# TAWS

## *FAA mandates a new proximity to safety!*

BY GARY PICOU

Sometimes a government mandate seems like bureaucratic meddling. Yet in the case of Terrain Awareness Warning System (TAWS) the mandate makes sense. It very well can save your life. The only airplanes that won't benefit from TAWS are those that never, ever fly with reduced visibility, over an unobstructed flat surface. The ocean is all that might qualify, as long as you don't go near oil rigs.

Controlled Flight Into Terrain, or CFIT, accounts for 17 percent of all general aviation fatalities. According to the FAA reports, "A CFIT accident occurs when an airworthy aircraft, experiencing no contributory systems or equipment problems, under the control of a certificated, fully qualified flight crew not suffering from any impairment, is flown into terrain (or water or obstacle) with no demonstrated prior awareness of the impending collision on the part of the crew. Most CFIT accidents have in common a chain of events leading to what human factors experts term "lack of situational awareness" on the part of the flight crew. Conditions of limited visibility (due to darkness or weather or both) are typically a major contributing factor."

***The TAWS buying decision is one that will pay immediate and future dividends when you go to sell your aircraft.***


The 1999 report, "Descriptions of Flight Paths for Selected Controlled Flight into Terrain (CFIT) Aircraft Accidents, 1985-1997" by the FAA's Robert O. Phillips, Operations Assessment Division, DTS – 43, Aviation Safety Division, DTS – 67, was used as a basis for TSO C151.

By March, 2005, all turbine-powered aircraft with six or more passenger seats (not including the pilot and copilot) must be equipped with a certified terrain avoidance system.

That is a significant number of corporate jets, and this will make those operators safer. The mandate extends the rules that used to apply to air transport aircraft operating under Part 121, to include aircraft that are even flown under the Part 91, which are the "rules for the rest of us."

But why even stop there? The technology for terrain avoidance is available to all, including portable terrain display systems which can sell for less than $2,000!

### Buyers Guide

Unlike a GPS or a transponder, you can't just pick a brand and go buy a TAWS system. There are a few considerations that must be included in the decision. There are class distinctions, as well as certification issues—the product you find most appealing may never have been installed on your airplane.

The first place to start after you have decided to have a TAWS system installed is with your professional avionics shop. They should evaluate your aircraft, determine your class distinction, inform you of certification

| STANDARD SET OF VISUAL AND AURAL ALERTS | | |
|---|---|---|
| **Alert Condition** | **Caution** | **Warning** |
| Terrain Awareness Reduced Required Terrain Clearance | **Visual Alert**<br>Amber text message that is obvious, concise, and must be consistent with the Aural message.<br><br>**Aural Alert**<br>Minimum Selectable Voice Alert:<br>"Caution, Terrain; Caution, Terrain" | **Visual Alert**<br>Red text message that is obvious, concise and must be consistent with the Aural message.<br><br>**Aural Alert**<br>Minimum Selectable Voice Alert:<br>"Terrain; Terrain" |
| Terrain Awareness Imminent Impact with Terrain | **Visual Alert**<br>Amber text message that is obvious, concise, and must be consistent with the Aural message.<br><br>**Aural Alert**<br>Minimum Selectable Voice Alert:<br>"Caution, Terrain; Caution, Terrain" | **Visual Alert**<br>Red text message that is obvious, concise and must be consistent with the Aural message.<br><br>**Aural Alert**<br>Minimum Selectable Voice Alert:<br>"Terrain, Terrain" |
| Terrain Awareness Premature Descent Alert (PDA) | **Visual Alert**<br>Amber text message that is obvious, concise and must be consistent with the Aural message.<br><br>**Aural Alert**<br>"Too Low; Too Low" | **Visual Alert**<br>None Required<br><br>**Aural Alert**<br>None Required |
| Ground Proximity Excessive Descent Rate | **Visual Alert**<br>Amber text message that is obvious, concise, and must be consistent with the Aural message.<br><br>**Aural Alert**<br>"Sink Rate" | **Visual Alert**<br>Red text message that is obvious, concise and must be consistent with the Aural message.<br><br>**Aural Alert**<br>"Pull-Up" |
| Ground Proximity Altitude Loss after Take-off | **Visual Alert**<br>Amber text message that is obvious, concise, and must be consistent with the Aural message.<br><br>**Aural Alert**<br>"Don't Sink" | **Visual Alert**<br>None Required.<br><br>**Aural Alert**<br>None Required. |
| Ground Proximity Voice Call Out | **Visual Alert**<br>None Required<br><br>**Aural Alert**<br>"Five Hundred" or selected altitude | **Visual Alert**<br>None Required<br><br>**Aural Alert**<br>None Required |

