PHOTO BY AARON FITZGERALD

STANDARDS AND REGULATION

Anyone who thinks that simply meeting the regulations achieves a coherent operating standard is mistaken. Aviation regulations often require operators to provide initial and periodic training for their crewmembers, but this guidance can be vague in wording and usually lacks any significant oversight by the regulators. Such weaknesses in the regulatory system can encourage smaller operators to do little or no training in the aircraft that they operate.

At best this approach engenders a less-than-professional attitude in the pilot staff – or worse, can have devastating consequences through accidents and associated injuries and fatalities. A lack of understanding of the airframe, for example, can have expensive consequences such as hot-starting an engine, or fatal consequences such as not recognizing a hydraulic failure on approach.

Large operators and government agencies have learned the lessons (and the NTSB database is full of them) of having less-than-proficient or highly trained pilots behind the controls of aircraft during emergencies. Because of this, these larger operators put a high priority on the implementation of training programs.

MAINTAINING SKILL

Large operators learned long ago that flying an aircraft daily does not guarantee pilots will have the skills they need to address malfunctions and emergencies. Not only does a pilot need an initial comprehensive knowledge and skill-base to deal with in-flight emergencies, but these skill sets need periodic review to maintain proficiency – at least every six months.

Unfortunately, there is a lack of proper recurrent helicopter training in many parts of the world and many pilots are deficient in the handling of malfunctions and/or emergencies. Many companies operate jets and helicopters and while sending their fixed-wing pilots to training every year they often fail to understand the need of continued education for their helicopter pilots. Many of these companies' regulators now recognize this failing and are starting to implement the required continued training for helicopter pilots.

The costs associated with the implementation of these programs can be substantial, but the cost of an accident, either in lives, equipment or reputation, can devastate any

THE COST OF TRAINING
(or ***NOT*** *Training)*

One of the most daunting tasks of managing any flight department is the creation and implementation of a comprehensive training program. The path from nothing to a well-functioning training system is a trail that not many are willing to travel. Success comes down to desire and budget. How important it is to the individual in charge, and the costs incurred to create and perform the training? GLEN WHITE examines some of the issues involved.

operation. Yet the benefits of a comprehensive training program are often unrealized since nothing devastating occurs. The realization that a thorough knowledge base of airframes systems or operations is not present in the company pilots can come too late. This is a classic case of being unable to measure things when they work – compared to measuring them when they do not.

WHEN THINGS WORK

There are many examples of pilots performing exceptionally in difficult situations. On 15 January 2009, US Airways Flight 1549 landed successfully in the Hudson River after a dual–engine failure – with no fatalities.

The list of training skills and experience that the captain of that aircraft Chesley B Sullenberger III holds, could fill a book. To mention a few of his achievements – he has been a pilot since he was 14 years old, served nearly seven years as an Air Force fighter pilot, runs a safety-consulting firm (Safety Reliability Methods Inc), is a flight instructor, served as the Air Line Pilots Association safety chairman, is an accident investigator, helped developed new protocols for airline safety, has more then 19,000 hours of flight experience and has earned numerous psychology degrees.

In March 2001, an East Bay Regional Park Police AS350B2 helicopter in Hayward, CA, successfully autorotated to a neighborhood street during a night-time surveillance after an engine failure, with no injuries. The pilot of that helicopter joined the East Bay Park Police department with a significant aviation background and at the time of the engine failure had more than 5, 000 hours of flight time, of which more than 2,000 hours were instruction time.

The pilot held an ATP rating for helicopters and airplanes, an instructor rating for airplane multi-engine, airplane single-engine, helicopter instrument and airplane instrument. He underwent his initial training at American Eurocopter and attends yearly recurrent training in the AS350 at another center. He now conducts seminars for other pilots where he outlines the 17 seconds from engine failure to landing.

These are great examples of highly trained and knowledgeable crewmembers performing emergency procedures in extreme situations. These performances were the result of knowledge, practice and training.

Unfortunately accident databases are also full of not-so-successful outcomes, many of which could have been averted with proper training.

