FLYING SAFETY

UNITED STATES AIR FORCE

MARCH 1957

Your New Airplane

File Thirteen

As depicted by our cover, March is "Your New Aircraft" month. During the period that you're transitioning to a new or different flying machine, you're highly vulnerable to accidents. Regardless of your total flying time, checking out in a new bird can louse up your accident record unless you play it cool. We have more to say about this on page 1. . . . *Flying Safety Officers*, keep your eyes peeled for an item in the Flying Safety Officers Bulletin in the April FSO kit. The subject is homing beacons situated fairly close to each other and having a frequency spread of only a few kcs. There are advantages and disadvantages with this set-up. The advantage being the ease of tuning close proximity frequencies within a control area. The disadvantage is the possibility of tuning the wrong beacon. The answer to the disadvantage, of course, is to *always identify the station*. . . . Crash landings by the F-89 on unprepared surfaces have always called for "gear up." It's fairly well accepted that gear down is the best procedure on fighters; however, in the '89 the nose gear would enter the cockpit and pin the pilot. Now, T.O. 1F-89-615 requires modification of the nose gear drag link. It provides a fail point in the link, thus precluding the possibility of the gear strut entering the cockpit. There have been two accidents proving that the fail point does operate as designed. So, if you drive Scorpions, check to see if this modification has been made.

Perry J. Dahl

Superintendent of Documents
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USAF PERIODICAL 62-1

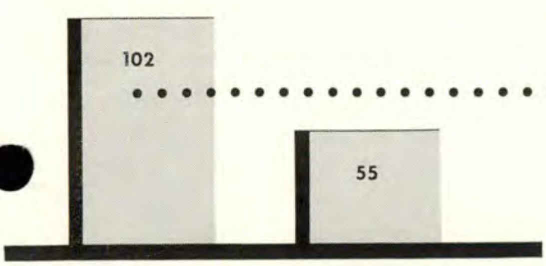
the  Transitioning Pilot

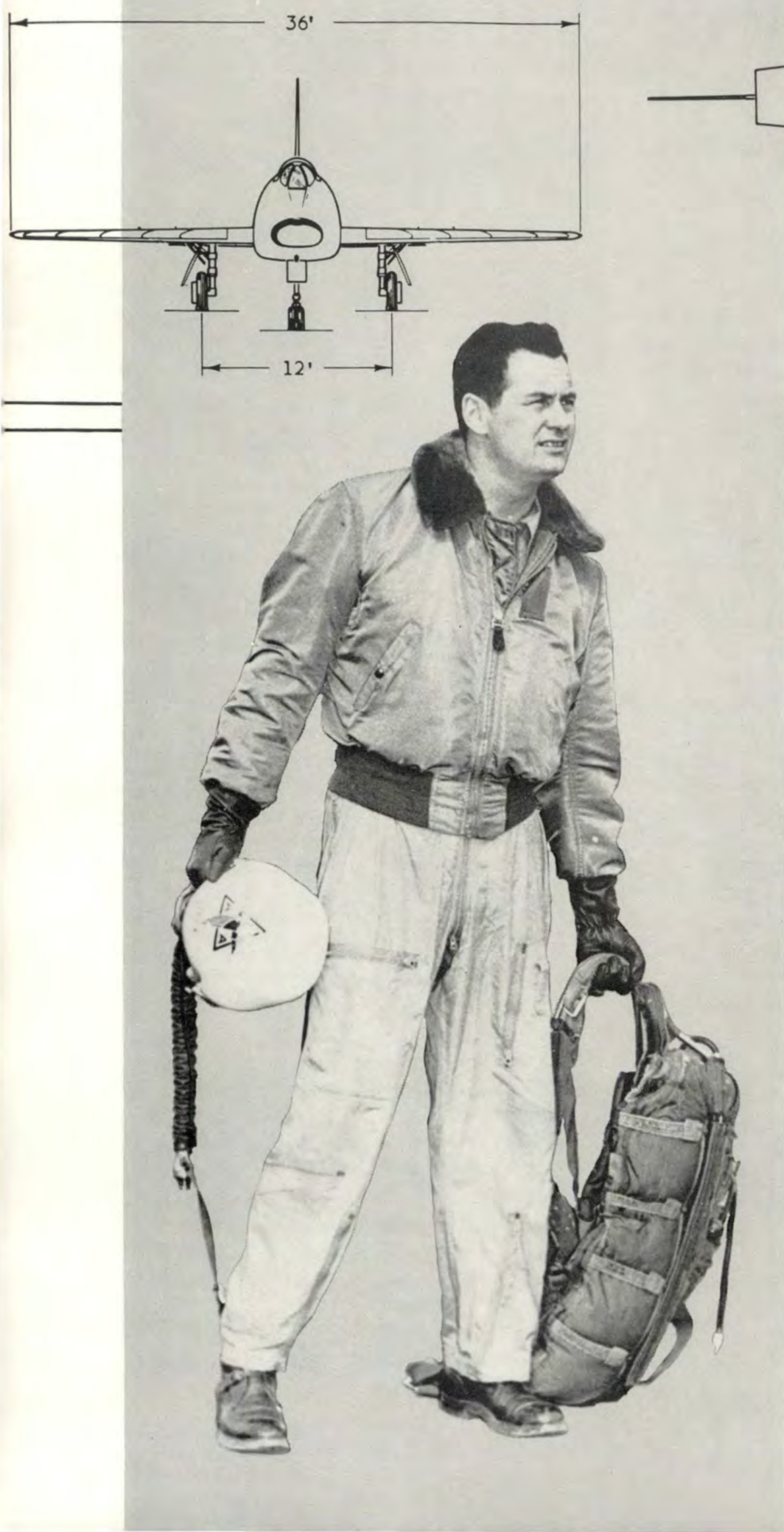
. . . in the accident picture

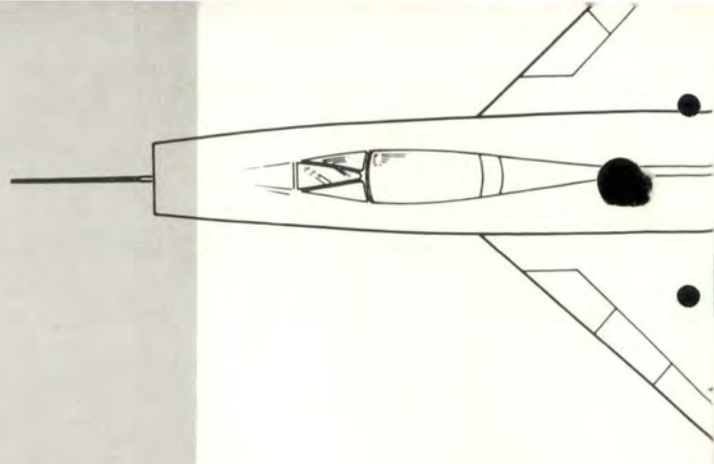
THE SUBJECT of March's contribution to the 1957 aircraft accident prevention program is "Your New Aircraft." It may seem to you old heads that all of this flying safety accentuation is strictly for the "new troops." You may feel that "Oh, that's fine for the new guys but I've been flying in this man's Air Force for 10 years, and that does make a difference."

But let's take a fast look at some cold facts. You, sir, also fit into the accident picture. Consider yourself as a transitioning pilot. A transitioning pilot is any pilot, regardless of total flying time, who flies a different model aircraft. When a pilot checks out in a new or different bird, he is highly vulnerable to having an accident. For example, during the year 1955 in jet fighter accidents, the pilots who had previously acquired some time in a specific model had an accident rate of 55. The transitioning pilots, those checking out in this model for the very first time, had a rate of 102. These accident rates indicate that transition time is a period which requires the utmost attention by all pilots, regardless of experience.

Keep in mind the illustration below when the time comes for you to "Report to the training office, Major, you're scheduled to check out in '86s."







FIRST

Ever imagine yourself as a test pilot for an aircraft manufacturer? The following story was written by a guy who is very much one—Chief Test Pilot for North American Aviation, Inc.—Bob Baker.

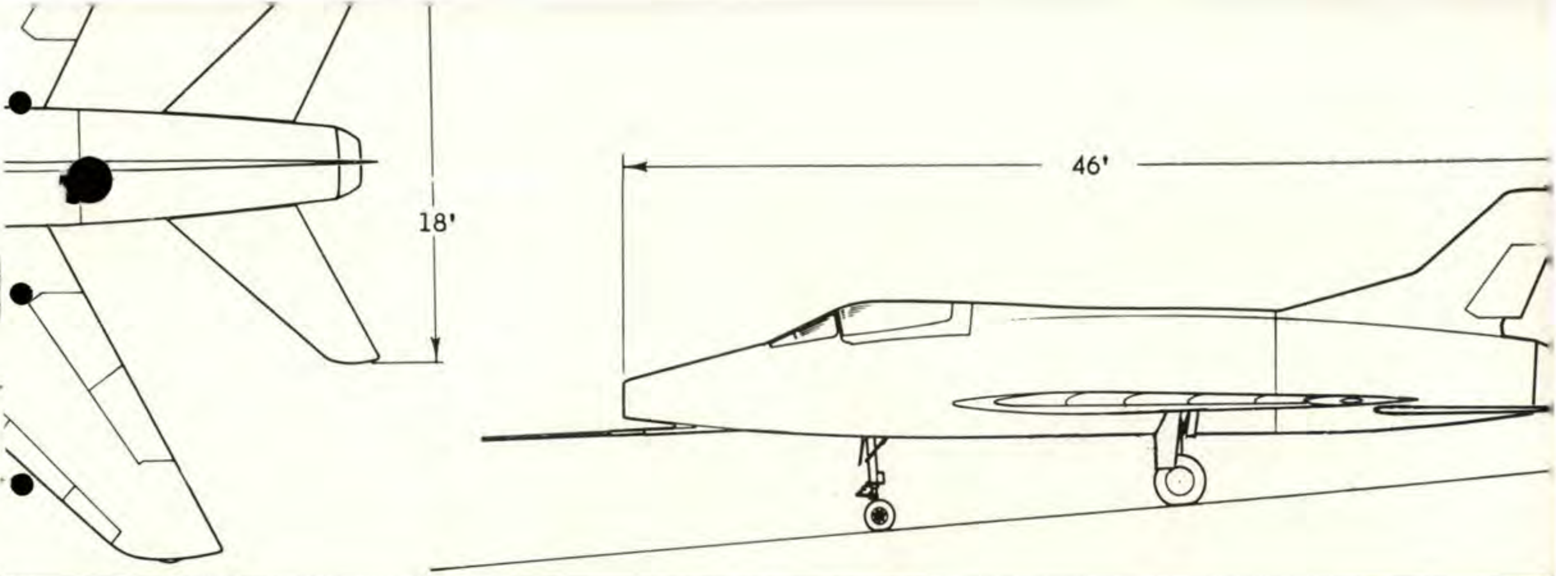
Here he gives you a fictionalized account of a test pilot's preparation for a first flight. However, the article is based on actual test flight incidents in the careers of Bob and other test pilots. The author's background for this article includes an aeronautical engineering degree and more than 6000 hours of flying all types of airplanes. He was the pilot for the first flight of four airplanes.

His advice? Know your airplane. When you think you've got it hacked, go back over it again.

Keep this thought in mind while you read: If you haven't flown a particular bird before, it's just as new to you as if it had just come off the drawing board.

YOU'VE JUST started a new job as an engineering test pilot with a large aircraft company that is currently building first-line fighter airplanes. Before this job, you flew these fighters; you know the thrill of being airborne. Now, with 2000 hours of flying time behind you, more than 1000 hours in jet fighters, you feel well qualified for this new job.

During the first week you go through the flight physical examination again, you meet all the important people and you're assigned locker



FLIGHT

Bob Baker
Chief Engineering Test Pilot
North American Aviation, Inc.

space in the hangar. You get a cockpit check in one of the new aircraft. This airplane has only 50 or 60 hours of flight time on it. Its first flight was only six months ago.

Then, one day the chief engineer asks you if you've seen the latest mock-up. Up to now, you thought you had access to every place in the plant but for this one you find that you need a special pass. You're ushered through a well-guarded door while the guard gives you a quizzical look when you are identified as a test pilot.

