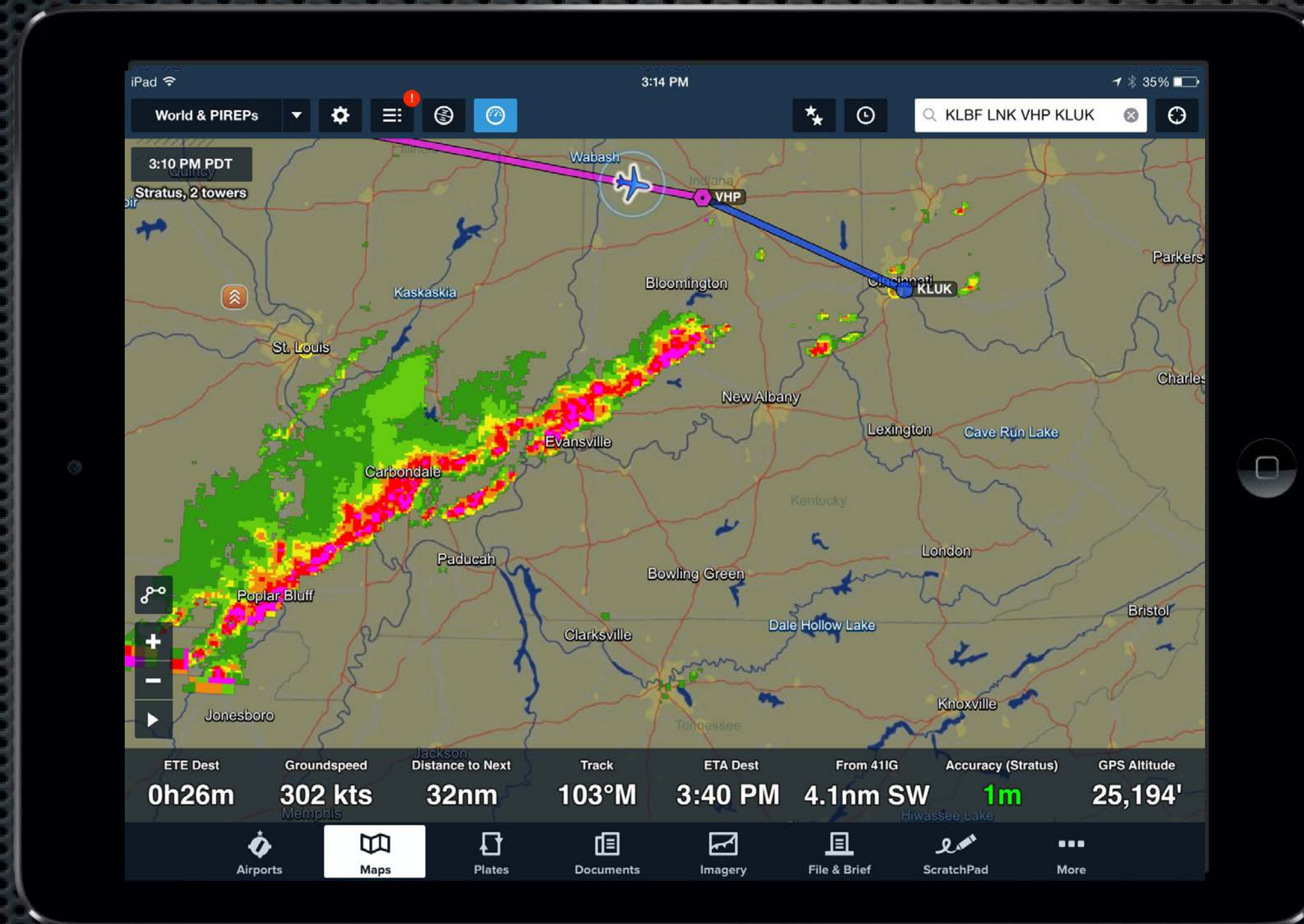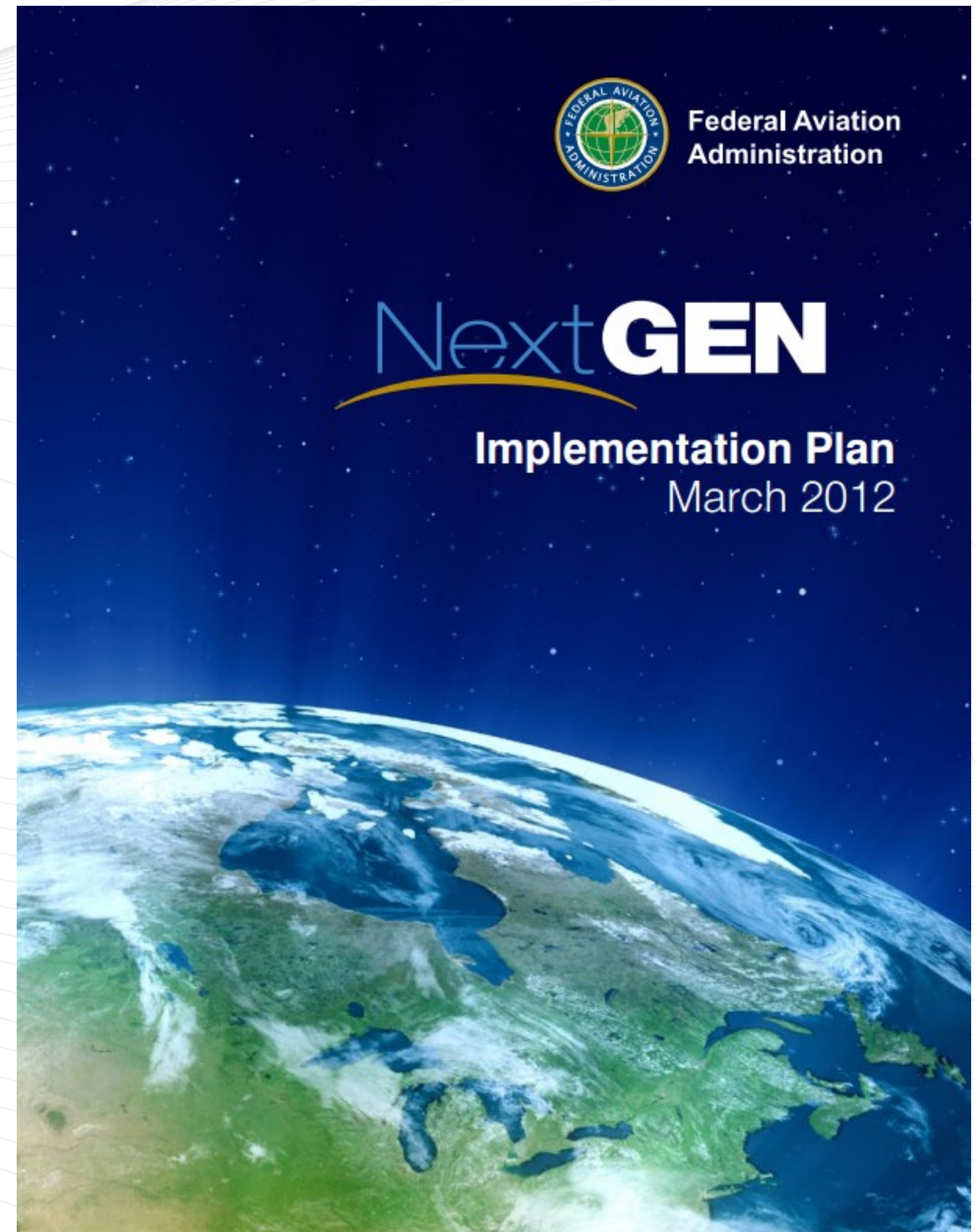# ADS-B: A Pilot's Guide

Understanding the system and the avionics

ADS-B: A Pilot's Guide

presentation overview

- What is ADS-B?

- Key terms

- How does it work?

- Panel-mount avionics

- Portable receivers
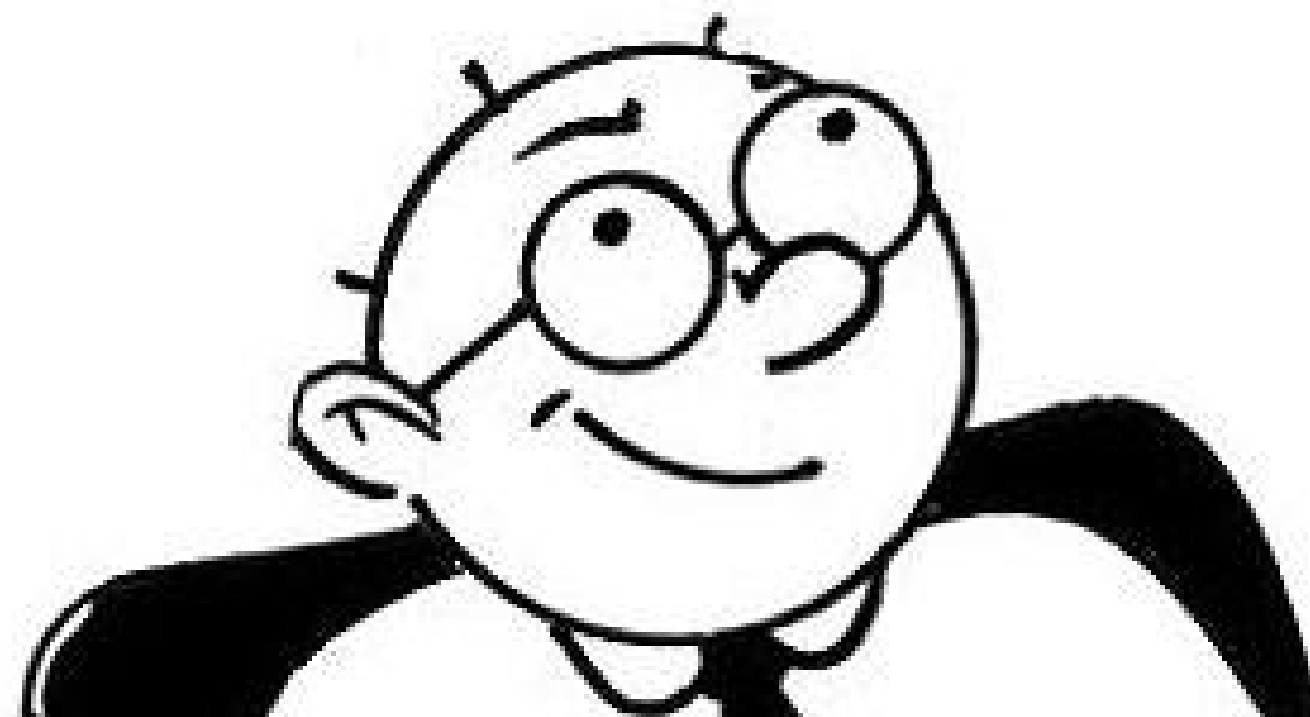
ADS-B System Overview

Key Terms

What does it all mean?

