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Aerospace SAFETY

THE MAGAZINE DEVOTED TO YOUR INTERESTS IN FLIGHT

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SPECIAL FEATURES

REGULAR FEATURES

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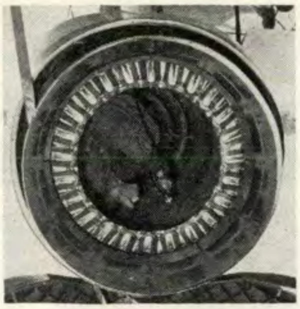
PREFLIGHT

Pilots' wives frequently wonder who is Nr 1 — they or the aircraft their husbands fly. We won't attempt an answer, but we do point to "The Super Seven" beginning on page 2. The author, Major Frank Tomlinson, obviously has a love affair going with the A-7D, USAF's newest attack aircraft. He describes its performance and many of its features, so read the article, study the illustrations and you'll be up to date on this bird.

There are a couple of other articles we highly recommend. "Little Known Drugs" by Major J. H. Cohn, USAF, MC, lays it on the line as to pilots and the drugs they use. All of us use drugs, even those of us who avoid pills with a passion. Tobacco, coffee, tea and other commonly used items contain certain drugs and they have an effect on humans. The author sums up by pointing out that flying is the aircrewman's business; medicine is the flight surgeon's.

"And Away We Go," by Major Nelson Allen reminds us that hydroplaning is still very much a hazard. This phenomenon has been a factor in 21 accidents in the past two years. Since no aircraft is completely immune, all jocks should find the article interesting and informative.

There are several other interesting articles, all aimed at the pilot, so read on and if you pick up a grain or two that will help prevent an accident we've all gained.




TOGETHERNESS = PILOT + MAINTENANCE TECHNICIAN

Maj William C. Mossholder, Directorate of Aerospace Safety

There have been many attempts to clearly define the relationship which exists between the pilot and the maintenance technician. Some discussions are intense and heated concerning which *one* is the more important. I submit that this approach can never have a final solution, for the main departure point is missing—the mission! All Air Force activities have missions which must be the main goal of the efforts exerted by all.

The pilot-maintenance technician relationship is unique in that the efforts of both participants have a common denominator that is so important that neither can ignore it—life itself! If either man fails to perform his assigned duties, the result could be fatal. This consideration alone should be the prime motive in performing the tasks related to each man's efforts.

This relationship cannot be reduced to statistics, data runs, or verbal debates; rather, it's closer to a definition of "togetherness" cited by Mr Webster—"by combined action; jointly; in or into agreement or harmony." Unless both the pilot, who straps on the weapon, and the maintenance technician, who cures its ills, communicate and cooperate with each other, all can be lost.

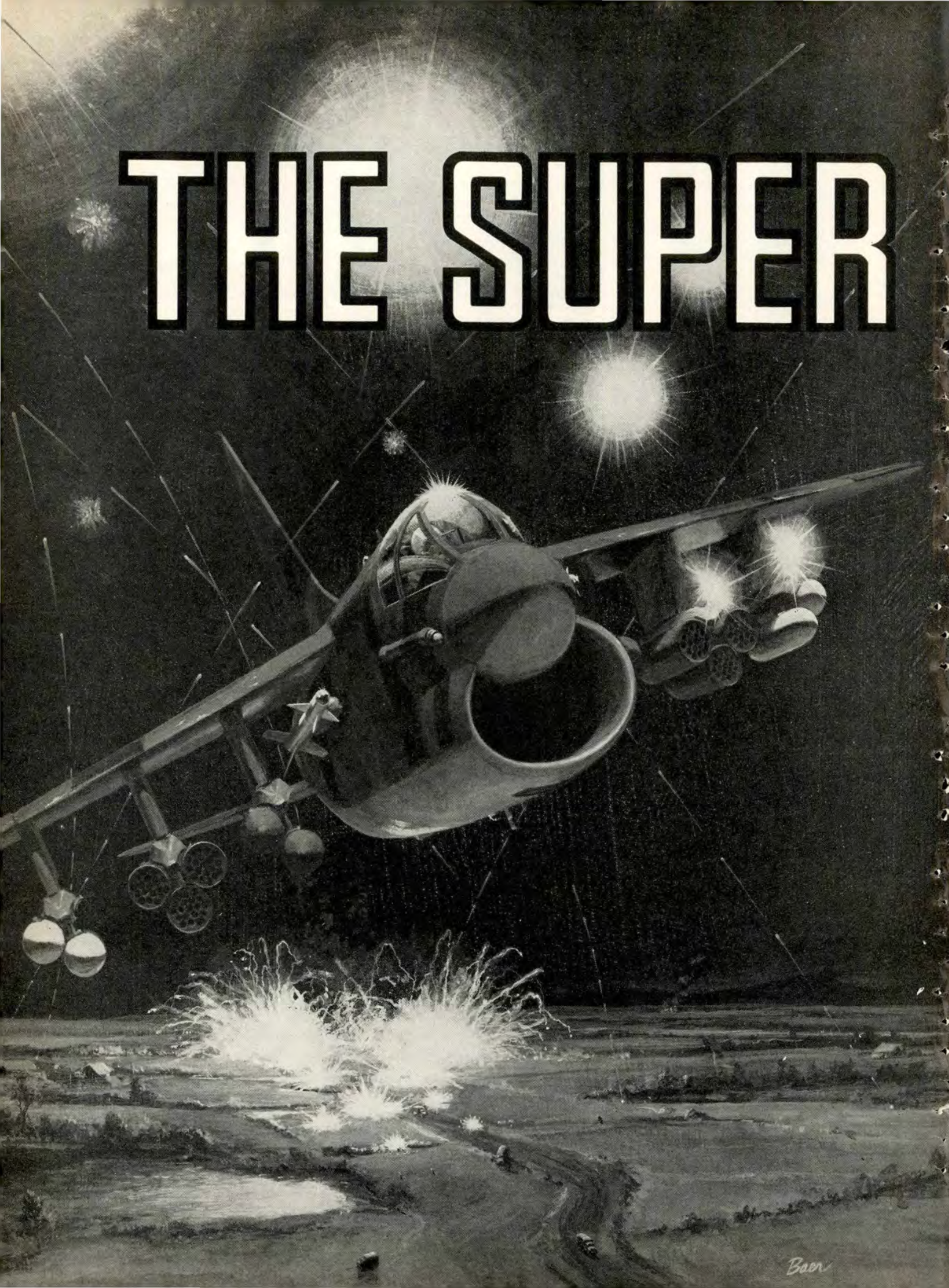
Cases in point:

The pilot in SEA who became upset prior to arriving at the aircraft and, when the crew chief and his assistant (a three-level being trained) moved too slowly in pulling the chocks, rammed the throttle forward until there was power enough to jump the chocks! Fortunately, the assistant crew chief was quick enough to avoid being run over by the main gear!

Equally important was the crew chief and munitions technician who failed to show for the walk-around inspection! In this instance, the fuzes were set wrong and the bomb ground safety pins were not all the way through the hole in the rack! SPECIAL NOTE: Adequate and immediate corrective action was taken by the commander, operations and maintenance officers concerned.

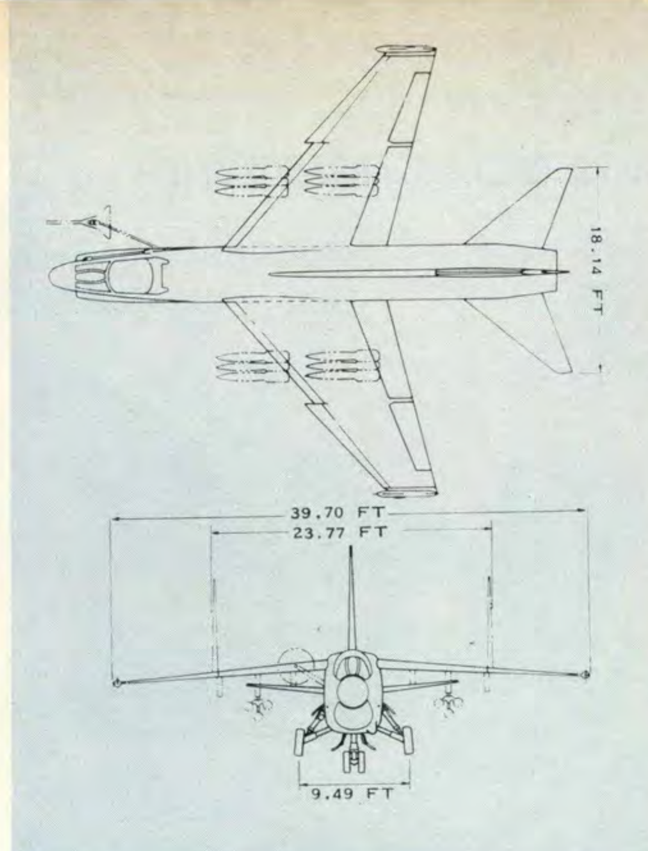
These are two extreme examples, I grant, but they clearly outline my point—that each man allowed his personal feelings to affect his task to the point that the mission was jeopardized and injury to man and damage to aircraft was possible! ★

THE SUPER



7

USAF's newest bird, the A-7D, flew for the first time on April 6. Soon the husky attack aircraft with its guns, big bomb load capability and all kinds of goodies in the pilot's office will be giving the troops a big new punch.



Maj Frank J. Tomlinson, Directorate of Aerospace Safety

On 6 April 1968 at Dallas NAS, Texas, the USAF A-7D Corsair II flew for the first time. This flight heralded into our tactical inventory one of the most versatile combat aircraft yet produced by the aerospace industry. I am confident it will take its place in the fighter aircraft hall of fame along with such well loved craft as the Mustang, Sabre, Thud, Super Spad and the Zip 4. Each has its loyal retinue of fighter jocks who will expound on its individual virtues, with or without encouragement, and there is already a small but vociferous band dedicated to this one-engine, one-pilot warbird. In this article we'll point out a few of the reasons for this love affair.

The A-7D is a single-place, land-based light attack airplane powered by the Allison-Rolls Royce TF41-A-1 non-afterburning turbofan engine, which provides a high subsonic level flight capability and an extended radius of action.

Basic features include a high ordnance loading capability, a large internal fuel capacity, superior flying qualities with multiple stores arrangements over the entire potential speed range, and substantially improved maintainability, serviceability and turnaround time characteristics.

With this description of the Super 7 as a point of departure and using Figure 1 for general reference, let's

Figure 1

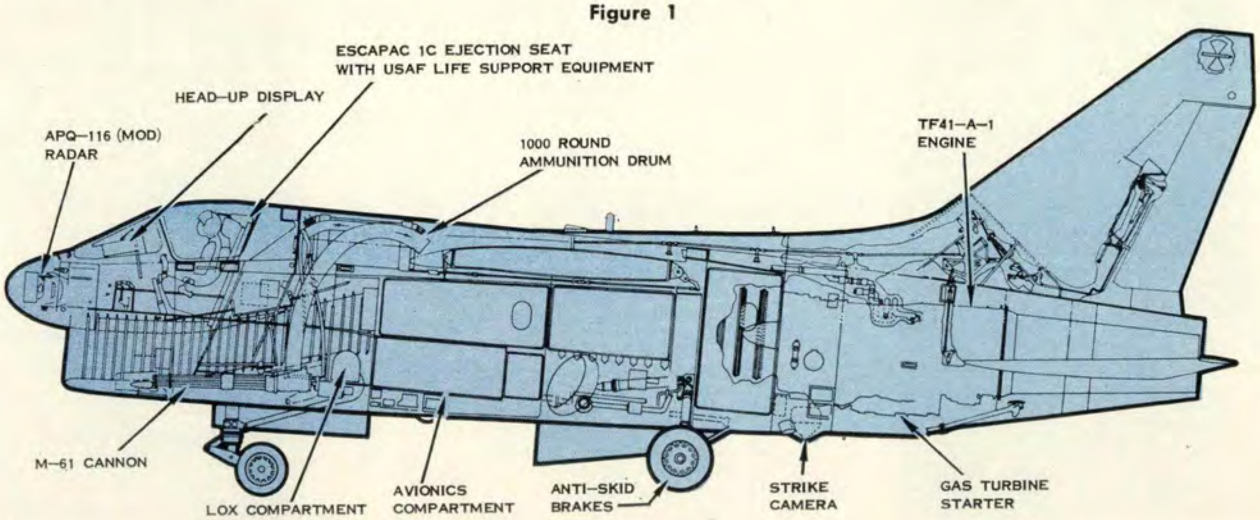
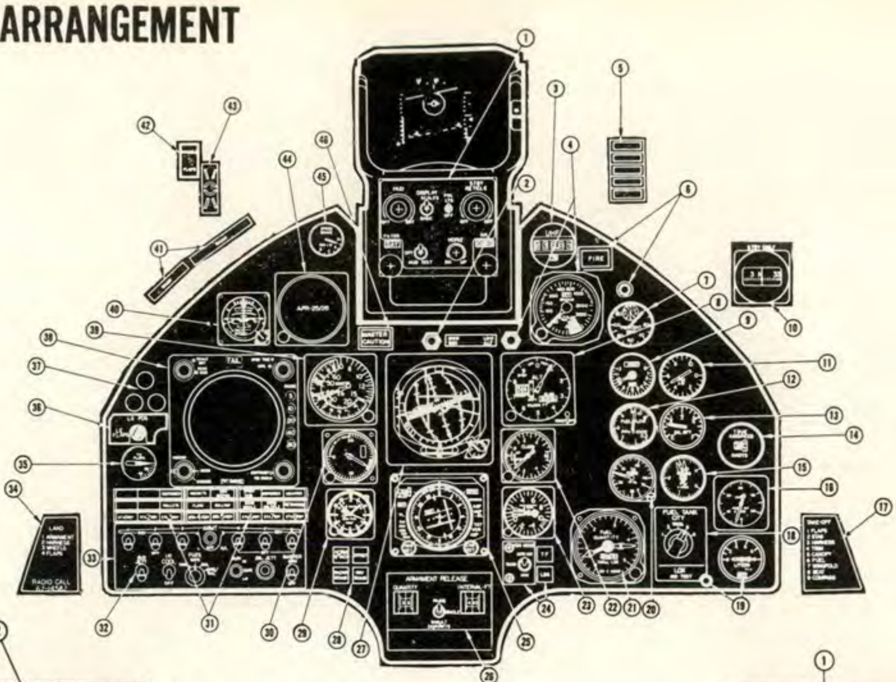
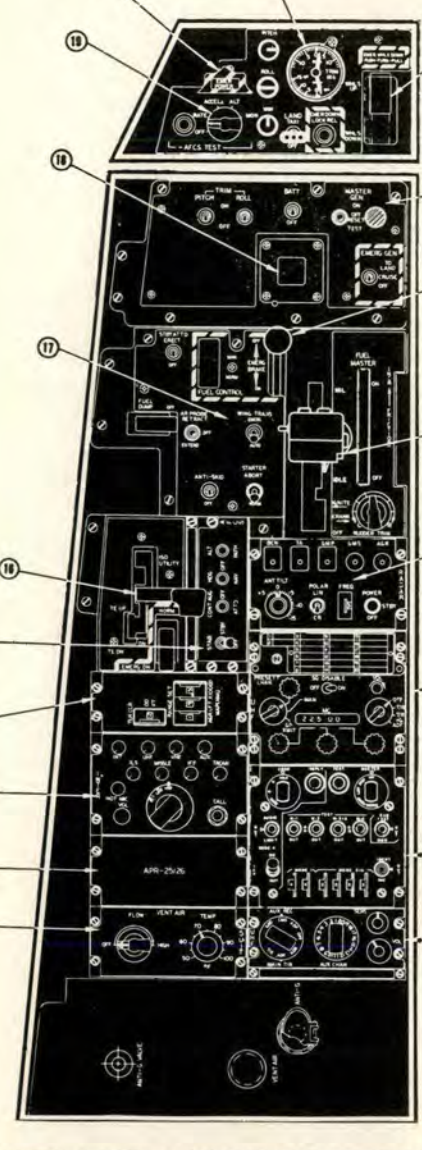


