

Sandel, Garmin and Honeywell develop new HTAWS to warn pilots about wires, cables and power lines

Significant progress has been made by these avionics producers with advanced databases, displays and alerting systems.

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Workhorse helicopters operating near power transmission lines and wires may have better protection with the new HTAWS technology. Advanced displays and high resolution terrain and obstacle databases are expanding the protection envelope for the helicopter industry.

The standards for operational efficiency and safety for helicopters are moving up, and so is the demand for new avionics that can improve overall operational safety. Combine the innovative use of modern computers, obstacle databases, a touch of ingenuity and the result is an

emerging new class of helicopter terrain avoidance warning systems (HTAWS). These new helo avionics systems are being developed to focus specifically on the 2 major problems workhorse rotorcraft face when flying close to the ground—wires and obstacles.

FAA's recent rule making announcements mandated some new equipment and higher levels of training aimed at stemming the increased accident and fatality rates. Today there are more uses and increased value in helicopter operations, which influence almost every aspect of society. And the dangers associated with operations down low for helicopters has led to a need to do something different. FAA notes that "These pilots fly year-round in rural and urban settings, over mountainous and non-mountainous terrain, during the day and during the night, and in conditions where visibility is good and in conditions where it is not. They must often land at unfamiliar, remote, or unimproved sites with hazards like trees, buildings, towers, wires, and uneven terrain."

Another aspect of what is occurring comes innocently from many that hire helicopters with the expectation of precision anywhere, regardless of the environment or terrain. Today the result is a tempo and type of helicopter operations that have taken older machines and instrumentation past their limits. The FAA poignantly added in a recent rule making document that, "Of the most significant reasons for an accident in a helicopter, wire and obstacle strikes are the greatest threats, followed by CFIT—controlled flight into terrain—at night."

Statistics related to low flying helicopter operations are actually mind numbing to a fixed-wing pilot. A TAWS briefing by Garmin recently cited that 90% of strikes with power lines are with wires below 200 ft, with most of those during daylight hours. And 70% of strikes are with wires below 100 ft. Noted also in this charming set of numbers is the fact that even pilot experience is not a discriminating factor since 80% of



Sandel's ST3400H HeliTAWS was designed as a nuisance-free alerting system to warn helicopter operators flying very close to the ground, power lines and wires.



Sandel's ST3400H HeliTAWS, seen here mounted in the AgustaWestland A109E, provides standard terrain awareness and warning as well as low to the ground protection.

strikes are with pilots who have at least 1000 hrs of logged time. So much for the "old pilots and bold pilots" theory of accident statistics (and the follow on of "but no old bold pilots"). The data about wire strikes goes on with another key fact that 60% of pilots failed to see the wire even though they may have known it was there.

One important point to keep in mind on this matter is that the current TSO for helicopters, TSO C194, is not sufficient for many helicopter mission profiles, such as search and rescue, or any off-airport operations. The TSO does not address power lines specifically but lumps them into the general area of obstacles.

In response the innovators of the avionics industry Sandel, Garmin and Honeywell have developed new TAWS technology for safety, which may also become the new core of efficiency in helicopter operations. Solve both warning and awareness for close proximity to these dangers, provide the needed buffer to enable routine helicopter operations, and you will save lives, sell this new technology and make money.

The challenge for the avionics industry is getting the needed data on power lines, transmission towers and wires. US government sources provide only a limited data set. Data exists on topographic maps and also in a variety of independent and eclectic forms from legacy paper to modern databases. When

trying to find digital sources that provide the location of high voltage transmission lines, it turns out that there is no common format for power line data and it's not easily accessible or compiled in one place. The utility companies each have different kinds of geographic information systems (GIS) or database storage methods with no standardization for either representation or attributes readily transferable to aviation formats. Information is always changing as well, with accuracy dependent on the source of data, and may not always contain all the data on both the poles and wire information. But the good news is that commercial data on above-ground cables, wires and towers is becoming available and getting better. As technology evolves, connecting people to power and billing them go hand-in-hand. This has resulted in a growth industry of digital data for both terrain and power lines.