- NextGen

- ADS-B

  - ADS-B Out and ADS-B In

- ADS-B transponder options

  - 1090ES and 978 (UAT)
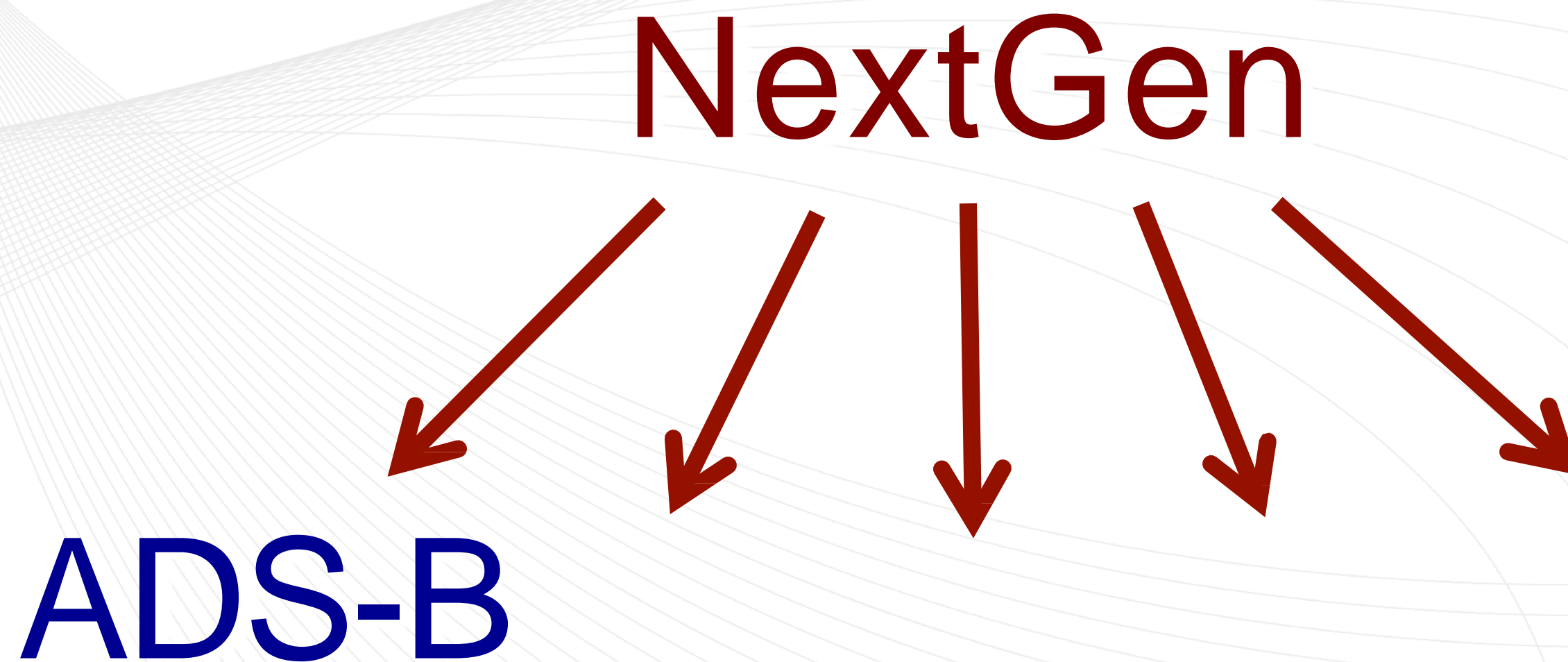
- ADS-B In terms

  - FIS-B and TIS-B

Key Terms

*NextGen: Next Generation Air Transportation System*

NextGen

ADS-B

NextGen has 5 major elements – only one of them is ADS-B
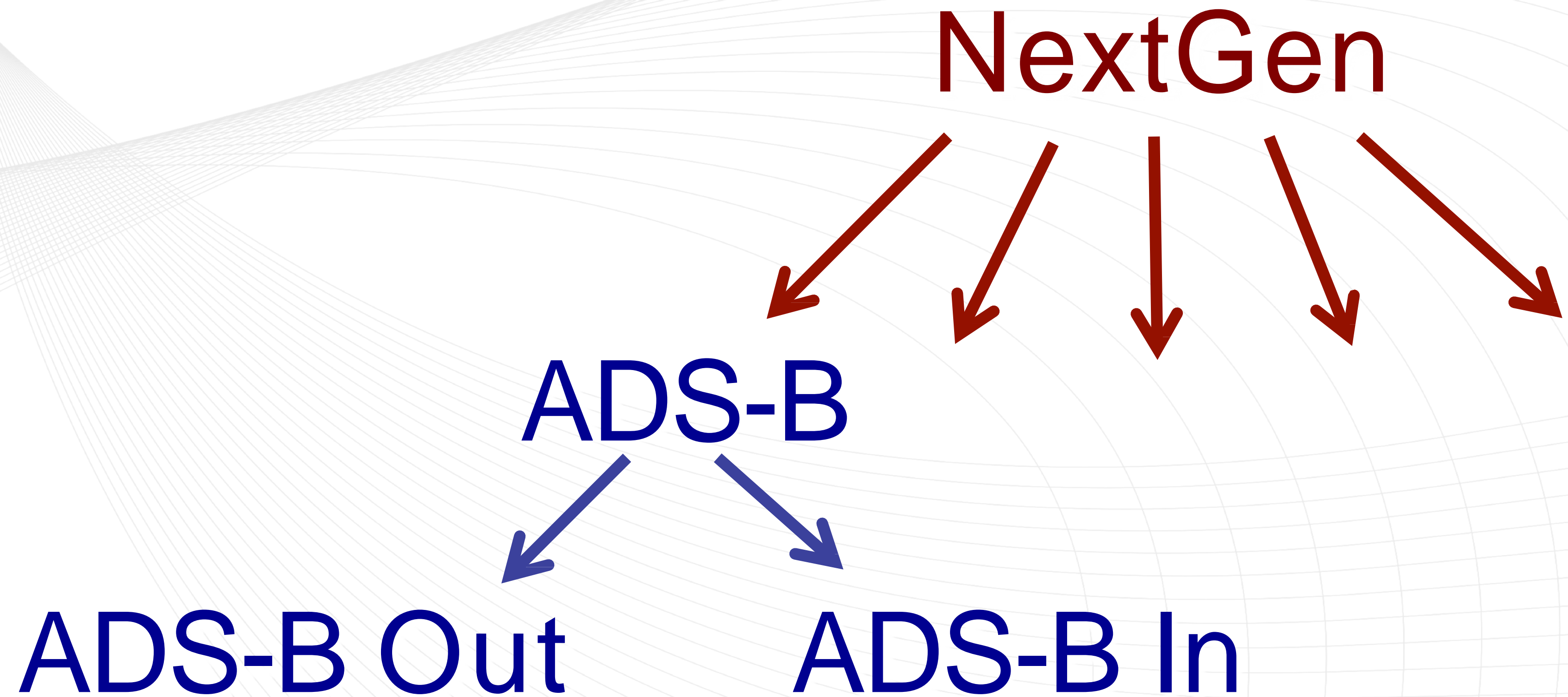
Key Terms

