidents caused by personal problems? The first step toward the solution in any problem is the recognition that the problem exists. Once each individual who may be concerned—this is everyone—accepts the fact that his personal problems may interfere with his efficiency, the battle is half won. Even though the problem of preventing accidents may not be solved directly, it may be attacked by indirect action.

There is a fine line between prying into someone else's affairs and showing one's concern. When one's problems become aggravated enough someone may offer help. An observant commander is in an excellent position to do so. The desire to avoid prying, however, makes such action difficult. Good friends are often in the same position. Professionals—Flight Surgeons and Chaplains—often have fewer compunctions about prying but are not usually in as good a position to note behavioral changes.

The result is that most of the time each individual must act as his own counselor. After all, in many instances who else knows? Everyone dislikes admitting weakness. There was a time when it was difficult to persuade some pilots that it was necessary to use oxygen for high altitude flight. The inability to stand the rigors of such flight without the use of oxygen was considered weakness. This was sheer folly. As everyone is adversely affected by oxygen depletion, so everyone is affected by emotional upset. The recognition of this truth will do much to overcome the feelings that failure to operate at peak efficiency in the face of severe emotional problems is a unique individual weakness. It is rather a universal limitation of the human race. The wise self-counselor will consistently seek help when not in optimum condition to cope with his problems. The genuine sympathy, understanding and practical help forthcoming when help is asked for is most gratifying.

Remember, there are seldom any problems as acute as those which follow an accident. ☆

If it says AFRES or ANG, anticipate . . .

FACILITIES LIMITED

You think to yourself that this is a real professional operation. The approach controller seems to anticipate your every requirement. He provides vectors, works you down to pattern altitude, sets you up on ILS final. You marvel at his skill. He talks constantly. If there were one more aircraft on the frequency you are sure he couldn't handle the traffic. You find yourself trying a little harder. Your acknowledgments are brief and crisp. You appreciate good service, and you try to show your appreciation by flying exact headings, altitudes and rates of descent.

You are in the clear now, the runway lights straight ahead. "You are 10 miles out on ILS final for runway 32. Switch to tower, channel 236.6, now."

"Roger, going to tower, 427," you acknowledge and change frequencies.

Tower's frequency is also jammed. You listen for a pause and report, quickly, "Air Force 15427, ten out for 32."

"Roger, Air Force 15427, report three miles. Lights on, please."

You oblige. At three miles you call with the gear and are cleared to land. Three runways are in use. Blinking red beacons and pairs of white landing lights are in every quadrant. You are cleared all the way and given the ground control frequency for use after clearing the runway.

Ground control is busy too. He sends you off in the direction of the military ramp. You leave the lighted area and slow your taxiing. Finally, you come to an intersection. Which way? "Ground control, Air Force 15427. Is there a Follow Me?"

"Negative, Air Force. You are on your own."

From here on out you find out what "on your own" really means. There is no one to help you. You follow a taxiway until you find a ramp with a few C-119s, C-47s and a pair of T-33s on it. Nobody meets you. There isn't a light in sight. Finally, and slowly, you select a spot and park alongside a Gooney Bird. "Hey, Sarge, we got any chocks and tie down ropes?" you ask.

Finally you get everything shut off. You leave the brakes set because you have no chocks and you hope the wind doesn't get too strong because you have no tie down ropes. It's a long walk to the dark hangar. Your B-4 bag bumps against your leg and you change hands as your arm tires.

You head for a small door at the end of the hangar and find that you haven't been completely forgotten after all. There is a piece of paper fastened to the glass and with the aid of the engineer's flashlight you read "INFORMATION FOR AIRCREWS ARRIVING AFTER NORMAL DUTY HOURS." That's you. You follow the instructions and go down a darkened hallway until you come to an office with the sign, "Base Operations." The door is unlocked, and pasted on a window inside is information that, if followed, will get you by.

You learn that the white phone is a direct line to FAA Flight Service, and you are to use it to close your flight plan. The sheet also says that aircraft servicing can only be accomplished between 0800 and 1630, that maintenance is extremely limited and parts and personnel from the transient aircraft's home station will have to be flown in for specialized maintenance. There are neither quarters nor messing facilities. Motels and hotels that give military rates are listed. Pickup service is provided by some, with the numbers to call beside them. Six nearby eating establishments are shown, with the notation on two that they are open 24 hours. You note too that upon departure flight plans must be phoned in to Flight Service and after takeoff it is the pilot's responsibility to report his off-time and request that his flight plan be started by calling a nearby radio facility.

The above is representative of many civilian airports on which a Reserve Forces unit is located. But all this need not come as a complete surprise. Check the Enroute Supplement, Airdrome/Facility Directory section. If it says (AFRES) or (ANG) you can anticipate just such a situation as depicted in this article. Be sure and read all the information. Mondays and Tuesdays are the Saturdays and Sundays for many such facilities. Most of these units are not authorized sufficient personnel to permit 24-hour (daily) operation. You do get good service during normal duty hours, and, with advance notice, when you are on official business involving the unit on that base, they will go to extra effort to give good service, even after normal duty hours.

It's like a lot of other things; if you plan ahead, then use your head, you can operate into and out of Reserve Forces installations safely and efficiently. ☆

Flying in SEVERE TURBULENCE

ED NOTE: The following article deals specifically with commercial aircraft, the Boeing 707 and 720B. The information, except for representative speeds, altitudes and thrust settings, applies generally to all swept wing jet transports and bombers. Speed, altitude and thrust setting differences between similar military and commercial airplanes result from differences between military and civil flight regulations. Therefore, always refer to appropriate flight manuals for specific penetration information. The editors, courtesy of the BOEING AIRLINER, are reprinting this article in the interest of flight safety.

Recent incidents and data records from rough air encounters suggest the need for a refresher discussion of rough air flying techniques. An opportunity is thus presented to update the handbook procedural material to reflect the modern level of knowledge about atmospheric turbulence. To set the stage for such a discussion, it is perhaps useful to review, in skeletal form, the history of the development of rough air flying concepts. In the earliest decades of flight, low altitude flight was the rule, and weather was a dominating factor in deciding whether or not to attempt the flight. Flight speeds were not much greater than the gust velocities that might be encountered in severe storms. From the standpoint of blind flying, available instruments were inadequate, to say the least, and passenger comfort, while recognized as a desirable objective, was hardly a controlling feature of the flight plan. One might say that a totally smooth ride was highly unusual. In the later decades of the piston age, medium altitude flights became common, enroute weather became less of a factor, and transcontinental flight legs were longer, thereby allowing increased use of alternate courses to avoid weather and known severe turbulence. Radar became common for weather avoidance or picking one's way through stormy conditions, pressurized cabins increased the range of altitude available for attempting to avoid turbulence, flight through severe turbulence became less common, and normal flight speeds increased to values substantially greater than gust velocities which might reasonably be expected.

About this time, the rough air speed concept formally entered the design and operating practices of the industry. During this period, concern was largely centered on storm induced turbulence—the kind which can usual be seen—although the ability of later aircraft to operate occasionally in the lower fringes of the jet stream brought the early experiences with clear air turbulence. The higher speeds of the then current transports increased the risks associated with inadvertent penetration of severe turbulence and made it possible to penetrate further into regions of greater turbulence more quickly.

With the advent of the modern jet transport, the capability for flying over the weather was substantially increased. However, the need to climb and descend through the full altitude range remained. Although high altitude flight has been accompanied by increasing experience with clear air turbulence, most of the jet transport encounters with severe turbulence seem to be associated with thunderstorm activity. Reliable first-hand accounts by aircrews who have deliberately penetrated thunderstorms during the National Severe Storms Project or who have unexpectedly penetrated severe turbulence at other times, together with recording instrument data obtained during these encounters, has made possible a fairly accurate reconstruction of the events that occur. The observations which follow are based on an examination of these records and are intended to be helpful to those who may experience such encounters in the future.

In severe turbulence, two major concerns naturally arise in the pilot's mind. One is the concern of imposing excessive structural loads. The other is the concern that airplane attitude may reach undesirable extremes. Neither of these concerns is totally unjustified. On the other hand, the classical treatment of rough air penetration speed has perhaps placed too much emphasis on the structural aspects. Most pilots are well aware that flight through a given set of gusts at higher speeds will produce higher load factors or g's and a rougher ride for the passengers than a penetration of the same turbulence at a more moderate speed. The admonition to slow down to the rough air penetration speed when entering turbulence has only served to reinforce this concern. Engineering methods for computing the effects of turbulence on structural loads are well known for an airplane in level flight at the time of entry into the turbulence and, as a result, the classic discussion of the rough air penetration problem has tended to focus on such calculations and emphasize the structural significance of high speed entry.

The other major concern, namely that of control, is a much less scientific and less tangible problem and therefore is perhaps lost to some degree in the usual technical discussion. It is important to note here that there is a strong suspicion, if not specific evidence, that almost every structural breakup that has occurred in severe turbulence has been accompanied by a prior severe change in attitude and a subsequent combination of stresses resulting from both the recovery maneuver and the severe turbulence. The ride-smoothing qualities of the flexible swept back wing and the high wing loading of today's modern jet transport make it particularly likely that any structural damage which might occur in severe turbulence will be the result of a severe upset and/or recovery maneuver in combination with the turbulence, rather than the effects of the turbulence alone. Thus, the usual simple calculations illustrating the allowable gust magnitudes at different speeds in straight level flight are perhaps not sufficiently pertinent to the real problem. Rather, some relationship to an upset condition should perhaps be developed as the basis for defining operating techniques in severe turbulence.

AIRSPEED

In recent incidents where flight difficulties have been experienced while flying jet transports in severe turbulence, a common factor has been the reduction of airplane speed to a value that was close to or below the minimum speed formerly recommended for turbulence penetration. While flight at low speeds is satisfactory in moderate turbulence and may seem more comfortable, there are several disadvantages to flying at low speeds in severe turbulence. First, the airplane is closer to stall buffet and, since the angle of attack changes caused by severe turbulence can be high, there is a greater chance of encountering strong and alarming buffeting and the accompanying high drag that will cause loss of altitude and tempt the pilot to make undesirable thrust changes. Second, because the trim changes due to thrust changes are higher in the low speed region, because the airplane is flying on the back side of the thrust required curve at low speeds, and because the trim changes required to keep in trim as the airplane changes speed are greater when flying in the low speed region than when flying at higher speeds, the difficulty of maintaining adequate control is compounded. Also, it is easier for the airplane to be laterally and directionally upset at the lower speeds when turbulence is severe.

