

A plan for reducing wire strike accidents



Powerline sensors, HTAWS and specialized training can significantly lower helo collision rate with cables.

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Most helicopter missions are flown at very low altitudes, and powerlines are often nearly invisible to pilots. Specific training in the “wires environment,” proper crew resource management and technology can all lessen the threat of an accident.

Wire strikes are a serious threat to helicopter safety. Ranked as a leading cause of rotorcraft accidents worldwide, power lines claim on average 2 helicopters every week. Any aircraft operating below 1000 ft is vulnerable to a wire strike—and, since most helicopter missions involve prolonged flight at low altitudes, the risk is particularly high for this segment.

Government and industry safety organizations support a multilayered strategy to combat this threat. Mitigation strategies include train-

ing, awareness and technology, both airborne and on the ground.

The threat of wire strike accidents increases daily. In the US alone, the web of power lines covers 4.5 million miles and is growing. Industry and consumers around the world have an ever-increasing appetite for power and connectivity. To satisfy this demand, utility companies are building continually on vast networks of wires, towers and new technologies such as wind turbines. Like a spider web, this growing network silently awaits its prey.

FAA, NTSB and industry studies

identify wire strikes as a factor in roughly 5% of all rotorcraft accidents. For civilian aircraft, decade to decade, this rate is highly consistent, although since 1996 these accidents are becoming more deadly.

For the rotorcraft industry, wire strike accidents are very troubling—the threat is hard to see, the accidents are often fatal, and in every case it either substantially damages or destroys the aircraft.

Utilities/Aviation Specialists Pres Robert Feerst, an expert in wire strike prevention, says, “At typical

flight speeds, wires are almost invisible. If there is one takeaway, wire and obstruction strike accidents are preventable if the pilots and crew understand what the enemy looks like. You have to have the awareness every time you operate in the wires environment. Until you have a basic understanding of what can get you in trouble, it's a lethal place."

Unlike other accident categories, experience and weather are not typically identified as causal factors in wire strike accidents. In fact, according to FAA, the average age of the accident pilot is 43.5 years, with over 4000 hrs of flight time. Likewise, the weather is typically good—86% of these accidents occur in daytime VMC.

During the 1990s, lighter piston and turbine-powered helicopters such as the Robinson R22/44 and Bell 206 series accounted for approximately 2/3 of all wire strike accidents. In recent years, larger, more advanced helicopters have been involved in an increasing number of deadly collisions with obstacles such as wires and towers.

On Jun 30, 2012, a Eurocopter AS350B was destroyed while flying at low altitude in VMC through the Verde River canyon near Camp Verde AZ. The accident occurred when the aircraft struck a cable spanning the river. Investigators found a severed steel cable on the eastern shore of the river. Both the cable and aircraft main rotor blades had evidence of wire contact. The severed cable, which normally would have been suspended 40–50 ft above the river, had gray paint and composite blade fibers embedded in the wire strands. Two of the 3 main rotor blades were damaged 3 ft inboard of the tips. The pilot and 3 passengers were killed.

On Jul 25, 2012, a Eurocopter AS532 Cougar—a Super Puma derivative—on a predelivery test flight collided with electrical cables in the mountainous Gorges du Verdon (Alpes-de-Haute-Provence). The daylight flight under VMC had originated from Marseille and was carrying 6 Eurocopter employees for a final verification flight prior to delivery to the Albanian Army. All 6 Eurocopter employees died in the accident.

On Aug 5, 2012, a PHI Air Medical Bell 407 operating as an EMS



Safe Flight's powerline detection system (left side of instrument panel) "listens" for the electromagnetic signature of energized power distribution lines. As the helicopter nears the live wire, the audible tone increases in frequency, providing ample warning to the pilot to change the aircraft's flightpath.

flight from College Station to San Antonio TX collided with a cell phone tower. While operating under Part 135 in night-time VMC, the aircraft struck the tower, damaging a landing skid. The flight ended uneventfully due to some quick thinking by firefighters at SAT (Intl, San Antonio TX). On notification from ATC, the firefighters constructed an impromptu "landing pad" with mattresses and weights from their living quarters. The pilot, flight nurse, paramedic and patient escaped injury following a "balanced landing" with a severed skid.

Intervention recommendations

In 1980, NASA released *Civil Helicopter Wire Strike Assessment Study*—a report that analyzed NTSB and FAA accident reports. The study made several recommendations of interventions to mitigate the threat, such as pilot warning devices, wire cutters and improved training. The authors concluded that pilot warning devices would have been beneficial in preventing 76% of the accidents, wire cutters would have been 49% effective, and pilot training would have made a difference in 56% of the cases.

In Aug 2011, the Intl Helicopter Safety Team (IHST) released its analysis team's *Compendium Report*,

which analyzed 523 US civil helicopter accidents from the calendar years 2000, 2001 and 2006. IHST's intervention recommendations mirrored the earlier NASA study in suggesting improved pilot training and the installation of equipment such as proximity detection systems, wire detection systems and a wire strike protection system (WSPS or wire cutters), any or all of which would help mitigate the threat of a wire or object strike.