Figure 2

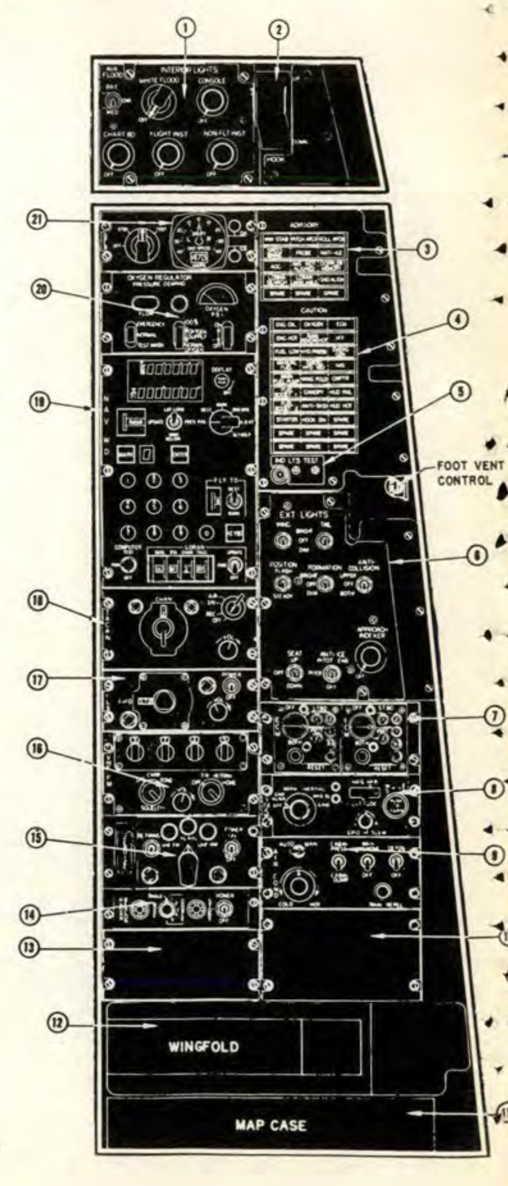
A-7D COCKPIT ARRANGEMENT





INSTRUMENT PANEL

1. Head Up Display
2. Marker Beacon Light
3. UHF Channel Frequency Indicator
4. Radar Altimeter/Warning Light
5. Radar Warning Lights
6. Fire Warning Light/Press-to-Test Switch
7. Tachometer
8. Servoed Altimeter
9. Turbine Outlet Temperature Indicator
10. Standby Compass
11. Oil Pressure Indicator
12. Fuel Flow Indicator
13. Oil Quantity Indicator
14. True Airspeed Indicator
15. Hydraulic Pressure Indicator
16. Cabin Pressure Altimeter
17. Takeoff Checklist
18. Fuel Quantity Tank Selector
19. Liquid Oxygen Quantity/Press-to-Test
20. Turbine Outlet Pressure Indicator
21. Fuel Quantity Indicator
22. Vertical Velocity Indicator
23. Accelerometer
24. Heading Mode Controls
25. Horizontal Situation Indicator
26. Armament Release Control
27. Attitude Directional Indicator
28. Attack Mode Controls
29. Clock
30. Angle of Attack Indicator
31. Station Ready Lights
32. Auxiliary Jettison
33. Armament Selector Panel
34. Land Checklist — Radio Call Placard
35. TE Flaps Position Indicator
36. LE Flaps Position Indicator
37. Landing Gear Position Indicators
38. Radar Indicator
39. Airspeed Indicator
40. Standby Attitude Indicator
41. Radar Threat Lights
42. Wheel Flaps Warning Lights
43. Angle of Attack Approach Indexer
44. APR-25/26 Display
45. Speed Brake Position Indicator
46. Master Caution Light



HUD SYMBOLOGY

The primary display shows the symbology presented with the selection of each HUD operating mode. At the pilot's option additional display information may be presented.

1. FLIGHT DIRECTOR
2. AIRCRAFT SYMBOL
3. ARTIFICIAL HORIZON
4. NEGATIVE PITCH LINE
5. SECOND SOLUTION CUE
6. FIRST SOLUTION CUE
7. AZIMUTH STEERING LINE
8. TARGET RETICLE
9. PULLUP CUE
10. ANGLE-OF-ATTACK COMMAND
11. LANDING DIRECTOR
12. HEADING (179° SHOWN)
13. RANGE (80 MI SHOWN)
14. ALTITUDE VERTICAL VELOCITY SCALE
15. VERT VELOCITY INDICATOR (−200 FT MIN SHOWN)
16. ALTITUDE INDICATOR (9,200 FT SHOWN)
17. POSITIVE PITCH LINE
18. AIRSPEED ANGLE-OF-ATTACK SCALE
19. AIRSPEED INDICATOR (380K SHOWN)
20. ANGLE-OF-ATTACK INDICATOR (17 UNITS SHOWN)
21. TARGET RETICLE
22. ANGLE-OF-ATTACK COMMAND

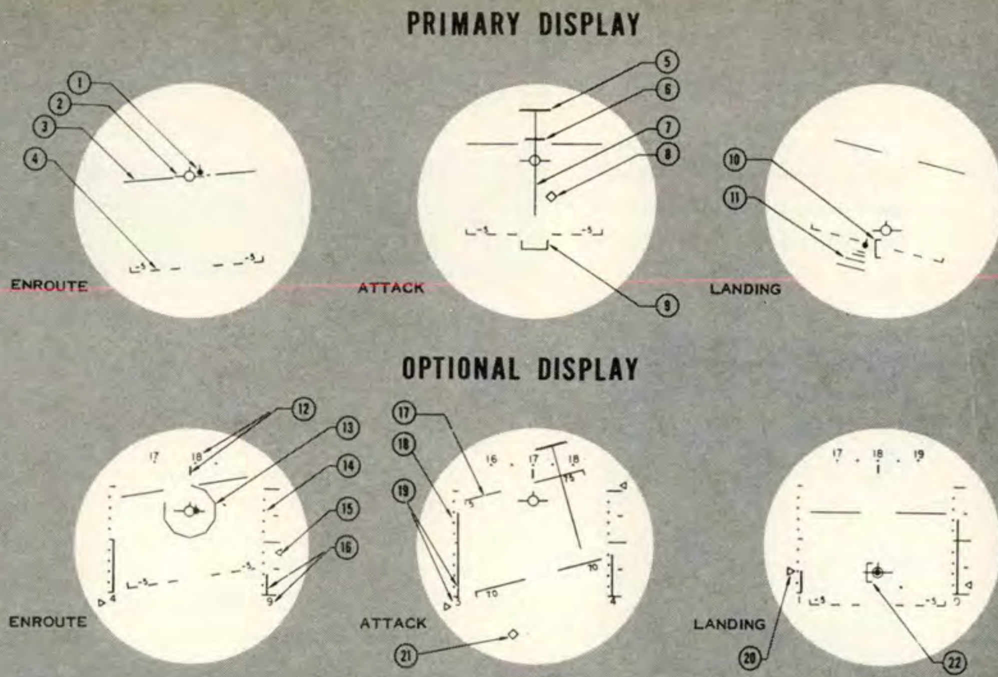


Figure 3

LEFT HAND CONSOLE

1. Emergency Power Package Control Handle
2. Roll Pitch Trim Indicator
3. Landing Gear Control Handle
4. Generator Control Panel
5. Emergency Brake Control Handle
6. Throttle Control
7. Radar Control
8. UHF Control
9. IFF Control
10. Auxiliary UHF Control
11. Suit Vent Air Control
12. APR-25/26 Control
13. Audio Control
14. Radar Range-Terrain Clearance Control
15. Automatic Flight Control
16. Flaps Control
17. Fuel Management Panel
18. Bullpup Control Stick
19. AFCS Test Control

RIGHT HAND CONSOLE

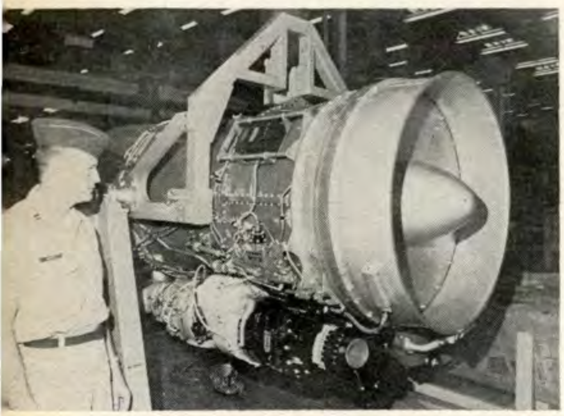
1. Interior Lights Panel
2. Arresting Hook Control Handle
3. Advisory Annunciator Panel
4. Caution Annunciator Panel
5. Caution and Advisory Lights Press-to-Test
6. Exterior Lights Panel
7. ECM POD Control
8. IMS Control
9. Environmental System Control
10. Blank Panel
11. Map Case
12. Wingfold Control Handle
13. Blank Panel
14. Radar Beacon Control
15. Juliet 28 Control
16. VHF FM Control
17. ILS Control
18. TACAN Control
19. Integrated Nav/WD Computer Control
20. Oxygen Regulator Control
21. Doppler Radar Control Panel

take a look at what the pilot's office will consist of. Figure 2 shows that the proposed instrument placement reflects HIAD design guidance coupled with the best ideas of Korean and SEA combat veterans. Functionality and pilot task simplification were key design parameters during the development of this cockpit layout. Although the A-7D packs a lot of sophisticated gear such as RHAW, NAV/weapon delivery radar, and integrated bomb/NAV computer, the proposed controls, shown in Figure 2, are designed and located so as to greatly simplify the pilot's job and permit more time for keeping his head out of the cockpit.

The key element in the philosophy of "keeping the pilot's head out of the cockpit" is the Head Up Display (HUD). The HUD integrates instrument symbology with weapon delivery symbology to enable the pilot to fly, fight and land with minimum requirement to look inside. Figure 3 shows what the proposed HUD symbology will consist of during the three modes of operation—Enroute, Attack, and Landing. In addition, the A-7D will have ILS localizer and glide path crossbars presented during the landing mode when ILS is used. The HUD, first of its kind in a USAF tactical aircraft, represents a quantum step forward in the attempt to reduce accidents due to "head in cockpit" bashes during weapon delivery, formation, low-level navigation, etc., as well as enhancing combat capability. Once you have had a chance to use the HUD you'll never want to go back to former instrumentation, for, as a popular commercial goes, "It's the *only* way to fly."

Obviously one of the most vital components of an aircraft is its power plant, particularly in single engine birds. The Allison-Rolls Royce TF41-A-1 engine incorporates self-starting capability. Starting is initiated by an electric motor, powered by the aircraft battery, driving the air-breathing gas turbine starter. The gas turbine starter burns jet fuel provided by the airplane

Basic features of this single-engine, one-pilot fighter include a high ordnance loading capability and a speed range to get you there 'n back.



TF-41 jet engine mockup used to check attach points and fittings in the first A-7D Corsair II for the Air Force. Capt Nick Jones, USAF, on duty with Navy A-7 squadron in Vietnam.

