Cyriel@uAvionix.com

Our Mission

- Airspace safety is non-negotiable
- We believe it is achievable when **all participants** have persistent and reliable situational awareness, surveillance and seamless connectivity
- We enable it with certified low Size, Weight, Power, and Cost (SWAP-C) avionics and accompanying services for communications, navigation, and surveillance (CNS)
- Since our founding in 2015, we have built a deep product portfolio and certification expertise across three major industry segments, disrupting the cost-functionality paradigm of **certified** avionics

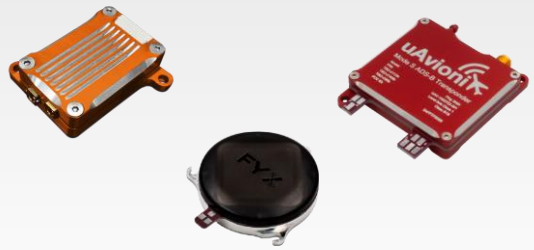
The Challenge

- Traditionally lower ADS-B equipage rates for older and smaller aircraft
- Ability to provide services below a certain floor in mixed mode environments
- General Aviation diversity for Space Based ADS-B
- Integration of UAS
- Situational Awareness in mixed mode environment

Our Solutions – Communicate, Navigate, Separate

UAS Solutions

- BVLOS data links (C2C, CNPC)
- GNSS SBAS receivers
- ADS-B IN and OUT transceivers
- Mode S transponders



General Aviation Solutions

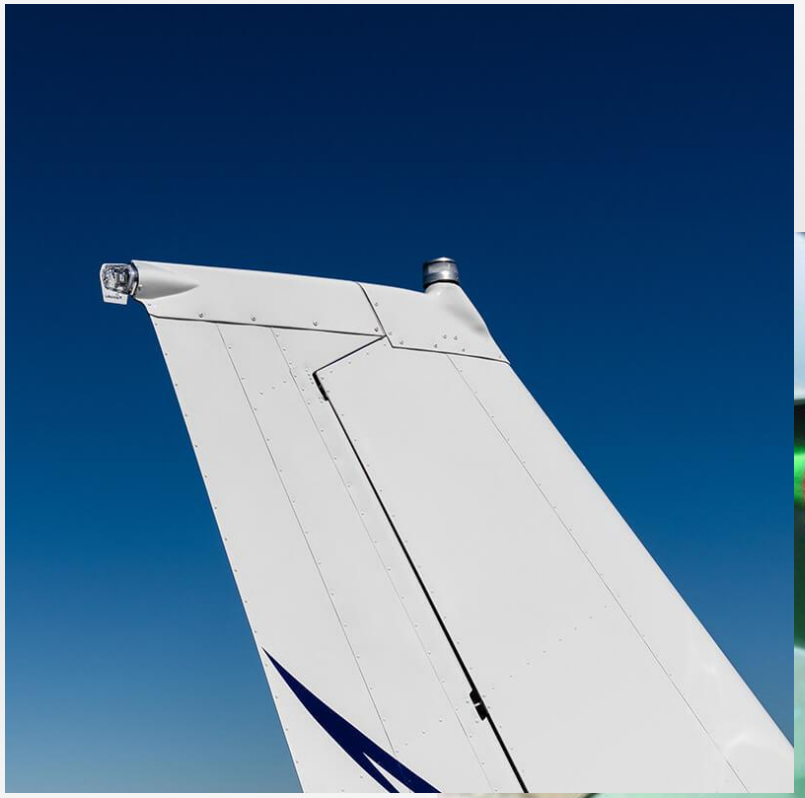
- Mode S transponders
- 978/1060 MHz ADS-B IN and OUT transceivers
- Integrated transponder, ADS-B, and position solutions
- Portable systems
- Cockpit panel displays