In the context of a proactive safety management system (SMS)—and based on the severity (loss of equipment and harm to the occupants) and frequency of these accidents—operators would be required to put controls in place to mitigate the risk associated with continued flight operations at low altitudes. The most successful risk mitigation strategies involve employing both soft and hard safeguards (controls).

Soft safeguards may include procedures and training focused on preventing collisions with obstacles such as wires and towers. A Flight Safety Foundation (FSF) study suggests a thorough preflight review of aeronautical charts and high-altitude surveillance or reconnaissance flights over the area of operations. While familiarity with all terrain and obstructions in an area is desirable, this becomes challenging



Wire strike protection system (WSPS)-equipped Bell 407 operates at low altitude. As a last line of defense, WSPS can lessen the consequences of a wire strike accident by slicing through the cable.

when covering large geographic areas—and it is important to understand that not all power lines and towers are charted. High-altitude reconnaissance flights will aid the pilot in locating towers and wires, but maintaining a high level of situational awareness is difficult while flying single-pilot during periods involving multiple distractions—both internal and external—such as radio communications or searching for airborne traffic.

An invisible threat

According to an FSF report, experts agree that precautions such as a chart review and reconnaissance flights may not be adequate for detecting all wires. Multiple NTSB accident reports support claims that wires are often nearly invisible in flight. Contributing factors vary widely—from dirty windshields to low light, or even too much light when flying directly toward the Sun.

Optometrist Warren DeHaan adds, “Pilots notoriously have the misconception that they will see the wires in time at the wire level. You just cannot count on it. The wire is not consistently visible.”

Feerst adds, “Wires are difficult to see, partly because the way the human eye functions and partly because of the effects of some backgrounds and light angles in camou-

flaging wires. The eye starts to lose its visual acuity at 3° off center. Unless you’re looking right at the wire, you’re unlikely to see it.”

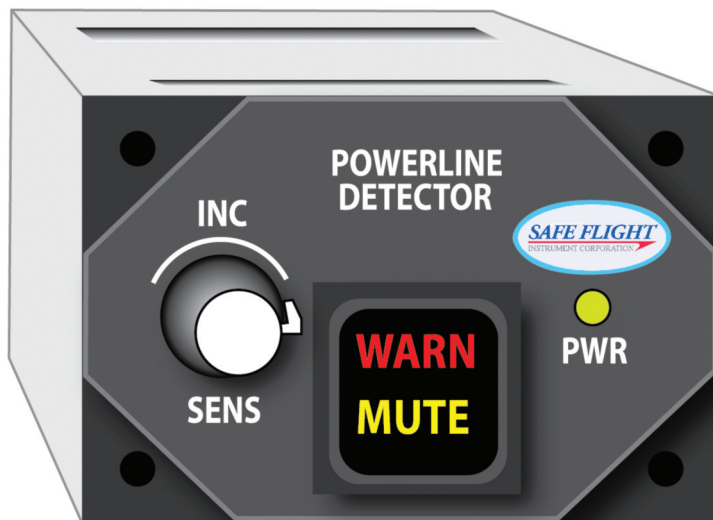
Having trained more than 25,000 crewmembers worldwide since 1985, Feerst adds, “There is no substitute for training. Our course teaches core survival skills for low-level operations—this includes crew resource management (CRM) for not only the pilot, but all occupants of the aircraft, whether it’s a paramedic, lineman, observer or patrolman.”

Feerst notes that, during single-pilot ops in the low-level wires environment, it is critical to have everyone engaged in the search for hazards. CRM is a core component of his wire strike prevention courses. HAI recommends formal training for any operator engaged in low-level flight operations.

Hard safeguards may include the use of airborne technologies and/or ground equipment to prevent or provide an added level of protection to the aircraft and its occupants during low-altitude flight ops. Airborne technological solutions may include both preventative systems and reactive devices.

Preventative systems include proximity detection systems such as terrain awareness and warning systems (TAWS) and power line detection systems. Reactive devices include wire cutters. Ground-based equipment ranges from simple spherical power line markers to more technologically advanced obstacle collision avoidance systems.

Sandel Avionics HeliTAWS is a unique proximity detection system that combines WireWatch—a continuously updated database of known power lines and towers—with a high-resolution terrain and obstacle database. Sandel CEO Gerry Block says, “Just as HeliTAWS itself helps pilots avoid CFIT, our WireWatch feature helps eliminate the hazard of near-invisible transmission lines by enabling helicopter



Safe Flight says its powerline detection system—a low-cost, lightweight detection system—can be installed in a helicopter in 2 days. More than 50 examples are in service on 17 helicopter types.

crews to spot known wires.”