A-7A with access panels open. Work areas are readily accessible so that maintenance can be performed easily, right at working levels.

fuel system. The starter unit includes: (1) a turbine-driven compressor which compresses air for combustion, (2) a free turbine for accelerating the engine to a self-sustaining speed, and (3) an integral control system. External electrical or other power is not required for starting. The engine has self-contained ignition for start/airstart, automatic relight (activated by a drop in burner can pressure) and selective ignition. The engine development is ahead of schedule and it is reported to be providing more thrust and better fuel specifics than originally anticipated.

Other "goodies" incorporated in the Super 7 and not previously mentioned are:

• Self-retaining bolts on critical throttle, engine, and flight control linkages.

• Enhanced survivability through additional armor, fuel system, self-sealing and redundant components.

• All solid state electronics with extensive use of "Hard Harness" wiring developed by the Vought Aeronautics Division of LTV, Inc., in lieu of conventional wire bundles.

• A Ram Air Turbine (RAT) which supplies hydraulic pressure and electrical power down to airspeeds below those used on normal landing approaches or flameout patterns.

•Fuel system fire suppression and alternate fuel feed system.

• A backup flight control system that provides the capability to land the aircraft.

• Limited aircraft integrated data system for engine monitoring.

• Ejection system to provide:

Fully inflated chute within three seconds after sequence initiation,

Positive seat/man separation,

Stabilization of the ejected pilot and seat,

Optimum pilot comfort and mobility.

• Improved exterior lighting for night formation.

• Wheel brake system and MLG tires designed to minimize hydroplaning.

Throughout the A-7 development program, safety, reliability, and maintainability have been applied as design constraints. During the design phase, safety, reliability and maintainability engineers worked with other engineers in the development of design concepts and preparation of procurement specifications. Many of the best features, some of which have been mentioned in this article, are the direct result of inputs from company and blue suit safety engineers, and constitute the payoff from years of efforts to integrate safety requirements into the early phases of weapon system development.

This scrappy little gun fighter will get you there and back, whether you are truck bustin' up along the Ho road, giving close support to the Doggies and Grunts, cutting the roads out of Mugia, interdicting rail lines north of the Red or anywhere else the powers that be decide to employ it.

So, Salud! Kampai! Skal! and Sawasdi! to the "Super 7", latest in a long, proud line of "fighter pilots' " aircraft. ★

the I.P.I.S. approach

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

Q When cleared for an approach, may a pilot, after reaching the IAF, maneuver in the holding pattern to align himself with the penetration course?

A Clearance for an aproach without holding does not include clearance for the holding airspace. When over the IAF, turn in the shorter direction towards the penetration course. Descent may be started when over or abeam the IAF headed in the direction of the initial penetration course. If an inbound transition course to an IAF is adversely aligned, the pilot may well consider maneuvering the aircraft into a more favorable position. However, clearance for this maneuvering must be obtained from ATC.

Q When the holding pattern and IAF are not collocated, where should the pilot plan to be at an EAC time?

A Planning to meet an EAC time should be based on the point of departure from the holding pattern. If the IAF is located outside the holding pattern, the pilot should be at the published point of departure from the holding pattern at the EAC time. The pilot must obtain clearance prior to departing a holding pattern for an IAF.

IPIS has recommended JAFM 55-9 (TERPs) require that when holding is necessary prior to entering the initial approach segment, the holding fix and IAF coincide. When this is not possible, the IAF should be located on the inbound holding leg.

INSTRUMENT FLYING PROCEDURES

Instrument flying procedures are becoming more complex. AFM 51-37, the Air Force instrument flying manual, is constantly revised to provide safe, efficient instrument flying procedures. AFM 51-37, Change 1, 1 April 1968, contains several changes. Some of the major procedural changes are outlined below:

1. *Altimeter Setting Procedures.* Altimeter correction factors are no longer computed and applied to all altimeter settings. Altimeter accuracy should be checked at a known elevation and the error in feet noted. If the error exceeds 75 feet, the altimeter cannot be used for IFR flight. In the past, the application of a correction factor has frequently compounded altimeter errors. Deletion of the correction factor aligns Air Force procedures with the rest of the aviation community—users of the same airspace.

2. *Teardrop Procedures.* All teardrop procedures, holding pattern entries or approach maneuvering, now require a teardrop of 30 degrees or less.

3. *Initial Approach Fix Airspeed.* If holding is not required, pilots are no longer required to reduce to holding airspeed or less prior to the IAF. When cleared for an immediate approach, pilots must now reduce to penetration airspeed or below before crossing the IAF.

4. *Procedure Turn Limitation.* Aircraft maneuvering in excess of 180 TAS must now correct back toward the inbound course if the turn outbound places the aircraft on the non-depicted side of the course. An intercept angle of at least 20 degrees must be used. If the inbound course is intercepted outbound, maintain it for the required time and turn inbound on the depicted side. If the course is not intercepted while outbound, turn towards the inbound course.

5. *ILS.* An ILS localizer signal is only considered reliable within 25 miles of the transmitter and 30 degrees of the course centerline, unless a published approach depicts a transition point at a greater distance. A glide slope signal is only reliable within 15 miles of the transmitter (*provided the aircraft is on the localizer course*). A pilot may not descend below glide slope interception altitude if the localizer course signal indicates a full scale CDI deflection.

POINTS TO PONDER

Did you know that AFM- 60-1 specifically states: "During an instrument flight check, the examinee will demonstrate his ability to operate aircraft safely and effectively in accordance with flight manual instructions and *AFM 51-37 procedures.*"

Instrument flying procedures are written by pilots for pilots. If you don't like them, let's improve them. Forward any suggestions to the USAF Instrument Pilot Instructor School (PT-IPIS-T), Randolph AFB Texas 78148. ★

THE NEW LOOK IN ALTIMETRY

David V. Stockman
Aeronautical Systems Division, AFSC

Of all the gages staring back at a pilot the one that is indispensable to every aircraft is the altimeter. Historically, it is also the one that has probably caused more cussing and discussing than any other instrument and has possibly figured in more accidents than any other. The records indicate that the altimeter has been a frequent topic of discussion in safety publications, primarily as the result of accidents and near accidents from pilots misreading this vital instrument. This problem existed 30 years ago, 20 years ago, 10 years ago, and it is still with us today.

If the above seems pessimistic, we hasten to add that there have been improvements over the years. The barometric scale was added sometime back in the dark age of *aviation; a third pointer, to indicate tens of thousands of feet, was incorporated in the mid-fifties along with the so-called barber pole. Then vertical tape instruments showed up but they are in only a few aircraft. Most aircraft still feature the round dial instrument. But there is a new look to this gage, and the following description will bring you up to speed.*

For years pilots have demanded better altimeter mechanism to reduce instrument errors, and improvement in the altimeter presentation toward eliminating, or at least reducing, the possibility of reading the instruments incorrectly.

And the crews have had good cause for these demands. One study that was made over a six-year period in the fifties implicated the altimeter in 33 accidents in which 35 aircraft were destroyed and 53 persons killed.

Early in 1965 a tri-service flight test program was begun in an effort to determine which suitable display to adopt to replace the current standard three-pointer altimeter. Twenty-three pilots from the Air Force, Navy and Army participated in 92 flights. Four displays were evaluated. The results of the joint flight test effort disclosed that a counter-drum-pointer display met with overwhelming pilot preference (19 out of 23). The preference was concurred in by the Instrument Pilots Instructor School and the Directorate of Aerospace Safety.

The counter-drum-pointer altimeter was designed by personnel of the Instrument Division, Systems Engineering Group at Wright-Patterson AFB to simplify the display and eliminate or reduce pilot reading error. Two of the pointers have been removed leaving only one which indicates hundreds of feet. Thousands and tens of thousands of feet are indicated on digital counters. A vertical drum placed beside the thousands counter indicates redundant hundreds of feet information. The combined easily read information presented by the counters and pointer indicates the altitude in thousands and hundreds of feet. The instrument also includes a new barometric pressure scale with a four digit counter for faster and more accurate reading and setting.

Designated the AAU-19/A altimeter, it is an electro-mechanical indicator; however, its primary mode of operation is electrical, being electrically servoed to a computer. The computer senses both pitot and static pressure and computes altitude corrections so that compensated altitude is displayed on the altimeter. The AAU-19/A altimeter automatically reverts to standby (barometric) mode in the event of an electrical power failure of the computer or any component of the computer pressure system. To reset the indicator the control on the bezel is positioned to RESET.

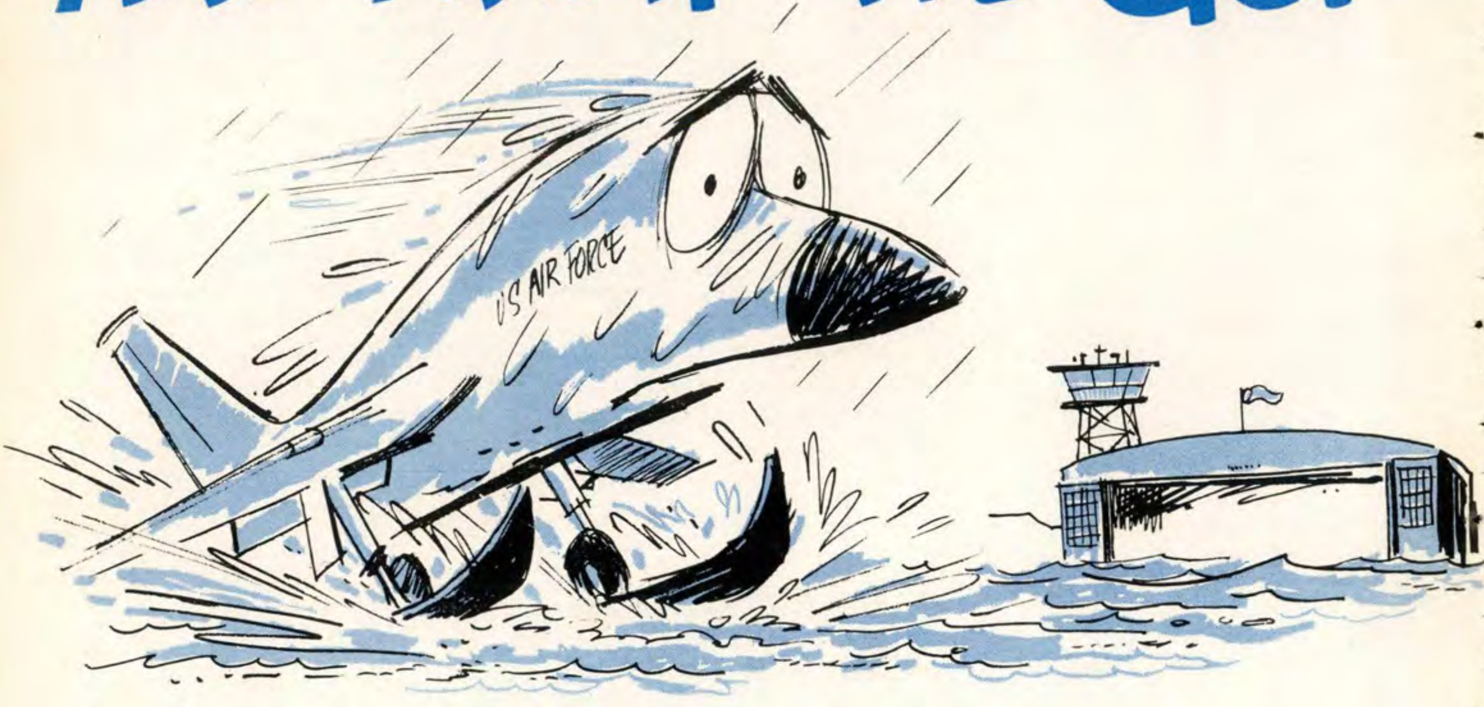
In the barometric mode, the altimeter functions as a completely independent back-up altimetry system. When the altimeter reverts to the barometric (standby) mode of operation, a flag marked STBY will appear in the window in the upper left section of the dial face.

It will be sometime before you see this new gage in Air Force cockpits; however, plans have been initiated to standardize the counter-drum-pointer altimeter display in all high performance USAF and Navy aircraft. ★

The old familiar found in most aircraft. Pilots have been misreading it for years, with occasionally dire consequences.

Counter-drum-pointer altimeter resulted from tri-service tests conducted by Systems Engineering Group, ASD. Plan is to eventually standardize this display in all high performance USAF, Navy aircraft.

AND AWAY WE GO!



Maj Nelson Allen, Directorate of Aerospace Safety

Scene 1: Fungo Aerdrome.
Time: Too Late.
Mission: Get home to the homedrome after being gone too long.
Weather: One thou overcast, five miles viz, crosswind 12 knots, and RCR four.
Question: Time to go?
Time to wait?
Answer: You guessed it. With that RCR you'll go ballistic at touchdown. Time to wait around for awhile.

* * * * *

Scene 2: Fungo Aerdrome.
Time: Two hours later.
Mission: Same same.
Weather: One thou overcast, five miles viz, crosswind 12 knots, *RCR 10!*
Question: Time to go?
Time to wait?
Maybe?
Answer: Maybe.

* * * * *

Scene 3: Homedrome.
Time: ATA.
Mission: Same same, *almost* completed.

Action: Mission flown as advertised, final approach speed on the money, silky smooth touchdown, everything OK so far. Then, much to our surprise, the flying machine is out of control—we've just discovered perpetual motion—thousands of pounds of airplane, JP4, and adrenalin sliding smartly over the ground with no apparent intention of coming to rest in the accepted manner. The whole schmeer is just so much $\frac{1}{2}mv^2$ heading south. With that crosswind you'll be lucky to get as far as the barrier; you're probably going to eat some runway lights on the way and become intimately acquainted with the real estate adjacent to the concrete.

