FLIGHT SAFETY FOUNDATION

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White Paper: Commercial, Passenger-Carrying Helicopter Operations Safety

The helicopter industry, like much of aviation, has reduced fatal accidents over the past 20 years through a combination of better training, increased focus on high-risk operational issues and improvements in technology, among other reasons. But fatal crashes continue to happen with tragic regularity, including among small commercial passenger-carrying operations. Statistics show that for-hire and air taxi helicopter operations have a higher fatal accident rate than the industry has as a whole. It is clear that more needs to be done to drive down helicopter accident rates, improve crash survivability and develop industry-wide improvements in managing aviation risk. It also is clear that there is no single solution. Instead, a mix and of short- and longer-term strategies involving operators, manufacturers, regulators and consumers is required to improve the industry's safety performance. And there needs to be a sense of urgency. In the past six months, there have been numerous fatal helicopter accidents, including two high-profile crashes that killed both pilots and a total of 14 passengers.

Purpose

Because of their versatility and ability to take off and land in places where fixed wing aircraft cannot, helicopters fly a wide variety of missions, ranging from offshore operations in support of the oil and gas industry, to air ambulance or helicopter emergency medical services (HEMS), sightseeing tours, news gathering, law enforcement and external load operations, to name a few.

This paper, however, focuses on the safety of commercial, passenger-carrying, visual flight rules (VFR) operations because of the potential risk these flights pose to the traveling public. The majority of commercial helicopter accidents occur during day visual meteorological conditions in single-engine turbine aircraft operated by commercial pilots, according to the 28th Joseph T. Nall Report, published by the Aircraft Owners and Pilots Association.

For the purposes of this paper, this sector includes on-demand passenger charters, air taxi operations, corporate aviation missions, sightseeing and tour operations. Most of these flights would fall under U.S. Federal Aviation Regulations Part 135, or international equivalents, governing on-demand, unscheduled air services, but some are operated under the less restricted Part 91 for general operations.

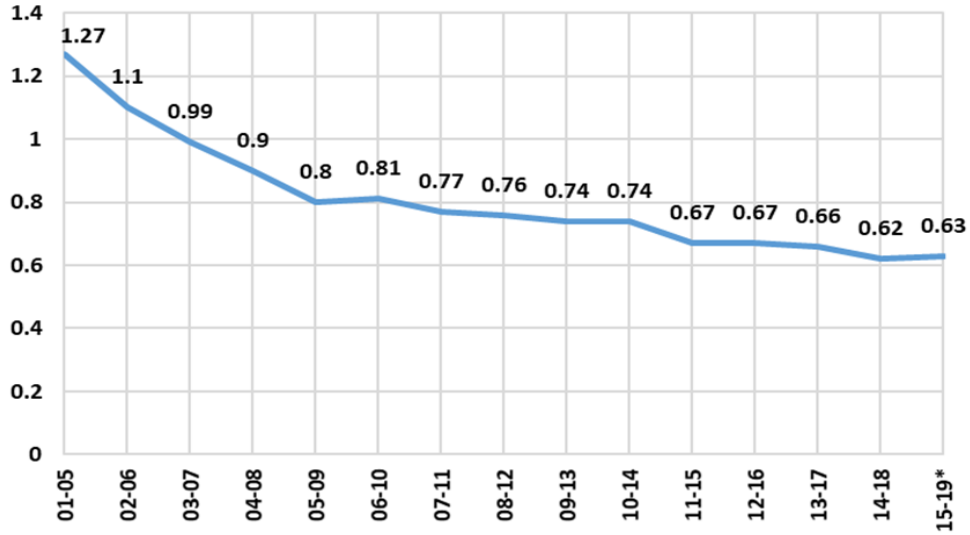
Background

Worldwide, there are just over 40,000 civil helicopters in operation, according to data cited by both the European Union Aviation Safety Agency (EASA) and the U.S. Helicopter Safety Team (USHST). The United States is the largest single market, with 9,073 rotorcraft, followed by Europe with 8,716, all but 954 of which are operated by EASA member states. There are 5,363 helicopters in Asia, 4,895 in Latin America and 3,249 in Russia.

Because of a lack of exposure data, such as hours flown or number of flights, it is difficult to calculate meaningful global accident and fatal accidents rates, which makes safety performance tracking difficult. However, rates can be calculated for the U.S. market.

