FLIGHT SAFETY FOUNDATION
Accident Prevention
Vol. 46 No.7 *For Everyone Concerned with the Safety of Flight* July 1989

A Tool For Communication

Using the "challenge-and-respond" method of working the checklist encourages clear communication in a multi-pilot operation and lessens the chance for error.

by

Donald Wilson

Professionalism in the corporate cockpit has come a long way in the last decade. Such things as unqualified copilots, barnstorming mentalities, no training and poor maintenance have become more the exception than the rule.

A lot of influences can claim their share of credit for prodding improvements along in this maturing process. Among them are the corporate training companies, the air carriers, industry periodicals, trade associations, a lot of outstanding individuals and government agencies. As a result, there are very few lonesome cowboys left out there driving their jets around the country with some kid in the right seat, neither of them knowing their aircraft or the regulations. Today, a casual observer poking his head into a corporate cockpit almost invariably finds two highly trained and well-prepared individuals operating their aircraft and interacting with the system and with one another in a consistent, effective way.

Now that pilots have learned the value of training, procedure and conservatism, it is widely agreed that the ripest area of opportunity for improvement in aviation safety (in all cockpits, not just corporate) is the area that the experts have labeled "human factors." Human factors is as clear a name as could be given to the study of how one's human limitations put up barriers to safety, and what one can do to protect himself against them.

Defining The Categories

The name "human factors" paints the issue with a broad brush that covers a number of categories of problems. Among them are mental and physical readiness, machine-human interface, resource management and communication. Digging deeply into any one of these areas provides a wealth of prospect for improvement.

The human factor issue that seems most prevalent is that of communication. The potential for error exists in many exchanges in and out of the cockpit. The aviation business is so communication-critical that it is amazing how cavalier pilots can be about it. Complex communication systems are set up involving relaying information through many individuals before it reaches the end user; it is assumed, without reason, that the recipient of data is ready to receive it at any time; only partial information is given, expecting the receiver to fill in the gaps; pilots knowingly say what they do not mean; pilots mumble and in general, act as though communication were something simple and automatic. In fact, it is not.

There is no place where effective communication is more critical than in an aircraft cockpit. Lives literally depend on it, and yet, so many pilots approach communication in the cockpit no differently than they approach it on the ground.

But the full issue of effective communication is too big a subject to tackle in one discussion. This article focuses on one specific, practical communication problem that a pilot faces several times on every flight. The problem is that of assuring each pilot that the critical processes involved in flight have been completed and, more to the point, communicating this assurance to each other. The tool used for this is the checklist.

Communicating Via The Checklist

The checklist has been around a long time. It would be interesting to know just when it began to be used, but at some point in time, a pilot realized that the machine was getting too complex for the crew to remember everything. Some notes were made for reference, and the checklist was born. It is now a common tool found in the flight manual of every certificated aircraft and hopefully, in the cockpit as well. U.S. Federal Aviation Regulations (FARs) even go so far as to designate for turbojet aircraft what phases of flight require a checklist. For those aircraft, if a pilot does not at least have a checklist in the cockpit and use it in some way, he is operating illegally.

Although the value of the checklist is well recognized, there is very little guidance given to the user as to how to employ it effectively.

For the single pilot, a checklist provides him with personal assurance that he has completed all the tasks required to prepare for his flight. In a multiple crew member environment, the checklist takes on an added dimension. If both (or all) crew members are to be sure that everything is done, each crew member must either refer to the checklist personally or trust another crew member to complete it.

It does not take much depth of thought to realize that it is impractical for each crew member to review the checklist personally after each phase of flight. The whole purpose for having a second crew member is to ease the load on the pilot doing the flying and allow him to concentrate on his work. How can the pilot flying be assured that his after-takeoff items, for instance, are complete? The logical solution is communication. It should be one of the most important responsibilities of the pilot-not-flying to effectively communicate his review of the checklist to the pilot flying.

Detecting Weaknesses In The Use Of The Checklist

Here is an example of an operation whose checklist procedure was a real problem. The attitude from the top was that it was the copilot's job to review the checklist and, essentially, that any attempt to communicate each item to the captain was an unnecessary distraction. Management's philosophy was that the pilot in the right seat was qualified and experienced, and that the pilot flying should be able to depend on him to check the items, thus freeing the person in the left seat to concentrate on guiding the machine.

Although it was company procedure for the pilot flying to call for the checklist and for the pilot-not-flying to announce when it was complete, things had deteriorated to the point where the left-seater just assumed that the right-seater had done the checklist at the appropriate times. It was not unusual for whole checklists to go undone.

Another example occured at a hangar, when one of the airplanes rolled in from a routine trip. After the passengers were sent on their way, maintenance noticed a significant wrinkle in the skin of the fuselage just aft of the retractable landing lights. In fact, one light was not fully retracted. After all the denying and blame-tossing were over, it became apparent that the landing lights had not been retracted following the last takeoff until at least 50 knots over their indicated airspeed limit, thus wrinkling the skin and damaging the retraction mechanism.

Given this operation's philosophy and procedure, the blame should have been laid squarely on the right-seat pilot. But in this case it was not. Why? The copilot on the leg in question was the chief pilot! His solution: a procedure memo prohibiting the use of landing lights for day takeoffs.

