AVIDYNE

Choosing a Traffic System

A Comprehensive Buyer's Guide

February 2009

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Introduction

Hazard Avoidance is a primary tenet for safety of flight in today's busy airspace environment and one of the most important safety devices you can add to your aircraft is for avoiding other aircraft. That device is the Traffic Advisory System (TAS). TAS is a lighter-weight and more-affordable derivative of Traffic Alert and Collision Avoidance Systems (TCAS) which were mandated for all Air Transport-category aircraft and are also found on virtually all Corporate-class turbine aircraft. Seeing and avoiding other aircraft is paramount to safety of flight, and these lower-cost TAS systems provide a second set of eyes in the cockpit to help you fly more safely. This booklet will help you see why Avidyne's TAS600-Series of TAS systems provides the best performance and the best value for all general aviation aircraft.

Choosing a Traffic System

Introduction

Mid-air collisions are a growing concern throughout the world. High air traffic volume, once only a concern around congested metropolitan airports, is elevating the risk of mid-air collisions. The expansion of regional hubs, along with increasing use of helicopters in emergency medical service, electronic news gathering, fire control, and paramilitary operations including national security forces is creating higher risk for mid-air collisions. Critical to safe flight is the accurate and timely pilot awareness of potential threat aircraft information. Combining visual and aural alerts provides a higher degree of accurate decision making in high workload situations within the modern flight deck. Dependence on ATC does not guarantee separation. Responsibility for collision avoidance rests solely with the pilot in command (PIC).

Federal Aviation Regulations 91.113 states:

> *When weather conditions permit, regardless of whether an operation is conducted under instrument or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to "see and avoid" other aircraft.*

Understanding the PIC and the Air Traffic Controller (ATC) responsibility is also critical as detailed in Airman's Information Manual Section 5-5-8 and Section 5-5-10:

See and Avoid

Pilot –

1. *When meteorological condition permit, regardless of type of flight plan or whether or not under the control of the radar facility, the pilot is responsible to see and avoid other traffic, terrain, or obstacles.*

Controller –

1. *Provides radar traffic information to radar identified aircraft operating outside positive control airspace on a workload permitting basis.*

2. *Issues safety alerts to aircraft under their control if aware the aircraft is at an altitude believed to place the aircraft in unsafe proximity to terrain, obstructions, or other aircraft.*

Choosing a Traffic System

Clearly, the PIC is solely responsible for collision avoidance.

A recent review* of accident statistical data suggests that the risk of traffic conflicts are actually greatest between a fast moving and a slow moving aircraft. Equally compelling is that in several mid-air accidents, the NTSB determined that the probable cause was "the inherent limitations of the see and avoid concept," and "underscoring the need for low-cost proximity warning and conflict detection systems."

1. *On average, NASA receives 577 pilot reports of near in-flight collisions each year.*
2. *On average, there are 15.6 midair collisions each year in US civil aviation.*
3. *Failure to 'see and avoid' is cited as the probable cause for 94% of all inflight collisions.*
4. *Advisory Circular 90-48C suggests that the total time required by a pilot to identify an approaching aircraft, recognize a collision course, decide on action, execute that action, and allow the aircraft to respond as around 12.5 seconds. (Avidyne's TAS600 traffic systems provide a huge benefit with up to 30 seconds of warning time, more than twice the time required).*
5. *Private pilots on VFR flights spend about 50% of their time on outside traffic scan during cruise, and only 40% during arrival & departure.*
6. *Referencing an MIT-Lincoln Lab study: VFR pilots given a "TCAS-type" traffic advisory were able to visually acquire traffic 86% of the time, compared with 56% when no traffic advisory was available. And that's in "severe-clear VFR." (Of course, the presence of a traffic display allows pilots to "see" transponder-equipped traffic virtually 100% of the time on their display).*
7. *Mitigation strategies include having reliable altitude encoding transponders activated at all times on all aircraft, and affordable and reliable collision avoidance technologies in all general aviation aircraft, as the NTSB recommended in 1987."*

It's clear that today's on-board traffic avoidance systems -- which have become more and more affordable -- provide you with a 'second set of eyes' in the cockpit for the added measure of safety you need in today's busy airspace.

**Reference: January 2007 issue of Business & Commercial Aviation titled "Blinded by See and Avoid" by Patrick Veillette, Ph.D.*

Choosing a Traffic System

Deciphering the many different types of traffic systems can be daunting. There a five different technologies currently available for traffic detection and surveillance. Below is a summary of the systems technological differences.