Because of the disadvantages of low speed flight enumerated above, it is now considered desirable to emphasize flight at somewhat higher speeds than formerly recommended. The speeds now recommended (Fig. 1) for all turbulence penetrations tend toward the high side of the range previously recommended. For simplicity it has been considered desirable to emphasize only one indicated speed, 280 knots or .8 Mach whichever is

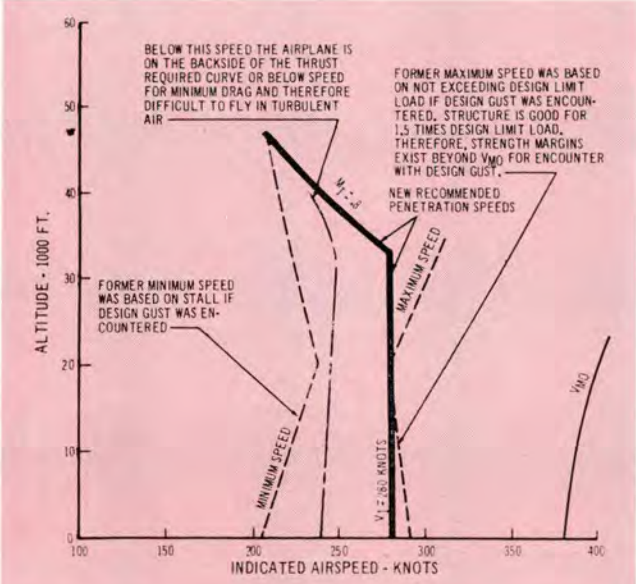


Fig 1. The new penetration speed is on the high side of the speed envelope previously recommended.

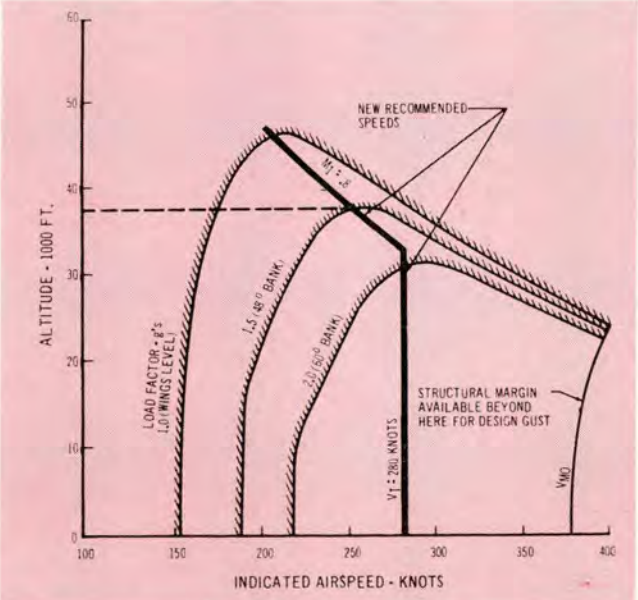


Fig 2. This chart shows the relationship between speed, altitude, and the load factor at which heavy buffet would occur. For instance, when flying at recommended penetration speed, heavy buffet would occur at a load factor of 1.5 at 37,000 feet.

less, as target speed with the realization that sizeable and rapid variations will likely occur depending on the severity of the turbulence. Above 35,000 feet a Mach number of .8 is recommended because of compressibility effects. M = .8 provides the maximum tolerance to high speed and low speed buffeting caused by any combination of high altitude, high load factor, and large gusts (Fig. 2).

The question then arises as to the general practices to be employed in attempting to hold within a reasonable variation from the target speed. Moderate variations, either above or below, are of minor consequence. Therefore, excessively abrupt or severe control motions should not be required, particularly when it is recognized that some of the fluctuation of the instruments is a result of the turbulence itself and does not necessarily represent a real change in the airplane's speed or altitude.

For the reasons previously enumerated, emphasis should be placed on flying on the high side of the target speed rather than the low side. However, it is considered highly undesirable to chase airspeed either with elevator or throttle manipulations since these efforts are usually ineffective and, as will be pointed out later, attitude should be the principal flight reference in turbulence.

ATTITUDE

Flying under extremely turbulent conditions requires techniques which may be contrary to a pilot's natural reactions. Rapid and large aileron control inputs are permissible to hold the wings level, but in extreme turbulence, pitch attitude must be controlled using only small to moderate elevator control inputs to avoid over-controlling or over-stressing airplane structure. The natural stability of the airplane will work in a direction to minimize the loads imposed by turbulence.

The pilot should rely to a major extent on this natural stability and not become too greatly concerned about pitch attitude variations. Since there is always the uncertainty of the direction, timing, and size of the next gust, it is often better to do nothing at all than to attempt to control airplane pitch attitude too rigidly. The moderate control inputs that are considered desirable will not always allow very precise attitude control. Ideally, elevator control should be applied smoothly in a direction to resist motions away from the desired attitude, and the elevator should be returned to neutral when the airplane is progressing toward the desired attitude. The above described technique will help prevent over-controlling, will reduce the size of pitch attitude excursions, and will result in less g loads than a technique which very closely controls pitch attitude (Figs. 3 and 4).

Pitch attitude should be controlled solely with the elevator, NEVER with stabilizer trim. Rapid changes in airspeed and attitude due to extreme gusts and drafts make stabilizer trim difficult to apply effectively. Also, any updraft or downdraft which might tempt the pilot to change trim can be expected to reverse itself in the next few seconds. If trim has been applied to counter the first draft, the second draft, which will likely be in the opposite direction, will exaggerate the out-of-trim condition. It is therefore considered desirable to LEAVE THE STABILIZER TRIM ALONE in severe turbulence.

THRUST

Once the proper thrust setting for the speed recommended for penetration is achieved, it is generally undesirable to make thrust changes during severe turbulence encounters. Large variations in airspeed and altitude are almost certain to occur in severe turbulence, and simple rules of thumb for setting thrust are not universally applicable for all altitudes and weights. The most desired thrust setting is one which will provide near level flight at the recommended penetration speeds in smooth air. In an emergency, however, an initial N_1 setting (for 720B series only) of approximately 93 per cent will be satisfactory at high cruise altitudes, and an initial setting of 84 per cent will be good at 10,000 feet. The most important objective is to obtain an initial thrust setting reasonably close to the correct one.

ALTITUDE

Because of the very high velocity updrafts and downdrafts in severe turbulence regions, large variations in altitude are almost certain to occur. Too much concern about these variations will merely lead to excessive control manipulations causing large g load variations and unwanted airspeed excursions. Altitude should be allowed to vary within reasonable bounds. At high altitudes or during high-speed cruise at intermediate altitudes, turbulence encounters may produce high speed buffeting (Fig. 2). The airplane has been flown into the high-speed buffet regime many times during flight tests in the process of determining and evaluating its qualities under these conditions. No unusual flight characteristics have been noted. However, to the uninitiated, the buffeting or shaking might be disconcerting, being somewhat similar in nature but more severe than the shaking that occurs under some conditions when speed brakes are extended.

When experienced in combination with severe turbulence, these effects might easily be incorrectly diagnosed as increased severity of the atmospheric disturbance, and result in an exaggerated assessment of the seriousness of the situation. Experience to date has shown that severe turbulence encounters at high altitude have caused positive g's as high as 2.5. However, it is believed that if the recommended attitude control procedures are followed, high load factors need not be imposed. Even though these procedures are used, an occasional encounter with high-speed buffeting in unexpected severe turbulence may be unavoidable above 35,000 feet. Such an occurrence should not be cause for great alarm nor be misinterpreted as a low speed stall with an accompanying rapid pushover for recovery, since any such action might aggravate the buffet situation by merely increasing the MACH number. This

TABLE I
CONVENIENT CHARTS OF THIS TYPE COULD BE USED FOR THRUST SETTING IN SEVERE TURBULENCE

TURBULENCE PENETRATION POWER SETTING
PERCENT N_1 RPM

G. W. 1000 LB	ALTITUDE – 1000 FT.			
	10	20	30	40
140	79.3	82.2	87.8	92.3
180	80.4	84.7	89.9	97.0
220	81.7	87.2	92.4	104.0
260	83.6	90.0	95.9	—

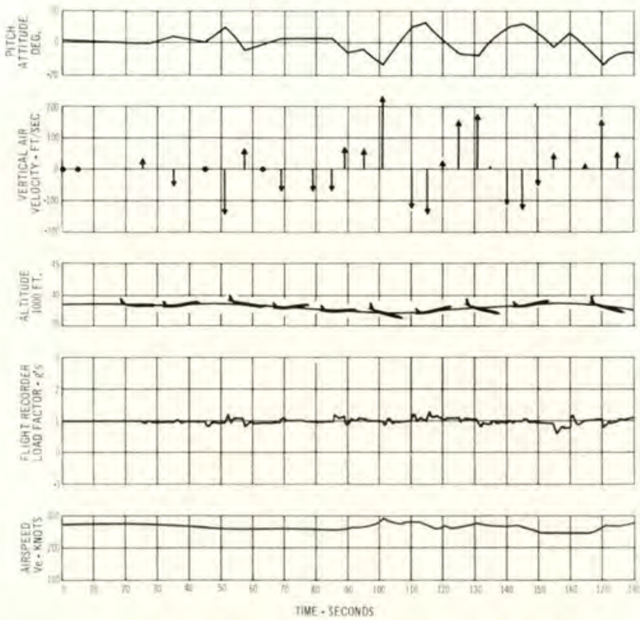


Fig 3. The indicated vertical air currents are typical of those encountered during penetration of severe turbulence. The other curves in this figure illustrate the behavior of the airplane encountering the indicated air currents without any pitch correction by the pilot.

Fig 4. These curves show the behavior of an airplane encountering the same vertical air currents as in Fig 3, but with absolute pitch control applied. Although it is not possible to apply such absolute pitch correction, the curve illustrates the larger g loads by too rigidly controlling pitch attitude.

tendency to encounter high-speed buffeting in severe turbulence is increased with increasing altitude. It is therefore apparent that climbing in an attempt to avoid an area of expected severe turbulence could lead to this type of buffeting difficulty if the turbulent region could not be completely topped.

AUTOPILOT

It is recommended that the autopilot be disengaged immediately upon encountering severe turbulence. First, the autopilot has only limited authority over the elevator control system and will call for stabilizer trim motion to augment this authority when necessary. Thus there is a good possibility that the airplane could be placed well out of trim by autopilot action. Also, an inadvertent disengagement at an inopportune time might initiate a maneuver from which it would be difficult for the pilot to recover. Thus, although the autopilot will do a reasonably good job of flying the airplane in light to moderate turbulence, it is not recommended for severe turbulence flight.

YAW DAMPER

The roll and side slip motions of the modern jet transport are more difficult to control than its predecessor, principally because of its swept wing, its high weights, and the high altitudes at which it flies. This type of motion is quite uncomfortable to passengers and generally is difficult to cope with from a piloting standpoint. Because the motion is easily excited and poorly damped on swept wing configurations, the modern jet is equipped with a yaw damper to aid the pilot in flying the airplane. Flight test data substantiate that important benefits are obtained from use of the yaw damper during turbulence penetration. Excursions in side slip and roll are minimized and, even though the rudder control may be more active, the structural loads imposed on the vertical tail are considerably reduced. It is therefore recommended that the yaw damper always be engaged during penetration of severe turbulence.