You recognize the form that takes up much of the room, as that of an airplane but the size and lines are brand new. You, of course, haven't seen this shape fly, but you wonder at some of the innovations. You're awed by the size of the air intake and the large amount of space left for the engine. In and around the intake duct are strange mechanisms. In contrast to the large space allotted for the engine is the cockpit, looking small on the huge airframe.

The chief engineer tells you how fast the airplane will go, how high it will climb, the speed at which it will land and the thrust of the engine that will drive it, in figures of new size and meaning. The fuel capacity rivals that of a bomber, but when you hear the fuel consumption rate, you know you're still in the fighter business.

You start to consider the problems that will be presented by a brand new airplane. Then you relax because you realize that you've just joined the company and the airplane in front of you will not fly for 18 months or two years. There will be time enough then to worry about the complexities of this strange bird.

You go to work at your job, pushing projects against time. Competition is strong in the aircraft business. Flight test is the last item before the airplane is delivered so that time consumed by shortages or other delays during design and construction, results in tests being started after they were scheduled to be finished. You gain experience as you are faced with instances of afterburner rings blowing out, fuel starvation with modified tanks, unexpected buffeting, and fuel tanks hitting the pitot boom during jettison tests. Improvements in production airplanes create a continuing need for flight testing.

Then, there is excitement as a new airplane is towed off the final assembly line in the special experimental department. Your calendar tells you that 20 months have slipped by before you realized it. And you reflect that neither you nor the other pilots have put much time into getting acquainted with this airplane; the projects have kept you busy. You wonder how the project pilot can possibly learn all he needs to know before he flies the new airplane. But when this latest addition to the company's fighter line comes out of the shop, it goes into the flight test hangar where it will remain for another two months for instrumentation and ground testing.

Something else has happened during the past 20 months. You've changed from a fledgling test pilot to an experienced one. Still, you are surprised when you are assigned as the project pilot to fly the new airplane for the first time. This bird that appeared so strange to you 20 months ago, suddenly takes on a different aspect.

Now, you're faced with a job more important than any you've had to date—to learn this airplane inside out. The first time that you sit in the cockpit you find many familiar things. The human factors group had checked with you and other pilots during mock-up and now you find that the suggestions have been incorporated in the cockpit.

The first day the airplane is in the flight test hangar, the flight test project engineer contacts you and gives you a listing of all the major component parts. You're scheduled to study one-half day on each major section of the airplane and two days on the more complicated sections. In addition, you will use simulators, visit special mock-ups and check field system tests. You are eager to get started and at first wonder why they don't schedule you for a full day of study instead of a half day. You find that the fuel system mock-up is a full-sized boiler-plate version of the fuel system, with all the pumps, lines and tanks exactly as they are in the air-

Memorize every item. Once you are airborne, you will have to analyze problems for yourself.

plane. Before the first week is out, you're so saturated with new information that you are grateful for the half-day schedule.

Your instruction begins with general arrangement of the airplane. The importance of this information strikes you when you realize that after you are airborne you will not have anyone to explain these things to you. If something buffets, breaks, gets plugged, bends the wrong way, or jams, you will have to analyze the problem yourself.

You memorize each item that you learn in order to become completely familiar with the airplane. You note that the expansion turbine for the cockpit air conditioning is located just aft of the back rest and that there is one on each side of the airplane. This is a dual system so that when one fails you will still have pressurization and cooling at high speed and altitude.

You note that the landing gear folds partly into the wing and partly into the fuselage. This is different from other airplanes you've been flying and it makes you wonder what aerodynamic influence the gear will have during retraction after takeoff.

Twenty months ago, nearly all airplanes had trailing edge control surfaces. Only a few of the newer fighters had all-flying horizontal tails. But this airplane has no trailing edge control surfaces. The all-movable horizontal stabilizer and the all-movable vertical stabilizer give the control required at high Mach number. The ailerons have been eliminated and you no longer have to worry about aileron reversal speeds. You are, however, faced with a new concern. What are the characteristics of the new spoilers and how do you use the special controls to put them "in" or "out" if they are too effective or not effective enough?

Weeks go by, and you become fully acquainted with the longitudinal, directional and lateral control systems. The boundary layer control and the flap system are items that you know about from prototype versions on more familiar aircraft. The inlet duct system requires two days of review because the operation is so new to you. The slats and speed brakes are conventional but there are some changes in design and mounting.

It is difficult to get into the actual airplane with the instrumentation engineers working full time around the clock, so you visit the cockpit mock-up several times. Gradually, you are getting to know the physical characteristics of the airplane. In addition, however, you must know what is expected of it. You go over the wind tunnel results with the aerodynamicist and you discuss inertia coupling, a phenomenon only recently new to pilots. Although you don't plan to spin the airplane, you go over the spin characteristics thoroughly. You learn the different flight characteristics that result from spoilers instead of ailerons.

Other preparation requirements are checking reports and flying as many airplanes with prototype controls as are available. Also, you take a trip out to the engine test stand to get acquainted with the instrument indications. You find that the exhaust gas temperature no longer is a self-generating instrument but instead operates from ac generator power. You study the fuel system operation and try to get a good mental picture of the operation of the new electrical and hydraulic systems. You cycle the landing gear and watch the landing gear tests as the gear is loaded to simulate air loads.

Sometimes when the information is being pumped into you, you might feel like a balloon being inflated, and even though you may think you are close to the saturation point, there always seems to be room for more. You memorize the restrictions and limitations because there'll be no time for questions in a pinch. And you fly the flight simulator as fast as the mathematicians can change the electronic circuits.

In addition to the regular airplane instrumentation you also must be familiar with the flight test instrumentation. Data analysis is important since you have just so much recording time available and you'll have to know (when you encounter a phenomenon) whether or not you have the instrumentation to record it. It would be a waste of time to repeat a run for a phenomenon that could not be recorded.

You read the Flight Handbook for the new airplane from cover to cover and find yourself more in the position of an associate editor than a pilot. You and the flight test project engineer have the only overall picture of the entire airplane, since others on the project have devoted their time to specific sections.

Your schooling is nearing completion and you have your first examination:

- If the ac failure warning light comes on, what do you do?
- If the No. 1 hydraulic system pressure drops below 1000 psi, what can you expect?

Use special mock-ups and field systems tests.

Will you know if their job has been done right?

• If you have a flameout, what is the emergency landing procedure?

You're going to have to know the answer to any problem that may present itself up there.

Then, after completing the exam, *you* have a question. The hydraulic valves for the flaps look too small for the job. You ask the hydraulic project engineer about the valve and learn that five pounds of weight was saved by having a single-action valve. When electrical power is on this valve, it is in the open position and the flaps are down. When electrical power is interrupted, the valve raises the flaps. No one had realized that on an emergency landing when you turn the battery off just before coming in, the flaps will come up and spill you short of the runway. There is no time to change the valve before the first flight, so emergency landings will have to be made flaps up.

You go over every part of the airplane and then you go over it again. When you release the brakes, a lot will depend on what you know.

Taxi tests are a problem on the new airplane. This same problem has been plaguing first flights for the past several years. The weight of the airplane and its takeoff and landing speeds are not compatible with last year's tires. New tires have been designed but they have not yet arrived.

Standard procedure is to determine the ground handling characteristics on taxi tests by making turns at low speeds, figure eights, and complete reversals. On higher-speed runs, you watch for shimmy, resulting from the nosewheel steering system. You remember some taxi tests that you observed several years ago when the nosewheel would not caster and tests were held up for several days to change the design. You hope that nothing like that happens to delay these tests.

After the high-speed taxi tests, normal procedure is to make lift-offs a few feet from the ground. This was all right with straight wings, but with highly swept wings where the wing flow characteristics break down to make high drag at minimum speeds, this might not work.

Again you remember an incident where a research airplane had just become airborne on its first flight and fuel starvation caused an immediate landing. At that time, an old-time pilot remarked, "This problem of fuel starvation is one we had 20 years ago. Don't tell me they still have it!"

However, it is decided that it is safer to fly than to hop off the ground and return immediately. Not only the aerodynamic characteristics of a high-speed fighter but also the landing gear and tire conditions help to shape this decision.

The date of the first flight arrives. You feel quite confident that you know the airplane systems and all of the predicted wind tunnel characteristics. If everything goes as designed and predicted, you'll have no trouble.

As final preparations are made, you think of some of the things that could go wrong. You remember the jet fighter that had looked so sleek as a result of a special process that had given it the smoothest skin you'd ever seen. On the first flight, the pilot had experienced a flameout with the experimental engine used in the airplane. The pilot had made a successful landing on Rogers Dry Lake. Then, in the next series of flights, the pilot had found that the stall characteristics resulted in an abrupt half snap roll without warning. How well had the wind tunnel data predicted the minimum speeds for this bird?

The control systems in the airplane you will fly should be a big improvement over previous systems with which you have had experience. You remember that the same airplane that had the nosewheel that wouldn't caster, had one of the first irreversible control systems in it. The first time the airplane had tried to exceed 250 knots, a pitching oscillation was encountered. The pilot had released the stick to determine if the oscillation was caused by the aerodynamics of the airplane or a pilot-induced feed-back in the control system, and the oscillations stopped. The lessons learned at that time had been digested and trouble of this type should not occur in your airplane.

Ten years ago, all first flights were made without retraction landing gear but the speed of present-day fighters has changed that. You recall the fighter on which the landing gear came up and jammed on landing? There were cases where landing gear doors failed to open to receive the gear, cases where the landing gear would not come down, and one case where the nose gear stuck in the retracted position and came down after the main gear touched the runway to provide a perfect landing.

In another case, a pilot had completed the taxi test the evening before the first flight and no one had touched the airplane during the night — he thought. Immediately after takeoff, the cockpit filled up with hot air directly from the engine compressor without going through the expansion cooling turbine. Fortunately, the pilot had been able to open the canopy in flight, but after a fast circle of the field, his shoes were too hot to touch.

Wind tunnel tests of the entire machine are sometimes done for positive checks on theory.

Everything is ready . . . the ramp looks more like a movie studio than an aircraft engineering project. You double check with your crew chief and tell him again, "Don't let me out of here unless everything in the cockpit is in the right position, the speed brakes are up, the flaps are set for takeoff and the controls are in trim."

As you push the engine starter button, all the confusion outside the airplane is lost. You are concentrating on a job. RPM comes up, throttle is brought around to idle, fuel flow is 750 pounds per hour, engine RPM is still increasing from the starter force and exhaust gas temperature starts to rise. The engine comes up to idle speed and the starter cuts out.

You signal the crew chief to disconnect the external power and move the starter unit. As you taxi out to the end of the runway with your chase plane in formation, it seems like just a routine procedure. A photo airplane has already taken off. You line up at the end of the runway facing east. Fifteen thousand feet of runway and several miles of dry lake bed lie in front of you.

The taxi tests have taken some of the novelty out of the cockpit procedure. The photo chase plane reports on base leg and the tower gives clearance for takeoff. You glance at your controls and indicators:

Military power . . . RPM . . . exhaust gas temperature . . . oil pressure . . . loadmeters . . . hydraulic pressure. Okay, release brakes . . . afterburner ignition. The 1000-foot marker goes by, the 2000-foot marker. Airspeed passes 150 knots at the 3000-foot marker. You lift the nosewheel. You're actually airborne and a new airplane is in flight.

At a thousand feet you have to come out of afterburner so as not to exceed the gear-down limitation speed. At 3000 feet you have good ground clearance but you have not moved the controls unnecessarily.