Traffic Collision Avoidance System (TCAS)

- TCAS I – Active interrogating system issuing real-time traffic alerts (TA) – Primarily found on Turboprop aircraft and smaller jets
- TCAS II – Active interrogating system issuing traffic alerts (TA) and resolution advisories (RA)

    * Federal Aviation Administration (FAA) mandated in Part 121 aircraft – applications usually found in large business jets & commercial aircraft

Traffic Advisory System (TAS)
(i.e. Avidyne TAS600, Honeywell® KTA870, L-3 Skywatch®)

- Active interrogating system - Not dependent on "third party interrogation"
- Meets FAA TSO-C147 specifications
- Provides up to a 30-second warning at up to 1200 knot closure (same as TCAS I)
- Interrogates threat aircraft transponders for reply
- Provides "real-time" collision alerts

Passive Traffic Detection Devices

- Transponder-based technology
- Passive reception – relies on 3rd party interrogation
- Receiver only, rarely provides bearing information
- Reduced effectiveness outside of radar coverage areas

Traffic Information Services (TIS)

- Utilizes Mode-S transponders only *(TIS not available outside continental US)*
- Datalink information received from select Approach Radar facilities only
- Not intended specifically for use as collision avoidance
- Information susceptible to data loss due to "line-of-sight" reception
- Information delayed 5-15 seconds based on radar interrogation "sweep"
- Phase out of TIS-capable Ground Stations already underway

Automatic dependent Service - Broadcast (ADS-B)

- Developed as FAA's Safe Flight 21 project
- Supports air-to-air traffic situational awareness, dependent on GPS to determine position
- Implementation still in its infancy and geographically limited
- Technology is still not fully defined regarding 1090MHz versus UAT transceiver hardware. NPRM suggests no mandate until 2020.

Choosing a Traffic System

Three models of TCAS/TAS exist today for air carriers or aircraft owners and operators. All TCAS/TAS systems are transponder based. If a nearby aircraft has a transponder that is not functioning or is in the "OFF" position, then the TCAS system will not detect the threat aircraft.

Three basic components make up the TCAS/TAS systems. The first component is the Antenna system; the second is the Processor; and the third component is the instrument panel Display.

Other Traffic

Proximity Alert

Traffic Advisory (TA)

TAS and TCAS I systems provide three levels of alert. (Shown here on an MHD).

The first level of alert is indicated on the display as an open diamond shape, with the altitude separation indicated between the host and threat aircraft and an arrow indicating if the threat aircraft is climbing, descending, or at the same altitude. This is referred to as Other Traffic (OT). OT is not an immediate threat but is within the surveillance area and the pilot should be aware of existing traffic.

The second level is the Proximity Alert (PA) which is displayed with the same information as OT, with the exception that the diamond is now a solid shape on the traffic display. Both OT and PA alerts are typically cyan on a color display or white on a monochromatic display.

The third level is the Traffic Alert or TA. Traffic with a calculated intercept course for altitude and direction become a TA. When a TA is encountered, the intruder traffic is indicated as a yellow circle. The pilot is also alerted by an automated voice alert that says "Traffic! Traffic!" or Avidyne's Heads-Up Audible Position Alerting™ announces the threat traffic's clock position, relative altitude and distance. The alert is based on time to closure rate. The maximum alert is 30 seconds at a maximum 1200-knot closure, which calculates to a ten-mile distance.

If the target aircraft is higher than your altitude, its relative altitude will be displayed above the target with a plus sign (+02 = 200ft above) and if lower, with a minus sign below the target. A direction arrow next to the target indicates that the target is either climbing or descending at a rate of 500FPM or greater.

Choosing a Traffic System

TCAS II provides a similar level of alerts as TAS and TCAS I with the addition of Resolution Advisory or RA. When the TCAS II system detects an imminent intercept course, the intruder aircraft is displayed as a red square and the pilot is audibly instructed to "Climb" or "Descend" and visually directed by the RA/IVSI display with the appropriate vertical speed needed to avert a collision. Both aircraft must be equipped with TCAS II systems to experience an RA.