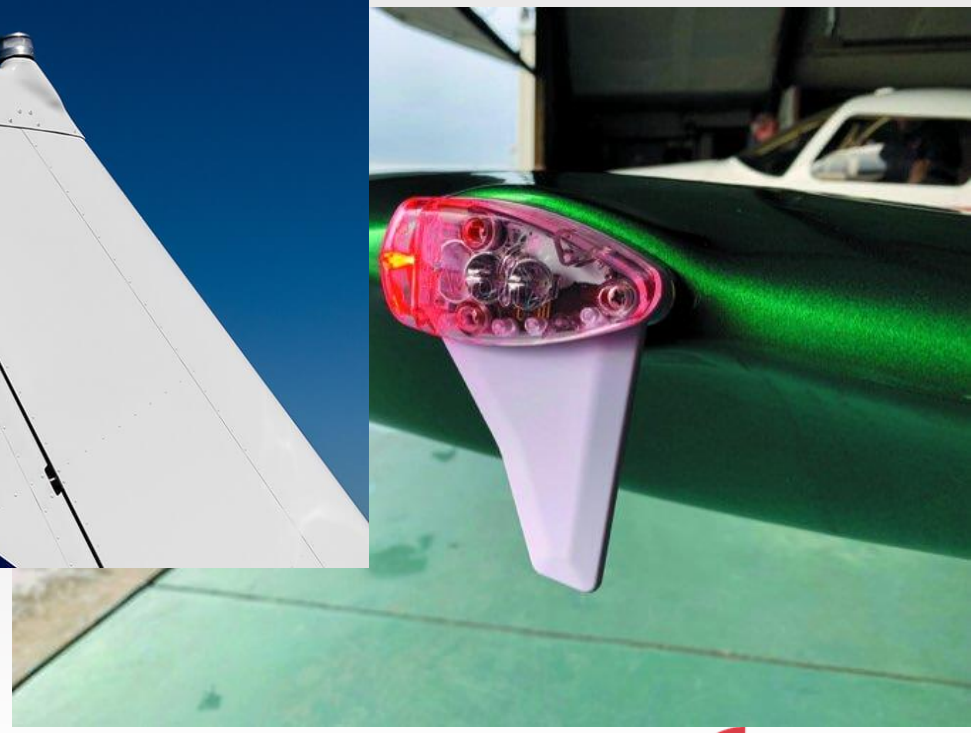
Infrastructure Solutions

- Airport ground-based surveillance systems
- Airport surface operations tracking and management
- ADS-B ground-based broadcast solutions (TIS-B/FIS-B)
- UAS BVLOS C2 networks

U.S. Success: skyBeacon & tailBeacon

- skyBeacon & tailBeacon introduced late in US mandate timeline (2018-2019)
- Low costs at premium performance
- Significant majority of UAT equipage
- Built a ground up installation network of 1400 Qualified Installers in 12 months
- Typical installation: 1 hour
- Challenge: Would a similar form factor meet the 1090 requirements of the rest of the world and Aireon?

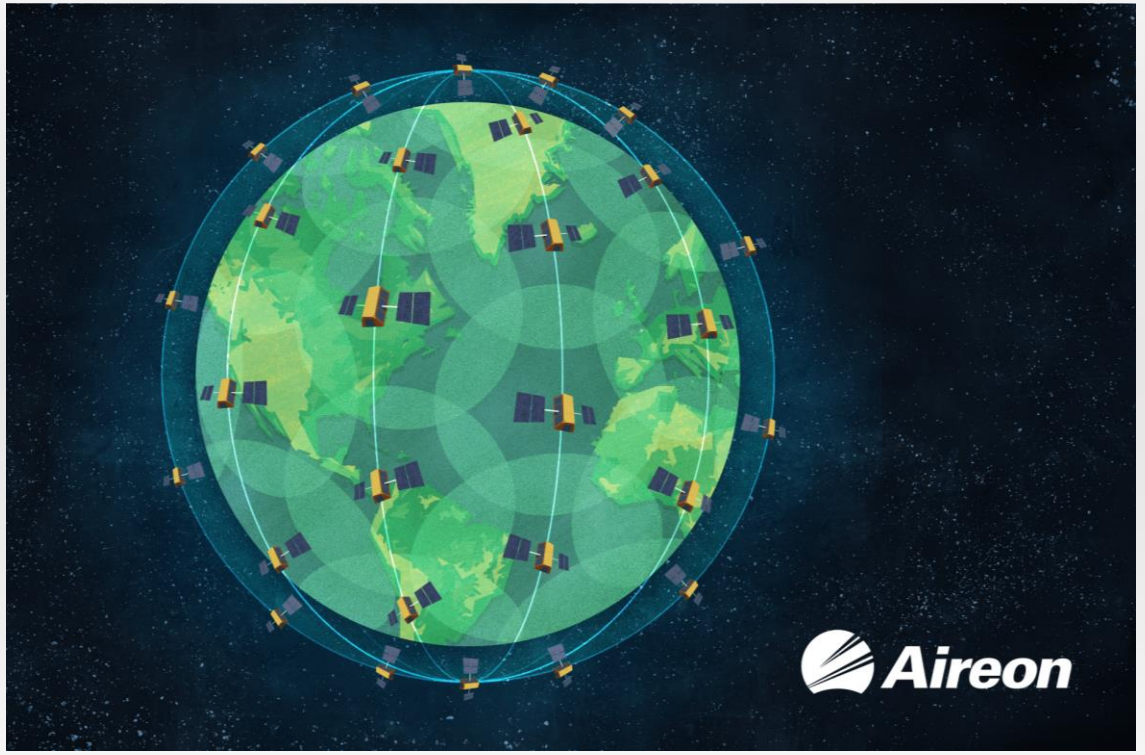




tailBeaconX

Space-Based ADS-B Surveillance

- Increased adaptation of Space Based ADS-B enables benefits to ANSPs and users where infrastructure doesn't currently exist
- However, to achieve best performance for all users, transponders with antenna diversity (top and bottom) are required.
- With traditional diversity solutions, this significantly increases costs for the equipment and installation
- Affordable solutions available today enable ADS-B mandates worldwide, increasing airspace safety