The U.S. helicopter industry's fatal accident rate declined 50 percent from 2001 through 2019, based on a five-year moving average. USHST, an organization comprised of government and industry experts dedicated to reducing the civil helicopter community's fatal accidents to zero, said the rate for the 2001–2005 period was 1.27 fatal accidents per 100,000 flight hours, while the rate for the 2015–2019 period was 0.63 fatal accidents per 100,000 hours (see figure below).

U.S. Fatal Helicopter Accident Rate, 5-Year Moving Average, 2001–2019



Source: USHST

As can been seen in the figure, however, the five-year moving average fatal accident rate has essentially plateaued.

In Europe, there is, on average, one non-fatal rotorcraft accident per week and 1.3 fatal accidents per month, according to EASA's Rotorcraft Safety Roadmap. "Progress in reducing EU-wide fatalities caused by rotorcraft accidents has stagnated in recent years," EASA said in the Roadmap, which was published in mid-December 2018.

For the 10-year period 2008–2017, European commercial operators suffered 62 accidents, including 16 fatal events, and 23 serious incidents, or an average of 6.2 accidents, 1.6 fatal accidents and 2.3 serious incidents per year.

Recent Accidents

Included in the statistics for the past few years are a number of accidents that each have resulted in multiple passenger fatalities. For example:

- On March 11, 2018, an Airbus AS350 B2 being operated as an aerial photography flight in New York City ditched in the East River after losing engine power. All five passengers were killed. National Transportation Safety Board (NTSB) investigators determined that the probable cause of the accident was the use of the harness/tether system "which caught on and activated the floor-mounted engine fuel shutoff lever and resulted in the in-flight loss of engine power and the subsequent ditching." The uncertified harness/tether system also prevented the passengers

from evacuating the aircraft. The flight was operated under Part 91, as opposed to Part 135, in VFR weather conditions.

- On March 28, 2018, an AgustaWestland AW109SP on an executive flight crashed near Sao Paulo, Brazil, in bad weather, killing all six people on board.
- In July 2019, an AW139 with seven people on board crashed in the Atlantic Ocean off Grand Cay Island in the Bahamas, killing everyone on board.
- On Dec. 26, 2019, an AS350 B2 being operated on a sightseeing flight in Hawaii crashed into a ridge at 2,900 ft and then fell approximately 100 ft, according to NTSB. The pilot and six passengers were killed.
- On Jan. 26, 2020, a Sikorsky S-76B collided with hilly terrain near Calabasas, California. The aircraft was destroyed by impact forces and fire, and the pilot and all eight passengers were killed. Among the passengers were basketball star Kobe Bryant and his 13-year-old daughter, Gianna.

Discussion

Helicopter operators and operations vary widely in size, complexity and equipment.

In the offshore industry, for example, safety management systems (SMS) are common, as are large fleets of multi-engine aircraft equipped with advanced safety equipment. Missions are primarily flown with two-pilot crews that are trained, and have experience, in instrument flight rules (IFR) operations. Passengers often have practiced escaping from submerged aircraft. Likewise, HEMS pilots often are IFR-qualified and trained in the use of night vision imaging systems.

On the other hand, commercial, passenger-carrying missions often are offered by smaller organizations with limited resources, small fleets and less training, and flights are operated by single pilots in lighter, single-engine helicopters that are not equipped with advanced safety equipment.

U.S. civil helicopters flew nearly 34 million flight hours and suffered 233 fatal accidents during the 11-year period from 2009 through 2019, which works out to a rate of just under 0.69 fatal accidents per 100,000 flight hours, according to USHST data.

Using USHST data on the number of flight hours flown and fatal accidents suffered by 13 different types of rotary wing operations, Flight Safety Foundation calculated that commercial operations, including air taxis and for-hire, had a rate of 1.1 fatal accidents per 100,000 flight hours during the 11-year period. Personal/private flying, which likely includes some commercial type operations, as was the case with the New York City accident noted above, had a rate of 5.94 fatal accidents per 100,000 flight hours, the rate for business/corporate operations was 0.86 per 100,000 flight hours, and the rate for air tour/sightseeing was 0.34 fatal accidents per 100,000 flight hours.

