AEROSPACE

SAFETY

UNITED STATES AIR FORCE

JULY 1963

. . . For excellence in coping with an inflight emergency . . .

THE KOLLIGIAN TROPHY

Lt. Col. Forrest W. Wilson

Strategic Air Command

Lt Colonel Forrest W. Wilson was awarded the Koren Kolligian, Jr. Trophy for 1962 during ceremonies 7 May 1963 at the Pentagon.

The award went to the SAC WU-2 pilot for an extraordinary achievement during an upper air sampling flight. While over Alaskan waters, about 300 miles from land and at night, the aircraft generator failed causing complete electrical failure. This resulted in failure of communications, electrical flight instruments and navigation equipment. Cockpit temperature went to full cold and trim power was lost. Without engine instruments, a letdown was imperative to prevent exceeding engine limitations and possible failure. Caution was required to prevent a flameout, since a restart would not have been possible without electrical power.

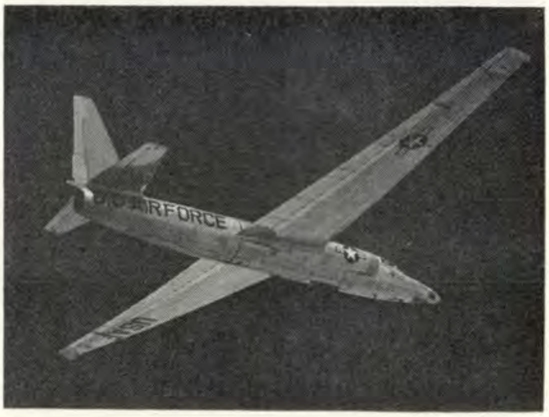
Lt Colonel Wilson descended to a lower altitude successfully, but now had the problem of navigating from an uncertain position to a suitable field. The only instruments available were the standby compass and altimeter. Using a flashlight to read the instruments, he set course for Kodiak, Alaska. Meanwhile visibility was restricted by ice on the canopy and frost on the face piece of his pressure suit. Further discomfort and fatigue were caused by the necessity to keep constant pressure on the controls because of the out-of-trim condition.

Despite the handicaps, Lt Colonel Wilson's navigation was precise and he arrived over Kodiak, only to find the field lights off. Rather than attempt a landing with no aircraft landing lights and a dark field, he decided to go to Elmendorf Air Force base.

Three hours and 15 minutes after failure of electrical power he made a successful landing at Elmendorf.

In presenting the award, General William F. McKee, vice chief of staff, Air Force, cited Lt Colonel Wilson's skill and courage under almost impossible emergency conditions.

The Kolligian Trophy is presented annually to the Air Force crewmember who most successfully coped with an inflight emergency. ★



IN THIS ISSUE

FALLOUT

February Cover Pic

Reference is made to the February cover pic and the inscription "Are you doing your job right?" I looked in vain for an article pointing out at least two actions the fly-boy is doing wrong.

First, he is carrying his parachute in an unauthorized manner.

Second, he is wearing low-quarter shoes.

Not as important, but nevertheless wrong, is that his helmet and mask should be protected inside a bag, and he should be wearing head gear of some type.

Was this picture printed to test us?

SMSgt John C. Chandler
9 Bomb Sq, Carswell AFB, Tex.

Our artist claims Rex is wearing boots but admits to a little artistic license on the other items.

From the Army

At present we're receiving one copy of Aerospace Safety. We enjoy the publication and we have a sound prevention program. We also have a problem. There are 96 officers, 10 flying warrant officers and 550 enlisted men here and that one copy just doesn't get around. If you can let us have additional copies, we can assure you they will be read and digested by flying personnel and will gather no dust.

Capt Robert C. Cook, Jr,
APO 46, New York, N. Y.

Your distribution upped to 10 copies.

Swept Wing Savvy

May we have permission to reprint the article "Swept Wing Savvy" from the March 1963 issue of your excellent magazine, Aerospace Safety?

R. Peel
Trans-Canada Air Lines.

Yes!

The March Cover

The March issue of Aerospace Safety has a slight mistake on the cover. Pictured is a KC-135 tanker in a right bank attitude. The aileron flight controls are reversed for this attitude. They should be right up and left down. Thank you.

A1C Robert A. Guertin
AF11387122, PO Box 1675
Williams AFB, Arizona

Could be the aircraft was rolling out of a right bank.

Well Done Award

I enjoy reading the "Well Done" feature in Aerospace Safety. In every case the pilot(s) and crews have demonstrated outstanding courage and airmanship in "bringing home the bacon." In many cases, besides saving valuable aircraft and lives, these aircrews have provided a basis for "get well" and "fix" programs that might never have been initiated if the problem aircraft had been abandoned.

Maj Lewis H. Batty
AFSC, Andrews AFB, D. C.

P.S. However, I'm an advocate of bailout whenever the situation warrants.

Selection of the Well Done Award winner—sometimes not an easy job—is made quarterly by a board of highly qualified pilots. One consideration that is always involved is the careful weighing of all factors concerned, to be certain that the pilot made the proper judgment.

Parachute Canopy Release Tips

We in the Parachute Branch appreciate the fine publication of the Parachute Canopy Release Tips in the April issue of Aerospace Safety.

However, there is one error which I overlooked in the transmittal letter that should be corrected by a short note, if possible. The initiator of the provided information is Mr. Charles E. Carroll, Chief of the Man-Carrying Section of the Parachute Branch, ASD, and not the undersigned who signed the transmittal letter. I think Mr. Carroll should receive the credit for the excellent information provided for the article mentioned above.

Alfons M. Hegele
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Volume Nineteen Number Seven — USAF Recurring Publication 62-1

The Weather Bureau initiated the National Severe Storm Project under the direction of C. F. Van Thulenar. In a broad scope, the project was to increase knowledge of severe storms, particularly in areas not investigated by previous work of this type.

The project was to be cooperative with the Weather Bureau, FAA, NASA, Navy and Air Force participating. The Air Force's contribution was to be the collection of data at altitudes up to 42,000 feet inside the developed thunderstorm. It was to be a five year project. The Air Force has actively participated for the last three seasons.

The project is based at Oklahoma City, Oklahoma, in the heart of "tornado alley" the scene of the most energetic spring squall lines in the United States. Many aircraft and pilots have flown in the storms and considerable operational and technical information has been gained.

The following article is Captain Kondracki's account of Rough Rider 1962, in which he flew the F-100 aircraft.

ROUGH-RIDER-1962

Captain J. G. Kondracki and Mr. E. T. Binckley
Aeronautical Systems Division

The Air Force's contribution to Rough Rider 1962 included 47 storm penetrations with an F-100F aircraft. Most of the storms occurred last spring in the southwest United States, within 200 miles of Tinker Air Force Base, Oklahoma, but a total of six penetrations were also conducted in thunderstorms in the New England area during July 1962. The configuration of this F-100F for all storm penetrations was the equivalent of two 275 tanks (a standard tank at the right intermediate station and an instrumented 275 gallon tank at the left intermediate station).

Modifications to this aircraft to minimize possible damage or failure in weak areas included:

- A metal cover for the antennae in the intake lip to replace the standard fiberglass cover;
- Numerous static dischargers added to wing and tail trailing edges;
- Erosion boot added to leading edge of the vertical fin to protect UHF antenna;
- Addition of airstart ignition switch to activate engine ignition without dropping the DC generator off the line, and
- Replacement of the air heated pitot boom with an electrically heated head.

A T-33 aircraft was also used in the 1962 project and usually penetrated the storms simultaneously with the F-100, but spaced 5000 feet below. All F-100 penetrations were between 20,000 feet and 37,000 feet MSL with the tops of these storms ranging between 35,000 feet and 70,000 feet MSL. Tops of the storms were measured by radar and estimated by U-2 aircraft.

Since T-33 thunderstorm experiences have been widely discussed in many previous articles, this material will be primarily devoted to experiences with the F-100.

The primary objective in penetrating these storms was to gather meteorological data for the U. S. Weather Bureau. Secondary objectives were to gather information for aircraft loads data analysis; to measure aircrew utilization of oxygen during critical situations; and to test a new type static discharger. A Flight Test Engineer was carried in the rear seat for all storm penetrations to operate special test equipment and to photograph the storm systems. Thus, the pilot was able to devote full attention to aircraft control and qualitative observations of precipitation, turbulence and electrical activity.

FAA's Oklahoma City Approach and Departure Facility provided the project aircraft with continuous radar monitoring and vectoring for storm penetration and also for departure and recovery service at Tinker. This service enabled the penetration aircraft to be positioned in selected intensities of the precipitation so that a gradual progression to the more intense areas (referred to as the "hard core") of the thunderstorms could be effected. The object of this gradual progression was to attempt to correlate the precipitation, turbulence, and electrical levels in these storms with the pattern and intensity of the ground radar returns.

The radar service also enabled the F-100 and T-33 to penetrate the same cells at the same time, on the same heading with approximately 5000 feet vertical separation. This positioning was designed to gather meteorological data which could be used to substantiate the vertical cross-section characteristics of severe storms. This radar service, supplemented with aircraft reconnaissance by B-57s and DC-6s of the U. S. Weather Bureau and U-2s of the Air Force, also provided means for selecting the most interesting storm systems for penetration. This radar and the aircraft reconnaissance were also used to observe the storm systems and general weather patterns throughout the test area before, during and after the penetrations.

PRE-PENETRATION PREPARATION

Basically, handbook procedures were followed for penetration with certain modifications to accomplish test objectives. All anti-icing equipment was activated well before icing conditions were encountered. Generally, each mission followed this outline:

- Pitot heat was actuated on the ground for flights with the air heated pitot boom or shortly after takeoff with the electrically-heated boom.
- Loose articles were stowed to prevent loss or interference with cockpit activity during severe turbulence.
- Seat Belts and shoulder harnesses were tightened to take up all slack. This proved to be very important in exercising proper control of the aircraft in severe turbulence and slight discomfort resulted from the proper fit.
- Guide vane anti-icing was turned on prior to penetration and left on 'til completion of penetration of icing conditions or heavy precipitation.
- Cockpit lights on bright to minimize momentary blindness after lightning flashes.
- Cockpit defrosting air on "low" to prevent canopy fogging during penetration.
- Navigation aids tuned prior to entering clouds. (Electrical interference may prevent proper identification of navigational facility if tuned in clouds.)
- Aircraft was stabilized and trimmed for 275 KIAS at penetration altitude and engine power setting and pitch attitude noted.
- Exterior windscreen air was not used so that qualitative observations of precipitation type and intensity could be made.
- Penetration heading was established prior to entering severe turbulence and also a heading for quickest exits from the storm established in case of emergency.
- Attitude gyro was primary flight instrument.
- Engine instruments were monitored closely for first signs of engine malfunction in heavy precipitation.
- After getting out of the storm and into the clear (when possible), the aircraft was visually checked for damage, icing or other unusual conditions. Slat operation was checked at this time.

RAIN

Heavy rain was encountered at all altitudes in the thunderstorms, even though the penetration level was well above the freezing level. This phenomenon was attributed to the very strong vertical air currents in large storms which were able to support extremely large masses of water and carry them rapidly aloft without freezing. This heavy concentration of rain was naturally most predominant in the "hard core" of the thunderstorms.

These heavy concentrations of liquid precipitation proved to be one of the hazards of thunderstorm penetration because of the disturbance of inlet airflow to the engine which resulted in a series of engine compressor stalls on seven storm penetrations. These engine stalls varied from single isolated stalls to a series of stalls where approximately 20 stalls were counted. This engine malfunction was anticipated, however, and due to past experience with the J-57 engine in heavy precipitation, a form of continuous ignition was installed. Engine ignition was actuated upon encountering compressor stalls to preclude the possibility of flameout. No sustained flameouts occurred during these engine stalls, but exhaust gas temperatures approached maximum during the long series of stalls, possibly due to flameout and rapid relight. All engine stalls were heavy (typical of the stall encountered on hard afterburner lights) producing a sharp vibration felt throughout the airframe and were accompanied by the noxious fumes in the cockpit that is so typical of engine stalls in the F-100. As long as the aircraft remained in intense precipitation these stalls persisted.

Heavy fogging of the cockpit also occurred shortly after entering the heavy precipitation area due to a rapid change of temperature and humidity conditions. Visibility outside the cockpit was completely obscured, but defrosting air soon cleared the windscreen and canopy.

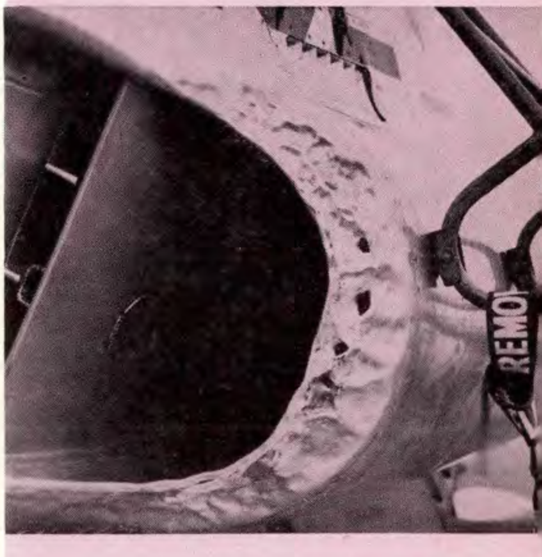
HAIL

Once the large masses of suspended water begin to freeze, the most imposing hazard of thunderstorm flying occurs—*hail.*

It is generally accepted that hail may be encountered at all levels of thunderstorm activity and is not necessarily restricted to the actual cloud itself, but may be also encountered in the clear air nearby. Hail may also be mixed with rain and on numerous occasions during this program, small hail was hard to distinguish from the pelting of large rain drops on the wind screen.

Larger hail, however, produced a distinct knocking sound and could be observed to disintegrate on contact with the windscreen. Hail damage during storm penetration consisted of airfoil denting, breakage of exposed composition and glass items, and distortion of pitot pick up. Some of the specific damages sustained by the F-100 during hail encounters were:

- APG-30 radar antenna cover torn (replaced with metal cover).
- Slight denting of wing slats.
- Rivets loosened on wing and tail.
- Slight denting of fuel tank nose cone.
- Cracked windscreen.
- Pitot head damaged.
- All exposed light lens and lights broken.
- Fillet seals damaged and fuselage-to-wing wiring frayed and severed.
- APW-11 antenna cover broken off.