uAvionix

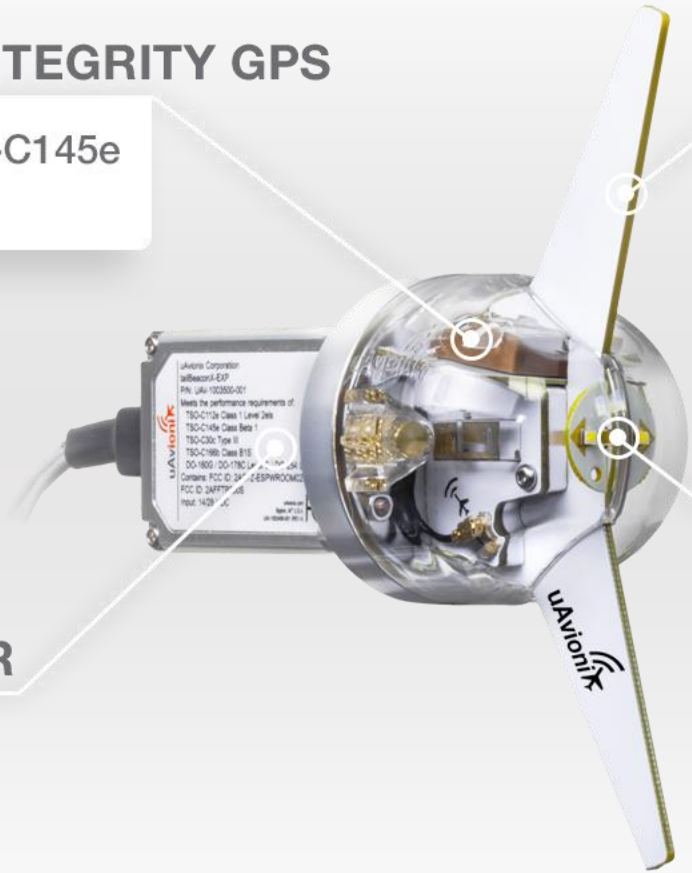
tailBeaconX

AIREON COMPATIBLE

Tail-mounted dipole antenna delivers clear line of sight to space-based and terrestrial surveillance systems

