PILOT ERROR:

A discussion of causes and some cures

by GEORGE I. LeBARON, JR., M.D. / AOPA 340741

■ ■"Pilot error" is an ambiguous term that translates into failure of the pilot to cope with the demands of flight.

As prudent pilots, we attend refresher courses, fly frequently enough to keep proficient, play the "rating game," and vow to avoid a stall/spin situation. Having done all of these things, we feel better and we say, "It won't happen to me." Then a pilot we know is killed in an aircraft accident, and our confidence is ruffled.

Our pilot friend often fits one of two categories. He may have been a fellow we suspected might have an accident because his attitude was known to be disrespectful of the risks; perhaps he hurried or took chances. In any event, we weren't too surprised. Or he may have been a "pilot's pilot," with all the ratings, highly regarded by his peers.

In the latter case, our first reaction to news of the accident is one of disbelief. Then we ask: Why?

Sometimes there is no answer, and we conclude that it was just bad luck—accidents happen to the best of men.

But sometimes we make a startling discovery. Our hero had deviated from his usual pattern of careful piloting. He had not filed a flight plan or even checked the weather before departure. No wonder his aircraft disintegrated in a thunderhead. Then why didn't he turn back—that simple 180—when he encountered severe weather?

Simple omissions, such as failure to file a flight plan, confirm the truth of pilot error accidents: the pilot should have "known better." It is the "dumb" nature of these accidents that confuses the careful pilot and at the same time leads him up the primrose path to the belief that it can't happen to him.

Have we overlooked something in pilot education? Some people think so, and they call it self-awareness—the conscious process of thinking about what we are doing.

Flight-training curriculums don't include information about human limitations in the area of thinking. Rather, they teach facts of flight, air regulations and piloting skills. The emphasis of these programs is on getting information into our heads; they do not deal with the problem of assuring that this information will be available when we are under stress. Nor does flight training deal with the psychological stress of flight itself, or the problem of input overload. It assumes that with repetition and practice a pilot will be equipped to handle any emergency.

Getting information into our heads is only half the battle; the other half is having it available when we are under stress. We need to practice simulated emergencies, but we must remember that there is a wide gulf between simulation and the real thing.

Let us look at airline pilots, among the most proficient airmen aloft today. Their skills stem from constant relearning and overtraining. But what happens if an element of complete surprise is introduced?

A study was undertaken by one of the major airlines, using a simulator. The captain was instructed to fake unconsciousness, as if he had had a heart attack. The simulator "crashed" in 25 percent of the initial tries because the copilot failed to recognize the situation and respond appropriately. The copilot forgot to fly the airplane first and deal with the captain's problem later.

This experiment illustrates my basic premise: that pilot error can be the result of an impairment in capacity to think, as well as a lack of proficiency. Our last hour of flight offers no guarantee for the next hour, since how we fly depends on how our "thinker" is working.

Accident Research

Accident researchers have casually assumed that accidents are psychologically motivated and are, perhaps, a kind of subconscious "suicide." A study of fatal single-car auto accidents showed

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that many of the drivers involved were intoxicated, but, in addition, they often had a prior pattern of either belligerence or depression. No such clear picture has emerged from the study of fatal aircraft accidents; however, it must be remembered that flying is a much more complex activity than driving, making the two difficult to compare.

Since it is difficult to draw valid conclusions from a retrospective study of fatal accidents, a study of nonfatal auto accidents has been made. Melvin Selzer, M.D., and Amiram Vinokur, Ph.D., of the University of Michigan's Highway Safety Research Institute, examined 274 drivers involved in nonfatal accidents. They found that transitory life stresses, such as serious worry over marriage, job, money, or health, had often occurred in the 12 months preceding the accidents.

Other studies have suggested that the auto accident rate for persons experiencing a divorce doubled during the six months before and after the divorce.

We need not conclude that any of the people involved in these accidents were "mentally ill," or that unrecognized "suicidal" intentions were present. We can speculate, however, that they were emotionally stressed by personal problems. On the basis of these studies, we postulate that personal stresses produce an impairment of perception, organization, anticipation and reaction—in short an impairment of thought—that can lead to an accident. Furthermore, the victim is often unaware of this impairment.

