FLIGHT SAFETY FOUNDATION
HELICOPTER SAFETY
Vol. 20 No. 5 *For Everyone Concerned with the Safety of Flight* September–October 1994

The Pilot's Efforts Determine Simulator Training's Value

Good preparation and an understanding of simulator training fundamentals can boost pilot performance and enhance the overall training.

Joel S. Harris
FlightSafety International

The two airline transport pilot (ATP)-rated pilots had a total of more than 15,000 rotary-wing flight hours. Each pilot, a veteran military aviator, had been trained and had significant experience in the operation of the twin-turbine helicopter that they were flying. They were on radar vectors for an instrument landing system (ILS) approach and had been cleared to descend to the glideslope intercept altitude of 2,000 feet (610 meters). The automated terminal information system (ATIS) reported that the ceiling was 500 feet (152.4 meters) and that visibility was one mile (1.6 kilometers). The aircraft's autopilot was engaged and was certified to fly the helicopter on the ILS to an autolevel at 50 feet (15.2 meters) radalt (radar altitude).

A loud bang, and then a left yaw, were the first indications of a problem. The distinctive tone of the "engine-out" audio warning blared through the pilots' headsets. The captain reduced collective pitch to keep the remaining engine within operating limits. At the same time, the first officer (FO) pressed the "#2 ENG OUT" warning light to cancel the audio tone. Suddenly, the FO began gazing at the instrument panel's warning lights and indicators. He seemed mesmerized. Then, without saying a word, he turned to his right, looked at the overhead throttle quadrant, grasped the engine lever closest to him and pulled the number one engine lever to the "off" position. The aircraft immediately entered a pronounced left yaw and the engine-out audio tone activated.

The captain bottomed the collective pitch and entered autorotation. He applied aft pressure on the cyclic, slowing the aircraft to the recommended autorotational airspeed. The FO, recognizing his mistake, pressed the starter button for the inadvertently shut-down engine. After the restart, he moved the engine control lever to the full forward position and in a cracking voice told the captain, "You have full power on number one now." The captain began a successful recovery.

The simulator instructor sat quietly, and hoped that the impact of what had just happened would be absorbed by the two helicopter pilots. They had made some serious mistakes that they would probably never forget, and would probably never make again. During the postflight debriefing the instructor explained to the crew that the opportunity to make mistakes in a safe environment, and learn from them, is what simulator training is designed to allow.

Simulator training and checking are a growing phenomenon in the military and civilian rotary-wing communities. Modern

simulators can be U.S. Federal Aviation Administration (FAA)-approved for a pilot checkride, including initial or add-on ATP ratings, without the pilot ever having flown the *real* aircraft.

Pilots preparing for simulator training should know some basics that will make the experience more productive.

Types of Simulators. The FAA has designated eight levels of aircraft training devices (TDs) and four levels of simulators. TDs are typically task trainers or cockpit procedures trainers (CPTs) used to orient pilots to aircraft systems, cockpit configuration, "switchology" and procedures.

To be designated as a simulator, a device must have a motion base and a visual system that meet FAA standards. Simulators are designated levels A through D, with D the most advanced level. Level A and B simulators differ primarily in their degree of fidelity to the aircraft. Level C and D simulators have a 180-degree wrap-around visual display and specific ground-handling capabilities such as runway texture and feel. A Level D simulator also must have a daylight visual system.

Types of Simulator Training. Initial/transition training is usually provided to pilots who are new to a specific type of aircraft. For example, if a company purchased a new type of helicopter, it might send the pilots to initial/transition training. In this training, through classroom and simulator work, the pilot learns the aircraft "from the ground up." If the training takes place in a level C or D simulator, the pilot also can elect to have an ATP type-rating check administered in the simulator (if the simulator is FAA-approved for that check).

Recurrent/upgrade training is given to maintain proficiency, and is usually shorter and more in-depth than initial training. Recurrent training often includes checking. For example, a pilot taking recurrent simulator training may take an instrument competency check (U.S. Federal Aviation Regulations [FARs] Part 61.57) either during or after the training.

Both initial and recurrent training may involve a period of line-oriented flight training (LOFT). During LOFT training the crew is expected to operate the simulator exactly as if it were a real aircraft. Flight planning, air traffic control (ATC), weather and malfunctions are programmed to be as realistic as possible. One unique aspect of LOFT training is that the instructor is a passive observer who will not instruct or assist the crew. Most LOFT training is conducted as "no jeopardy" training — there are no pass-or-fail criteria. After the mission is completed (successfully or otherwise) the instructor assists the pilots in debriefing themselves.