AVIATION INTEGRITY GPS

Integrated TSO-C145e WAAS GPS



MODE S TRANSPONDER

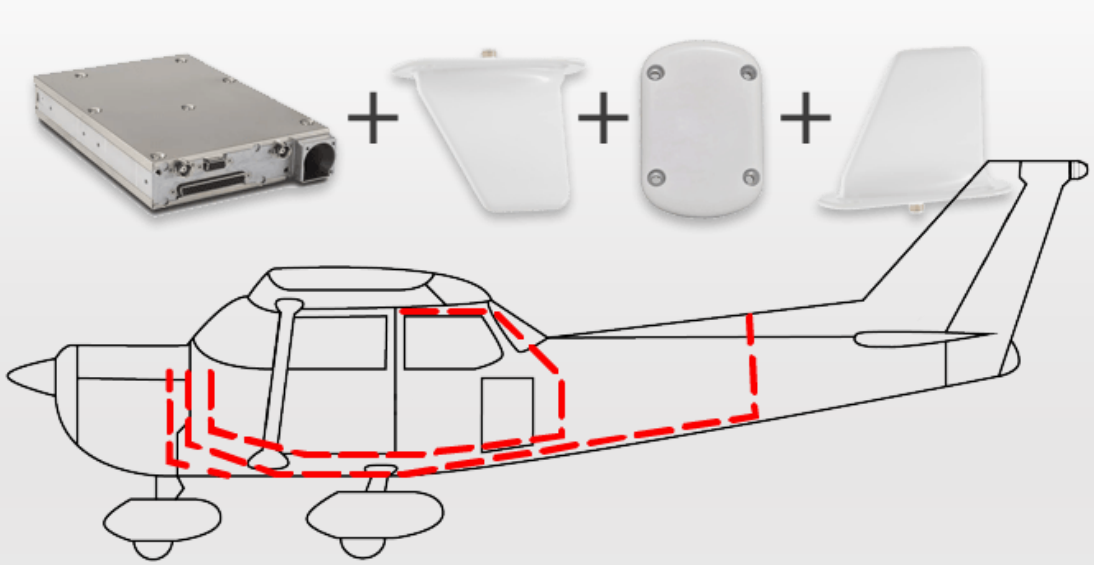
TSO-C112e, TSO-C166b Level 2els 250W

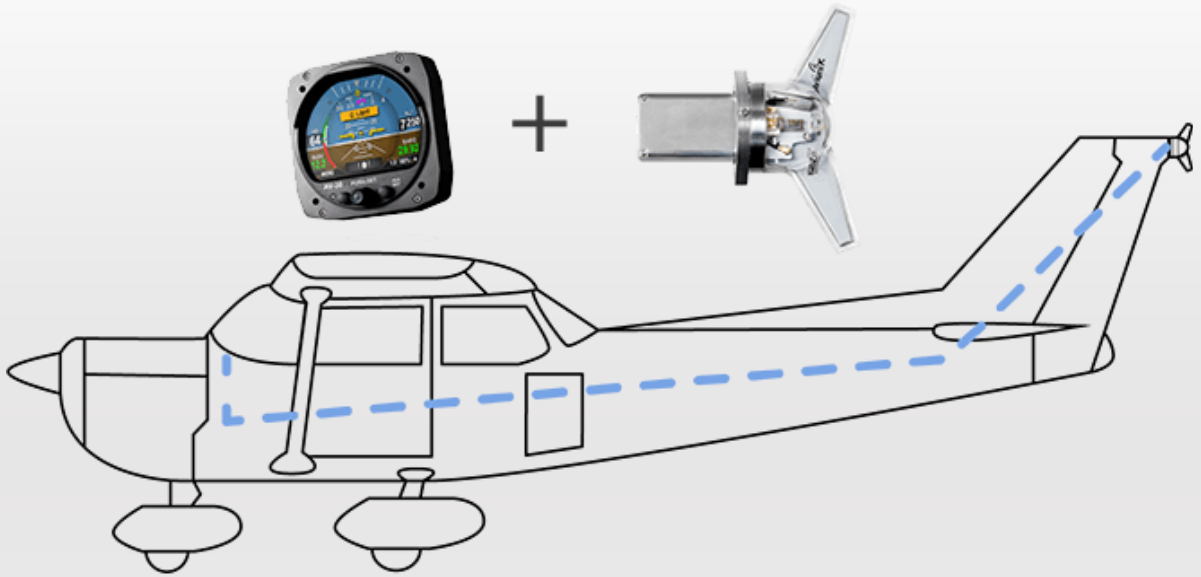
LED LIGHTING

TSO-C30c Type III, Aviation White, 20 Candelas

Multiple Control Options

Installation Comparison





- tailBeaconX with integrated GPS eliminates compatibility issues with existing or 3rd party equipment
- tailBeaconX eliminates need for interior removal or pressure hull penetration
- tailBeaconX reduces opportunity for human error
- tailBeaconX eliminates problems associated with antenna separation
- tailBeaconX is inclusive of everything, no additional antennas, coax, or harnesses required

Equipment Cost Comparison with AV-30*

- Targeted: a >50% Reduction of Installed Price vs. Cost of Traditional Systems
  - Achieved: ~40% reduction in equipment cost
    ~70% reduction in installation cost
- tailBeaconX TSO ~$3900 CDN + control head option (certified AV-30 EFIS + ~$2000 CDN)
  - All inclusive of antennas, GPS, and anything required for installation