PROCEDURE SUMMARY

In brief form, the procedures for flight in severe turbulence are summarized as follows:

1. Airspeed—Approximately 280 KIAS or approximately M = 0.80, whichever is lower. Severe turbulence will cause large and often rapid variations in indicated airspeed. DO NOT CHASE AIRSPEED.

2. Autopilot—OFF, Yaw Damper—Engaged. It is desirable to engage the yaw damper when the rudder is centered.

3. Attitude—Maintain wings level and smoothly control pitch attitude. Use attitude indicator as the primary instrument. In extreme drafts, large attitude changes may occur. DO NOT USE SUDDEN LARGE ELEVATOR CONTROL INPUTS.

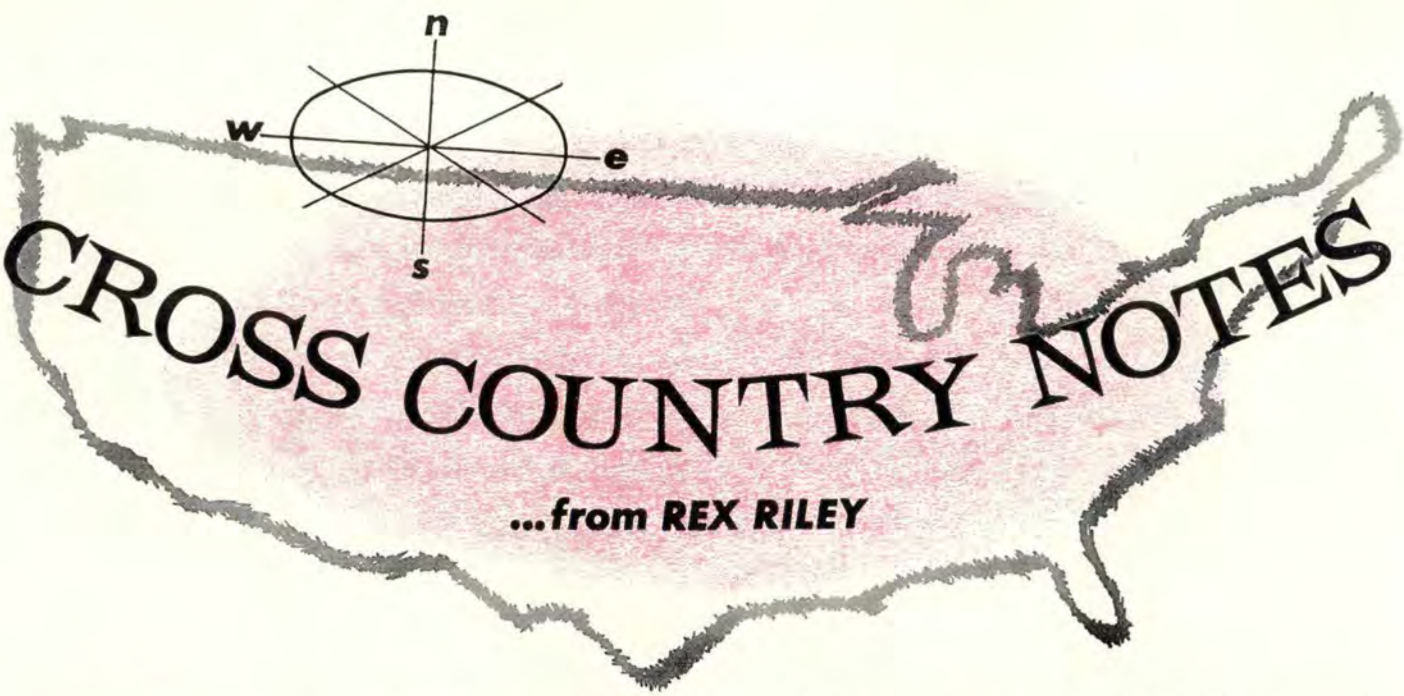
4. Stabilizer—Maintain control of the airplane with the elevators. After establishing the trim setting for penetration speed, DO NOT CHANGE STABILIZER TRIM.

5. Altitude—Allow altitude to vary. Large altitude variations are possible in severe turbulence. Sacrifice altitude in order to maintain the desired attitude and airspeed. DO NOT CHASE ALTITUDE.

6. Thrust—Engine starter switches should be in FLIGHT START. Make an initial thrust setting of N_1 RPM for the target airspeed depending on engine type and altitude as follows:

	30,000 Ft and Above	10,000 Ft
JT3D3 –120B/720B	**93%**	**84%**
JT3D3 –320B/C	**95%**	**83%**
JT4A	**81%**	**75%**
RCO 12 (N_2)	**89%**	**85%**
JT3C	**94%**	**86%**

CHANGE THRUST ONLY IN CASE OF EXTREME AIRSPEED VARIATION. ☆



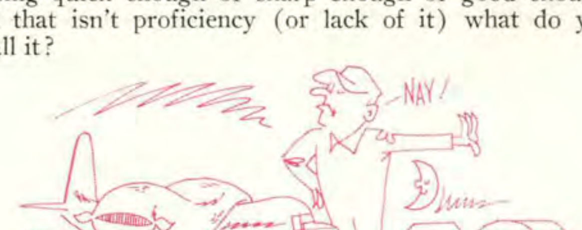
CROSS COUNTRY NOTES

...from REX RILEY

As usual Rex has been receiving mail, messages and accident/incident reports that just can't be passed up or filed. Sermons will be avoided but Rex can't help but hope that at least one of these tales will strike home and you'll remember it if a similar occasion arises.

GUARD CHANNEL AGAIN. Rex has long fussed about all pilots (USAF, Navy, civilian) and ground control garbling up "save your life" Guard channel but here is a case where the pilot should have and didn't. Mission: returning to base after low altitude intercepts. At 13,000 feet, reaching for 15,000, the pilot of the F-86L was 45 NM out at sea when he began getting severe fuel fluctuations. The emergency fuel system didn't help. The local Air Defense Sector gave him a vector to a Marine base closer than home base. The pilot contacted approach control and was told he was Nr 2 in the GCA pattern. He then requested a flameout pattern but kept getting GCA steers. After declaring a bona fide 100 per cent emergency he was told to go to tower on channel one. Channel one was all banged up with useless chatter so tower gave him another frequency. This one was occupied with a read back IFR clearance, so back to channel one. Still declaring an emergency he requested the active runway and the tower came through. The landing was uneventful. It's when you get in trouble that you use good old Guard and when you're not in an emergency, you don't. It's that simple.

LAUGH OF THE MONTH. A U-10A groundlooped after an otherwise successful landing. Damage was considerable. Cause: pilot factor in that the pilot lost control on landing roll. Here's the kicker—the investigation stated: "Pilot proficiency was not a factor." While Rex has never groundlooped an AT-6, C-45 (or a few others noted for this characteristic), he's come so close it wasn't funny. In each case the reason was not being quick enough or sharp enough or good enough. If that isn't proficiency (or lack of it) what do you call it?



REX RILEY LIST OR NOT. Rex gets occasional letters griping about the facilities at a base that is on the Rex Riley list of recommended bases. Like a sergeant that wrote long and mean about the lousy visiting airman quarters at a southeastern Rex Riley base. It was so bad he ended up sleeping in the airplane. Then, the other day a troop in the same building with Rex came in storming about another Rex Riley Recommended base. It turned out that this was the third or fourth time he had been there and had received lousy service. The point is: it's up to your aircrews and passengers to get the word where it will do some good—namely Rex. Don't sit around and fuss—a letter, postcard or brown wrapping will do the trick if you give me the poop. I promise to answer and furthermore it doesn't take but a few reports (or one real bad one) and Rex will be there. If a safety of flight item is noted in your report, action is taken right then and there. It's up to you.

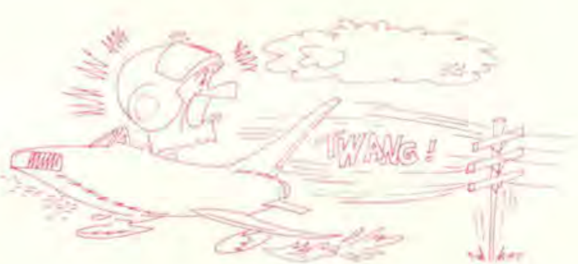
NOT NEW BUT STILL TRAGIC. During an emergency (high oil pressure) landing the F-100 crashed while turning to final approach. The pilot was killed after ejection. I won't go into the airplane troubles because the points to be made are:

(1) Pilot did not have the zero lanyard hooked up.

(2) Ejection was at 200 feet.

Rex isn't fussing with a guy who lost his life doing his best trying to save an airplane. But what about you troops reading this stuff? Have you got a pre-determined altitude fixed in your mind at which you're going to hit the next-of-kin button and save your life? And if you think you can manually beat the zero lanyard you better turn in your license to fly and take a course in selling shoes.