ICING

Airfoil icing did not present a control problem during this program. Light rime icing occurred at high altitude in the "blow off" (anvil) as the high winds carried light, slushy precipitation downwind of the storm. In the heavy rain of these storms clear ice did not build up, and in fact, any accumulated rime ice would be washed or knocked off the exposed surfaces. Lack of clear ice buildups on the airfoils has been attributed to the high true airspeeds that were necessary for penetrations, usually greater than 400 knots TAS.

Pitot boom icing did present a problem during the early phases of the project. Loss of airspeed occurred both in the rime icing of the anvil and in the heavy rain of the "hard core." Malfunction of the airspeed indicator due to icing was usually insidious at onset and was characterized by a gradual decrease in indicated airspeed.

When doubtful airspeed readings were suspected, care was taken to maintain proper pitch attitude with an occasional check of slat position. During all failures of the airspeed indicator, the *air heated* boom had been heated well in advance of encountering icing conditions, but the de-icing action was not capable of preventing ice formation. The air heated boom was subsequently removed and the electrically heated boom (standard on F-100F-20 models and later) was installed. No further probems with pitot ice were encountered after this change.

TURBULENCE AND CONTROL

During all penetrations the recommended turbulence penetration airspeed (275 KIAS) was used. As expected, severe turbulence was encountered in and near the "hard core" along with the intense rain and hail. The turbulence was caused predominantly by updrafts and resulted in increased altitude although occasional violent downdrafts were experienced, especially near the periphery of the storm.

In severe turbulence, the primary consideration in flying instruments was to trim the aircraft at penetration airspeed and then maintain approximately the same attitude as that held prior to storm entry.

Control problems were not extreme and the F-100 traversed the severe turbulence areas very well. Most deviations from the present penetration attitude occurred as rolling reactions with only slight reactions and very little reaction in the yawing axis of the aircraft.

Displacements of 45 degrees of wing roll and 10 to 15 degrees of pitch were not uncommon in the most intense turbulence. In this situation exact control of heading, airspeed, altitude and rate of climb cannot be exercised, thus relying on the attitude gyro almost exclusively greatly simplifies instrument procedures. Instantaneous airspeed fluctuations of 20 to 30 knots IAS were not uncommon during severe turbulence and, due to the predominant updrafts of the maturing storms, an overall gain in altitude of 1500 feet was not uncommon. Dampers were used for all penetrations, and yawing or sideslipping was not objectionable.

The value of attitude control in turbulent areas was emphasized during this program when the forward section of a special nose boom was torn from the aircraft by intense precipitation and severe turbulence. This failure of the nose boom, it must be emphasized, was due to an overload caused by a special installation of pitch and sideslip vanes and should not occur with the standard boom installation. The loss of the pitot boom occurred shortly after entering a large storm and rendered the airspeed and altimeter inoperative. Alternate sources of altitude were available, however. The rate of climb indicator glass was broken, and cockpit pressurization was turned OFF. Under these conditions, the altimeter and the cabin altimeter use cockpit air for an approximate altitude reference. Although not as readable as the normal altimeter, the cabin altimeter proved to be more accurate than the normal altimeter because of damage to the static lines. Although exact airspeed information was not available, a safe stall margin was maintained by monitoring the position of the wing slats. Sufficient information was available for a letdown and rendezvous with a chase aircraft for final approach and landing. By noting position of the slats during a typical final approach, safe airspeed could have been maintained on final even if chase were not available. Caution must be exercised however, when relying on slat position for airspeed information. Slats must be checked for icing which could cause incorrect operation and greatly increase stalling speeds.

LIGHTNING AND THUNDER

Aside from the mentally disturbing aspects of lightning and thunder, slight damage to the aircraft in the form of skin burns on the wing and tail trailing edges was sustained even though these portions of the aircraft had been generously equipped with static dischargers.

Lightning strikes on or near the aircraft produced a concussion wave that was felt throughout the airframe and, except for the accompanying flash of light and absence of engine fumes, might be confused with compressor stalling.

While flying through the areas of intense electrical activity that have just been described, electrical shocks were experienced by the crew on several occasions. These shocks usually occurred while touching metal switches or controls or other metal parts of the cockpit. The pilot of the T-33 during transit through one large storm received several substantial shocks from the canopy area and immediately sustained a mild headache from these jolts. It was noted that during flight through areas of high electrical activity the 75 mc marker beacon light would occasionally flicker on and off and at times glow brightly for short periods.

RADIO AND NAVAID RECEPTION AND RELIABILITY

Due to the intense electrical disturbances and the large amounts of precipitation that are characteristic of thunderstorms, the radio and navaid equipment was not as reliable as might normally be expected. Use of the low frequency radio compass was not even attempted in the vicinity of thunderstorms. Not only is low frequency equipment affected by these electrical and precipitation disturbances, but VOR navigation and UHF command equipment were at times limited during storm penetration. The disturbance on the VOR and UHF receivers varied from soft aural hissing in the less intense areas to an irritating high pitched squeal that at times completely blocked reception.

During periods of intense static on the VOR receiver, it was noted that the bearing indicator was unreliable due to fluctuation and aimless wandering. The static disturbances on the VHF and UHF receivers were more pronounced in the sloppy, or ice crystal precipitation near the "hard core."

Surprisingly, it was found that even though UHF reception would be blocked, UHF transmissions would get through and be received loud and clear by ground stations. The IFF transponder was used for all radar monitoring and vectoring service and proved to be very reliable during all phases of this project.

AIRCRAFT DAMAGE AND PERFORMANCE COMPARISON WITH T-33

As expected, the airfoil damage to the F-100 was substantially less than that sustained by the T-33. This was of course due to the heavier structure and the swept-back design of the F-100. By generally penetrating the same type of conditions, a chance for comparison of various features was afforded. The damage on the F-100 has already been discussed, but some of the damage sustained by the T-Bird was:

- Large dents and holes in intake ducts (replaced during project).
- Large dents in leading edges of wings.
- Large dents in horizontal tail leading edge.
- Large dents and hole in vertical fin (replaced during project).
- Tiptank cones sustained large dents and holes.
- Composition nose section shredded.
- Pitot tube dented.
- Windshield cracked.
- Armament compartment doors torn by hail.
- Lightning burns on wings and tail.

While the F-100 structure withstood damage better than the T-33, engine performance was below that of the T-Bird and in very heavy precipitation becomes marginal due to compressor stalling and possible overtemperatures. The T-33 pitot de-icing was also more reliable than the air-heated boom of the F-100.

In general, the old strategy of holding airspeed and attitude has proved sound, even at supersonic speeds. Preparation for storm penetration and confidence were again proved necessary. The penetration procedures given in Section IX of the Dash-One Handbook for the individual aircraft were satisfactory.

In addition to affirming that in emergencies storms can be safely penetrated, a number of other items of interest were determined.

It was found that the F-102 which had a history of flameouts in storms, could operate safely with the installation of a device to provide continuous ignition to the engine.

It was found that supersonic penetrations were possible and that the bumpiness does not increase with speed as it does in the subsonic range.

It was found that ice crystals or liquid water could cause as much damage at high speeds as hail.

It was found that any soft surface (such as a radome or antenna) or any rough surface would suffer damage in precipitation at high speed.

It was found that dacron seat belts could not be cinched down adequately to prevent pilot movement in heavy turbulence.

A better static discharge protection system was found.

Every flight has added more to the storehouse of knowledge to enable us to understand thunderstorms and to safely penetrate them if necessary. Since most storms are encountered unintentionally, a review of the phenomena and experiences a pilot might expect during severe weather encounters is certainly the "order of the day." ★

2 MINUTES T

IT WAS JUST BEFORE DAWN that the twin-engined transport moved into position on the active. Everything was ready, almost ready, for a routine mission support flight. A complete runup had just been completed. Everything checked out. Clearance had been received and read back. Fuel on board was adequate—more than adequate really, as the flight plan showed an estimated time en route of 2 plus 30 and nine hours fuel on board. But the overage on fuel could permit several subsequent legs to be flown without fueling delays. There were 20 souls on board—a crew of three and 17 passengers. Weight was just under max allowable, but in limits and calculated to provide at least minimum single engine rate of climb even at a field elevation of nearly 5000 feet.

"Air Force 2345, winds calm, right turn out of traffic, cleared for takeoff," the tower controller said.

"Roger, 345," the copilot acknowledged.

Power was advanced. Air Force 12345 was now two minutes and five miles from disaster.

A discrepancy soon became apparent. BMEP was low. The copilot noticed this, that the water had not been turned on (A challenge-reply item on the Line Up check), but did not call abort. Instead, he advised the pilot of the dry power setting. Although the flap setting (15 degrees) was for a wet takeoff, the pilot elected to continue takeoff. Liftoff was achieved and the pilot called for the gear.

"Is that backfiring?" the pilot asked at about the time of gear retraction. Light detonation or backfiring was coming from the right engine.

The flight steward noticed a blue-white flame approximately three feet in length coming from an augmenter tube on the right engine. He immediately went to the cockpit and told the engineer that blue and white fire was coming out of the exhaust and the engine was backfiring—tremendously, he said. He observed "They were very busy at this time." He came back and suggested to the flight examiner engineer that he go forward and explain the trouble. The steward again went back to the cockpit, then remembers the engineer coming up and pushing him aside. By this time others in the cabin had begun to mill around. The steward shoved two sergeants back into their seats, told them to sit down and strap in, then did the same himself.

Power was reduced to METO. The flight mechanic didn't remember hearing the call or reducing RPM to 2600. Detonation increased. The pilot reduced power on the right engine and, pushing the left throttle full forward, called for max power on the left. The flight mechanic, thinking that max power was still on, did not increase the RPM. The shrill ringing of the fire augmenter overheat warning bell started as right engine power was reduced. No fire warning light.

Stan/Eval procedure stipulates flight straight ahead or a right turn for emergency traffic. Clearance instructions were a right turn after takeoff. However, the pilot decided on a left turn to the normal traffic downwind, reasoning that a left turn would provide better control and visibility and put him in a position to land on another runway, should further trouble develop.

When he started his left turn, the pilot called to the copilot: "Check the right engine for fire."

"Tower, this is 345, we'll be turning left here. We'd like to come back and land. We have a fire in the left engine." The copilot thought he reported that the right engine was giving the trouble.

Cockpit activity increased. The pilot remembers someone came running up from the back . . . there was a lot of action . . . the pilot was most concerned with controlling and flying . . . most of the conversation was directed to the flight mechanic, behind the pilot . . . turned about 60 or 70 degrees . . . Nr 2 still bad, somebody said.

Now roughness, odd kind . . . something radical, maybe a prop about to come off.

"Feather the right engine!" the pilot ordered.

The copilot heard, but delayed briefly. He was still checking the engine for fire.

The flight mechanic heard the command, noticed the copilot delay, figured the copilot still busy on the radio and reached up and feathered Nr 2. He then pulled what he believed to be Nr 2 mixture control to the idle cutoff position. He didn't question the copilot's delayed response, or advise that the pilot had directed feathering.

At about this point in time, it is believed, the left engine carburetor heat control was inadvertently placed in the full hot position rather than the right engine mixture control being placed in idle cutoff.

"No, it's Nr 1!" This is what the pilot heard someone shout immediately after the Nr 2 prop had been feathered.

Now what? There hadn't even been indications on cockpit instruments of Nr 2 being bad. Doubts raced through the pilot's mind. Had he been given indications of the wrong engine before . . . had the flame been coming out of Nr 1, not Nr 2 . . . had they misinterpreted which engine they were watching . . . were BOTH engines going bad?

"Well, which one is it?" He yelled. He wanted to know, *had* to know!

It was possible, probable he now thought, that he was losing both engines. Turn away from the mountains. Get down toward the flat lands. Closest way to the right. He turned right.

"Max power on the left." Airspeed was falling off. The flight mechanic reached *toward* the prop controls and told the pilot he had max power. (Actually, RPM was 2590; despite the pilot's request for max power on two different occasions the RPM was never increased to 2800.)

At no time did the pilot call for water ON. (Performance charts show that with the left engine throttle full forward and 2600 RPM, a rate of climb of 220 feet per minute should have been attained, assuming a properly functioning engine. Water on, this rate of climb increases to 320 feet per minute.)

Roughness persisted. Airspeed 122 to 123. Why the buffet? Single engine climb speed had been computed as 123 knots. The pilot eased the nose down to try and pick up a little speed and decrease the buffeting. No change.

Lights on the ground were coming pretty fast. Airspeed dropped to around 120 very quickly, and intermittently down to 110. Cars could be seen on the highway to the south. Maybe they could reach that area. As good a place as any. Don't dare let the nose get too low, or a wingtip dig in. Cross check was airspeed and lights on the ground. Can't make the highway! Continue right turn. Ground slopes right. Hope. Pick the flattest spot. Set it down. Slowest possible airspeed without losing control.

The next thing the pilot remembered was people calling over him. Bodies were on top of him. His left leg was caught. He called to see if they could move or get off. Finally they moved. Next, he was walking up the hill.

Investigators concluded that the primary cause of this accident was "Inadvertent application of full carburetor heat on operating engine resulting in loss of power, and ground impact." Approximately 1700 BHP was being produced by the left engine.

What was wrong with Nr 2 engine? Here's the analysis made by maintenance investigators: Problems encountered on Nr 2 engine were determined to be the result of cylinder ignition malfunctions caused by the presence of two broken or cracked carbon brushes in an ignition distributor as well as missing high tension contact springs of ignition coils for two of the cylinders. Review of historical records available revealed the presence of repeat write-ups on these cylinder positions, marginal performance of the engine as well as the condition of engine instability during idle.

From the conditions noted and witness statements available, it was apparent that the "dry power" takeoff executed, compounded by these malfunctions, resulted in mild engine detonation in addition to intermittent "after firing." Other than torquemeter oscillation, evidence of loss of power on Nr 2 engine during takeoff and climb was not noted. (Investigators stated: "Had wet power been used . . . it is possible torching of the right engine would not have occurred.") Detailed investigation and a complete teardown of both Nr 2 engine and propeller revealed that both systems, except for the ignition discrepancies noted, were in excellent condition *and capable* of producing specification power output. The investigators also concluded that a three-cell government issued flashlight and a box end wrench found in the Nr 2 engine accessory section area after the crash in no way contributed to the aircraft crash. But they do make the effectiveness of maintenance discipline and supervision questionable. Supporting the questionable maintenance contention was the fact that the Nr 2 propeller electrical deicer power cable was completely burned through, and had been for a period of time sufficient

o DISASTER

to permit balls of melted copper adhering to ends of the affected strap to become well oxidized.