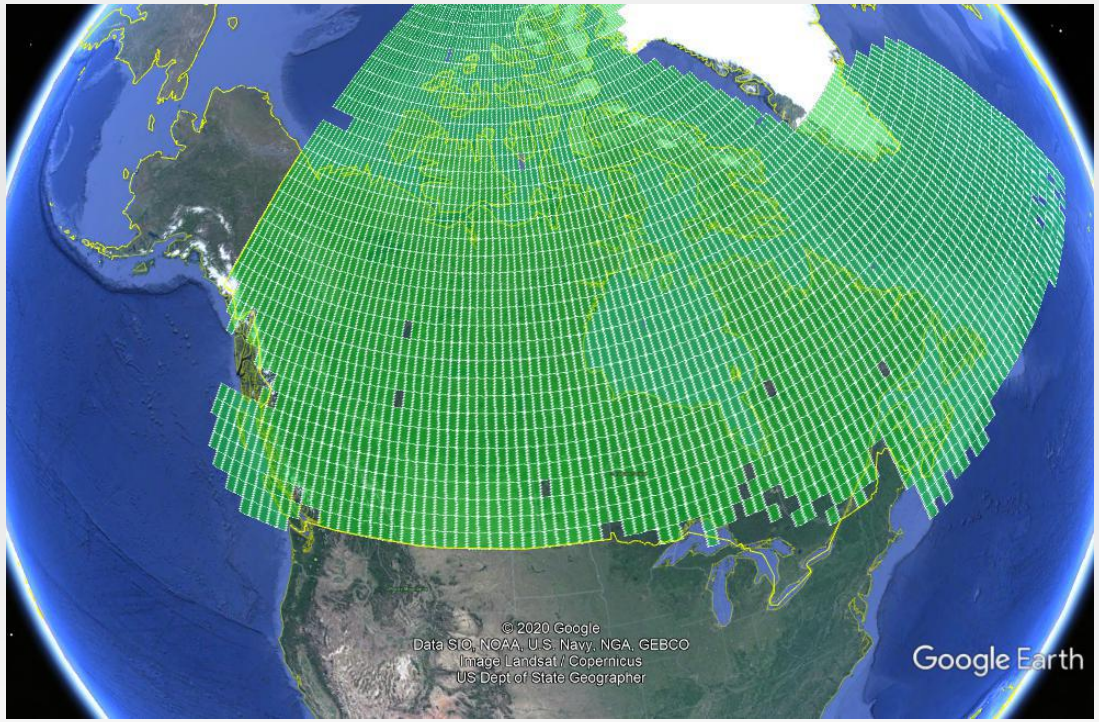
Transponder	MSRP ($CDN)	WAAS GPS ($CDN)	Installation Estimate @ $125 CDN/hr
Non-Diversity	$3500-$6500	$450-$750	$1500-$3000
Garmin GTX 330/335D Diversity	$7500-$8500	$450-$750	$7500-$10000
Garmin GTX 345D Diversity	$9500-$10500	$450-750	$7500-$10000
L3 NGT9000D Diversity	$9200-$10000	included	$7500-$10000
tailBeaconX w/AV30 EFIS	$5900 w/AV-30	included	$1200-$3000

*lower cost control head coming soon

Flight Tests

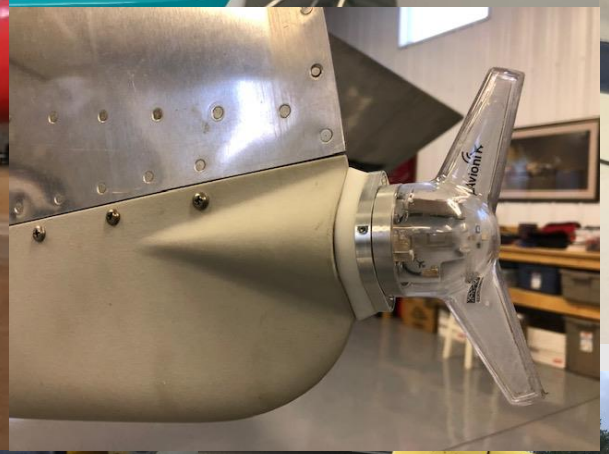
Flight Test Campaign

- We conducted a flight test campaign to benchmark performance.
- Over 300 tailBeaconX flights were compared against over 700 traditionally equipped aircraft
- Results indicate tailBeaconX performs as well as traditional diversity installations on GA aircraft and significantly better than bottom mount only




© 2019 uAvionix Corporation – Confidential and Proprietary
uAvionix.com
ALASKA
YUKON TERRITORY
NUNAVUT
Foxe Basin
Davis Strait
Nuuk
Hudson Bay
Gulf of Alaska
Labrador Sea
BRITISH COLUMBIA
ONTARIO
QUEBEC
NEWFOUNDLAND AND LABRADOR
PRINCE EDWARD ISLAND
NOVA SCOTIA
NB
St-Pierre
MONTANA
MINNESOTA
WISCONSIN
MICHIGAN
WYOMING
ILLINOIS
N.Y.
MASS.
R.I.
N.H.
MAINE
N.J.
MD
DELAWARE
CALIFORNIA
ARIZONA
TENNESSEE
NC
ARKANSAS
TEXAS
MISSISSIPPI
ALABAMA
Sargasso Sea
Bing