Stress and Flying

If everyday stresses can impair the thinking required to drive a car, these same stresses can also impair the more complex thinking required to fly a plane. Flying is itself a uniquely stressful activity, requiring constant alertness, clear perception, orderly thinking, and anticipation in dealing with navigation and potential in-flight emergencies.

Studies of a pilot's blood pressure, pulse and respiration during a routine flight reveal the tension generated by various flight maneuvers such as takeoff, course correction and approach to landing. During these periods the pilot is in a state of "arousal"—a readiness to act. His blood pressure and pulse can reach unusually high levels in anticipation of a maneuver such as an approach to landing, and then return to "normal" levels when he is finally on the ground.

As a pilot is exposed to increasing stress, such as multiple in-flight emergencies, he may reach a point of hyperarousal or "input overload." His thinking may become so impaired that he cannot control the aircraft. It has been shown that, as arousal increases, efficiency in performing a complex task (such as flying) improves up to a point and then rapidly deteriorates.

Stress and Thinking

As stated above, flying is stressful as measured physiologically, and while the capacity to think is improved by some stress, it can be impaired by too much stress. Now let us see how flying an aircraft affects the three levels on which human beings think.

The highest level is abstract, or *creative*, thought, and it involves a synthesis of new ideas. The mental

arousal of flying and the creative-thinking process are incompatible. Simply stated, pilots do not compose poetry while making an ILS approach. Flying may offer the inspiration, but the creative effort come later when the pilot is back on the ground.

The second level of thought is *reflective*, and it is compatible with flying. Reflective thinking compares past learning with the present situation and the available alternatives. It includes perspective, or the capacity to take some distance from our situation in a relatively detached manner. It occurs when we are under the stress of a demand situation but have some time available to reach a decision. Flight planning, navigation and in-flight emergencies all involve reflective thinking.

The third level of thought is *reactive* and is reflex-like in character. It takes place quickly, without conscious thought, and is involved in such "seat of the pants" skills as stall recovery and basic flight maneuvers.

We are engaged in both reactive and reflective thinking, in proper balance, when we fly. However, as pressures (emergencies) mount and input overload occurs, reflective thinking can be impaired. At this point, reactive processes take over, and regression to primitive levels of behavior can occur, leading to panic and total immobility. Thus, the fatal stall/spin situation may represent failure of all learned responses and regression to a primitive reflex of self-preservation, such as freezing on the controls.

No other flight experience teaches the distinction between reactive and reflective thinking as well as an introduction to aerobatics. Initially, the student anticipates unpleasant sensations and attempts to "shut off" his perceptions by tensing, squinting, and hanging on. As he masters the situation, he finds his defensive maneuvers unnecessary and begins to "think" about what is happening and how to control it.

A pilot must learn how to enter and recover from a spin before he can think objectively about his sensations during the spin and count the turns. When he can count the turns and recover on heading, reflective thinking has begun and fear has been mastered. Spin training and other aerobatic maneuvers can teach us much about our response to surprise. Spin training is unlikely to help a pilot who spins at 300 feet, but since spins can cause fatalities, they should be experienced and understood by the prudent pilot.

Similarly, since wake turbulence can roll a plane, a few practice rolls might help us to think—as opposed to panic—if we should suddenly find ourselves upside down. These investigations should be carried out under the supervision of an experienced aerobatic instructor in a properly certificated plane.

Pilot Error Revisited

Unfortunately, aircraft accident investigations reveal little information about the pilot's state of mind. Interviews with his friends and family lean heavily on inferences and may not tell us very much about what actually happened. If we learn that the pilot's wife was in the process of divorcing him, or that bankruptcy was imminent, we can conclude that he was under mental strain. If he had not flown for six months, we would wonder about his proficiency. Still we would not know what actually happened.