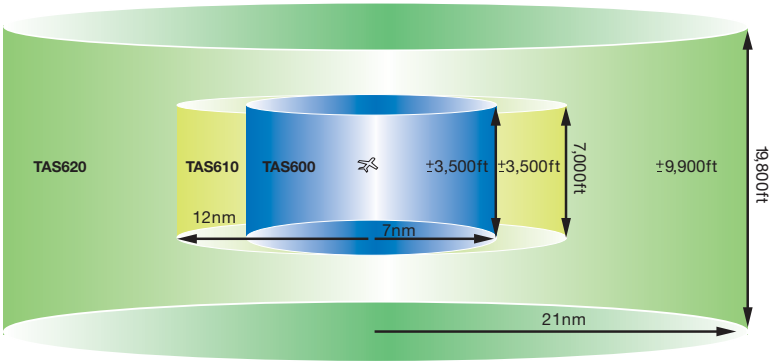
The three most popular TAS systems available for general aviation aircraft are the Avidyne's TAS600 Series, the L3 Skywatch systems, and Honeywell's KTA-870 system. These systems detect intruder aircraft based on the performance guidelines of TSO-C147 for traffic advisory systems. Detection is determined by using modeling algorithms to calculate relative altitude, distance, and bearing of the intruder aircraft. TAS systems include a main Processor and either a top and bottom antenna configuration (TAS600 and KTA-870) or single top-only antenna set-up (Skywatch). It is worth noting that all TCAS I and TCAS II systems utilize top and bottom antennas for optimum traffic coverage and minimal shadowing effects of the fuselage.

Dual-Antenna TAS600 System
Safety is the foremost concern when choosing a traffic system for your aircraft. Other concerns include price, functionality, and installation costs. In the next few pages we will clearly show you why Avidyne's TAS600 Series are the most safe and economical TAS systems on the market today.

Avidyne's TAS600 family of Traffic Advisory Systems (TAS) brings affordable active-interrogation collision avoidance to a wide variety of general aviation aircraft. All TAS600 systems include Avidyne-exclusive features and Ryan Active Surveillance™ (RAS) technology.

Choosing a Traffic System

Avidyne's TAS600 Series includes three models, designed for the type of aircraft you fly:



With the TAS600 series, you can choose the right traffic system for your aircraft based on operating altitude and closure rates (range and speed).

TAS600–Recommended for entry-level, single-engine piston aircraft, the TAS600 features a 7nm range, a 3,500-foot vertical separation maximum and 18,500-foot service ceiling.

TAS610–Recommended for mid-performance aircraft and rotorcraft, the TAS610 features a 12nm range, a 3,500-foot vertical separation maximum and a 25,000-foot service ceiling.

TAS620–Recommended for high-performance aircraft and rotorcraft, the TAS620 features a 21nm range, a 9,900-foot vertical separation maximum and a 55,000-foot service ceiling.

All TAS600 systems offer these additional features:

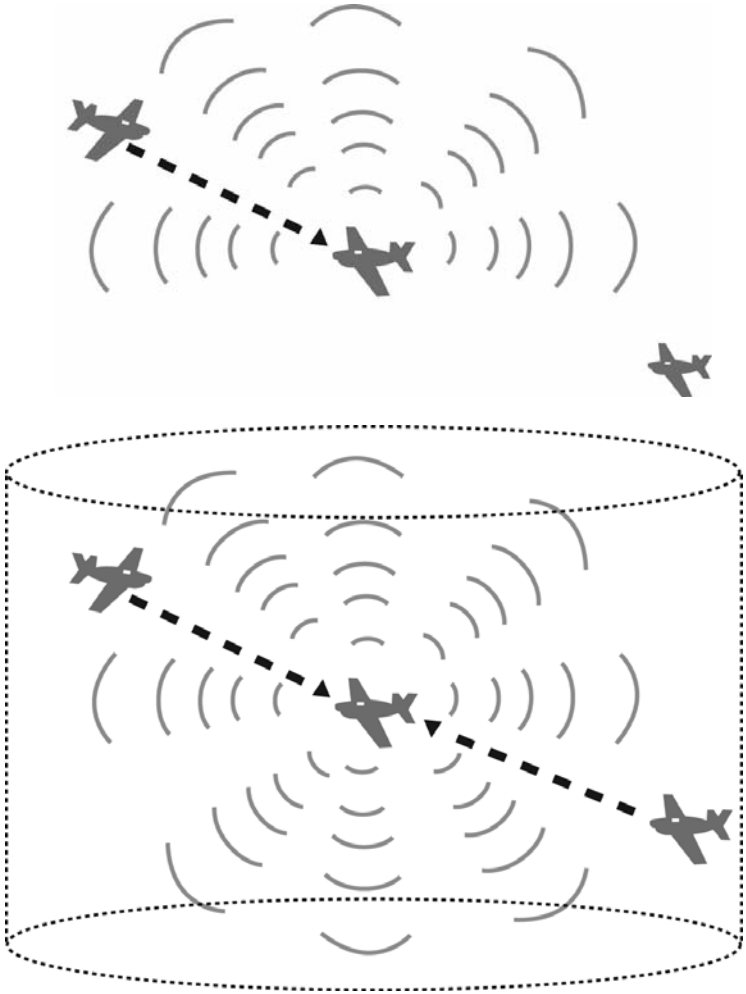
Patented Top and Bottom Antennas

Like the dual-antenna architecture of more expensive TCAS systems used in Airliners and Corporate jets, Avidyne's top and bottom directional antennas interrogate and receive replies from threat aircraft transponders above and below the aircraft. This dual-antenna architecture is designed to minimize surveillance interference from your own airframe.

The top antenna provides directional surveillance to the front and aft on the aircraft. The bottom antenna provides directional surveillance to the left and right of the aircraft.This dual-antenna architecture provides greater accuracy for range and bearing resolution of intruder aircraft.

Choosing a Traffic System

Single-antenna systems
The interrogation signals from single-antenna systems may not always receive replies due to airframe shadowing, or they can miss replies from aircraft beneath the host aircraft.



Patented Top and Bottom Antennas
Avidyne's TAS600 sends out interrogation pulses and listens for replies from other aircraft 360° around the host aircraft.

Avidyne's Heads-Up Audible Position Alerting™
Safety is not limited to visual interpretation, which is why Heads-Up Audible Position Alerting™ is incorporated into all TAS600 Series systems. Heads-Up Audible Position Alerting annunciates the threat alert, clock face position, and relative vertical position and distance of any threat aircraft within the surveillance envelope, thus reducing visual overload. With Heads Up Audible Position Alerting, the TAS600 clearly alerts the pilot to an imminent threat:

TRAFFIC! TWO O'CLOCK! HIGH! THREE MILES!

The TAS600 series eliminates the added step of acquiring the intruder aircraft on a display and then visually locating the threat. With the TAS600, you can now simply, HEAR AND ACQUIRE.

Active Interrogation
All TAS600 systems search the sky in real-time in any radar or non-radar environment. The interrogation of ATC, military radar, and other active collision avoidance systems is continuously sent up to 56 times per second by the TAS600 and can receive replies from Mode A, C, or S transponders.

The TAS600, TAS610, and TAS620 are designed to meet the specific needs of each class of aircraft, providing a full 30-second decision time at a closure rate of up to 1200 knots. TAS600 series traffic systems interrogate transponders from nearby aircraft within their respective coverage volume, and provide a warning to the flight crew when the calculated time to closest approach (CPA) of any intruder and the protected area around the aircraft reaches the 30-second threshold.

Avidyne TAS600-Series Features & Functions:

Ground Mode
Ground Mode enables the system to ignore traffic on the ground and mute audio announcement while displaying traffic more than two hundred feet above the ground eliminating "nuisance alerts." This feature is important as the aircraft taxis out, especially at uncontrolled airports. The "Weight on Wheels" mode will automatically enable and disable Ground Mode.

Approach Mode
The Approach Mode, when engaged, permits the TAS600 Series to ignore traffic on the ground during the approach phase of a flight eliminating "nuisance alerts." At times the pilot may desire to "see" traffic during approach, with this in mind, the system was engineered as a pilot selectable option.

Choosing a Traffic System

Weight on Wheels
This is a discrete input which automatically switches the TAS600 system into Ground Mode upon landing, minimizing any distraction from ground traffic. Traffic above the host aircraft is still shown on the multifunction display, without audio warnings. This also allows for continued situational awareness when preparing for departure.

Audio Yoke-Mounted Mute and Volume Control
The TAS600 Series is the only TAS system available with an audio volume control enabling the announcement to be heard by the pilot and crew but not necessarily heard by passengers. Also available is a yoke-mounted mute button which allows the system to be muted when needed. If another Traffic Alert (TA) is detected, the TAS600 system will automatically disengage the mute and announce the threat and updated intruder position.