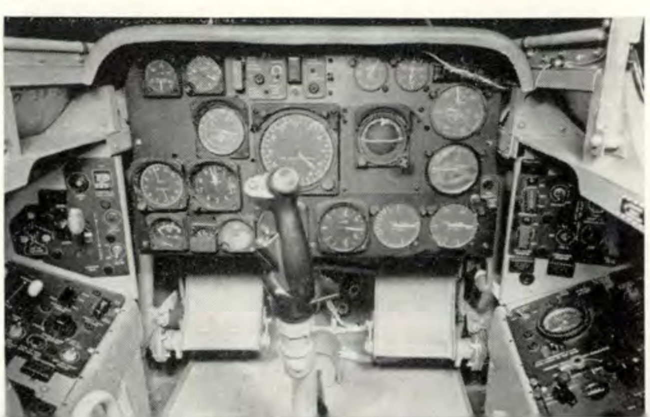
You pull the landing gear handle up and feel the gear sock home. Then you let the nose drop just a hair, to pick up speed and continue your climb. At 10,000 feet, you start a slow turn to keep the dry lake in sight. At 400 knots (that was close to top speed just a few years ago) you are just hitting the climb schedule for reduced power climb. Then you light the afterburner. Immediately you pull away from your chase plane.

You remember your careful preparation for this flight and feel the confidence that comes from knowing your airplane down to the last rivet. As you watch your airspeed and Mach indicator you reflect that although the '86s were okay in Korea, *this* is the airplane they'll need if more trouble comes. Suddenly you realize that you are writing a new chapter to the history of flight. ▲

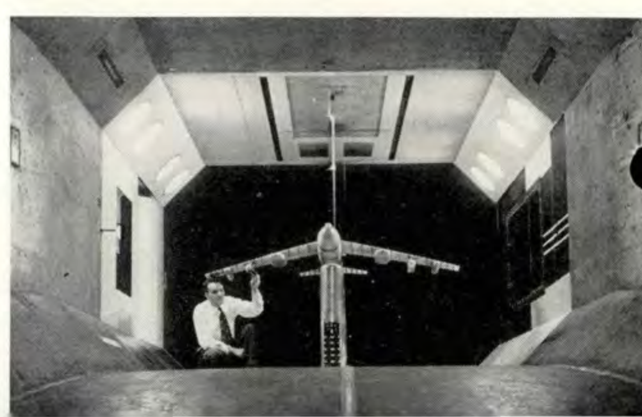
Simulators provide familiarity with controls.

The other half of your team. Work with him.

When you think you've learned it thoroughly, go over it again.



Each airplane has its own phenomena. Learn what applies to yours.



How Well Can You Remember?

January (Supervision)

1. About what percentage of all aircraft accidents involve a supervisor who had neglected to exercise his assigned responsibility?
   (a) 11.
   (b) 17.
   (c) 26.

2. There is now an entirely new system of weather reporting designed to give you a current observation every:
   (a) 20 minutes.
   (b) 30 minutes.
   (c) 60 minutes.

3. If you must engage the landing barrier in the F-100, the dive brake must be:
   (a) retracted.
   (b) extended.
   (c) either.

4. The minimum speed (low speed cutoff point) for successfully engaging the barrier in the F-100 is:
   (a) 11-17 kts.
   (b) 23-28 kts.
   (c) 28-33 kts.

5. The B-58 (Hustler) is powered by:
   (a) two J-79 engines.
   (b) four J-79 engines.
   (c) six J-79 engines.

February (New Pilot)

6. Almost half of all major jet fighter accidents are experienced by pilots with less than .... (rated) jet hours.
   (a) 150.
   (b) 200.
   (c) 250.

7. Pilots under 25 years of age represent 11 per cent of the total Air Force pilot pool and account for .... per cent of all pilot error fatalities.
   (a) 15.
   (b) 30.
   (c) 45.

8. Percentage-wise, what aircraft has the worst record for inadvertent gear-up landings?
   (a) T-33A.
   (b) F-86D.
   (c) F-84F.

9. Two jet fighters are on a head-on collision course, with a closing speed of 840 knots. With 20/20 vision, the pilots can first detect each other when they are approximately .... seconds apart.
   (a) 30.
   (b) 60.
   (c) 90.

10. Pilot-to-Forecaster Stations are available on UHF Channel 13. Facilities are listed in the RFC under:
   (a) centerspread.
   (b) remarks.
   (c) Airdrome directory information.

March (Your New Aircraft)

11. During 1955, in jet fighter accidents, pilots who had previous time in the aircraft had an accident rate of 55. Transitioning pilots had a rate of ....
   (a) 64.
   (b) 77.
   (c) 102.

12. During spin recovery in the F-100C or D, the ailerons must be:
   (a) neutral.
   (b) full against the spin.
   (c) full with the spin.

13. During the transitioning to a different aircraft, the known "critical flying period" is the first ....
   (a) 100 hours.
   (b) 200 hours.
   (c) 250 hours.

14. The F-101A is powered by:
   (a) one J-57 engine.
   (b) two J-57 engines.
   (c) two J-47 engines.

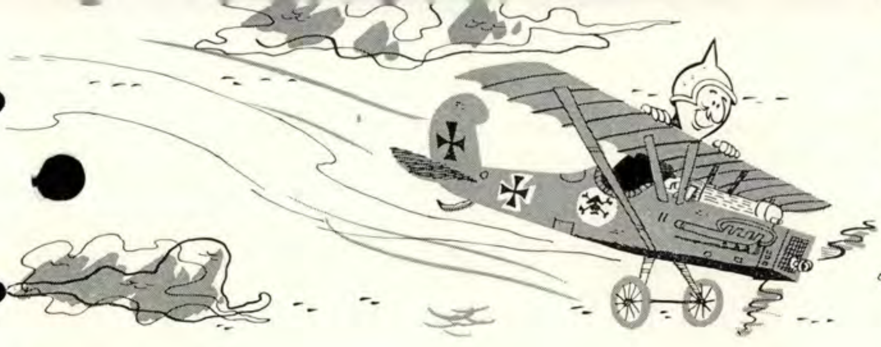
15. During aircraft testing and development, which phase is conducted by the Air Proving Ground Command?
   (a) Phase V.
   (b) Phase VI.
   (c) Phase VII.

ANSWERS

1. (b)	6. (a)	11. (c)
2. (a)	7. (b)	12. (c)
3. (a)	8. (b)	13. (c)
4. (c)	9. (a)	14. (b)
5. (b)	10. (b)	15. (c)

THERE IS only one way to treat spins in the bird of today. . . . Don't! Oh, I can hear it now — "What do you mean?—People spin these birds all the time." And this statement I can't fight, but for the information of all who care to listen, hear this: Guys are spinning in, too. And with our newer fighters, this situation isn't going to improve at all.

Spins today are a different breed of cat than in years gone by. The giant iron monsters that carry the tab "fighter" weigh in at between 20,000 to 50,000 pounds and go like the dickens. It used to be "stick back, opposite rudder, neutralize, stick forward. Bang, bang, bang, like that," and you flew out neat as anything. This may be one of the reasons a few troops spin in. That bag of lead you're driving today gets to going in one direction and it takes some doing and some time to stop it. When you kick opposite rudder, she doesn't obligingly respond — RIGHT NOW. Understandably, this can panic a troop more than somewhat. The F-84F for example will take another turn or two before rotation stops.



Treatment

There was a time when a single procedure for spin recoveries worked for all kinds of airplanes. That's by the boards. Any spin nowadays is an invitation to trouble. Your best solution is—DON'T.

Don't start slapping the controls all over the area, in a last minute desperation panic.

Ironically enough, after the pilot has ejected from his spinning bird, often the aircraft recovers by itself. This, of course, is most embarrassing but it does substantiate the possibility that the troops are getting impatient in the recovery response. Now I'll be the last one to criticize a bailout of an uncontrollable bird. But, altitude permitting, give 'er a chance.

It also should be remembered that spin recovery procedures vary with different aircraft. Knowing the specific procedures for your bird is a must, and they are probably different from the old standard recovery techniques of yesteryear.

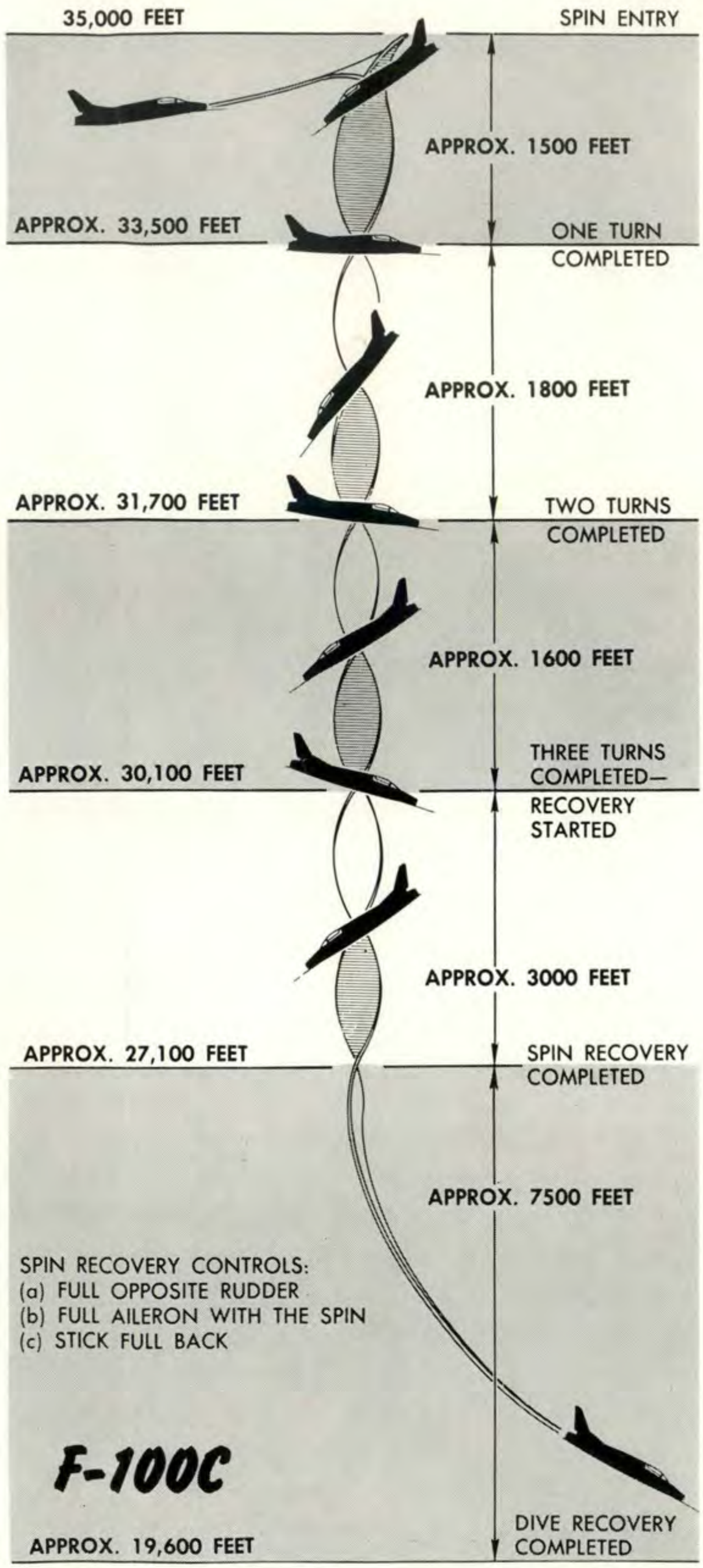
A review of accidents wherein the causes read, "Unable to recover from spin," indicates that many pilots do not know the exact recovery techniques for their particular aircraft. There are a couple of valid reasons for this. One, spins are not practiced anymore and, two, we have all been indoctrinated with the old NACA standard spin recovery procedures, and we use them. The net result is that a fellow slips into an inadvertent spin. It is the first one he has ever been in with this airplane and he automatically gives her the ailerons neutral, stick back, opposite rudder, neutralize rudder, pop the stick forward. Result? . . . Nothing. Use this procedure in the F-100D, for example, and you will flat run out of air. The '100 has different spin recovery procedures and if you do not hold the ailerons full with the spin you are going to make large fence post holes. The same idea is true with the '84F and others. Each aircraft has its own procedures and you have to know them.

Study the flight test data and get the facts down pat. Practice them just like you would practice ejecting. Sit in a chair and go over the recovery techniques again and again.

An old F-100 head sums it up like this: "You must realize that today's bird has an 'unstandard' spin recovery procedure. Also, every control must be manipulated correctly or you are out of business. Actually, it is better to do nothing than to do something wrong during recovery attempts. I always advise the troops that when they flip into an inadvertent spin to just do nothing for a few seconds and get yourself oriented. This is essential because if you put ailerons against the spin, for example, she'll just keep on winding up.