Nevertheless, anecdotal reports of nonfatal aircraft accidents, and verbatim accounts of recorded radio transmissions, may offer clues to the pilot-error process. The reports that have come to my attention lead me to believe that a pilot's logical thinking processes often become severely impaired immediately prior to an accident. Furthermore, the cause of such impairment is often an in-flight emergency or "surprise," compounded by other difficulties, that makes it impossible for the pilot to perform the most basic flight tasks. To suggest that the pilot used "poor judgment" gives him too much credit. Rather, it would be more accurate to say that, finding himself in serious difficulty, he first lost control of his faculty for thought and then, falling back on primitive survival instincts, lost control of the airplane.

This pilot may have been vulnerable to such a situation because of preoccupation with, or distraction by, some personal life stress, or because of fatigue or a lack of proficiency—any one or all of these. We must conclude, also, that the pilot was largely unaware of his deteriorating capacity to think as the pressure mounted.

Hypoxia, drugs and alcohol produce severe impairment of thinking capacity. Studies in both simulators and aircraft support the conclusion that any of these factors, acting in a relatively small degree, will impair the thinking of even the most experienced pilot without his recognizing his impairment or the approach of imminent disaster. Recent studies of psychological stress suggest that anxiety alone can produce a similar impairment of the thinking process. This hypothesis has yet to be scientifically tested in the aviation environment, but pilots have reported that it does occur and, if recognized, can often be controlled.

Consider the situation of a low-time private pilot lost above an overcast. After he called for help on a blind transmission, he was finally put in radio contact with a flight service station. The station tried to get a bearing on his location by asking him to depress his microphone button and count to ten. After the FSS failed repeatedly to obtain any transmission from the pilot, it was discovered that he was counting silently to himself, all the time believing that he was following instructions precisely.

Another lost pilot circled endlessly, until his fuel was exhausted, without even calling for help. Following a well-executed emergency landing, he was astounded by his lack of capacity to take any logical corrective action while airborne.

In yet another case, a lost private pilot was completely unable to follow a compass heading, even after he had been given a DF steer by a flight service station.

Panic Prevention

The simple truth is that we can do nothing about those problems of which we are unaware. For example, teaching people to relax depends first upon teaching them to recognize their own muscle tension. "Biofeedback" information systems use auditory or visual displays to relay data to the subject about

his pulse, skin temperature, and muscle tension. With this information, he is then able to exercise conscious control over physiological processes of which he is usually unaware.

Similar information about our *mental* processes can be made available to us through a technique called "cognitive self-guidance," and can be lifesaving. The technique consists of talking to oneself out loud, while carrying out relevant corrective action. Its application in aviation to control potential panic in an in-flight emergency has only occasionally been recognized by pilots who accidentally discovered it.

The technique is to give oneself verbal instructions at the first sign of an impending crisis. The self-instructions are simple and positive, and should be repeated aloud until the panic is controlled. The type of statement is: "Relax—fly straight and level—maintain airspeed—think—you can do it." As apprehension subsides, the pilot continues to do his thinking out loud, as if explaining his reasoning to an instructor in the right seat.

This method works because when we were children our behavior was directed by the words of adults. Similarly, when we were student pilots our behavior was directed by the words of our flight instructor. We are, therefore, highly sensitized to spoken words—anyone's—even our own. Further, it is virtually impossible to initiate speech without thinking, and hearing our own voice helps reestablish the biofeedback loop necessary for self-awareness.

Summary

Flying an airplane requires constant alertness, orderly thinking, and a plan for alternative action. Consequently, piloting involves a fairly high degree of necessary mental arousal. But pilots are also vulnerable to events that can impair their capacity to think. Pilot-error accidents are likely to consist of four basic ingredients: (1) life stress (worry, fatigue or illness); (2) flight stress (lack of proficiency or preparation); (3) in-flight emergency (surprise); and (4) impaired thinking (panic).

Stresses of everyday life are common to everyone; however, we should have them under control before we climb into an airplane. The stress of flight itself is controlled by maintaining currency and proficiency. An in-flight emergency always comes as a surprise, but it is a situation we have been taught to anticipate, if we can use the knowledge we have acquired. Impaired thinking in emergency situations—panic—can be prevented if we remember to "talk ourselves through" the crisis.

Let us remember that the last hour we flew offers no guarantee for the next hour we fly, because we all have human limitations. However, currency, proficiency and knowledge of our limitations will make that next hour a lot more predictable. □