Investigators reported such training area findings as:

Pilot. Last proficiency flight completed on a mission support sortie of 4:50 duration. AF Form 781 and AF Form 5 do not indicate that any landings or instrument approaches were accomplished by the pilot. During the same flight, another pilot was given credit for an Annual Proficiency Evaluation Flight Check as Instructor Pilot. Last instrument Flight Check in type was also given on a mission support type sortie. Duration of flight was 5:15, of which 2:40 was logged as actual weather. Both pilots were credited with one landing and two precision approaches each. AF Form 8B indicates unusual attitudes, steep turns, low, missed and non-precision approaches were accomplished during the mission. The IP was not placed on Flight Examiner orders until the following day.

Copilot. No recurrency check subsequent to his return from four months TDY during which he had not flown aircraft type. Annual proficiency check approximately four months overdue. No record of night qualification in type aircraft.

Flight Mechanic. Current in type, to receive spot check this flight.

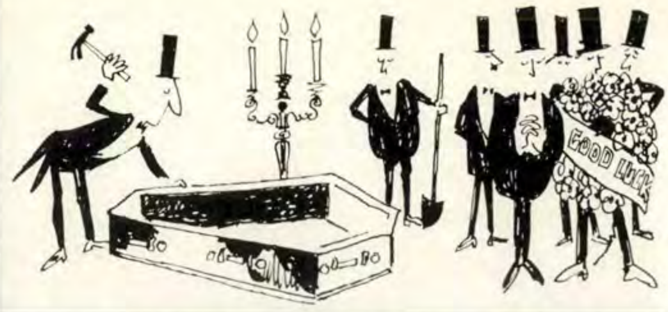
Instructor Flight Engineer. Current except review and reaccomplishment of aircraft questionnaire overdue.

Investigators further observed that flying hour allocation has not been given an increase commensurate with increased airlift requirement. Additionally, accomplishment of proficiency training on mission support flights is encouraged. A large percentage, therefore, of the training requirements for pilots must be accomplished on routine support type missions rather than in the local area, thus precluding a continuing intensive training program of simulated emergency type aircraft operation.

Aeromedical investigation resulted in findings and recommendations fairly representative of crash cases wherein the fuselage maintains its integrity—shoulder harness for aircrew members, stronger seats and seat attachments, better operability of escape exits, emergency lights, survival and emergency equipment, seriousness of distracting and confusing cockpit personnel in critical areas of flight and hasty actions in an emergency when an interval for careful analysis is usually present.

ED. NOTE. It is indelibly realized that analysis of this emergency takes a completely different complexion when viewed, unhurriedly, from the vantage point of an office chair and with the aid of specialists. Because of this, it may well be that others of us would have done no better, if as well, had we been faced with this same situation. This pilot had over 4000 hours, 35 hours in the past 30 days, and the copilot 38 hours in the past 30 days—more than many mission support pilots get to fly.

The purpose in printing the article is not in any way to castigate these crewmembers, but, it is hoped, to cause others to make sober self-evaluation. There may not be all the stick time we would like, but there seems to be plenty of link time, and plenty of cockpit time. Printing of the story in this magazine is in line with recommendations made by the accident investigation board: "That the Directorate of Aerospace Safety emphasize to all commands the need for increased and continued emphasis on crew discipline and proficiency training in command support type aircraft." and, that the Directorate of Aerospace Safety emphasize in the Aerospace Safety magazine this introduction section of the Dash-One: "Although many inflight emergencies require immediate corrective action, frequently difficulties are compounded by the tempo of the pilot's commands and hurried execution by the crew. It is essential that the pilot carefully analyze his difficulty prior to taking corrective action." ★



Are You Just Dying To Die?

Major Leonard Berlow, USAF, MC, APO 677, New York

Ever give much thought to dying? Will it be the result of an accident? Heart attack? Cancer? One thing's certain. Each of us has this event to face.

Since this is the case, why not look for the best way? There's one that's even pleasant. Let's eat ourselves to death! Come to think of it, that's quite a paradox. Food—the staff of life—and yet too much of it can do the job.

There are compensations for the extra weight while we're on the way out: new wardrobe, or at least some tailoring, to fit the bigger frame. This is worth dying for?

And you heavyweights on flying status may not have to face the ordeal of going into the wild blue yonder over 18,000 feet. You're not physically qualified. But in a way there's something to look forward to—no flight pay. Less groceries—less weight; equals out in the end.

Are military fat people so different from civilian fat people? Not at all. They're both fighting their way into hospitals with diseases of the kidneys, heart, gall bladder—even diabetes, arthritis, hernias and perhaps some forms of cancer.

Pity the poor surgeon as he cuts through layers of blubber, searching for tired out diseased organs all hidden in fat.

Then there's the problem of giving anesthesia to fatsos. It's a lot more difficult to "get them under" because the gas or other anesthetic has loads of places to go.

They say medicine isn't as effective in a fat person either. Same principle. And the heavy ones are much more fracture prone because the ole bones are burdened down with the excess baggage. As if this weren't enough, here's another way heavyweights are in trouble. They can always look forward to a fat embolism. There are little plugs of fat that develop in the blood stream. They just go sailing around until your heart or lungs get sneaky enough to stop 'em. And the farm's bought.

Doctors believe that overweight is merely an expression of emotional distress. You know—"If I can't have what I want, I'll show you, I'll get fat—so there." Anyway it's one means of saving money. Fat ones are usually turned down on life insurance as poor risks (means they die young—but happy).

Here's the clincher. Wouldn't you know they'd get the idea to document the whole thing in ERs. That'll *kill* you—if the excess weight doesn't.

Cheer up! There is a way out. It's a quick exercise three times a day. Merely place the hands at table's edge. Push back. Stand up. Take off. All this is done after you've had a complete meal consisting of less food than usual—no seconds.

Doctors at local medical facilities will gladly furnish information regarding weight programs. In the meantime, here are a few tips they suggest:

- Never miss a meal, particularly breakfast. It's a strain on the body and a major cause of fatigue. Eat meals at regular hours.
- Don't gulp or wash food down with liquids. Smaller amounts of food will be more satisfying and more easily digested if chewed well.
- Avoid in-between foods, including beer, liquor and soft drinks.
- Don't depend on exercise alone to lose weight. It'll help, combined with a sensible diet. Alone, it can overburden an already tired heart from the overweight.
- Don't try to sweat it off in the steam room. Three drinks later and it's all back again.

The answer? Why not eat to *live?*

BLOWOUT!

After taxiing two and one-half miles from the ramp to the arming area and then to the active, a flight of two F-100s was cleared for takeoff. The roll was normal until about 130 knots when lead felt a light vibration and a slight pull to the right. He corrected with rudder, then the aircraft veered sharply to the right. The pilot was unable to correct with rudder or brake and the F-100 left the runway. It rolled over a slight depression, across a taxiway, caught fire and finally came to rest 6445 feet from the beginning of roll.

When the aircraft stopped, after collapse of the left main and nose gears, the pilot raised the canopy electrically and left the aircraft headfirst without removing his personal equipment. The aircraft was on fire and the pilot's only concern at that moment was to get out and away!

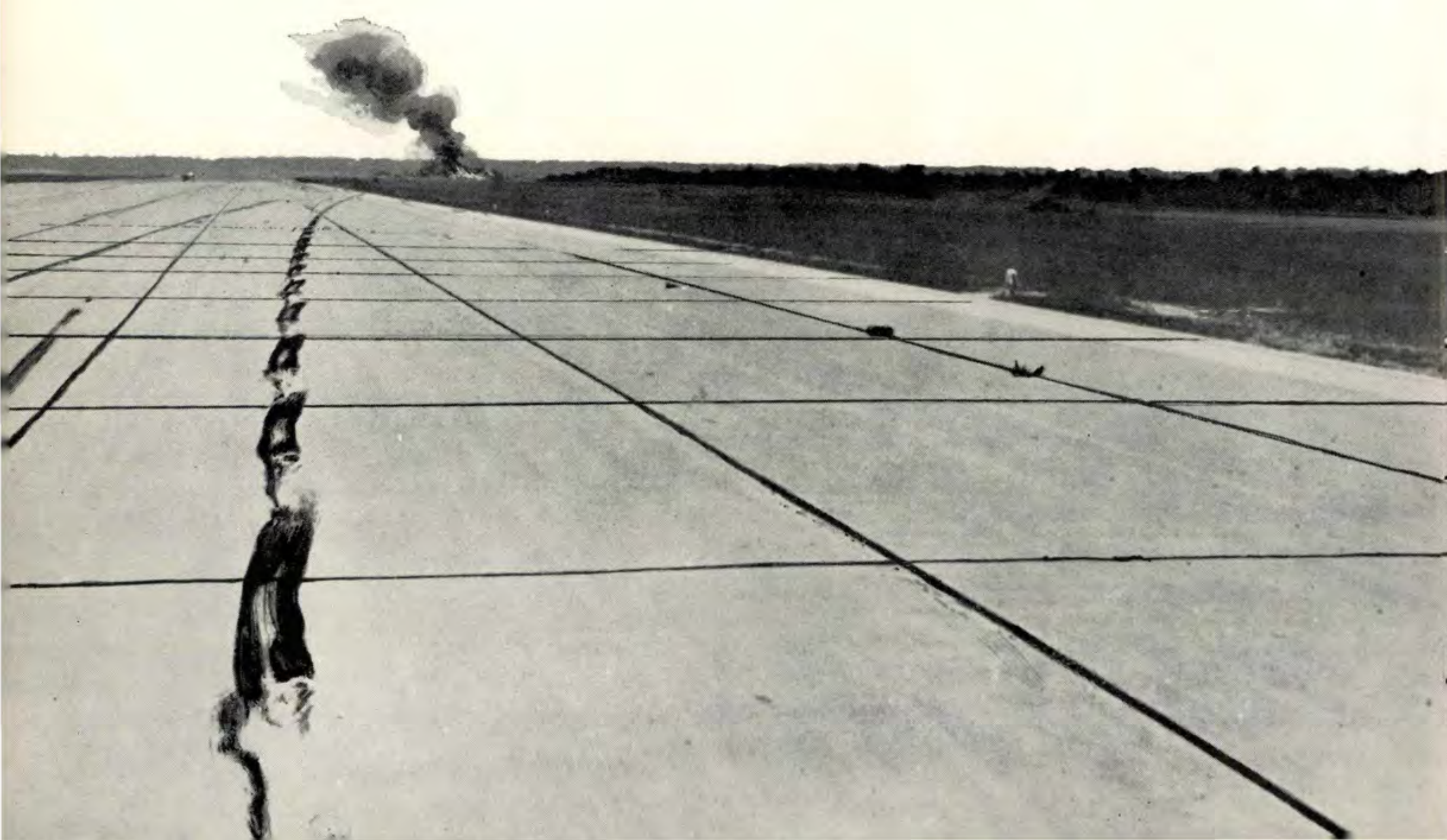
At takeoff both aircraft accelerated normally, Nr 2 maintaining a position to the left of and slightly behind lead. At approximately 130 kts, Nr 2 noticed smoke coming from lead's right tire, just after the lead pilot felt the slight veer to the right. A second or two later the wingman saw pieces of rubber coming from the tire. At 140-145 kts the lead pilot felt severe vibration as the right tire blew out. The aircraft started a sharp turn to the right which he was unable to overcome, although he employed left brake, left rudder and nosegear steering.

As the wingman continued past lead and began to climb he looked back and could see the pilot being violently thrown about the cockpit, and the aircraft catching on fire.

Meanwhile the lead pilot was attempting to deploy his drag chute and take abort action. Except for stop cocking the throttle, he was unable to take any action because of the violent movements of his body. The aircraft left the runway, crossed a shallow depression and became airborne momentarily on the other side. As it came back to earth the nosegear struck a culvert shearing off the wheel and causing the gear to collapse. The left main gear then collapsed and the left main tank struck the ground, ruptured and caught fire. It finally separated and came to rest about 50 feet short of where the aircraft stopped.

Back along the way, it was determined that the nose of the right drop tank had ruptured just after the aircraft passed over the culvert and ignited several hundred feet before the aircraft came to a halt.

When the aircraft finally stopped, the pilot noted the fire and heard the canopy melting from the heat. Declining to jettison the canopy for fear it would fall back on the cockpit, he raised the canopy electrically



and exited as fast as possible. After crawling a safe distance away from the flaming aircraft he removed his equipment. He was uninjured and was released from the hospital after an examination.

That the pilot was uninjured was extremely fortunate in that:

• There was a five-minute delay before the first crash equipment, a fire truck, arrived on the scene. This delay was brought about by a taxiing C-47 that restricted the movement of the fire truck, a landing R4D that prevented fire trucks from crossing the runway, a fire fighter falling off the lead fire truck.

• The rescue helicopter was flying in the local area and did not reach the wreckage until approximately six minutes after the accident. Four calls were required to contact the helicopter.

The cause of this accident was attributed to materiel failure of the tire, which was underinflated as the result of foreign object damage on the taxiway. This tire had been on the aircraft for only two landings. Because it was almost new, and the left tire had had to be changed after the preceding flight due to a deep cut, this tire had been carefully inspected and, during preflight, had been checked for proper inflation.

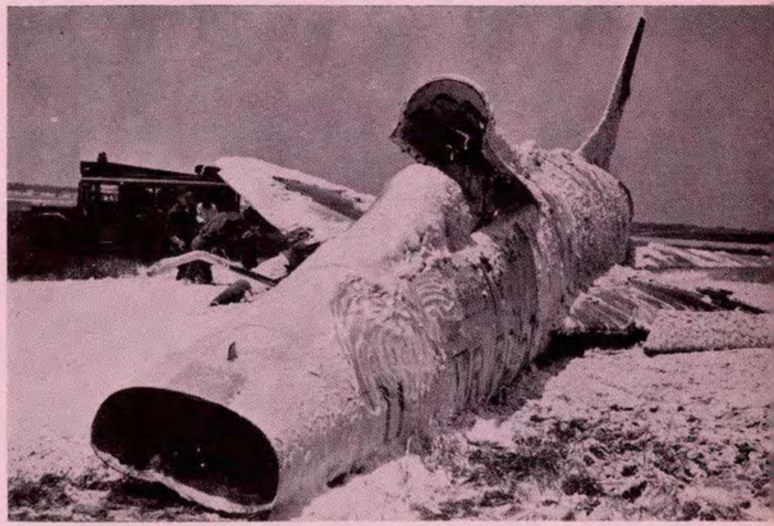
• One outfit, operating F-100s, was changing tires after 9.67 landings because of FOD.

