ALL PHOTOS COURTESY METRO AVIATION

Helicopter Training Simulators: The Real Deal

By Terry Palmer

In February 2014, the National Transportation Safety Board (NTSB) released a safety alert recommending simulator training for helicopter operators (bit.ly/ntsb-helisim). *Safety through Helicopter Simulators* cited several examples of how simulator training using real-life scenarios could have prevented fatal helicopter events.

Simulators provide large and small operators with a variety of training options that are cost-effective, realistic, and can be tailored to specific mission profiles. And simulator training will not put your pilot or aircraft at risk. Building simulation training into your safety and training program is simply the right thing to do.

Still, if you're new to simulator-based training, getting started can be confusing. What should you look for in simulator-based training? Should you build your own program or choose a vendor? What kind of training is best? How does training credit work? Let's look at what you can do to get the most out of your investment in simulator-based training.

A Long Time Coming

Simulator training has proven itself in other aviation sectors for decades, but it took longer to gain traction in the helicopter world. Demand was not obvious. Helicopter operations had traditionally been conducted literally under the radar of most aircraft and simulator manufacturers, and training remained unstructured. Sikorsky and the larger Bell aircraft had simulation options available, but there was little impetus to bring other options online in a timely fashion.

However, as the helicopter industry has matured, so too has the demand for more high-tech training. The number of operations are increasing, technology is expanding, and mission profiles are being added. Moreover, accident investigations started to reveal a lack of effective, standardized training for common hazards.

It has taken almost a decade for scenario-based simulator training to be made available to the majority of commercial helicopter operators, but today there are a wide range of helicopter simulator options available. Most operators — with a little strategic planning — can take advantage of simulator training to improve their operational safety.

Simulators: The Facts

The most basic question that pilots and operators ask about simulator-based training is this: can simulator experience substitute for training conducted during flights? Actually, simulators offer more comprehensive, cost-effective training at lower risk to the aircraft and trainee.

When using a simulator, emergency scenarios can be played out in a way that you could never do in a real

aircraft. According to the NTSB safety alert, "During flight training, it is difficult to recreate the element of surprise and the realistic, complex scenarios that pilots may experience during an emergency. Without simulators, viable lesson components may be limited." Without the benefit of simulator training, even high-time pilots may never have the chance to practice an entire emergency procedure to completion.

Simulator scenarios can be tweaked so that the trainee doesn't always know, for example, that an autorotation is coming or that the warning light will eventually lead to an engine failure. In addition, simulator training offers pilots increased authenticity and the chance to safely experience the consequences of their decisions: there's no need for the instructor to take over when the flight goes awry. In this way, simulator training better prepares pilots for real emergencies and unexpected hazards.

Another advantage of simulator training is that it's safe for both the pilot and aircraft. Indeed, training in an actual helicopter can stress the aircraft or put it at risk.

Finally, simulator training can often be more efficient. When practicing approaches, for example, there is no need to reposition the aircraft before another attempt. If a student needs additional repetition on a procedure, the reinforcement can occur immediately.

Costs for simulator training will depend on several factors, including the type of training and the type of simulator. However, when comparing costs for simulator and aircraft training, consider that training in a helicopter will take the aircraft (not to mention the instructor) out of revenue-generating operations for the length of training, and often longer when adding dual controls. You should also take in account the cost of fuel and wear and tear to the aircraft.

The Essentials of Simulator Training

When deciding on simulator training, the most important factor is that the program suits the needs of your operation. Your simulator training program should teach the scenarios that fit your operational profile, including mission, visual flight rules or instrument flight rules, day or night, and geographical properties, such as high-altitude or over-water flights.

Simulators are most effective when specific to both aircraft and mission; however, the mission-specific factor is actually more important than aircraft-specific. Developing pilots' critical-thinking skills through exposure to scenario-based training is viewed as a factor in decreasing accident rates. When you combine scenario-based training in an aircraft-specific simulator, almost any type of training can be accomplished for initial, recurrent, and human-factor training requirements.

Leasing Simulator Time

Your first decision in developing your simulator training program may be whether you should build your own training or use a training vendor. In this case, the choice is simple. Do you have the staff resources to build and instruct a training program? If the answer is yes, or even maybe, then the option to "dry" lease simulator time can be cost-effective, and the scheduling options for leasing simulator time can be more flexible as well.