One of the leading causes of accidents in VFR operations — both rotary and fixed wing and involving commercial and private flights — is inadvertent flight into instrument meteorological conditions (IMC). In a 2019 report, *Accidents Involving Visual Flight Rules Pilots in Instrument Meteorological Conditions*, the Australian Transport Safety Bureau (ATSB) said that in the 10 years from July 1, 2009, through June 30, 2019, it received reports of 101 VFR-into-IMC occurrences and that nine of those occurrences resulted in fatal accidents that killed 21 people. “Weather-related general aviation accidents remain one of the ATSB’s most significant causes for concern in aviation safety; the often fatal outcomes of these accidents are all the more tragic because they are avoidable,” ATSB said.

Of course, inadvertent VFR flight into IMC often can be related to other familiar accident causes such as loss of control–in flight, aircraft upset and collision with terrain or obstacles.

A search of the NTSB accident databases returns numerous examples of fatal helicopter accidents involving VFR flight into IMC or related factors. And many of the accident reports contain similar

language in the probable cause(s) section – i.e., the NTSB determines the probable cause(s) of this accident to be:

- "The flight's inadvertent encounter with night instrument meteorological conditions, which resulted in the pilot turning the helicopter and subsequently descending into trees and terrain due to spatial disorientation." (1 fatal, 2 serious)
- "The pilot's failure to maintain clearance from mountainous terrain while operating in marginal weather conditions, which resulted in the impact … and the pilot's subsequent inability to maintain control." (5 fatal)
- "The pilot's inadvertent encounter with instrument meteorological conditions resulting in spatial disorientation, loss of control, and subsequent impact with terrain." (2 fatal)
- "The pilot's decision to perform visual flight rules flight into night instrument meteorological conditions, which resulted in loss of control due to spatial disorientation." (4 fatal)

Contributory causes that have drawn a lot of attention in various forums include the real or perceived pressure — either external or self-imposed — to push on with a flight when circumstances would normally dictate that the flight be canceled or the aircraft landed as soon as possible. This particular scenario has been seen a number of times in HEMS operations, but it also can occur when pilots are under pressure from an executive or other paying customer to complete a flight, or when tour operators feel the need to squeeze in a sightseeing flight in marginal or decaying weather conditions.

Other related issues include pilot training and decision making. Contributing to the accident noted above in which five people died "was the pilot's decision to operate into an area surrounded by rising terrain, low and possibly descending cloud bases, rain showers and high wind," the accident report said. Another report on a fatal accident said, "Contributing to the accident was the pilot's self-induced pressure to complete the mission despite the weather conditions and the operator's inadequate oversight of the flight by its operational control center."

Five-Point Strategy to Address Near-Term Helicopter Safety Risks

There is no one-size-fits-all solution to the safety issues facing the commercial VFR helicopter industry. Instead, what is required is a strategy that addresses high-risk areas as quickly as possible while taking into account operational requirements and operator type, size and capability.

Based on the discussion above, reducing inadvertent VFR flight into IMC would go a long way toward improving the safety performance of the commercial helicopter sector, as would better pilot decision making, adherence to standard operating procedures, enhanced weather information and other factors that would improve pilot situation awareness. Additional safety benefits would result from organizational commitments not to pressure pilots into flying in marginal or deteriorating weather conditions.

It also is important to note that small operators should not be given a pass on equipment and training requirements simply because they are small. Safety is assumed by the traveling public and is the

responsibility of the operator with oversight by the regulator. Delivering dependable safety results is the cost of doing business in aviation.

The strategies outlined below are intended for passenger-carrying VFR helicopter operations.

Implement regular risk identification and mitigation/management strategies and other tools as part of an effort to improve or develop an organizational safety culture.

Developing a safety culture and implementing a SMS can take time and requires buy-in from all levels of any organization, particularly from the CEO. While establishing an SMS is important for any organization, there are steps operators can take in the interim to make their operations safer, such as:

- Re-emphasize the importance of pre-flight risk assessments to help pilots identify hazards (such as weather, terrain and time pressures), plan for alternate landing sites along the route, and brief passengers on what to expect, including the possibility of diverting, turning around or ending a flight.
- Improve organizational risk assessment through the use of standard tools such as a bow tie diagram to identify threats such as aircraft upset or bad weather, and to identify defenses or controls that can be implemented. For example, the controls used to mitigate the threat of weather may include effective flight planning, the receipt of regular weather reports or forecasts, an adverse weather policy and modern weather radar installed or otherwise available in the cockpit.
- Develop a set of safety performance indicators (SPIs) based on desired outcomes, monitor progress against those SPIs and provide feedback to pilots and other operational personnel.
- Contribute to industry-wide safety data collection and analysis and dissemination of safety performance information to allow for easier and more accurate tracking of safety performance.