Analysis: Water skiing out of season! You have just put on a million dollar exhibition of "hydroplaning."*

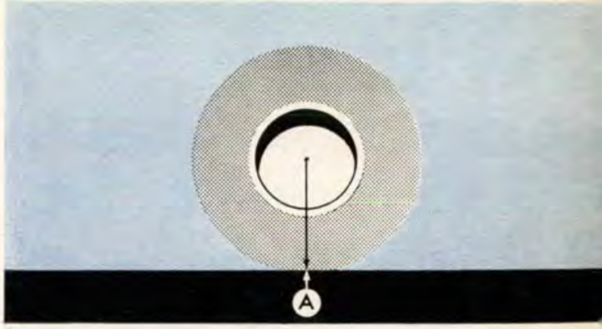
Hindsight: Here's how it happened. The ice or snow on the runway had pretty well melted so the RCR went up to a value that could be handled with a reasonable air-

** There are three general categories of traction loss: viscous skidding, rubber reversion, and dynamic hydroplaning. The first is alternately known as thin film lubrication which we associate with smooth wet surfaces. This is the phenomenon that we experience in an automobile or flying machine when the street or runway is "slick." The "slickness" can be from water or ice. The second phenomenon is one which is only partially explained at this time. A prerequisite is a non-rotating tire on a wet surface that develops frictional heat in the tire footprint. This develops steam pressure that lifts the tire, reducing tractional values. The third category of traction loss is dynamic hydroplaning. This is caused by the lifting component of the dynamic pressure in the footprint resulting from forward velocity on a wet surface. Sometimes tractional skidding and tire reversion are referred to as forms of hydroplaning, and other times the term hydroplaning refers to dynamic hydroplaning as such, depending on which school you went to. This article addresses dynamic hydroplaning; and the use of the word "hydroplaning" throughout refers to and is limited to that phenomenon.*

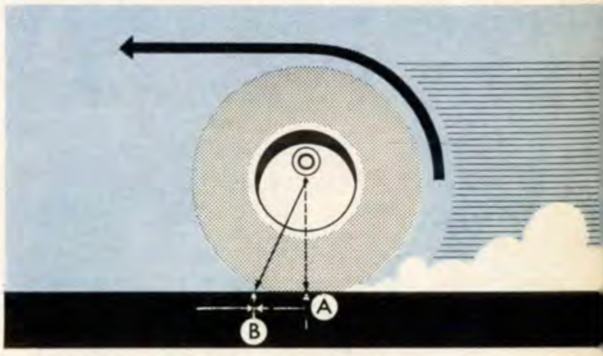
plane at a reasonable gross weight on a reasonable runway. That is, if there weren't a joker in the deck. In this case, there was. As a matter of fact, there were two. That 12-knot crosswind would normally be a piece of cake, but once the flying machine becomes a hydroplane, it can be the crosswind factor that becomes the airplane bender. Joker number one, however, is a force resulting from "hydrodynamic pressure." (It's important to look very knowledgeable when you use words like that.) What this really means is that water, or a water/snow/slush combination, piles up in front of the aircraft tires. At low speed this results in nothing more than a bow wave, for the mass of the machine is sufficient to force the fluid out from under the tires so that contact can be maintained with the runway surface. However, if you're going fast enough, the combination of the fluid's inertia, the wedge-shaped angle made by the runway and the oncoming arc of the tire, and a few other forces results in the fluid not getting out of the way fast enough. In the extreme case, the tire loses complete contact with the runway surface.

NASA has conducted tests on this phenomenon using a transparent runway surface that is photographed from underneath. As speeds are increased, the photos show a decrease in the area of the tire that is in actual contact with the runway surface. When the hydroplaning phenomenon is fully developed, the tire has actually lost contact with the solid surface and away we go!!

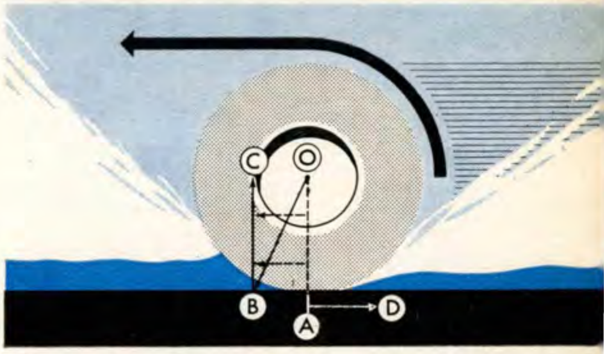
Strangely enough, when this thing is fully developed, the wheel stops without benefit of braking. The frictional, or tractional loads representing spin-up forces at this point are less than the spin-down forces which are comprised of bearing friction and the forward shift in the vertical loading point due to ground reaction to the forward movement. The bearing surfaces are still supporting the



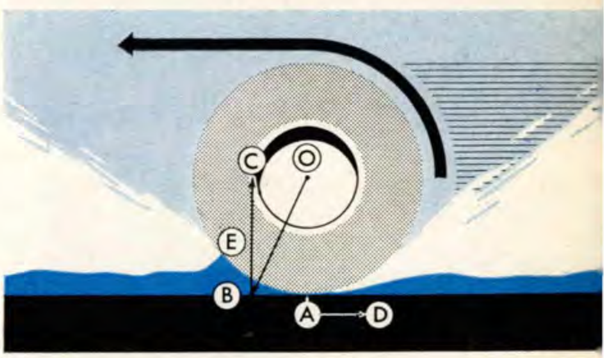
1. TIRE AT REST
When the tire is at rest the weight of the aircraft is exerted at point "A" and the vertical ground reaction occurs at "A." At the foot print area "X" the tire pressure equals the weight equals the vertical ground reaction force.



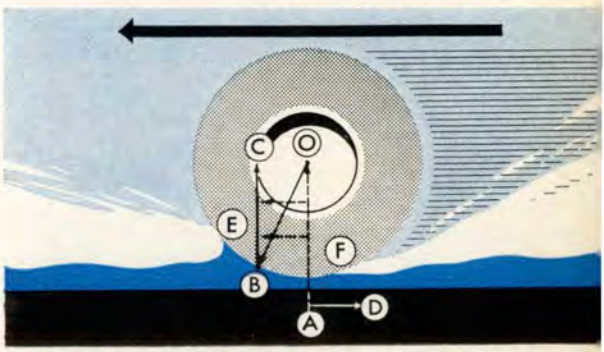
2. ROLLING TIRE—DRY PAVEMENT
When the tire is rolling on a dry surface there is surface resistance (BA) to the forward motion. The forward motion/force/vector (AB) overcomes this resistance.



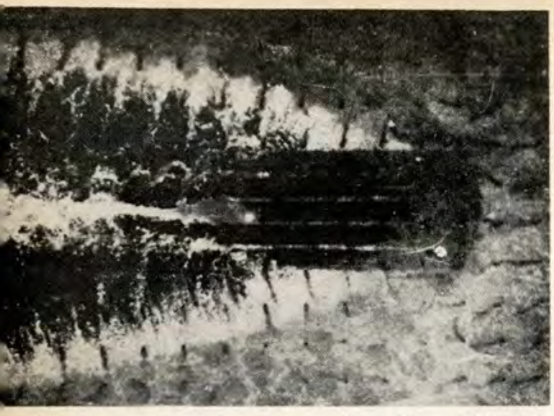
3. ROLLING TIRE — DRY RUNWAY
Because of the resistance to forward motion there is a forward shift in the vertical ground reaction to point "B". OB is the resultant of the two vectors WT (OA) and velocity (AB). Now, the vertical reaction vector is exerted at point "B" and is represented by BC. This is a spin-down force. On a dry runway, with normal traction/friction forces, the overwhelming rotational force (AD) is a **spin-up** force.



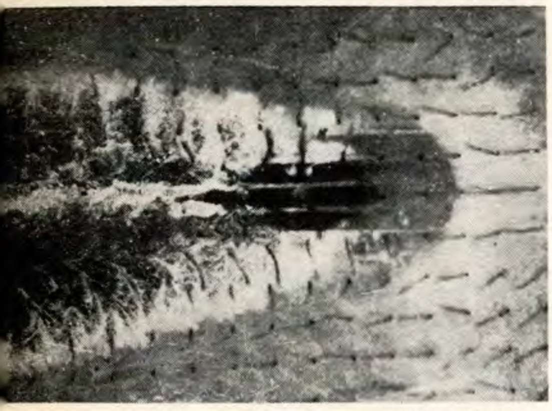
4. ROLLING TIRE — PARTIAL HYDROPLANE
As partial hydroplaning develops, the foot print area decreases due to lifting. This reduces AD, total spin-**up** force. Resistance BA is also reduced as the lifting develops. However, the vertical ground reaction point remains forward because the surface against the tire is working in the arc EA. The normal center of this arc is point "B". BC is still a spin-down force.



5. FULLY DEVELOPED HYDROPLANE
1. Vertical component of hydrodynamic force exerted on tire surface EF exceeds the total weight of the aircraft.
2. This vertical force is exerted forward of point "A" and therefore represents a spin-**down** force.
3. The total spin-down force equals, or exceeds the total spin-up force AD, and the wheel stops.



$V_G = 28$ knots



$V_G = 56$ knots

Photographs of 20 x 4.4 aircraft tire on glass runway at NASA track under partial and total hydroplaning conditions. Vertical load = 500 lb; tire pressure = 30 lb/sq in; water depth = 0.5 inch.

$V_G = 71$ knots

$V_G = 88$ knots

weight of the aircraft and, therefore, experience a much greater friction than you observe when you spin a freely mounted wheel on an aircraft or automobile that is up on jacks. The shift in vertical ground reaction is explained in the diagrams on page 11.

Though we cannot completely overcome the forces that lead to hydroplaning, we can mitigate them to some extent. The name of the game is to get the water or water/snow/slush combination out from under the tire so it can retain contact with the runway and perform its braking/controlling function. Listed here are the more significant parameters involved.

TIRE PRESSURE. The higher the tire pressure, the higher the speed required to hydroplane. Expressed in terms of tangible experience, the narrower the water skis the greater the horsepower required to make it. On a smooth runway surface with smooth tire tread or tread that has less depth than the water depth, total hydroplaning will occur at a ground speed (knots) equal to nine times the square root of the tire pressure. Like, 144 psi tires hydroplane at 108 knots. Like, 169 psi tires water ski at 117 knots. Like, 196 psi tires float at 126 knots. Like, 225 psi tires unglue from the runway at 135 knots. (When applying this formula, bear in mind that the effects of tire tread design, fluid viscosity, and runway texture are ignored and the fluid depth on the runway is assumed to be greater than tire tread groove depth.)

Question: What's the tire pressure on *your* aircraft? (Figure the nosewheel while you're at it. You might want to know where you lose nosewheel steering.)

Question: What's your touchdown speed?

Note: Strange as it may seem, aircraft weight has no *direct* bearing on this formula. As you gross the aircraft, the tire squashes out a little flatter, making a bigger footprint, but the *psi* experienced at the footprint is essentially the same. Higher gross weights require higher landing speeds, of course, so there is *indirect* relationship with weight and hydroplaning.

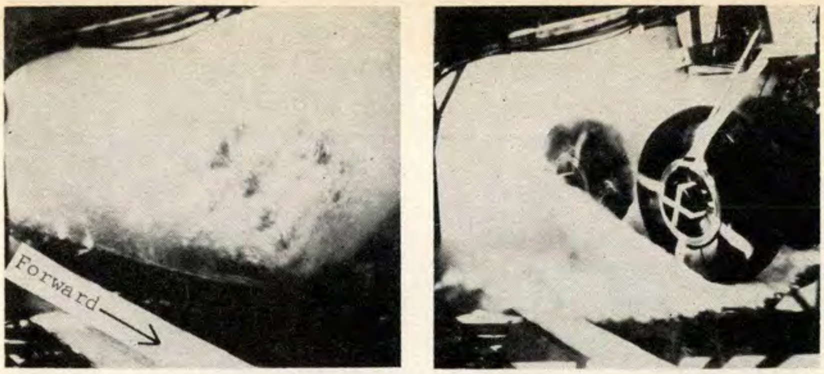
VELOCITY. This one's obvious. Same water skiing. If you aren't going fast enough, you don't have enough hydrodynamic pressure (there I go again) to hack it.

TIRE DESIGN. Tire grooves, especially if they are deeper than the water level, provide some help. The grooves merely provide a channel for the trapped water to escape. If the water (under pressure) has an escape route, the tire can regain contact with the ground.

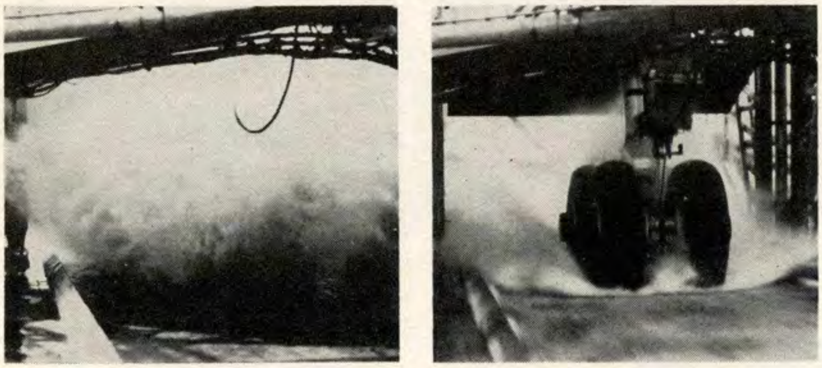
RUNWAY TEXTURE. This has a great deal to do with the degree of hydroplaning we will encounter. If the surface is smooth, it has a low coefficient of friction and also accommodates puddling. This puddling is what produces the hydroplaning effect. Rough, irregular surfaces tend to drain standing water away, but more important they provide tiny channels for the fluid to escape from under the tire when exposed to the pressure imposed by the tire.