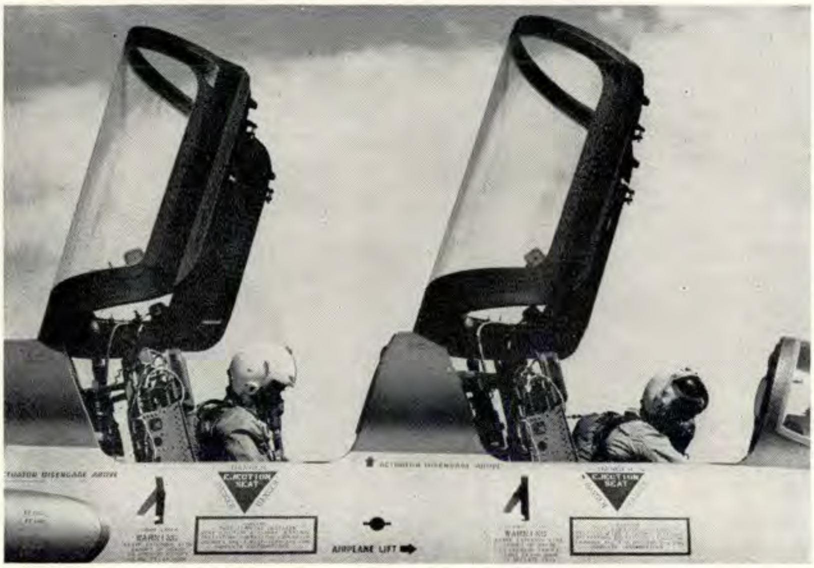
PLEASE, NOT AGAIN. As faithful ASM readers know, one of Rex's pet peeves is complicated requirements levied on aircrews. There has been some progress in recent years in reducing the number of frequency changes, etc., etc., but there is room for a lot of improvement yet in such simple and basic air maneuvers as the procedure turn. A recent FLIP planning change notice carries this: "Restriction: if the first outbound turn places the aircraft on the side opposite the maneuvering side turn to intercept the reciprocal of the inbound course. It is recommended that not less than a 20-degree intercept angle be used to intercept course. If the reciprocal of the inbound course is intercepted prior to completion of the maximum time outbound, maintain course outbound." S'help me, that's what it says. With a chalk and blackboard it is soon apparent that when the turn-shortest-direction-outbound procedure places the aircraft on the non-maneuvering side it is now necessary to intercept the reciprocal prior to turning inbound. Basically that is about it. But try this in an airplane, especially you proficiency pilots who can't get local practice but must pick it up on mission support flights. Gets a little confusing when you get to do it maybe once a month. 'Nother thing, when you run your bird around this imaginary track (throw in a little wind drift problem, as it's usually there) you'll find that you're pretty busy watching the gages. And when you are getting in a little VFR conditions practice in this procedure just who is keeping a close lookout for other aircraft? Rex says again, if it's safe, it had better be simple. The mental gymnastics required to fly some of the modern day patterns leave little time to sort out radio calls, Guard chatter, checklist reading and performing, change attitudes and altitudes, acknowledge and perform SIF changes, verify that the VIP's transportation has been ordered . . . there is no apparent limitation on what can be requested or required of a pilot at this phase of his flight. ☆



THAT'S CLOSE, MAN. Mission: F-100s (two on a hi-lo-hi navigation bit). During low level portion of mission, at turning point, the pilot lost sight of his wing man. While searching for him the pilot allowed his aircraft to descend to approximately 200 feet above ground level. He then saw power lines in his flight path but did not have time to take evasive action. The aircraft struck the lines which ruptured the right 335-gallon drop tank and bent it up against the inboard slat, damaging the slat. The pilot then climbed to altitude and performed a stall series to check for controllability. Control of the aircraft was marginal so the pilot elected to jettison the right tank at the tank jettison area. A malfunction occurred and both tanks released. Damage to aircraft: both right wing leading edge slats damaged, right wing tip damaged, both horizontal stabilator tips damaged, and minor damage to right wing leading edge.

OOPS! During preflight inspection of the missile bay (F-106A) the pilot noted that the spare drag chutes had been placed above the luggage carrier. He accepted this condition and took off from Podunk AFB en route to home station. During flight he noticed two dull thuds. No other unusual conditions were observed. After a low approach at Podunk, mobile control advised him that a drag chute was hanging from the missile bay. After landing, it was discovered that the drag chute had fallen from the luggage carrier onto the missile doors. The D-ring had evidently worked out through the air vent pulling the rest of the chute out in the airstream. The pilot chute did not go through the vent and kept the chute from falling from the aircraft. Lower anti-collision beacon destroyed. Main gear doors scratched. One two-inch tear and a five-inch tear in the lower aft fuselage skin. This damage was probably caused by the flailing D-ring. Corrective action was to advise all ground personnel to secure spare drag chutes on the baffle plate area with adequate tie-down straps or cable; inform pilots not to accept aircraft until all equipment has been properly secured.

WHAT IS IT?



If you haven't guessed yet what those two pilots above are sitting in, don't feel bad. Not many people have seen this bird yet. It's TAC's new F-105F, a two-seat version of the F-105D.

Designed primarily as a weapon to be used for the same missions as its single seat predecessor, the versatile two-place model will also provide actual mission, radar and instrument training. In this secondary role it will be employed to:

- Train in use of fire control system, radar and weapons delivery.

- Serve as a standardization/evaluation aircraft.

Since the two-seat version was designed to perform combat missions side-by-side with the F-105D, minimum performance degradation and logistics were prime design factors. Both cockpits are at the same level above the aircraft centerline in order to maintain performance. Wherever possible the same subsystem components were employed on both the single and two-place versions.

Major changes in the design of the F-105F are:

- Bigger vertical fin to maintain directional stability comparable to the F-105D.

- Reinforcement of the center and aft sections of the fuselage to take care of greater tail aerodynamic loads.

- A 350 knot gear retraction capability.

- Relocation of the angle of attack vane to the right side to preclude the possibility of damage during air refueling.

- Increased capacity of the air conditioning package.

- Redesign of the forward fuel cell with an additional pump to maintain CG control (fuel capacity same as in F-105D).

- Use of a combined canopy actuator/remover unit for each crew station.

- Simplified survival kits for easier maintenance and to improve reliability of the communication subsystem by removal of communication personal lead from the kit.

- A 750 VA static inverter to provide for increased AC electrical power requirements.

- Modification of control systems to provide dual capability.

Handling characteristics are reported to be similar to the single seat models with improved stability at high speeds and low altitudes. The aircraft may be operated at Mach 1.2 on the deck without stability augmentation. The absence of adverse yaw and pitchup tendencies make stick shakers and artificial stall devices unnecessary.

Engineering estimates indicate range loss as compared to the single seat version will be approximately three per cent. Top speed, for a given weight, may well be above that of the D model as a result of the longer fuselage.

Armament generally is similar to the D model. The two-seater is equipped with the M-61 Vulcan 20 mm gun and can carry AIM-9B and AGM-12 missiles as well as special weapons. The AGM-12A is not operated from the rear cockpit.

Maintenance features include unusually long tire life, highly reliable drag chute, and unusually durable brakes. Structural changes have eliminated the "ballroom" (electronic equipment compartment) and its congestion. There are two electronic compartments in the F-105F, one on each side of the aircraft below the aft end of the extended crew compartment. ☆

Something has been added. Two-seat version of F-105 fighter bomber (left) is contrasted with single seat version (right).

GOOD WAS MY COPILOT

Major T. J. Slaybaugh

At Base Ops Chumley was met by his copilot, a tall, alert looking lieutenant colonel who held out the completed '21a, the '175, a takeoff performance card and the manifest.

"Mornin' captain," he said. "I have the paper work finished, but you'd better check it; I've been flying T-Birds and just got a copilot checkout in the Goon so as to get a little refresher on the recip picture."

"Yeah, yes sir. Good for you." Chum wasn't so sure. Nobody had a right to look this alert at 0500. "You stan/eval?" he asked, suspicious.

"No." The little laugh didn't comfort Chumley much. "I'm what you might call special assignment. Flying safety is my racket, with transient services a growing sideline."

"Hmmmm . . ." Safety officers were next to stan/eval types in Chum's book. He'd play this one close to his vest. He glanced over the paper work. Everything was neat and legible and all the columns were filled in. Chum wasn't familiar with the detailed Section C of the '175 but did figure out that it was some type of operational clearance. The four bases where they were to stop were listed, along with ETAs, and their home field was shown as final destination. C. Z. shoved it over to the dispatcher. The dispatcher checked everything, following the end of his pencil along all the columns, slid it back with the suggestion that Chumley sign it. Then he handed C. Z. the carbon copy, saying, "Have a good trip."

Still suspicious, Chumley made a more careful walk-around than usual. The light colonel said he'd already been around with the engineer, but suggested that Chum would probably want to check it anyway. A drop of oil fell on his left cheek when he peered into the right wheel well; this served to make him wish he had stuck to his rule-of-thumb preflight—if you don't see anything dripping from 50 feet, take it. When he got aboard he found that the light colonel, checking items in a black notebook, was briefing the passengers. Chum shrugged and went forward. Hardly anything ever went wrong in a Goon.

Engine start, taxi and runup went smoothly enough. Chum curbed his impatience for a change and let the engineer run through all the items on the checklist. One thing he noticed, this copilot was the sharpest he'd seen on the radio; better even than that first lieutenant who had come in from an overseas tour in '100s.

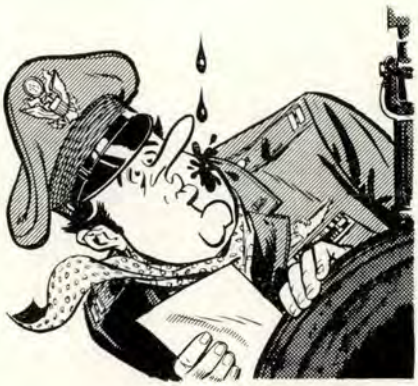
Takeoff was routine and climbout seemed normal enough to Chumley. The throb of the 1850s was sort of comforting in a way and Chumley began to relax a bit. Then his copilot had to spoil it all when he reached over on the pedestal, asked "May I?", and with a thumb and forefinger edged the right prop control back. The beat that Chumley had been used to for years smoothed to a steady blend of engine sound.

Chum didn't say anything, but copilot stock, which had begun to rise, dropped sharply again.

But by the time they made their first pax stop the light colonel was back in good graces. Chum, trying to figure it out, surmised as maybe this boy had some Geisha blood in him—the way he anticipated everything. He never gave C. Z. a chance to exhibit one of his more noted traits—forgetfulness. Chum even pictured himself as a doctor in an operating room the way this guy kept handing him maps, letdown plates, checklists, always just before he needed them. Everything was opened to the correct page, too. About five minutes out from terminal fix the copilot had received permission from Approach Control to file the IFR portion for the next leg. Best FAA guy ever—for the first time C. Z. could remember, nothing had to be repeated or added.

C. Z. didn't have much to do but sit there and drive and give the orders. He found he was sitting up a little straighter and when he had rolled the big, soft tires on at the first pax stop he felt a little thrill at the "squeech, squeech." (It had been quite a long time—even beyond his last proficiency when he had blown the left main in a tail high try at a short-fielder.)

The only rough moment came when he braked abruptly in response to "hold it" as they were turning between two other birds to park at Base Ops.



"Better hold it here a moment," his copilot explained, "AFR 60-11 says we have to have a wingwalker when within 25 feet. And, as you know of course, a tug within ten feet."

Chum nodded. He had thought it was 50 and 25, but didn't want to argue the point.

Seemed like they had just parked when this light colonel was climbing back into the right seat and making a circle with his thumb and forefinger. He'd been in the back again. Some kind of a nut on passenger briefings, apparently.

He handed Chum a thin folder. "SID departures, one of the passengers brought it for us."

Chumley just blinked. After all.

They had forty minutes of IFR on the next leg. Our hero wasn't surprised when his copilot asked, "Be okay to take 'er off autopilot and keep my hand in?" C. Z. was a bit watchful for a few minutes, until he made the unusual discovery that this particular Goon obviously held headings and altitude better for hand flying than for autopilot flying. Chum shook his head and sent the engineer back for more coffee—real unusual airplane, and it landed well too.

