FLIGHT SAFETY FOUNDATION
HELICOPTER SAFETY
Vol. 19 No. 6 *For Everyone Concerned with the Safety of Flight* November/December 1993

Operators Say Rule Changes Could Improve Helicopter IFR Safety

Helicopters are capable of operations at very low altitudes under instrument flight rules, and many operators believe that U.S. regulations must be changed to keep pace with technical advances, or safe helicopter flight may be compromised.

by
Joel S. Harris
FlightSafety International

In Canada, some commercial helicopter crews and aircraft are authorized by the Ministry of Transportation (MOT) to execute instrument landing system (ILS) approaches to a 100-foot (30-meter) decision height (DH) and a runway visual range (RVR) of 600 feet (183 meters).

The Government Flying Service of Hong Kong routinely makes coupled approaches to a 50-foot (15-meter) hover in instrument meteorological conditions (IMC) with its search-and-rescue (SAR)-equipped Sikorsky S-76 helicopters. The U.S. Coast Guard and the U.S. Navy have long been capable of the same maneuver. Pilots operating in FlightSafety International's Phase C S-76 helicopter simulator are able to demonstrate coupled instrument approaches to a 50-foot DH and a 600-foot RVR. With some additional pilot training, these approaches are not particularly difficult to fly without an autopilot.

Many helicopters make excellent instrument-flight platforms because they are often as well-equipped as their fixed-wing counterparts.

Electronic flight instrument systems (EFIS), digital flight control systems (DFCS), color radar and/or Stormscopes™, flight management systems (FMS) and global positioning systems (GPS) are increasingly common.

In addition, helicopters have the distinct advantage of not being subject to slow-flight stall characteristics usually associated with fixed-wing aircraft. Slow flight during an instrument approach gives a pilot more time to make decisions during the approach and to see the landing area. The available length of the runway or the landing area, and the subsequent maneuvering required to land in that given distance, is much less a concern of the

helicopter pilot. When precision GPS approaches become available, the helicopter's slow-speed capability will allow the use of much steeper angles of approach without developing excessive descent rates. This should provide more liberal U.S. Terminal Instrument Procedures (TERPS) criteria for helicopter precision approaches and result in improved noise-abatement profiles.

Helicopter IFR Operations Have Limits

There are technical and legal limitations on the helicopter's capability to operate successfully in the IFR environment.

A serious technical limitation is the civil helicopter's unfitness to operate safely in icing conditions. Icing may be present in visible moisture when the air temperature is near freezing. Only a few helicopters are equipped for flight into known or forecasted icing conditions, and most of these are not certified for civil aviation. The U.S. Army's Black Hawk helicopter, for example, and its various derivatives are equipped for flight in light and moderate icing. Some versions of the large Eurocopter Puma are certified for flight into icing conditions. Nevertheless, with the rarest exceptions, U.S. civil helicopter operations are not conducted in icing conditions.

A serious technical limitation is the civil helicopter's unfitness to operate safely in icing conditions.

Inflight icing is a technical problem that may be remedied in two ways. Manufacturers must realize the need for cold-weather IFR helicopter operations and produce low-cost aircraft systems to meet that need. The air traffic control (ATC) system must also develop a low-altitude IFR route structure for helicopters. By operating at lower altitudes, where the air is usually warmer, icing conditions are less likely to be encountered.

Another technical limitation on IFR operations is the restricted range of the helicopter because of its high fuel consumption per mile flown. This limitation in range severely restricts options for alternates and fuel reserves.

At a U.S. Federal Aviation Administration (FAA)-sponsored workshop on extremely low-visibility instrument flight rules rotorcraft approaches (ELVIRA), participants discussed this limitation from a legal, rather than a technical, standpoint: It would be more appropriate to change the rules (assuming safety is not compromised) than to change the inherent range limitations of helicopters.

The legal limitations on helicopter IFR operations can be summarized as follows: U.S. Federal Aviation Regulations (FAR) Part 91 requires an alternate airport for a flight filed under IFR unless the destination has a published instrument approach, and the ceiling is forecast to be at least 2,000 feet (610 meters) and visibility of at least three miles (five kilometers) for at least one hour before and one hour after the estimated time of arrival at the airport.[1] Because of the helicopter's relatively short range, the weather at the destination is often similar to the weather at the departure point. If a helicopter is going to depart in IMC, an alternate is usually required.

