FreeFlight Systems and ADS-B

April 2015

Christchurch, NZ

FreeFlight Operating Locations

FREEFLIGHT SYSTEMS

SHAPE THE SKIES

Alaska RCEP Program Office
Anchorage, AK

Sales & Marketing
Westerly, RI

Manufacturing, Part 145 Repair
Waco, TX

Executive Management, Engineering,
Program Management
Irving, TX

Timeline

SHAPE THE SKIES

1990 - 2000

Trimble Develops and Certifies GPS Navigation Management Systems for Business / General Aviation Aircraft and Rotorcraft

Trimble Acquires Terra Avionics

Trimble Develops Airline Transport NMS.

Trimble partners with Honeywell for the HT-9100 FMS

Trimble Awarded numerous TSO / STC and patents related to GPS Navigation

2001

Trimble decides to exit the Civil Aviation Market

FreeFlight Systems is formed from the assets of the Trimble Business And General Aviation Division and moves from Austin TX to Waco TX

2003

FreeFlight Systems Receives World First TSO for WAAS Receiver

FreeFlight Systems provides WAAS GPS receivers for FAA Capstone program

2007

FreeFlight Systems Receives TSO for ARINC WAAS Receiver

2008

FreeFlight Systems Acquired By Current Management and Ownership team

FreeFlight Systems receives TSO for Radar Altimeter (RA 4000)

2009

FreeFlight Systems Signs Contract with Fokker Services for Airline Transport RNP Retrofit Systems Development

Development starts for ADS-B Product line

DO-260 A ADS-B STC for B-757 with ACSS transponder

2010

FreeFlight Systems Receives World First TSO for UAT Transmitter

FreeFlight Systems delivers prototype V-MAT ADS-B System to Exelis for Boston Logan Trial

FreeFlight Systems Selected By Lockheed Martin to Develop MIL-STD Jetcall for C-130J

FreeFlight Systems receives TSO for Radar Altimeter (RA 4000)

2011

FreeFlight Systems RNP Retrofit Systems gains TSO and STC approvals. Production deliveries begin FIrst Fokker 70 /100 ADS-B STC's (DO-260A)

2012

FreeFlight Systems Receives TSO for UAT transceiver with integral GNSS

FreeFlight Systems wins FAA Rule Compliant Equipage Program (RCEP) in full and open competition

ADS-B Retrofits begin

FreeFlight Systems Selected By Aspen Avionics for Private Label ADS-B systems

FreeFlight System Selected by General Dynamics to supply core NextGen technologies for Naval Aviation

FreeFlight Systems Receives World First Rotorcraft STC for UAT Transmitter

FreeFlight Systems Receives World First Fixed Wing STC for UAT Transmitter

FreeFlight Systems gains FAA approval and delivers production V-MAT System to Exelis for Boston Logan

2013

2014

Model 1203C "260B" STC's with Honeywell and ACSS transponders

FreeFlight Systems receives 400 aircraft + AML STC for UAT Transceiver family

FreeFlight Systems Selected By Bendix King for Private Label ADS-B systems

FreeFlight Systems delivers first equipment to General Dynamics

FreeFlight Systems Delivers 1000'th ADS-B Radio

FreeFlight Systems signs LPA with Exelis for V-MAT

Markets Served

SHAPE THE SKIES

GA Retrofit (All Categories)
Direct Fleet Sales
Civil and Military OEM
Govt Sales

GA Retrofit
Airline Transport Retrofit
Civil /Military OEM

Civil Retrofit (Mostly Rotorcraft)

Civil Retrofit (Mostly Rotorcraft)

Civil Retrofit
(Mostly Transport and
Rotorcraft)

Civil Retrofit (Mostly Rotorcraft)