"You can't aggravate the situation by not doing something for the first second. Gad, the bird is stalled out

It was bad enough in Spads of the Escadrille.



dead and has fallen off a wing. . . . Things are about as loused up as they can get. Just get yourself oriented then perform the correct spin recovery movements as published."

Next to knowing the correct spin recovery techniques for your particular bird, you can best stay out of trouble if you . . . DON'T SPIN in the first place.

As far as I know there is no requirement for the spin maneuver. The Escadrille, flying Spads Mark IV, used this crazy maneuver to elude the Fokker but even this was not too highly recommended. Ol' Jerry would just follow you down and when you pulled out, he would nail you.

Aside from the lack of requirement, in the latest Century Series aircraft there is even more to substantiate the "Don't Spin" concept. You may not be able to recover. Now I'm really on thin ice and everybody from the aircraft companies to the aviation Kaydet Corps will probably take the pipe. But I stand by my guns.

Theoretically, all birds get the spin test treatment. But these test aircraft are (1) being flown by fellows who really know their craft and (2) they have everything from wingtip spin chutes to wingtip rockets to assist the recovery.

Take Convair and the F-102, for example. They're going to conduct a spin test program but will still probably come up with the same Dash One recommendation which they now have, namely, "Do Not Spin." We have a real good fighter in the '102. It does everything well and really scoots. So it has rather weird spin characteristics—so who cares?

The spin tests conducted on everything from the T-33 through the F-100 indicate rather favorable spin recovery characteristics, if you use the proper procedures. But even with these, why get into a spin?

With the amount of power available there is no need to get down to stalling airspeeds. If you insist on letting your airspeed drop out of sight while flying upside down and sideways, you can end up in an inadvertent spin. So when you're practicing acrobatics and such, play it cool. Fly some 20 knots plus above the stall regardless of maneuver.

Needless to say, if you don't get into a spin you won't have any spin recovery problems. ▲

the first 250

Colonel Paul P. Douglas, Jr.
Chief, Investigation & Safety
Engineering Div. D/FSR

Those dry, old statistics say, "A large percentage of aircraft accidents occur during the transitioning period and that the first 250 hours are the roughest."

WHAT HAPPENS when a new pilot comes aboard, or when a unit transitions to new equipment? In either case the problems are similar and may be solved by applying the same basic principles.

All flights, other than actual operational missions and engineering test flights, fall into the category of training flights. Let's take a look at some of the problems of training.

Training is accomplished by accumulating experience. And it is essential that certain phases of this training be properly supervised.

Statistics show that the first 250 rated flying hours make up the most critical flying period in any pilot's career. This holds true whether the pilot be assigned to a bomber, fighter or cargo outfit. However, bomber and transport pilots do receive an extended "apprenticeship" as student pilots and copilots before they assume first pilot duties. In jet fighters and a new jet bomber aircraft, an identical apprenticeship is impossible. These pilots must rely greatly on their own personal knowledge, capability and experience. In any case the course of training is directed towards building the "man and machine" into a practicable and useful weapon.

We can start his academic training by handing him a flight handbook and a questionnaire. He attends a mobile training unit, if available, and is briefed on pertinent regulations and SOPs regarding local rules and procedures. His aircraft knowledge is checked by the standardization board and the unit flying safety officer should review with him the accidents involving this type of aircraft.

Then follows a period of cockpit checks, taxi training, simulator rides (if available) and his first flight in the unit aircraft. Some organizations require the pilot to demonstrate his capabilities as an instrument pilot prior to soloing.

The pilot becomes thoroughly familiar with formation flying, acrobatics, simulated combat, navigational flying with strange field operations, gunnery, bombing and interception procedures. These include both day and night operations, not only from the purely academic approach but specifically as they must be applied to accomplish the mission of the unit.

During the period that the pilot is receiving his checkout towards becoming combat-ready, his flying is supervised very closely, especially during takeoffs and landings. Then, as he proves his adeptness, this supervision is lessened gradually until he is pretty much on his own. No longer is there an "old timer" standing by to watch every move that he makes. Also during this period, our pilot will probably advance beyond the 150-hour mark but he will still be in the "known critical flying period."

It is understandable that unit operational requirements make it necessary to lessen personal supervision over each new pilot as soon as practicable, and also that commitments may call for a new pilot to be assigned to a mission sooner than was anticipated. But, whatever the circumstances, we must satisfy ourselves that the pilot is at least capable of

The academic approach is fine, but the real test is the ability to apply it to the new bird.

handling emergencies. Here is a sample of what can happen:

The pilot of a B-57 had a total of 1748 flying hours, 81 jet hours, of which 18 were flown in this type of aircraft. While cruising at 39,000 feet on a navigation and radar bomb scoring training flight, the pilot observed a fuel flow fluctuation on the left engine which increased in magnitude. He did not correlate the fuel fluctuation with engine RPM, exhaust gas temperature and aircraft control characteristics to determine if an emergency did exist, but instead switched the left engine emergency fuel control to TAKEOFF position. The engine overheat warning light came ON, engine RPM increased to 120 per cent and the navigator reported flames from the left engine. The pilot then stopcocked the left throttle and advanced the right throttle but received only an indication of 50 per cent RPM.

The right throttle also was stopcocked. The interphone failed and he lost voice communications with the navigator. Excess electrical circuits were not turned OFF and the battery was discharged.

After descending to approximately 17,000 feet, three airstarts were attempted, but without success. Both crewmembers abandoned the aircraft.

Let's consider the factors in this accident. The emergency procedures used by the pilot were not according to instructions in the handbook or in the checklist. As a result, the left engine failed after being subjected to overspeed and overheat conditions. There was no evidence of left engine malfunction that could have contributed to the reported fuel fluctuation. The magnitude of fuel flow fluctuation should have resulted in engine surge or inflight yaw. These conditions were not noted by the pilot. The right engine failed when the fuel shutoff valve was inadvertently closed.

We can hope (and assume) that a number of our fighter problems will be alleviated by the introduction of TF versions of each of our operational fighter aircraft. Meanwhile, here's another accident report which indicates that like problems exist in all aircraft. This one involves a pilot with limited experience.

This pilot had a total of 449 flying hours, 146 jet hours, 71 of which were in F-86F aircraft. As he was preparing to enter the traffic pattern at 2000 feet, with the engine operating on the main fuel control system, he noticed that engine RPM began to fluctuate, then drop. Tailpipe temperature also began to drop. The pilot immediately set up a pattern for an emergency landing at a nearby civil airfield, then attempted several airstarts using the main fuel control system. During the fourth attempt, the aircraft was crash-landed in a field one mile short of the airfield. The pilot received major injury.

All right, let's see what might have prevented this accident.

First, the pilot made no attempt to start the engine using the emergency fuel system as outlined in the flight handbook. Actually, had he alerted the emergency fuel system immediately (since a malfunction was indicated by the fluctuating RPM), the subsequent flameout probably would not have occurred.

Interrogation of the pilot disclosed that he did *not* fully understand the operation of the emergency fuel system. His F-86F questionnaire, however, completed only two months earlier, *did* contain satisfactory answers relative to this item.

Next, the pilot could probably have landed safely at the airfield he selected, had he followed prescribed flameout landing procedures. He had not retracted the speed brakes or established the prescribed glide speed. As a result, the glide distance was shortened considerably.

Other instructions regarding belly landing emergencies which were not followed, included these:

- The wing flaps were not lowered.
- The battery and main fuel shut-off switches were not turned off.
- The canopy was not jettisoned.
- The shoulder harness was not locked.

This pilot, with his 146 jet hours, was still in the "peak accident potential area" although he is considered a fully qualified F-86F driver.

Three other pilots of the squadron, with experience comparable to his, were questioned and not one could correctly relate emergency procecedures. Each stated that he had read the handbook and had participated in periodic discussions with flight leaders concerning these procedures, but still didn't know them.

Both the squadron commander and the operations officer were aware of the need for training pilots in emergency procedures and for continued emphasis on knowledge thereof, during briefings. Yet, there was no published schedule to insure this training—and therein lies our problem.

How can we assure ourselves that all pilots do understand the aircraft they are assigned to fly?

How can we be sure that pilots understand the operation of primary and auxiliary aircraft systems so that step-by-step emergency procedures actually mean something, and are not just items for recitation or for listing on a questionnaire?

Flight handbooks are designed to provide pilots with the latest information on the operation of an aircraft and its systems, and there is no other procedure in existence to parallel this means. Standing Operating Procedures (SOPs) are fine for their intended purposes—that of providing pilots with specific data relative to aircraft operating procedures as used by units in accomplishing a mission—but they do not give intimate details relative to operation of a specific aircraft. These must be known.

The Transition Indoctrination Team, provided by the Air Proving Ground Command, should be included in the program after the crews have accumulated approximately 10 hours of flying time in unit aircraft.

While there still remains no magic word for the problems associated with transitioning from one type of aircraft to another, there are many things that can be done to assure that all available knowledge and training facilities have been used. This can be done only through the use of thorough planning for the task to be done. To assure that your planning is complete, establish a comprehensive program adapted to your needs. Only you can determine the complete requirements but here is a sample that is tried and true. But the success of it, and yours, depends entirely upon how well it is carried through. ▲

Academic Training

- Lectures on the aircraft, its systems and operation.
- Flying characteristics.
- Accident review and emergency procedures.
- The Dash-One.
- Completing a questionnaire.
- Squadron and higher headquarters SOPs and regulations.
- Physiological training.
- Mobile training unit.
- Standardization board check.

Simulator Training

- Familiarization.
- Normal procedures.
- Emergency procedures.

Transition Training

- Demonstrate instrument proficiency.
- Visual inspection of the aircraft and forms.
- Cockpit familiarization.
- Start, taxi, shutdown.
- Mission briefing.
- Solo.
- Complete detailed transition program.
- Standardization flight check.

Tactical Training

- Formation, acrobatics, simulated combat.
- Navigation, strange field landings.
- Rocketry and/or gunnery.
- Intercept procedures.
- Bombing.
- Reconnaissance and photography.
- Cargo and troop airlift procedures.
- Standardization board interview.

Despite the chatter you hear in the ready room, this bird does not fly "just like" another one. Every one has its own set of idiosyncrasies. Here's the proof.

PREVENTABLE human error accidents which occur as a direct result of inadequate experience continue as one of the most prevalent types. Typical of this is the accident involving a student who was to participate in a four-ship formation flight. During takeoff everything appeared normal. On climbout the pilot became concerned over what he considered erroneous airspeed readings.

A dual ship in the area was asked to check with him and fly his wing down the final approach for landing. This was done with the dual ship breaking away just before the touchdown point was reached. At this time the airspeed indication was 130 knots. The student pilot landed with approximately 5000 feet of runway remaining, but because of faulty braking techniques, he didn't stop the aircraft. The arresting barrier was contacted but because the student hadn't remembered to retract the dive brakes, the barrier did not engage. The nose gear collapsed and the aircraft was damaged considerably.

Fortunately, the student was not injured, although—as in other flights—his shoulder harness was not locked.

BRIEF STORIES DEALING WITH

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DEPART

A post-accident check indicated no malfunction of the airspeed indicator. The accident (charged to pilot error) is wholly explainable by the fact that the pilot had not yet learned his aircraft procedures.

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AN F-86A pilot with more than 2300 hours, 28 of which were in this type of aircraft, was on a night checkout. He was briefed about high winds and the unusual pattern (3200 feet above the ground). He made the initial approach at 4000 feet, at 200-230 knots. Mild pitch was observed and downwind held in apparent compliance with briefed pattern. The turn onto final was somewhat low in comparison to high initial. Final approach appeared flat and slow and abrupt drop was noticed as aircraft seemed to stall and drop in. The aircraft landed short, colliding with a blast fence. The board concluded that the pilot had failed to compensate for pattern altitude and the 15 to 20 knot wind.

★

A FLIGHT of two F-100Cs took off on a routine day transition mission. The transitioning pilot had only 11 hours in the bird, so far. With his instructor he climbed to 45,000 feet for the acrobatics which he was scheduled to perform and when that phase was finished, the two planes dropped down for landing. The first approach was too fast and the pilot was told to go around.