RUNWAY GROOVING. This has great promise. Grooves in the runway that are transverse or perpendicular to the direction of travel attenuate the hydroplaning thing very significantly. As with rough surface texture, but more so, these grooves provide an escape route for the water and/or slush so that the fluid, under pressure, has an escape route. This deflates the pocket of water trapped under the tire, releasing the hydrodynamic pressure (there it is again), allowing the tire to settle to the runway surface and get back to work.

Note: Preliminary tests included runway grooves that ran longitudinally down the runway, or in the direction of travel. This didn't help; in fact, it made things worse. It



Side view of spray patterns at partial (left) and total hydroplaning speeds. Tire pressure: 75 lb/in²; water depth 2 inches.



Front view of spray patterns at partial (left) and total hydroplaning speeds. Tire pressure: 5 lb/in²; slush depth one inch. Photos were taken during tests at NASA Langley track.

seems that the water found an escape route all right, but most of it escaped to the front where it piled up in a bow wave creating more mass, meaning more inertia to overcome, meaning more hydrodynamic pressure (oh-oh), meaning UP UP AND AWAY!

Numbers and Figures and Things. So much for what hydroplaning is and how it works. How about the working man? What are the good words for the aviator? Tests are still being conducted on this subject, and there are sufficient combinations of all the variables so that a rigid book of rules cannot be written right now. We can, however, offer some guidance that may keep you out of trouble.

• Don't assume that the RCR tells the whole story. This value is measured at a velocity that is too low to encounter hydroplaning: insufficient hydrodynamic pressure.

• When landing on very wet runways, use such techniques as minimum safe touchdown speed, early runway contact, early use of spoilers.

• Insure that the aircraft tires are inflated to tech spec.

• Determine water depth on runway if possible. Ribbed tires may hydroplane in 2/10 to 3/10 inches of water. Smooth or worn tires may hydroplane in 1/10 inch of water.

• Consider the crosswind. In well-developed hydroplaning, it doesn't take much of a crosswind to lose it. (There is a Number One flick by NASA "Hazards of Tire Hydroplaning to Aircraft Operations," Serial Number L-775, that covers the entire subject of this discourse. Among other things, it illustrates the crosswind effect most graphically. The test aircraft is one of those big things with all the motors and it is roaring down this dry runway that has a 1000-foot patch of slush and stuff spread out for the purpose of this test. Sure enough, it works! Not only does he do the hydroplaning thing, but he starts this sideways stuff. He probably didn't yaw out past 15 degrees, but I suspect that the guy driving that big thing had a little bigger thrill than he was looking for. Fortunately he ran into the dry runway when he was kind of lined up and before he did a pirouette. Good movie. Catches your attention.)

Hydroplaning has been a factor in 21 accidents/incidents in the past two years. Conditions don't have to produce complete hydroplaning in order to get you in trouble. Partial hydroplaning (meaning at least a small portion of the tire is in actual contact with terra firma) can get you in a jam if other conditions like crosswind or runway available are marginal. Runway grooving helps, and many conditions instigate or aggravate the problem. The important thing is that when you are making your judgments regarding the destination, don't forget to consider the hydroplaning caper. It won't appear on the teletype. You're going to have to use your noodle and figure it out yourself. And finally don't forget the eleventh principle of war: "When in doubt, abort and go back to the bar!" ★

ED. NOTE: While runways have been grooved at some Air Force bases and civil airports, much remains to be learned about this process. Research is currently going on and Aerospace Safety *will in the near future bring you a status report.*

REX RILEY'S CROSS COUNTRY NOTES

FAA HAS ADOPTED a new standard for "runway remaining lighting." At some of the nation's biggest airports, alternate red and white runway centerline lights will alert the pilot that he is approaching the end of the runway. The lights will be installed from 3000 feet to 1000 feet with all red lights for the last 1000 feet.

The system is intended to provide greater safety on runways in low visibility for both takeoff and landing. Existing all-white centerline lights can be adapted to the new system by the insertion of red filters.

THERE'S AN OLD UNWRITTEN RULE concerning personal use of electrical power. Never plug your electric razor, or any other personal appliance, into a receptacle unless it is specifically placarded to allow such use. Many crewmembers have recently acquired flashlights with rechargeable NICAD batteries. One of these troops plugged his flashlight into a 115-volt AC receptacle located at the galley, which is normally used to provide AC power for the aircraft hot cup. A short time later the crew compartment was filled with electrical smoke and fumes. Electrical power was turned off and the smoke rapidly dissipated.

This type of flashlight is designed for 110- to 115-volt 60 cycle recharging; the aircrewman was using 115-volt 400 cycle current. Luckily this incident occurred on the ground. If they had been airborne, during actual instrument conditions, the situation might well have been considerably more hazardous.

INCORRECT DECAL—During crew preflight of a B-52G, the decal for installation of safety pins and streamers on both pilots' seats, by the ground crew had the wrong poop. The instructions read "Pin Nr 3 thru M3A1 initiator in upper inboard area of aft instrument panel." This is the way it reads on the EW's and gunner's seats; but it's incorrect for a pilot seat. The rest of the instruction is correct. Suggest your decal be checked.

AN F-86H PILOT had trouble getting his seat to lock full down when he strapped in for an overwater gunnery mission. It seems there wasn't much room—his being a 220-pound, six-foot-four type sharing the cockpit with a chute and MD-1 survival kit. Apparently he snagged one of the lap belt adjustment buckles under a seat arm rest and unlocked it, because confusing things began to happen shortly after takeoff. At first he thought the engine had exploded and reacted by raising the armrests to eject. Nothing happened. At this point he settled down and re-analyzed the situation. Nothing happened because the canopy was already off. The engine was running quite well. He put the pins in the seat initiators and brought the bird back in.

The unit rebriefed all pilots to push downward on the ejection seat handles after getting settled in the cockpit and before pulling the pins. They also warned the larger types to make sure their lap belt adjustment buckles are well clear of the armrests.

MINIMUM EN ROUTE ALTITUDES (MEA)—IFR. Pilots operating aircraft in Canadian and U. S. Airspace probably are quite familiar with the term *minimum enroute IFR altitude* (MEA). Those flying in the high-altitude structure have few occasions when they must be concerned with MEA; however, pilots operating in the low-altitude structures are more concerned not only when applying communication failure procedures but also in routine flying. Although the term may be familiar, the criteria used in determining MEAs may not be as commonly known.

MEA is defined as the lowest altitude above sea level between specified fixes on airways or air routes at which acceptable navigational signal coverage is received, and which meets the obstruction clearance requirements. The MEA is often higher than the minimum obstruction clearance altitude (MOCA) but in no case is it lower.

Low altitude airways and air routes in Canada are normally 10 miles (statute) wide. MEAs provide at least 1000-foot terrain and obstruction clearance within the dimensions of the airway or air route. For the purpose of determining the terrain clearance in Western Canada's mountainous regions only, the area protected is 20 miles wide, although the airways width remains 10 statute miles.

Noteworthy is that obstruction clearance is provided only between the fixes throughout the width of the airway (double the width out west) and not beyond the fix (Figure 1). For this reason, in Canada the aircraft must be at the higher MEA by the time it crosses the fix. The governing obstruction for the

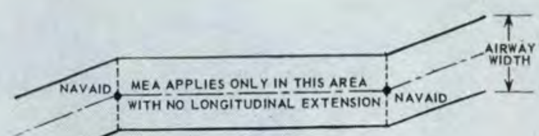


Figure 1

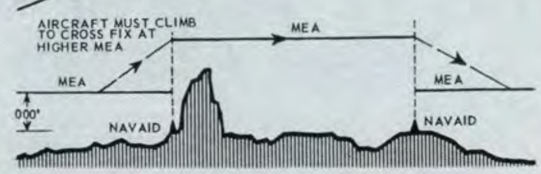


Figure 2

entire segment may be just beyond the NAVAID (Figure 2).

In the United States the criteria are essentially the same (except for the 2000-foot terrain clearance in mountainous regions) but normally the climb to the higher MEA is made *after* the fix. This climb must be made at a rate not less than:

- 150 ft per nautical mile from MSL to 5000 ft,
- 120 ft per nautical mile from 5000 to 10,000,
- 100 ft per nautical mile above 10,000 ft.

The pilot must decide whether he can climb at this rate, and if he cannot he must begin his climb earlier. Obstruction clearance is provided up this climb slope

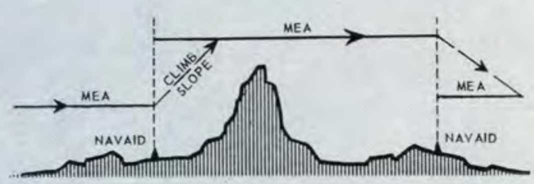


Figure 3

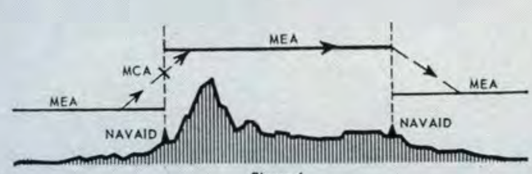


Figure 4

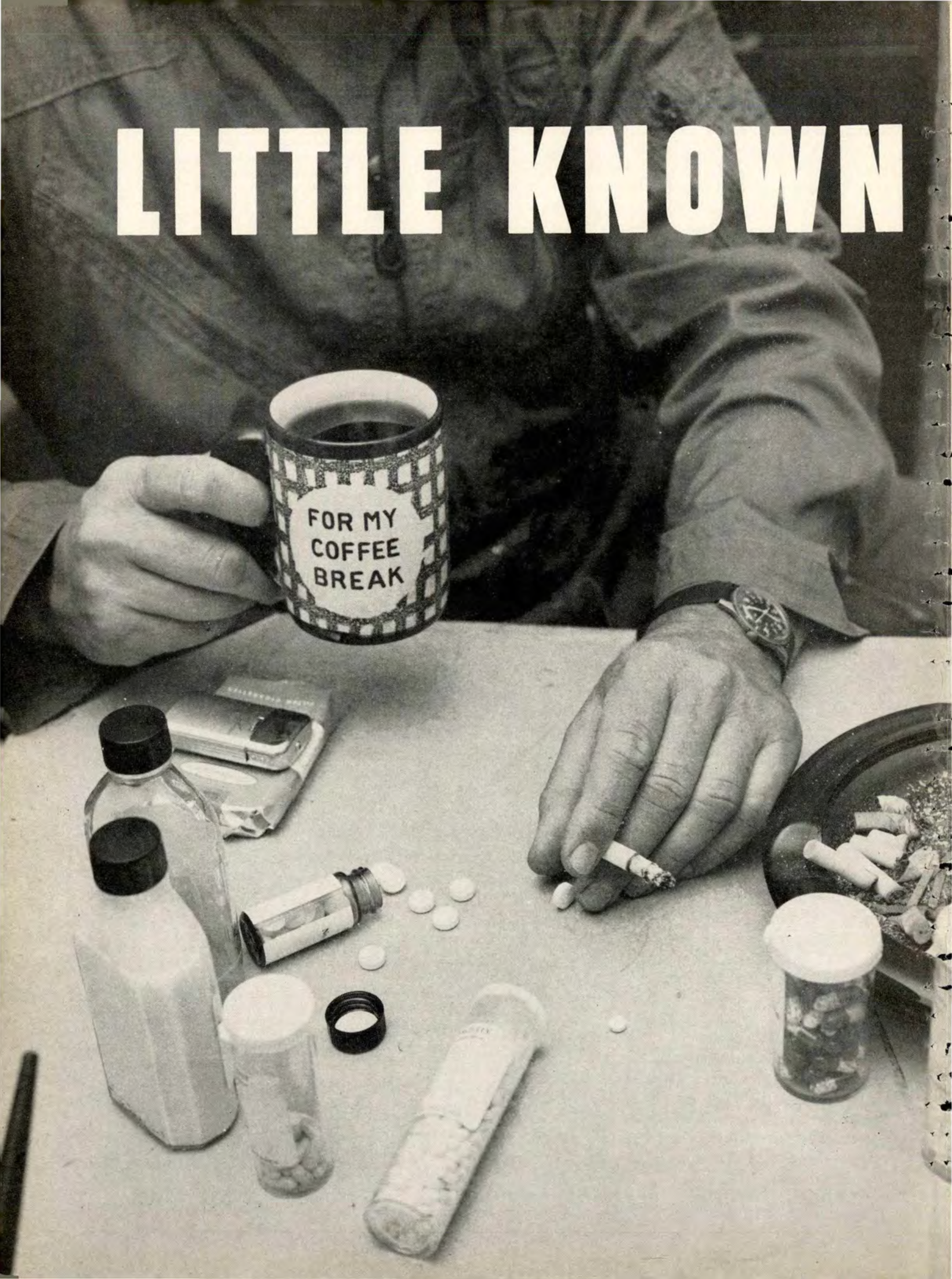
as well as along the remainder of the route segment (Figure 3).

There are areas, however, where the climb rates listed above are unusable because of an obstruction penetrating the criteria climb slope which makes it necessary to establish a minimum crossing altitude (MCA) (Figure 4). Here the pilot must begin his climb to cross the fix at the MCA, and then continue his climb at the rates mentioned earlier.

Remember, MEAs are true altitudes, and the required calculations must be made before using them.