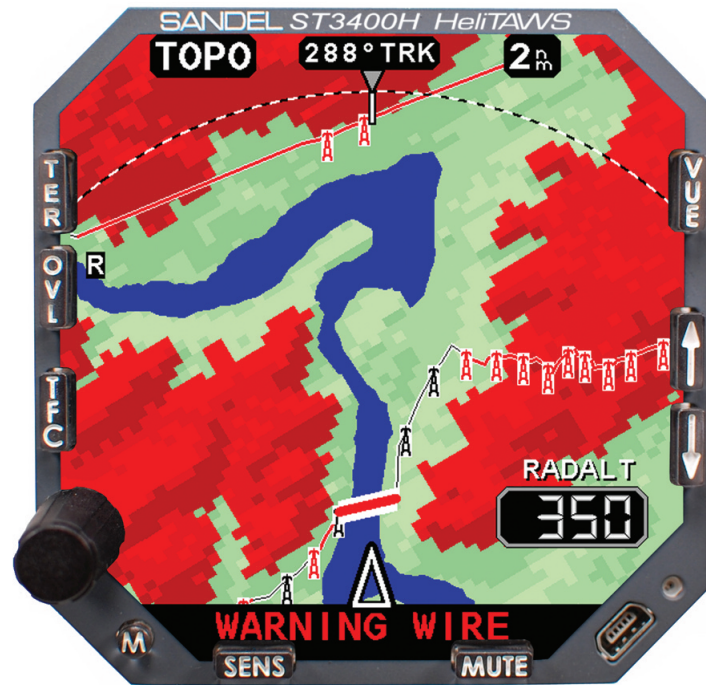
Launched during Heli-Expo 2011, HeliTAWS is the only multihazard avoidance system currently available. WireWatch provides pilots with additional situational awareness and alerting of known wires above 100 ft AGL. The database is updated using information from utility companies and operators.

Several power line detection systems have been developed in recent years. Safe Flight Instrument Corp’s powerline detection system (PDS) is an example of a relatively low-cost device designed to warn pilots when they near wires that are energized. Safe Flight’s PDS senses the electromagnetic field generated by live electrical power lines and emits a pulsing audible sound and visual alert. Alerts begin around 1800 ft and the frequency of the audible sound increases as the helicopter nears the wires. According to the manufacturer, only 17% of wire strikes involve de-energized lines. Thus, PDS would have effectively provided a warning in 83% of the accidents. Currently, more than 50 Safe Flight PDS systems are installed on 17 different helicopter types worldwide. Installation of the receiver, display and antenna takes approximately 2 days. Cost is roughly \$12,500.

Helicopter laser radar (Hellas) is another more advanced and costly detection system that uses an eye-safe laser to scan the environment for wires and other flight obstacles. Developed by Fairchild Controls—an EADS company—the system provides optical and acoustic signals to warn pilots of a hazard. Hellas is deployed on several advanced helicopters and costs in excess of \$100,000.

A WSPS or wire cutters may lessen the consequences of a frontal impact with power lines. A typical installation consists of a roof-mounted cutter and one or more other cutters on the airframe. The system also incorporates a deflector that runs vertically along the windshield.

For a WSPS to be effective, the helicopter must be flying at speeds greater than 30 kts and strike at an angle less than 60° to the wire (and $\pm 5^\circ$ of pitch). The system is designed to cut a 3/8-in steel cable with a breaking strength of 12,000 lbs. In 1992, the US Army began equip-



Sandel Avionics HeliTAWS is the industry’s only multihazard avoidance system. HeliTAWS provides advance warning of terrain, obstacles and wires while virtually eliminating nuisance warnings through its proprietary algorithms.

ping all of its helicopters with WSPS. This, coupled with increased wire strike awareness and prevention training, has greatly reduced the number of fatal wire strike accidents. Worldwide, more than 20,000 WSPS kits have been installed on 65 different helicopter types.

Wire or aerial markers are colored spherical balls (usually orange or another high-visibility color) installed on the power lines by utility companies. P&R Tech has been supplying SpanGuard markers since 1960. They are available in different sizes and colors—some are equipped with reflective tape or painted to illuminate at night.

A higher-tech, ground-based solution is the obstacle collision avoidance system (OCAS). Developed in Norway, its main feature is a powerful low-energy radar that detects airborne traffic approaching within 3 miles of a power line or wind turbine. The radar tracks the aircraft’s heading, altitude and airspeed, and determines if a warning should be activated. If it does so, all primary ground-based lights are activated, illuminating the threat to the incoming aircraft. An optional secondary VHF warning can issue an audio alarm to the approaching aircraft.

Once the aircraft passes the site safely, all lights and alarms are deactivated. Several utility companies in Europe and Canada have deployed OCAS.

Wires continue to present a significant risk in the low-altitude environment. While new wire strike prevention technologies hold promise to reduce the number of accidents, not all aircraft are equipped and not all wires are marked. Feerst of Utilities/Aviation Specialists agrees. “Technology is a wonderful thing,” he says, “but it’s a failsafe that’s no substitute for training.”

The best methods for reducing the wire strike threat are education about this potentially lethal environment and increased vigilance in the cockpit. ✈



Stuart Lau is a consultant. He leads the IHST HFDM Working Group and acts as an IHST liaison to the Global HFDM Steering Group. He is also a pilot for a large international airline and a safety and accident investigation committee member. Lau has been associated with Pro Pilot since 1996.