On the second approach, everything looked and felt normal to the pilot so the landing was made. Touchdown

was made at or near 180 knots. He popped his drag chute and felt normal deceleration, until the pin that holds it sheared. This happened about 4000 feet from the end of the 10,000-foot runway. There was a vigorous application of brakes, and both tires blew out—the left one first.

The F-100C hit the crash barrier but continued to roll onto the overrun where the nose tire blew and the nose gear sheared.

There were several causes for this accident.

The pilot had deployed his drag chute at or above 180 knots and immediately failed the shear pin. (It is designed to fail at 180 knots or above.) Following this, he used improper braking technique which blew out the tires. This was further complicated by the fact that the nose strut trunnion pin sheared, because of a cracked condition from a previous hard landing or a flaw in the material.

Why did he land so fast? The pilot thought he was about right. But then, normally he wears glasses. Without them, he sees 20/40, and can not pass the depth perception test. With them, he's okay, even as you and I.

But here is the thought for today: Although this pilot had a total of over 2000 hours plus the 11 hours experience in this type of bird, these 11 hours had been stretched over a 90-day period.

★

THIS ONE was in the F-86F . . . and it was to be his first ride. So far, he had been able to pick up some 1800 pilot hours, a few in jets, but none in the '86.

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MENT

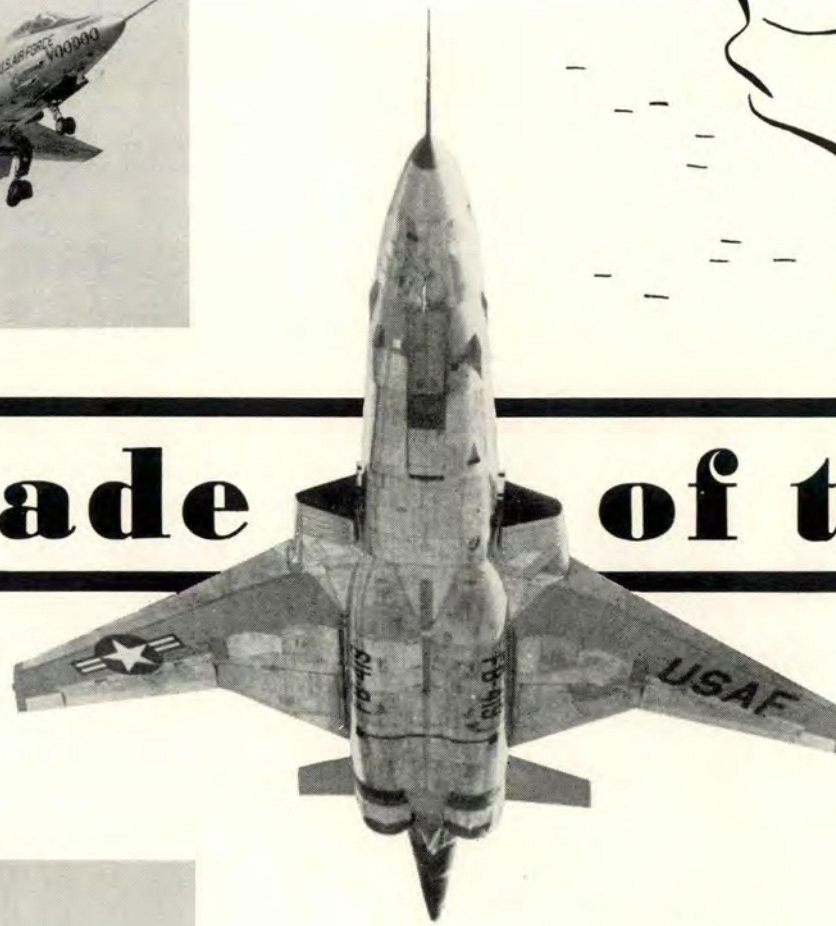
ACCIDENTS DURING TRANSITION

In a flight of two, the takeoff and climb were normal and the aircraft leveled off at 25,000 feet. After practicing some familiarization air work, the pilot returned to the base to shoot some touch-and-go landings with the flight leader acting as chase-instructor-pilot.

On the second touch-and-go landing, the flight was told to make a late break to allow another aircraft to clear the runway. The pilot executed the break with dive flaps, approximately one-third of the way down the runway. The gear was dropped on the downwind and the pilot started his turn to base leg at 170 knots. Flaps were lowered to the full down position on the base leg. The pilot rolled out on final approach, maintaining 165-170 knots with power.

About half way down the final, the IP advised the pilot to "set it up for 130 knots." At this time the pilot reduced power and raised the nose of his aircraft. The chase-instructor pilot started to slide by him just as Mobile Control advised him to correct his approach. The chase-IP then told the pilot to add power but the aircraft continued to sink at an excessive rate. It hit the runway on the right main gear in a stalled condition. The right pylon tank was jarred loose on impact and the left main tire blew. The pilot managed to stop the aircraft and evacuate without further incident.

According to the board, the primary cause of this accident was the instructions to the pilot on final which led to incorrect action by him. Prior to this flight he had flown one hour and 50 minutes jet time in the previous 60 days (two rides in a T-33 with IPs). He failed to qualify for checkout.



Parade of the

Robert C. Little
Chief Test Pilot
McDonnell Aircraft Corporation

Here is the latest on the "next generation" of fighters. The F-101, named the "Voodoo," is scheduled to make its debut into operational service in the near future.

IN THE PAST, I have found many of these "How to Fly" articles so full of "wild blue" that it is difficult to realize their relation to flying safety or even their usefulness in presenting basic facts to the average reader. I treat the development and test flying of a new airplane as a business, admittedly exciting at times, but nevertheless a serious business.

With this thought in mind, I would like to give you the facts, not restricted by security, on the F-101 and let you stack up the "wild blue" when you fly the airplane.

No one person or no single handbook of written instructions can automatically make you a safe and efficient pilot. You are the one who must get the feel of a new plane, exercise the right judgment and develop the correct flying techniques. Knowledge is a necessary form of safety, however, as you all well know. I suggest that you read the pilot's handbook on the F-101 and discuss the flight characteristics with other pilots who have flown the aircraft.

It is also a good idea to make use of the flight simulator. It was built for you, so use it.

I hope that this article will aid you in getting more out of your early Voodoo flying and make your transition a safe and pleasant one.

The Voodoo's flight characteristics aren't much different basically than other high performance aircraft you have been flying. It's the next generation of fighters, sure, but it flys the same. It just does everything faster. There is a lot of airplane in the F-101, both in size and mission capability. This aircraft is 67 feet long, has a

F-101 Centuries

wing span of 40 feet and is 18 feet from the ground to the top of the fin. Gross weight varies from 49,000 pounds, with two external tanks and MK 7 store, to 28,000 pounds, clean at the completion of the mission.

Twin engine reliability is available with two J-57 engines developing 15,000 pounds of thrust each with afterburner. The Voodoo has 35-degree swept wings and is capable of speeds from 160 miles per hour to over 1100 miles per hour, altitudes from sea level to over 55,000 feet, extreme rates of climb, and maneuvering capabilities throughout. Inflight refueling may be accomplished easily with either the flying boom or the probe and drogue type tankers.

Over the past two years of development, many improvements have been incorporated into the aircraft, making it a safer and easier one for you to fly. It is not a T-33 however, so I believe that the Voodoo driver needs to be both a good fighter pilot as well as a good bomber pilot for the following reasons:

- You are handling more thrust per pound of airplane than you have ever felt before, so it is especially important that you stay ahead of the aircraft and be prepared for the very rapid acceleration and high rates of climb possible.
- This fighter has a very high wing loading (110 pounds per square foot at normal takeoff gross weight) which means that for certain conditions, particularly high gross weight takeoffs and landings, you must handle this airplane like a highly wing loaded bomber aircraft.

In other words, you have a tremendous amount of thrust available and plenty of control but you can't expect to horse this airplane around with wild abandon at low airspeeds.

Let me point out briefly some of the things to expect and some of the techniques you should use on an average flight with the '101. I'll start with ground handling.

Ground Handling

Once you have the engines running and have completed your pre-taxi checklist, you are ready to go. It takes a little power to start rolling, however, the thrust in idle is enough to keep you going. Use the nosewheel steering for taxiing rather than differential braking. You can double the tire life with care in taxiing by using slow speeds especially when making sharp turns. The '101's power brakes have excellent feel, but when coming to a full stop during taxi, some brake-strut chatter may be encountered. Anticipate turns and full stops and it won't bother you.

Takeoff

Once you are lined up on the runway for takeoff, check each engine separately—leaving the other in idle. The brakes will hold with both engines in military, however you will probably rotate the tires on the wheels

With stores or external tanks installed, there is no change in Voodoo flying characteristics.

You will like maximum level flight speeds attainable. Zoom climb supersonic holds promise.

which isn't conducive to safety. After you have checked your engine and are ready to go, advance both throttles to approximately 85 per cent rpm, depress the nosewheel steering button, release the brakes and continue the throttles to military as you start to roll. Because of the ram air-bellows type artificial feel system, you will find very light stick forces on the ground. As you pick up airspeed on takeoff, these forces increase; however, during takeoff and landing they are lighter than other types of feel systems to which you might be accustomed. Therefore, during takeoff and landing, don't rely on stick forces, but use airspeed as a basis for proper aircraft control.

On your initial checkout a military power takeoff is advisable since the acceleration with afterburners is terrific and may take you by surprise. Even with military power, you will have better takeoff performance than most other fighters using maximum power. Use the nosewheel steering for directional control until the rudder becomes effective at approximately 70 knots IAS. Use the brakes only if the steering malfunctions. The same old fundamentals you've been using still apply. If you ease the nose gear off at 150 knots and relax stick back pressure, to hold your attitude, the aircraft will fly itself off as speed increases to approximately 165 knots IAS. The gear must be retracted immediately in order to prevent exceeding the gear placard of 250 knots IAS. With some airplanes you know that a steep attitude will get you on the back side of the power curve and you'll never get off the runway. In this airplane, rapidly rotating into a steep attitude can get you into just as much trouble. Sure, you can horse this airplane off the ground at airspeeds lower than recommended but even with all that power you can get in a bind. Why not play it cool and stay out of any difficulty?

Climb

You will find the acceleration of the F-101 after takeoff, very rapid. When maximum power is used, you will reach best climb speed in a minute or less (depending on temperature) after brake release. In order to maintain this climb speed the nose must be rotated steeply unless a supersonic climb is desired. You'll find it easier to maintain climb speed at maximum power with the machmeter and attitude with the artificial horizon. Using military power, the rate of climb is naturally lower, and the attitude is not as steep, presenting improved visibility over the nose.

Altitudes well above the combat ceiling may be attained by employing what is known as the zoom climb. This capability holds real promise as a new tactical intercept technique for use in attacks at extremely high altitudes. It makes use of the high kinetic energy that can be developed by the Voodoo in supersonic level flight.

Level Flight

The level flight acceleration of this big bird is impressive at all altitudes and you will like the maximum level flight speeds attainable by the aircraft. (These speeds have exceeded the original contractor estimate.) Flying qualities are stable and control characteristics are positive throughout the placard speed envelope of the F-101. No wing drops or transonic speed effects are encountered. You will notice a faint airframe buffet around 0.90 Mach number, however, supersonic flight is completely smooth.

The F-101 carries 13,000 pounds of internal fuel and you will like the amount of burner flying available without having to stay in the vicinity of the base. Nevertheless, you should follow the fuel gaging procedures set forth in the Dash One to assure that the proper sequencing is obtained, and that the master fuel tank does not get too low. Extensive use of the afterburner will run you just as short as in any other airplane.

Maneuvering

The Voodoo, being a true supersonic airplane, is not designed to have high maneuvering capabilities at subsonic speeds. You will find, however, that the maneuvering capabilities at supersonic speeds are excellent and that you will be able to maintain both Mach number and altitude during supersonic maneuvers in a far better fashion than in any other airplane you have ever flown.

The maneuverability of all fighters you've been flying was restricted by structural strength and the F-101 is no different. Again, follow your handbook placards.

