ROTOR

MARCH 2021 THE MAGAZINE OF HELICOPTER ASSOCIATION INTERNATIONAL

Helicopter Association International

Pilots must practice skills to avoid IIMC if possible, to recover when needed.

By Scott Boughton

A 360-Degree Approach to IIMC

ISTOCK/SANKAI

TIME AND TIME AGAIN, perfectly good helicopters are flown into the ground, killing everyone on board. The root cause is often inadvertent entry into instrument meteorological conditions (IIMC). These accidents have claimed at least 59 lives over just the past 10 years in the United States alone.

How do we put an end to IIMC accidents? Some operators have increased instrument training or made significant investment in equipment. Still others have placed more emphasis on not flying in marginal weather. There is movement in the right direction. What is still needed is a focused, unified effort by the industry to pull together ideas and best practices from around the world and deal with all facets of this problem, from how to avoid IIMC to how to recover from it.

One thing is clear: there is no silver bullet that will fix the problem. Warning pilots of the dangers of flying in marginal weather has not prevented them from doing so. Conducting instrument training does not address a pilot's initial reaction to IIMC. A successful approach to curbing IIMC fatalities must cover all angles. Let's dive in!

The Problem

What's so dangerous about IIMC in the first place? Pilots have flown safely in instrument conditions for decades, and they continue to do so. The danger comes down to the difference between *planning* to be in the clouds and *unintentionally* ending up there.

Pilots who intend to fly in the clouds expect to be operating in those conditions. They understand how important it is to commit to instruments and not try to fly visually without solid visual references.

On the other hand, pilots who encounter IIMC aren't expecting to be there. They're likely straining to maintain visual reference right up to the point of no return. As we'll discuss later, this is where the real danger in IIMC lies: trying to fly in instrument conditions using only visual references leads to spatial disorientation. As shown in the US Helicopter Safety Team's (USHST) recent video, the average helicopter pilot under those conditions has only 56 seconds to live.

IIMC Avoidance: Before Takeoff

One incredibly successful tactic to IIMC survival is to avoid an IIMC encounter in the first place. Let's look at all that you can do—while still on the ground—to minimize your risk of ending up in the clouds.

Management can help with a clear message to pilots that not only is it OK to turn down a flight, but they MUST do so when conditions warrant it.

Preflight Risk Assessment Tools

We can agree that visual flight rules (VFR) flight in zero-zero conditions is unwise. Similarly, accepting a flight with no ceiling and unrestricted visibility is an easy decision to make.

The problem comes when pilots are deciding whether to fly in marginal conditions, especially at night, that carry elevated risk but often don't deliver a compelling reason to stay on the ground. However, there is a widely available tool that helps pilots take inventory of risk factors, consider suggested risk mitigations, and arrive at a no-go decision when conditions warrant: the flight risk assessment tool (FRAT).

While ceiling and visibility are important, including more subtle weather factors in a FRAT will help pilots to assess conditions more accurately. How far apart are weather reporting stations? How closely are current observations matching forecasts? What is the temperature / dew point spread? Does the possibility of icing exist along the route and below the minimum safe altitude?

Take this opportunity to assess your operational or personal FRAT. How well does it capture the weather-related hazards that could lead to IIMC?

Route Planning

Route planning is critical to IIMC avoidance. Because types of helicopter operations vary widely, it's difficult to set strict planning guidelines that fit every operation. The key here is that the pilot must conduct planning from multiple angles.

It isn't enough to simply check the METARS and TAF. Will this ceiling allow me to maintain visual reference and safe distance from terrain and obstacles in the area? Will flat-light conditions prevent visual reference to the horizon, regardless of ceiling and visibility? Are there nontraditional information sources, like highway webcams, that might help fill in the space between observations?

A pilot needs to consider all available information, not just some numbers in a weather minimums table. IIMC is one of the top causes of fatal helicopter accidents. Spending an extra moment during preflight planning to avoid IIMC is worth it.

Learning to Say "Not Today"

The best way to avoid any accident is to simply not fly.

However, let's address the elephant in the room: when we do the right thing and turn a flight down because we don't believe we can safely complete it, there are often very real consequences. If the helicopter doesn't fly, people wait longer for medical care, police ground units go unsupported, oil doesn't flow, revenue is lost—the list goes on.

