



Welcome

- Restrooms
- Exits
- Emergency Evacuation
- Sponsor Acknowledgment
- Interactive Presentation Style
- Breaks



Outline

- My Background
- Overview of FAASafetyTeam
- History of Aviation Automation
- NextGen Capabilities Focus: ADS-B
- Audience Response Quiz Game



My Background

- 1976 – US Army Avionics Technician GA, WA
- 1984 – CFI & Part 135 NJ, WA, OR, CT
- 2004 – FO LR-25, 35, 55 TX, & FL
- 2006 – 2007 CA LR-35/CE500 Part 135 North America, Africa, Middle East
- 2008 – FO Part 121 B747-200 & 400 Worldwide
- 2010 – CA B-747-400 Director of Flight Standards
- Present Owner ASR Products & Services



Safety Seminars

FAASafetyTeam Website
www.faasafety.gov



Safety Seminars

FAASafetyTeam Mission Statement

Improve the Nation's aviation accident rate by conveying safety principles and practices through training, outreach, and education; while establishing partnerships and encouraging the continual growth of a positive safety culture within the aviation community.



FAAST Relationship With Aviation Community

FAASTeam Members are individuals who makes a conscious effort to promote aviation safety and become part of the shift in safety culture. Members are:

- Pilots – participate in WINGS - Pilot Proficiency Program
- Mechanics – participate in AMT Awards Program
- Everyone who attends FAASTeam Seminars



Join The FAASTeam!

Join the FAASTeam at whatever level is right for you: Pilots; Maintenance; Volunteers; attend safety seminars and help to promote a positive safety culture.

Together, as a team, we can make a difference by reducing aviation accidents!

Sign-up at FAASafety.gov and take part in all it has to offer!

Thank You!



History of Aviation Automation

NextGen is the continuous modernization of our national airspace. A comprehensive set of initiatives that integrates new air traffic technologies and procedures that is transforming how we manage our skies. [Video about Next Gen](#)

Procedural Based Control: <i>Control on Where We Think the Aircraft Is</i>	Surveillance Based Control: <i>Control on Where We Know the Aircraft Is</i>	Satellite Based Control: <i>Control on Where We Know the Aircraft Will Be</i>
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Where We Are In Delivery

- 100 % of the ADS-B radio stations for new aircraft communication & surveillance are installed across the country
- ERAM is replacing the former system for ATC across the country. ERAM is operating in 16 of 20 ARTCCs nationwide.
- Data Comm is operating field tests in Newark and Memphis
- More than 3,000 WAAS procedures provide access for GA pilots nationwide



NextGEN is happening now



Operational

- Precision departure paths (PDP)
- Reduced departure spacing
- Digital weather services
- Time-based sequencing of aircraft
- Optimized profile descents (OPD)
- Precision arrival paths (PAD)
- Surface data sharing
- Integrated flight planning

Transformational

- ADS-B
- SWIM
- NVS
- DataComm


Foundational

- Terminal Automation Modernization and Replacement (TAMR)
- En Route Automation Modernization (ERAM)
- Terminal Automation Modernization and Replacement (TAMR)



History of ATC Automation

- 1921 Rotating light beacons replaced bonfires
- 1929 First ATC Controller then light guns soon replaced signal flags
- 1932 Radio beacons then 2-way radio
- 1936 Three ARTCCs Newark, Cleveland and Chicago
- 1952 Radar (approach and departure control)
- June 30, 1956 mid-air collision prompted a major upgrade to ARTCC system



History of Automation (Transponder)

- 1960 FAA began requiring transponders
- 1965 – 1975 FAA Radar Systems computerized
- 1986 Cerritos mid-air collision DC9 & PA28 requiring TCAS (jets) and Mode C (everyone)
- 1993 All commercial aircraft equipped with Traffic Collision and Avoidance System (TCAS)
- 1997 UAT used in CAPSTONE



RADAR

Typically, surveillance radar sends a signal that causes the aircraft's transponder to reply and provide its position.



Most Radar antennas revolve at a rate of ~5 RPM, therefore the time between Signal returns is ~ 12 sec. For an aircraft flying at 500 Kts, this means that the aircraft can move ~ 0.6 Nm between returns.

The Potential

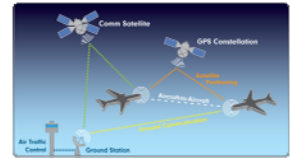
- Currently, when flying in or out of non-towered airports without radar service, IFR Departures and arrivals can only occur one at a time, resulting in long delays between aircraft.
- ADS-B creates the potential for reducing these delays by more accurately reporting aircraft positions to ATC in areas where radar coverage was previously unavailable.