Training vs. Checking. There is an important difference between training and checking. Training involves learning new skills or knowledge or enhancing and refreshing existing skills and knowledge. Most simulator time is spent training. It is important for the pilot to understand that perhaps the greatest value of simulator training will come from the mistakes that he or she makes while training. In aviation, unlike most other professions, learning by experience can have very serious consequences. An improperly executed autorotation in a helicopter can be costly — and deadly. In a flight simulator, however, mistakes harm only the ego. Many pilots may remember nothing of past training sessions except their mistakes. The same mistakes will probably not be repeated while operating the real aircraft.

Checking, on the other hand, means that the pilot is being examined as to his or her competence as an aviator. Various pilot checks are administered in aircraft simulators. These checks include FARs Part 135.293 and Part 135.297 checkrides, and Part 61.58 pilot proficiency checks and instrument competency checks. Initial-issue or add-on ATP type ratings may be earned in at least Level C simulators.

Progressive Checks. Some simulator operators have received FAA authorization to perform progressive checkrides. This means that the check is given during the training course, which may include several simulator sessions. To pass a progressive check, the pilot must reach proficiency in each required maneuver by the end of the course. If a pilot does not do well in a particular area, he or she receives additional instruction (time permitting) until able to demonstrate proficiency. There is less pressure on pilot performance during progressive checks, and mistakes are viewed as learning tools instead of "failures."

Other checkrides are given as discrete events, usually at the conclusion of the training center visit. These are pass-or-fail situations and have to be handled differently by the pilot. Making too many mistakes, or the wrong type of mistake, during a discrete checkride will result in failure. Knowing this may result in a type of checkride performance anxiety commonly known as "check-itis."

Some pilots tend to perform better during training sessions than they do during a checkride. If the instructor even mentions the "checkride," the pilot's pulse rate and blood pressure elevate immediately. Sweaty palms and a flushed look are sometimes accompanying symptoms of check-itis. Even those who are competent in the required maneuvers can lose their previously demonstrated ability when asked to perform the maneuvers in a checkride setting. Most instructors are familiar with this phenomenon and will take measures to ensure a relaxed, friendly environment to counter it. Many instructors favor progressive checks as a means of avoiding check-itis.

The first, and perhaps best, method to help overcome check-itis is to apply the maximum effort to master each required checkride element prior to the checkride. The self-confidence that accompanies proficiency goes a long way toward quelling anxiety. Individuals for whom check-itis continues to compromise their proficiency can benefit from the principle of compartmentalization.

All pilots make mistakes when flying the simulator. Pilots suffering from check-itis tend to focus on their mistakes to the exclusion of all else. Doing this distracts the individual from the current maneuver, which leads to additional mistakes. An instructor who recognizes this condition is likely to stop the checking (or training) to address the problem with the pilot. Nevertheless, the individual pilot must set aside past mistakes and focus on the current situation. Compartmentalization, then, is exercising the ability to focus on current or future events to the exclusion of past mistakes.

Other suggestions for overcoming check-itis include:

- Be prepared. Bring the necessary cockpit supplies, such as paper, kneeboard, pen or pencil.
- Reduce tension by making a conscious effort to relax. Sometimes taking deep, controlled breaths may help to relax.
- Remember, the instructor or checkairman's would prefer to pass you, not to fail you.
- Explain what you are doing. If you think you have made a mistake, explain it and ask to repeat the maneuver.
- Make sure that you know exactly what is expected of you. If you are not sure, ask for clarification.
- Do not believe that you have failed a checkride because the instructor is taking notes; they are probably for the debriefing. Most good instructors keep notes about the positive aspects of a pilot's performance as well as negative ones.

Preparation. Preparation is the key to success in simulator training. Jim Spillman, director of training at FlightSafety International's Sikorsky West Palm Beach Learning Center, said, "It's easy to tell if a customer has spent time preparing for a visit to the center. Those who have [prepared] often come equipped with a list of pertinent questions, and they are always better prepared to absorb the training. Instructors respond to the well-prepared pilot and are more willing to go that extra mile as needed. Preparation lets the instructor know that the individual cares, and this helps establish a good rapport between the customer and the instructor."[1]

A review of the rotorcraft flight manual (RFM) is highly recommended prior to training. Pay special attention to the normal procedures section because it deals with aircraft checklists and takeoff and landing profiles. Review carefully the limitations section and emergency procedures. Memorize all emergency "memory items." Review the aircraft systems and your use of the aircraft checklist. If you have your own checklist, bring it with you to training. The less you change your habits (assuming they are good) in training, the better you will do.

List questions that arise as you review this material. There is no better place to learn answers than at a training center.

Because much simulator training is done under instrument flight rules (IFR), a review of IFR approach plates is appropriate. Sections 1 through 5 of Chapter 5 in the *Airman's Information Manual* (AIM) serves as a good review of IFR procedures.