In some of the airplanes you've been flying, you have experienced a characteristic commonly known as pitch-up. While pulling G in a turn, you reached a point where there was a sudden strong tendency of the airplane to nose up without the addition of stick force on your part.

The F-101A displays this undesirable characteristic, but all airplanes will be delivered with an adequate pitch-up warning device. This device incorporates a horn which sounds in your headset when you approach the pitch-up boundary, and a stick pusher which actually pushes the stick forward for you in case you should reach the pitch-up boundary. The horn and pusher signals are actuated by angle of attack and/or aft stick rate, and are scheduled with Mach number. If you hear the horn, relax your aft stick pressure or ease the stick forward slightly.

If, for certain flight conditions, you have pulled through the horn warning and have engaged the pusher, you will find that the stick will be moved forward at a rate of 1½-degree/second stabilator motion. This pusher actuation provides a final positive warning to the pilot to take corrective recovery action. Also, it will disengage after two degrees of stabilator nose-down motion. Pilot overpower force for the pusher is 25 pounds.

In case of malfunction of the pusher, a disengage button is provided on the stick; also, on-off master switches for the horn and pusher, a test button and a malfunction warning light are prominently located in the cockpit. With either gear or flaps down, the pusher becomes inoperative for safety reasons since an unexpected stick push might be dangerous during critical portions of a takeoff or landing. The horn warning stays operative on angle-of-attack as an additional safety feature for landing and takeoff.

The horn and pusher are for your safety. Take warning from them and stay out of trouble!

Spins

Although we have performed more than 65 spins in the F-101, the demonstration is not complete and recommended recovery procedures in the Dash One are subject to change. If you don't ignore the pitch-up warning horn and don't overpower the pusher, you will never have a spin. However, should you somehow manage to spin the F-101, follow the latest handbook instructions. The spin itself is not a violent one but you should expect to lose from 10,000 to 15,000 feet with currently recommended recovery techniques.

Engine Operation

The design of the F-101 is such that normal operation of all systems is available with either engine shut down. The J-57 has proven to be a good, rugged engine, and with two of them you can't miss unless you run out of gas. (Deadstick landings, by the way, are not on the approved list of maneuvers for the F-101!) Engine airstarts are excellent and you will be impressed with the single engine performance of the bird. We have never encountered an engine flameout. You will find it comforting to be able to shut down an engine with no sweat if a malfunction is suspected.

Compressor stalls won't bother you in your normal flying but they may be encountered at very high Mach numbers in combination with high load factors. They can vary in intensity from mild pops to heavy bangs. Stalls may cause a burner to blow out but a relight usually can be obtained immediately. A compressor

Twin J-57 engine installation allows you to shut one down, no sweat, if malfunction occurs.

To maintain best climb speed, nose must be rotated steeply unless supersonic climb is desired.

stall also may occur during some gunfiring conditions. Concentrated efforts presently are being made to correct this undesirable situation.

Landing

Since the easiest time to have an accident is during landing, we should all pay particular attention to this phase of the flight. As I said before, the F-101 has a very high wing loading which means you can't get gay with the airplane on the final approach. I drop my gear at about 230 knots on the downwind leg and then close the speed brakes and extend the flaps at about 200 knots.

For an average landing with 3000 pounds of fuel remaining, you should set up a smooth pattern from the base leg to flare out at 170 knots. I maintain a rate of descent of about 1000 feet per minute using 82 per cent rpm on both engines.

You should fly the airplane onto the runway and never try to float in that last quarter of a mile with the throttles at idle. The deceleration of the Voodoo—once you chop power and begin to flare out—will surprise you. It is on the order of five knots per second. Don't get caught in this position 50 feet in the air and a quarter of a mile short of the runway or you just won't make it.

Fly the '101 onto the runway and make a normal touchdown at about 150 knots. Parabrake deployment presents no problem for any normal crosswind condition and there is no pitch transient. Consult your Dash One for the proper landing pattern speeds versus fuel remaining.

For single engine landings, you should fly the same basic pattern as you do for normal landing, but use 15 knots higher speed. This gives you a margin to play with.

Except on hot days or high field elevations, you will have enough thrust from one engine to fly the pattern with both gear and flaps extended, however, in general you should leave the flaps retracted until you have the runway made and then dump flaps and make a normal landing. Remember that once you allow the airplane to begin to decelerate on final approach, it will be very difficult to catch it with only one engine, so set up a good stabilized approach with no steep turns.

In the event a go-around is required, use of the afterburner is recommended as an insurance factor, although military power would be adequate for most conditions.

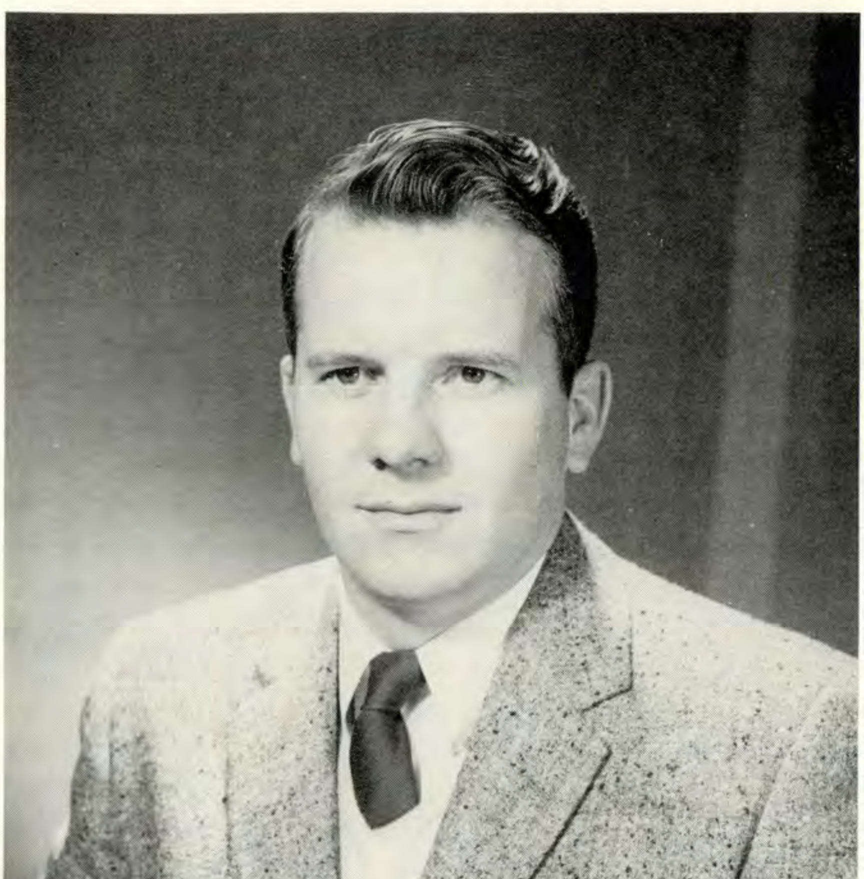
Mission Accomplishment

You will find the F-101 to be a superior weapons system equipped with the MB-1 cruise relief autopilot, ASN-6 (GPI) dead-reckoning navigation system, ARN-14 navigation radio, MA-7 fire control system with the all-weather radar and optical gunsighting, the APS-54 radar warning system, and the MA-2 low altitude bombing system. Space and security does not permit me to delve into details of operation, but highly successful special weapon strikes have been flown under simulated and actual instrument conditions using radar and ASN-6 (GPI) as the only navigational aid for the entire flight right up to the target in question which was of the order, in size, of an airfield.

Special stores have been carried and released throughout most of the F-101 flight envelope. The F-101 is capable of level supersonic flight with stores or external tanks installed and without any change in flying characteristics. With these all-weather, long range capabilities, you will be able to deliver attacks on extremely distant targets with ease.

Well, I hope this article will be of some help in getting to know your F-101 better. The finer points are sometimes the most important. ▲

During WW II, Bob Little flew F-51s in the European Theater. He completed 68 combat missions and was awarded the Distinguished Flying Cross. Following the war he graduated from Texas A&M, with a degree in Mechanical Engineering, and became a flight test engineer for McDonnell Aircraft Corporation in 1948. He performed the first flights in the F-3H Demon and the F-101 Voodoo.



Force of habit

The development of a "habit" can save you a lot of mental gymnastics. The trick is learning when to rely upon it.

IT IS NOT CLEAR just what learning is, but an important psychological factor associated with it is habit interference. Once you've learned some sequence of acts after a great many repetitions, it becomes a relatively permanent part of your response system.

As you acquire skill in any activity, parts of this activity become more and more stereotyped and require less and less attention. In other words they become habits. Even a complex activity, if repeated often enough, will become so habitual that it is almost completely automatic. This situation produces some problems but the advantages far outweigh the disadvantages. We could not function if more than a limited number of our activities required voluntary control. While doing some things habitually, we are able to attend to other, unpracticed activities.

However, there are occasions where the movement which has become habitual is not the appropriate one; then, an "error" results. We respond habitually to aspects of our environment with which the movements have been associated. This does not mean that the stimuli are always identical, but that they are perceived in terms of their common aspects. For a simple example, you can walk down a street in conversation with a friend and step up and down curbs without being aware of it, even though the curbs differ in material, color and height. On the other hand, when a given pattern of stimuli call for a response differing from the habit that has been learned, the tendency to move in accordance with the habit is very powerful and very likely to occur. The tendency is more powerful in an emergency or under the stress of strong emotion.

The application of this human characteristic as an explanation of accidents is obvious, particularly in transition from one aircraft to another, since—normally—aircraft have different locations of controls and require different types of movements.

The following is a case in point: A pilot was performing an initial checkout ride in an F-89D. Upon completion of the air phase, he entered the traffic pattern for landing but overshot the final approach and made a go-around. His second entry was normal—all airspeeds were within limits and touchdown was about 1000 feet from the end of the runway slightly to the left of center.

As the airspeed decreased to 100 knots, the pilot applied brakes, skidding the left tire. Moments later, he locked both brakes, blowing out the right tire and then finally the left one. The aircraft swerved off the runway and hit a ditch 3½ feet deep and 5 feet wide. This sheared the right main gear. The aircraft then hit a mound of dirt 10 feet high. Here the flight ended.

Cause factors? Multiple.

The pilot's previous jet experience was in F-86Ds. In that type of aircraft it is standard procedure to begin braking action as soon as the speed goes below 100 knots. Probably as a result of stress and channelized attention, he reverted to this well-established habit pattern and began braking action at slightly under 100 knots, causing tire failure and loss of control. (Granted, the ditch and the mound of earth just shouldn't have been there. But they were.)

The comment by the Aero-Medical Safety Division, regarding this accident, is interesting:

"Concur with the flight surgeon in his evaluation of the pilot's action. With only one hour in this type aircraft, the pilot reverted to the procedures with which he was more familiar. The result was premature braking action which precipitated an accident. The problem of transitioning in a tactical unit remains a critical one. With rare exceptions, either the transition training mission or the operational mission must be neglected. Often both are compromised. Seldom are both adequately fulfilled."

This involves a plain and simple case of having to face the facts. You must keep in mind that this new airplane is different. Sometimes major differences even exist in airplanes of the same type.

When a technique becomes embedded through hundreds of hours of experience, the response is almost automatic. In order to change, it is necessary for the old response to be superseded by the new. This only can be done by extended practice in the new activity.

This habit interference cannot be considered forgetting. It is a built-in limitation which can be demonstrated in the laboratory as well as in operational situations. (Do you still reach for the clutch sometimes on your new automobile?) In conjunction with this, the use of simulators, cockpit trainers and other training aids can greatly minimize the effects of this limitation. It's simply a human characteristic. Learn to recognize it. Expect it. And live with it. ▲

THE ONLY reason that thing can fly is because it just doesn't know any better."

Ever hear that? Or—"Just like a bumblebee: Aerodynamically impossible!" I've been inclined to think this about several contraptions that parade themselves as airplanes. The more I look at them, the more I'm inclined to marvel.

How does an Air Force aircraft come into being? The answer to that is a story which might be called the "Life and Hard Times of a Dream."