ADS-B

- Automatic Dependent Surveillance –Broadcast

  - Automatic: it works in the background

  - Dependent: depends on other aircraft being equipped

  - Surveillance: it's a technology to track aircraft

  - Broadcast: each aircraft broadcasts its position and velocity

Key Terms

ADS-B In and Out

NextGen
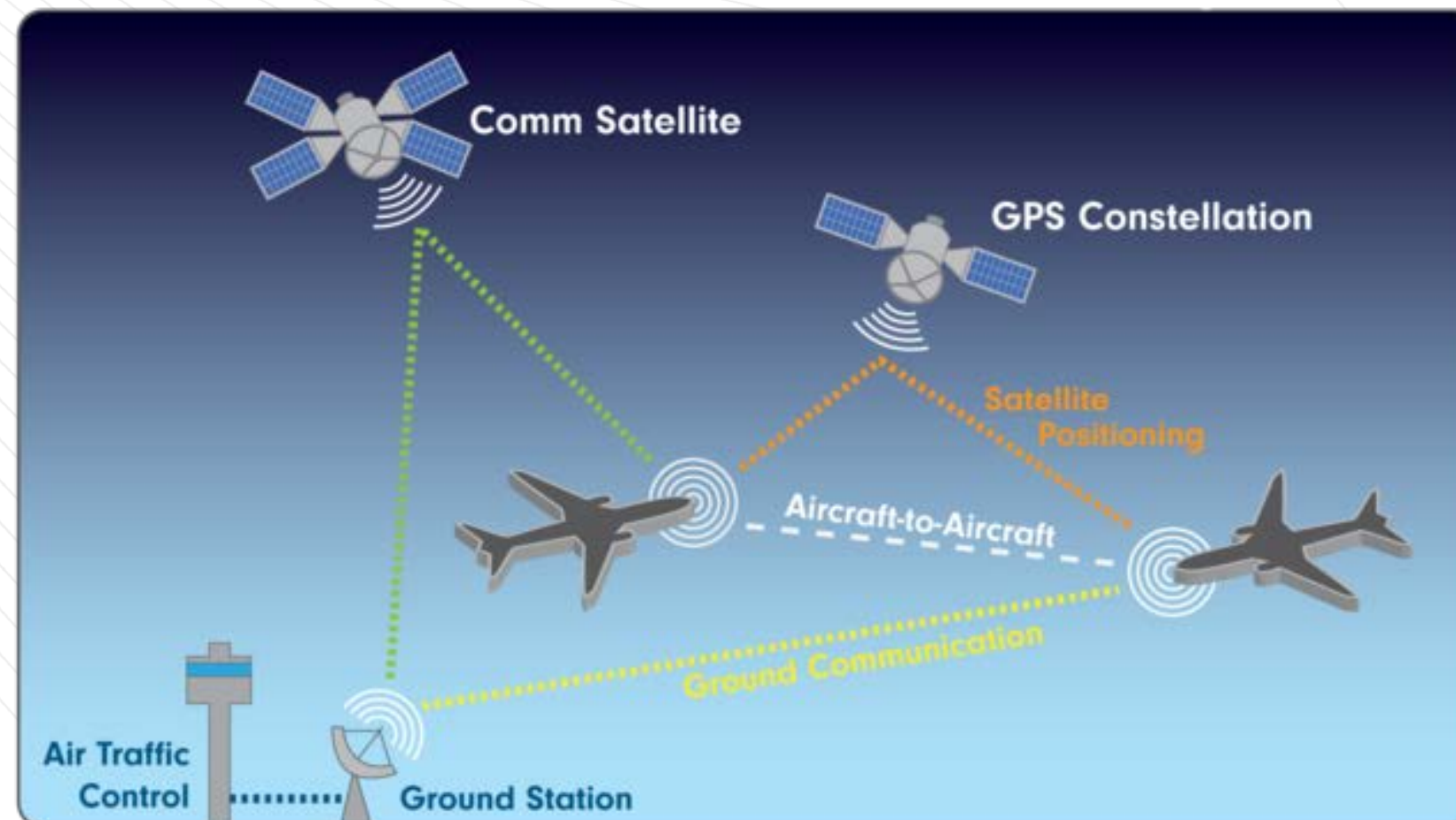
ADS-B

ADS-B Out   ADS-B In
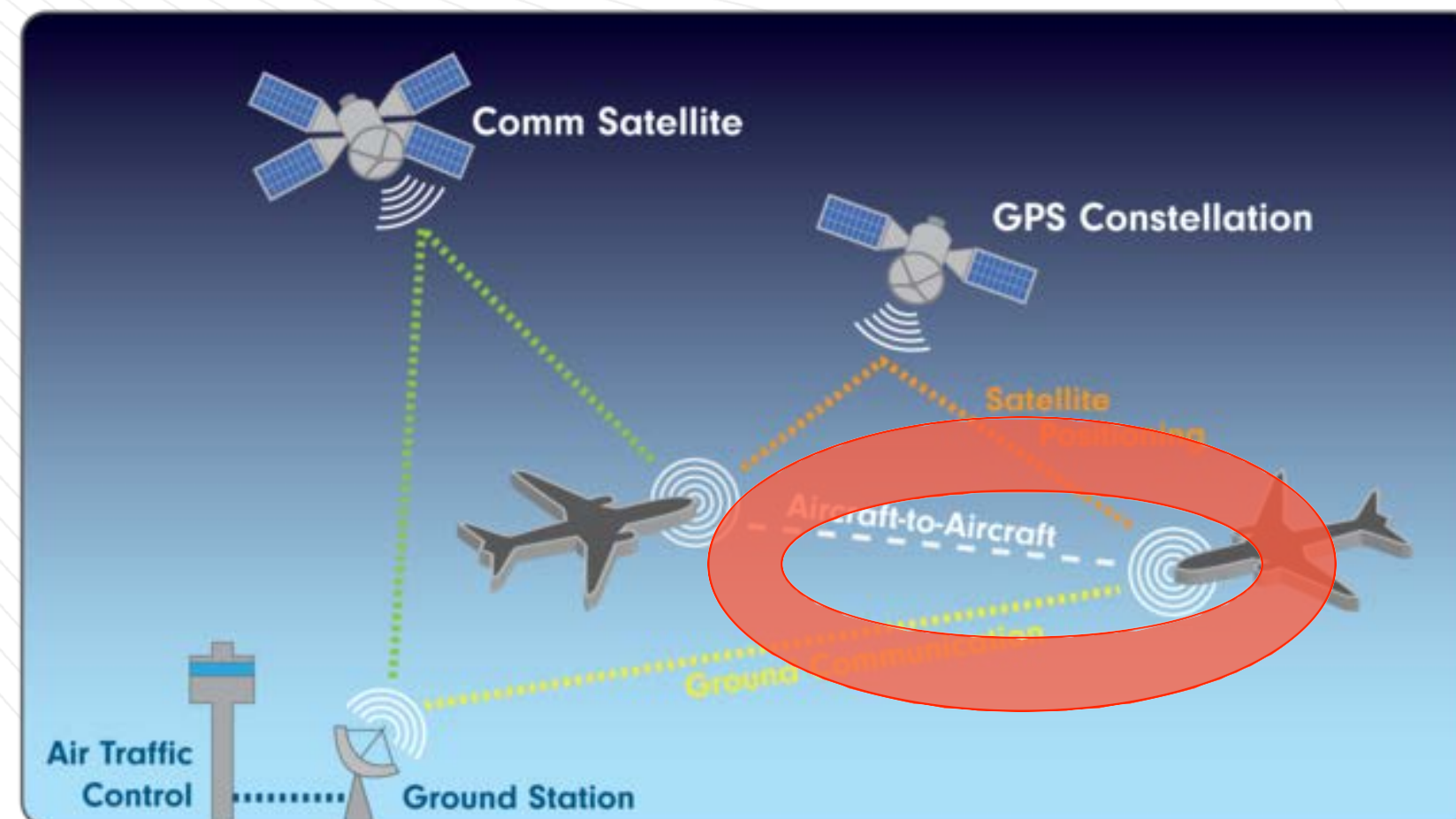
Key Terms

ADS-B In and Out

- ADS-B Out: a surveillance technology for tracking aircraft

- Aircraft report position, velocity and altitude once per second

- Aircraft will be required to equip with ADS-B Out by January 1st 2020 if operating in class A, B, C airspace and above 10,000 ft.
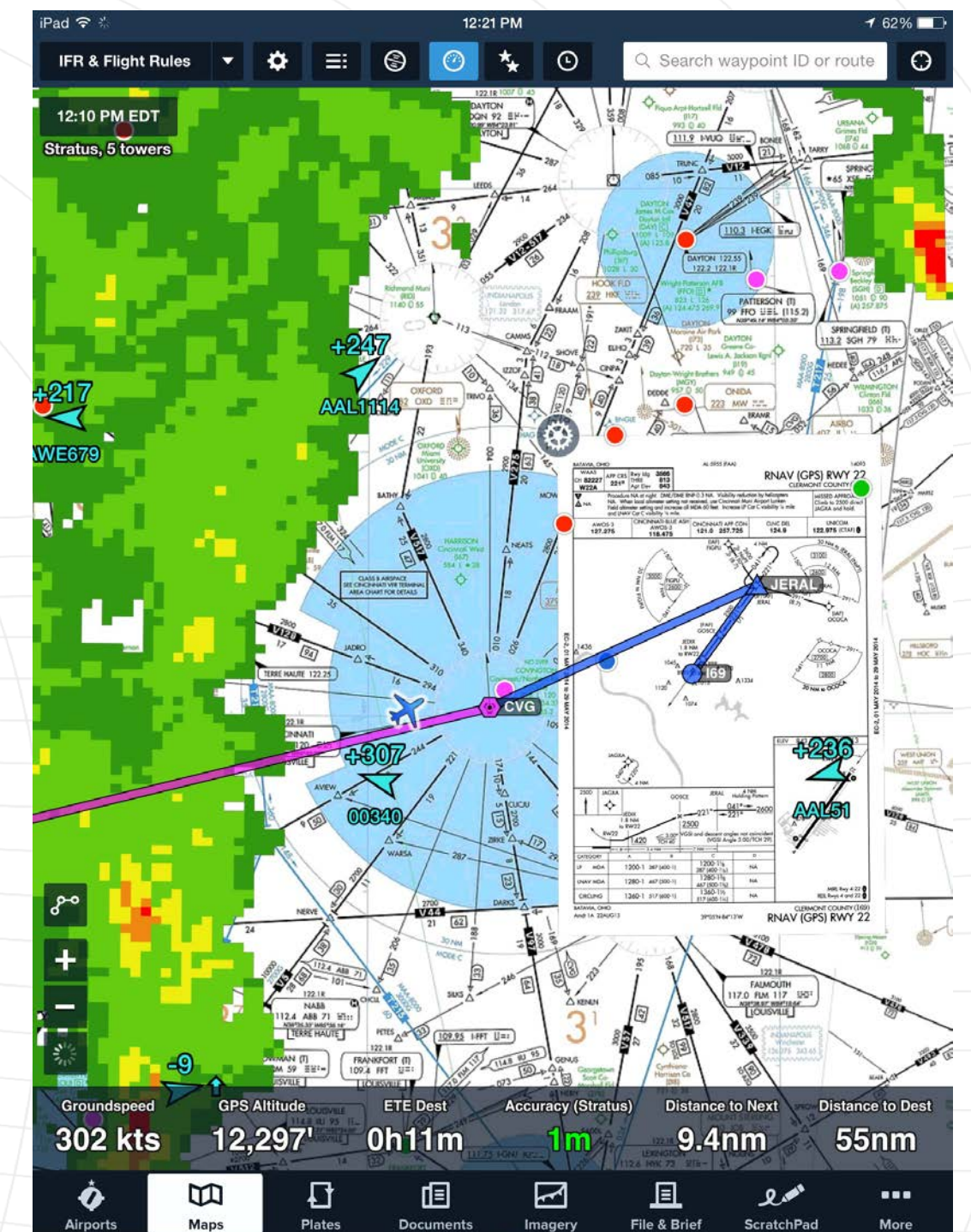
Key Terms

