Getting More Technology into Civil Cockpits:

Restoring Single Engine Helicopter IFR Certification

A Joint Industry and Association Initiative

By Paul Schaaf

There is no doubt that many of the technological advances in today's helicopter cockpits serve to improve the safety of Visual Flight Rules (VFR) operations. But despite the technology, when the weather gets worse, statistics show the odds of a fatal VFR accident go way up. For a pilot attempting to maintain VFR – especially in Inadvertent Instrument Meteorological Conditions (IMC) –interfacing with technology, no matter how effective it may be, can become a distraction that can exacerbate a bad situation. Low ceilings force pilots limited to VFR to fly lower to maintain ground contact. Reduced visibility impairs a pilot's ability to detect terrain, obstacles and other hazards in time to avoid them. Furthermore, VFR flight in less-than-VFR conditions dramatically increases the stress and fatigue that generally contribute to poor pilot decision-making. The very real hazards of VFR flight in less-than-VFR bare themselves out in some gruesome statistics and are the leading cause of *fatal* helicopter accidents worldwide. More use of Instrument Flight Rules (IFR) by helicopters is part of the answer to this safety problem, but airliner-level aircraft certification standards – for even light, single engine IFR helicopters – stand in the way.

The Bell 407GXP is one of many single-engine models available with advanced glass cockpits. None are approved for IFR operations. (George Mandes)

The Problem

However, these standards are not regulatory, but simply a matter of interpretation reinforced by an FAA Advisory Circular – AC 27.1. As it relates to the revolutionized, safety-first digital cockpit, AC 27.1 may as well be written on a papyrus scroll as it does not make any allowances for the actual technology in use today or take into account the radical changes in IFR infrastructure over the past 15 years.

Prior to the issuance of this Advisory Circular in 1999, certifying single engine helicopters for IFR was a reasonably straightforward process. As such, a plethora of single engine aircraft including an entire fleet of civilian-certified US Army TH-67 Creek helicopters were certified Single Pilot IFR. The kits were expensive, heavy and complex, but operators chose to spend the money, suffer the loss of payload and deal with additional maintenance and training for the sake of safely performing tens of thousands of safe IFR missions and giving pilots the ability to obtain helicopter experience in routine Instrument Meteorological Conditions (IMC).

Technology and certification standards are now at odds with one another: Today's Wide Area Augmentation System (WAAS)-enabled GPS and solid-state Attitude Heading Reference Systems (AHRS) are reliably and accurately driving glass cockpits and coupled digital autopilots with built-in integrity monitoring and critical component redundancy without yesterday's cost, complexity and weight penalties. This equipment, along with Helicopter Terrain Awareness and Warning Systems (HTAWS), synthetic vision, collision avoidance equipment, severe weather detection equipment, data link options and ADS-B connectivity "in" and "out", all would have seemed Buck Rogers futuristic back in 1999 and yet these systems are certified, affordable, light weight and are installed in all manner of VFR-only helicopters.

These dramatic advances in technology combined with the rapidly expanding network of Point-in-Space (PinS) instrument approaches, and air-traffic control systems based on ADS-B and GPS direct routing, result in IFR flight that is practical, simple to execute and safer than ever. A decade ago, IFR flights took the better part of an hour to plan and usually 15-25% more flight time to execute due to the use of ground-based navigational aids. Today, IFR flights are planned in 2-3 minutes and generally flown GPS direct – requiring no additional flight time. Consequently, many IFR helicopter operators now require IFR as a rule, with VFR only an acceptable alternative for specialty missions requiring visual contact with the ground.

The US Army purchased 102 IFR-approved single-engine Bell 206B-3 Jet Rangers, operated as the TH-67 Creek, in 1993. No new single-engine helicopter models have been approved for IFR in the US since 1999. (©Blue Falcon Foto by Steven Michael Howa. Used with permission.)

Proposed Solution

A recent white paper developed by representatives from industry and relevant associations – the Helicopter Association International (HAI), Aircraft Electronics Association (AEA), General Aviation Manufacturers Association (GAMA) and AHS International – outlines a generic method of compliance with 14 CFR 27 as it pertains to IFR certification. The proposal ensures that a failure or loss of a system deemed to be catastrophic would occur less than once in a million (1E-6) flight hours. Fatal accident statistics attributable to IIMC and weather-related Controlled Flight Into Terrain (CFIT) support the soundness of this level of probability. For the key issue of stability and stability augmentation – an acknowledged difference between rotorcraft and typical airplanes – a performance demonstration in failure modes and human factors workload assessment is proposed versus the numerical safety analysis method required by AC 27.1. Furthermore, a strong argument exists that the criticality of failures in helicopters, even in IFR, is less than for airplanes due to the helicopter's ability to slow down, let down and land in a much more controlled fashion – without the need for a runway. This logic will be key to facilitating the re-introduction of amended Type Certificates for IFR single-engine helicopters.

Working with industry partners, the association team studied a period of 12 years (2001to 2013) of detailed worldwide accident data in an effort to quantify the safety case for this potential paradigm shift. Data was extracted and limited to accidents related to IIMC, CFIT and improper execution of IFR procedures. Of the 247 accidents studied, 194 of these accidents were in *single-engine helicopters restricted to VFR*. 133 of these single-engine helicopter accidents were fatal and resulted in the deaths of 326 people.

53 additional accidents – 46 of which were fatal – were in multi-engine helicopters of which a vast majority were IFR certificated. Of these accidents, 36 were VFR flights in less-than VFR conditions. So clearly, IFR certification is not the panacea that will de-fang IIMC and CFIT. The solution to the problem is better described as IFR certification *combined* with willingness and readiness of pilots and operators to use the IFR system.

IFR helicopters can become cost effective to buy and maintain. Routine operational flights of these helicopters under IFR will enhance safety, reduce noise, and maintain pilot's IFR proficiency. IFR is a good practice even when the weather is VFR and is the key to building the IFR willingness and readiness components of the new IFR helicopter culture. Once the practicality of IFR is discovered in the helicopter industry, the culture will steadily shift away from one that accepts routine VFR flight operations in less-than-VFR conditions. The net result will most certainly be more helicopters flying more often and a steadily declining fatal accident rate – both goals that are worth the effort.

About the Author

Paul Schaaf is the former chief pilot of the Fairfax County (Virginia) Police Department, and a former US Army National Guard utility helicopter pilot. He was previously the Vice President for Operations at HAI, and is now an advisor to AHS International for technology in regulations.

Composite Lightning Strike Protection

By AHS Staff

Automated Dynamics, which manufactures advanced fiber placed composite structures and high performance composite processing equipment, has developed a new method to automate incorporation of lighting strike protection layers into composite structures. This new patented approach significantly lowers production costs over existing methods and improves production time.

The innovation incorporates the metallic lightning strike materials using traditional equipment and techniques for fiber placement and tape laying, and is compatible with both thermoset and thermoplastic resin systems. The metallic mesh is embedded into pre-impregnated tape, offering the mesh support during placement and assuring full consolidation into the composite matrix. Automated Dynamics notes that this new technology can be easily incorporated into composite structures they produce, and their automation equipment can also be easily augmented to enable this capability.

Automated Dynamics provides advanced composite solutions to extreme applications worldwide, and provides automated fiber placement and automated tape laying equipment used in 17 countries.