Flight Comment—RCAF

LITTLE KNOWN



DRUGS

Maj J. H. Cohn, USAF, MC

Reprinted from 5AF Safety News

A not uncommon exclamation among the general population and, perhaps more so among the flying population, is "I never take medicines." This man, generally healthy and often subconsciously preoccupied with his manliness, regards a pill as a demonly threat to his virility, a small indication that his body, not so all powerful, may need help on occasion. That medication acts as a threat to this man's security is substantiated by a further statement occasionally verbalized, "I'm afraid to take medications for too long a period, even if I have to. I'd hate to get into that kind of a habit." This comment further supports this man's fear of dependency—or fear of loss of manliness.

If I have nurtured your indignant wrath by the foregoing, perhaps, because you know it may be true, I have gained my purpose—have gained your attention. However, I hope to either allay your anxieties or increase them by stating that I know of no man who does not take drugs and has not taken them almost every day of his life. The fact that these do not affect your concept of your virility, despite your frequent dependence on them, should help perhaps in alleviating your resistance to taking needed prescribed medications, as well as point out a warning to a potential hazard to flying safety. Though we rarely conceive of them as drugs, there is no denying that nicotine of cigarettes (the absorbed amount from a single pack taken in one dose could have extremely serious effects), caffeine from coffee, tea, Coke (the combined caffeine from six to eight cups would have you crying for a tranquilizer), theobromine from cocoa or chocolate, not to mention the subtle effects of hydrocarbons from exhaust and fuel fumes, insect sprays, occasional home painting jobs from paint and paint solvent, and of course, alcohol from the night before are all drugs. They have very definite effects on your physiological and mental functions far beyond most people's realization. Moreover, withdrawal of these drugs, most often involuntarily because of mission requirements, also has a conspicuous effect, physiologically, but primarily psychologically, which can significantly deteriorate performance capabilities.

Those drugs which the majority of us indulge in are generally classed as either stimulants or sedatives. Caffeine, theobromine, and nicotine are stimulants and alcohol is a sedative. Alcohol will not be discussed here because its effects physiologically and mentally, the effects of its long term use and its withdrawal, and the complexities of its contraindications in the flying population have been well documented and are generally well known (whether heeded or not) among almost all airmen.

Caffeine, as a stimulant, is best pictured as the "picker-upper" on arising in the morning. It is more poignantly visualized in its role as a potential safety hazard in its absence when one witnesses the psychological effects of its acute withdrawal in a habituated airman who unwantingly is forced to his aircraft without that first cup. Could you believe that a mild stimulant, as found in one cup of coffee, could have such profound effects? The man drags, he is devoid of enthusiasm, he constantly iterates and reiterates how he "could sure use a cup of coffee." In

other words, this man is preoccupied with other than his job. The extremely heavy coffee drinker (15-25 cups/day) is far worse and actually is physically and mentally slowed until he has consumed at least several cups.

Coffee, derived from the seeds of coffea arabica, contains primarily caffeine. Tea, from the leaves of thea sinensis contains caffeine and theophylline. Cocoa, from the seeds of theobromacacao, contains caffeine and theobromine. Finally, "Coke," from the paullina plant, contains large amounts of caffeine. These drugs—caffeine, theobromine and theophylline — are, chemically, methylated xanthines which have similar pharmacological properties but differ in the intensity of their actions on various structures. Primarily, they all stimulate the central nervous system, stimulate the heart muscle, relax certain smooth muscle structures, notably the coronary arteries of the heart and the bronchi of the lungs, and act on the kidneys to produce diuresis (stimulation of urine production). Whereas caffeine has the greatest effects on stimulation of the nervous system and skeletal muscle, theophylline has its most profound effect on smooth muscle relaxation, diuresis, and coronary and cardiac stimulation. Theobromine is similar to theophylline but is less potent. All have an effect in constricting peripheral blood vessels, increasing cerebral blood flow, increasing blood pressure, augmenting gastric secretions and generally increasing metabolism. A cup of coffee contains 100-150 mg caffeine as does tea, which is approximately two-thirds of the therapeutic dosage. Although the toxic dose is 10 grams, unless reduced by fatigue, exhaustion, illness or other drugs, that person consuming 10 cups a day (common) receives about 1½ times the *continual* daily therapeutic dose and that person drinking 20 cups a day (not uncommon) consumes three times a *continual* daily therapeutic dose.

In the space provided, I cannot describe all the potential effects of these drugs on flying, but describing their pharmacological actions should provide many answers for you. Certainly the flier predisposed to ulcer disease or "nervous stomach" or with borderline hypertension should beware of heavy consumption. Certainly those airmen on aircraft without latrine facilities should heed the significance of the term "diuretic." All should realize the potentialities of these drugs which undoubtedly significantly influence much of their daily activities and may well account for many of their physical and mental symptoms during an ordinary day, as well as affect their crew rest or lack of it. Perhaps most important, once again, is the occasionally necessitated abstinence from his habituation and its profound effects . . . think about it!

Deviating to our other "curse," nicotine, we find a similar though perhaps more insidious and more serious problem. More than two-thirds of our flying population are smokers, most smoke cigarettes and the majority smoke one pack or greater per day. Other than the effects of the various hydrocarbons on the respiratory mucosa, their relationship to cancer, and their deleterious and potentiating effect on numerous diseases, primarily cardiac and respiratory, we are concerned here with the immediate effects of nicotine.

As the foregoing will indicate, it is fortunate that tobacco smokers develop a rather marked tolerance to nicotine, but unfortunate that such tolerance is probably of great importance in causing fairly profound symptoms when withdrawal is necessitated. Nicotine is a natural liquid alkaloid from the nicotiana tabacum leaf which is pharmacologically classified among the ganglionic blocking agents. It is a highly toxic drug which has no specific therapeutic usage. It acts by initially exciting all sympathetic and parasympathetic ganglia with subsequent paralysis of the ganglia, having a similar effect on skeletal muscle, and the central nervous system. The primary central nervous system effect is on the respiratory, vasomotor and emetic (nausea) centers of the brain. There is initial stimulation of adrenalin secretion followed by decrease. There is an initial slowing of the heart followed by an increased rate and occasional abnormal rhythm with large doses. Peripheral blood vessel constriction causes elevated blood pressure and coldness of the extremities. There is stimulation of intestinal activity with occasional diarrhea and nausea initially followed by inhibition. Numerous minor effects are present as well, not including the effect of the smoke itself.

What does this mean to the smoker, who, as stated, develops considerable tolerance? Consider that a person smoking 20 cigarettes in a day will absorb 58 mg of nicotine, or 3 mg per cigarette. The fatal dose of nicotine in the adult is 60 mg and 4 mg will produce severe symptoms in the nonhabituated individual. Two factors are alarmingly apparent. First, we are dealing with a markedly potent chemical agent and second, the "smokers" have developed an alarming tolerance. The smoker well knows when he has smoked too much and is also well aware of the "nicotine fit" after withdrawal. Are not these drug effects quite capable of interfering with the stability of a presumaably alert airman? and what effect will they have in an emergency situation? Can the pilot who is forced into abstinence for several hours or more function clearly when he has a recurring "need" for a cigarette? Think about it!

Prescribed drugs should not be avoided because, as has been shown here, many stimulants and sedatives are consumed daily. However, we can use the illustration of these "everyday drugs" to illustrate another problem area—the potential hazards of drugs in relation to a job which requires the optimum alertness and a full physical potential. When it is necessary to take a drug given by your physician, consider the fact that this drug is probably more potent than those which you already consume, and recognize his reasons for warning you not to fly while you are taking medications. When considering the BX or the drug store as a source of your medications for your minor illnesses (so you won't run the risk of being grounded), think about their pharmacology. If you know it, you won't fly anyway without adequate diagnosis, follow-up or excusal from flying duties.

In summary, it is well realized that the majority of us are habituated to drugs which exert potentially profound effects, both in their presence and in their absence (withdrawal). Therefore, when your physician does find it necessary to prescribe a drug for you, it should not be avoided but the resulting effects of the drug should be acknowledged and respected. Remember, flying is your business, medicine is your Flight Surgeon's business. ★

FSO IN COMBAT

Most flying safety officers will tell you theirs is a full time job. Add to this a regular turn at flying combat missions over North Vietnam and you have something more than a 40-hours-a-week routine. One of these combination combat pilot-flying safety officers is Captain Steven W. Long, Jr., recently of the 388 Tactical Fighter Wing, Korat RTAB, Thailand.

Flying in probably the most unsafe environment that any pilot would encounter—aerial combat over North Vietnam — Captain Long, 32, Bainbridge, Georgia, completed 100 combat missions in the F-105 Thunderchief while serving as full time Flying Safety Officer (FSO) for the wing.

As wing FSO, Captain Long was responsible for coordinating all flying safety matters, establishing policies and preparing directives to insure that the all-unit operational procedures were oriented toward accident prevention. During his tenure the wing enjoyed an almost accident free record.

"Captain Long's ability to apply his combat experience to the flying safety job gave us a unique bonus in conducting our wing safety program," says 388th TFW Chief of Safety, Major Billy R. Givens.

More than a third of Captain Long's one hundred missions were flown against the heavily defended targets in the area around Hanoi, and his most memorable is still the first one he flew into that area on August 23, 1967.

"It was the first time the wing had struck the Canal Des Rapides railroad and highway bridge just north of Hanoi," Long related. "We put it out of commission for quite a while."

Captain Long flew six missions against the Kep strategic area. One of these earned him the Distinguished Flying Cross for successful delivery of ordnance on target, despite extremely heavy and accurate enemy ground fire.

Captain Long's abilities as a combat pilot were also recognized when he was chosen from an already highly selective pool of 388th TFW pilots to be program officer on the wing's employment of the AGM-12C Bullpup air-to-ground missile. The Bullpup is used on strikes against particularly key targets which demand pinpoint placement of ordnance.

Captain Long's flying ability, combat experience and flying safety knowledge are now at work in the 36th Tactical Fighter Wing, Bitburg AB, Germany. ★

100 completed! Captain Long is greeted by crew chief, receives champagne and celebrates. He is one of several flying safety officers who have turned in outstanding performances at two exacting jobs.

FLIP changes

There are some changes coming soon in Section II booklets of FLIP Planning that aircrews should know about. The changes will reduce the number of booklets needed for flight planning, eliminate some duplication, and cut costs.

There are two major changes: The first will result in combining some of the Section II booklets as shown on the chart below.

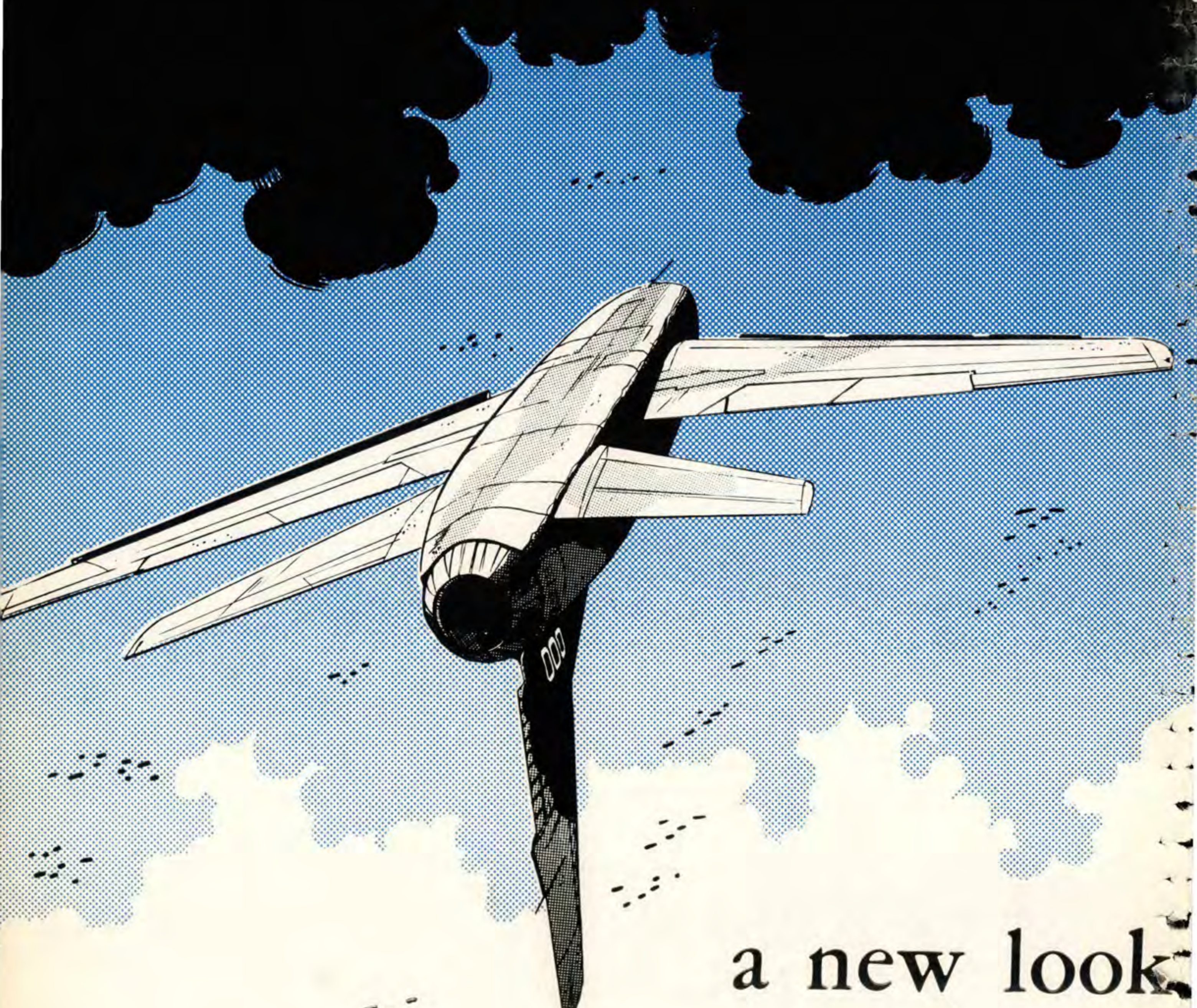
The new combinations, according to the Aeronautical Chart and Information Center, should be an improvement because unnecessary duplication is eliminated. Whereas two booklets might be required today, the new combination can reduce this to one book. The other change will result in deletion of all Special Use Airspace from Section II booklets. This information will be covered in three separate booklets entitled Section II-B covering areas indicated in the right hand column of the chart.