ARMY




5

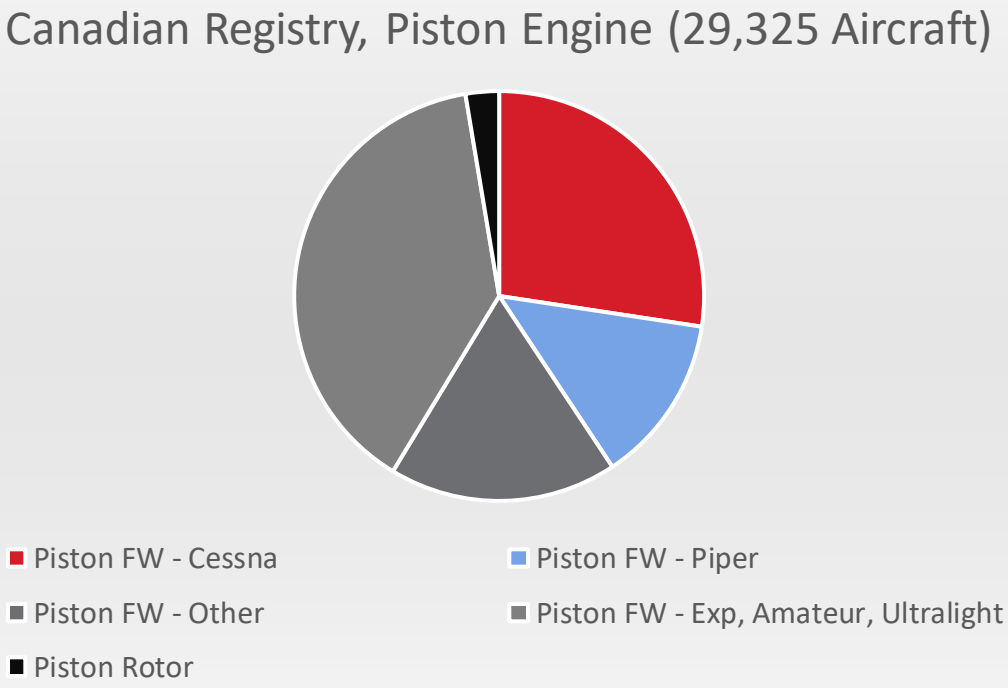

C-GJZI

Summary Table tests using Aireon data

Product	Flights in Green Cells	Airframes	Avg PUI 8s	Avg PUI 5s	ED-129B
tailBeaconX all	67	9	98.73%	96.71%	High Density ER Low Density TMA
tailBeaconX >=1.3.2 GPS FW	25	3	98.94%	97.98%	High Density ER Med Density TMA
Other Diversity	485	11	98.12%	97.48%	Med Density ER Low Density TMA

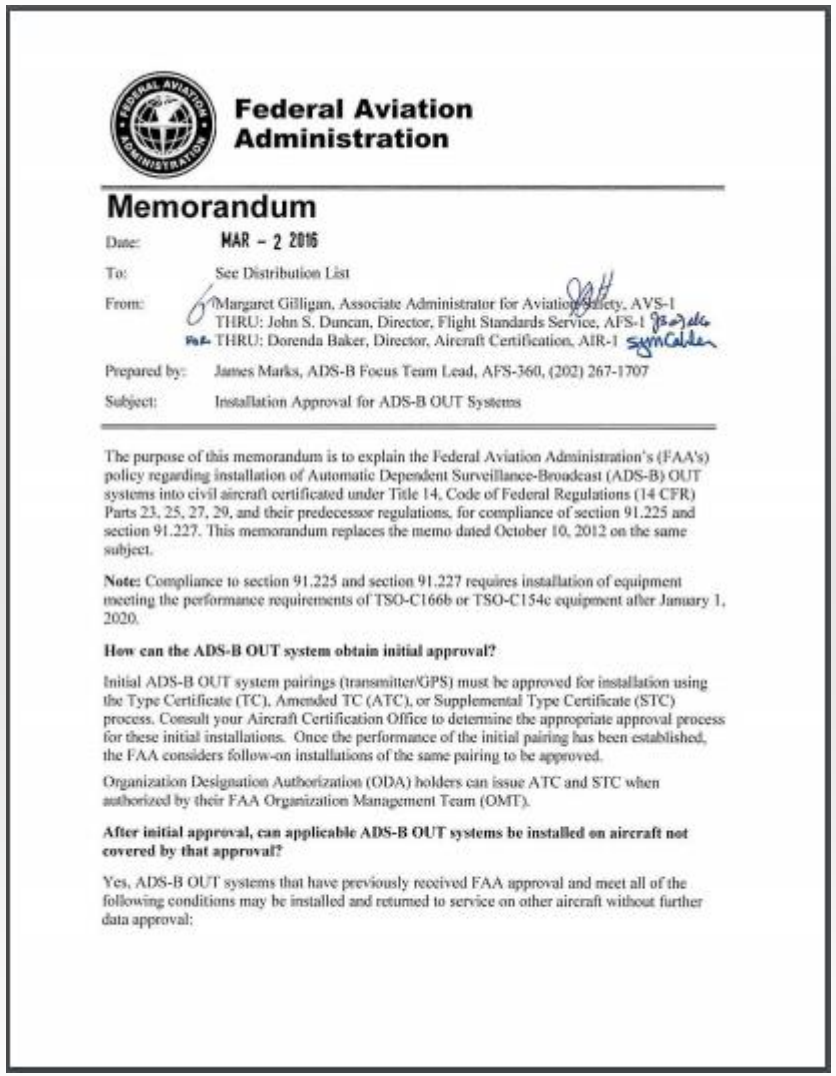
Sample Canadian Registry (37,059 Aircraft)

- A typical uAvionix customer is Piston Engine, Fixed Wing, older aircraft, recreational pilot
- Currently 184 Aircraft Models on the draft STC AML addressing 85% of the Type Certified population
- Fleet Age:
  - 55% mfg before 1980
  - 34% mfg before 1970



What can make this even easier?