The point of this example is that it shows a weakness in the checklist philosophy that has been repeated over and over in discussions with corporate operators. This qualified and experienced chief pilot was human. Accordingly, he was subject to the whole gamut of possible failures known as human factors.

Using "Challenge and Response"

This idea of communication between pilots during the execution of the checklist, taken to its most effective degree, is usually called "challenge and response." The safest operations use at least some form of this technique.

The term "challenge-and-response" defines itself. It is a technique in which the person reviewing the checklist "challenges" both himself and the rest of the crew to prove, in a sense, that each item is complete. He does this by reading each item aloud and then checking the item and getting some sort of "response," indicating that the other crew member has also checked it. Then and only then, does he move on. The major complaint voiced when this system is suggested is that it is too distracting to the pilot flying. One particular captain thought that the whole idea was "dangerous."

If this experienced gentleman had been willing to give the idea an objective try, he would have found that is it not the distraction it seems to be. It does involve, however, a change of habit if one is not used to it, and changing habits does involve effort.

A passionless and open-minded evaluation of the challenge-and-response concept should involve a clear statement of what the system requires of each pilot. The main requirements of this method for the non-flying pilot are merely that he slow down a bit and make an effort to be clear. There is very little opposition to this part of it. This should not interfere to any significant degree with the copilot's other duties. There is no reason that he cannot maintain a vigilant traffic scan or handle radio calls while he does this.

Understanding The Demands

The majority of the resistance to this system is related to its demands on the pilot flying. Challenge-and-response expects the pilot flying to divide his attention between manipulating the controls and checking the items as they are read. Typically, the first time a pilot has a heavy-weather or high-traffic-density departure, he wants to throw this system out the window in favor of leaning on the copilot. But these kinds of busy departures and arrivals are the very times when an operation is most open to error.

If crew members think about it, challenge-and-response asks only that the pilot flying do what he should be doing anyway. The checklist is designed to be used at appropriate times; that is, if workload requires, it should be suspended until it can be done properly. But under all-but-rare circumstances, implying that it is unsafe to expect a pilot to operate and check his systems while at the same time accurately maneuvering the airplane is to say that he needs some proficiency training. If the captain of a two-pilot airplane cannot safely check and respond to each checklist item as it is called, then certainly an aviator in a single-pilot airplane should not be trying to use his checklist at all. Surely this is not the case.

Whatever method is decided upon for executing the checklist in a multi-pilot operation, it should be decided with the understanding that the checklist is a tool designed to shield the pilot from his propensity for error. If the tool is used by only one pilot, it takes only one human error to lead to trouble. No matter how capable, how experienced or how trained a pilot is, he is still only one human — relatively easily preoccupied, distracted or tired out. If two pilots are involved, both must make the same mistake in order to get into the same trouble. This doubles the margin against error. ♦

Shoulder Harness Restraints Considered

A recent report detailed what it would take to make shoulder harness restraint systems second nature to general aviation. The statistics alone should make everybody believers, says the author.

by

Allen K. Mears

". . . pilots were questioned . . . concerning their preference for purchase of aircraft safety equipment. Over 75 percent indicated they would choose some item of safety equipment other than a shoulder harness retrofit (1)."

This disturbing finding is cause for concern because it reveals that too many general aviation pilots are putting personal survival far down their individual priority lists. Statistics show that a shoulder harness restraint system

should instead be placed at the top of that list.

The U.S. National Transportation Safety Board (NTSB) study of light aircraft accidents for 1972-1981 (2), showed there were 36,466 such accidents. Of the 75,596 occupants, 18,614 were killed or seriously injured. The NTSB concluded that many of those fatalities and injuries could have been prevented had shoulder harnesses been installed and used.

To quantify their findings, the NTSB did a tightly focused study on 535 accidents that occurred in 1982. The study showed that 40 percent of the aircraft had shoulder harnesses installed, and 40 percent of those were in use at the time of the accident. That means that only 16 percent of the victims were wearing a shoulder harness restraint system. The NTSB's analysis showed that 82 percent of the victims would have benefited from using such a restraint system. Of those who died, 75 percent would have been saved by the system.

By any approach, the cost benefit analysis shows that installing a shoulder harness restraint system — and using it at least during takeoff and landing (but most safety experts recommend using it all the time from prestart checks to shutdown), will greatly improve your margin of safety.

Federal Aviation Regulations (FAR), Parts 23 and 91, require shoulder harnesses in small civil airplanes manufactured after July 18, 1978, and Part 23 was further amended in 1986 to require them for seats in aircraft with less than nine seats. Owners of pre-1978 aircraft should contact their manufacturer's representatives and install a retrofit kit. Prices on most aircraft run from $400-700 (for both front seats) for the shoulder harnesses and inertial reels. That's money well spent. ♦

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References

(1) Parker, J.F., Jr., Christensen, D.G.: Development of an Intervention Program to Encourage Shoulder Harness Use and Aircraft Retrofit in General Aviation, Federal Aviation Administration, Office of Aviation Medicine, May 1988.

(2) NTSB/National Transportation Safety Board: General Aviation crashworthiness project: Phase two — impact severity and potential injury prevention in general aviation accidents (PB85-917002/NTSB/SR-85-01). Springfield, VA. National Technical Information Service, March 15, 1985.

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