To be a legal alternate, an airport must have approved weather reporting capability. This rule eliminates hundreds of airports with otherwise usable instrument approaches from being used as alternates. In Michigan, for example, the U.S. Terminal Procedures booklet published by a division of the National Oceanic and Atmospheric Administration (NOAA) lists 95 airports that have instrument approaches. Of these, 76 do not have approved weather reporting and are therefore not authorized as alternates. Ten others have part-time weather reporting that cease operations when the airport control towers close at night. Thus, in Michigan, 86 of the 95 airports are not usable alternates during late-night hours (when many emergency medical service [EMS] operations take place), and the problem seems to be worsening.

To date, the FAA has successfully closed many Flight Service Stations, but it is behind schedule in its plans to replace them with automated weather observation systems (AWOS) and automated surface observation systems (ASOS). Thus, the number of airports without approved weather reporting has increased.

Assuming the helicopter pilot can identify a legal alternate within his helicopter's range, the weather at that alternate must be forecast to be at least a 600-foot (183-meter) ceiling if a precision approach is available, or an 800-foot (244-meter) ceiling if only a nonprecision approach is available. The visibility at the alternate must be at least two miles (3.2 kilometers). If the forecast reports that there is a "chance" or even a "slight chance" that the weather will be below those minimums at the estimated time of arrival (ETA), that airport is not a legal alternate.[2]

The weather reporting problem is further compounded for Part 135 operators. To file an IFR flight plan under that part, approved weather reporting must also be operating at the destination airport at the time of arrival. Using the Michigan example (which is not unusual), Part 135 helicopter operators may not file IFR to as

many as 86 of the state's 95 airports even if they have a legal alternate available.

These rules are restrictive for the helicopter pilot who wants to operate under IFR. The FAR, however, are less restrictive of helicopter operations conducted under visual flight rules (VFR). Part 91 allows helicopters to operate under VFR with no visibility minimums in uncontrolled airspace below 1,200 feet (366 meters) above ground level (AGL) "clear of clouds if operated at a speed that allows the pilot adequate opportunity to see any air traffic or obstruction in time to avoid a collision."[3] In uncontrolled airspace at 1,200 feet AGL or less, Part 135 requires only one-half-mile (.8-kilometer) visibility during the day, and one-mile (1.6-kilometer) visibility at night for VFR operations.[4]

There are many examples of weather situations that allow helicopter pilots to operate legally in marginal weather under VFR, but not under IFR. In fact, a bit of dark humor that circulates among helicopter pilots is that "when the weather gets too bad to go IFR, we'll go VFR." The problem is that some pilots actually make such decisions.

There are many examples of weather situations that allow helicopter pilots to operate legally in marginal weather under VFR, but not under IFR.

The U.S. National Transportation Safety Board (NTSB), in a report on EMS helicopter safety, said that "alternate airport requirements specified by the FAA for IFR flight and the lower VFR minimums for helicopters make the use of EMS helicopters in IFR conditions difficult, which encourages pilots to conduct missions VFR that they would rather complete IFR."[5] This report also illustrates that the high number of helicopter EMS accidents (59 total, including 19 fatal) that occurred during the study period of 1978-1986 was a result, in large part, of "scud running."[6] Not a single accident occurred during a planned IFR flight. Although this was because, in part, of the limited number of IFR operations, the NTSB recommended that the FAA "determine the feasibility of allowing the helicopter pilot, without designating an alternate airport, to file IFR with a lower destination weather forecast than is currently specified."[5] Since the NTSB report was issued in 1988, nothing has changed to make helicopter IFR either more feasible or more practical.

Rule Changes Proposed

ELVIRA workshop participants discussed each of these legal limitations with the goal of promoting more IFR operations as a safer alternative to low-visibility VFR operations.

The consensus process required some compromise, and provided much-needed input from operators. For example, when the recommendation was put forward to reduce IFR destination weather minimums requiring an alternate from a 2,000-foot (610-meter) ceiling and three miles (4.8 kilometers) visibility, to a 1,000-foot (305-meter) ceiling and two-miles visibility, one operator said, "That just won't work!" When questioned, he cited the example of a rural airport in the mountainous area where he operates. This airport has only one approach — a nondirectional beacon (NDB) with an minimum descent altitude (MDA) that is 1,200 feet above the runway surface. He said that under the proposed rule, a pilot might file IFR to that airport and not be required to list an alternate airport, even though the forecast ceiling was below the MDA. It was decided that the requirement for an alternate airport could be reduced safely from a 2,000-foot ceiling and three miles visibility to "400 feet [122 meters] above the highest MDA for any approach at the destination airport, and two-miles visibility."