ADS-B In and Out

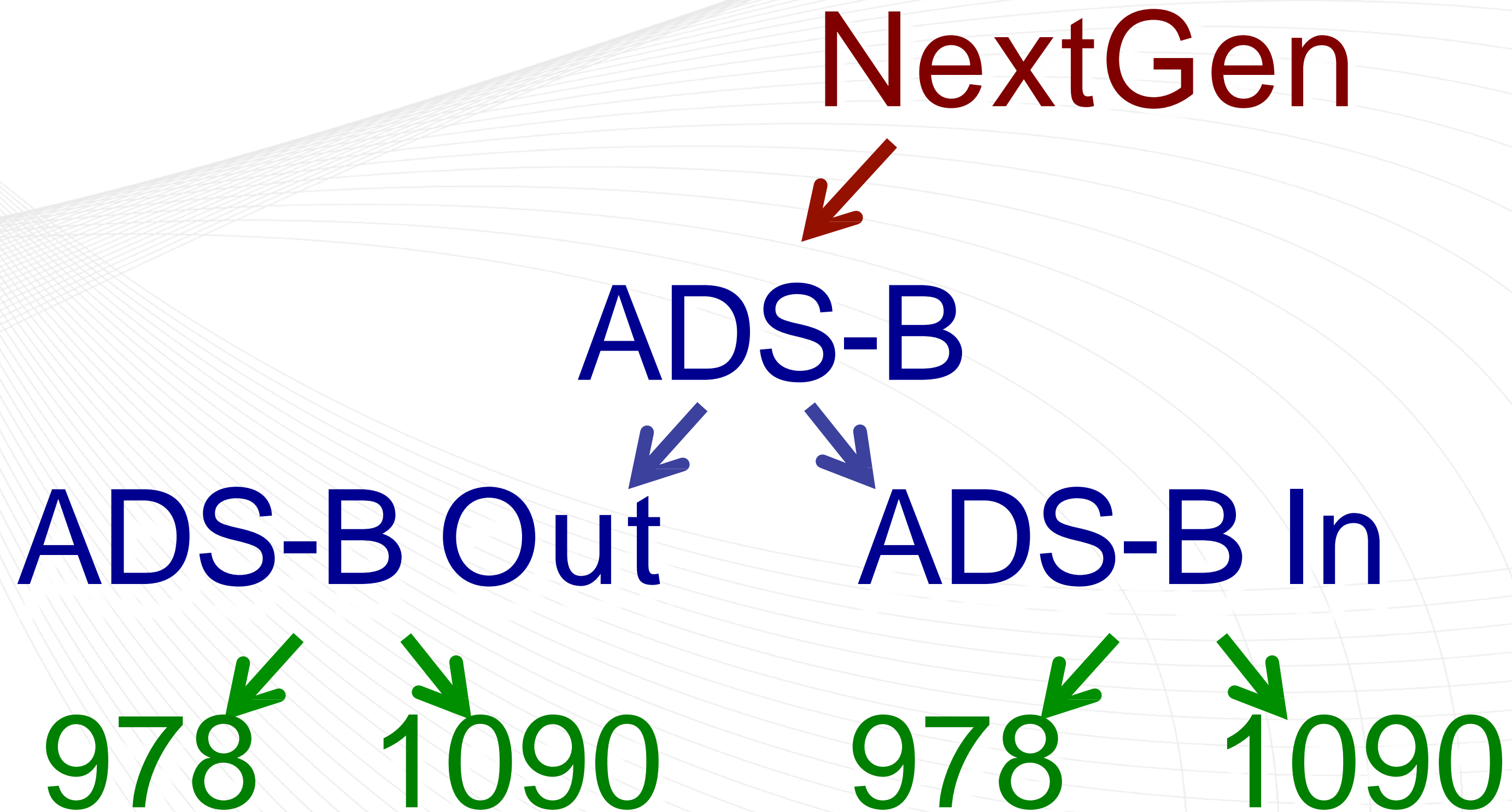- ADS-B In: an aircraft's ability to receive transmissions from ground stations and other aircraft

- Allows pilots to receive weather and traffic

- ADS-B In equipage is *optional*

Key Terms

NextGen

ADS-B

ADS-B Out   ADS-B In

978   1090   978   1090

Key Terms

978 vs. 1090

- ADS-B in the US supports two different datalinks:

  - 1090 MHz Extended Squitter (ES)

  - 978 MHz Universal Access Transceiver (UAT)

Key Terms

1090ES

- 1090ES – ADS-B Out

  - ES is based on 1090 MHz just like Mode A/Cs transponders

  - Mode S transponders can be upgraded to ES transponders by adding a WAAS GPS and upgrading software

  - ES is the only ADS-B transmitter accepted outside the US and above 18,000 ft.

Must be certified and installed

Key Terms
978 UAT

- 978 UAT – ADS-B Out

  - Only allowed in the US, and only below 18,000 ft.

  - If you use 978 UAT you still need to carry at least a transponder

Must be certified and installed

Key Terms
1090ES

- 1090ES – ADS-B In

  - Can detect other aircraft equipped with 1090ES transmitters

  - Receives other traffic from ground stations (TIS not TIS-B)

  - Does NOT receive weather

Can be portable or installed

Key Terms

978 UAT

- 978 UAT – ADS-B In

  - Can detect other aircraft with 978 MHz transmitters (air-to-air)

  - Receives information about other traffic from ground stations

  - 978 receivers *are* capable of receiving ADS-B weather

Can be installed or portable

Key Terms
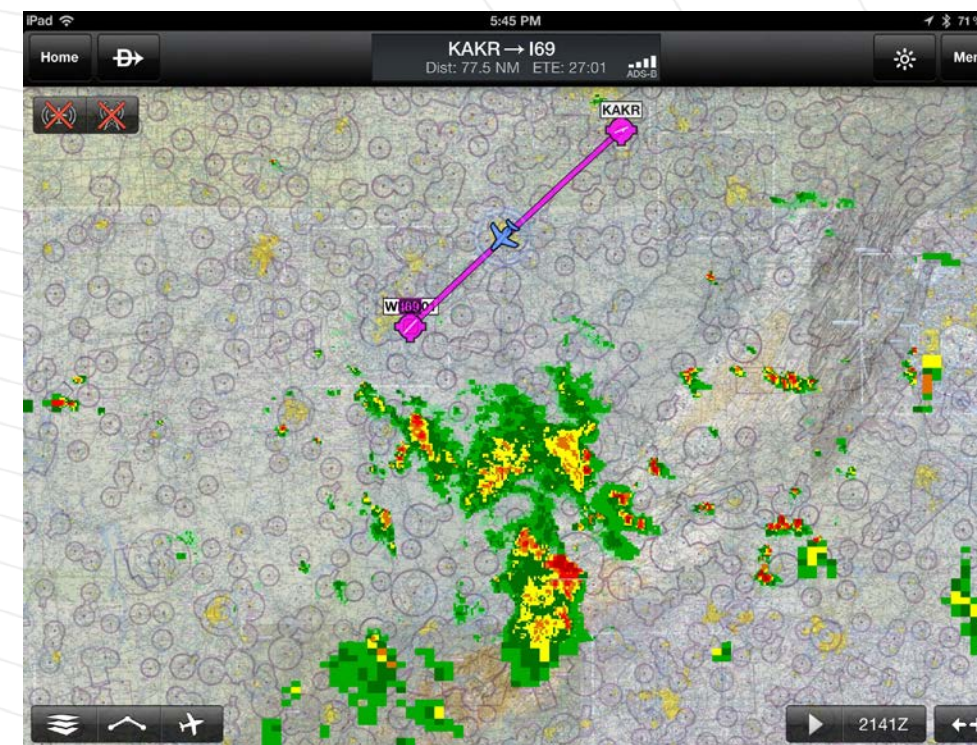*NextGen, ADS-B, In/Out, 978/1090*

- 1090ES (Out)
  - Above 18,000 ft. and int'l
  - Turboprops and jets

- 978 (Out)
  - Below 18,000 ft. in US only
  - GA/piston

- 1090ES (In)
  - Traffic only
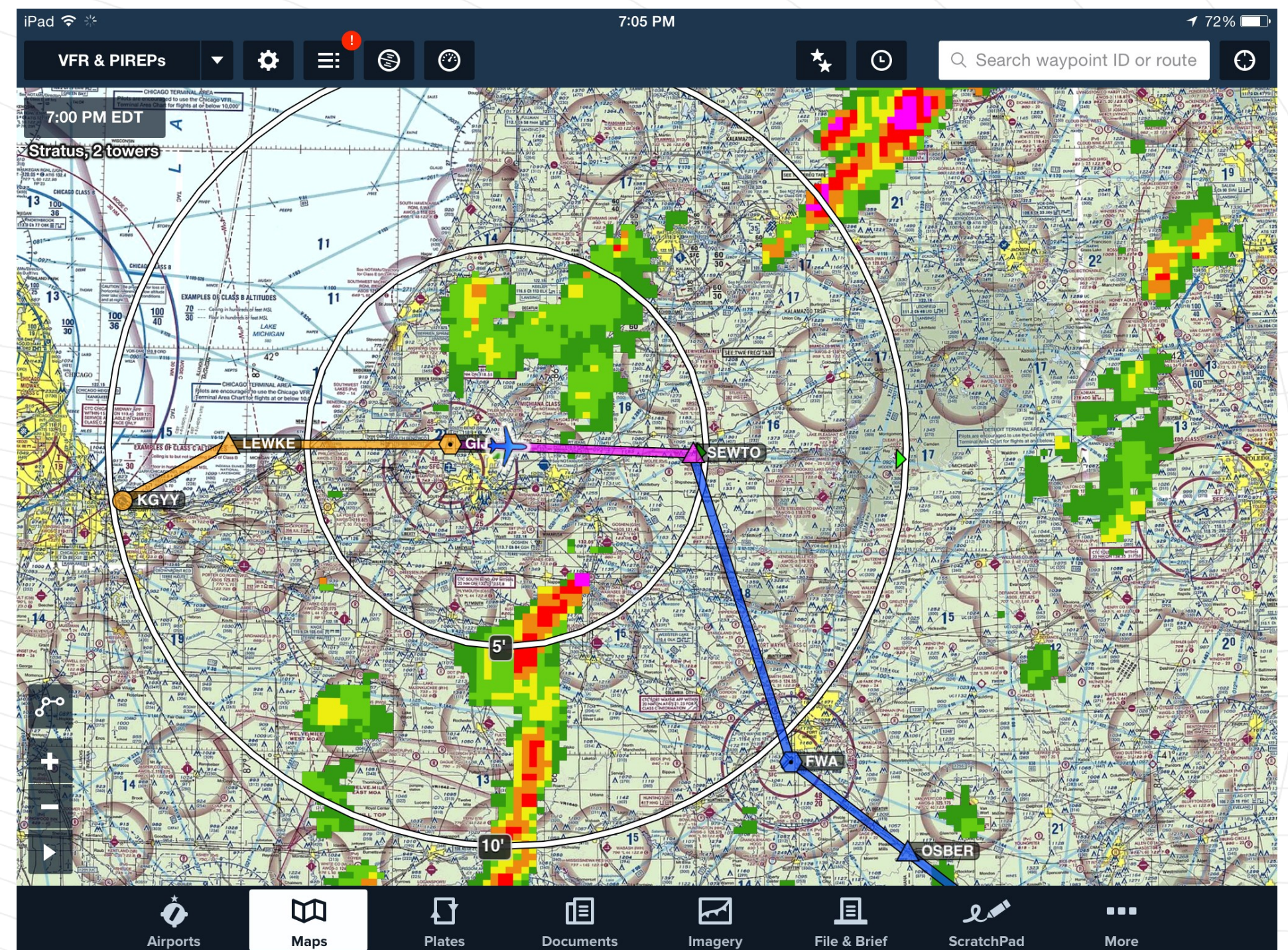 - No weather