Automatic Dependent Surveillance - Broadcast

- Automatic** – Always on and requires no operator intervention. Equipped aircraft automatically report position
- Dependent** – ADS-B is dependent on an accurate GNSS signal – and Broadcasts
- Surveillance** – Primary purpose is for ATC to know where aircraft are – much like Radar
- Broadcast** – Messages are broadcast to everyone not just sent to specific receivers

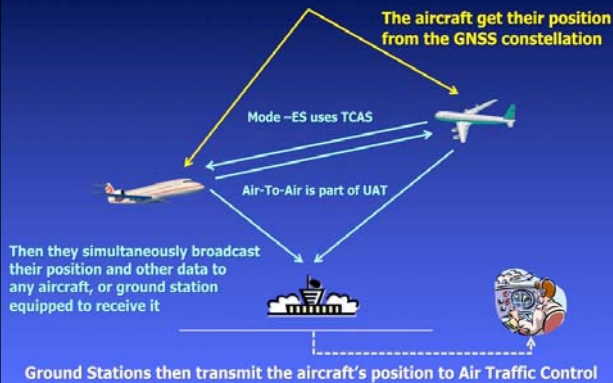
Automatic—Messages are sent out periodically without interrogation (unlike transponder)



Dependent—relies on onboard navigation and broadcast equipment to provide info to other ADS-B users Position and velocity derived from the Global Positioning System



How Does ADS-B Work?



Automatic Dependent Surveillance - Broadcast

Radar Surveillance → Satellite-Based Surveillance

Satellite-based surveillance

- Precision position updates
- Cockpit traffic and weather
- Safer flights
- Improved separation
- Oceanic altitude changes
- Ground infrastructure in place nationwide (March 2014)

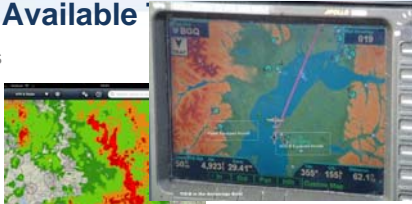


Transformational Program



Traffic and Weather Information Are Available

- Equipped pilots can now see other aircraft
- Get free live weather data
- Receive NOTAMS, METARs and TAFs



Flight Information Services – Broadcast (FIS-B)

Traffic Information Services – Broadcast (TIS-B)



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ADS-B Equipage

ADS-B Out equipage components

- GPS receiver
- 1090 MHz Extended Squitter (1090ES) or 978 MHz Universal Access Transceiver (UAT)
- Antenna

ADS-B In equipage options (necessary for in-cockpit information)

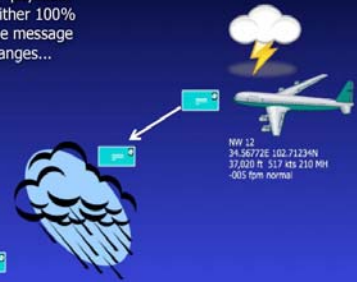
- Installed (certified) Multi-Function Display capable of receiving and displaying traffic and weather information
- Portable display (iPad or similar) – not certified / installed



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Accuracy & Reliability

ADS-B uses digital message "payloads" whose accuracy is binary (either 100% correct, or discarded), so the message integrity is the same at all ranges...



Similar technology as Digital cell phones v. Analog cell phones



NW 12
24.58772E 102.71224N
37,020 ft 317 kts 210 MH
-005 fpm normal

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24.58772E 102.71224N
37,020 ft 317 kts 210 MH
-005 fpm normal

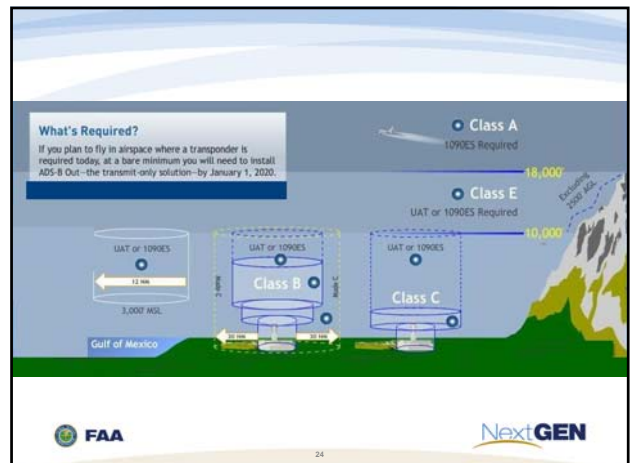
ADS-B Out Rule Compliance

By January 2020 all aircraft will be required to have ADS-B Out equipment to fly in

- Class A, B and C airspace
- Class E airspace in the contiguous U.S. 10,000 feet MSL and above, excluding airspace 2,500 feet and less above the surface



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Exceptions- 91.225 Certified aircraft without Electrical Systems, not subject to mandate in certain circumstances.