• An F-106 unit reported that it had to change tires every nine hours and thirty-five minutes of flying time, and that during one month the frequency was raised to every four hours and fifty minutes. Again, FOD was the reason.

All bases have FOD problems, but at some bases the seriousness is more pronounced. One safety officer at a desert base reports that almost constant surveillance of the runways and taxiways is necessary. The wind is usually blowing and carries beer and soft drink cans and bottles, along with rocks, paper, wooden objects, etc., onto the concrete surfaces.

Another base has the problem of deteriorating concrete. Some of this concrete has been in place since World War II. Patching helps temporarily, but the area around the patches breaks down. Holes on the ramp are plain to see and obviously the concrete that filled those holes went someplace, hopefully not into an engine intake.

Foreign object control measures are well known, so there is little point in presenting a detailed list here. However, the action taken by the wing where the accident described above occurred may be of interest and use to other bases.



Pilots and maintenance men testified to the dirty condition of the taxiways and the investigation revealed that seldom was a tire changed due to wear, but that the life of tires at that base was very short due to damage caused by FOD. Investigators cited the excessive number of rocks, stones, nuts and bolts on the taxiways and runway.

FOD has been a serious problem at this base for a long time. Due to its location and several tenants using varied types of aircraft, the base is very busy. This and the rock stabilized taxiway shoulders have been a critical factor in the FOD problem. Engines of larger aircraft hang out over the shoulders of the 50-foot wide taxiways. Extensive new construction during the past years has also contributed to the problem, the seriousness of which is illustrated by reports from two tenant units on tire life.

• Tires are checked for cuts and serviceability prior to the aircraft taking the active runway.

• Daily inspection of taxiways and runways prior to the first flight of tactical aircraft. Foreign objects are brought to the attention of proper personnel for removal.

• Recommendations to the base that a more aggressive program be established to reduce foreign objects; stabilized areas next to runways and taxiways be sodded; better control of vehicular traffic on the airfield.

• Briefing pilots on the rapid chain of events following a tire blowout, and procedures to be followed.

• Use of a portion of each simulator period to practice emergency procedures. ★

"... Roger tower, it's a T-33, IFR from Andrews to Lockbourne, 15,000 feet . . ." The voice on the handoff telephone line sounded crisp and efficient. "He's critical fuel and his airspeed indicator is inoperative . . . do you have him?"

ATCS Emory Fleener, Coordinator, Columbus Tower, searched his vertical radar display and, as the voice continued — "He's now 20 miles east of Lockbourne . . ."—he located the radar target, identified it and pointed it out to ATCS Dean Skidmore, Radar Approach Control, who nodded acceptance.

"Roger center," Fleener spoke into his handoff line, "radar contact, 20 miles east of Lockbourne, 15,000 feet, change him over."

Within seconds Skidmore was in airport within range of his fuel supply (now 30 minutes) where weather would allow a visual approach. ATCS Charles Meng, Watch Supervisor, who was supervising the operation, had anticipated this development and had just completed checking airports within range of the jet for latest weather. All, with the exception of Columbus, which was giving ceiling indefinite, 600 overcast, visibility one mile, light snow and haze, and Lockbourne, were below minimums. Meng gave this information to Skidmore for relay to the pilot. Although the weather information was disappointing, the pilot had the satisfaction of knowing he had a half-way decent ceiling and visibility and, at least, a chance at Columbus.

This chance was almost short lived. As the pilot continued his descent inbound to Lockbourne his altimeter became erratic. It started to wind slowly then rewind rapidly. The pilot leveled off—still on instruments — and urgently called Skidmore, relating this new crisis and asking for assistance (requesting that a T-33 be scrambled from Lockbourne to lead him down through the overcast). Skidmore immediately cleared the T-33 to climb to a position on top (previous PIREPs reported tops 19,000 to 23,000 feet, clear above). Meanwhile, Fleener contacted Indianapolis Center, explaining briefly the situation and requested that all altitudes up to 30,000 feet over Columbus be cleared of air traffic and released to Columbus Tower. He stood by—within 30 seconds this was

With the weather in the weeds, airspeed indicator out and fuel supply critical, the T-33 pilot needed help. How he got it is an outstanding example of . . .

COOPERATION

contact with the pilot and had him lined up for a straight-in approach to Lockbourne. He gave the pilot current weather: ceiling indefinite, 500 overcast, visibility ¾ mile, light snow. The pilot acknowledged for the weather and continued his approach. Then he became apprehensive about an approach in this weather with an inoperative airspeed indicator, and asked if his airspeed could be calculated by radar. Although Skidmore could estimate the speed it would not be of sufficient precision to conduct an instrument approach and he so informed the pilot.

Skidmore shared the pilot's predicament; he knew that precise speed control was necessary to land the aircraft. If the pilot came in too hot he would most assuredly run off the runway; if too slow—without airspeed indication—then maybe a critical stall at low altitude which was inviting disaster; then critical fuel ruled out a missed approach. The cards were really stacked against the pilot.

The pilot requested an alternate

done. At the same time, Meng had alerted Lockbourne. They would expedite a rescue plane to the T-Bird.

Skidmore continued to monitor the T-33 and provided steers that would keep the pilot in the area. He vectored him over Columbus and within a few minutes the pilot broke out on top, in-the-clear and sighed with temporary relief (fuel was still being used rapidly—too rapidly). Skidmore, now that he had a second, explained to the pilot that the intercept aircraft would be in a much better position to locate him on top, than in the thick weather below. The pilot readily agreed and rechecked his fuel—*less than thirty minutes now.* Meng again called Lockbourne to check the status of the rescue plane and give the pilot intercept instructions. The tower informed Meng that the aircraft taxied out but had, just this minute, developed mechanical trouble, could not get off, and that they could not release another plane. Now what?

Fleener and Skidmore dug deep into their bag of tricks and were

just about to give up, in utter frustration, when they simultaneously saw their means of saving the T-33: TWA Flight 18, a Boeing 707, just reporting in to Skidmore, 10 miles northeast of Columbus at 5000 feet. Skidmore informed the pilot, Capt Herbert Ottewill, of the urgent situation and asked if he would help. Captain Ottewill agreed immediately. Skidmore informed the T-33 pilot of the recovery and then cleared TWA 18 to 25,000 feet, to report when on-top, and vectored TWA direct to the T-33 target. Captain Ottewill increased speed and climb. Soon he was rapidly closing on the T-33 target but not yet on top. Skidmore gave Captain Ottewill vectors around the target, maintaining five miles separation until the TWA 707 broke out on top and in the clear, and spotted the T-Bird. Now Skidmore had both aircraft change to 121.5 (the only VHF frequency aboard the T-33 except for VOR). This was done and Skidmore continued vectoring TWA towards the T-33. This allowed for a coordinated recovery. The T-33 was estimated to be at 19,000 feet; TWA came in on the target at 23,000 feet. As they converged, recognition was exchanged and Skidmore outlined his plan for the recovery: He would vector them for an approach to Columbus; he would give descent instructions, and requested reports leaving altitudes and report when runway 27L was in sight. Captain Ottewill and the T-33 pilot concurred. Present weather and altimeter were given.

Prior to starting descent, the T-33 had some difficulty in keeping up with the Boeing 707. Captain Ottewill continued to reduce his airspeed until a mutually agreeable distance and common airspeed was established. The airspeed was 220 knots, then the T-33 took up a position slightly above, off to the right and behind TWA.

All set, TWA dipped into the overcast with the T-33 locked-on. They disappeared from sight continuing down on instruments through the weather. Down in the IFR room, Skidmore, Fleener and Meng followed their progress anxiously. Leaving 20,000 . . . , leaving 15,000 . . . , leaving 10,000 . . . , leaving 5000 . . . the target (not targets) moved closer in. The tension was almost unbearable; it seemed like an eternity. Skidmore was getting anxious, wondering if he should break it off, when TWA, then two miles out, altitude 1400 feet, spotted the high intensity lights. Both aircraft continued inbound; at 600 feet they broke out beneath the overcast—runway in sight. Captain Ottewill proceeded down, over the runway—contact—at a few hundred feet and when he was sure the T-Bird was lined up for a safe landing, he executed a missed approach! The T-33 pilot landed safely and was followed by TWA 18.

This incident was prevented from becoming a possible disastrous accident by a combination of heads-up thinking and excellent cooperation. Aerospace Safety congratulates Controllers Dean Skidmore, Emory Fleener and Charles Meng and TWA Captain Herbert Ottewill for their outstanding achievement.—Ed.

LATE NEXT YEAR, according to today's timetable, two astronauts will take the 100-foot elevator ride to the top of a Titan II, climb into a Gemini capsule, and soon thereafter the second generation man-in-space project will be underway.

Three prime objectives are: to test the feasibility of space rendezvous with another space vehicle; to learn problems and effects of man-in-space environment for periods of up to 14 days, and to demonstrate a controlled re-entry and landing.

The importance of man-in-space vehicles gets added emphasis in Gemini — a vehicle that depends more on the astronaut and less on the black boxes. The crew will have much more control than was available to astronauts in the Mercury program.

Safety of the equipment and the astronauts continues to receive top attention. Simplicity of design has been a keynote in development of the capsule. A modular construction form has been used, with improved access to component parts. A redundant malfunction detection system (MDS) is employed and is monitored by one of the two astronauts. To minimize the probability of false warnings, sensors of both the primary and redundant system must be activated to provide an indication on the panel. Two types of malfunction detectors are employed: one presents either a green (go) signal or a red (no-go) signal; the other presents a metered indication.

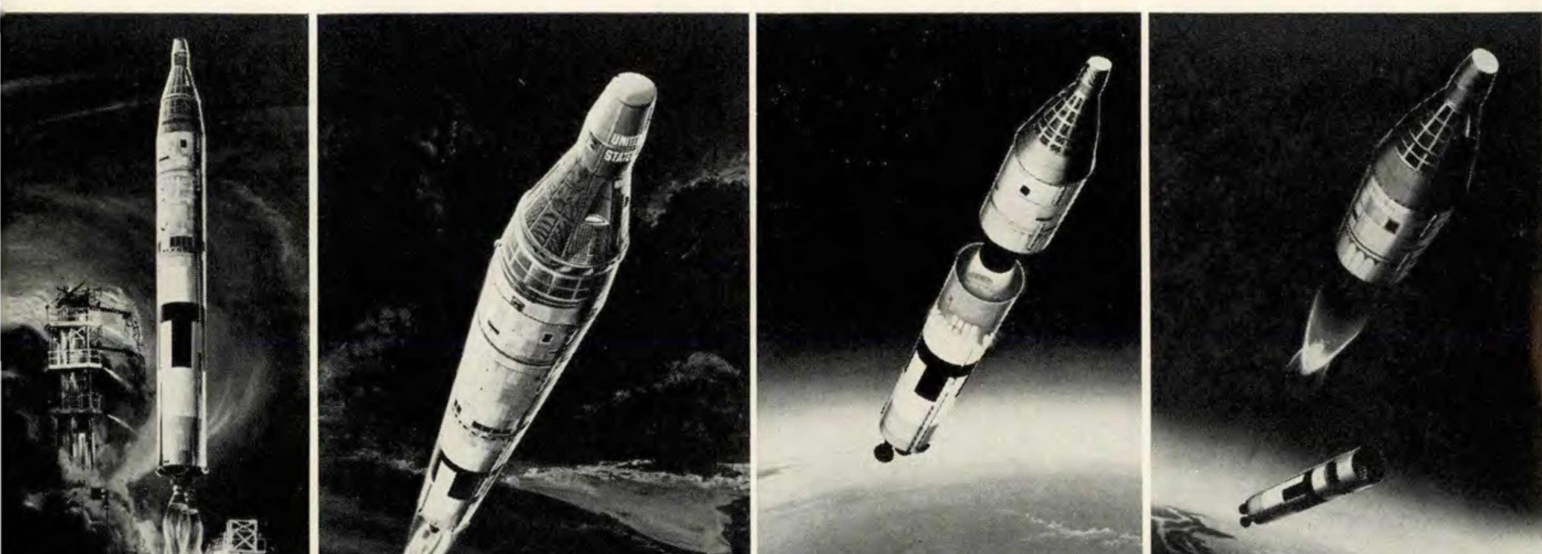
Quality control requirements are hitting a new high in this project. A critical component program has been instituted which requires unprecedented testing. A Cape Canaveral launch complex is being prepared for preflight running of the booster engines to provide the most thorough checkout yet of a manned vehicle boost component. Plans are to have Martin static fire both first and second stages twice. This will be followed with a sequence compatibility firing of both booster stages and, finally, a first stage firing with the second stage in place. When the booster passes these checks, the Gemini is to be mounted and prepared for the orbital shot.

Should a booster failure occur prior to reaching an altitude of 75,000 feet, astronaut escape is provided for through the use of rocket ejection seats. Either astronaut will be able to eject himself and his companion should the other occupant be incapacitated. Above the ejection seat altitude, provision for separating the manned vehicle from the booster is being provided with subsequent landing using the Ragallo wing.

In addition to manual abort capability, virtually all operational aspects of Gemini will be controlled by the astronauts alone, with the exception of trajectory change from lift off to orbit. They will be responsible for monitoring the MDS systems and correcting malfunctions or switching to redundant systems as necessary. Major MDS monitored areas include: all propellant tank pressures, combustion chamber pressure for all engines, pitch rate about all axes, rate gyro operation, power output and staging sequence.

Two inherent safety features built into Titan II that promise more reliable operation include a more stable fuel that will allow greater detection time if anything begins to go wrong, and considerably simplified hardware over-all. The following graph of some key components discloses simplification in a comparison with the parent Titan I.