- 978 (In)
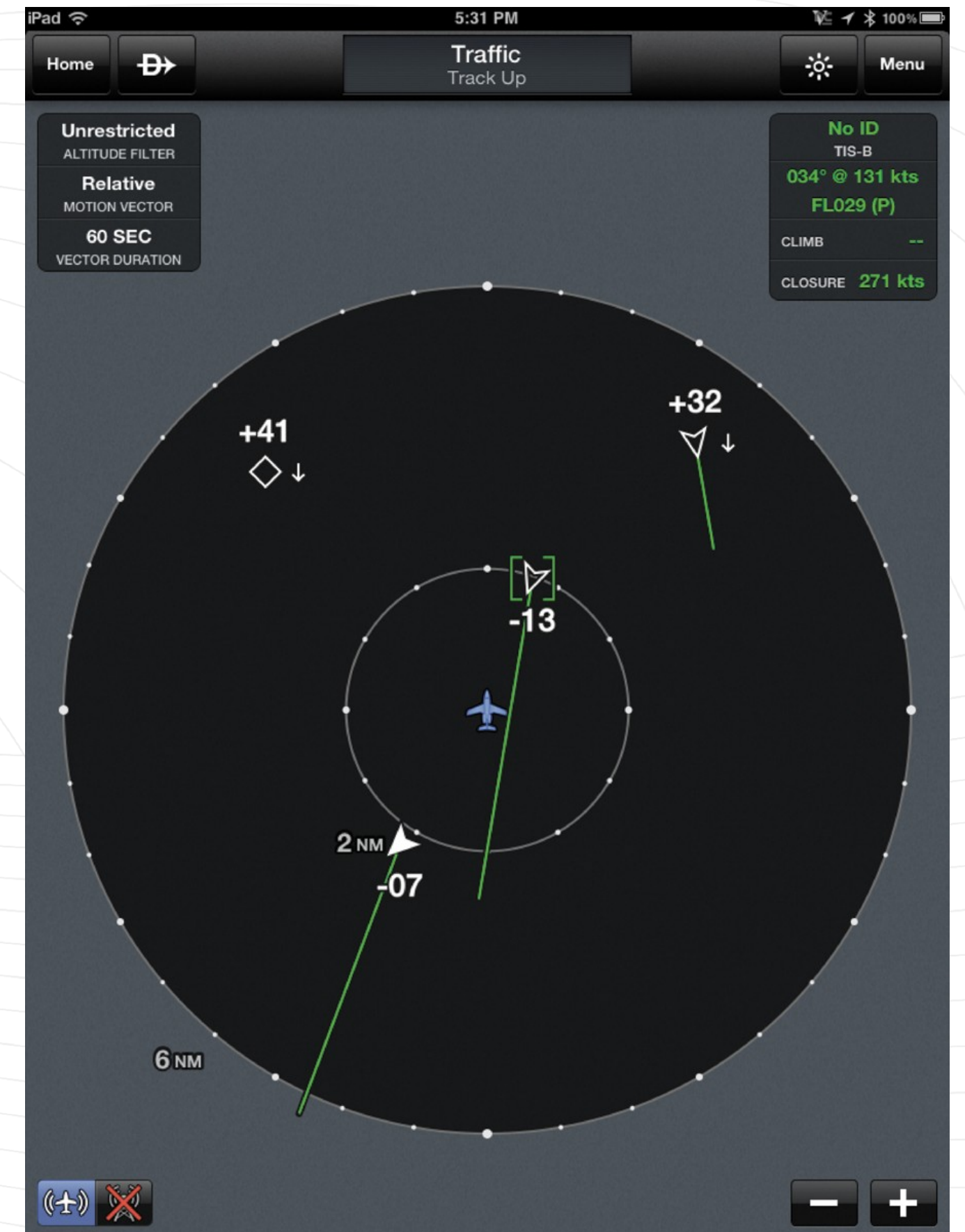 - Traffic
  - Weather

Key Terms
FIS-B

- Flight Information Services – Broadcast

  - Text weather (METARs, TAFs, PIREPs)

  - Graphical weather (radar)

  - Airspace status (TFRs, NOTAMs)

  - Constantly broadcast

Key Terms
TIS-B

- Traffic Information Services – Broadcast

- A custom traffic report sent only to aircraft equipped with ADS-B Out

- Aircraft with ADS-B In can also see other aircraft *if* they are equipped with ADS-B Out (air-to-air traffic)

- Most airplanes do not have ADS-B Out

- *Not the same as Mode S or TIS traffic*

ADS-B In – how does it work?

ADS-B In – how does it work?

ADS-B Traffic

- Weather is broadcast continuously

- Traffic is different. Ground stations only broadcast in response to ADS-B Out aircraft

  - FAA sends a customized traffic product to each Out aircraft

  - 30nm in diameter around the Out aircraft and within 3500 ft.

  - If you're close to an ADS-B Out aircraft (in the "hockey puck") you could see traffic. But it's for the other aircraft.

  - Since most airplanes do not have ADS-B Out, this is rare.

= ± 3500 feet

30 NM
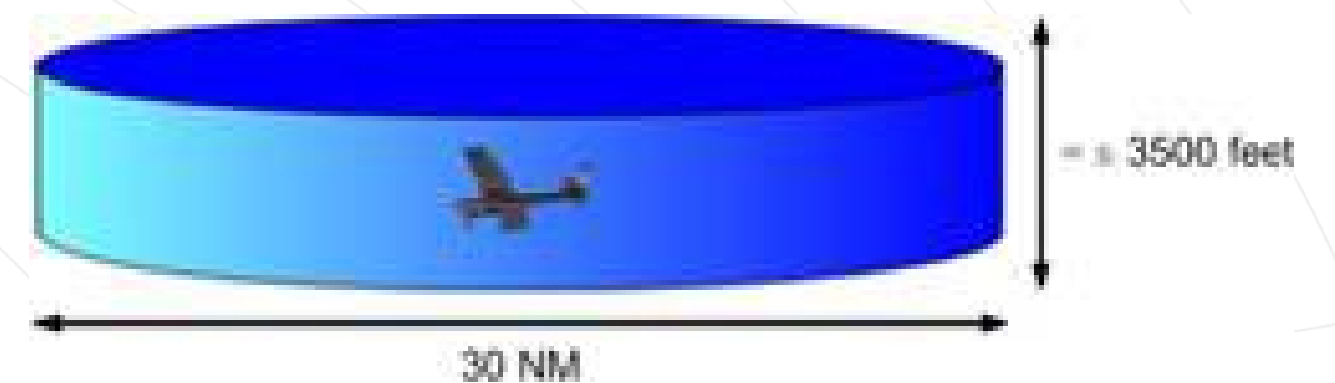
ADS-B In – how does it work?
ADS-B Traffic

- Except – you will always receive air-to-air traffic

  - Doesn't depend on ground stations

  - Single band receives only 978 air-to-air;
    dual band receives both

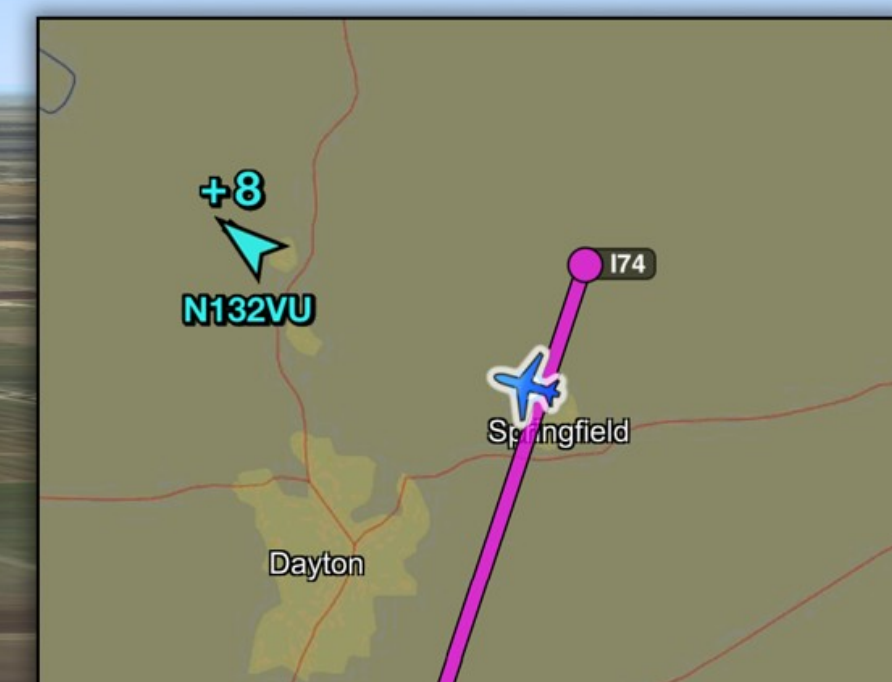# ADS-B In – how does it work?
ADS-B Traffic

ADS-B In – how does it work?
ADS-B Traffic

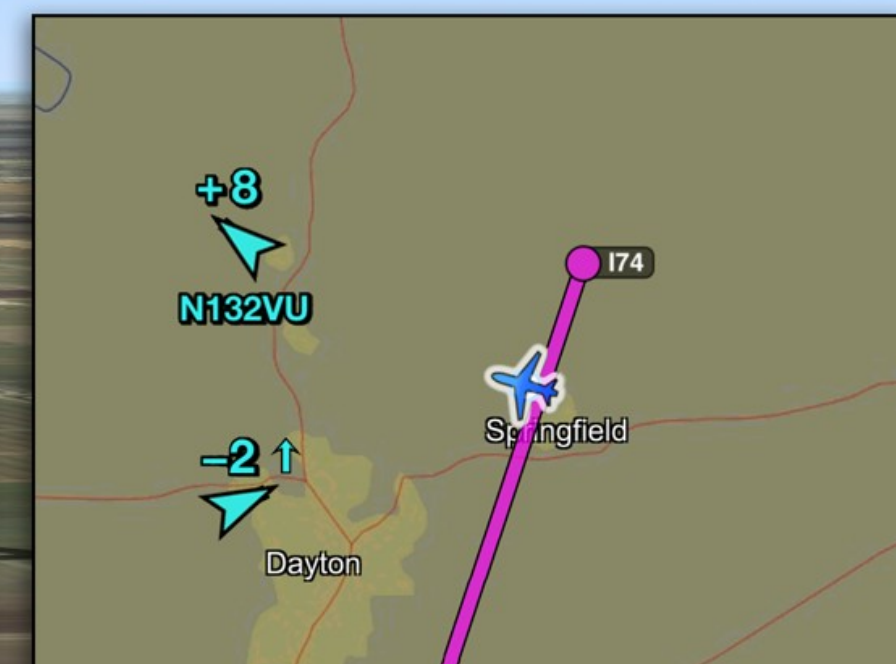Stratus, no ADS-B Out, but close to another airplane with ADS-B Out