WHEN THINGS DON'T WORK

In 2004, a newsgathering AS350BA helicopter encountered a hydraulic failure over the Brooklyn borough of New York City. Since the operation was under Part 91, the pilot was not required to have any airframe training. In 1982 the pilot attended a Eurocopter factory-training course for the AS355 – a similar aircraft but one that utilizes a dual hydraulic system. The AS350BA has a single hydraulic system. Two weeks prior to the accident the pilot was scheduled to attend an AS350 factory-training course, but he did not attend.

Prior to the failure the helicopter was in a 1,000-1,200-ft hover, covering a news story. The helicopter's red hydraulic light illuminated and the cockpit horn sounded – the pilot however has no memory of this portion of the sequence.

As discussed in a prior *HeliOps* issue, the human body reacts to danger and stress in a very profound manner depending on conditioning (or training). Due to the fight or flight defense mechanisms we as humans possess, some observable symptoms include elevated heart rate, tunnel vision, tensing of muscles, loss of hearing, memory loss, pain threshold lowering and increased sweating. The pilot's first memory of the accident sequence was the helicopter in an extreme nose-down position. He had no memory of the hydraulic light illuminating, the horn sounding, the aircraft spinning left, the lowering of the collective or pushing the cyclic forward.

The pilot was communicating with the John F Kennedy International Airport (JFK) air traffic control tower at the time of the failure. The pilot did not recall reporting any specific problems over the radio; however, a review of communication recordings revealed that the pilot stated he experienced a "tail rotor failure". This is a combination of muscle memory and again memory loss.

One could conclude that since the pilot had previous Bell helicopter experience, that the illumination of a red light and an aural warning in a Bell product is associated with an engine failure. The lowering of the collective and pushing the cyclic forward to gain speed would support the theory of muscle memory reaction to an engine failure. Since the aircraft rotated to the left the subconscious thought process may have been a tail rotor failure, hence the radio announcement of a tail rotor problem.

Now the reason the helicopter rotated to the left was simply that the pilot did not push hard enough on the right pedal. The AS350BA does not have tail rotor control assist following a hydraulic failure. This makes the pedals stiff and they have a tendency to re-center which causes the helicopter to rotate to the left.

When the pilot nosed the helicopter over, speed was increased causing the vertical fin to off-load the anti-torque of the main rotor and the helicopter "straightened". At this point the cyclic and collective reacted normally because the hydraulic system contains accumulators to allow a pilot to adjust the airspeed between 40 and 60 kts or land the helicopter from a hover. Probably due to the lack of knowledge and training on the airframe, the pilot did not identify the emergency to be a hydraulic problem.

The AS350 accumulators have a finite time of operation depending on the control movements, usually lasting approximately 15 seconds. Because of the initial extreme maneuvering in this case, that time was dramatically reduced.

As the helicopter reached approximately 200 ft above the ground the pilot leveled the helicopter. At this point the collective and cyclic felt normal (due to the accumulators), the aural warning was sounding, the red hydraulic light illuminated and if depressed the pilot would have found the pedals to be stiff, although the nose of the helicopter would be straight due to the effectiveness of the vertical fin.

At this point the accumulators started to deplete. Because the system has 1xpitch and 2xroll accumulators, the recovery from the initial extreme nose over attitude meant that the pitch accumulator first depleted. This caused the cyclic to become very stiff in the fore and aft direction, but roll was still boosted. Since the cyclic wants to neutralize, the cyclic attempts to travel rearward.

Without the proper pressure to the cyclic, the nose of the helicopter pitched upward. This caused the helicopter to slow down and lose the effects of the vertical fin. As the helicopter slowed, it started to spin to the left due to the fact that the pilot was not pressing hard enough on the non-boosted right pedal. The roll

PHOTO BY SARAH BOWEN

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There is a lack of proper recurrent helicopter training in many parts of the world and many pilots are deficient in the handling of malfunctions and/or emergencies.

accumulators then depleted, causing a stiffening of all controls. With training, the controls are not difficult to manage, but once behind the power-curve, the helicopter can be very difficult to manage.

The helicopter entered a violent, out-of-control spin to the left and contacted an apartment building. After the initial impact the helicopter rolled into the neighboring building and landed on its roof.