issues and help you select the TAWS system that best suits your budget, your aircraft and your needs. There are several terrain display systems available from the leading avionics manufacturers. Weather its the aforementioned portable or and overlay on a moving map display these terrain systems can be excellence life saving assistants. However, keep in mind, TAWS is an active system that provides a clear aural and visual warning of impending trouble instead of simply displaying your color coded surroundings.

The above table is from TSO C151b, and shows examples of the Class C alerts present in a TAWS system.

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| CLASS A AND B SUMMARY REQUIREMENTS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Taws Class | Operating Rule | PAX Seats (MIN) | FLTA | PDA | GPWS DO-161A | FMS/RNAV or GPS | Terrain Display Mandatory | Terrain/ Airport Database |
| A | 121 | See Note | YES | YES | 1-6 | FMS or GPS | YES | YES |
| A | 135 | >9 | YES | YES | 1-6 | GPS | YES | YES |
| B | 135 | 6-9 | YES | YES | 1,3,6 | GPS | NO | YES |
| B | 91 | = or >6 | YES | YES | 1,3,6 | GPS | NO | YES |
| C | No regulation | Nay | | | | GPS | NO | YES |

***NOTE:***

***There is no minimum seat requirement for Part 121. All Part 121 airplanes affected by the TAWS rules must install TAWS.***

### Class distinction

There are two types of TAWS systems in existence. Class A, which was pioneered by Honeywell, as Enhanced Ground Proximity Warning System, or EGPWS, is the top of the line system, interfacing with Airdata, FMS, etc. I/O for an integrated system. Universal Avionics is also a market maker with their TAWS System.

Class B, as L-3 Avionics Systems offers, is a GPS-based system for general aviation. Consider it compact, but full-featured.

The "Seat" number is as the aircraft is currently configured, not as it was certified originally. What's the difference? The operator may own an airplane that is capable of nine passengers, but the interior cannot seat more than four executives. TAWS is not required, but we certainly would want those execs protected, wouldn't we?

Class C TAWS is a designation added in the latest revision of TSO C151b (December 2002). It is for the avionics that would be voluntary—it is designed to lift some of the legal burden, and reduce the cost. Officially, according to the TSO C-151b, "Class C equipment is intended for small GA airplanes that are not required to install Class B equipment."

Class C systems must meet nearly the same standards as the Class B, but have exemptions for airdata requirements—as the class of aircraft probably doesn't fully compensate pitot static system, and must rely on GPS for AGL altitude. Chelton Flight Systems is a provider of Class C TAWS.


### The laws on TAWS

There are two equipment requirements dictated by the regulations, and another class that is voluntary. We'll deal specifically with retrofit, because aircraft manufactured after March 29, 2002 were shipped with TAWS on board.

Operators of any Part 121 aircraft must have Class A TAWS installed by March 29, 2005.

Part 135 operators, with six to nine seats, are required to have Class B TAWS, while 10 or more seats requires Class A, also by March 29, 2005.

For us general aviation types, part 14 CFR 91. 223 (b) says that for. . . "Airplanes manufactured on or before March 29, 2002. No person may operate a turbine-powered U.S. registered airplane configured with six or more passenger seats, excluding any pilot seat, after March 29, 2005, unless that airplane is equipped with an approved terrain awareness and warning system, which as a minimum, meets the requirements for Class B equipment in TSO-C151."

In a nutshell, if we are not carrying those souls for hire, we don't need to pony up the extra

$50,000 for Class A. Class B is fine for the regulations, while Class C is fine for people wanting the safety enhancements, but don't need Class A or B.

## Manufacturers

Who makes certified TAWS systems?

At press time, TSO C151 TAWS systems were made by Honeywell, and their Bendix/King brand. Also, L-3 Avionics Systems, Universal Avionics, Chelton Flight Systems and Sandel Avionics.