ADS-B Out - Air to Air

Mode C

You

Mode C

ADS-B Ground Station

ADS-B In – how does it work?
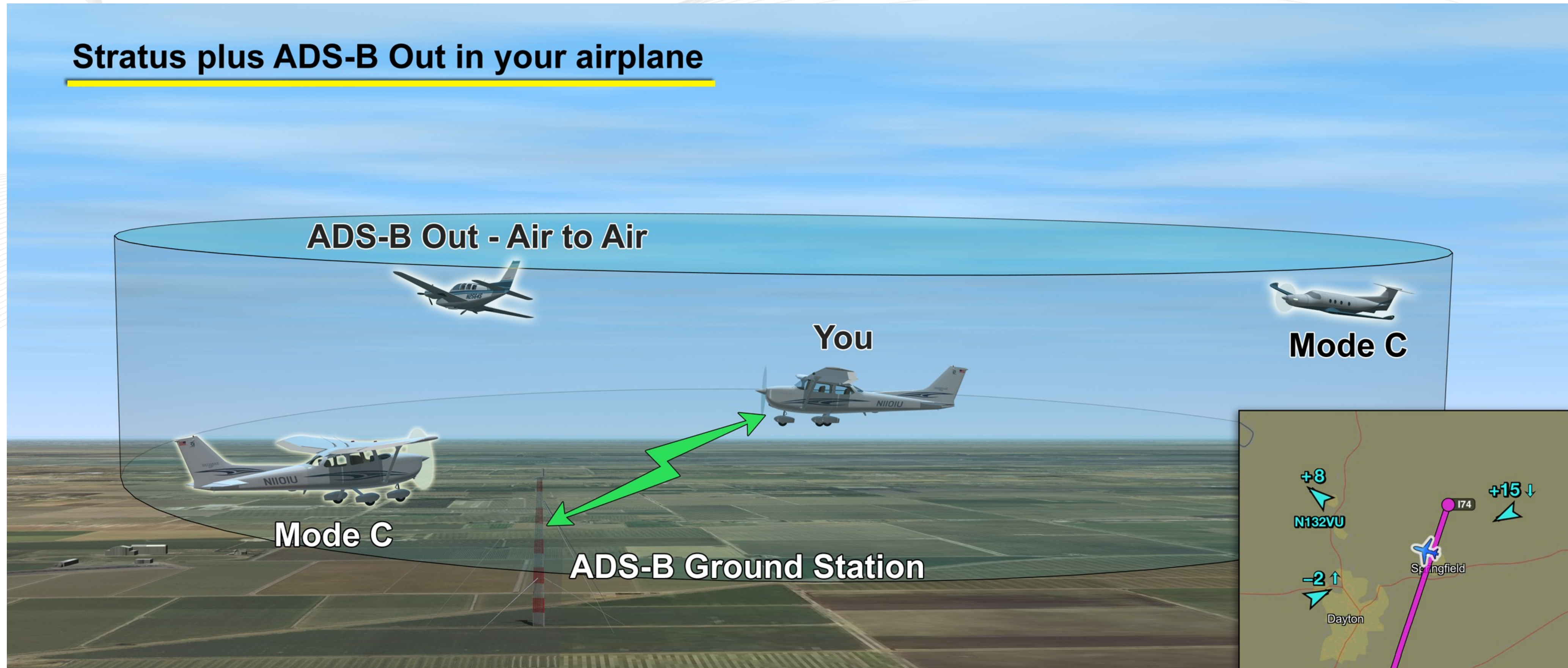
ADS-B Traffic

ADS-B In – how does it work?

ADS-B Traffic

Key takeaway:

Unless you are squawking ADS-B Out and creating your own customized hockey puck of information, you are not getting an accurate picture of surrounding traffic.

ADS-B In –how does it work?

ADS-B vs. XM Weather
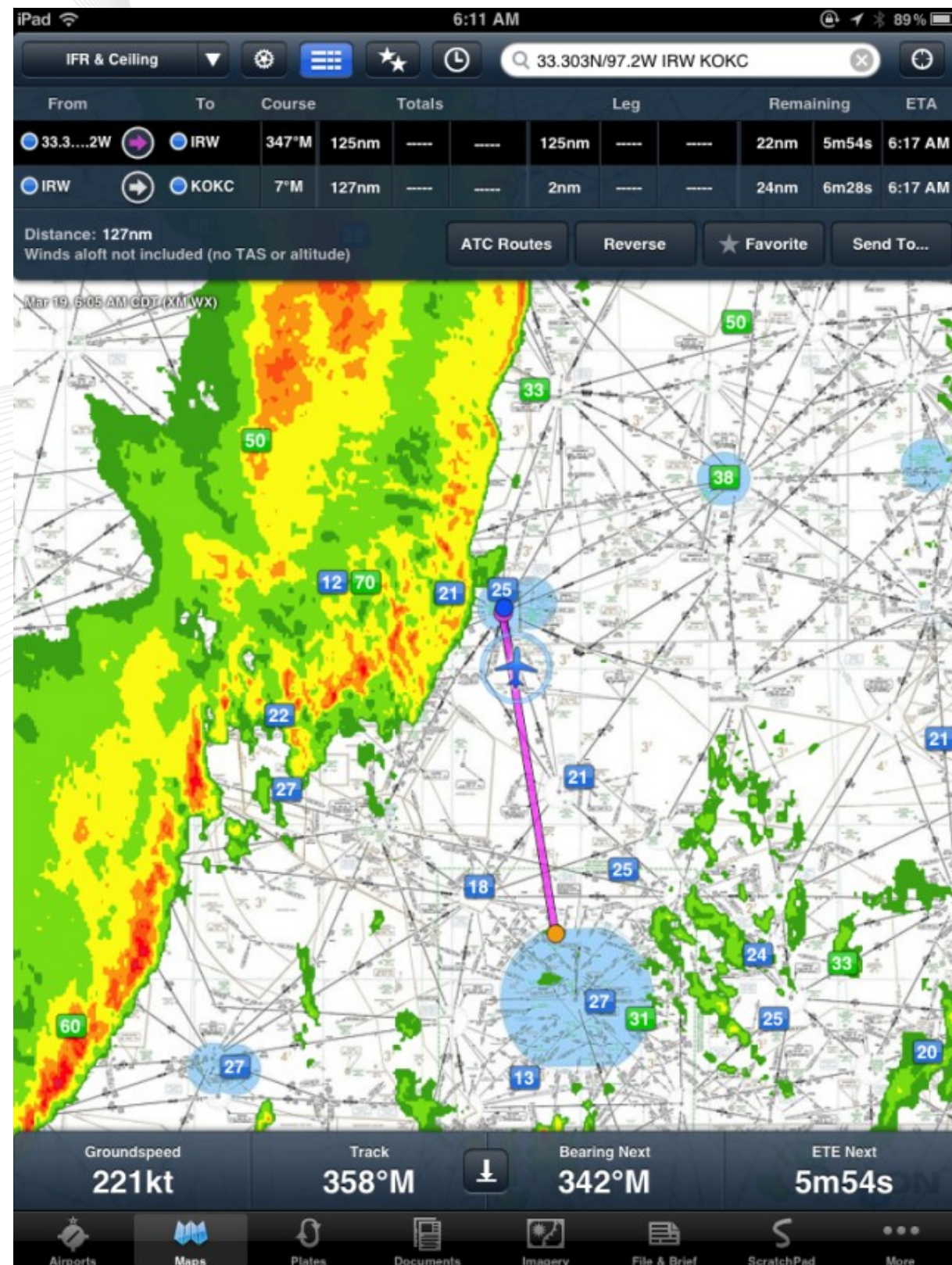
XM
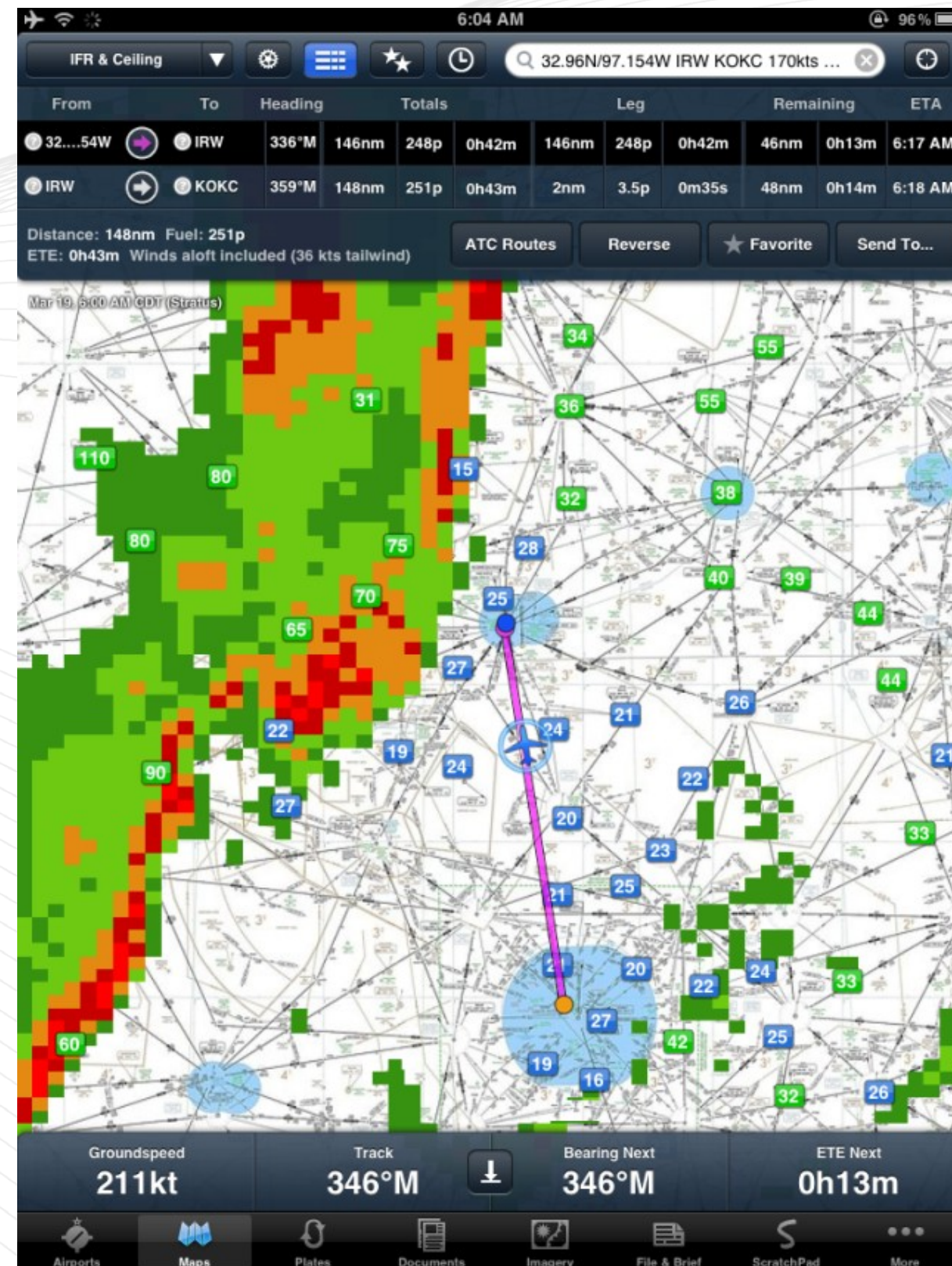
ADS-B National >250nm
(Updated every 15 mins.)
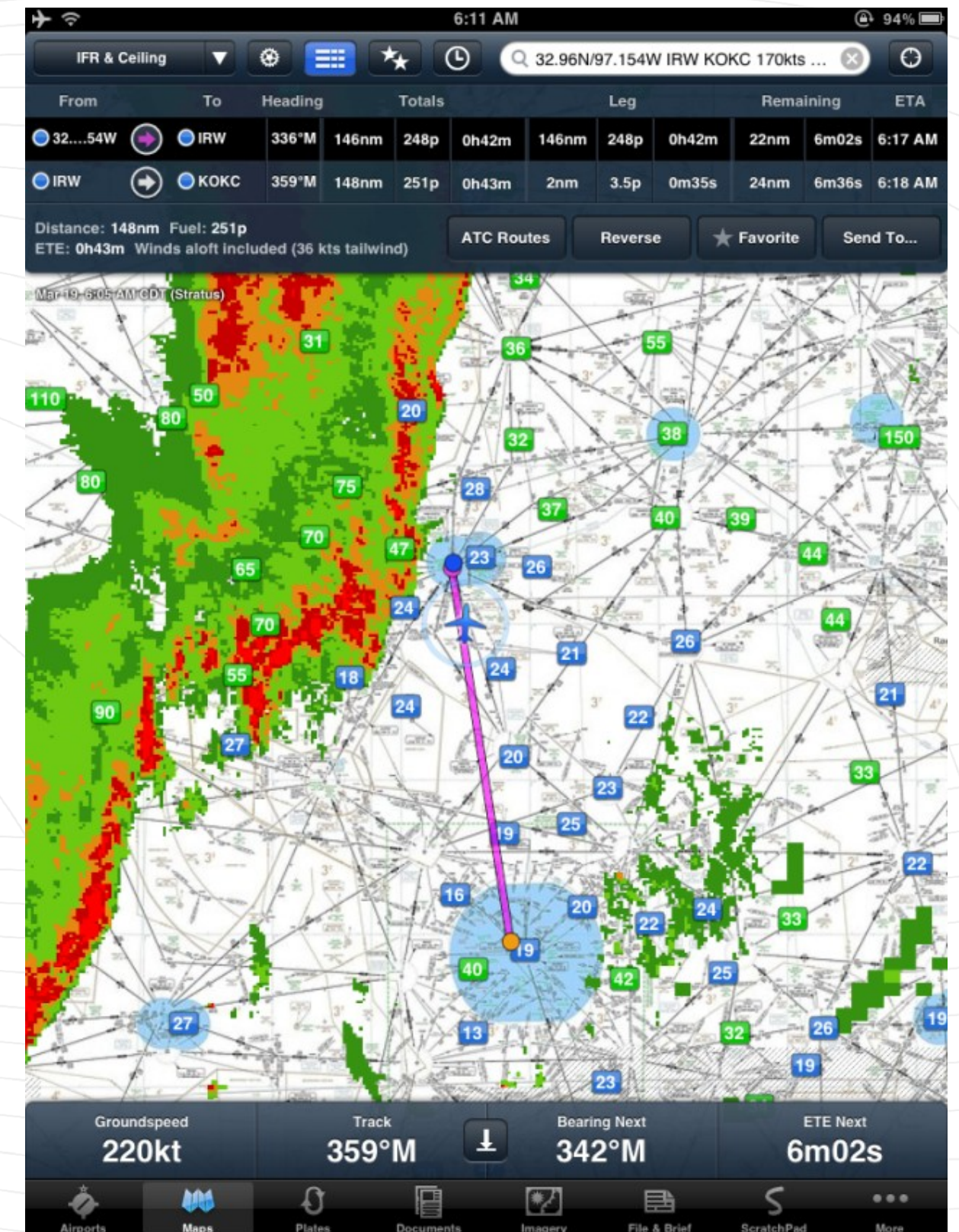
ADS-B Regional < 250nm
(Updated every 5 mins)