Improve pilot decision making and adherence to procedures

Training and technology, while an additional cost, can help to improve pilot decision making and reduce the risks identified above. Below are some possibilities to consider:

- Provide pilots with training on how to safely fly out of deteriorating weather and consider IFR training. VFR-only operators would benefit from having pilots trained and experienced in how to fly in IFR conditions.
- Install small flight recorders that record continuously from takeoff to landing. Information from these recorders can be used for pilot training and to ensure compliance with procedures, and is important to flight data monitoring programs and SMSs. Models with crash-survivable memory are invaluable in incident and accident investigation. Conversely, the lack of recording devices in accident aircraft can impede investigations and have a negative impact on safety
- Install or provide technology to improve situational awareness, such as equipment featuring digital terrain maps and current weather displays. It is important that pilots have access to the most up-to-date and accurate weather information possible to reduce the likelihood of VFR pilots flying into IMC.
- Training in single-pilot resource management (SRM) or aeronautical decision making can help pilots in single-pilot operations better manage the onboard and outside resources available before and during a flight, reducing the risk of loss of control–in flight. As the Federal Aviation

Administration's General Aviation Joint Steering Committee has said previously, a structured approach to SRM can help pilots learn to gather information, analyze it and make sound flight-related decisions.

Establish clear operation guidelines and procedures to eliminate pressure on pilots to fly in marginal or deteriorating conditions and to enable easier and more consistent go/no-go decisions.

Reducing the pressure on pilots to fly in marginal conditions is essential to cutting down on the occurrence of VFR flight into IMC. The following actions may help operators reduce such pressure:

- Enforce and measure adherence to established weather minimums. .
- Have in place a process for informing customers of decisions to cancel/postpone operations and to otherwise deal with pressure to keep going. The Helicopter Association International has a number of "land and live" resources available on its website to help pilots determine when it is better to land than to press on. Pilots must have the unequivocal backing of management to cancel planned flights because of safety concerns related to weather/visibility, fatigue or airworthiness of the aircraft.
- Limit late flight plan changes -- Effective planning, flight path management and situational awareness skills also are essential to safe operations. The flying schedule must be structured in way that allows time for effective flight planning. Making late changes to a flight plan to accommodate weather or other factors and then rushing to get off the ground before visual flight rules minimums come into play is a recipe for disaster.

Educate the consumer.

An educated consumer is a legitimate line of defense against an unsafe situation developing on a helicopter sightseeing trip or glacier landing excursion. If a customer can create pressure to fly, he or she also can push for postponement.

- Mandatory preflight safety and weather briefings – Companies and individuals that contract for charter flights should insist on detailed passenger safety briefings, including instructions in when and how to operate appropriate safety equipment. Consumers also have a right to know that an aircraft and its pilot meet all relevant airworthiness, training and experience requirements.
- Develop a consumer reporting system – The reporting system should provide transparency on operator safety culture, training, technologies and operational procedures that enhance safety. Transparency of safety aspects to the consumer is an important feature that can proactively improve consumer knowledge of operator safety.

Enhance oversight and the regulator's role.

Regulators have an important role to play in establishing adequate minimum safety standards and ensuring, through comprehensive and effective oversight, that those standards are met.

- National aviation authorities should work with industry to develop SMSs, flight data monitoring and/or aviation safety assurance programs that are appropriate for small operators with limited resources. Installed flight data recorders should be capable of supporting flight data monitoring and SMS.

- Ensure that all commercial operators have adequate risk assessment programs, that these programs are used appropriately and that risk assessments are conducted before each light.
- Because so many helicopter crashes involve continuing VFR flight into IMC, should there be new requirements for pilot decision making and weather-related training, with an emphasis on awareness of en route forecasts, getting out of unexpected encounters with IMC and landing the helicopter instead of pressing on into IMC. Regulators also should work with operators to develop pilot training that focuses on the risks unique to the operator's environment.
- Tighten restrictions so that flights operated for remuneration are flown as commercial operations, such as under Part 135, rather than under less restrictive general operations.