GEMINI



	Titan I	Titan II
Launch functions	230	23
Checkout functions	322	35
Umbilicals	32	4
Relays	49	7
Valves	91	16

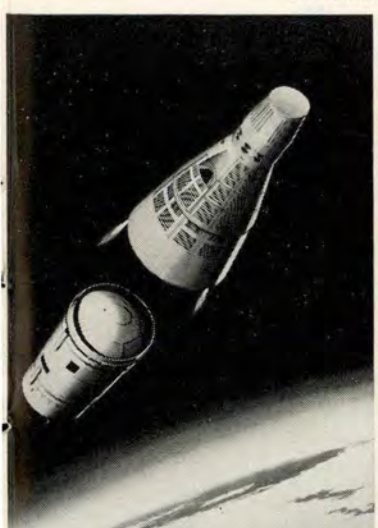
Titan II, a two-stage booster, provides a total thrust of 530,000 pounds. Capsule weight will be approximately 7000 pounds. The exact weight will depend upon the objective of the particular mission and the anticipated time it is to remain in orbt.

The rendezvous operation entails firing an Agena-D vehicle into a circular orbit, then, a day later firing a Gemini into an elliptical orbit with the apogee equal to the orbit altitude of the Agena-D, thus the orbital period of Gemini is less than that of the Agena-D, and Gemini will "catch up" with the target. Gross errors between the two orbits may be eliminated by firing the Agena-D engine on ground command. At about 250 miles range, the Gemini radar will lock onto a transponder in the Agena-D and the on-board computer will determine the exact trajectory to effect the rendezvous. At the proper time the Gemini maneuvering engines will be fired to circularize the Gemini orbit at the target altitude, and the astronauts will, as range is decreased, use maneuver control thrust jets and attitude control thrust jets to work their capsule into position for rendezvous with the Agena-D. The crew will actually fly Gemini into the Agena-D adapter section by aligning a bar with an adapter section. The hookup, in so far as the astronauts are concerned, might be likened to that of a mid-air refueling. Lock-on connections will be provided, and disengagement will be accomplished by reversing the docking process.

Both rendezvous and the longer orbital missions are expected to provide vital information for the next major space project — the Apollo moon shot. Consideration is being given to eventually making provision for the space-suited astronauts to climb out of the vehicle and make repairs or adjustments while in orbit. Much is expected to be learned about the effect of weightlessness and other space environmental conditions during the longer flights. In preparation for Gemini many research projects are currently underway. Use of algae as a combined waste disposal and oxygen-water regeneration system is such a project. Space suit refinements to meet the requirements of prolonged flights is another important consideration. Guinea pig astronauts are spending prolonged periods in space laboratory capsules to enable project personnel to better ascertain the human requirements.

The astronauts are being given considerably more control over the re-entry and landing phase than was the case in Mercury. Instead of a parachute, a Ragallo wing or paraglider is to be used for the final descent and landing phase. The wing, a test model of which is now being initially tested at Edwards AFB, is a delta-shaped, flexible control surface that is to be deployed at about the 50,000-foot level. Astronauts have some control over their landing point by reeling in cables which tilt the wing, thus causing a turn. Similar cable operated pitch control provision is made. The landing concept is to maintain a fixed rate of descent to 400 feet. At this point, pitch control is changed to effect an increased rate of descent and forward speed to just under 150 feet where flare is to be started. Sink rate at touchdown is thus decreased, much in the manner utilized in landing an aircraft. Astronauts are to be given practice to achieve proficiency in landing with the Ragallo wing or paraglider prior to Gemini flights. ★

ILLUSTRATIONS BY DI PIETRO AND GORSUCH • COURTESY MARTIN COMPANY AND McDONNELL AIRCRAFT CORPORATION




SWIM SAFE

Richard L. Brown, Asst. National Director, Water Safety, The American Red Cross

FOR SUMMER FUN, more people than ever think in terms of recreation in, around or on the water. An estimated 100,000,000 people use America's public and private pools, beaches, rivers, lakes and coastal waters for swimming, boating, fishing, skin and scuba diving, and water skiing. Of this number, some 40,000,000 people are unable to swim, or to swim well enough to save their own lives.

Facts behind drowning accidents reveal the rather surprising information that the *majority of drownings occur within 15 to 20 feet of safety.* Even experienced swimmers can get into trouble by overestimating their strength in the beginning of the swimming season, by holding their breath too long under water, by taking unnecessary chances, or by showing off.

In most accidents, drowning occurs when some rule of water safety was not known, or was ignored. For example, even some expert swimmers do not understand the danger of holding the breath too long under water, or what happens when this is done. Yet, some fine swimmers die each year from this cause. Ignorance of what is happening within the body during underwater swimming can be the cause. In order to hold your breath, you must be conscious. While you are holding your breath, carbon dioxide (CO_2) builds up in your blood stream and brain. Too much carbon dioxide causes you to lose consciousness. When you lose consciousness, you can no longer control your breathing, and you *automatically* start to breathe. If you are under water, it is impossible for you to get air, and if you are without air, even for a very short while, death may result.

Anyone can buy a boat and, whether he knows about boating or not, he is privileged to operate it. In only a few states are there any requirements for boating knowledge or operating efficiency. In 1961, the U. S. Coast Guard reported 1101 persons killed, 1088 injured. Capsizing led all the rest of causes with 297 deaths, and falling overboard was the second leading cause with 238 deaths. In 74.3 per cent of the fatalities, the cause was laid to the fault of the operator. The age groups most involved were ages 25 to 34 years with 181 persons, and 35 to 44 years with 180 victims, primarily because the greater number of boat owners are in this age group although percentage-wise, children and adolescents have more boating accidents than adults.

DURING 1962
FORTY-EIGHT AIR FORCE
PERSONNEL DROWNED WHILE
PARTICIPATING IN
WATER SPORTS.
WILL THIS NEEDLESS
LOSS OF LIFE BE REPEATED
THIS SUMMER?

Of the 48 Air Force deaths, 26 were due to drowning while swimming. Nine were due to diving accidents, six while the victims were boating, three fishing, two water skiing and two men fell into the water during other activities.

It is axiomatic that an ability to swim is the first rule for safety in, on or around the water. Since 1914, the Red Cross has conducted swimming and lifesaving classes for all age groups, free of charge, in some 2800 of its chapters. Other organizations with aquatic programs also have classes for people of all ages who want to learn to swim. The Red Cross also conducts basic boating, canoeing and sailing courses with the main prerequisite for enrolling being the ability to stay afloat in the water, fully clothed, for 10 minutes. The U. S. Coast Guard and the U. S. Power Squadrons conduct boating courses which teach the "Rules of the Road," safe boating procedure, and seamanship.

Everyone should learn to swim, and anyone, at almost any age, can learn to swim. It not only may save your life, but it also may make it possible for you to save the life of another. The Red Cross, for example, not only conducts classes for people of all ages, but has provided a program "Teaching Johnny To Swim" which shows parents of young children how to teach their children to swim at a very early age. This is the age group, incidentally, in which a great number of drownings occur each year.

Along with formal classes, the

HERE ARE SOME TIPS THAT CAN SAVE YOUR LIFE:

Red Cross has, for years, disseminated water and boating safety rules through the press, radio, television, and the use of films and slides. These films are available, on loan, at no charge, through the Red Cross chapter at your base.

- Never swim alone. At beaches, stay near a lifeguard.
- Stay out of the water when overheated, for at least an hour after eating, and during electrical storms.
- Stay away from the area immediately in front of the diving board.
- Don't depend on a tube or inflated toy to hold you up.
- Don't dive in shallow water or in unknown waters.
- Watch your step. Walk, don't run around the pool area.
- Stay out of deep water if you can't swim.
- Beware of sunburn, even on a cloudy day.
- Dry off after swimming. Cover up if it's chilly.
- In ocean and river swimming, watch for riptides and currents. Lifeguards will tell you how to recognize these conditions and how to save yourself if you are caught.
- Stay away from piers and pilings.
- Alcohol and swimming don't mix. Stay out of the water if you have been drinking.
- Fence your swimming pool to keep small children from falling in.
- Separate deep and shallow water in your pool by a buoyed line.
- Keep handy such rescue equipment as ring buoys and reaching poles, as well as a first aid kit.

BOATING SAFETY TIPS

- Keep the passengers in your boat down to a safe number. Don't overload.
- Don't overpower your boat. Your dealer can tell you what size motor is safe.
- Equip your boat with safety items. A life jacket for every passenger and running lights (if you plan to be on the water at night) are "musts." Recommended also are anchor, oars, boat hook, extra line, fire extinguisher, tool kit, and first aid kit.
- Don't smoke while fueling.
- If your boat capsizes or overturns, don't swim away from it. Hang on until help comes. It usually will float.

DRY OFF AFTER BATHING — WATCH YOUR STEP — BE CONSIDERATE OF OTHERS

DON'T DEPEND ON A TUBE — NEVER SWIM ALONE — DON'T DIVE IN STRANGE PLACES

DON'T SWIM DURING STORMS — DON'T SWIM AFTER EATING — DON'T SWIM UNDER DIVING BOARD

TOO MUCH SUN WILL SPOIL YOUR FUN — LEARN TO SWIM CORRECTLY

WATER SKIING SAFETY TIPS

- Know how to swim well.
- Never ski without a flotation device—a jacket is usually better than a belt.
- Ski in marked areas.
- There should be an extra person in the boat to act as observer.
- Skier, observer, and operator should know all signals: to start, adjust speed, change direction, stop, and the "I'm OK" sign.
- The boat operator should pilot the craft according to the skier's ability. Sharp turns should be avoided.
- Skiers should not try to land directly into shore.
- The boat operator should approach a fallen skier downwind with the skier on the driver's side of the boat for maximum visibility. Reduce speed as you near the skier and stop motor completely before taking skier aboard. ★

Although written expressly for C/KC-135 operation, there is ample information here for pilots of other aircraft as well.

hard landings in the C/KC 135

Reprinted from Boeing Service News, Feb 63

Hard landings are one of the pitfalls of pilot training during transition to a new type of aircraft such as the KC-135 or C-135. However, hard landings are not limited to transition training; they can occur anytime throughout a pilot's flying career. The outstanding problem for the flight crews is to determine if an unusual landing occurrence has resulted in a hard landing and possible structural damage to the aircraft. Instrumentation capable of determining structural damage caused by a hard landing is not normally installed in the aircraft. This makes it necessary for the flight crew to decide if a hard landing has occurred and if an airframe inspection for structural damage is necessary.

A so-called "hard landing" causing structural damage usually results from one or more of the following conditions: excessive crab angle, excessive rate of descent, miscalculating landing gross weight, and gusty wind conditions. Anytime the flight crew is in doubt whether a hard landing has occurred, the condition should be written up and a structural inspection made. A hard landing is usually noted by any one or more of the following: excessive airframe noise, blown tires, distinct jar in the airframe or an uncomfortable feeling on the part of the pilot produced by the higher than normal landing loads.

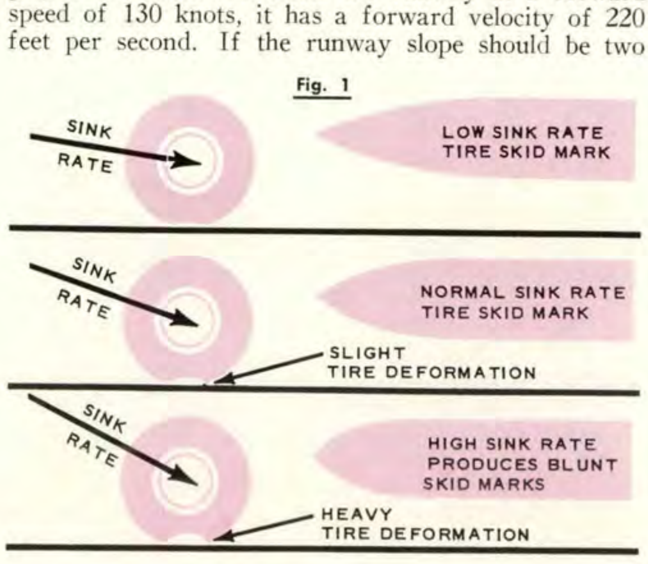
Theoretically, at least, a landing should be classified as a hard landing whenever the rate of sink of the aircraft at time of contact with the ground exceeds the limit contact sinking speed for the landing gross weight. The vertical speed indicator provides very good rate of sink information during the final approach phase of the landing. However, as the aircraft comes under the influence of ground effect, the vertical speed indicator may have rather large errors and cannot be relied upon to determine accurate rates of sink at touchdown. At present, pilot judgment must be relied upon for reporting hard landings.

It is often possible to gage the severity of a hard landing from the size and shape of the skid marks. The skid marks resulting from a hard landing generally stand out above the normal landing skid marks. If it is known that the forward velocity of the aircraft was within the desired range, the aircraft contact sink speed can be determined from the size and shape of the skid marks. The sharpness of the skid mark varies according to how quickly the tire absorbs the shock. A blunt initial skid mark indicates a high sink rate. See figure 1. Because of the nature of the shock load on the tires during the impact of landing, the shape of the tire skid mark is practically independent of the tire pressure.

Runway design can be a factor in converting a normal landing into a structure-rattling hard landing. Due to local topography, all or a large part of the runway may have been constructed with a definite upslope or rise in one direction. Runways may slope down near the ends to facilitate drainage or as a result of intersecting taxi strips. Even steeper slopes may be built into the stabilized transition section between bare ground or grassy sod and the main runway surface. These slopes mean the aircraft has to climb a rising slope from the point of touchdown until the runway levels off.

How this sloping runway surface affects landing contact sink rates can be seen from figure 2. For example, if an aircraft contacts the runway at a forward speed of 130 knots, it has a forward velocity of 220 feet per second. If the runway slope should be two

Fig. 1



feet in a hundred (two per cent), the runway produces a sink speed relative to the aircraft of 4.4 feet per second. The sink speed of 4.4 feet per second would use up nearly half of the allowable sink rate for the C/KC-135 at landing gross weight of 200,000 pounds.

A more serious problem that may exist at some airports is the severely sloped transition pavements at the end of the runway. For example, if a paved area should slope at a one in ten rate (ten per cent), the effective sink speed at 130 knots would be 22 feet per second. Even if the aircraft touches the runway in level flight, the sink rate will be more than double the allowable sink rate for the 200,000 pound aircraft used in the previous example. These built in sink rates beyond or near the end of the runway could easily cause serious structural damage during what would otherwise be a normal, though short, landing.