Helicopter tower and wire avoidance TAWS equipment from Sandel, Garmin and Honeywell

Sandel, a company well known for innovation, has focused on an extension of its successful ST3400 TAWS/RMI to produce HeliTAWS. The new product, the ST3400H HeliTAWS, was designed as a nuisance-free alerting system that could easily warn helicopter operators fly-

ing very close to the ground of the threats posed by towers and wires in the pilot's flying area. Sandel's HeliTAWS uses 4 modes of sensitivity and can show obstacles greater than 50 ft above the ground and transmission lines higher than 100 ft. The 4 selectable modes are based on altitude and include Normal operations (500 ft), a Low mode for 300 ft, a Tactical mode for 150 ft and an Obstacle-only mode. Sandel has also developed a new line of thinking on how wire obstacle data can be integrated within their HeliTAWS by logically connecting the dots between transmission lines and poles, improving on alerting helicopter operators. WireWatch is the company's trademark for the ability of its HeliTAWS to help pilots avoid wire obstacles. It is based on where data is available and it includes synthetic vision topographic displays of roads, water and rivers so that it provides an excellent reference for VFR flight. HeliTAWS has been designed to interface with the helicopter's onboard GPS, and includes a 3-arc-second terrain database, charted man-made obstacles, airports and heliports. The pilot operating Sandel's HeliTAWS can also define the location of obstacles as well as a landing area. The HeliTAWS is about a 3-inch wide panel mounted unit instrument and weighs only 2.7 lbs. Self-contained, it provides aural and visual announcements and warnings and has a 3D plan view with "ultrahigh



Garmin's HTAWS being developed for the plague of wires and obstacles posing threats for helicopter pilots is available for the Garmin GTN touchscreen product.



GNS 430/540W navigators with Garmin HTAWS includes operating modes for Normal and RP (reduced protection) modes.

resolution terrain." Database updates can be downloaded from Sandel's website and ported with a USB drive. Sandel's HeliTAWs is now in service in a variety of government and military helicopters, and is standard onboard equipment for the new Sikorsky S70-I Black Hawks. HeliTAWs is undergoing further evaluations by all the US military services.

Garmin's development of their adoption of TAWs for helicopters began to make its way into the market some years ago with the rollout of the company's G500H, which provided an affordable SVS PFD package. The Garmin TAWs was integrated with the PFD for terrain and obstacles, and the terrain of the SVS PFD would change to the appropriate color along with providing aural alerting. The new Garmin HTAWS being developed for the plague of wires and obstacles posing threats for helicopter pilots is available for the Garmin GTN touchscreen products and for GNS 430/540W navigators. Garmin HTAWS includes operating modes for Normal and RP (reduced protection) modes. Normal mode is the default mode used of up and away and IFR. The RP mode is pilot selectable for low VFR as a means for protection. The Garmin HTAWS display provides a visual depiction of the obstacles and power lines that are threats, and includes a terrain

map depicting altitude, with voice call outs in 100 ft increments up to 500 ft down to 50 ft above the surface. Garmin has also designed visual cues showing obstacles in an overstated way to keep the pilot well away from the threat. Following power lines for example, the pilot sees the power lines and, as he cruises over them, they change color. The human factor questions Garmin has investigated for warning down low of power lines, wires and obstacle is aimed at the specific issues of flying at very low altitudes from the ground up to 200 ft. Garmin has been taking into consideration research into the density of power lines in an urban setting, what modes of flight such as helicopter drift change a threat condition, or when should power lines be removed from a display and considered not to be an immediate threat? Other points of the Garmin research effort relate to how to scale the different types of wires, and how to differentiate between relative heights with color or other display symbology? A novel approach that Garmin has developed is wrapping a color boundary such as yellow or red bar around the wire threat area, making the pilot think about keeping a safe buffer distance from the wire threat. This approach leads to pilot alerting in advance time to develop buffer distances, even integrating unique aural alerts for power lines and changing alerting volumes.