A dream? Sure. Somebody had to have one before he started doodling on the drawing board. Or, if you don't like the expression, then call it an idea. An idea of something that was better than anything that had ever preceded it. A dream of an airplane that would far surpass the performance of those in existence.

By and large, the days of the one-man design have gone by the boards. It was fine for a time. But that was at the start, the threshold of the aircraft development era. A number of men had the courage and daring to risk their lives on a dream — the Wrights, de Seversky, Sikorsky, Martin—to name a few.

But it's rare that you hear the name of an individual associated with the overall design of a plane anymore. You hear of the "Fowler Flap," the "Davis Wing," but even these are old.

How about the "slab tails," the "flying tails" and all the other design features that you more or less take for granted? No proper name associated with them? No, because names tend to get lost in the maze of design, development and production.

For many of the improvements that have been made on your machine, nobody really knows just who had the original idea. But if you want a review of people who have contributed more than the common man, drive slowly through the Edwards Air Force Base, and look at the street signs.

But let's run through the birth and childhood of a new bird. Far oversimplified, conception starts this way. Air Force planners see the need for an airplane that will meet specific, strategic and tactical requirements, and bids go out for design. Of those submitted, several are selected for study. As much as possible must be known about the proposed aircraft and its potential before ever starting actual construction.

Will it meet the requirements laid down for it? Can it be built in the time allotted? Does it provide a maximum of safety, both on the ground and in the air? Can we maintain it? How long can we expect to operate it? Or, all summed up, is it a worthwhile investment for the Air Force?

All of this doesn't happen over one cup of coffee. Nor do just two or three people get in on the act. Before the first jig has been built, hundreds of people have studied the various aspects of the bird. Before the first plane has flown, thousands of people, both Air Force and hired contractors, have combed through details of design and potential.

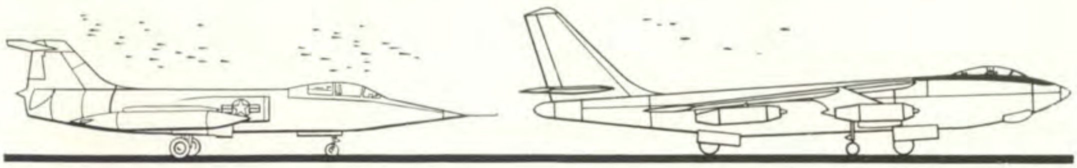
A Mock-up Board studies a full scale model of the proposed item for workability, suitability, safety and improvement. This board alone, involves dozens of people. Not only do the engineers look at the bird, there are represenatives from the Air Force Major Command which is expected to use it. It could happen that these would be chosen from the unit to which the first operational plane will be delivered.

Project officers are assigned to monitor the development of the fledgling, to study its potential and to plan its use. There are project officers in the Air Research Development Command, in Air Materiel Command, in Air Proving Ground Command, in the using command and in the Directorate of Flight Safety Research. Each officer studies his own area of interest. Finally, there is the Senior Officers Board representing Headquarters USAF to study the entire problem and to make final decisions on matters brought out by all interested agencies.

When the final nod is given, it reflects the considered opinion that, "This is the best we can do—based on what we now know." Only then does the building begin.

The key phrase here is "what we now know." We are going places where we've never been. On your first trip to the moon, you won't have a road map. And there is none here. During the actual construction of the

THE BEGINNING - - -



No airplane "just happens." Nor does any set of instructions pertaining to the operation and maintenance of that airplane. The detail and planning that actually goes into the development of an aircraft may surprise you. This story will give you an idea of how the program is set up and what happens to the bird before you get it in an operational unit.

first model, the builder will discover things that hardly anyone could have predicted concerning the actual finished product. Decisions must be made as to what to do. These are considered by members of the development board — again representing all interested agencies. At every step, tests must be made to determine if the slide rule was correct. The Constitution does not apply to a new airplane: It is guilty until proved innocent—on every count.

At every step, something new comes to light. As corrections, modifications, adjustments, substitutions and re-arrangements are made, the bird comes nearer and nearer to the big day—to that moment of truth wherein it will face the ultimate test.

Will it fly? By now there is little real doubt. It has undergone too many tests: Wind tunnel tests of components to be exposed to the blast; vibration and endurance tests; strength, shock, skid, temperature reaction tests and others ad finitum.

Despite all the plans and all the studies and all the tests, we must know what it really will do in the air, and to do this we use the so-called Phase Testing System. Flight testing of the aircraft is divided into eight separate parts. Each segment is a part of the overall test program and each has a specific objective.

Phase I

The designer said that it would fly and the contractor must have believed him. But before the first one can be "sold" to the Air Force, this has to be proved beyond doubt.

Phase I of the testing program is calculated to do just that. Called the "Air Worthiness and Equipment Functioning Phase," it is designed to show that the bird will fly and that all of its basic equipment will operate as per design. This is a responsibility of the contractor.

If you have ever wondered why a civilian test pilot always flies the first model, here's the reason. It is his job to determine air worthiness and to insure that the aircraft and equipment function and properly meet engineering specifications.

The initial flights having been made, the contractor turns the new bird over to the Air Force to meet its critical gaze.

Phase II

This gaze is not always easy to meet because the basic purpose of Phase II is just what its title implies: To check "Contractor Compliance."

This is the first Air Force flight in the new bird. It is conducted by

Specially instrumented F-86 uses booms on nose, tips and tail to find operational data for you.

test pilots of the Air Force Flight Test Center at Edwards Air Force Base. Usually, this phase is a short one. The basic requirements are to check performance guarantees and to determine the potential value of the aircraft to the Air Force. The fact that it is brief doesn't mean that little is done. It is common to expect a number of recommended changes from this phase. It is important that discrepancies be discovered now so that changes can be made before more airplanes are built. Thus, we gain time and better products.

Phase III

At this point, the testing routine is transferred back to the contractor. It is his responsibility to correct the kinks uncovered during Phase II. This, Phase III, is called simply "Design Refinement." Refinements and tests are continued until all required changes have been made.

Phase IV

Then comes one of the most important of all phases, as far as you are concerned, Phase IV. It is called the "Performance and Stability Testing Phase," and based primarily upon the results of this phase, data are furnished for the building of Dash Ones. The tests included are conducted at Edwards Air Force Base by pilots of the Flight Test Center.

This involves testing performance and stability characteristics in detail. Data are relayed to the Flight Data Branch for checking the contractor's figures. Information on control forces and deflections is passed along to aeronautical design groups. The Bible which pilots will use is on its way.

Phase V

Actually, there is a lot more to be done with this new machine. One of the big things you want to know is 'what is going to happen to the new bird and you when the weather goes lousy?' And to show you how much everybody else agrees with the necessity for your knowing, they've set up a special testing phase to obtain information and data on the flying and handling characteristics of the aircraft under adverse weather conditions. This phase is conducted by Air Force pilots at Wright Air Development Center, Dayton, Ohio.

Phase VI

The next phase is one in which you may be requested to participate, one of these days. It is called the "Functional Development Phase."

The tests include use of three or more first production models. Commands which will use the airplane, such as the Tactical Air Command or the Strategic Air Command, as well as the Air Proving Ground Command, are invited to send pilots and maintenance personnel to take part in

A civilian test pilot flies it first.

Phase II checks and modifies faults.

Phase VI tests. These tests simulate operational conditions on night, weather, maximum range, gunnery and other missions.

This phase usually requires about 150 flying hours per aircraft. The Air Force Flight Test Center project engineer prepares a report at the end of the test in which he sets up maintenance requirements, parts consumption and inspection times. This report also covers the adequacy of initial personnel skills and training requirements. Field commands use this report in drawing up their operating requirements.

At the end of Phase VI, if the Air Force Flight Test Center reports that the aircraft is a weapons system capable of doing a job, the Air Proving Ground Command determines how this weapons system can be used by a tactical unit. The AFFTC determines an aircraft's flying characteristics; the APGC determines an aircraft's combat capabilities.

Maintenance personnel participate in tests which simulate normal operational conditions.

Phase VII

The tests included in this phase are conducted by the Air Proving Ground Command. The phase is known as the "Employment and Suitability Phase"—or Phase VII. This is a test of tactically equipped airplanes to determine how they will perform under combat conditions. These tests are conducted at Eglin Air Force Base.

Phase VIII

Phase VIII—"Unit Operational Employment Testing"— also is monitored, but not conducted, by the Air Proving Ground Command. Just as the phase title suggests, you are the guys who'll do the work. This phase includes testing and evaluating operationally configured equipment. This is accomplished at an operational base with personnel and equipment authorized in a squadron. This means simply that we try it out under everyday, operational conditions. The unit normally chosen to participate in these tests is the first unit to be equipped with the airplane.

Simultaneous Testing

Looking at the rundown of the various phases of the Flight Test Program, you may think that they happen in a one-two-three order, with each waiting for the preceding test to be finished. This is not necessarily true. It depends largely on the availability of airplanes.

The entire program is rigidly controlled and planned in detail to complete the tests with all possible speed, obtaining a maximum of information. Usually, the first eleven airplanes are designated as test items. While these may later go into operational use, they are scheduled initially for the flight testing program.

Obviously, Phase I should be completed prior to the beginning of Phase II. Phase III should be concluded prior to he beginning of Phase IV, but it is not absolutely mandatory under certain conditions. For example, if refinements are minor in nature, other testing can be initiated prior to completion of all the refinements being made by the contractor. By this time, the assembly line is picking up speed and new birds are coming off. As fast as they are made available, they go into the various phases of testing outlined above.

While Phase IV is in progress at Edwards Air Force Base, Phase V might also be going on at Wright-Patterson. By the same token, Phase VII might be started at Eglin and the boys at Edwards would be shaping up to run the Phase VI tests there. It is a closely knit operation with information being interchanged on what nearly amounts to a daily basis.

The experience of all the testers is furnished to the Flight Data Branch which is the agency responsible for the contents of the Pilots Operating Instructions—the Dash One. The long and short of it is just this: By the time the new bird has been in the field for a couple of months, it has been tested for about everything there is to test it for. To that extent possible, the "bugs" found by test have been ironed out, and you are given a pretty good idea what to expect in your Dash One.

For some, it may be nice to know that all of these tests are voluminously documented. If you have a need for proof, it is available.

So it really isn't "aerodynamically impossible." It's the calculated refinement of a dream. And although the lead sled you happen to be driving at the moment may not seem to fit right into that description, there was a time when we could actually say, "This is our best—based on what we now know." ▲

How will it perform under combat conditions? The test of a tactically equipped airplane.

Many come but few are chosen. That a plane is built does not guarantee its acceptance.

Capt. Elmer L. Barnes
38th Air Rescue Sq (MATS)

WE WERE FLYING one of those strange and peculiar beasts known as an SH-19B type helicopter. I've probably had as much experience as the average 'copter pilot, considering the number of years I've been flying these airborne windmills. I have served as an instructor pilot and test pilot at the helicopter school, and I've had many hours of operational flying, plus 135 combat missions in Korea. Needless to state, inexperience is not a factor in this particular story.

The flight started as one of those that promised to be two hours of pleasant flying, but as you will see, it didn't work out that way.

Another qualified chopper pilot and I filed a local flight plan (I was acting as IP) and after proper briefings, preflight and checks, we took off.

As our flight progressed, the pilot, who was in the right seat of this pulsating piece of mass-produced nightmare, made an approach to a landing at one of the small liaison landing strips located on this base. As we came to a hover, one of those little idiosyncrasies related only to the helicopter, made its presence known. Thi item is known as a one-to-one latera beat. Layman language would describe it as being a sidewise shuffle; one shuffle per rotor revolution. It attracted my attention and I became interested in finding its cause. The other pilot—still doing the flying—made another takeoff and we proceeded to another landing strip. Again we made an approach to landing. As the approach was started, this one-to-one beat became active again. At the end of this approach, we landed.

Valuable asset of the "Chopper" is the rescue sling/hoist assembly designed for inflight pickup.

I decided to take the controls to try to find the cause of this one-to-one beat. (One of the causes of this type of beat can be a malfunctioning blade damper on the rotor head.) A check was made and I found that one of the dampers was not in phase with the other two. This condition is not considered very serious and my chief interest was to try to isolate it.