The accelerometer (g-meter) is an unreliable instrument for gaging the severity of a landing and should not be used as the indicator of a hard landing. For example, readings of over three Gs have been reported while taxiing and towing and over six Gs during maintenance on or around the instrument. The accelerometer is satisfactory only for use in determining inflight loads or accelerations.

Structural Inspection After a Hard Landing

Repeated hard landings, reported or unreported, will eventually cause a structural deformation or failure. Whenever a hard landing is reported, the aircraft structure should be visually inspected to detect the early signs of structure deformation or failure.

Inspections after a hard landing should normally concentrate on popped fasteners, wrinkled skin, cracked paint, cracked skin, and deformed structure. The areas inspected normally should include the entire landing gear, landing gear attachment to aircraft, flight controls and cables and engine/nacelle points of attachment. TOs 1C-135(A)-6 and 1C-135(K)A-6 contain detailed inspection information necessary to accomplish the inspection after a hard landing.

Service experience indicates that the following additional items, if inspected, may also reveal evidence of structural damage incurred as a result of a hard landing.

- Main landing gear trunnion support fittings for cracks (including lower external rib chord at wing buttock line 129).
- Main landing gear wheels for cracks.
- Main landing gear truck beam and forks for cracks.
- Main landing gear shock strut for fluid level. If fluid is ten pints low or more, remove inner cylinder and inspect for distortion and cracks.
- Access Panel—Inboard Flap Gear Box upper surface for buckling adjacent to forward inboard corner of inboard spoiler. If buckling is found, examine upper flange of wing trailing edge rib at wing station 299 for buckling adjacent to forward inboard corner of inboard spoiler.
- Nose gear wheels for cracks. Nose gear outer cylinder, outer cylinder steeple lugs and trunnion fitting, drag brace link assemblies and knee joint side plates for distortion, cracks, and pulled or missing fasteners.
- Whenever a hard landing is one main gear first or includes side drift, examine the side strut linkage, station 880 and 890 forgings and side strut attachment parts at water line 202 for cracks, pulled and missing fasteners. Pressure web at water line 202 from station 820 and 960 for cracks, pulled and missing fasteners.
- If hard landing is nose gear first and if there is no reason to believe that either the inner cylinder or the piston rod has been damaged, examination of the piston rod need only be performed at the first convenient opportunity following the report of a hard landing.

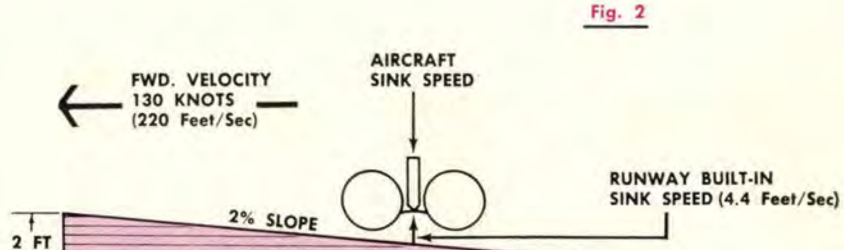
NOTE: Damage to the inner cylinder or piston rod should be suspected if any unusual conditions, such as low hydraulic fluid or difficulty in maintaining normal pressure in the shock strut, are observed while operating or servicing the nose landing gear.

If any external damage caused by the hard landing is observed, or if there is any reason to suspect damage to the inner cylinder or piston rod, further investigation or action, before the next flight, should include examination of the nose gear piston rod.

In summary, it will normally be the judgment of the flight crews as to what constitutes a hard landing. Even without measured data to substantiate a hard landing, a good inspection of the aircraft structure should be made to assure continued flight safety. ★

The shape of tire skid marks can indicate the relative sink speed at which an aircraft lands. A blunt skid mark results from a high sink rate because the tire yields under the load while progressing forward only a relatively short distance. A sharp-pointed skid results from a slow sink rate on landing.

Fig. 2



Landing on a runway or approach area with an upward sloping grade has the effect of increasing the sink rate of a landing and may effectively convert a normal landing into a hard landing.

MISSILANEA

ELECTRO-EXPLOSIVE DEVICES—Over the last six months there have been many reported missile incidents involving electro-explosive devices (EEDs) and associated circuits. Maintenance errors, design deficiencies or materiel failures were either contributing factors or primary causes in these incidents.

It is gratifying to note, however, that AFLC and AFSC as well as the operational commands are taking an active interest and presently have remedial efforts underway. These actions include the following:

- Supervisory requirements and quality control procedures concerned with inspection, test, installation, and operation of EED circuits are being re-emphasized.
- Technical data and operational checklists are being reviewed for adquacy of warning notes and safety procedures.
- A review of EED circuit design in the various operational systems and their supporting aerospace ground equipment (AGE) and real property installed equipment (RPIE) is being pursued by AFSC and AFLC.
- It has been determined that many of the EED accidents and incidents have been caused by corrosion of the circuit wiring and/or the connectors involved. These corrosion problems are being studied to incorporate necessary fixes into the affected weapon systems.
- Recently the Directorate of the Engineering (SCSN) with AFSC was designated for the development and publication of a specification for EEDs and explosive bridgewire devices.

With the attention that is now being focused on the elimination of this source of costly incidents, it is hoped that the number of incidents associated with EEDs will be drastically reduced.

Maj Richard P. Berry
Missile Safety Division

GAR-8—Mishaps continue to occur due to careless handling and other loading problems. For example, it is suspected that umbilical blocks are being sheared or partially sheared during both loading and testing on the M-341 Go-No-Go Tester. Extreme care must be used to prevent such mishaps. However, watch a crew load one of these birds on an F-105. The rails are about six feet off the ground, which means overhead loading for the average size man. This means the loading team must raise the missile over their heads—it's heavy too—and try to find the rail without damaging the missile or the launcher. A lift or an adapter for the MJ-1 Bomb Lift would greatly simplify this job and, if properly designed, should prevent many loading mishaps. One basic idea is being developed by enterprising individuals at Nellis AFB.

ALIGNMENT MARKS FOR GAR LAUNCHERS AND MISSILES — Again, a GAR-2A was damaged because it was not properly positioned on the rail. The command concerned feels this incident could have been prevented if adequate and proper alignment marks had been placed on the GAR missiles and launchers. Consequently, units have been instructed to place alignment marks on the missiles and launchers.

GAR DAMAGE FROM JET WASH — Six GAR missiles were pre-positioned for a turn-around exercise. The lid of casket Nr 1 was lifted by jet wash and fell across Nr 1 and Nr 2 missiles which were still in their caskets. The triggering area and one stabilizer of the Nr 2 missile were damaged.

Investigation disclosed that the incident was caused by an F-102 pilot's using too much power in the parking area and his failure to follow the prescribe taxi route.

SPACE SYMPOSIUM

A Symposium on Space Rendezvous, Rescue and Recovery will be held September 10-12 at the Air Force Flight Test Center, Edwards Air Force Base, California. The national symposium will be co-sponsored by the American Astronautical Society and the Air Force Flight Test Center.

Primary emphasis will concern earth-orbital systems and techniques though consideration will be given to lunar and planetary operations.

For more information and reservations contact Mr. Kirk Irwin, AFFTC (FTFE), Edwards AFB, California. Phone CL 8-2111, Ext. 23121, Area Code 805.

"Actually, it's our new Officers' Club. . . . We just wanted to give the enemy something to think about. . . ."

LIGHTNING IS FRIGHT'NING

ASTROPHOBIA—IF YOU'VE GOT IT, YOU'RE LUCKY. If not, you'd better acquire it. It could save your life. This strange-sounding term means *fear of* lightning. You can use this trait now and for the next few months because the peak of the lightning season is here and will extend through November. During this time, lightning will take scores of lives and injure hundreds of persons. Many will die in fires kindled by lightning.

The main reason for lightning casualties is that too few people possess a good healthy fear of this killer. Few understand what it is, its dangers and how to avoid them.

Here are answers to the most-often asked questions about lightning:

What is lightning?

As Ben Franklin found out with his kite and key, lightning is a giant spark of electricity with tremendous energy—millions of volts and sometimes up to 200,000 amperes. It occurs in a storm when the electrical attraction between clouds and the earth is great enough to overcome the strong resistance electricity encounters when traveling through air.

A lightning bolt is actually a series of discharges, one following the other like bullets. The speed of these charges is so great that they burn the air. The flash we see is usually the path of burning air through which the bolt has passed.

Where is lightning most likely to strike?

Generally it picks on the highest object in an area. An electrical charge strives to find the easiest and shortest route from the clouds to the earth. Tall buildings and trees, especially oaks with high conductivity, are frequent targets. In fact, nearly 40 per cent of the fires in outlying areas are caused by lightning. City dwellings are rarely hit because they are protected by surrounding skyscrapers that take the brunt of the damage.

What are your chances of being struck by lightning?

Lightning is likely to strike one spot once in 100 years. And if it does, the odds are one in several million that the bolt will seek you out—personally. If your house is in an average-sized city, lightning is apt to strike it once every 1000 years.

Can you survive if hit by lightning?

Yes. To cite a case: An Ohio boy had a lightning bolt pass through his body and from his feet into the ground, leaving pinpoint holes in his rubbersoled shoes, but not killing him. And another: An Illinois woman standing on her back porch saw a blue flash come in through the screen. It knocked her backwards and went on down an electric socket. She too lived.

According to medical authorities, many victims of lightning could be saved if they could be given artificial respiration *immediately*. As electricity passes through a person's body, if often paralyzes his nerves and muscles, stopping his breathing mechanism. Resuscitation during this paralysis can keep the victim breathing and alive.

Who is lightning's favorite target?

Nine out of ten victims of lightning are sportsmen, vacationers and farmers. Of these, golfers as a group probably suffer the most casualties. When a storm approaches, they all too often fail to seek proper shelter in a protected building. They are likely to continue playing, duck inside an open shelter where lightning can find them, or worse yet, seek refuge under a tree—the most dangerous spot of all.

The most threatening time for lightning is not during the storm but just before it breaks. A golfer proved this one day when he was literally knocked down by a bolt out of the blue. The dark storm clouds were still several miles away.

Does lightning ever strike twice in the same place?

Definitely—despite the old superstition that says otherwise. For example, the Empire State Building has been struck 48 times in one year. And another: One summer in Illinois, a man had lightning burn his barn down and kill his livestock. Ten days afterwards, lightning hit a barbed wire fence he was working near. Finally—a bolt sought him out in a barn, entered his chest and killed him.

Where are the most dangerous spots during a thunderstorm?

Out of doors, on a golf course, in a boat, in swimming, atop a hill, under an isolated tree, on a bicycle or horse, and near a wire fence, clothesline or overhead wires.

What should you do during a thunderstorm? If you are outside, look for a building—any building is better than being out in an open area. If you're in a car, stay there. If you can not find shelter, get into a ravine, under a cliff, in a cave, or lie flat on the ground. *Never let yourself be the tallest object in the area.*

Are television antennas good lightning protection?

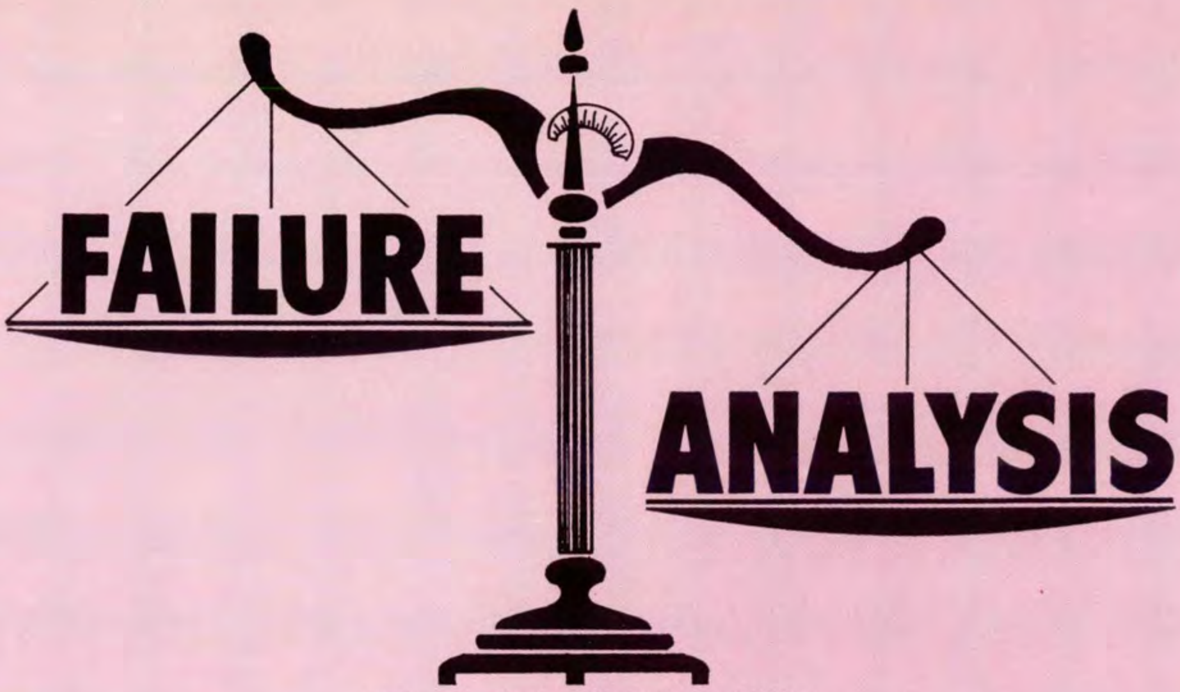
NO. Even a grounded antenna is not equipped with a conductor of adequate size to ground a lightning bolt.

How can you protect your house from lightning?

There's only one way: INSTALL A LIGHTNING PROTECTION SYSTEM OF LIGHT METAL RODS AND CONDUCTORS. They will carry the charge harmlessly into the ground. Insist that your system be tagged and installed according to Underwriters' Laboratories (UL). ★

(USAF TAC Missile School)

FAILURE ANALYSIS



William P. Rodgers, Missile Safety Division

IN THIS ERA of missile systems, supersonic aircraft and space exploration, all of us hear more about the importance of good failure analysis. But, in discussions with AF line personnel, it has become evident that the process of failure analysis is not well understood. Consequently, few operations, maintenance and support personnel realize they are the key to a successful AF failure analysis program. This article is written to describe what failure analysis is and how operations and maintenance people can help to assure success of this program.