At the next stop they had to hold 20 minutes. The bird flew so well in the holding pattern that Chum figured the copilot could make the approach without any trouble. That's the way it worked out, too. Because of the delay, and Metro's forecast of stronger winds on the next leg, C. Z. made the decision to add fuel, and refile. He was pleased to note that the copilot was thinking ahead too. In fact, he had suggested just such a course of action shortly before Chum had made the decision.

They checked weather together and as was his practice, Chumley let his copilot gain more experience in making out the paperwork. They had coffee, the light colonel picking up an extra donut for the engineer, and went back out to the plane. He opened his checklist as they approached the bird, but the passengers were en route so C. Z. waved him on with the comment, "I'll catch the outside if you'll get aboard. Won't take me a minute."

In his book, en route inspections, if made, were the engineer's duty. After a perfunctory, medium-distance look at the wheel wells he was satisfied; then he noticed his copilot up by the power unit, unrolling cable. When he walked over he heard, "Every once in a while somebody forgets to chock the bird, or set the brakes, or starts on a wet, sloping ramp and when the power unit is parked ahead of the nose or props the plane rolls into it. Goodbye, power unit, and sometimes goodbye airplane."

The copilot then helped the alert man pull the power unit to the length of the cable.

Thirty minutes later, airborne and out of the weather, the copilot pulled his little black book from a pocket of his flying suit and, between frequent scans for other aircraft, made entries.

"I've seen lots of little black books," Chum said, in an effort to be casual, "but never anybody making entries at eight thousand feet with no females on board."

The light colonel smiled. "It's not what you're thinking. I keep notes on facilities provided for transients at every base."

"Hmmmm," a little light began to flicker somewhere back in the cob-

webbed recesses of Chumley's brain. He let it perplex him a few moments, but the answer didn't appear. He gave up. That was another typical trait—give an idea a chance to jell and if it doesn't, forget it . . . couldn't have been worth much.

The second two legs were replicas of the first. This nothing-to-do-but-steer bit set well with Chauncey Z. Chumley. In fact he commented a time or two on how well rigged this particular plane was. His landings were much better than normal. And this copilot—once after Chum had hurriedly wadded up his L-3 chart and sat on it to get it out of the way, the copilot carefully refolded it without a word.

When they taxied in at the end of the mission, Chum was at his expansive best. "Colonel," he addressed his copilot, "You're coming along real well for having just been checked out. Enjoyed having you. Be glad to take you along again and give you a few more pointers. I'm going to tell training that, with a few more flights like this, you won't have any trouble checking out as AC—not any trouble at all."

The light colonel smiled.

After they had parked the bird and Chumley picked up the 781, the light flickered again, then came on bright. On the second line, neatly printed, was the name, "Riley, Rex. Lt. Col." Just to make sure, Chum called, "Colonel Riley . . . I thought I'd heard that name somewhere. Didn't you used to be in some sort of restaurant award business—sure, that explains the black book . . ."

Riley smiled. "No, you're thinking of two other guys. They've been retired. I'm just helping out, sort of an additional duty." His smile widened. "I'll see you . . . it's been interesting—most interesting."

He was gone, leaving Chumley scratching his head. He was puzzled for a minute, but he shrugged it off. One thing, Riley would have to admit it had been a good flight. The airplane had flown well. Four excellent landings. None of the usual trouble with traffic controllers. They hadn't been pestered with a lot of questions by the passengers. No hassl'ing with Base Ops types on the paperwork . . .

As Chum climbed out of the seat he remarked, to no one in particular, "You don't know how lucky you are, Riley, you should be along on some of the flights I make." ☆

TWX's

ACCIDENTS, INCIDENTS AND ALMOST . . .

LOCKED RUDDER. After a normal formation troop drop sortie, a 360 overhead pattern was flown. As the C-123 was flared for landing the rudder locked in a near neutral position. Fortunately, there was little wind and the landing could be completed without incident. Directional control was maintained with nose steering. During rollout, when pressure was applied on the left rudder it became slack and rudder cables were observed hanging slack in the cargo compartment. The rudder torque tube right pulley had failed.

C-54 PITCH UP. During roll out from a steep turn on an instrument practice flight, and as the copilot was applying nose down trim, a loud noise was heard. The aircraft immediately pitched up, requiring 30 to 40 pounds forward pressure on the controls to hold level flight. Movement of the trim wheel had no effect. With the copilot holding forward pressure to assist in overcoming heavy elevator force a landing was made. The cable to the elevator trim tab had broken.

CLEAR BEHIND? As the engineer was beginning his operational check of propellers the pilot started a visual check of the control surface and, at this time, noted a light aircraft approximately 400 feet directly behind. The pilot of the light aircraft was obviously having control troubles. Power was retarded immediately, but not before the light aircraft was blown over onto its nose and right wing. Air Force crews must assure they have a clear run-up area, preferably in an area where other aircraft cannot be taxied behind. All engines should be positioned over a hard surface, particularly when reverse checks are to be conducted or jet vortices could pick up gravel or other debris. Turboprop crews must remember that pilots of other aircraft cannot estimate the amount of prop wash from sound and will not know whether or not they can safely taxi behind.

LAPS FULL OF INSTRUMENTS. Shortly after passing S1 speed the pilots of the KC-135 noticed that the instrument panel was ajar. Immediately after rotation the top of the panel fell toward them. The pilot and the IP sitting in the right seat caught it after about four inches of movement, thereby averting a lap full of instruments, and the IP flew the aircraft while the pilot fastened the panel back in place. This was the first flight since the aircraft returned from the depot. Depot personnel had forgotten to secure the panel.

FAULTY RAFT. During periodic inspection CO_2 cylinder was actuated, but raft failed to inflate. Removal of the cylinder revealed the filler fitting on the raft was not drilled, preventing gas from entering the raft. The fitting was cut from the raft to check for other discrepancies. Discharge ports were covered with rubber. Is there other such defective equipment provided for airmen down at sea?

NO DOORMAN. After maintenance on the rudder the aircraft was being backed from the hangar. Someone forgot to open the center overhead doors and the rudder was torn in three places. An estimated 50 manhours was required to remove and replace and 100 hours to repair the damaged section. Of course, the aircraft would have to be out of service during this period. ☆

WHAT'S AHEAD IN ATC RADAR

Sometime before the end of 1967 an Air Traffic Controller will look at a blip on his scope and, beside the blip, see

AF12345
6284

And, if you are the pilot flying Air Force 12345 that day he will immediately know exactly where you are and that you are at a flight level of 28,400 feet.

Exactly who you are, where you are and how high you are—that's the information air traffic controllers will have on every military pilot by this target date if the goal established by the Secretary of Defense is realized. Programmed implementations to achieve this goal include:

Installation of the new Air Traffic Control Radar Beacon System (ATCRBS/IFF) in all aircraft types being delivered in 1965.

Action in current production designs so as to minimize retrofit.

A 20 per cent retrofit by the end of 1965 and a 60 per cent retrofit by the end of 1966.

Although the above refers to airborne retrofit goals, necessary military ground facilities retrofit requiring interrogator, decoder and display modifications are anticipated in a corollary program.

To best understand what's coming in ATCRBS, perhaps it is well to briefly trace generations of radar up to the present:

PRIMARY (RAW) RADAR is the original radar in which beams are sent out from an antenna and displays of energy are reflected back from these beams. This is the type of radar that shows up on the scope as aircraft skin paint returns. With primary radar any beam reflective material (ground clutter, moisture, etc.) will also evidence itself as a return on the scope, thereby making identification of aircraft targets more difficult and this system of limited value for traffic control purposes.

BASIC MARK X was the first secondary system, which in addition to the ground transponder, had an airborne receiver transmitter to transmit a signal back to the ground station. This system was developed in early 1942 to identify the aircraft as friend or foe (IFF). The present radar system is essentially the same as the BASIC MARK X. Advantages over PRIMARY RADAR stem primarily from the fact that the scope display is dependent not on energy reflections, but pulses transmitted from the airborne transponder. The big drawback of MARK X is that it does not have a capability for displaying coded displays. For the ground operator to identify MARK X returns it is necessary to present all radar beacon responses on his scope, thereby defeating the selectivity benefits of the coded system.

MARK X SELECTIVE IDENTIFICATION FEATURE (SIF) is a modification of BASIC MARK X that makes provision for transmission of coded replies. These replies can be decoded by the ground unit for presentation as a discrete display.

ATCRBS is the standard air traffic control surveillance radar system. It makes use of a 10 channel decoder to sort out only returns of those aircraft for which a particular controller is responsible. Codes are presented on the common air traffic control Mode 3/A. Civil Mode A is the same as the military Mode 3, hence Mode 3/A. (Military Modes 1 and 2 are tactical modes and are not used in traffic control.) Mode C is the designation of the mode that will be used for altitude transmissions. Mode D has been designated, but no use specified.

OPERATION of ATCRBS is by interrogation from the ground equipment and reply by the airborne equipment. Interrogation from the ground on Mode 3/A is by transmission of radio pulse pairs, 21 microseconds apart, on 1030 mc. Reply codes (ATCRBS interrogates on modes and the airborne transponder replies with codes on these modes) are formed by the arrangement of individual pulses in a 20.3 microsecond long pulse train and are transmitted to the ground on a frequency of 1090 mc. Within the pulse train of framing pulses there are information pulses at 2.9 microsecond intervals. Information pulse transmissions depend upon the airborne transponder selection setting. Presently there are 64 possible code settings from 00 to 77.

SIDE LOBE SUPPRESSION is necessary for true target identification. Whenever there is shaped or pulsed energy transmission, side energy transmissions are a common characteristic. When aircraft are close to the ground interrogator one transponder will produce multiple target displays. Suppression is achieved by transmission of extra pulses by the interrogator with the transponder using these extra pulses to differentiate the main lobe. Three pulse suppression is common in the U.S., with an additional two pulse suppression feature for overseas use.

MODE C will be for altitude information. It is intended to display with an accuracy of plus or minus 250 feet in 100 foot increments from minus 1000 feet to plus 127,000 feet. When Mode C is added more information pulses will be required. This provision is to be effected by a first pulse spacing 1.45 microseconds after the first framing pulse. This will multiply the information pulse capability by 64, making a total of 4096 available codes per mode. Altitude information will be transmitted automatically, regardless of the mode/code selection by the pilot.

OTHER CHANGES, either programmed or considered include:

A Special Position Identification (SPI) pulse that can be used with any of the codes upon request.

Selective code assignments to provide more positive identification.

A light gun with which the controller can focus the beam on a beacon target and get a readout of the target's code on a control box.

Identity and altitude information presented by the position blip on the scope.

Reduction in the number of advisories and traffic avoidance vectors.

Increased positive control capability, including high activity airspace below 14,500 feet.

Reduction in the volume of communications between controllers and pilots.