Honeywell was a leader in this technology, beginning with Ground Proximity Warning Systems three decades ago, to the Enhanced GPWS systems which lead to the modern TAWS systems. For example, their KGP560 and KGP860 systems, from Bendix/King, are inputs to the Integrated Hazard Avoidance Systems (IHAS).

L-3 Avionics Systems' LandMark TAWS system is a Class B solution that provides interface to a number of different display types. It offers five basic types of alerting modes including Forward Looking Terrain Avoidance (FLTA), Premature Descent, and GPWS modes 1, 3 and 6 and touts its longer warning times, landing configuration capabilities and higher resolution display.

Universal is one of the leaders in TAWS certifications, and their TAWS provides the real-time graphical displays showing terrain around the aircraft, displayed in real time in three views: Map View, which is looking down from above, Profile View as if looking from the side, and their unique 3-D Perspective View.

Chelton's FlightLogic EFIS provides TAWS—Class A, Class B and Class C options. This company says that their Electronic Flight Instrument System (EFIS) is the only system in the world that provides 3-D terrain visualization directly on the Primary Flight Display (PFD).

Sandel's ST3400 is a self-contained Class A or Class B system that includes an integrated full-color, multi-screen, display that is unique in the industry. The TAWS system actually replaces, and includes an RMI display, making it a great choice for limited panel space retrofit.

According to Sandel Avionics the ST3400 can be installed in most business aircraft for 50 percent to 70 percent of the cost to install other TAWS equipment. This includes installation, labor and all necessary interfaces.

## STC availability

Terrain Awareness should be installed under an FAA Supplemental Type certificate, and these are usually very aircraft type/model specific. The full-up TAWS system interacts with the avionics suite, and especially the crew, so the interface and human factors are critical to making a safe system

As a potential TAWS customer, you will need to be sure that either your specific airplane model has a TAWS STC available, or your installer is interested in undertaking the process. Chances are that if you are mandated to have the installation by 2005, there is an STC available. Scheduling the installation may be the issue.

STCs can be expensive. Yet this is a value added effort. Each phase of the installation from design to hardware and nuts to bolts installation is reviewed and vetted by experienced engineers from industry and FAA inspectors.

## Cost benefit

Sometimes we hesitate to buy new technology because we know for certain that the cost will drop and the capability increases just as soon as the check clears. You may be thinking that the TAWS prices will drop as the mandated deadline nears. Is this likely?

The price may come down AFTER the deadline, when there are no more airplanes to retrofit. The price may come down if several more companies enter the market, except for some small details, like the enormous cost involved in development and certification.

Class C TAWS, with a cost of less than $20,000, is a good value for the benefit received. Any pilot will certainly be willing to pay top dollar, for any system, at the moment the props slice through the tree-tops.

Maybe you are considering a change in your airplane before '05. So what? Go ahead and make the TAWS upgrade. The TAWS buying decision is one that will pay immediate and future dividends when you decide to sell your aircraft. When faced with two identical aircraft, one with and one without TAWS, the TAWS-equipped aircraft will always be a better value. Who would want an aircraft that has to be downed for installation in a few months? In addition, potential buyers will be asking themselves, "If they 'deferred' the TAWS, what else have they 'deferred' to cut costs?"

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### Summary

OK, here is the payoff. We said we'd give you the questions to ask:

Ask yourself: Do you want a terrain display or TAWS? Is this going to be an advisory display, or something that will grab you by the collar and say, "Pull Up!"

Ask the avionics shop: Is there an STC available for my aircraft? Can you do one? What are the options available? Can you handle the installation? How long will the down time be? How much will this cost?

Avionics is wonderful stuff; it makes flying fun, easier and essentially safer. The addition of TAWS to any airplane will dramatically reduce the chances of having a CFIT accident. For years we have added things like EGT systems and fuel flow systems to make the airplane more efficient and safer as we protect the machinery. We have added moving maps to make finding the destination easy. We have a couple of different weather avoidance schemes, including radar, lightning detection, and uplinked data with powerful tools. Let's not forget the collision avoidance systems, which range from portable warning beepers to TCAS systems which cost more than many airplanes. TAWS is one of the last pieces of the safety equipment to fall into place technologically, and it represents the most serious threat. How serious is the threat? Since the Wright Flyer plopped down into a sand dune in 1903, damaged beyond repair, Controlled Flight Into Terrain (CFIT) has been the leading cause of accidents. This mandate clearly gives the pilot a new proximity to safety. ■