Building a training program around the simulator is not as difficult as it sounds. There are resources and sample programs to get you started. To

Free IIMC Flight Simulation Training at Booth #1115

Stop by the HAI Safety Booth (#1115) at HAI HELI-EXPO® and test your IIMC skills and recovery procedures in an X-Copter simulator. After all, practice makes perfect — and during an emergency is no time to practice. This free simulator training is provided by the HAI Safety Committee.

The realism of the training environment provided by this FFS Level D simulator for an EC135 P2 aircraft is enhanced by motion, visual, and sound cues.

Using the same visual graphics as an FFS, this Level 7 FTD provides a realistic flight environment for pilots. The instructor at the right can program location and weather conditions and system malfunctions.

be eligible for FAA credit, a Part 135 operator must get his FAA principal operations inspector (POI) to approve the training program. This can be accomplished fairly quickly if you use a standard course template approved for similar operations. Some operators will share their approved courseware; the simulator provider may also offer generic and sample training programs.

Once you have a standard template, it is important to adapt the simulator scenarios to reflect actual missions or routine flights within your organization so pilots receive training on the conditions they will face in the field. Some operators have used information from incident and accident reports to create training scenarios. Once the scenarios are in place, they can be adapted for new situations and pilot competency.

Turnkey Solutions

If you don't have the in-house staff to develop your own simulator training, you can choose from a number of

Specialty training such as night-vision goggle or inadvertent entry into instrument meteorological conditions can be accomplished in a certified FFS or FTD, regardless of aircraft model.

providers. One advantage of this approach is that the cost is usually fixed: initial and recurrent courses have set rates and schedules. The company will provide all of the training materials and instructors, as well as the simulation. In some cases, aircraft are available to supplement the simulation.

If you have recently purchased an aircraft, you should know that some manufacturers have added simulation to their training offerings. In some cases, additional training options are available that include mission-specific recurrent training or special equipment such as night-vision goggles.

Match Training Scenario to the Mission

When considering simulator training, many first look for a simulator based on a particular aircraft. However, a causal factor in most accidents is not the pilot's unfamiliarity with the aircraft. Rather, most accidents involve poor pilot decision making because of distractions and human-factor elements. For example, a pilot's decision to press on when confronted with an inadvertent entry into instrument meteorological conditions (IIMC) is more about that pilot's reaction to unfolding events than his or her expertise in flying a particular aircraft.

It's great if you can match your simulator training to the types of aircraft in your operation. However, in most cases, matching the training scenarios to the typical missions flown by your pilots is even more important.

Whether you are building your own training program or purchasing an off-the-shelf product, put some time into thinking what you want your pilots to practice. Scenario-based training should include the typical scenarios faced by your pilots, with aircraft malfunctions and environmental distractions added in. If all of your flights are offshore to oil rigs, then your training scenarios should include these types of flights and the accompanying "standard" emergencies, such as ditching.

If a typical mission for your operation is to navigate through mountainous terrain to small, unlit landing zones, your training scenario should incorporate these features, providing pilots with the challenge of maintaining situational awareness while making good decisions. The same is true for practice in cold weather operations, high and hot situations, and IIMC — the latter being a common event in almost all geographical locations and a factor in the highest percentage of fatalities in helicopter accidents.

Almost any situation, distraction, or environmental obstacle can be depicted in a simulator. The goal in this training is to establish a pattern of critical thinking skills in unexpected or unfamiliar circumstances — building confidence and professionalism, which ultimately leads to safer decisions.

Technical Lowdown of Training Credits

There are two categories of devices recognized by the FAA to provide flight simulation training. A flight training device (FTD) is a nonmotion trainer that replicates a specific aircraft, including instruments, equipment, panels, and controls, in an open or closed flight deck.