ACIC says, ". . . textual description of Special Use Airspace is not needed in the planning of the majority of military flights because the Enroute FLIPs provide all essential data." ★

FLIP PLANNING DOCUMENT - SECTION II CONVERSION ACTIONS

PRESENT FORMAT SECTION II BOOKLETS BY PRODUCT	FORMAT OF SECTION II BOOKLETS AFTER CONVERSION AND FIRST ISSUE DATE OF NEW PRODUCT	NEW SECTION IIB BOOKLETS AND FIRST ISSUE DATE OF NEW PRODUCT
United States Alaska	Continental United States and Alaska - 22 August 1968 and every 56 days thereafter	North and South America - 22 August 1968 and every 112 days thereafter. (Cumulative PCNs will be published every 28, 56, and 84 days after publication of each new booklet.)
Canada and North Atlantic	Canada and North Atlantic - 24 October 1968 and every 70 days thereafter	
Caribbean and South America	Caribbean and South America - 22 August 1968 and every 56 days thereafter	
Europe and North Africa Africa and Southwest Asia	Europe, Africa and Southwest Asia - 23 July 1968 and every month thereafter	Europe, Africa and Southwest Asia - 25 July 1968 and every 84 days thereafter. (Cumulative PCNs will be published every 28 and 56 days after publication of each new booklet.)
Pacific and Southeast Asia Australia, New Zealand and Antarctica	Pacific, Australasia and Antarctica 22 August 1968 and every 56 days thereafter	Pacific, Australasia and Antarctica - 25 July 1968 and every 112 days thereafter. (Cumulative PCNs will be published 28, 56, and 84 days after publication of each new booklet.)

MANUAL BAILOUT...



a new look

upright or inverted?

Maj Robert J. Vanden-Huevel, Aeronautical Systems Div, AFSC

The Flight Manuals of most ejection seat-equipped USAF fighter and trainer aircraft prescribe an alternate method of bailout in case of seat failure. The alternate method invariably uses an inverted, negative G maneuver to attain pilot-aircraft separation. This maneuver is based upon a popularly believed, but incorrect, assumption that there is one "extra" G available to aid separation in inverted flight.

There is an instrument in the aircraft which gives a direct indication of "separation potential." It is the G meter. In level flight it indicates "one." This means that the weight in the G meter is attempting to separate downward with a force capable of causing a one G acceleration away from the aircraft. The same force acts on the pilot. He does not move, obviously, since he some airspeed in upright flight, would approximate that value of G in inverted flight. Qualitative flight tests were made with a T-33, F-100, F-101 and F-4. It was found that the theory was correct. This was easily seen with the aircraft trimmed for one G flight. If the aircraft were rolled over without applying a pitch input the G meter continued to read one G although the aircraft, when inverted, was following an effective two G turn toward the ground. The aircraft was then held in one G upright flight, trimmed a small amount cannot go through the bottom of the aircraft.

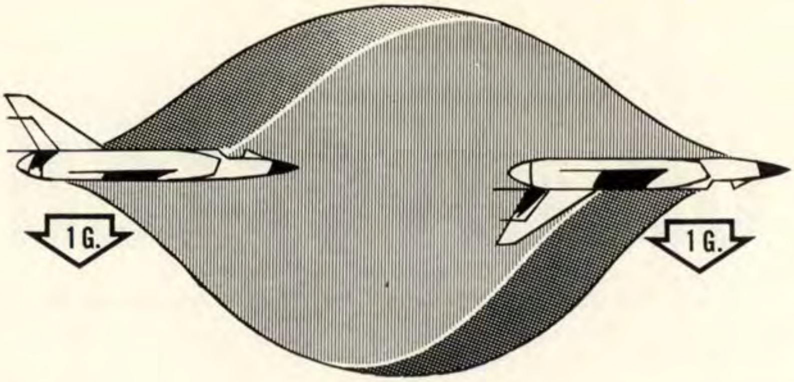
With the G meter reading "zero," the separation potential is zero and both the G meter weight and the pilot are "floating" in the aircraft. If the aircraft were maneuvered to —1 G reading, the weight in the G meter would now be tending to move up the vertical axis of the aircraft with a one G "separative acceleration". The pilot would tend to do the same. If the canopy were no longer on the aircraft and the pilot were not restrained, he would depart the aircraft with a one G "separative acceleration." Note that the attitude of the aircraft was not a factor. The next aspect to consider is the effect of attitude, as well as trim, on the separation potential G.

It was theorized that an aircraft, trimmed to a given value of G at nose down and released. The G meter reading was noted. At the same altitude, airspeed and trim setting, the aircraft was rolled over, holding one G, and the stick released. This was repeated using greater increments of nose down trim until the pilot's stomach limitation was reached. For a given trim setting, the G meter readings after stick release were the same inverted as they were upright.

Note that, at this point, after having shown that the G meter is the "separation potential" meter, it has also been shown that the desired G can be obtained just as well in upright flight. Then why do we have the inverted flight bailout?

The popular misconception is that the pilot falls away from the inverted airplane but falls toward the up-

at a last ditch procedure....



right airplane, hence he has one G working for him in one case and against him in the other. This is not so! The same one G of gravity is affecting the plane as well as the pilot. If the plane is inverted and trying to fly up from the pilot, the force of gravity is restricting it. If the plane is upright and diving away from the pilot, the force of gravity is assisting it. Result—cancellation of "one G advantage," resulting in equivalent separation.

Since the two methods of bailout appear to achieve equal separation from the aircraft a comparison of other factors should be made to determine which, if either, is optimum.

INVERTED BAILOUT

Advantages —None

Disadvantages—Requires roll and pitch control.

Requires higher air speed for maneuvering.

Requires higher altitude due to altitude loss during positive G rollover.

At low speed aircraft could stall and fall on pilot.

Pilot must be fully ready to depart before rolling over.

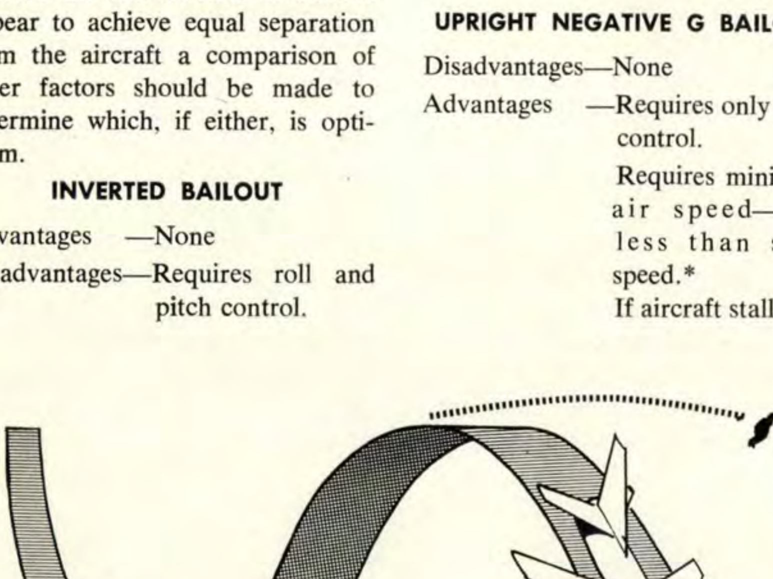
UPRIGHT NEGATIVE G BAILOUT

Disadvantages—None

Advantages —Requires only pitch control.

Requires minimum air speed—even less than stall speed.*

If aircraft stalls due to negative G during maneuver it will fall away from pilot. Can be used in conjunction with zoom maneuver from low altitude.*



* The proof of the pudding was seen in a simulated F-100 "zoom and boom" maneuver. An F-100F with a calibrated G meter was used to simulate failure of the seat to fire following the Dash One procedure of zooming to 140K. At 140K ejection seat failure was simulated and forward trim was applied as the aircraft was pushed nose down to maintain control. Would you believe that, when stick release was made at 120K with full forward trim, the aircraft was able to generate minus one G? Would you believe that we had enough smart not to see what would happen if we tried to roll inverted at 120K?

It is not the point of this article to recommend upright manual bailout as a *safe* way of getting out of airplanes. It does present a *less unsafe* way of getting out. Statistics show that manual bailouts are few and far between, but as long as we have to have the procedures in the Dash Ones, let's have the right ones.

Recommendation: Change manual bailout procedure in all applicable Flight Manuals from the inverted to the upright method. ★

This article was cleared with the Flight Dynamics Laboratory, ASD, which verified the author's findings. It was recommended that, "if the dash one handbooks are revised, the bailout procedure include instructions to trim the rudder to provide sufficient yaw to permit clearing the vertical fin."

The flight handbook people are considering including the general provisions of the procedure described in the aircraft flight manuals. Ed

WINDWISE

Wind is not as serious a problem to the average Air Force pilot as it used to be, but for those flying our lightest aircraft it is just as lethal as it ever was. Some recent mishaps make this evident so we'll discuss a couple of them to point out the problem. One of these involved a T-41 and the other an aero club Cessna 172. These are substantially the same airplane and the causes appear to be nearly identical.

The T-41 was taxiing on a heading of about 200 degrees when a gust estimated at 35 knots from 290 degrees upended the aircraft.

The '172 was taxiing in wind from 330 degrees at 18 to 28 knots. The tower requested a turn and when the aircraft was turned to where the wind was on its tail, it flipped on to its back.

The messages describing these two mishaps were preliminary to the final reports so we don't know every detail. But since this is the season for spring winds and thunderstorms this summer can produce some hazardous local wind conditions for light aircraft, a few words on the subject won't hurt.

Since the T-41 and most aero club aircraft have tricycle gears, the directional control problem on the ground is not as acute as for the O-1, A-1 or the other taildraggers. But a gust can catch a pilot who is off guard in any of these aircraft.

The first rule, of course, is know and don't exceed the crosswind limitations for your aircraft. This holds regardless of type or size. For the light birds this may mean, under extreme conditions, that you should shut down and not try to taxi if getting back to the ramp means driving along with strong, gusty winds. You probably won't get into too much trouble as long as the wind is on the nose, but a turn can get you in a squeeze fast. The accompanying diagram (furnished by Cessna) provides good guidance for use of controls while taxiing in wind.

A cardinal rule for taildraggers is keep the tail on the ground. If the wind is from behind the aircraft this may mean forward stick. A problem with some of the trigeared birds is that the narrow span of the gear results in a rather unstable platform. A gust from the side or rear quadrant can easily tip the airplane forward and to the side, which might mean that it would go all the way over onto its back.

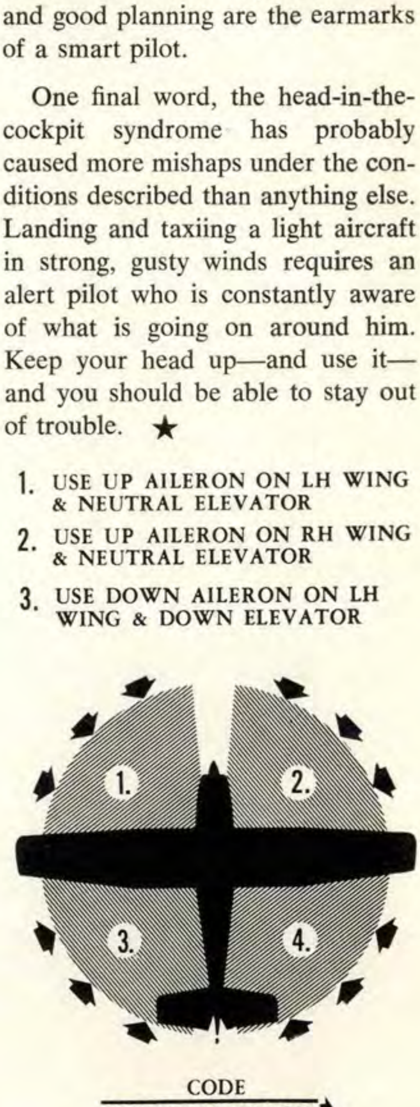
Generally, light planes can be taxied with minimum use of brakes. But in strong, gusty winds some pretty hard braking may be called for in conventional geared aircraft in order to turn and to maintain directional control. Better to put a little wear and tear on the brakes than lose the airplane. But with a tricycle gear go easy on the brakes.

Anticipation adds spice to life; for the pilot it may add to life, period. If you know the crosswind limitations of your aircraft, it won't be hard to make a quick computation when tower gives you the winds. If the situation is plainly no-go for you, ask for another runway. Normally, landing traffic will be fairly well aligned with the wind. But, remember, the tower isn't going to change runways when the primary instrument runway and the wind are out of phase unless the wind is very strong or gusty.