While a pilot should not accept a flight in poor conditions in order to avoid the negative consequences of a turndown, it is difficult to completely remove the pressure to fly, from both external sources and internal beliefs, which are often the greatest source of pressure. Management can help here with a clear message to pilots that not only is it OK to turn down a flight, but they MUST do so when conditions warrant it—they're being paid to make smart aeronautical decisions. Routine use and sharing of FRAT, which provide pilots and management with a structured way to analyze and discuss flight risks, is another way to remove emotion from the decision to fly.

To avoid undue pressure, let's also educate our customers and clients about what goes into the decision to turn down a flight because of weather. Many clients don't understand the

©2021 Helicopter Association International. Reprinted with permission.

IIMC TOOL KIT

BEAT THOSE 56-SECOND ODDS

"A helicopter pilot who unintentionally continues VFR flight into IMC will very likely lose control of their aircraft and be dead within an average of 56 seconds."

—Nick Mayhew, industry co-chair, US Helicopter Safety Team

1 IIMC AVOIDANCE: BEFORE TAKEOFF

Take a few minutes on the ground to avoid a later IIMC encounter

⚠ **Use a flight risk assessment tool (FRAT)** to assess and mitigate mission risks

⚠ **Create enroute decision points (EDP)** by selecting a minimum acceptable altitude or airspeed for the flight

- ✔ When I go below either of those minimums, I must change my flight plan

⚠ **Plan your route**

- ✔ How will en route weather conditions impact the safety of my flight?
- ✔ How will terrain/obstacles along the route affect my flight plan?
- ✔ What conditions will require me to change my flight plan?
- ✔ If I do end up in the clouds, what's my plan for recovery?

⚠ **If conditions aren't GO for VFR flight**

- ✔ I say, "Let's delay" *OR*
- ✔ I file and fly IFR

2 IIMC AVOIDANCE: IN THE AIR

Be alert for and respond to changing weather conditions during flight

⚠ **When you go below your EDP** (minimum altitude OR airspeed), do ONE of the following:

- ✔ I turn around *OR*
- ✔ I divert to better weather *OR*
- ✔ I Land & LIVE *OR*
- ✔ I pick up an IFR clearance (if trained and equipped)

⚠ **Respond decisively** BEFORE losing visual references

LEARN MORE AT USHST.ORG/56SECS

3 IIMC RECOVERY: IN THE AIR

Surviving an IIMC encounter requires prompt recognition and action

⚠ **You're in IMC** if ONE of these conditions is true:

- ✔ I lack proper visibility *OR*
- ✔ I don't have visual reference to the horizon *OR*
- ✔ I can't control the aircraft visually

⚠ **To survive an IIMC encounter,** you must:

- ✔ Admit that I'm in IMC
- ✔ Commit to instruments
- ✔ Maintain aircraft control
- ✔ Keep my composure
- ✔ Follow my recovery plan
- ✔ Notify ATC

4 IIMC AVOIDANCE AND RECOVERY: TRAINING

IIMC avoidance and recovery are lifesaving, essential skills for pilots

⚠ **Train to stay current, competent, and confident in your IIMC skills.**

I train regularly to keep skills fresh

I train in all aspects of IIMC prevention, beginning with the decision to fly

I train for IMC recognition and instrument transition, as well as instrument flight

I use scenario-based training that reflects my typical missions, environment, and weather

I use simulators, aviation training devices, and desktop flight programs to experience safely the result of poor decision-making and delay in IMC recognition

GINA KVITKOVICH, CONTENT, AND ERIN HORLACHER, GRAPHICS

impact of weather on general aviation operations, particularly at the lower altitudes that helicopters fly in. If they understood the risks they were embracing, they wouldn't be so eager to go in poor weather.

Filing IFR

Another option, and a highly underused one, is to just file and fly IFR in the first place. However, we know that many rotorcraft operators don't field IFR-certificated aircraft or retain IFR-rated pilots. Perhaps now is the time for operators and pilots to consider these upgrades that would dramatically enhance their operational capabilities.

IIMC Avoidance: In the Air

You've done your route planning and risk assessment. You've decided that taking the flight is the safe, prudent, and legal course of action.

Then reality happens. The ceiling and visibility aren't quite what you expected. But is the weather "bad" enough to change your plans?

