***Fundamentals:***

TCAS (TAS, TCAS I and TCAS II) are collision avoidance systems

TAS Provides inquiry-based traffic avoidance information using lower power than TCAS I

TCAS I Provides inquiry-based traffic avoidance information TCAS II power levels providing traffic alerting

TCAS II Provided inquiry-based traffic avoidance information and resolution advisories

**ADS-B TIS-B** is a traffic situational awareness aid (https://www.faa.gov/nextgen/programs/adsb/pilot/atas/)

**ATAS** adds ATAS uses ADS-B to detect and alert pilots to potential traffic conflicts.

**DO-XXX and TSO-YYY** prohibits the separate display of TCAS and ADS-B data on separate (non-fused) certified cockpit displays.

**TCAS** systems will provide derived position range and bearing from interrogation systems

**ADS-B TIS-B** is a georeferenced broadcast that included, position, heading and altitude

**ATAS** adds ADS-B traffic conflict alerting

**Hybrid surveillance** merges the display of ADS-B and TCAS traffic information and provided alerting using TCAS information

Possible traffic output format selections include Standard TCAS Intruder File (STIF or TIF) and Display Traffic Information File (DTIF).

**STIF** is the legacy TCAS symbology

**DTIF** is the enhanced (directional, position and trend) symbology

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|  **Subject**: Airworthiness Approval of Traffic Alert and Collision Avoidance Systems (TCAS II), Versions 7.0 & 7.1 and Associated Mode S Transponders  | **Date:** 07/21/2017 **Initiated by:** AIR-100  | **AC No: 20-151C** **Change:**  |

2.1.5 Hybrid Surveillance. Hybrid surveillance is a function of TCAS used as a means to decrease Mode S interrogations. Aircraft may use passive surveillance instead of active surveillance to track intruders that meet validation criteria and are not projected to be near-term collision threats. Active surveillance uses the standard TCAS transponder interrogation that provides range, bearing and altitude to the intruder. Passive surveillance uses automatic dependent surveillance-broadcast (ADS-B) data broadcast from other aircraft. The passive surveillance data is broadcast and received through the use of Mode S Extended Squitter, that is, 1090 megahertz (MHz) ADS-B. Hybrid surveillance does not degrade the performance of TCAS active surveillance. This is a requirement and is tested by ensuring active surveillance performs as specified by the TCAS II performance standards.

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| **Subject**: Airworthiness Approval for ADS-B In Systems and Applications | **Date:** 05/20/15**Initiated by:** AIR-130  | **AC No:** 20-172B**Change:**  |

**2-3. ADS-B Applications.**

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**c.** The enhanced visual acquisition application (EVAcq), also displays ADS-B traffic on a plan view (bird's eye view) relative to own-ship. This application is designed to support only the display and alerting of ADS-B traffic, including ADS-R, TIS-B, and TCAS derived traffic. Implementations that include application classes other than EVAcq and ATAS must use the AIRB application instead. The traffic information assists the flight crew in visually acquiring traffic out the window while airborne. EVAcq does not relieve the pilot of see and avoid responsibilities under 14 CFR 91.113b. This application is expected to improve both safety and efficiency by providing the flight crew enhanced traffic awareness. Installations that provide in-flight moving map displays in addition to traffic should comply with TSO-C165a.

**…**

**2-6. Airborne Surveillance and Separation Assurance Processing (ASSAP).**

The ASSAP subsystem accepts data from one or more sources including ADS-B reports, TIS-B reports, ADS-R reports, and TCAS tracks (if installed). ASSAP correlates data from these sources, generates tracks, and performs application-specific processing. Surveillance tracks and application-specific alerts or guidance are output by ASSAP to the CDTI function. The ASSAP equipment must be compliant with the Class C requirements of TSO-C195b and should be installed in accordance with manufacturer instructions. TCAS processors track transponder-equipped aircraft. Therefore, TSO-C195b equipment requires installations with TCAS to provide these tracks to the ASSAP equipment to complete the traffic picture. TCAS in this AC is meant to apply to all versions of certified traffic advisory system (TAS) or TCAS compliant with TSO-C147(), TSO-C118(), or TSO-C119(). Hybrid surveillance TCAS are included. For aircraft installations without TCAS, the TIS-B service provides tracks of transponder-equipped aircraft.

For the nerds amongst us…

“**Integrated Display and Simulation for Automatic Dependent Surveillance–Broadcast and Traffic Collision Avoidance System Data Fusion**”, Yanran Wang, Gang Xiao,\* and Zhouyun Dai

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5713123/>

**“TCAS/ ADS-B Integrated Surveillance and Collision Avoidance System”**

Yajun Xu, Aviation Engineering Institute, Civil Aviation Flight University of China, Guanghan Sichuan,China

[www.atlantis-press.com/article/4600.pdf](http://www.atlantis-press.com/article/4600.pdf%26usg%3DAOvVaw3-CgSEbUSCabgY6vI5p5VG)