

HUMAN ERROR:

A Manageable Certainty

By their very nature, humans make mistakes. Therefore, it should come as no surprise that in many FAA and NASA studies, human error is implicated in 70% to 80% of aviation accidents.

By Michael W. Sedam, Pilot/Safety Officer, California Highway Patrol, Central Division Air Operations Unit

On Oct. 10, 2001, a Cessna 208 took off from an airport in Alaska with one pilot and nine passengers on board. Shortly after takeoff, the airplane pitched up, rolled 90 degrees to the left, yawed and then crashed into terrain killing everyone on board. The probable technical cause of the collision was ice on the upper surface of the wings. However, it could be argued that human error was the underlying cause of the crash.

Although the airplane had remained outside overnight in freezing temperatures accumulating snow and frost, neither the employee that de-iced the aircraft or the pilot physically checked to ensure there was no ice on the wings. An understanding of human error and a systems approach to reducing human error could have prevented the crash.

While human error can be a difficult concept, it is extremely important because mistakes will always be made. Since aviation is not as forgiving of errors as other occupations, we must focus on understanding the nature of human error and how error can be reduced at the individual, crew, unit and organizational level. The purpose of this article is to discuss human error and a systems approach to reducing human error.

WHAT IS HUMAN ERROR?

Errors are activities that fail to achieve their intended goals. Errors differ from violations, in that violations are willful, conscious decisions to disregard policies and procedures that govern safety of flight. A pilot who commits a violation consciously knows that what they are doing violates safe practices.

Errors are much more difficult to pinpoint because pilots who commit errors do so unknowingly. James Reason (1990), the author of *Human Error*, describes three basic error types: Skill-based, rule-based and knowledge-based.

Skill-based responses are mostly physical responses that take little thought. For instance, as a pilot becomes more skilled, banking the aircraft does not necessitate a thought process, but merely requires hand-eye coordination and the physical skills developed through practice. Skill-based errors occur when skills are not sufficient for the particular goal-oriented task.

Rule-based responses are based on the rules that govern particular actions and are largely automatic, similar to skill-based responses. For example, Federal Aviation Regulation requirements, departmental policies and unit standard operating procedures are all sources of rules. Rule-based performance requires knowing what the rules or procedures are for a given situation. In situations where skill or rule-based responses are required, pilots usually refer to problem-solving routines, which are based on procedures, practice and rote memory. Rule-based errors usually occur when the rules are either not known, or the situation is misinterpreted and the wrong rule is applied to the situation.

Knowledge-based responses are required with more complicated issues that are unfamiliar to the pilot or crewmember. A knowledge-based response requires an analytical process and stored knowledge. Knowledge-based responses place substantial importance on the ability to process information. High-stress, unfamiliar situations have resulted in a lack of human performance and mistakes being made with disastrous results. Knowledge-based errors can occur when the crewmember lacks the knowledge of a rule or procedure to handle a situation.

Problem solving requiring a knowledge-based response can result in focusing on one aspect of the problem while ignoring others. An example of this type of behavior would include concentrating on an annunciator light and not flying the aircraft resulting in controlled flight into terrain. Another knowledge-based problem solving behavior includes giving attention to one problem after another without focusing or solving any of the issues.

In order to mitigate human error, it is critical to address the decision-making process. At the skill-based level, decision-making is somewhat simple. For instance, while on final approach the pilot observes that the aircraft is slightly off of centerline. The position of the aircraft relative to the centerline triggers an alert in the pilot who has observed the abnormal indication of being off centerline and the pilot initiates actions to align the aircraft with the runway. Law enforcement aviators do this daily without consciously thinking about it. If adjustments were not constantly being made at a skill-based level, the goal of landing the aircraft safely may never be reached.