Workshop participants also concluded that standard alternate minimums for helicopters could be reduced safely from a 600-foot ceiling and two-miles visibility, and an 800-foot (244-meter) ceiling and two-miles visibility, to a 400-foot ceiling and one-mile visibility, and a 600-foot ceiling and one-mile visibility. Many Part 135 operations specifications already allow the use of alternate minimums this low, and accident statistics do not suggest that this practice has compromised safety.

In addition, the participants formalized a suggestion that the "prevailing" weather be used to determine the suitability of the alternate. By using the prevailing weather phraseology, pilots could still list an airport as an alternate even if there was a chance or a slight chance that the airport ceiling and visibility would be below the alternate minimums (but not the approach minimums) for that airport. The U.S. Army uses prevailing weather, and there has been no demonstrated negative influence on safety.

Another important recommendation from the ELVIRA workshop concerned EMS operators. Several participants cited EMS operations as being specifically hindered from the use of "safer" IFR operations because of the rule requiring that the destination airport have active approved weather reporting on the airport.

For these Part 135 operators, the participants recommended that weather reporting at the destination airport

not be required to file IFR, as long as area weather reports are used and a legal alternate is available. Weather reporting at the destination is not required in Canada for commercial helicopter IFR operations (it is required at the alternate). Thus, Canadian helicopter pilots are more likely to fly IFR instead of VFR in marginal weather conditions.

Another subject of concern was Part 135 IFR takeoff restrictions with standard takeoff minimums of one-half mile visibility for helicopters if minimums are not prescribed for the airport under Part 97.[7]

When operating under VFR, the commercial pilot is authorized to judge when the visibility is at or above takeoff minimums. Weather observations, made and furnished to pilots for IFR operations, must be taken at the airport where the IFR operations are being conducted, unless the FAA has approved the use of weather observations taken at another location.[8] Under Part 135, a helicopter pilot may legally depart VFR with one-half mile visibility during the day, but the pilot is restricted from departing IFR with the same visibility unless an approved weather reporting source is operating on the airport. Again, the regulations encourage VFR operations, even in marginal weather, rather than IFR operations.

The workshop participants concluded that pilots should be allowed to determine visibility for IFR takeoffs under the following circumstances: Pilots must be trained to determine visibility for takeoffs, and the takeoffs must be from a runway or an area with a published departure procedure. The absence of this restriction has not been

ELVIRA May Require Some Training

The following familiarization consisted of a crew attempting an instrument flight rules (IFR) approach to a 100-foot (30-meter) decision height (DH) and a 600-foot (183-meter) runway visual range (RVR) in FlightSafety International's Phase C S-76 helicopter simulator. Although the crew was well-trained in IFR, they had no experience attempting extremely low-visibility, lower-than-standard DH, helicopter instrument approaches.

I asked them if they wanted to try the approach and they enthusiastically agreed, even offering to "hand-fly" the simulator instead of flying a coupled approach with the Sperry SPZ 7000 autopilot. They also chose to fly a speed of 120 knots, a decision they would later regret. The crew flew a skillful approach, aided by the fact that their company insists on excellent crew coordination practices, including IFR approach callouts.

All went well until they broke out 100 feet above the field elevation. The nonflying pilot was surprised by what he saw. Instead of the familiar approach light system with high-intensity strobes, he saw the runway center line and touchdown-zone lights. After a second or two, he said that he saw "some lights." The flying pilot stayed on the gauges and responded that he was "continuing the approach," apparently waiting for the words "landing assured" or "runway in sight."

At 120 knots, an aircraft descends about 650 feet per minute (198 meters per minute) on a three-degree glide slope. That is equal to about 11 feet per second (3.3 meters per second). During the time it took the nonflying pilot to recognize the lights after breaking out and to verbally confirm visual contact, the aircraft was already approaching 50 feet (15 meters). The flying pilot thought about what he heard and responded, but it was too late. The helicopter crashed.