- Consider Installation Policy Memo
  - FAA memo establishes a policy that approves ADS-B equipment installation on aircraft that are NOT on the STC AML
  - Eases burden of manufacturers to target every make & model
  - Allows field approval as a minor modification
  - Meets strict performance requirements
  - Low cost to small operators



Federal Aviation Administration

Memorandum

Date: MAR – 2 2016

To: See Distribution List

From: Margaret Gilligan, Associate Administrator for Aviation Safety, AVS-1
THRU: John S. Duncan, Director, Flight Standards Service, AFS-1
THRU: Dorenda Baker, Director, Aircraft Certification, AIR-1

Prepared by: James Marks, ADS-B Focus Team Lead, AFS-360, (202) 267-1707

Subject: Installation Approval for ADS-B OUT Systems

The purpose of this memorandum is to explain the Federal Aviation Administration's (FAA's) policy regarding installation of Automatic Dependent Surveillance-Broadcast (ADS-B) OUT systems into civil aircraft certificated under Title 14, Code of Federal Regulations (14 CFR) Parts 23, 25, 27, 29, and their predecessor regulations, for compliance of section 91.225 and section 91.227. This memorandum replaces the memo dated October 10, 2012 on the same subject.

Note: Compliance to section 91.225 and section 91.227 requires installation of equipment meeting the performance requirements of TSO-C166b or TSO-C154c equipment after January 1, 2020.

How can the ADS-B OUT system obtain initial approval?

Initial ADS-B OUT system pairings (transmitter/GPS) must be approved for installation using the Type Certificate (TC), Amended TC (ATC), or Supplemental Type Certificate (STC) process. Consult your Aircraft Certification Office to determine the appropriate approval process for these initial installations. Once the performance of the initial pairing has been established, the FAA considers follow-on installations of the same pairing to be approved.

Organization Designation Authorization (ODA) holders can issue ATC and STC when authorized by their FAA Organization Management Team (OMT).

After initial approval, can applicable ADS-B OUT systems be installed on aircraft not covered by that approval?

Yes, ADS-B OUT systems that have previously received FAA approval and meet all of the following conditions may be installed and returned to service on other aircraft without further data approval:

Other Benefits of ADS-B

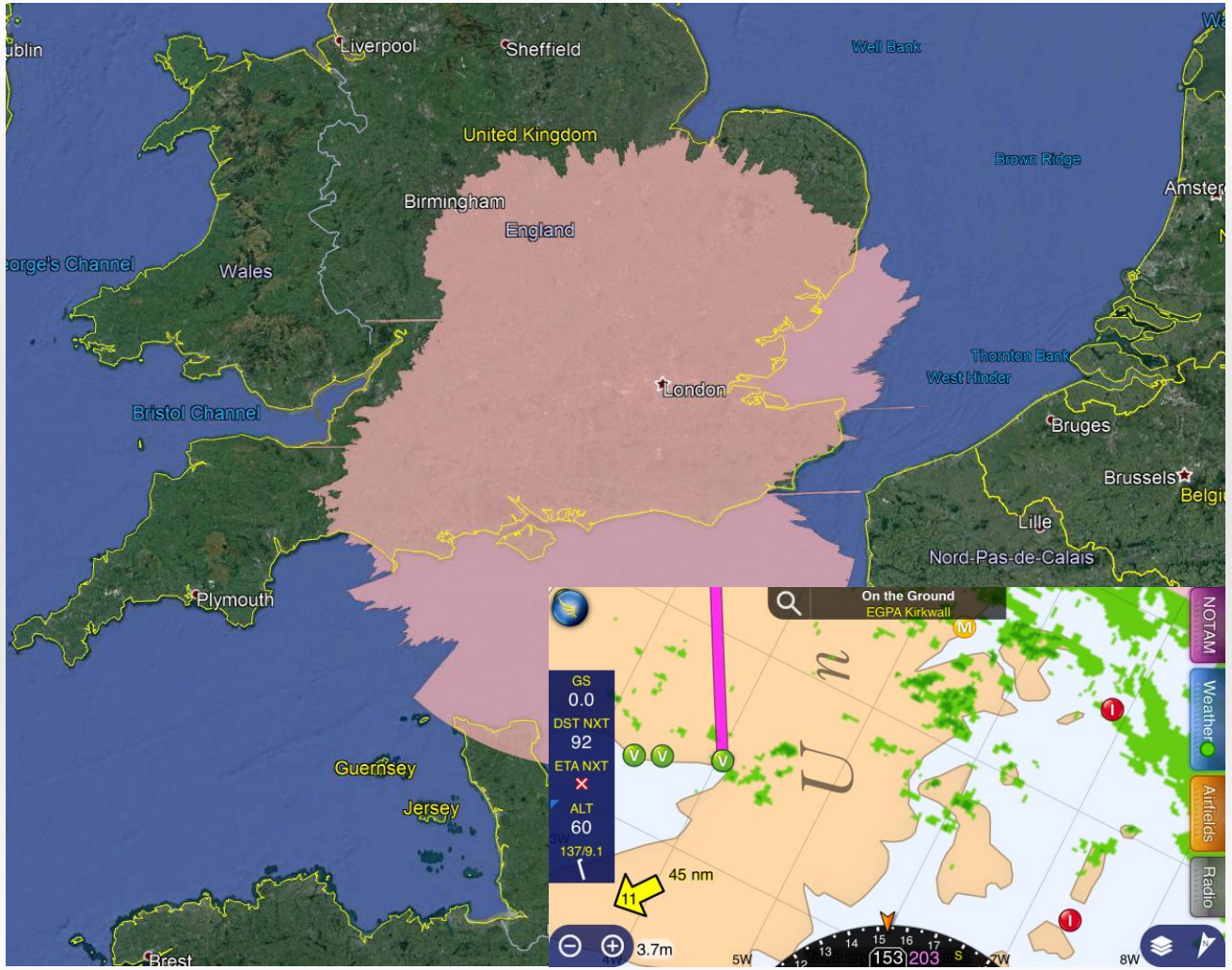
ACCOMPLISHMENTS

Infrastructure / Airport Solutions

- Airport Vehicle and Ground Based Surveillance Solutions
- Supports Airport Surface Management
- FAA Approved Solutions
- International CE Certified Solutions

Surveillance & Broadcast Services

- uAvionix & UK CAA have been conducting and expanding advisory FIS-B/TIS-B trials in support of UK's voluntary Electronic Conspicuity (SEE and BE SEEN) initiative.
- Currently broadcasting FIS-B (weather) and obstacle beacons in Scotland / North Sea area in support of offshore helicopter operations.
- Leveraging 978MHz, which is also envisioned to be leveraged for UAS surveillance
- 25W / 250W Transmit Options
- Interest in offering similar services to NC/TC



Electronic Conspicuity Infrastructure

Surveillance services

- 1090MHz ADS-B
- 978MHz ADS-B
- Mode S (1090MHz) Multilateration
- FLARM
- PilotAware
- Unmanned Aircraft Systems (UAS) remote identification (RID) based on ASTM Standard
- Local weather sensors

Electronic Conspicuity Infrastructure

Broadcast services

- Traffic Information Services – Broadcast (TIS-B) on 978MHz
  - Translation of MLAT, FLARM, UAS RID traffic to 978MHz ADS-B targets
- Flight Information Services – Broadcast (FIS-B) on 978MHz
  - WeatherRadar
  - METAR
  - TAF
  - SIGMET

SBS Components

uAvionix

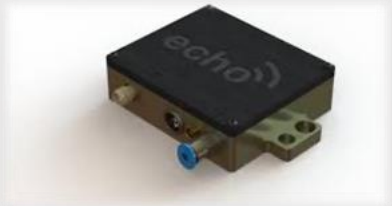
Electronic Conspicuity Infrastructure

Use Cases:

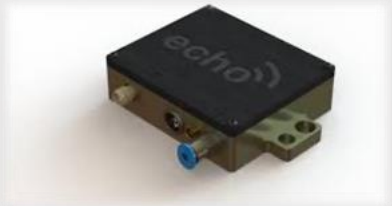
- Glider Operations
- Smaller non-towered airports (traffic information)
- Weather broadcast (national)
- Tactical Flight Restrictions (special use)
- Off-shore weather and traffic
- BVLOS integration

Summary

- We believe ADS-B benefits go well beyond commercial aviation only
- uAvionix has many demonstration activities in progress to bring diverse technologies together in a constructive way, whilst working towards a mandate.
- Perpetuate and increase voluntary equipage of EC amongst the entire GA community whilst not alienating any one technology or user group.
- Significant and clear safety benefits for the entire community.
- An positive enabler for the future integration of other aerial platforms such as UAV
- Utilises existing technology, standards and procedures which can be regulated, monitored and managed.



We are ready to engage in proof of concept / tests and demonstrations in the Latin America / Caribbean region.



Cyriel@uAvionix.com