The bigger, heavier jobs with high wingloading aren't going to be bothered much unless the wind is pretty strong on the tail or across the runway. But the light plane with its low wingloading can be in serious trouble where a jet fighter pilot would hardly notice the difference. So don't be afraid to ask for another runway if the existing conditions aren't in your favor. At some bases, of course, there won't be a choice. So that's why alternatives and good planning are the earmarks of a smart pilot.

One final word, the head-in-the-cockpit syndrome has probably caused more mishaps under the conditions described than anything else. Landing and taxiing a light aircraft in strong, gusty winds requires an alert pilot who is constantly aware of what is going on around him. Keep your head up—and use it—and you should be able to stay out of trouble. ★

1. USE UP AILERON ON LH WING & NEUTRAL ELEVATOR
2. USE UP AILERON ON RH WING & NEUTRAL ELEVATOR
3. USE DOWN AILERON ON LH WING & DOWN ELEVATOR



CODE
WIND DIRECTION ➡

4. USE DOWN AILERON ON RH WING & DOWN ELEVATOR

FROZEN PHANTOM. Shortly after takeoff an RF-4C crew noticed their cabin air control was ineffective; it was stuck full cold. They continued to climb while trying to warm things up using every cockpit control that came to mind, including the defog foot-heat control. By the time they reached FL 390 the temp was down to an estimated —20°C, so they decided to get back on the ground. During descent the cockpit fogged and the AC had to lean forward to read the gages. Once out of the clouds he found the instrument faces had frosted over, so he tried to dump cabin pressure, but the control was frozen. Fortunately, the canopy stayed clear and recovery was more or less normal, although some switches had to be thawed out before the crew could clean up their cockpits.

Mechanics traced the trouble to a broken wire that disabled the cabin temperature control. Had there been more moisture in the air this crew would have had somewhat more trouble, like trying to convince ground controllers that they would need vectors around ALL traffic while they flew around at low altitude to thaw off iced-up canopies and windscreens. If surface temperature was very low, they would be unable to clear ice and frost and would have had to land blind or give up the ship. Cabin heat malfunctions can be serious and are not to be treated lightly. Most certainly, you shouldn't take this sort of malfunction to altitude.

CULPRIT: BALLPOINT PEN?—This one might be hard to believe but it'll do for now. Upon returning from a night recce mission, on final the F-4 lost the front canopy. Immediate inspection was made but no malfunction was detected in the canopy locking or jettison systems. The canopy operating lever was found in the locked position but somehow the canopy became unlocked and was blown off by the windstream. The pilot hadn't noticed any telelight panel lights before or during the canopy loss. Since the cartridge had not been fired, it appeared the cause was one of those "undetermined" bits. Then one of the pilots happened to notice the clip on his pen was bent outward about 45 degrees, although he recalled it had been down level against the barrel during flight. Both pilots decided the most probable cause to be inadvertent actuation of the canopy opening lever by the pilot's ballpoint pen in the left sleeve pocket.

ENGINE SWALLOWS RR TRACKS—A pilot at an overseas base was preparing for engine start after completing the walk-around phase of his preflight. In preparing for flight he placed his flight cap on the shelf above the instrument panel. After engine start and before taxiing, a wind gust lifted the cap from the shelf and blew it out of the aircraft. The pilot made a futile attempt to grab it as it left the cockpit, but the wind gust carried it into position where it was sucked into the engine air intake. He immediately stop-cocked the throttle, but the damage was done. Cloth remnants of the cap were found at the compressor face, but the captain's metal rank insignia was missing. As a result, the engine had to be removed for teardown inspection. Because teardown facilities were not available locally, the engine had to be airlifted to a support base.

If you add up the expense of repairing one jet engine, including removal, transportation and reinstallation costs plus one aircraft out of commission unnecessarily, you come up with one *expensive* captain's flight cap.

F-4 780 MODIFIED TEST FLIGHT EVALUATION—Nine test flights were made by McDonnell Douglas to evaluate control response when the aileron and spoilers were operating on only one wing.

Aircraft roll response was "more than adequate" at speeds from 250 kcas to military power V-max at 10,000 and 30,000 feet.

In the emergency approach configuration (½ flaps and gear down) the test pilot reported the single-wing lateral control roll response "very sluggish" at "on-speed" (19 units AOA) and below. For this reason a 17-unit AOA approach, until just prior to touchdown, is recommended when experiencing a PC and utility hydraulic failure.

The only marginal control condition encountered occurred when a single-engine/single-wing approach was made. When the good engine was on the same side as the operative controls, nearly full lateral stick travel was required to neutralize the asymmetric power when an A/B go-around was attempted. This left inadequate control for further maneuvering.

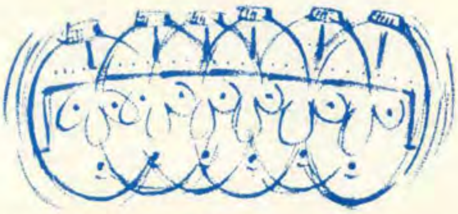
The new hydraulic plumbing design seems to allow adequate control for emergency operation as well as landing (as long as a slightly faster approach is made). However, caution is needed during single-engine/single-wing approaches and go-arounds.

USAFE FLIGHT SAFETY MEMO

THE PAPER TIGER—Film SFP 1696 "The Story of an Accident Report," 23 min, color. This film was to be released through the AF Film Library Center approximately 15 May 68, for showing throughout the

Air Force. The content of the film shows the evolution of an accident report from its inception at the accident scene through the investigation and up the chain of command to its final reviewing authority—the Directorate of Aerospace Safety. It depicts how these accident reports are translated into meaningful data that can be applied to a positive accident prevention program. Shows how data are retrieved for trend analysis study, where potential soft spots are identified and preventive measures can be taken. It concludes the end result of any accident prevention analysis can only be as good as the basic information fed into it.

ALERT PILOTS averted a midair recently when their C-141 was climbing out after takeoff. They saw a small single-engine aircraft on a collision course and dove down and to the left, missing the bug-smasher by several hundred feet. One crewmember, who was performing a walk-around inspection in the rear of the big bird, broke both his wrists during the evasive maneuver. But, chalk up one save because the crew was aware of and looking for heavy, light aircraft traffic on climbout. Radar control definitely doesn't guarantee separation from other aircraft; visual observation is still your best insurance in congested areas.



SHAKE AND BREAK—Returning from a recce mission, the pilot of an A-26A was making a GCA to his home base. When the landing gear was lowered on final approach the pilot saw that the left main gear green light did not come ON and the red unsafe gear light did.

After attempting all normal and emergency procedures to obtain a down and locked indication of the gear, the pilot decided to land at another air base with a longer runway. The landing on the foamed runway was without incident; the aircraft was stopped on the runway and ground safety pins were installed on all three landing gears. To facilitate towing the aircraft from the runway, the nose gear lower torque arm scissors assembly was disconnected, and a tow bar was hooked to the nose gear.

Okay, you guessed what followed, but read on to confirm it! The original difficulty in obtaining a green light was due to an out of adjustment micro switch, and the left main was down and locked all the time. With a quick adjustment of the switch, the bird was ready to return to home base. Following preflight and run-up, the pilot took the runway and added power for takeoff. At about max power a severe vibration occurred and the nose of the A-26 began to drop toward the ground. As power was being pulled off and brakes applied, the props dug into the runway. Both props and engine reduction gear sections were torn off and the nose section of the aircraft was bashed in.

The nose gear had collapsed due to materiel failure created by the severe vibrations received with the torque arm disconnected. The arm was not re-connected following towing, and it was not noticed by the tow crew who serviced the aircraft, or the pilot during his preflight. Proper use of the pilot's abbreviated checklist would have prevented the accident as a check of the "torque arm disconnect—safetied" is required.

Archie D. Caldwell,
Directorate of Aerospace Safety

AVIATION SAFETY IN NEW HAMPSHIRE

The New Hampshire Aeronautics Commission is constantly seeking ways to promote aviation by visual aids as well as hangar flying sessions.

Your *Aerospace Safety* publication is an excellent example of "getting the word" to Air Force crew members.

I was especially attracted to your January, 1968, issue's back cover referring to the A/C's concern regarding the status of the fuel in his aircraft.

In view of this, I would appreciate it if you will supply this commission with fifteen copies of this enlightening picture so that we may post them at some of our more active airports in New Hampshire.

Thank you for your kind attention in this matter.

Gordon Bunker
NH Aeronautics Commission
Concord, NH

They're on the way.

TRAFFIC ADVISORIES

The article titled "FAA Responsibilities During Traffic Advisories" on page 26 of the March 1968 issue seems to be a little misleading. ATP 7110.1B, the FAA Procedures Manual, states that separation vectors are provided only if the pilot requests the service *and the controller feels that he has the time to do so.* We have had at least one case at our base where the pilot requested separation vectors and the controller would not provide the service. The pilot was upset since he felt that once he requested separation vectors the controller was obliged to issue them. We found that many others held this same mistaken idea. The publishing of this qualifying information in your fine magazine could prevent other pilots from becoming irritated when requested separation vectors are not provided due to other FAA controller duties.

Maj David E. Raley
3525 Plt Tng Wg
Williams AFB AZ

The article "Traffic Advisories and Controller Workload," page 16, in the May issue of Aerospace Safety *should clarify the situation you describe.*

THE PRIDE OF USAFE

Our congratulations on a truly outstanding cover illustration on your February 1968 issue of *Aerospace Safety.* Since we are Phantom Phixers with the 417th Tactical Fighter Squadron, "The Pride of USAFE" and fiercely proud of our F4s, the cover painting was indeed gratifying. As far as we are concerned it is far better to view the airborne Phantom from this angle than from the receiving end. It all adds more meaning to the phrase: "Don't mess with the Phantom or it might turn against you."

Our only request is that you send us two of these fine illustrations. Keep up the good work and thanks for a magazine that has both eye and content appeal to attract everyone.

Sgt Charles R. Hovey
A1C Carlton N. Yancey
CMR 2108 417 Tac Ftr Sq
APO New York 09012

Aero Club MAY DAY

I have just finished reading the March issue of your excellent magazine and would like to make a few comments on the article entitled "Aero Club May Day" and the editor's note.

1st Lt Michels, who incidentally seems to have handled a difficult situation very well states: "Seeing I was short of my desired touchdown point, I lowered the nose to increase my airspeed taking the aircraft to 10 feet above the terrain. The increased airspeed lengthened my glide and enabled me to reach my desired touchdown point."

Your Editor's note then suggests that this was not the proper procedure and comments: "Many a pilot has fallen into this trap with catastrophic results."

I would think that his procedure was correct and timely and that the trap lay in the other direction. Had the pilot attempted to lengthen the glide by raising the nose, he would indeed have ventured very close to the stall/spin trap, which could have resulted in a very different ending to his story. In support of my contention that this pilot was not in the wrong, I would like to present a few facts, most of them gleaned from Wolfgang Langewiesche's excellent book on the art of flying, "Stick and Rudder":

1. In a steady glide it is necessary to raise the nose, thus increasing the angle of attack and induced drag and reducing the airspeed in order to shorten the glide distance.

2. Conversely, it is necessary to lower the nose, thus decreasing both the angle of attack and the induced drag and increasing the airspeed—thereby obtaining a more efficient glide profile, in order to lengthen the glide distance. This is true incidentally because the "normal" glide speed is determined with a view to arriving at the flare point at an airspeed which is suitable for landing. This airspeed is therefore usually somewhat lower than the optimum glide speed (which would provide the most feet of forward movement per foot of altitude lost).

3. It is worth noting that in both of the above cases, the immediate effect will be opposite that desired but the long term and important effect is the one described.

4. An important consideration in Lt Michels' case is the fact than an airplane is much more efficient close to the ground, due to ground effect. His higher airspeed at a very low altitude would then significantly lengthen his glide distance.

May I take advantage of this opportunity to congratulate you and your staff on the production of a very fine and worthwhile magazine.

Capt R. M. McGimpsey
Canadian Forces Base
Chatham, New Brunswick, Canada

The editors did not intend to leave anyone with the impression that taking advantage of ground effect was a bad move. However, we did intend to emphasize the importance of maintaining best power-off glide speed (the speed at which the airplane will cover the greatest distance, horizontally, from a given altitude). Possible ground effect will still be there to help at the bottom of that most efficient glide. Trading altitude (in the hand) for a possible *ground effect (bird in the bush) shouldn't be encouraged. However, attempting to stretch a glide is still the most dangerous practice. You'll keep the odds on your side by sticking to the old happy medium, the best glide speed!*

☆ U.S. GOVERNMENT PRINTING OFFICE 1968 301-218/9

WELL DONE

MAJOR ROBERT C. RILLING

355 TACTICAL FIGHTER WING, APO SAN FRANCISCO 96273

Major Rilling was leading a four ship flight of F-105s when he lost the major portion of the vertical stabilizer. The rudder, except for the bottommost hinge, was completely severed from the stabilizer. Major Rilling was forced to use full left rudder trim and varying amounts of aileron and spoiler control to maintain level flight. Enroute to a diversionary base, additional pieces of the stabilizer came off the aircraft and control became more difficult.

Major Rilling, when over an unpopulated area, performed a controllability test in the landing configuration. He found that the aircraft became dangerously uncontrollable below 225 knots, but confident of his ability, Major Rilling decided to attempt a high speed landing. Upon arriving at a totally unfamiliar base, Major Rilling established a 225 knot straight-in approach. The approach was flawless and the aircraft touched down at 215 knots. Major Rilling utilized the drag chute and optimum braking procedures, enabling him to stop the damaged aircraft without use of the barrier.

Through outstanding professional flying ability and airmanship, Major Rilling prevented the loss of a valuable aircraft and possible injury to himself. WELL DONE! ★

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