An altitude cross check between pilots and controllers.

Increased ATC efficiency in serving high performance aircraft.

Afford ATC an improved means of determining when greater vertical separation is needed due to turbulence.

Reduction in the number of required code changes.

Reservation of specialized codes for unusual situations; e.g., Code 77 for emergency and Code 76 for radio failure. (At present all ground equipment does not have the capability of picking up all airborne transponder emergency settings—when an emergency exists, to insure that the emergency is seen by all equipment within range it is suggested that Code 77 be selected as well as the emergency setting.

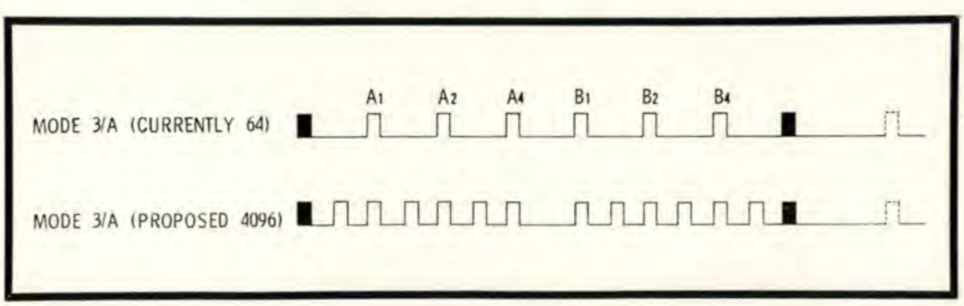
Using computors, the future holds promise that computer stored data can be matched to the beacon target and displayed on the controller's scope. In this connection, use of automatic tracking devices can monitor routine flight and make traffic conflict predictions.

Center marking of blip returns to provide safe separation in highly congested areas.

Some of these changes are already beginning to show up in the system. Others can be expected as rapidly as necessary equipment comes into use and pilots and controllers can be informed.

There is no doubt that programmed radar systems are designed to enable more efficient airspace use with increased safety. ☆

Transponder reply codes are depicted below.



MIL-S-38130 A SAFETY MILESTONE

Maj George P. Haviland,
Directorate of Aerospace Safety

A lifetime of safety for Aerospace Systems is the goal of a new Military Specification (MIL-S-38-130) prepared by Headquarters, AFSC. Bearing the usual turned-around title of "Safety Engineering of Systems and Associated Subsystems and Equipment, General Requirements For," the document will require contractors to apply safety engineering principles during design, development test and inservice changes to aerospace systems.

In effect, contractors will be required to adopt a "what if" attitude during system design and to make safety changes when the "what if" question indicates an unsafe condition.

You're probably wondering why another specification has been published in addition to the large number of specs already in existence. The answer is simple. First, until MIL-S-38130 was developed, no Military Specification on safety existed. Second, the USAF has needed one for years. The Directorate of Aerospace Safety has recognized this need partly from surveys, staff assistance visits, accident investigations and other sources. These activities have clearly shown that many systems which are now operational have safety deficiencies designed into them. No one purposely engineered a hazardous component or procedure into any system, but the fact remains that through oversight or lack of a safety influence during design, some operational systems are less safe than they should be.

It also became clear that, in many cases, when safety deficiencies are discovered after a system goes operational it is impossible to correct them. It's just too late. This is true because extensive retrofit programs in the name of safety are costly in terms of both money and time off alert status.

When safety deficiencies are found, what approach has the USAF used to avoid the hazards? Usually, the appropriate agency corrects the minor problems with minor engineering changes. The major problems are made the subjects of engineering study and new procedures are devised which *go around* the hazards. The hazards are still there, but now the probability that they will result in death or damage is reduced. With a system that is already operational, this is about all that can be done, but even this superficial type of solution is expensive.

As a result, it became evident that correcting safety problems after fielding the bird was not the way to do the job. Using a little hindsighted philosophy, it has been noted that the USAF has consistently procured weapon systems with the hope that safety would be delivered along with the hardware. It was hoped that through some magical process, operational systems would not have safety deficiencies built into them. In some cases this hope was realized, but more often than not, safety problems were accepted by the USAF simply because it was too late to do anything about them. No stones are being thrown at weapon system contractors by saying this. In fact, whatever degree of safety was received in the past came largely from the contractors motivation to turn out a good product and to create good will with the customer. Commendable as these motives are, the quantity of safety provided has all too often been inadequate.

The Directorate of Aerospace Safety therefore decided that formalized statements of safety requirements were needed. A project was initiated to see what could be done to introduce safety into some of the key USAF directives.

The 375 series of Air Force Regulations offered a fruitful line of approach, at least from the viewpoint of the USAF management effort. Consequently, changes were recommended for the 375 series which placed more emphasis on safety. These changes are being processed currently. In addition, AFR 58-4 was revised and changes to AFR 80-14 have already been accomplished. But these actions, though needed, did not make the contractor a member of the safety team and he should be the prime target since it is precisely within the contractor's engineering section that the need for safety philosophy and influence is so important.

The contractor thus became the focal point of the efforts to require safety during the design. It was concluded that a Military Specification, to be made a part of weapon system procurement contracts, was the best method for accomplishing this objective.

Before writing the specification, it was necessary to research existing documents on safety. One of the most significant contributions was in the form of a BSD exhibit (62-41), which covered safety engineering requirements during the acquisition phase of ballistic missiles. This exhibit offered an opportune point from which to begin the preparation of a Military Specification on safety engineering. It is noteworthy that BSD, which is intimately involved in missile system design and fabrication, recognized the need for formal safety requirements so early. The preparation of Exhibit 62-41 was a far-sighted effort.

So, D/TIG started work on a specification which applied only to missile/space systems. Hq AFSC reviewed the draft and then volunteered to expand it to include all systems. D/TIG agreed.

This covers the background leading up to the publication of the AFSC specification. Concerning the specification itself, it might be helpful to describe a few of the requirements it contains. Let's take a new weapon system, not yet on contract, and outline some of the applications the specification will have during the system's life cycle.

During the proposal stage, when contractors are requested by the Air Force to bid on a new system requirement, the specification requires the bidder to describe how he intends to incorporate safety into the proposed system or subsystem design. A contractor will be required to identify the safety hazards of his design as well as his program to reduce these hazards. The program is summarized in a document called the Preliminary System Safety Engineering Plan (PSSEP). It is submitted to the Air Force as part of the contractor's proposal.

The PSSEP includes safety requirements, procedures for conducting safety analyses, failure mode analyses, and actions programmed by the contractor to reduce the level of hazards identified in the system or subsystem. Contractors are also required to select the focal point within their organizations for the safety engineering effort. This will provide a single point of contact in the contractor's organization for all safety engineering matters.

It is significant that all this occurs before a contract is awarded. This means that safety will become competitive in the sense that all bidders will include safety in their proposals and the source selection board will use safety as one of the many criteria on which a contract award is based.

Once selected, the contractor will revise his Preliminary System Safety Engineering Plan into a System Safety Engineering Plan applicable to his portion of the work. When a Prime or Integrating Contractor is designated, each SSEP will be reviewed by him and the interface safety responsibilities will be resolved. Out of these actions will come the Integrated System Safety Engineering Plan which is then submitted to the procuring agency for approval.

In the past, when MIL-S-38130 was discussed with various groups, someone usually stated an objection to the duplication of effort with similar analyses required by the Reliabi'ity and Maintainability Specifications. This is not a valid objection since the specification requires the contractor to use any data generated by these other specifications in conducting safety analyses. In fact, he is contractually obligated to avoid any and all duplication of effort.

So far, the hypothetical system has progressed through the definition and acquisition phases. After acceptance of the first operational unit by the Air Force, the Operational Phase begins. It is realized that despite the introduction of safety engineering into system design and development, there may be safety deficiencies uncovered during the Operational Phase. To apply safety engineering to every period in the system life cycle, the procuring agency (in this case an Air Materiel Area) can require its contractors to provide safety engineering covering inservice changes, modernization and up-dating programs. Much can be accomplished in the area of operational safety engineering if the specification is made a part of AFLC support contracts.

Well, that's the story of MIL-S-38130 except to indicate where it goes from here. AFSC has published it and it is now available for use by any agency. The incorporation of MIL-S-38130 into new contracts will be made mandatory by AFSC through subsequent actions involving changes to existing directives. Its applicability to existing contracts should probably be handled on an individual basis. There is a likelihood that it may become a Military Standard which, after proper coordination with other services could then apply to the systems procured by them.

MIL-S-38130 has been needed for several years as any responsible SAC, TAC, or ADC man will attest. When implemented as part of a contract, this management tool will reduce the damage to USAF systems and injury to personnel from accidents. In the long run, it will increase the mission capability of our weapon systems by designing safety into the systems before they enter the inventory.

Publication of MIL-S-38130 represents a safety milestone in the USAF. It is the result of a team effort. For the last two years, D/TIG, BSD, ASD, SSD, Hq AFSC, AFLC, SAC and the Aerospace Industries Association have been briefing it, discussing it, rewriting it, arguing about it, and finally coordinating on it. Hq AFSC is to be commended for finalizing and publishing the first Military Specification for safety engineering in the USAF. ☆

MISSILANEA

DO YESTERYEAR'S ANSWERS SOLVE TODAY'S PROBLEMS?

Maj Curtis N. Mozley,
Directorate of Aerospace Safety

The missile era, from the personnel viewpoint, is rapidly entering the second generation stage. The "old heads," who in the late fifties or early sixties formulated the policies that evolved into the operational procedures, are taking their experience from the dispatched maintenance teams and the operational missile crews into other specialized areas, i.e., Quality Control, Job Control, MAPCHE Teams, Command Posts, Training, Standardization Crews, etc. This is a normal progression in any weapon system, but it does leave a void.

The replacements to fill these shoes are, in the main, relatively inexperienced in the missile field. True, they have had ATC training, completed Operational Readiness Training (ORT) (probably in the unit), and accomplished either a quality control evaluation or a standardization check, but the experience background is yet to come.

This state in the replacements' careers is the focal point for increased concern and is the time to ponder some things. As our replacement has gone through this training, he has received basic rudiments of his weapon system. He has learned in ORT that nothing is done without a checklist. But, a checklist to the "old head" reminds him to perform in sequence certain familiar functions to accomplish a given task. To our new man, a checklist tells him step by step how to accomplish a given task.

What he is doing on these steps is mostly alien to him. He knows which switch, which valve, which gauge and what pressure, but he probably doesn't know exactly which system is being operated as he flips this switch, turns this valve, etc., or, that by following the checklist he is doing tasks safely. Are we sure that every step on the checklist is safe? Is there a chance, however remote, that we have created the checklist for the experienced man and have counted on his knowing what to expect? Or, are the checklists built so that compliance will not endanger personnel or equipment, even if our new replacement is using them? Have we developed an improper attitude that as a result of experience, we no longer need pre-task briefings? That supervision is not required any more because the task has been performed so many times before?