This emergency response when preformed correctly is normally a very mild maneuver – but without any training it can be a very difficult. To establish this pilot's airframe knowledge base, the pilot was asked after the accident if he performed the required hydraulic checks after start. The pilot initially stated that he did not perform the required hydraulic system checks prior to flight, because he did not want to "fool around" with the hydraulic system.

The argument for maintaining well-trained pilots is not a hard one to make. The question is how to achieve it. There are two choices for any operation – do it internally, or hire a vendor such as Eurocopter, Bell, FlightSafety, Simuflight, Night Flight Concepts or EuroSafety. The choice will depend mainly on the aircraft the operator operates and the size of the company.

TRAINING STANDARD

For larger aircraft, a simulator is the most cost-effective and productive manner in which to provide airframe training. Generally a simulator is in the neighborhood of $US1,000 to $2,000-plus per hour, where the actual direct operating cost of a large aircraft is much higher. Since dealing with emergencies in larger aircraft can involve analyzing complex systems, a simulator provides a platform to not only induce these failures, but also provides a safe environment to analyze, understand and deal with them.

A corporate jet flight department will use a company such as Simuflight every six months to provide their pilot training. Commercial carriers such as American Airlines also use simulators, but because of the number of pilots it is more beneficial for them to purchase their own simulators, each at more than $US20 million.

In the helicopter industry, there is a wider variety of company and aircraft sizes – each of which requires a different approach. For larger helicopters, e.g. Bell 412 or a Sikorsky S76, the majority of the training revolves around systems emergency training and IFR flight. For these aircraft a simulator is the most cost-effective and productive form of training, again for the reasons given above. For larger helicopters, pilot training usually occurs every six to twelve months.

For helicopters below 10,000 lbs,

or approximately 4,500 kms, the choices become more difficult and varied. For aircraft such as the EC135 there are simulator options available in North America through American Eurocopter and FlightSafety, although many operators choose to perform the training in the airframe.

For companies that operate aircraft below the size category of the EC135 the choice between a vendor and in-house training is primarily based on the number of pilots in that company. For larger operators such as PHI, ERA and Temsco the most cost-effective manner in which to perform training is to have an in-house training department. These training departments have a team of pilots whose only job it is to perform pilot training. They are, or become the experts on the airframes they teach. Their job is to not only have a thorough knowledge of the airframes on which they teach, but to stay up-to-date on changes to documentation and recent occurrences.

SMALL COMPANIES

For smaller companies operating aircraft such as the AS350 or Bell 407, the choices become more difficult. The choice is generally based on cost and personnel. Is it less expensive to conduct the training in-house and is there an in-house pilot who can provide the training? If a company decides it is more beneficial to provide training in-house, a pilot (or pilots) is designated as a training officer. Depending on the size of the company, these pilots can be assigned other flying duties, but generally spend most of their time in a training environment.

TRAINING PROGRAM

For training officers in companies that want to create comprehensive training programs, time is essential. A large amount of courseware needs to be compiled to provide the aircraft training and often the pilot needs to expand his/her knowledge.

The creation of courseware can be an overwhelming task for a new training pilot. Determining whether the class is an initial or a recurrent class drives the depth to which the instructor will provide training. Generally, for smaller airframes (e.g. AS355 or EC120) a recurrent airframe ground school should last a full day, while an initial should last a full three days.

For recurrent and initial classes all the airframe components are reviewed, but the initial class goes into more depth. For example, the first portion of either the recurrent or initial class would normally be a review of the aircraft flight manual – and the second segment could be a review of the main transmission. The initial class may take three hours to complete the flight manual segment. In the recurrent course it may take an hour.

Limitations are a great example of what needs to be covered in the classroom presentation. All aviation regulations throughout the world have some wording to the effect that all manufacturers’ limitations require compliance. This may be a red line on a gauge, a maximum weight or temperature limitation.