ADS-B In – how does it work?

ADS-B coverage at 1500 ft.
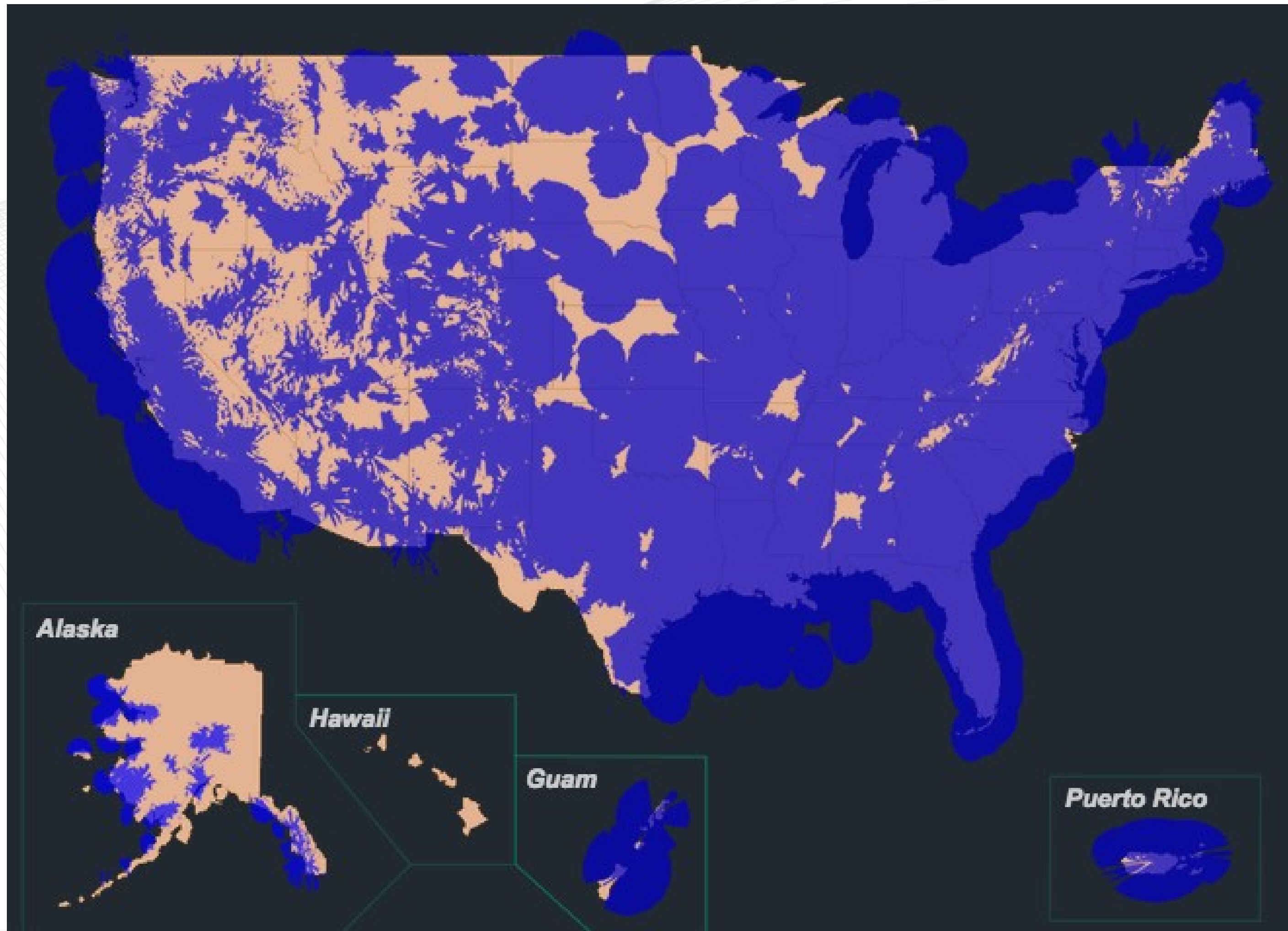
ADS-B In – how does it work?