Simulator Instructors. The instructor is a professional who has probably observed hundreds of pilots in simulator training. Listen to the instructor, because the value of the training is sure to be enhanced.

Avoid being a "passive" learner. Seek a rapport with the instructor and establish good communications. Ask questions and be sure that you understand what is required of you.

One problem that may create confusion during simulator training is whether the pilot should do what he or she would actually do in the real aircraft, or what the pilot *believes* the instructor wants done. This may cause a pilot to be hesitant and perform an imagined "school solution." As a rule, it is better to behave in the simulator as you behave in the aircraft, or "train as you fly and fly as you train." This helps to maintain good habits and allows the instructor to observe your "real-world" behavior.

Nevertheless, the simulator's unique capabilities should be exploited. John Wiley recommended that pilots take an active role in the direction of their simulator session.[2] If a pilot has gotten so far behind the simulator that training becomes counterproductive, Wiley recommended that the instructor should "freeze [stop] the simulator and back up to the point where [the pilot] can regain control and continue learning."

Wiley added: "I vehemently disagree with the notion of continuing because 'you can't put the airplane on freeze.' The student is in the simulator to learn and learning is the primary purpose of the session. One of the greatest assets of the simulator is that it allows the pilot the chance to freeze time and events so that the problems can be analyzed, studied and resolved. Continuing to muddle through procedures and problems is wasted time and resources."

Generally, instructors will freeze the simulator as a means of rapidly enhancing systems knowledge, crew performance or orientation (situational awareness).

It is gratifying to an instructor to train a pilot who perceives simulator sessions as chances to improve, not to show that he or she is the world's greatest aviator. Humility is an essential ingredient in learning.

Flying the Simulator. In some flight regimes, the simulator may be almost indistinguishable from real flight. In other regimes, however, there are differences. For example, a pilot may be able to hover a real helicopter with great ease. His first

attempts to "hover" a simulator, however, may have him wondering whether he is really a helicopter pilot.

The simulator is not able to precisely duplicate proprioceptive ("seat of the pants") and visual cues that are provided while a pilot is flying the real aircraft. Even the most impressive technology cannot provide simulated visual scenes with the same degree of depth perception and detail that the three-dimensional world offers. In addition, computer delay — the slight difference between the time the pilot makes an input to the controls and the time the computer responds with the motion and visual system — sometimes induces overcontrol of the simulator. The result is what is commonly called pilot-induced oscillation (PIO). This pendulum-like action, once begun, is very difficult for the novice simulator flyer to stop, and may require instructor assistance.

The worst way to fly a simulator is to be rough on the controls. Getting angry with your performance may cause you to respond by overcontrolling. This in return results in poor performance. A United Airlines training manager wrote, "… whenever we transition from a stable machine to one that is touchier and more responsive (e.g., McDonnell Douglas DC-8 to Boeing-727, or from any airplane to any simulator) we are stimulated to use quicker and larger control inputs. Exactly the opposite of what we should do. It takes almost constant and intense concentration to keep our control inputs small and smooth."[3]

The training manager suggested flying the simulator gently, as if "there is a load of passengers in the back of the simulator," and easing the aircraft back on course as a means of avoiding overcontrol.

Simulator training improves a pilot's abilities to operate aircraft in both normal and emergency conditions. Its value is well-recognized by the worldwide aviation community. Nevertheless, the benefit to the pilot receiving simulator training is directly proportional to the effort made by the pilot.♦

References

1. Spillman, Jim. Interview by Harris, J.S. West Palm Beach, Florida, United States, 30 Sept. 1994.

2. Wiley, John. "Sessions with a Simulator." *Professional Pilot* (May 1987).

3. Nielson, Robert. "Welcome to DENTK — Part II." *The Cockpit* (June 1984).

About the Author

Joel S. Harris holds an airline transport pilot certificate and a flight instructor certificate with ratings in both helicopters and airplanes. He is an instructor, supervisor and courseware developer at FlightSafety International's West Palm Beach Learning Center in Florida, U.S. He has given more than 10,000 hours of flight, simulator and ground school training to professional helicopter pilots. Harris is the author of numerous articles about helicopter flight.

HELICOPTER SAFETY

Staff: Roger Rozelle, director of publications; Girard Steichen, assistant director of publications; Kate Achelpohl, editorial assistant; Rick Darby, editorial consultant; and Dwyane D. Feaster, production consultant.

Subscriptions: US$60 (U.S.-Canada-Mexico), US$65 Air Mail (all other countries), six issues yearly. • Include old and new addresses when requesting address change. • Flight Safety Foundation, 2200 Wilson Boulevard, Suite 500, Arlington, VA 22201-3306 U.S. • telephone: (703) 522-8300 • telex: 901176 FSF INC AGTN • fax: (703) 525-6047