A good discussion for a classroom presentation, for example, is temperature limitation. Most Eurocopter helicopters have the same temperature limitation. For the Eurocopter operators reading this, can you name it? If you said ISA +

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AS 350 B3, basic configuration:

- Delivered new in New Zealand late May 2009, ex Factory
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- Dual controls (with twist grip)
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- Heating and demisting system (standard)
- Left hand sliding door
- Right hand sliding door
- Comfort lay-out
- Cargo hook (1,400 kg) – fixed parts

Avionics:

• Gyro Horizon	Thales H321 EHM
• Gyro Directional	AIM 205-1 BL
• GPS / COM1	Garmin GNS 430
• VHS / AM Com 2	Honeywell KX 165 A
• Course Deviation Indicator	Honeywell GI106A
• Transponder	Garmin GTX 327
• Altitude encoder	Shadin 8800T
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Avionics (installed from Eurocopter factory):

• Gyro Horizon	Thales H321 EHM
• Gyro Directional	AIM 205-1 BL
• GPS / COM1	Garmin GNS 430
• VHS / AM Com 2	Honeywell KX 165 A
• Course Deviation Indicator	Honeywell GI106A
• Transponder	Garmin GTX 327
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PHOTO BY MARK BOWEN

35°C (Limited to 50°C at sea level), you are correct. But what does that mean? Every summer, I get phone calls requesting to clarify this limitation. I see photos on the internet of VEMDs, while the engine is running, with a displayed temperature of 54°C. To exceed the temperature limit is the same as exceeding any other limit, and can have fatal consequences.

But what does ISA + 35°C mean? ISA is the abbreviation for International Standard Atmosphere, which is 15°C at sea level. As an average, the International Civil Aviation Organization (ICAO) defines an international standard atmosphere (ISA) with a temperature lapse rate of 3.56°F or 1.98°C/1,000ft from sea level to 11km (36,090ft). 1.98 is close enough to 2°C/1,000ft for calculative purposes. So at 3,000ft, the lapse rate would add up to 6°C (3 x 2°). Take 15° and minus the 6° lapse and you have a standard temperature of 9°. Then the formula becomes 9° + 35° = 44°. So the maximum operating temperature at 3,000ft is 44°. When the limitation states "Limited to 50°C", it is clarifying that the operator cannot go above 50°C at any elevation, even if you were to go below sea-level, for instance in Death Valley, CA.

The discussion can be further expanded. What temperature do you use? Is it the temperature that the tower reports, or is it the air mass in which the helicopter is sitting? Obviously the temperature limitation is based on the temperature of the air in which the helicopter is operating, not a shaded area two miles away from the helicopter.

Every helicopter system offers the opportunity to discuss its operation along with useful examples of why it is important to know. Again, accident databases are full of examples of successful, and not so successful demonstrations.

FACE-TO-FACE

One of the biggest mistakes instructors make is to try to teach a class in an office on a desktop computer. This is not only uncomfortable for the participants, but the screen is difficult to see and provides an atmosphere of non-importance for the class. It is worthwhile to find a room within the facility that can act as a classroom. This greatly enhances the learning environment for the participants – and gives a sense of importance for the event.

A recipe for mediocre training is utilizing a training manual as a substitute for courseware. As the class reads out of the manual every participant rightly thinks, "I could do this at home." Some sort of projected presentation needs to be created in order to facilitate the training event and make it productive.

For the flight training portion of the course there needs to be a goal of improving performance in the pilot's skill-set. Too often, a training flight is nothing more then flying around. This is a skill set that should have been mastered way before that flight. A training flight is an opportunity for a pilot to practice non-standard events.

For a pilot of a single-engine helicopter there is no more important maneuver to master then the full-down autorotation. Unfortunately most companies perform power recovery autorotations. This maneuver can teach airspeed and rotor rpm control, but teaches the incorrect muscle memory at the bottom of the maneuver. Generally a pilot who performs all autorotations to a power recovery will either not pull the collective sufficiently at the bottom and hit the ground hard, or pull too early and end up in a 40 ft out-of-ground-effect hover when a full-down is performed. With proper training a company instructor can safely perform full-down autorotations within the safety parameters of a power recovery.

The other training option for a company is to contract a vender to provide airframe, external load, or NVG training for its pilots. Within this option the vender comes with all courseware and the company is relieved of the burden of implementing a training program. This is particularly cost-effective for companies with fewer then 10 pilots.

But how do you change a culture in which no training, or training no more then checking boxes off on a form to make the FAA happy – is too often the norm? It starts with us.

The question isn't what training costs. The question is – What is the cost of not training? ■