This fuzzy area (pun intended), where a pilot still has some visual reference but isn't in visual meteorological conditions (VMC), is where people can really get hurt. By the time they realize they can't see enough to safely control the aircraft, their sense of spatial orientation is likely not aligned with reality—or gravity, for that matter. They've forced what they're seeing to align with what they're feeling, regardless of what the instruments indicate. Unless a smooth transition to instrument flight is made right at this moment, the outcome is unlikely to be good. The key is to not let it get this "bad."

Defining IMC

The problem here is that "bad" is an unclear term, and allowing ourselves to continue into deteriorating weather without clear guidelines can have disastrous results.

VFR define the distances from the clouds and flight visibility required to operate legally in a particular airspace type. But how do I tell if I'm 2,000 ft. horizontally from a cloud? How much reaction time does half-a-mile (800 m) visibility really give me?

At the direction of the HAI Board of Directors, the HAI Training and Safety Working Groups have developed IIMC training resources for the industry, including:

- VFR/VMC best practices
- Techniques for estimating distances from clouds and obstacles
- Guidance for IIMC decision-making
- Recommendations for IIMC prevention and recovery training.

These resources will be published soon; watch ROTOR Daily for the announcement or visit rotor.org/safety.

Here's one IMC definition that focuses on what matters: if you lack ANY of these—proper visibility, visual reference to the horizon, OR the ability to control the aircraft visually—you are in instrument meteorological conditions.

Changing Your Flight Plan

Pilots need strategies—developed ahead of time—for determining when it's necessary to alter their flight plan. A technique to help pilots evaluate deteriorating flight conditions is the enroute decision point (EDP), where reaching preselected minimum altitudes or airspeeds triggers the need to make a decision.

By requiring pilots to take alternative action when they've had to descend or decelerate below predetermined altitudes and airspeeds, some of the burden of making that decision is removed from the pilot. In a sense, by committing to an EDP, he or she has made the tough decision BEFORE taking off.

Whatever the method for reaching the decision, when we realize that our plans must change, we need to choose one of these alternatives:

- Turn around
- Divert to better weather
- Land & LIVE
- Pick up an IFR clearance (if trained and equipped).

IIMC Recovery: In the Air

Up to this point, we've looked at ways to reduce the number of IIMC *encounters*. While these measures should reduce IIMC incidents, real-world weather is just too unpredictable to eliminate them completely. If we want to reduce IIMC *accidents* to zero, pilots must plan and train to survive the encounter.

Staying Calm

Your initial reaction to losing visual reference is key to your survival of an IIMC encounter. Most student pilots learn the 4 Cs for reacting to an emergency at some point in their training: Climb, Communicate, Confess, and Comply.

Bruce Webb, director of aviation educational and community outreach for Airbus Helicopters, suggests that we should change those Cs to "composure, composure, composure, and composure." As in most emergency situations, not panicking and keeping a clear head is most important.

It's also important to be aware of what happens to pilots physiologically during emergencies. Fine motor skills are temporarily lost, and tunnel vision sets in. A person under extreme stress will also tend to mirror physical actions from one side of the body to the other (bilateral symmetry). You may not want your right hand pulling back on the cyclic as you pull up on the collective with your left hand.

This is why pilots need to have a plan in place for encountering IIMC: so when the initial loss of motor skills occurs and tunnel vision takes over, they have a process to keep them alive until their composure returns.

Maintaining Control

Conventional advice to pilots in IIMC is to transition to instruments. Then stabilize attitude, heading, power, airspeed, and trim, followed by initiating a controlled climb to a safe altitude.

This plan works for many aircraft, but not all. Operators of minimally equipped aircraft (for example, no attitude indicator) must customize their IIMC plan to fit their unique situation. The key factor here is that every pilot has a plan for encountering IIMC, has practiced that plan, and is ready to commit to that plan during those first critical moments.

Getting Back on the Ground

Now that we are under control and maintaining a safe distance from the ground, what's next?

Depending on the type of aircraft, installed equipment, and pilot proficiency, our choices vary. Do we climb to a VFR altitude above the minimum safe altitude and ask for vectors to an approach? Do we turn around and try to

©2021 Helicopter Association International. Reprinted with permission.

fly out of the bad weather? Do we use our knowledge of the surrounding terrain and attempt a slow descent? Depending on location and aircraft equipment, all of these could be valid choices. One thing is certain: the pilot needs to form his or her unique recovery plan before leaving the ground.