Failure analysis may be defined as the process whereby procedures are followed in examining a failed component or subsystem to determine the cause of failure and to establish the corrective action needed to prevent future failures of the same type. To effectively accomplish failure analysis of any given component or subsystem, four distinct and sequential steps should be taken by the failure analysis engineer or investigating group. The following are the four areas of investigation in the general order in which they should be considered:

1. *Determine the condition prior to and during the time of failure.* The operating or maintenance task in process, and the condition of equipment and operators all play an important part in failure analysis. To accomplish this, the analyst or group must review operating procedures; materials used (solid and liquid); operating conditions, such as pressures, temperatures, flow rates, speed, voltage, current, atmosphere, and fragmentation patterns, if appropriate; and the type of failure which could include torsion, tension, compression or results of corrosion, chemical and contamination (this may not be possible 'til areas 2 and 3 are considered).

2. *The investigation must include the review of written technical data and maintenance/operations records.* Drawings and qualification test reports should be thoroughly examined so that the analyst may become familiar with design limits pertaining to the part or system. Maintenance records should show what modifications or repairs have been accomplished which might affect the performance of the system or component. The analyst should also have available a history of previous failures involving this particular system or item. The operations records should indicate the operating time and how the system or part had been used; i.e., maximum performance operation, intermittent operation, operation for training with experienced or inexperienced personnel and in adverse environmental conditions. All technical data associated with the failed item should be reviewed for accuracy and completeness.

3. Once actions outlined in 1 and 2 have been accomplished, then *a plan of action to isolate primary and contributing failure cause factors may be established.* In formulating this plan, the following should be considered:

(a) Functional tests.
(b) Complete component tear down report.
(c) Chemical or metallurgical laboratory analysis.
(d) Continuity checks.
(e) X-ray or dye checks.

4. As a result of actions taken under 1, 2 and 3 above, the analyst should have the necessary information from which to determine the cause or causes of failure. At this point, a course of action can be determined leading to a fix. Corrective action could involve complete or partial redesign of the system or component; modification of or addition to the existing part; revision to or augmentation of the existing technical data and/or operating procedures; and/or change in operating performance and limits. It is important to note that corrective action is not complete until the responsible agency is notified and has taken formal steps to implement the changes in the field.

By now you are probably saying this is all well and good, but it takes a skilled, trained engineer or analyst group to actually do this. What can the man in the field do to help expedite this process so he can get the equipment repaired and back in safe operating condition?

It is true, it does take special skills and training to be a good failure analyst. As for what you, the man in the field can do, remember: it is your records the analysts are reviewing; it is your word as to what happened that he is evaluating; you were either the operator or the maintenance person on the job at the time of failure; you worked on or changed the failed component. Therefore, it should be clear that an accurate comprehensive report by you is absolutely essential to good failure analysis. Here are a few things to remember when a failure occurs:

- Don't disturb the parts or pieces unless assisting injured personnel. If this is not possible, at least get pictures from all angles before moving any components.
- Write down exactly what you did prior to and at the time of failure. Especially put down any peculiar sounds, or unusual events that were not normal for that operation.
- Tell the analyst all the facts and don't try to cover up a mistake. Human beings, by nature, make mistakes. If an occasional human error is not discovered, they aren't doing anything, and that in itself is a big mistake.
- Record all maintenance and operating records accurately and in detail.
- Follow prescribed procedures and, if certain functions need to be corrected or improved, submit an electrically transmitted unsatisfactory report (EUR) in accordance with TO 00-35D-54. (It's legal and we encourage it. Read Section II, paragraph 2-5 and 2-9.)

Yes, *the man in the field is the key* to a successful failure analysis program. Good reporting is essential if the failure analyst engineer or group is to have the essential information needed to conduct good evaluation. A good evaluation is required to obtain a timely fix. Failure analysis is not a one man show, but a team effort, and the sooner we start functioning this way, the sooner the team will be productive in fixing those materiel failures which keep bugging us. ★

TAX's

ACCIDENTS, INCIDENTS AND ALMOST...

► EAST IS LEAST, WEST IS BEST—Two spare F-100 fighters departed the refueling area for Kindley and were given 235 magnetic as heading to Kindley. Since this varied considerably from pre-planned and briefed heading shown on the 21a, the heading was questioned by the element leader. The tanker navigator confirmed. The element flew a 245 heading for approximately 30 minutes, then flew a 280-degree heading for 40 minutes. With 2500 pounds of fuel remaining and unsure of their position, they jettisoned external stores and climbed to 37,500 feet and established optimum cruise speed. After destination ETA had expired they turned due north. Immediately thereafter contact was established with Kindley UHF/DF at 250 NM. Aircraft were given DF steers of approximately 330 degrees until in contact with RAPCON. The two aircraft had 600 and 300 pounds of fuel after landing. The navigator had subtracted 20 degrees west variation to true course rather than adding.

► TAXI CRASH—During flight, a drop in fuel pressure together with intermittent power was experienced. A successful emergency landing was made. A mechanic was sent to the scene. All fuel was drained and replaced with fuel from a different source. Both of the C-47 engines were started and given a complete and successful operational check utilizing the approved checklist. After 10 minutes of engine operation, the pilot elected to perform a high speed taxi check. At 60 knots the aircraft became airborne, the left engine failed, the aircraft turned 15 degrees to the left and crashed into the jungle. Major damage.

► COOKIE CUTTERS—Circular cuts of three tires on the right truck of a C-137 were noted upon arrival at an island destination. Apparently the cuts had been made at the departure field when the aircraft had been taxied over 2½ inch conduit that protruded two inches above the surface. The conduit is an essential part of a naval mirror landing system. Normally, lights had been installed on each of the conduits, but a typhoon had destroyed the lights. The pilot said he noted the protruding pipes, adjusted his turn to miss them, ". . . but it is evident I did not miss them all."

► THIS TERMINATES. The transport landed gear up on termination landing of a series of transition landings. Damage to underside of fuselage unknown. Tip of right prop damaged. Suspect cause as failure to place gear switch in the down position.

► A TRIFLE TRICKY. The crew knew that Nr 3 starter was inoperative, so-o-o, they decided upon a five-engine abortive takeoff to start Nr 3 by windmilling, then taxi back and make a normal takeoff. Due to construction work on the main runway an alternate was in use. The alternate was 75 x 10,000 feet. The pilot stated his intentions to make an aborted takeoff and was cleared by the tower. Takeoff roll was initiated with power balance by use of the two jets, Nr 1 and 4 recips and Nr 2 recip at idle. At the 4000 foot point and 80 knots the planned abort was initiated. Both jet engines were stopcocked and Nr 1 and 4 recips were reversed. The aircraft began veering to the left. Initial corrective action was additional reverse throttle on Nr 4, followed by nose steering, full right rudder and right brake. The left main went off to the left, sank into the soft shoulder and the left main outboard tire blew when a lateral taxiway was crossed. Shortly thereafter the aircraft stopped and all occupants evacuated without injury.

F-100 ACCIDENTS

ONE HUNDRED PROBLEMS got 1963 off to a bad start. In the first six weeks ten F-100 major accidents occurred. Minor accidents and incidents added emphasis to the fact that the Air Force is not doing too well with an aircraft that has been in the inventory now for nearly ten years. Here, briefly, is a review of these first ten accidents.

THE PILOT crashed from a right turn while rejoining formation at 8000 MSL. The aircraft was observed descending, in a right turn, and not observed to be spinning or pitching. The pilot's attempt to eject at a very low altitude was fatal.

AS THE FLIGHT entered the bombing pattern, Nr 3 called that his radio compass and TACAN were inoperative. The range officer advised the flight of snow showers on the downwind leg. The leader made a fly by and observed light snow showers to the north. The leader advised the flight to use a right pattern and stay clear of the snow showers. After three runs the leader noted the snow dissipating and elected to return to a left pattern. Nr 3 reported on this third and last pass and called turning short of the IP. When he was four and one-half miles short of the IP, Nr 3 called turning final. Nr 2 informed Nr 3 he had not reached the IP. Nr 3 acknowledged This was Nr 3's last transmission. The aircraft hit in a dive angle of 30 degrees and in a 50 degree right bank.

AT 25,000 FEET the pilots noted an increase in oil temperature, smoke in the cockpit. They decided to return to base. External stores were jettisoned and a straight-in approach started. At 15,000 oil pressure gradually decreased to near zero. As they entered the overcast they began getting compressor stalls and the RPM dropped to 50 per cent. Breakout occurred at 2000 feet and the pilots prepared to eject. The front seat pilot blew the canopy and waited for the rear seat pilot to go. He glanced back, thought that the rear seat pilot had gone, and ejected at 1500 feet. The rear seat pilot was still in his seat upon impact. Arm rests were up, pins were out and the seat belt appeared to have been opened manually. The seat had not fired.

DURING RETURN from a gunnery mission, Nr 2 flight control system became inoperative. The pilot noted smoke in the cockpit and the wingman confirmed that fire was coming from the bottom of the aircraft, aft of the wing. The pilot ejected successfully.

THE AIRCRAFT WAS Nr 4 on a cross-country flight. Two 450 gallon drop tanks were carried. Single ship takeoffs were made at 15 second intervals. All aircraft broke ground at computed roll points. Shortly after liftoff, Nr 4 gradually entered a 30-40 degree nose high attitude and began a slow roll to the right toward the inverted position. The aircraft struck the ground at 115 degrees right bank in a shallow dive.

Six months previously this aircraft had been involved in a major accident. During repair the left wing was replaced and the right wing reinstalled. Test flights were flown, clean, with only minor discrepancies. The only flights flown with 450 gallon drop tanks were a series of five X-Cs. The pilot on these flights reported that the airplane attempted to roll to the right on all takeoffs, but he was able to maintain control by using aileron, rudder and trim. He stated that positive aileron and rudder were required. The pilot did not write this condition up as he felt the aircraft could be controlled and flown safely.

WHILE CLIMBING through 12,000 in military power the pilot noted a loud thump and a mild explosion followed by a guide vane anti-ice warning light, instrument AC power light, AC generator failure light, rapid rise in EGT and low oil pressure. A restart was attempted at emergency but EGT rose to 1000 degrees with insufficient RPM to maintain flight. There were no fire warning lights. Ejection was successful.

THE AIRCRAFT was acting as the target during a GCI, low altitude intercept. The pilot of the intercept aircraft observed the target aircraft to roll inverted and dive behind a mountain range. Crossing the mountain range, the intercept pilot observed the crash scene.

AT 500 FEET, 470 KIAS, the pilot felt the engine surge. He checked the RPM and noted it falling through 87-88 per cent with the throttle in military. RPM then increased to military power and at this time the engine compressor fire warning light illuminated. The pilot started an immediate climb and asked his wingman for indications of fire. Wing reported white smoke trailing the aircraft. The engine surged again and the throttle was reduced to idle. The fire light remained on. The pilot stopcocked the throttle and ejected.

TOUCHDOWN and drag chute deployment were normal. Shortly afterwards severe nose shimmy, or possibly a walking gear, was noted. The right main gear collapsed and the aircraft skidded off the right side of the runway. Both remaining gear collapsed when the aircraft hit a ditch and stopped.

A ROUTINE radio contact was made after departure and reaching VFR on top. There were no further contacts. Ground witnesses reported the crash. There were no indications that the pilot attempted to eject.

That, briefly, is what happened to ten F-100s during the first six weeks of this year. (A check at press time disclosed that there has been some improvement). In many cases, as so often is true when destruction is sudden and virtually complete, the exact cause factor is spelled u-n-d-e-t-e-r-m-i-n-e-d. But, in an effort to evaluate what most likely happened, the best available F-100 experts are asked to sift the wreckage and come up with most probable causes. As might be expected, these most probable causes and probable contributing causes can't help but single out areas of guilt. And, naturally, those so identified frequently resent the implication. What makes this a particularly sensitive area is the fact that proof positive is impossible. Virtually no one escapes — the airframe, engine and accessory manufacturers, supervision, training, operations, maintenance, the pilot — and therein lies a justification for such findings; it is an impartial attempt to alert all in a position to take corrective action to the fact that their area may be suspect as an accident cause.

There is a chicken-and-the-egg aspect to this that deserves more elaboration. Power loss, warning lights illuminating and smoke in the cockpit can be an indication of inadequate materiel, or inadequate maintenance of adequate materiel. Often the real cause can never be known because the pilot had to get out and the source of the trouble gets smashed into tiny pieces and mixed with a million other pieces that had no bearing on the problem. What's important is that everyone concerned accept the attitude that his job is to work with every scrap of evidence to prevent the same thing from happening again. At the rate of approximately one and one-half major F-100 accidents per week there is ample cause for everyone to explore the question, "What can I do?" Every shred of evidence, no matter how seemingly insignificant, must be examined critically and reported. A maintenance man once remarked, "The best write up I get is when I talk to the pilot." Also, every individual who can possibly contribute to analysis should be given the opportunity to do so.

Major deficiencies, previously pointed out but worth repeating, include:

- Quality control
- Delays in accomplishing Tech Order Compliances
- Inadequate engine failure detection procedures
- Time delays in providing modification fixes

Last fall major commands were asked to submit top materiel deficiencies in this weapon system. These items also bear repeating as a key to areas that still must be watched most carefully.

- Fuel control
- Main fuel shutoff valve
- Throttle linkage
- Poor quality of overhauled engines and engine accessories
- Engine oil system
- Bearing failure
- Main fuel manifolds
- Drag chute system
- Tailhook

For the most part, materiel deficiencies causing F-100 accidents have been identified and corrective actions are being taken or initiated. However, F-100 aircraft are forecast to continue to experience major accidents at a disturbing rate until corrective modifications are completed. Because of quality control difficulties during overhaul, the engine modernization program at overhaul facilities has been discontinued indefinitely. As a result many of the old engines are being put back in the F-100. Present scheme is to modernize the J-57 at base level with kits and parts supplied by AFLC.