Honeywell has a SmartView SV HELO program that pushes further into the flightdeck integration of helicopter TAWs and the Primary Flight Display (PFD), bringing wire and obstacle data and enhanced vision within the PFD and Nav Display operation. The combination of real sensor imagery for both day and night and low visibility, along with wire and obstacle data, provide continuous cues as to the dangers down low. Recently tested in the New York City area, the Honeywell SmartView SV HELO program evaluation included bridges, vertical city obstacles, radio towers and windmills. Honeywell even has obstacle models of wind turbine tower blades rotating in the wind to further bring your attention to these dangerous areas of flight. Integrating the flight display with both the obstacles and a TAWs terrain and color warning scheme is both logical and quite advanced. Combined with a Honeywell-provided Flight Path Vector, this new TAWs technology gives the pilot confident control of the aircraft in its potentially dangerous surroundings. Honeywell's developments for power lines and wire sensing take into consideration helicopter maneuvering such as negative pitch attitudes, large splits in heading and track and steep approaches. In fact the design of the new Honeywell SV HELO flight display specifically supports the VFR environment for corporate flight ops



Honeywell's Marc Lajeunesse puts the new SV-HELO TAWS through the paces over New York City. This is the helicopter industry's 1st real Combined Vision System (CVS) bringing HTAWS into the Primary Flight Display (PFD) and merging wire and obstacle data with enhanced vision.

with helicopters or functions like EMS and other “down and dirty” workhorse-type operations. The SmartView HELO is a Flight Path Vector instrument providing instantaneous energy and direction information to the pilot, matched with terrain and obstacles. Keep the flight path vector pointed where you're going and you are warned about obstacles in your path. The equipment keeps you out of trouble. Honeywell also added a lot of new and unique symbology for close-to-the-ground helicopter operations, such as being able to have a point in space to navigate to off-airport landing areas. And it includes high approach angle glide reference cues with landing zone data for stable approaches.

Honeywell's SV HELO with enhanced vision covers 2 technical challenges for “see-and-avoid” charted and uncharted wires and obstacles. The current state of affairs with wire and obstacle databases, the potential for inaccuracy or total lack of any data makes the use of a sensor a significant advantage to solve these problems and provide flight safety for the helicopter pilot. Use of enhanced vision sensors (infrared) with SVS creates the helicopter industry's 1st real Combined Vision System (CVS), and works for

both day and night operations. Integrating EVS and SVS into the TAWS operation leverages all of these technologies into 1 flight instrument, resulting in a practical flightdeck operation that potentially overcomes the database issue.

What's coming next in HTAWS

Growing focus among avionics OEMs on power line and wire obstacle alerting for HTAWS products is a sign of the times in terms of technology for helicopter flightdecks. In the past the size of the database, software and even the video display working decently in real-time, presented some huge computational challenges. And whatever was developed by the avionics supplier was very difficult to move economically between platforms. The certification process for these new technologies has also meant obstacle avoidance progress for fixed-wing aircraft. This new vectoring of engineering energies toward more advanced HTAWS, then, means increased safety for both airplanes and helicopters. But the real power line dangers are faced by the helicopter pilots so the new HTAWS developments are very welcome.

Today's industry approach is to cre-

ate an HTAWS that is independent of the type of aircraft installation so that it can offer standard and repeatable performance, signaling the reality that helicopter avionics suppliers see this as its own world with specific needs and solutions. Both technology and innovation have now made their way into the helicopter community and avionics suppliers have become Ninja-like in their attack on the safety issues, turning the end result into equipment that is affordable for the helicopter operator.

New HTAWS technology isn't stopping here, however. Soon real-time sensors will detect obstacles and may even incorporate 360 degree 3D display technology. Helicopters are a growth industry and the life-savers and workhorse aircraft in the field. And so dedicated imagineering of new systems and displays are for once really on the way just for helos.



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