After I had made this check I decided to try another of a different type to see if the lateral would appear in this one. This check was to be a short field takeoff. I proceeded with the takeoff and found that my pitch and throttle controls had reached the limits just as I had attained my r line power. In the SH-19B type helicopter, at least 44″ Hg should be available, if needed, although the red

OUT
Elow

Just how much experimenting should one do to find cause of one-to-one lateral beats in flight?

line is at 39.5" Hg, because of structural limitations.

(One thing I wish to bring to your attention is that I now have much "hindsight" to guide me in writing this article—while the flight was being flown by "foresight.")

Finding that I had runout of control on my pitch and throttle caused me to forget all about my little one-to-one beat that I was tracking down. This new condition caught me by surprise and I changed my type of check to find the cause of my new dilemma. I immediately thought my rigging was off. One of the checks for rigging is to perform an autorotation to see if the rotor RPM in the autorotation is as it should be. In this case, it was. After this was completed, I came to a hover and made another short field takeoff. Again, I found that my control on pitch and throttle had reached their stops at red line power.

None of these conditions impressed me as being serious enough to return to base immediately and land, to find out my troubles. I had encountered the one-to-one lateral beat many times in my course of helicopter flying. The control limitations still allowed me to obtain all the power that I was permitted to use, except in *emergencies*. I decided to continue the flight as planned and at the end would write up my findings and let maintenance find my trouble.

At the end of about an hour and 15 minutes of flying we decided to return to our base. I intended to demonstrate a downwind approach to the other pilot—who was also an IP. The wind at this time was reported by the tower to be from the NNE at 10 knots. Indications on the ground were that the wind was from the SW at about the same velocity.

The approach was started on a heading of NNE and was a good one until about the 75-foot altitude was reached. The chopper started a rapid rate of descent and I noticed I was overshooting my intended landing spot. By this time I had applied all my available power and found that I could not reduce my rate of descent fast enough to stop the chopper in time to avoid striking the ground before I intended to. The terrain ahead was rough and overgrown in tall grass. I therefore started an immediate turn, hoping to get into the wind in time to stop my rapid fall and also to stay out of the rough ground ahead.

I turned to the right because in helicopters a right turn will provide a small amount of additional power, since the turn is being made with torque. Before I could stop the descent and level the chopper, it struck, causing the right main landing gear to break off.

After the accident had occurred, it was found that the carburetor air door was partially closed due to a malfunction of the linkage system which caused a restriction of the amount of air that could flow through the opening.

What was the cause of this accident? Was it caused by my putting the helicopter into a condition which I was unable to recover from? I had performed this maneuver many times before and always had recovered, with power to spare.

Was it caused by the fact that not enough pitch control was available when it was needed? Was it caused by a sudden shift of wind? Was it caused by the malfunctioning carburetor air door? Or, was the cause a combination of all these conditions?

No matter what caused this accident, one thing could have prevented it: A *precautionary landing* when the control trouble was first found! If I had returned to the ramp and landed, maintenance could have given this "infuriated palm tree" a good look see and probably would have found my trouble before it was brought to their attention the hard way.

I have learned that a precautionary landing has never cost the government one thin dime on aircraft repairs. Take a lesson from me when you find a doubtful condition prevalent. Land that machine you're flying before you find that you are between the well known "rock and a hard place," and wind up with a mass of twisted metal to your credit. ▲

CROSS FEED

LETTERS TO THE EDITOR

★ ★ ★

Mister Contractor

Reference is made to the article "The Braking Point" in the December issue of Flying Safety.

This contractor studied the subject article with interest, since in normal business with your Command, this contractor comes in day-to-day contact with the author, Mr. Wm. M. Roberts.

This contractor is pleased to advise you of the excellence of the article and of the high regard of this contractor for the author.

The Frank G. Schenuit Rubber Co
Roy C. Neely, President

Thanks for the kind words, Mr. Contractor!

■ ■ ■

Little Red Blinker

I've read with much concern, both in your magazine and in civilian magazines, about the crowded airways which are caused by the limitation of the human eye in even the clearest visibility. Air Force and CAA Regulations will soon request pilot reporting of details on near mid-air collisions. It must be getting "hairy" and I, for one, hope that a solution to the problem will be made soon.

I am wondering, if by chance, your office and the Civil Aeronautics Administration have thought of the possibility of the old tail warning light which was installed on P-51 aircraft in the ETO during the "Brown Shoe" war. Here was a simple device whose weight was negligible on the aircraft. It consisted of a compact little radar set in the aft section of the fighter with a red blinker in the cockpit to warn the pilot that another aircraft was approaching from approximately 2000 to 3000 yards and was in the same line of flight.

A simple jink of the stick in any direction would make the warning light go out and the closing aircraft would not be in the same line of flight. It was an effective little gadget used primarily as a defensive tactic against an enemy fighter making a sneak attack from the rear. It could be used today to prevent midair collisions. At least it would get two aircraft out of the same line of flight, forward and aft, provided another compact set was installed in the forward section of the aircraft.

A red blinker, like in the old P-51, could warn of overtaking aircraft.

A green blinker in the cockpit could warn straight-ahead approaching aircraft.

It would definitely minimize the most dangerous head-on and "overtaking" hazards. Lastly, it would facilitate those near mid-air reports that you and CAA will soon be asking for.

The device is a simple electronic gadget designed for F-51s. Also I believe it parallels the same principle of the old radio compass.

In summary, the gadget is effective, is of negligible weight and will certainly augment the over-taxed eyes of pilots flying in a crowded sky.

Maj. Lucius G. LaCroix
3550th PM Sq (T-33)
Moody AFB, Ga.

I remember that gadget. We had the same thing on the P-38s. The airlines are evaluating a like principle.

■ ■ ■

Crash-Rescue Manual

This is in regard to the letter from Captain Byers in the December issue of Flying Safety. We, in ARS, also are interested in a crash rescue manual, but information indicates that one is not in the "works." A training aid does exist. It is AF Visual Aid Chart AFVA 50-8, "Emergency Rescue Information for Aircraft." This set of charts consists of 77 sheets, 33 x 40 inches in size. This is fine, but rescue personnel (including ARS, base crash-rescue and firefighters) need a *reference* manual.

It is hardly conceivable that anyone could memorize all the crash-rescue information for each type of aircraft. I believe that all organizations that have a requirement for a crash manual should make their needs known to the Air Force through URs or letters. I know that ARS has, but it is only one organization.

Capt. Donald G. Jones
Hq ARS, Orlando AFB, Fla.

Several have written, in reply to Captain Byers' inquiry by referring to the set of charts designated as AFVA 50-8, "Emergency Rescue Information for Aircraft." In fact, a set has been presented to this office.

As to your suggestion for a crash manual for each organization, it's a good one, Captain!

■ ■ ■

From the Navy

We read with a certain emotional 'pang' the article in the September issue of Flying Safety by Lt. Col. Mitchell J. Mulholland, entitled 'Oops—Wrong Switch.' It presents vividly the problems we are faced with solving here at the Navy Electronics Laboratory. I am sorry that the Colonel did not mention that much intensive work is in progress, which aims at eliminating the problems confronting the human operator in the performance of his flying duties. The troops, especially the younger 'Tigers,' should be acquainted with this fact.

Once more, our many thanks and best wishes for a continuing 'quality' publication.

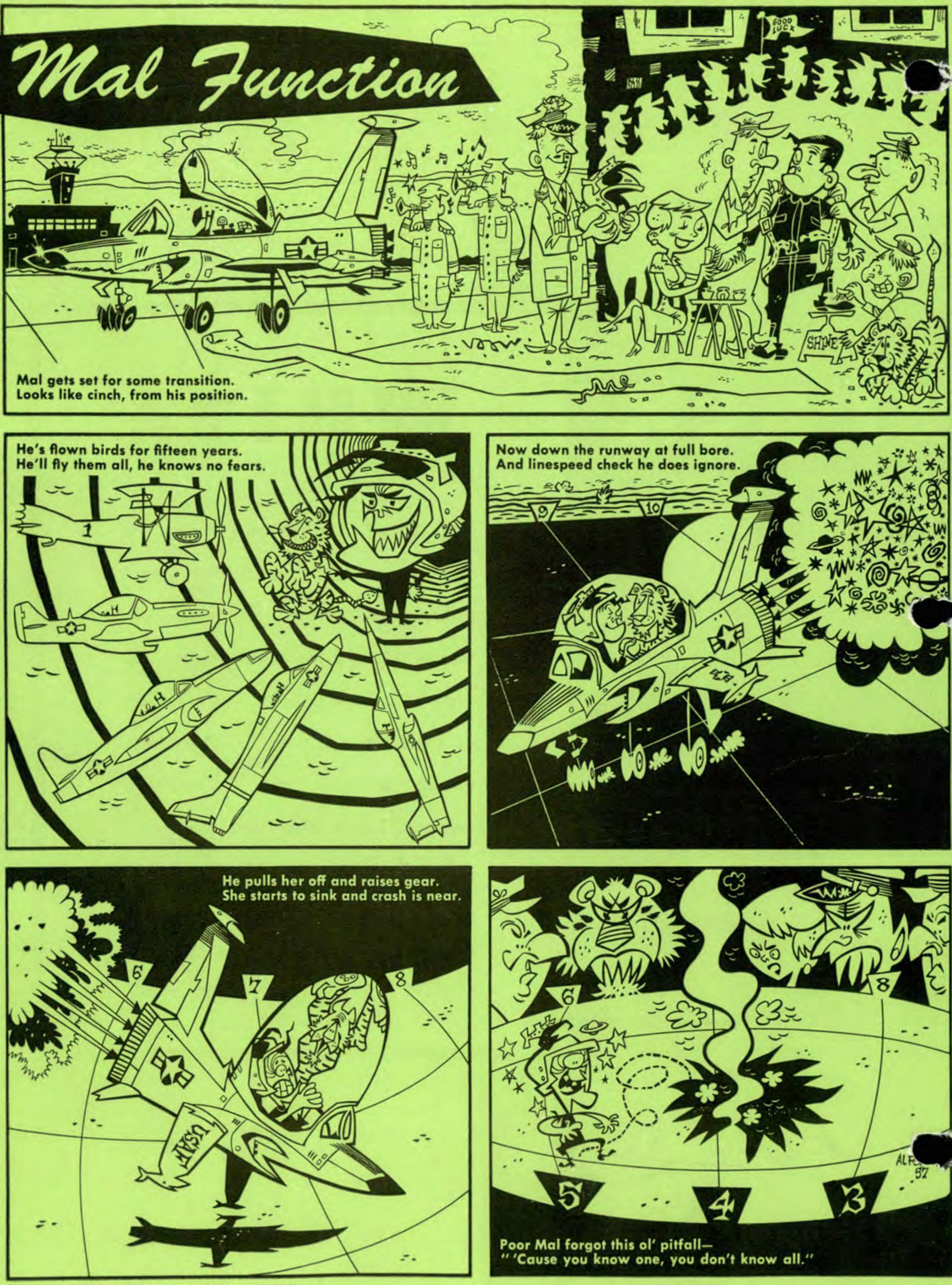
Lyle E. Hufford (1/Lt USAF, Ret.)
U.S. Navy Elec. Lab
San Diego, Calif.

Good to know that things are being done to cut down on some of the problems. And, thanks for the pat on the back regarding FLYING SAFETY.

It's all down in

BLACK and WHITE

Yes, it's all in black and white. The figures show that transitioning to a different aircraft is the time when you're a patsy for an accident. You may be a high-time type with years of experience but when you check out in that new bird . . . you're a student. Learn your task well and prove that the transition from one aircraft to another need not contribute to the aircraft accident toll.


Mal Function
GOOD LUCK
SHINE
Mal gets set for some transition.
Looks like cinch, from his position.
He's flown birds for fifteen years.
He'll fly them all, he knows no fears.
Now down the runway at full bore.
And linespeed check he does ignore.
9
10
He pulls her off and raises gear.
She starts to sink and crash is near.
6
7
8
USAF
6
8
5
4
3
Poor Mal forgot this ol' pitfall—
" 'Cause you know one, you don't know all."