Commanders and supervisors take a good look at the attendees the next time you have a briefing. Are these the same faces you saw back in the installation and checkout days? Or, are there some new faces? Remember the concern we went through as the weapon system was being "de-bugged?" The folks who did the "de-bugging" probably aren't sitting there today. Your experience level is dropping so your supervision level has to rise. Your concern now is to safely maintain the "de-bugged" weapon system with every means you have. Take a good look at your checklists, your procedures, and your supervisors. Don't hand a new man a tool that requires experience to use. The job, any job, can be done safely with the right tools, and checklists are weapon system tools!

Initially, checklists were developed by people who were not yet experienced due to the state of the art of the weapon system. As the weapon system gained operational status, changes were made to the list as dictated by experience. Some of these changes were command authorized "one-time" changes waiting final decision to revision through the AFTO 22 system. Occasionally, the change would not be approved and this notification was not received by the using organization.

Have your checklists been reviewed recently for existence of any of these unauthorized changes? Has AFTO 22 action been taken in all cases where the review of operational procedures indicated the need due to the discovery of a hazardous procedure? Is every potentially hazardous task properly supervised? Is every TCTO verified by Quality Control to insure that it is compatible with all systems? Complacency can be catastrophic. The weapon system is inherently static, but the maintainers and the operators come and go. Our thinking then must be to have the right tools, the safe tools, for the new man as well as the "old head."

We have posed the question. Now, we suggest that commanders, MSOs, and other responsible missile personnel take a good hard look to assure that we are on the safe side of the curve. We, in Aerospace Safety, will also look into this area during staff assistance visits, surveys, and project officer visits. Our objective is to help commanders, supervisors, and missile safety personnel identify any questionable procedure that could cause a mishap. ☆

3+1=1

SMSgt Thomas B. McCall,

Ground Safety Director, Misawa AB

The arithmetic in the title would make most teachers flip, but at Misawa Air Base, Japan, it's part and parcel of the everyday routine. 3 + 1 = 1, in Misawa lingo, means Education, Engineering and Enforcement plus Enthusiasm equals Safety. This formula for ground safety has won for Misawa the National Safety Council's "Award of Honor" for the third consecutive year.

I was proud when Colonel R. C. Crawford, Jr., suggested that General McCorkle "give the award to Sergeant McCall" during the presentation ceremony. But after 18 years in the ground safety business I know *I* didn't win the award. It was every officer, NCO and supervisor on Misawa Air Base; they are the *doers;* they are the winners. For any safety program to be successful, enthusiasm must emanate from the top. The Division Commander demands efficiency from his command and spells it out when it comes to conservation of men and materiel through accident prevention.

Being charged with ground safety at this base I will, at times of peak rotation, groan and curse the exigencies of the service, for rotation means that the topnotch crews, best drivers from the motor pool, crack mechanics and other service people —all safety-minded, low accident personnel—depart for stateside bases. But the job of breaking in new hands is an operational must—as much a part of the business of the military as the hazards that are part of the industrial and business life of the nation.

Safety education of new people begins when they arrive at Misawa. Military, civilian and dependent personnel attend an orientation by the base commander, legal officer, Red Cross director, information officer, director of security & law enforcement, et al. Accident prevention in one form or another is emphasized throughout the orientation.

We Misawans feel we have the safest base in PACAF and we intend to do all in our power to keep it that way. Before you can drive your favorite clunker, two- or four-wheeled, you are given an orientation on Japanese traffic laws. The international traffic signs are explained and the base driving rules are covered in detail.

If you have never driven before you can receive "behind the wheel" instructions in one of the two dual control vehicles assigned to the Driver Education Division of Special Services. The cost is nominal and the driver instructors are AAA certified. Their instruction consists of classroom and actual driving techniques. Upon satisfactory completion, students are awarded a driver's license. Stateside insurance companies offer reduced premiums to eligible graduates of the course—one more proof that safety pays dividends. The identical course is offered as part of the Misawa high school curriculum. This highly popular course is filled to capacity.

Misawa's Transportation Division, headed by Major Edward H. Stegar, Jr., has everything from cleat-track weasels, light and medium sedans, to pickup and half-ton trucks, buses and special vehicles. These roll up more than three million miles a year. Last year they accomplished this outstanding record with only two reportable accidents.

Ask SMSgt Floyd W. Lewis, NCOIC Base Motor Pool, how they maintain this enviable record and he will tell you, "We take action on the small accidents *before* they become the big reportable type." What did they do to chop down the minor accidents? They re-trained every driver who so much as brushed against a bush. And their intensive training paid off. The result? Top drivers—fewer accidents—reduced costs.

Misawa has an Integrated Safety Council: here, problems involving flying, ground, missile or nuclear safety are resolved.

The Vice Commander, Colonel Herbert E. Ross, former PACAF Chief of Safety, presides as chairman. Council members include division and air base staff officers plus all the squadron commanders and additional duty safety officers. This assembled wealth of training, education and experience, headed by a chairman with comprehensive knowledge of accident prevention programs, makes Misawa the safest base in PACAF.

If your base safety program includes Education, Engineering and Enforcement plus the one vital E—Enthusiasm—then you've got a safety program because 3+1=1. ☆

Aerobits

NEAR MISS—A recent incident illustrates as well as anything the hazards of mixing IFR and VFR traffic and the necessity for pilots to be eternally vigilant when such mixing is possible. The pilot of a C-124 cruising at 10,000 feet observed a light twin-engine aircraft at the transport's 12 o'clock position. As the C-124 overtook the smaller airplane, it became apparent that the transport would pass slightly left and about 500 feet below it. Suddenly, with no warning, the small twin began a rapid descent, passing through 10,000 feet very close to the '124 at its 3 o'clock position. The Center advised the C-124 pilot that they had no other traffic in the area. A later check with the Center revealed that a similar light twin had just landed at an airport near where the incident occurred. We can do a lot of speculating about a case like this—what if the light plane had started a left turn along with the descent? But need we say more?

WHOA, NELLIE—An H-43B was being flown on a functional test flight during which the pilot obtained permission to perform an autorotation onto a runway. He reported touchdown approximately 100 feet short of the BAK-9 barrier at 18-20 knots. Upon touchdown the throttle was rotated to the full open position but no attempt was made to stop the aircraft or to become airborne prior to reaching the barrier. The front gear passed over the barrier but the bear paws of the rear gears engaged the barrier cable deploying the cable as the helicopter rolled straight ahead. The cable held the rear bear paws on the runway, causing them to dig into the asphalt, forcing the wheels off the ground. The resulting nose low attitude motivated the pilot to respond with corrective application of cyclic control and power application. The application of power carried the helicopter farther down the runway where it struck the surface in a nose low attitude. Both front gears failed at their fork assemblies.

The accident investigation board determined the primary cause of the accident to be pilot factor—poor judgment in attempting to operate a bear paw equipped helicopter over a BAK-9 barrier.

Lt Col James F. Fowler,
Directorate of Aerospace Safety

THE F-102 AND ITS GEAR PROBLEMS—Three F-102s, three similar gear problems, three solutions, and how they worked out: A '102 pilot could not get a gear down and safe indication, even after deployment of the emergency system. It was determined that there was an electrical malfunction and the pilot was advised to turn the master switch "OFF." With all power disconnected the gear came down and locked. A successful landing followed. After the aircraft came to a stop the pilot turned the master switch on to make a radio transmission. With electrical power "ON" the nose gear collapsed and the main gear unlocked.

Several months later another F-102 pilot experienced a similar inflight incident. Based on the above case, the pilot used the procedure of turning the master switch "OFF." The gear came down and an uneventful landing was made.

In the third incident the aircraft was landed with the nose gear up, causing extensive damage to the nose and fuselage.

In incidents such as these there is normally 3000 psi secondary hydraulic pressure on the up side of the gear actuating cylinder. Where gear extension and relief of this pressure does not result from use of the normal emergency system, cutting the power source is the only means of terminating the gear up signal and relieving the hydraulic pressure on the up side to allow the gear to extend and lock.

As this specific malfunction is not covered in the Dash One, it is recommended that commanders of all units possessing F-102 aircraft make sure that their pilots are aware of the procedure, also of the necessity to not reapply electrical power once the gear has been extended by this method.

SAFE CHAIN OF EVENTS—During a runway inspection the airdrome officer noted pieces of rubber at the end of a runway. He notified the command post. Investigation disclosed that the pieces were from

a B-52 tire. The Wing had one B-52 airborne. Radio contact with the aircraft resulted in inflight inspection and the discovery that the Nr 7 tire had failed. A serious unbalanced condition existed. The Wing coordinated with the Division, and a decision was made to land the aircraft with the right aft gear retracted. Landing was normal, except for a slight right, aft list. Aircraft was shut down on the runway, placed on jacks and the right aft gear lowered. Knowledge and coordination by at least three separate groups paid off here.

HELMET RETENTION—Despite repeated admonitions in this and other safety publications, pilots still —for one reason or another—lose, discard or in some way get rid of their head gear right when they need it the most. Here's a recent f'rinstance: This lad had to make a powered exit from an F-100. Then things got sticky. The seat got tangled up with the risers and slid up into his parachute canopy and tore several large holes in the nylon. The pilot's attempts to dislodge the seat were futile and he found himself descending somewhat faster than the posted speed limit.

At this point he decided to take action which amounted to discarding his helmet and mask. Presumably he figured that this would lessen his weight and slow the descent. It cut the weight all right, about three pounds. Meanwhile, however, he kept his survival kit which weighs about 32-36 pounds. To make a long story short, this pilot apparently made out okay. Had there been a wind and the possibility of his being dragged along the ground, this lad may have sincerely wished that he had hung on to his hard hat.

We'll say it again. At all costs, hang on to your helmet! Not only is it protection during landing, but it may come in handy during over-water ejection as a rain water container, bailing bucket, sun protector, etc. Also, in the case mentioned above, there was the possibility of the seat coming loose from the canopy and striking the pilot on the head.

OXYGEN DISCIPLINE. While cruising at 35,000 on a night celestial grid navigation leg, the pilot and copilot of a B-52 aircraft noted the tail compartment low pressure warning light come on and immediately noted tail compartment cabin altitude was 35,000 feet. Attempts to contact the gunner on interphone were unsuccessful. An immediate emergency descent was made to 12,000 feet. During the first part of descent, the gunner mumbled a few unintelligible words, but did not respond to questions from the pilot.

After reaching 12,000 feet, the navigator was alerted to go aft to the gunner's compartment; however, the gunner reported on interphone at this time. He sounded confused and did not know that a descent had been made.