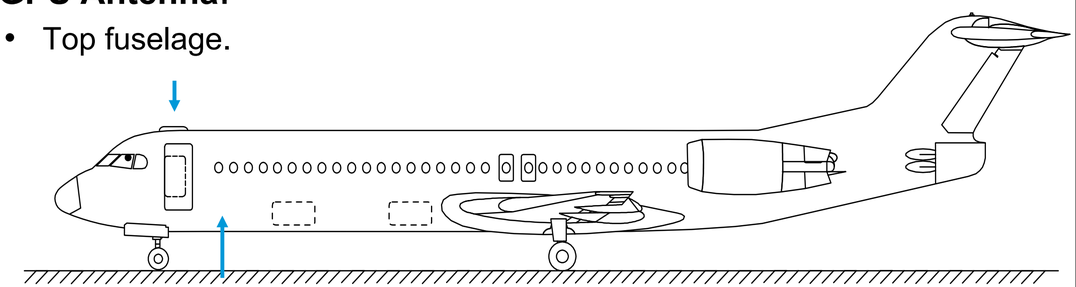
Civil Retrofit (Mostly Rotorcraft)
Military / Paramilitary Retrofit (Mostly Rotorcraft)

GA Retrofit
Airline Transport Retrofit

Fokker 70 / 100 ADS-B / RNP installation

SHAPE THE SKIES

- **GPS Antenna**:
  - Top fuselage.



- **GPS/WAAS Sensor**
  - Avionics Bay or
  - Avionics Racks above floor.

1203 GPS/WAAS Sensor and High Speed Antenna

In The US...

ADS-B Equipage is accelerating

- ☆"Call to Action" and "Equip 2020"
  - ☆Sub $2K(US) GA ADS-B Out in the market - UAT
  - ☆Determination that "Position Source STC" (non MMR) will work for Out-of-Production Air Transport Aircraft
- ☆10,000 Rule Compliant Aircraft Flying in Feb 2015

Certified ADS-B Systems being deployed on Surface Vehicles at Major Airports

ADS-B is a "hot" topic in UAS / NAS Integration

FFS and 1090 ADS-B

TSO-C145c (SA Aware, FDE, SBAS) Position Sources

- ☆ARINC 743 A/B for large aircraft (1203C)
- ☆RS-232 for small aircraft (1201)
- ☆New “Lite” version in certification
- ☆Multi-Constellation (GPS Galileo) in development

1201

601

1201 GNSS

1203C GNSS

Non Diversity TSO-C166B ADS-B Out Transponder

FDL-1090-TX ADS-B Out transponder

“Business Jet” Non-Diversity TSO-C166B ADS-B Out transponder with internal GNSS (2015)

