

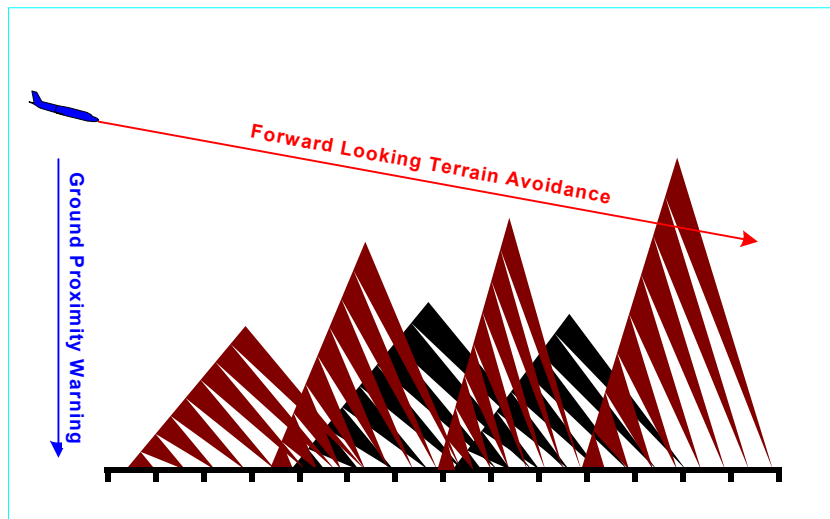
## TAWS Primer

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The most asked question about Sandel’s ST3400 TAWS, from pilot and installer alike, is about the difference between “Class-A TAWS” and “Class-B TAWS”. Since Class-A carries a rather large premium in total cost, we thought it would be a good idea to provide a simple explanation of these differences.

### GPWS + FLTA = TAWS

Loosely speaking, a TSO C151a TAWS is composed of two parts – the Ground Proximity Warning System part (GPWS) and the Forward Looking Terrain Avoidance part (FLTA)



### Relationship between GPWS and FLTA

FLTA produces alerts from things *ahead* of the airplane using a terrain database, GPS position, velocity, etc. GPWS produces alerts from things *underneath* the airplane and alerts from *configuration*, such as excessive descent rates while close to the ground, gear and flap warnings during landing, etc.

The FLTA features in Class-A and Class-B are identical and represent the same level of safety. The main difference is in the *GPWS* portion of the system. Class-A requires a “fully autonomous” GPWS while Class-B does not. The practical effect of this means:

- Class-A requires Radar Altitude and Class-B does not
- Class-A requires Airdata and Class-B does not
- Class-A requires both Gear/Flap inputs and Class-B requires only flaps
- Class-A requires an STC and Class-B does not (\$\$\$ and time!)
- Class-A requires a map display and Class-B does not

This does not mean, however, that a Class-B lacks all the GPWS features. Instead, what was done in the regulation was to specify a minimum feature set in Class-B which could be implemented by substituting “synthetic radar altitude” derived from the terrain database and GPS altitude to allow most of the GPWS alerting functions. Class-B GPWS alerts are *not* autonomous, because failure of the GPS receiver will fail both FLTA and GPWS. In a Class-A system failure of GPS will *not* fail the GPWS.

Also, even though technically a Class-B system does not require a map display, as a practical matter 99% of users who need or want TAWS also want a display.

## Configuration Chart

In chart form are the Sandel ST3400 input sensors:

	Class-A	Class-B
GPS	√	√
HDG	√	√
Gear/Flaps	Both	Gear Optional
Loc/Glideslope	√	Option
Radar Altitude	√	Option
Airdata	√	Option
STC	√	Option

## ST3400 Implementation

The ST3400 implements the Class-B FAA regulations in an ingenious way by allowing configurations that *exceed* the minimum Class-B requirements. If your aircraft is so equipped (for instance, with Radar Altimeter) you may choose to configure beyond the minimum and add a full GPWS implementation while still under a Class-B certification. This is why these items are listed in the chart above as “options”. This capability is unique to Sandel.

A basic Class-B system would include the following. It would provide all the basic alerts:

- GPS (as position and altitude source)
- HDG
- Flaps

A practical enhanced Class-B installation would include the following. It would add Gear alerting and Glideslope alerting:

- GPS (as position and altitude source)
- HDG
- Flaps and Gear
- Loc/Glideslope

A very enhanced Class-B installation would include the following. It would have all the performance of a Class-A system:

- GPS
- HDG
- Flaps and Gear
- Loc/Glideslope
- Radar Altitude
- Airdata

## **Summary of TAWS Alerts**

### **GPWS ALERTS**

- ERD Mode 1 (Excessive Rate of Descent)  
Uses a combination of barometric altitude and radar altitude, alerts excessive barometric rate of descent when close to the ground. When radar altitude is not available, the calculated height above terrain from the terrain database is substituted.
- ECRT Mode 2 (Excessive Closure Rate to Terrain)  
Alerts on high rates of change of radar altitude when close to the ground. (Class A only)
- NCAT Mode 3 (Negative Climb Rate After Takeoff)  
Uses radar altitude, barometric vertical speed, and barometric altitude to detect negative climb rates and/or accumulated altitude loss after take off or a missed approach. When radar altitude is not available, the height above takeoff altitude is substituted.
- FITNL Mode 4 (Flight Into Terrain Not in Landing Configuration)  
Uses radar altitude to detect too low an altitude without gear and/or flaps in landing configuration.
- EDGSD Mode 5 (Excessive Downward Glideslope Deviation)  
When in landing configuration, provides an alert in the event of an excessive downward deviation from an ILS Glideslope when below 1000' radar altitude. When radar altitude is not available, the calculated height above terrain from the terrain database is substituted.
- VC Mode 6 (Altitude Callout).  
Provides a voice callout "Five Hundred" when the aircraft descends through 500 feet radar altitude with the gear down. In a Class B installation without radar altimeter, this callout will occur 500 feet above the runway elevation using aircraft altitude compared to the nearest runway elevation.

### **FLTA ALERTS**

- FLTA (Forward Looking Terrain Avoidance)  
Looks ahead of the aircraft along the lateral and vertical flight path against the terrain database to provide an alert if a potential terrain threat exists.
- PDA (Premature Decent Alert)  
Uses the vertical and lateral position of the aircraft compared to the proximity of the nearest airport to determine if the aircraft is abnormally below a reasonable altitude for approach to the airport.