In the simulator, exceeding crash parameters causes a "crashing noise" and the simulator "freezes" at the moment of impact. We sat in silence for a moment or two, slightly stunned. The visual cues that the crew had expected were simply not there, and the crew's response times were lengthened by the confusion of seeing the runway instead of the approach lights. Their callouts, which worked well at a 200-foot (61-meter) DH, proved inadequate for a 100-foot DH at 120 knots.

Getting It Right

Next, they decided to try the approach fully coupled with the "DECEL" mode engaged. The DECEL mode automatically decelerates the aircraft so that it reaches a speed of 70 knots at 200 feet radar altimeter on the instrument landing system (ILS). The difference was profound. At 70 knots, with a sink rate of about 380 feet (116 meters) per minute, the crew had time to transition from instrument flight to visual flight and to make a smooth, uneventful landing. Even if the crew had become distracted, the autopilot would have autoleveled the aircraft at 70 knots and at 50 feet radar altimeter.

Their third attempt was hand-flown using the experience acquired from the two previous approaches. The crew made another smooth, uneventful landing. — JSH

proven a hindrance in Canada to safety, which could lead to the conclusion that removing restrictions to IFR for properly equipped and certified helicopter operators actually promotes safety.

Canadian regulations also authorize helicopters to make lower-than-standard DH precision approaches. The Canadian MOT has approved simulator-trained commercial helicopter flight crews, operating appropriately certified aircraft, to perform ILS approaches to a 100-foot DH and a 600-foot RVR.

Although the TERPS contain a provision for helicopters to use a 100-foot DH for specially approved precision approaches,[9] the workshop participants knew of no operator who had attempted to obtain approval to use this special provision. The workshop also recommended seeking approval for lower RVR values for selected ILS approaches by simulator-trained helicopter crews.

Current U.S. aviation regulations may be compromising helicopter safety. Unless a mechanism can be found to change these rules, helicopter accidents will continue to occur. The ELVIRA workshop proposals, if adopted, would contribute significantly to bringing the helicopter community into a safer 21st century. ♦

[Editor's Note: *The author wrote the proceeding article from information that he gathered at the FAA-sponsored ELVIRA workshop in Santa Fe, New Mexico, in August 1993. More than 63 representatives of operators, manufacturers, researchers and members of the FAA's Vertical Flight Program Office gathered to consider the future of U.S. helicopter IFR operations.*]

References

1. U.S. Federal Aviation Administration (FAA). U.S. Federal Aviation Regulation (FAR) 91.167, "Fuel Requirements for Flight in IFR Conditions."

2. FAA. Document No. 8400.10, paragraph 1407, "Policy on Conditional Phrases in Remarks Portion of Weather Forecast."

3. FAA. FAR 91.155, "Basic VFR Weather Minimums."

4. FAA. FAR 135.205, "VFR: Visibility Requirements."

5. U.S. National Transportation Safety Board (NTSB). *Safety Study of Commercial EMS Helicopter Operations.*

6. During the period of the study (1978-1986), there were 59 accidents. Fifteen of the 19 fatal accidents were weather-related and occurred in uncontrolled airspace at low altitude.

7. FAA. FAR Part 91.175(f), "Takeoff and Landing Under IFR."

8. FAA. FAR Part 135.213, "Weather Reports and Forecasts."

9. *U.S. Terminal Instrument Procedures (TERPS)*, Chapter 11, paragraph 1126d.

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.

Safe Applications of Technologies In Corporate Aviation

FLIGHT SAFETY FOUNDATION

39th annual Corporate Aviation Safety Seminar (CASS)

St. Louis, Missouri, U.S.
April 13-15, 1994

For more information contact J. Edward Peery, FSF.

HELICOPTER SAFETY

Staff: Roger Rozelle, director of publications; Girard Steichen, assistant director of publications; Kate Achelpohl, editorial assistant; and Monique Kohly, production consultant.

Subscriptions: US$60 (United States-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.

What's Your Input?

In keeping with FSF's independent and nonpartisan mission to disseminate objective safety information, Foundation publications solicit credible contributions that foster thought-provoking discussion of aviation safety issues. If you have an article proposal, a completed manuscript or a technical paper that may be appropriate for *Helicopter Safety*, please contact the director of publications. A manuscript must be accompanied by a stamped and addressed return envelope if the author wants material returned. Reasonable care will be taken in handling a manuscript, but Flight Safety Foundation assumes no responsibility for material submitted. The publications staff reserves the right to edit all published submissions. Payment is made to author upon publication. Contact the Publications Department for more information.