N-Number Capability
Mode S transponder-equipped aircraft have the ability to transmit their N-number, which can be decoded by the TAS600 system. This number can be viewed on compatible multifunction displays when interfaced to the TAS600 via its RS232 data bus output.

Most Display Options
The TAS600 Series provides industry-standard ARINC 429 and RS232 display outputs and has the most display options available for TAS systems.

With interfaces to the displays of over 15 popular display manufacturers, including Avidyne's Entegra, EX500 and EX5000, the Garmin GNS430/530 and G1000, it's a pretty safe bet that the TAS600 can connect to your display with ease.

Choosing a Traffic System

Why should I install a traffic system on my airplane?
The most feared of all flying incidents is the mid-air collision. Even when we are vigilant in our "See and Avoid" technique, we fear what we can't control; the occurrence of "the other guy" who might not be as diligent as us. Perhaps the fear is out of proportion to the actual threat, but nonetheless it is regarded one of deadliest flying hazards.

It's obvious that mid-airs happen when they are least expected. The pilot's responsibility is to visually scan for traffic, and even the best set of eyes can miss a fast-moving approaching aircraft. This presents a real need for a traffic advisory system. Throughout the years, statistics have proven that these systems have decreased the total number of mid-air collisions.

Dare to Compare
Aircraft owners now have the advantage of installing the most technologically advanced traffic advisory system at a very affordable cost. Avidyne has designed the TAS600 Series with safety as the predominant feature. And starting at only $9,990, the TAS600 is the most affordable active TAS system in the general aviation marketplace.

Competitive traffic systems start at a minimum price of $15,000 with less features and surveillance capabilities. We encourage you to compare features, functions, technology and value. Consider the TAS600 Series for installation in your aircraft.

With Avidyne's MHAS Package Pricing, the savings can be considerable when the TAS600 system is bundled with an EX500 or EX5000 MFD and an MLB700 Broadcast Datalink Receiver. Review the full competitive matrix for Traffic, MFDs, and Datalink on the following pages to see what we mean.

Choosing a Traffic System

Feature	TAS600	TAS610	TAS620
Suggested List Price	$9,990	$14,990	$20,990
Active Interrogation	Yes	Yes	Yes
Audible Range, Bearing, Altitude, and Altitude Trend Call-outs	Yes Heads Up Standard	Yes Heads Up Standard	Yes Heads Up Standard
Top & Bottom Antennas	Yes	Yes	Yes
Range	7nm	12nm	21nm
Vertical Range	±3,500	±3,500	±9,900
Service Ceiling	18,500	25,000	55,000
Ground Mode	Yes	Yes	Yes
Weight on Wheels	Yes	Yes	Yes
ARINC 429 Heading Input*	No	Yes	Yes
Yoke Mount Muteherbie	Yes	Yes	Yes
N-Number Intruder Display	Yes	Yes	Yes
Number of Targets Tracked	50	50	50
Number of Targets Displayed	9	9	9
Processor Weight	6.8 lbs	6.8 lbs	6.8 lbs
Processor Dimensions	W 3.10” H 7.25” D 11.675”	W 3.10” H 7.25” D 11.675”	W 3.10” H 7.25” D 11.675”

*NOTE: The TAS610 and TAS620 each have a Heading Input, which permits rapid repositioning of targets during high-rate turns, especially valuable for helicopter operations.

Choosing a Traffic System

Feature	Skywatch 497	Skywatch HP	Honeywell KTA-870
Suggested List Price	$18,890	$25,980	$24,690
Active Interrogation	Yes	Yes	Yes
Audible Range, Bearing, Altitude, and Altitude Trend Call-outs	Yes Optional VIP	Yes Optional VIP	No
Top & Bottom Antennas	No	No	Yes
Range	11nm	35nm	40nm
Vertical Range	±9,900	±9,900	±8,700
Service Ceiling	55,000	55,000	55,000
Ground Mode	Yes	Yes	Yes
Weight on Wheels	Yes	Yes	Yes
ARINC 429 Heading Input	Yes	Yes	Yes
Yoke Mount Mute	No	No	No
N-Number Intruder Display	No	No	No
Number of Targets Tracked	30	35	60
Number of Targets Displayed	10	10	60
Processor Weight	8.9 lbs	9.2 lbs	9.2 lbs
Processor Dimensions	W 12.52” H 3.56” D 7.62”	W 12.52” H 3.56” D 7.62”	W 4.5” H 7.0” D 13.8”

Comparison data based on mfg. website data and is subject to change without notice.

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