ADS-B coverage at 5000 ft.
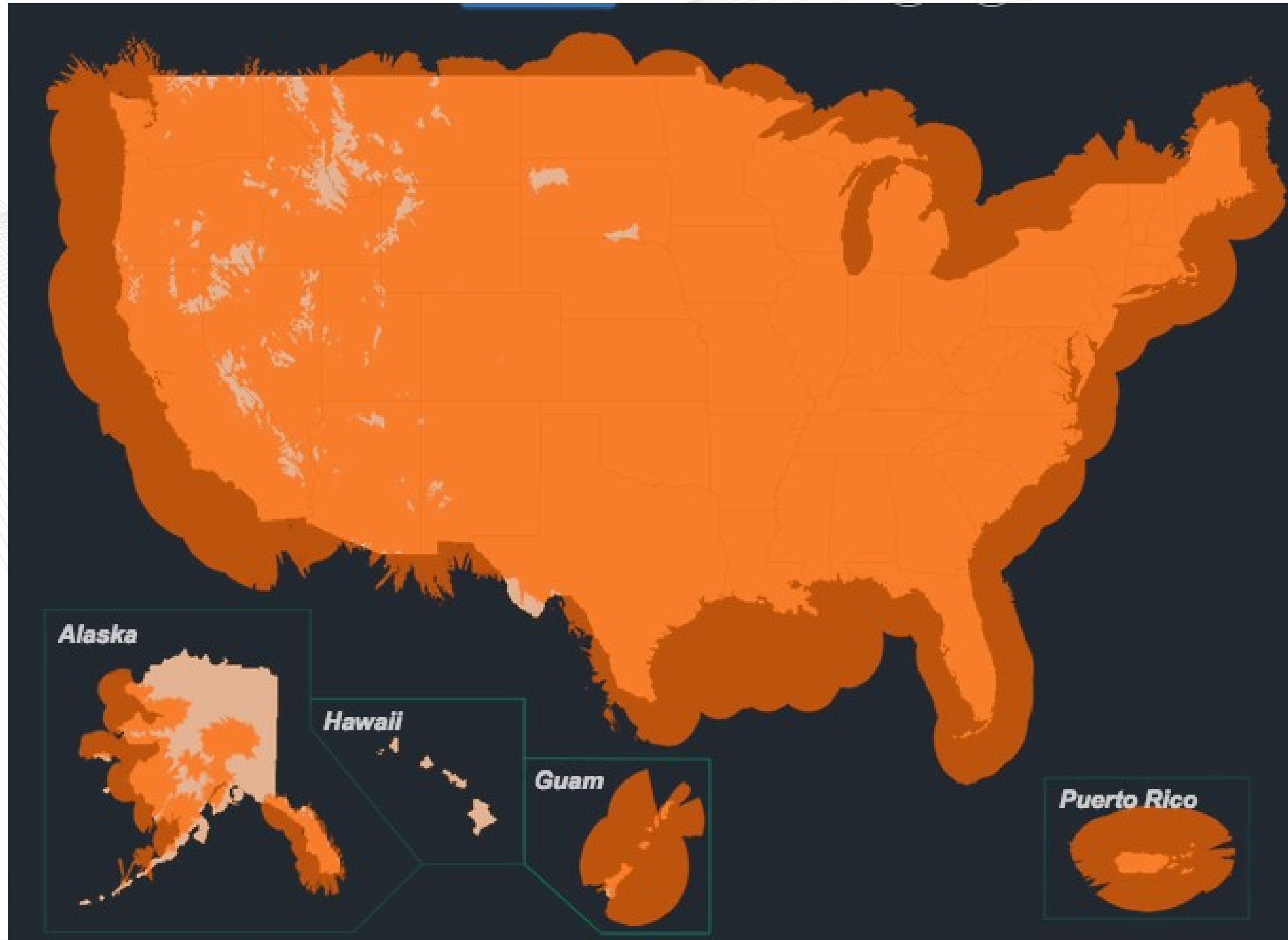
Panel-mount ADS-B

ADS-B In Action

5 things to know before you upgrade

1. ADS-B Out will be required in most airspace where a Mode C transponder is today on 1/1/2020

2. A WAAS GPS must be included in your install

3. ADS-B Out compliance must be panel-mount (no portables).

4. ADS-B In equipage is optional.

5. You still need your Mode C transponder if 978.

ADS-B In Action

Appareo Stratus EGS

- 1090ES OUT Transponder

- Replaces you existing Mode A/C transponder

- Includes internal WAAS GPS

- Seamless integration with Stratus 2S for ADSB IN

- Stratus ESG for ADSB OUT, Stratus ESGi for ADSB OUT / IN

- Stratus EGS: $2,995 - Stratus EGSi: $3,495

STRATUS

by APPAREO

ADS-B In Action
Garmin GTX 330ES

- 1090ES Out transponder

- Panel-mounted

- No GPS option

- GTX 330 can be upgraded to ES (~$1100)

- Starting at $2,995 list price

ADS-B In Action
FreeFlight RANGR

- With or Without Internal WAAS GPS

- Keep your existing Mode A / C Transponder

- Remotely mounted

- RANGR Lite with WiFi Connection to Ipad

- RANGR Blue Integrates with Glass Panels

- $2,995 ADSB OUT Only (FDL-978-TXL Lite w/ GPS)

- $3,695 ADSB OUT / IN (FDL-978-XVRL Lite W/GPS)

FREEFLIGHT SYSTEMS

ADS-B In Action

Lots of options!

Questions to consider

ADS-B In Action

Questions to consider

- Do you ever fly above 18,000 ft. or outside US?

- If so, you need a 1090ES transponder.

ADS-B In Action

Questions to consider

- How is your Mode C transponder?

- If it's in bad shape, you probably need a 1090ES transponder – get ADS-B Out and a new transponder.

ADS-B In Action

Questions to consider

- Do you have a WAAS GPS?

- If you do, some remote mounted boxes work well. If not, remember to buy a solution that includes it.

ADS-B In Action

- Do you already have ADS-B In (portable)?

- If so, you may only need to buy ADS-B Out for the panel

Portable ADS-B Receivers

ADS-B In Action

Portables

- Many of the benefits of installed ADS-B, for less money

- iPad has been the game changer

- Great for renters, clubs

- Portable devices are ADS-B In only

- Lots of options to choose from
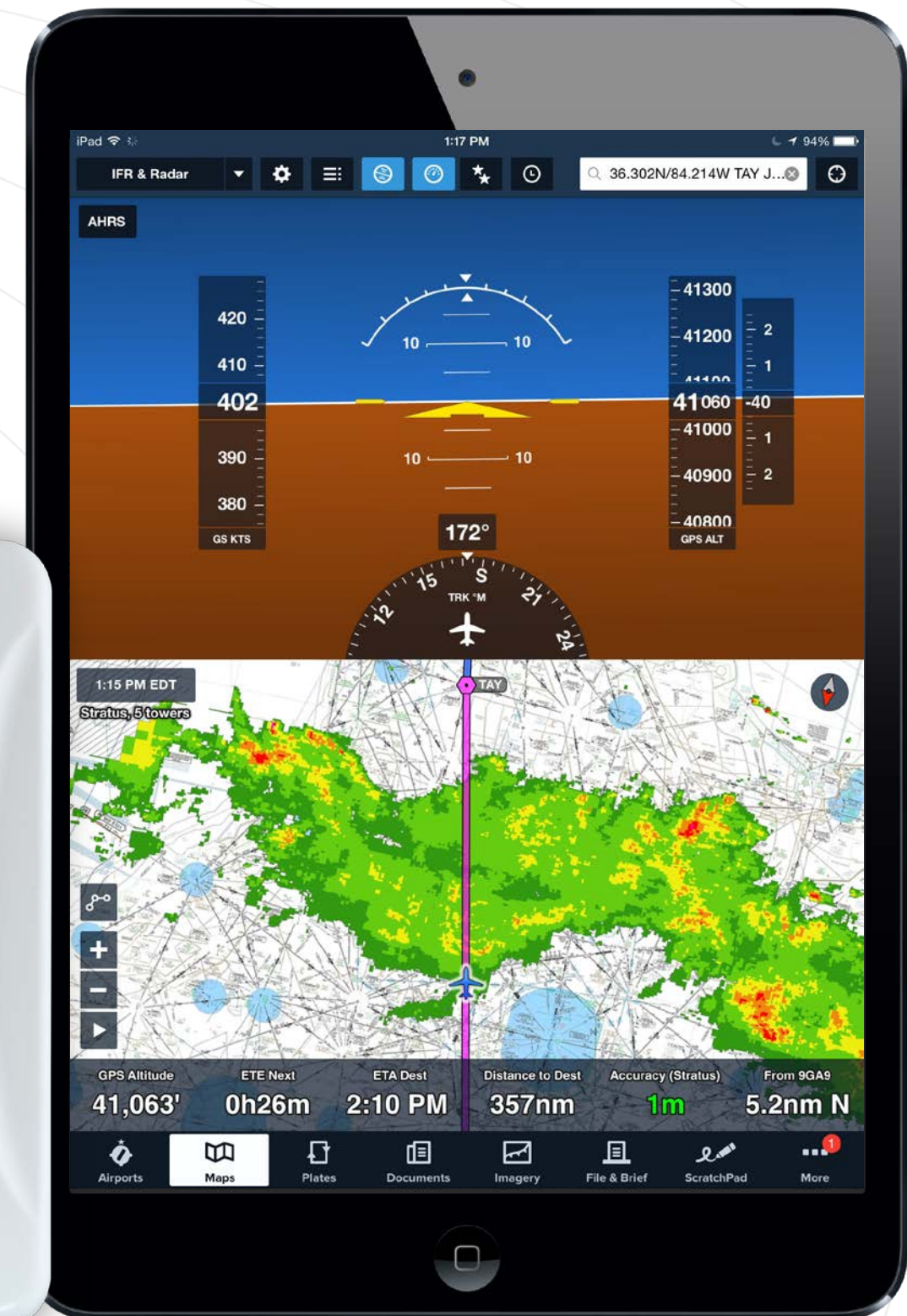
Choosing a Receiver

First choose an app

- ForeFlight Mobile ➔Stratus 2S

- Garmin Pilot ➔Garmin GDL 39 or GDL 39 3D

- WingX Pro 7 ➔SkyRadar, Dual XGPS170, Clarity,iLevil

- FlyQ efb ➔Dual XGPS170, Clarity,iLevil

Appareo Stratus 2S

- ADS-B weather and GPS

- Dual band traffic mode

- AHRS capable
(Attitude and Heading Reference System)

- Built-in pressure altitude sensor

- Built-in flight data recorder

- Built-in 8-hour battery

- No wires or antennas (WiFi)

- Works with ForeFlight app

- $899

SkyRadar D and DX

- ADS-B weather and GPS

- Dual band traffic

- Optional AHRS

- WiFi connection

- Works with WingX, DroidEFB, iFly

- Requires external power

iLevil 3 SW and AW

- ADS-B weather and GPS

- Single-band traffic

- Built-in AHRS

- Works with WingX, FlyQ, Xavion

- Internal battery and solar panel

Dual XGPS170

- ADS-B weather and GPS

- Single-band traffic

- Built-in battery

- Works with WingX, FlyQ, others

Sagetech Clarity

- ADS-B weather and GPS

- Dual band traffic

- Optional AHRS model

- Built-in battery

- Works with WingX, FlyQ, Fltplan Go

- Small size and light weight

2.5" x 2.5" x 1.5" / 5.5 oz.

Garmin GDL 39 and GDL 39 3D

- ADS-B weather and GPS

- Dual band traffic

- Optional AHRS model

- Optional battery

- Works with Garmin Pilot app

- Also works with Garmin GPSs

Don't Forget the FAA $500 ADSB Rebate Program!

To be eligible for a **REBATE,** your **aircraft** must meet these requirements

✓ Aircraft is U.S. registered

✓ Fixed-wing single-engine piston driven aircraft

✓ Aircraft not currently equipped with Version 2 ADS-B Out

ADS-B Questions?

Thank You!

Bob Ross
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ADS-B Slides Courtesy of **John Zimmerman** Sporty's Pilot Shop