One thing is certain. The F-100 has been around quite a few years and by now the Air Force should be pretty familiar with it. Many modifications have been made to make it a safer machine. A tremendous amount of information has been accumulated on its traits and characteristics. It would seem that, with everyone on the prevention team working at prevention first, last and always, we could do better than one to one and a half major accidents per week. ★

AERO BITS

CONFUSED—Occasionally there comes a day when it hardly pays to get up. It must have been one of those days last fall for the two lads in a T-Bird who filed the following OHR:

Weather briefing for destination, Olmsted AFB, was: Destination 2500 overcast, seven miles visibility, enroute winds 290 degrees at 45 for FL 33. En route winds at FL 33 were actually 100 knots (McGuire forecaster verified that en route winds should have been given as 90 knots). Also, on arrival over Harrisburg Omni, Olmsted Metro, contacted by copilot, gave Olmsted weather as 1300 feet and three miles. This was well below the forecast weather and was below the minimums for the St. Thomas approach assigned by the New York Center for approach to Olmsted.

The aircraft had been descended to 20,000 feet at this time by the New York Center. Clearance was immediately requested to McGuire AFB. New York Center gave the aircraft clearance at 20,000 feet via V 1532 to Echelon Intersection. Echelon Intersection could not be found on the intermediate route map structure. It is indicated only on the low altitude route structure. The aircraft proceeded via V 1532 to Westchester and via the 104 Westchester radial to McGuire for a GCA. After landing at McGuire, Olmsted weather was rechecked with the wx station in base ops. At that time they were reporting below 1000 feet and one hour later 400 feet with about one-half mile visibility. NOTAMs checked on Olmsted prior to the flight and after flight showed the following NOTAM on Olmsted: MDT ASR PAR out 'til ten. The question is, ten what? A check of the Enroute Supplement on Olmsted indicated that IFF/SIF service O/S 'til 10 November 1962.

JUNK IN THE COCKPIT—Straight and level at 24,000 feet, the pilot in the front seat of an F-100F rotated the mode selecter switch to LABS ALT in order to check the LABS system. Meanwhile the man in the rear seat pressed the bomb/rocket release to check G and yaw/roll transfer. A pair of 335-gallon tanks, the only stores, promptly left the aircraft.

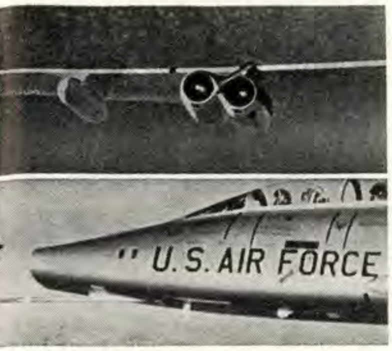
The subsequent investigation revealed the intermediate tank jettison relay to be faulty and, once activated, the relay would remain closed despite recycling. In addition a lot of junk—nuts, bolts, washers, pieces of safety wire—was found under the front cockpit console. Each of these foreign objects was of sufficient size to cause a short of the armament selector switch. As a result all aircraft cockpits were vacuumed and the base is cracking down on proper cleanup of cockpits as part of a drive to prevent FOD.

DO YOU SMELL SOMETHING?—After leveling out at altitude the pilot of an F-100 began to feel dizzy and detected an odor that smelled like paint thinner. He disconnected the oxygen and returned to base where it was found that paint had been allowed to drip onto the personnel leads manifold. Subsequent check of both the aircraft system and the LOX cart from which it had been serviced revealed no contamination.

This aircraft had been spot checked a couple of days before and written up because the cockpit was not properly painted. The day before the flight a repaint job was done with paint getting on the personnel leads manifold. This apparently was what the pilot smelled. There was no explanation as to what made him feel dizzy.

The meticulous care necessary in proper oxygen system maintenance might have prevented this occurrence.

B-47—The aircraft made a normal landing and was rolling out when the pilot was asked by the tower to expedite runway clearance for a C-124 on final approach. Because of excessive speed the pilot had already refused two exit taxiways. Now, feeling that he was slow enough to make a successful turnoff, the pilot accepted the next exit. As the aircraft turned to approximately 45 degrees, the forward main gear began sliding on the snow and ice on the taxiway. Steering response was lost and the aircraft drove into



an eight-foot snowbank. When steering was lost, the pilot shut down all engines but the B-47 continued about six feet into the snowbank, causing damage to the right forward wheel well door, its hinge points and the adjacent fuselage skin.

The pilot caught the blame for this mishap because he elected to clear the runway at an excessive speed. Contributing causes were ice and hard packed snow on the turnoff and the request from the tower to expedite.

Recommendations included:

- Under poor braking conditions it would be better to slow to a speed which would require additional power to change direction.
- Tower personnel refrain from requesting expeditious turnoffs when braking conditions are poor.

WRONG LEVER—During cruise, a fluctuation in RPM was noticed on Nr 4 engine. The engineer was able to manually adjust the RPM. Approximately 18 minutes later, Nr 4 started overspeeding and was uncontrollable with toggle. The order was given to "Feather Nr 4" as the RPM approached 2850. Nr 4 throttle was retarded, Nr 4 feather button was pushed, Nr 4 mixture was placed to idle cutoff and Nr 4 CO_2 selector set. The next item on the checklist is "Firewall Lever Pulled." At this point *Nr 3* shutoff lever was inadvertently pulled instead of Nr 4. Because there are no instruments available to the aircraft commander to indicate impending failure, this action was not noticed by the aircraft commander. A short time later the engineer experienced difficulty with Nr 3 engine. The second flight engineer arrived on the flight deck at this time and noticed Nr 3 shutoff lever in the OFF position rather than Nr 4. Nr 3 throttle was retarded and Nr 3 shutoff lever eased toward ON position. However, the engine had already suffered internal damage, as evidenced by intermittent vibration. Nr 3 had to be feathered.

Nr 3 was feathered, METO power was set and descent made to 3500 feet. As fuel consumption at this power setting would have exceeded that which would have permitted flight to the first available field, approximately 5000 pounds of baggage and equipment were jettisoned. (Some of the baggage had to be cut into small pieces to permit jettisoning.) After this weight reduction, it was possible to reduce power to allow for a 40-minute fuel reserve. Upon landing, nearly six hours after the runaway, Nr 1 quit when Nr 1 and Nr 2 engines were reversed. Brake pressure was momentarily lost, but emergency position was selected and the aircraft stopped.

CHOPPER ACCIDENTS, 1962. Review of helicopter accidents and incidents reveals a general lack of knowledge of operational factors and techniques. This hampered aircraft accident investigating boards and detracted from realistic supervision of helicopter operations and maintenance. Heretofore, because of the few helicopters assigned each base and primary emphasis being placed on the tactical mission, rigid control of helicopter operation was not always exercised. With integration of the H-43B into the base crash rescue system and programming of additional helicopters for missile site support, additional serious operational, maintenance and personnel problems are being encountered. Commanders and supervisory personnel must possess an awareness of helicopter operations and associated problems if safe positive control and desirable effectiveness is to be obtained.

Review of the accidents and incidents reveals that when there was a lack of qualified supervision, there was also a lack of crew professionalism. This applied to both air and ground crews. Pilots failed to perform proper preflight planning and failed to maintain the desired degree of proficiency. Ground crewmen, left to themselves, became slipshod in the performance of their duties. In any case, it's quite obvious that some were less than professional.

Lt Col James F. Fowler, Transport Section
Directorate of Aerospace Safety

BAD CHOW—Flight lunches may not be gourmet eating, but we've seldom encountered a spoiled one. Here's such a case, which indicates that it would be wise to use the old sniffer before the fork. Shortly after consuming part of their hot lunches, which consisted of steak with mushroom sauce, the crew commander and engineer became nauseated—the engineer to the extent that he had difficulty performing his duties. The copilot opened his lunch, took a whiff and instructed other crewmembers not to eat any part of theirs.

It is suspected that these lunches had been stored longer than the nine months AFM 146-2, Sec. C, recommends as a limit. Flight crews should take a look at the manual and remember to check the date on the lunch, check thawed indicators, keep the lunches frozen and do not thaw prior to heating in the oven. Further, these lunches should not be refrozen in the event they thaw.

AERO *CONTINUED* BITS

AERO CLUB accidents continue to be a problem. Recently a member was killed when the T-34 he was flying struck the ground while rolling out of a low level inverted pass over a strip near a relative's house.

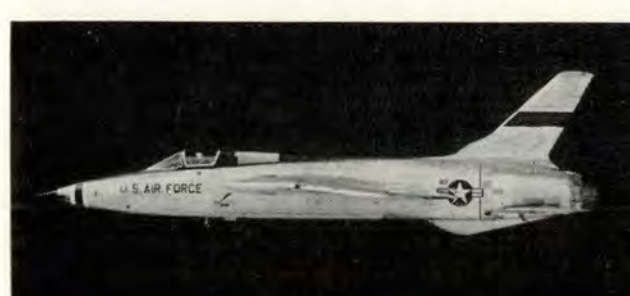
This is the sort of thing that could very well put the aero clubs out of business. With the assistance and guidance available to the clubs, aero club accidents ought to be almost nonexistent. Regulations and manuals, however, are no substitute for effective management. Commanders and safety officers must monitor club activities and provide the necessary support and guidance to assure safe equipment and safe practices. At the same time they must be prepared to take whatever action is necessary to insure that members adhere to AFR 34-14, command and base regulations, as well as the CAR. Club management must take the responsibility for actively managing their clubs.

Air Force aero clubs have a lot going for them that similar civilian flying clubs do not have. Consequently, they should be a model for this type of flying operation.

F-84, DART DROP—While returning from an air-to-air gunnery mission towing a TDU-10/B dart which was being tested, the pilot planned his drop at 750 feet instead of the normal 1000 feet to insure minimum damage to the dart when it struck the water. Actually, the pilot got down to 600 feet and the dart struck the water snapping the cable. The 200 feet of cable that remained attached to the aircraft snapped forward striking the horizontal stabilizer and draped itself over the left wing. Despite this, the pilot was able to make a normal landing. Damage to the aircraft was minor.

Going below recommended drop altitudes at low speed can be extremely dangerous and, in an incident such as the above, the pilot could find himself in a position where a crash would be imminent and his chances of saving himself practically zero.

EJECTION HAZARD—Investigation of a recent F-105 accident uncovered a possible hazard. The pilot used normal ejection procedures and, in the course of ejection, raised the seat pack emergency release handle concurrently with raising the ejection handles. This disconnected the survival kit from the parachute. F-105 pilots should understand that there is a possibility of inadvertently raising the seat survival pack emergency release when raising the leg braces (ejection handles) during the ejection sequence. ★



WELL DONE

Capt. David M. Holdsworth, AFSC

Captain David M. Holdsworth, Air Force Test Pilot, was on a speed flight to check F-105 roll-off characteristics and aileron lockout speed (680-710 KCAS). At MACH 1.9 (700 KCAS) and 35,000 feet altitude, Captain Holdsworth heard and felt a violent explosion immediately followed by severe engine vibration and pitch instability. A quick check revealed flames coming from the right forward fuselage section and the majority of the master caution warning lights illuminated. Captain Holdsworth came out of afterburner and pulled into a hard climbing wingover to become sub-sonic and retarded the throttle to idle. Quick analysis indicated a strong probability that the ATM had blown out through the fuselage of the aircraft and been ingested by the engine. Since the ATM powers the utility hydraulic system and the AC generator system, Captain Holdsworth was deprived of leading edge flaps, speed brakes, the variable air inlet system, aircraft stability augmentation, fuel boost pump operation, pitch mechanical advantage shifter, operation of all tape instruments and the Lear All-Altitude Platform, normal gear extension and normal wheel brakes, along with other systems powered by the AC secondary bus and utility hydraulic system.

Captain Holdsworth decided to attempt an emergency landing. Because of the extreme engine vibration which was shaking the airframe and instrument panel, he considered stopcocking the engine and using the ram air turbine for emergency flight control operation. In the idle position however, the vibration was not adjudged to warrant this course of action at the expense of losing both flight control systems so he left the RAT stowed to take advantage of P1 and P2 flight control systems with the roughly idling engine. At 40,000 feet he established a precautionary flameout approach. On a relatively high "low key" he lowered the trailing edge flaps. The duct plugs were jammed in the full forward (supersonic) position, limiting engine output. The variable mechanical advantage shifter was stuck in the high speed range, thereby limiting horizontal slab effectiveness. Because of the high fuel consumption during the speed run and the loss of the forward and aft fuel boost pumps, Captain Holdsworth was forced to land the aircraft in an aft CG condition. He skillfully flew his flameout pattern using his standby airspeed and attitude indicators. Cognizant of the critical nature of the flareout portion of the pattern due to the aft CG and restricted elevator travel, Captain Holdsworth crossed the fence at 200 KIAS in a shallow rate of descent and touched down at 165 knots. Drag chute and emergency brake system stopped the aircraft 2000 feet from the end of the runway. His professional performance earned Captain Holdsworth a WELL DONE! ★

"Man, when I get cleared for an approach I really come down!"

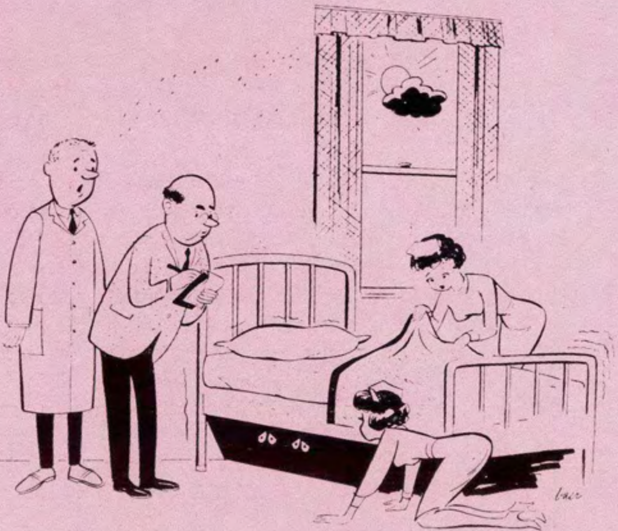
"Well, he's out of 12,000 . . Three minutes to descend to 1000 feet!"

TWO POINTS OF VIEW

BEFORE

AFTER

"No Sweat . . I've been through hundreds worse than that cloud!"



"Strange case, Doctor. This happens each time a cloud passes over."

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