A full flight simulator (FFS) is the most advanced type of flight simulation available to pilots and training institutions. An FFS has a motion base and includes a full replica of a specific make, model, and series of aircraft cockpit. All aerodynamics, flight controls, and systems must perform as the actual aircraft would in flight. More information about the different flight simulation training

Table 1. FAA-Recognized Flight Simulation Training Devices

FLIGHT TRAINING DEVICES	
FTD Level 4	• Helicopter-specific with at least one operating system
FTD Level 5	• Helicopter-specific with at least one operating system • Primary and secondary controls must be physical controls
FTD Level 6	• Enclosed helicopter-specific flight deck and aerodynamic program with all applicable helicopter systems operational • All controls, switches, and knobs must physically replicate aircraft control operation
FTD Level 7	• Enclosed helicopter-specific flight deck and aerodynamic program with all applicable helicopter systems operational • All controls, switches, and knobs must physically replicate aircraft control operation • Visual system must provide cross-deck viewing from both pilot seats • Vibration cues are available to enhance realism of training experience

FULL-FLIGHT SIMULATORS	
FFS Level B	• Requires at least a three-axis motion platform • Visual system responds to pilot input of controls within 300 milliseconds
FFS Level C	• Provides motion platform with all six degrees of freedom • Simulator controls must replicate feel of aircraft • Visual system responds to pilot input of controls within 150 milliseconds • Visual system has 180-degree field of vision; can replicate visual illusions for landing, dusk, daylight, and special weather situations
FFS Level D	• Provides motion platform with all six degrees of freedom • Simulator controls must replicate feel of aircraft • Visual system responds to pilot input of controls within 150 milliseconds • Visual system has 180-degree field of vision; can replicate visual illusions for landing, dusk, daylight, and special weather situations • Motion and aural effects are available to enhance the realism of the training experience

devices approved by the FAA can be found in table 1.

In each case, as the simulators go up in complexity, they provide a more realistic training environment in terms of the flight systems, visual display, motion simulator, and cockpit environment. The highest level, FFS Level D, provides a motion platform capable of moving in all six degrees, a visual system with a view of 180 degrees, and a number of special motion, visual, and aural effects to provide a realistic cockpit environment.

The FAA awards training credit to pilots who complete an approved training curriculum according to the level of training device used. The amount of training credit is subject to the interpretation of the POI and may reflect differences based on type of operation or unusual environmental challenges.

Many operators have questions in regard to the training credit allocated in different devices. The final decision as to the amount of training credit for a Part 135 operator is entirely the decision of their POI. In general, however, the more complex simulators receive the higher amounts of training credits.

For example, almost everyone gets 100 percent training credit for work done in a Level D FFS, which is used by Part 121 airline operations and many Part 135 corporate fixed-wing operations. This level of simulator is also the most expensive. Credit obtained for training in a Level B or C FFS depends on the equipment capability and the decision of the POI.

Another factor in choosing your simulator is cost. In general, the more complex simulators are more expensive. This is why it's important to review your budget and think about what you want to get out of the simulator training. For example, there is a significant difference in the operating costs of a Level D FFS and a Level 7 FTD. It can be very cost effective for an operator of single-engine aircraft such as Airbus Helicopters AS350 and the Bell 206 and 407 to use the Level 7 FTD. Training credit for a Level 7 has been equal or better than a Level B full-motion simulator and costs a lot less to use.

The latest technical advances in simulator visual systems provide a very realistic training environment. There are a number of Level 7 FTDs for single-engine helicopter training, and training credit ranges between 80 and 95 percent, depending on the operator and the POI. A Level 6 FTD gets a slightly lower training credit as it usually does not have a seat shaker or vibration in the simulation. Anything below a Level 6 will definitely have training value; however, FAA training credit varies significantly.

Some operators have expressed concerns about receiving anything less than 100 percent of the training credit. However, if you consider that most operations require some sort of local-area orientation flights, the difference can easily be made up in the aircraft at minimal cost.

Plan Ahead for Maximum Payoff

There is no one-size-fits-all answer to simulator training. But there is an answer that will fit most operations and budgets — and, as the NTSB has stated, "Consistent, standardized simulator training will help prepare pilots for the unexpected and will decrease the risk of an accident."

To get the most out of your investment in simulator training, develop specific goals for the training that match your operational challenges. Then research the most cost-effective means to meet those goals. There are many resources to help you get started in building an effective simulator training program — and eventually a safer flight operation.

Terry Palmer has more than 20 years of experience in aviation safety and training and is the recipient of numerous awards, including HAI's 2010 AgustaWestland Safety Award. She currently serves on the HAI Training and Safety Committees. After more than a decade at FlightSafety International, Terry is now the director of the Helicopter Flight Training Center of Metro Aviation in Shreveport, Louisiana.