Regardless of the specific plan, the pilot should use all resources available. Once your aircraft is under control, declare an emergency. It helps air traffic control (ATC) clear the airspace around you, gives you another resource for assistance, and even helps protect your certificate (contrary to some pilots' fears, the FAA will support your efforts to keep out of the accident database).

Of course, ATC wants to help, but they can do more harm than good for a pilot who hasn't yet regained control of his or her helicopter. Until you've established aircraft control, resist making radio calls, entering squawk codes, or changing frequencies. Spatial disorientation, loss of control, and a fatal accident are almost a certain outcome when a pilot fails to prioritize aircraft control above all other actions. When talking to ATC, pilots need to know when to say "Stand by" or "Unable."

Train for IIMC Avoidance and Recovery

When visibility begins to deteriorate, a pilot must be able to recognize those signs and make the appropriate decision to land or commit to instruments before spatial disorientation sets in, all while under extreme stress. This is critical to surviving an IIMC encounter and requires very specific skills.

How can you practice those skills? Frequent, effective, realistic training in reacting to IIMC is the final and essential part of the IIMC solution.

IIMC training isn't the same thing as instrument training. Bryan Smith, safety program manager for the Airborne Public Safety Association, reminds us that it isn't during the vectors and instrument approach phase that most people are killing themselves. Of the 22 IIMC accidents that occurred between October 2010 and October 2020, exactly ZERO occurred after the pilot had properly transitioned to instruments.

Controlling an aircraft by reference to instruments and executing an instrument approach is a key component of IIMC training. However, training in recognizing IIMC conditions and transitioning promptly and appropriately to instrument flight is just as, if not more, important.

Scenario-based training, use of flight simulators and aviation training devices (ATD), as well as recent advancements in view-limiting device technology have greatly increased the quality of IIMC training in recent years. Like any tools, though, they need to be employed properly.

IIMC training should always include a scenario-based course of action for the pilot to work through that reflects the conditions or missions that the pilot would be likely to encounter. Simply slapping a hood on a pilot and telling him or her to recover from an unusual attitude or to shoot an instrument approach isn't good IIMC training. The scenario should involve the whole process, from the decision to accept the flight to the recovery from an inadvertent encounter.

Many pilots in training are permitted to set avionics for an approach while still sitting on the ground. While a pilot in a real-world scenario should be encouraged to prepare ahead as much as possible, it's important in training to allow the pilot to build the skills to handle the whole process in flight. This should also include emphasis on gaining positive control before even thinking about setting up an approach. (Any pilot in a real-world situation who feels the need to set up an instrument approach while still on the ground "just in case" should reconsider their decision to launch in the first place.)

Training in simulators and ATD allows pilots to play out a scenario to its likely conclusion. The moment you pause the simulation and remove the weather to reveal the aircraft is inverted and pointing toward the ground can have a great impact on the training pilot. Spatial disorientation is insidious precisely because it can trick pilots into "knowing" that their instruments are wrong. Sometimes a person needs to see to believe.

View-limiting devices that allow an instructor to slowly decrease visibility can lull a pilot into staying visual just long enough to be extremely disoriented when he or she finally commits to instruments. What the pilot thought was the horizon was actually a road, and the pilot's head and aircraft instruments disagree. Doing this exercise in actual flight involves the vestibular system and is the only way to get the pilot truly, physically, spatially disoriented. Experiencing this sensation might just convince a pilot to turn around a little sooner next time or decline to take off in the first place.

Next Steps

It's now obvious that our industry needs to provide pilots and operators with a 360-degree approach to IIMC prevention and recovery, including procedures, tools, and recurrent, effective, realistic training. This will be an ongoing process, requiring the input and buy-in of the whole industry—including everyone reading this article.

You can become part of the IIMC solution by implementing the steps discussed in this article (see p. 3 for a convenient one-page summary). Thanks to our industry's dedicated volunteers and safety professionals, there are resources—many of them free—that you can use to improve your ability to avoid or recover from IIMC. Visit rotor.org/safety to get started, and spend at least 56 seconds committing to a plan to increase your skills in IIMC prevention and recovery.

If you lack ANY of these—proper visibility, visual reference to the horizon, OR the ability to control the aircraft visually—you are in IMC.

©2021 Helicopter Association International. Reprinted with permission.