The pilot instructed the gunner to check his cabin pressurization controls. After several minutes the gunner was able to repressurize to 8000 feet cabin pressure.

A climb was made to 35,000 feet; the tail compartment maintained 8000 feet. The pilot decided to land and have the gunner examined by a flight surgeon. The gunner explained that he had operated the cabin pressure dump valve by mistake while attempting to operate the switch to change cockpit lights from white to red. This switch and the cabin pressure dump switch are guarded switches located close together.

This incident once again points out the extreme hazard of loss of pressure in the isolated tail gunner's compartment of the B-52 aircraft and the importance of proper oxygen discipline by the crew. Approximately two years ago a B-52 tail gunner lost his life as a result of an unnoticed depressurization of his compartment. This latest incident could very well have ended in a fatality if the pilot's "tail compartment low pressure warning light" had been inoperative. Thorough checks of this system by maintenance personnel as called for in inspection workcards are essential and, as in this case, could save a life.

Lt Col Robert P Rothrock
Directorate of Aerospace Safety

Aerobits

POLYMER FUME FEVER—Due to an engine malfunction at pre-takeoff, a C-54 with 25 passengers aboard was taxied back to operations where maintenance was performed. Since it was raining the passengers remained inside the aircraft which eventually took off 2½ hours later. During this time the APU (auxiliary power unit) located in the aft portion of the passenger compartment was operated intermittently. After level off, the passengers became ill and complained of constricted feelings in the throat and chest, muscle aches, pains and chills. When the aircraft landed, after three hours of flight, seven passengers were hospitalized, with three remaining in the hospital overnight.

The flight surgeon made exhaustive tests and established conclusive proof that asbestos tape used on the APU exhaust pipe was responsible for the sickness experienced by the passengers. Tests using smoke generated with the asbestos tape alone duplicated the sickness in test subjects. The offending asbestos tape, Stock Number 9390-618-5919, was a substitute item, and not the type (Stock Number 5640-292-6439) which is specified for wrapping the exhaust ducts of APU's. Fumes from asbestos tape, Stock No. 9390-618-5919, are toxic due to a teflon plastic filler which this tape contains.

USAF Medical Service Digest, Nov 1963

FUSELAGE FIRE—A select crew was scheduled for an ATO takeoff to be followed by instrument checks for the copilot and the copilot of another crew who was the fourth crew member on this sortie.

The ATO rack and bottles were checked during the external preflight. They were ascertained to be secure and connected and ATO circuit checks were completed during the interior preflight.

Engines were started and the aircraft was taxied at scheduled time to the runup pad near the end of the runway. Pre-takeoff checks were completed and power was advanced to 100 per cent for the takeoff roll. Water/alcohol switches were activated and at S-1 speed the ATO was fired.

Unknown to the crew, a fire developed in the aft fuselage and tail of the aircraft. After the aircraft was airborne the crew was advised by the tower operator that the aircraft was on fire. The copilot confirmed the fire to the pilot who alerted the crew for bailout. The pilot then zoomed the aircraft to an altitude of 2400 feet and ordered bailout of all crewmembers. All four crewmembers successfully evacuated the aircraft; however, the pilot suffered fatal injuries when he did not separate from his seat before ground impact.

The fire resulted from materiel failure of a bracket on the ATO rack which allowed an ATO bottle to swing around and burn a hole through the fuselage into a fuel cell of the aft main tank. Discrepancies found in the pilot's escape system included: shoulder harness loops were not connected to the lap belt, a hole in the lap belt ballistic hose allowed gas to escape before it reached the automatic release mechanism.

Corrective action taken included: all ATO racks have been inspected for deficiencies to insure that only completely serviceable racks are used on future operations, flight crew personnel are required to personally inspect their escape equipment to insure there are no visible defects due to normal wear or usage.

Even though outstanding crew procedures and aircraft handling are exhibited, seemingly minor deficiencies in escape equipment may cause flight safety hazards. ☆

Lt Col David J. Schmidt,
Directorate of Aerospace Safety

KUDOS, A-MEN

The straight-A ratings attained by the officers named here, while attending the Flying Safety Officers' Course at the University of Southern California, are fifteen reasons to anticipate continuing improvement in aircraft accident prevention.

Capt Charles W. Bradley, Cannon AFB, NMex, TAC
Capt Keith C. Kuester, Shaw AFB, SC, TAC
Capt Ellis C. Vander Pyl, Jr, Myrtle Beach AFB, SC, TAC
Capt Laurance E. Kirschner, Gtr Pittsburgh Aprt, Pa, ADC
Capt John A. Schissel, Municipal Aprt, Des Moines, Ia, ADC
Capt John E. Seaton, Webb AFB, Tex, ATC
Lt Col Claude R. Nelon, Griffiss AFB, NY, SAC
Capt John R. Ousley, Dow AFB, Me, SAC
Maj Winston R. Dole, Otis AFB, Mass, SAC
Capt Gerlad T. McCarthy, Minot AFB, NDak, ADC
Capt Keenan C. Bone, Hill AFB, Utah, ADC
Capt Walter I. Bostwick, Langley AFB, Va, TAC
Maj William R. Stack, Minneapolis-St Paul Intl Aprt, Minn, CONAC
Capt Albert L. Ferzacca, Wright-Patterson AFB, Ohio,
Capt Grant S Pyle, III, Fresno ANG Base, Calif, ADC
AFLC

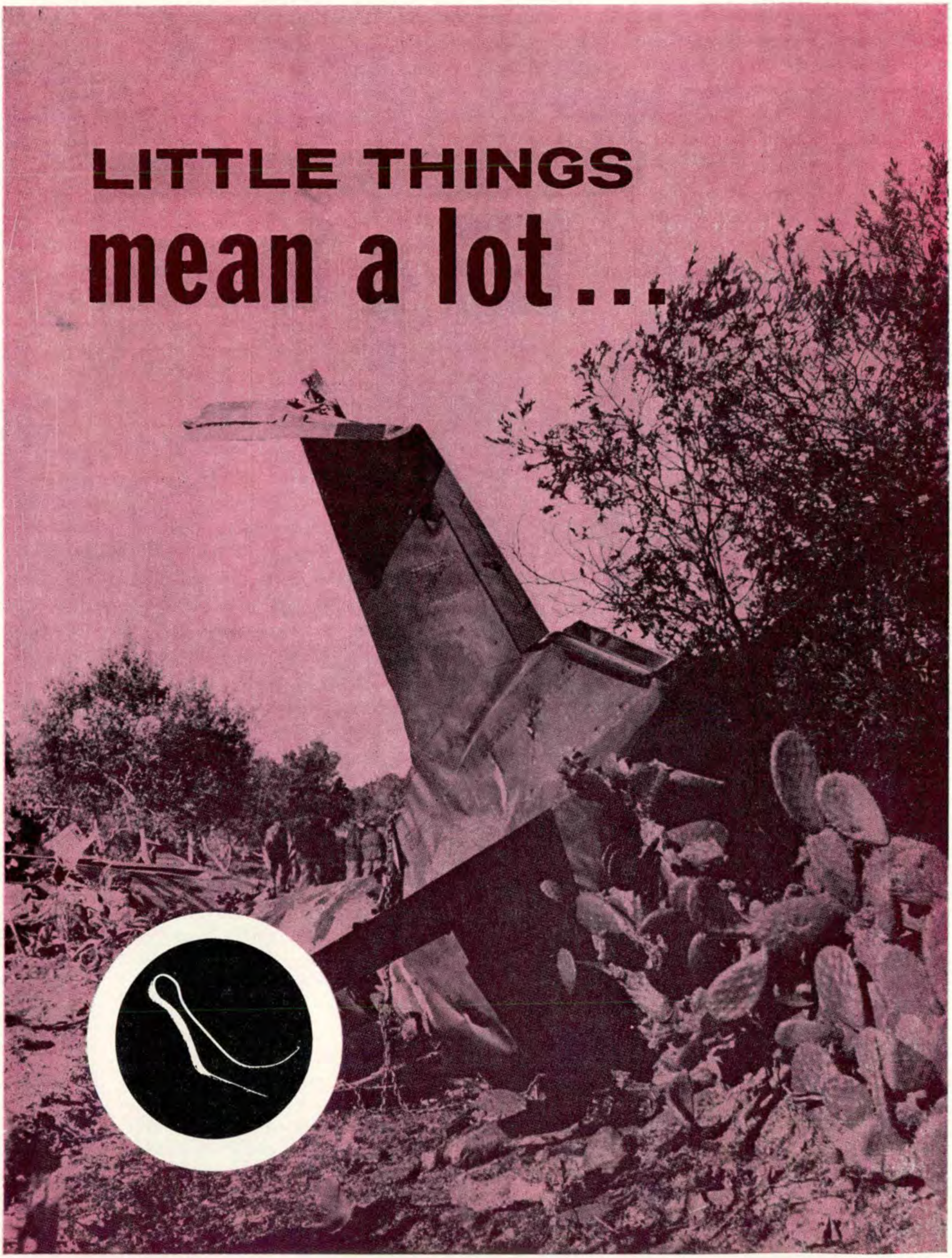
WELL DONE

CAPT. RALPH R. CARLOCK

319 Fighter Interceptor Squadron, Homestead AFB, Fla.

During the night phase of a tactical evaluation, Captain Ralph L. Carlock was scrambled as a wingman in a flight of two F-104s with a TAC EVAL chase. After level off at 35,000 feet, the flight was paired against a low level target. With speed brakes extended and descending through 15,000 feet, Captain Carlock, who had a total of 29 hours in the F-104, noted an engine rumble followed by decreasing EGT and RPM. Engine airstart procedures were effected with no response from throttle movements. An immediate transmission of the emergency was made and the speed brakes closed. At this point all cockpit lighting and communications were lost as both generators dropped off the line. In total darkness without emergency cockpit lighting or communications, Captain Carlock employed below 15,000 feet stall clearing procedures, stop-cocked the throttle and successfully obtained a relight and regained power and cockpit lighting at 5000 feet altitude. Engine acceleration was normal up to 95 per cent where it hung indicating a cold shift compressor stall. Again engine recovery to full power; however, under these conditions engine power cannot be reduced below 97-98 per cent for remainder of the flight and under this power condition it is extremely difficult to keep the aircraft under gear and flap placarded limitations.

Captain Carlock successfully landed his F-104A without incident after making a night weather approach while evading numerous thunderstorms in the area by applying G-loading to the aircraft to keep his speed down with the power at 98 per cent until he was over the end of the runway. The outstanding airmanship and extreme coolness that Captain Carlock displayed and complete knowledge of prescribed emergency procedures enabled him to cope with an emergency situation at night far out at sea and effect an extremely difficult recovery and landing both at night and in weather. His achievement is indicative of his high degree of professional airmanship and is a credit to the United States Air Force. Well Done!



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