Decision-making at the rule-based level is more intricate. Rule-based decision-making begins the same as skill-based decision-making in that the pilot or crewmember must be alerted to an abnormal situation and makes an observation. Prior to taking action, however, they must identify what is occurring, select the proper procedure from their knowledge base and then execute the actions to mitigate the situation. So long as the procedure is the correct one, the goal will be reached. Not knowing the correct procedure or selecting the wrong procedure could lead to an error being made.

Knowledge-based decision-making is much more complex. The pilot or crewmember must be alerted to an abnormal situation, observe what is abnormal about the situation, identify the issue, and due to the complexity of the situation must determine what the outcomes could be while they select and formulate a plan.

HOW CAN WE REDUCE HUMAN ERROR?

In the past, reducing human error has focused on the perspective of punishing the person who commits an error. Although still in practice throughout the law enforcement community, an individual approach to reducing human error is not nearly as effective as a systems approach to reducing human error.

Utilizing a systems approach to reducing error, such as ALEA's Safety Management System (SMS), can more effectively reduce error because instead of focusing on how to make a single person less fallible, energy can be directed toward a comprehensive system that targets the individual, the crew, the unit, and the organization. A comprehensive system such as SMS allows law enforcement to reach goals while still withstanding the operational dangers inherent in law enforcement aviation.

Instructor pilots can have a dramatic effect at the individual level of the systems approach to error management. Regular training flights and classroom sessions will move many situations into the realm where skill-based or rule-based decision-making can be used. Although in other technical systems there may be time for knowledge-based planning and

determination of likely outcomes, in many aviation-related emergency situations at low altitudes where law enforcement aviation takes place, time is of the essence. Training will allow pilots and crewmembers to apply skill and rule-based decision-making in dealing with situations.

A systems approach to error management will also account for a reduction in errors by realizing the importance of crews working together as a team. Crew resource management (CRM) is one way to reduce errors. Regardless of the make up of the crew, crewmembers must act as a team to reduce error. Although many aviation units utilize a pilot and flight officer crew as opposed to two pilots, non-aviator crewmembers are still highly trained and valuable resources for reducing error. Since errors are unintentional, it is usually very difficult for the person committing the error to notice that an error has been made, and thus the second crewmember is extremely important to error recognition. The relationship between crewmembers thus becomes very important.

Crewmembers must not only be individually trained, they should train as a team. This will help the crew to work as a team and improve communications since they will both be on the same page. Communication between crewmembers must be effective and efficient. Crews that communicate well can raise situational awareness and can improve the timely notification of errors so that the consequences of errors can be avoided. To improve communications, a crew can increase commands, increase inquiries, acknowledge each other, and verbalize the status of the flight.

At the unit level, standard operating procedures (SOP) have a tremendous impact on recognizing and reducing errors. Not only must the unit have SOPs, the culture of the unit should require the adherence to SOPs. Units that routinely disregard the requirements set forth in a SOP normalize deviant behavior that could lead to a mishap. SOPs are valuable because they set a baseline for performance. When deviations from SOPs are not normal to operations, any deviation will be cause for concern and identification of errors will be more easily recognized.

At the organizational level, management is a key to reducing errors. Management must be supportive of the unit's focus on safety over mission as a priority. Management can also support reductions in human error by understanding the importance of training and supporting the training of flight crews. Management should also be willing to shift from the focus on blaming individuals to focusing on a systems approach to reducing error. Management is a key issue to reducing error as the implementation of any error management system will be hindered significantly by managers who do not support or are indifferent to a system that reduces the chance of human error.

In summary, human error will happen. By understanding the nature of human error, realizing the consequences of human error, and taking steps to recognize and reduce human error, law enforcement aviation will be much safer. None of us are invulnerable or perfect. Errors will be made, therefore recognizing errors and taking the correct action is imperative to realize a safe outcome.

In the case of the Cessna 208, which took off with ice contaminating the surfaces of the wings, human error occurred. Although any one of the persons involved could have recognized the error, they did not. An unfortunate and tragic accident resulted. Human error is a certainty; however, tragic consequences of human error can be avoided with a systems approach to error management.