- ☆Suitable for aircraft up to 15,000 Kg GTW in the US
- ☆More limited elsewhere

FTX-250 Non Diversity ADS-B Out with GNSS

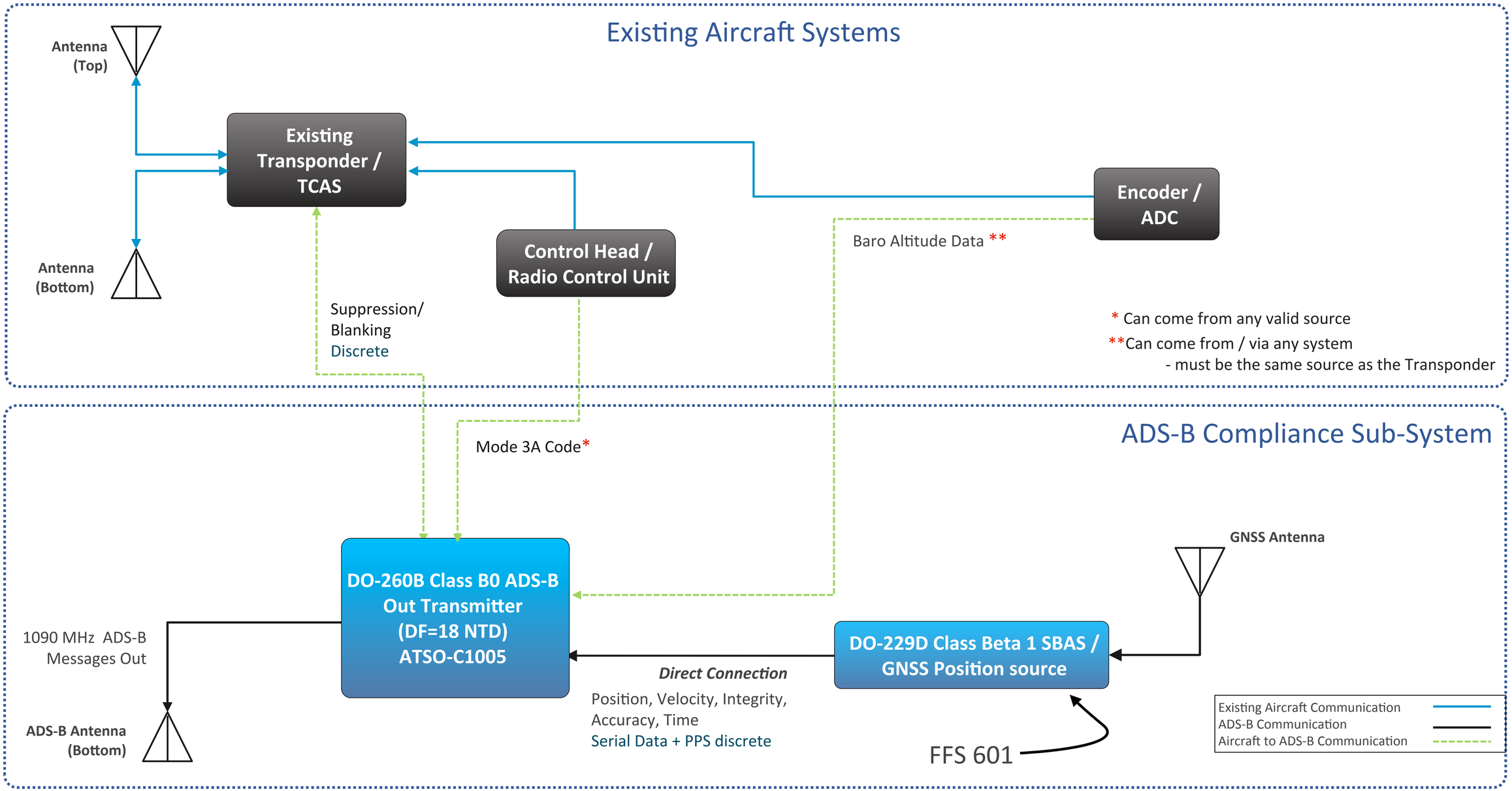
Exploring DF=18 Non Transponder Device (ATSO-C1005)

- ☆“Appliqué” for aircraft with Non-ADS-B-but-otherwise-approved transponders
- ☆Similar concept to US UAT

DF=18 1090 GA ADS-B Integration

FREEFLIGHT SYSTEMS

SHAPE THE SKIES



DF=18 Application

Where allowed, (for example Australia)

- Aircraft of all sizes equipped with non ADS-B Mode S or Mode A/C (?) transponders.

In other jurisdictions

- "Special" aircraft..
- Ground Vehicles (Safety of Life applications, slightly modified message)

Advantages

- Easy to install, minimal disruption to existing aircraft systems
- Broad aircraft configuration compatibility
- Very Inexpensive
- Decouples NAS compliance from other complex / sensitive systems (military platforms)

Disadvantages

- Does not support future Enhanced Surveillance Applications
- Possible extra use of Spectrum (Depends on installed equipment)

Summary

Low cost / high performance retrofit solutions are possible / available for all classes of aircraft (or ground vehicles)

US Lesson learned for GA - equipage happens when the price is right

- ☆ Benefits available globally (GNSS sensor price)

Flexibility from regulators can drive big cost savings without compromising the system