What's Required?
If you plan to fly in airspace where a transponder is required today, at a bare minimum you will need to install ADS-B Out—the transmit-only solution—by January 1, 2020.

Class A
1090ES Required

Class E
UAT or 1090ES Required

Class B
UAT or 1090ES

Class C
UAT or 1090ES

12 mi

3,000 MSL

Gulf of Mexico

FAA NextGEN

Overview 1090ES UAT Both

FL180

1090ES

UAT

1090ES

FAA NextGEN

Overview 1090ES UAT Both

FL180

1090ES

1090ES

Aircraft flying at or above FL180 are required to transmit on the 1090ES link, and it is also the international standard for many countries. However, FIS-B (weather information) is not available with 1090ES.

FAA NextGEN

Overview 1090ES UAT Both

FL180

1090ES

UAT

Aircraft equipped with the UAT standard can receive TIS-B (traffic) and FIS-B (weather) information.

FAA NextGEN

Overview 1090ES UAT Both

FL180

1090ES Out/
1090ES In
UAT In

UAT

1090ES

Both

It is possible to use both links. You can transmit (ADS-B Out) on 1090ES and receive (ADS-B In) on 1090ES and UAT. This option allows you to fly at any altitude while receiving traffic information and still benefit from the free weather information.

FAA NextGEN

METAR

AIRMET

NEXRAD

SPECI

NOTAM

SIGMET

TAF

PIREP

TEMP

SUA

FAA NextGEN

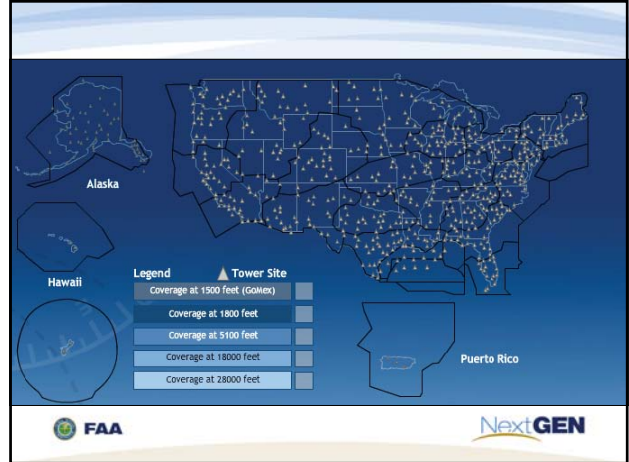
NextGen Arrivals to JFK



FAA

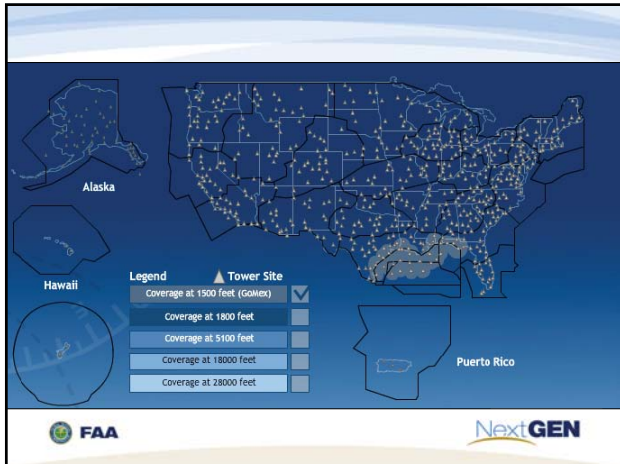
NextGEN

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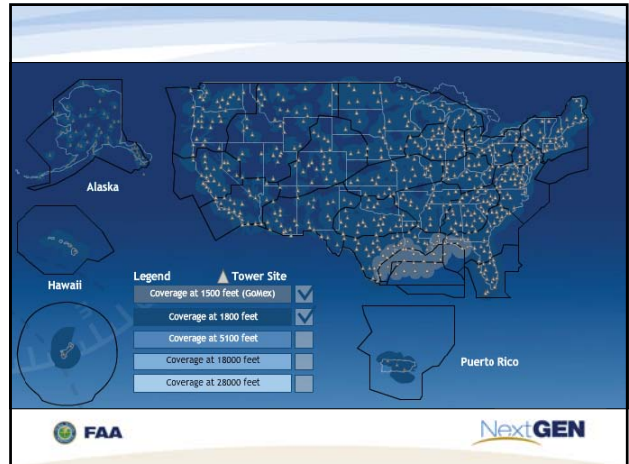
FAA

NextGEN



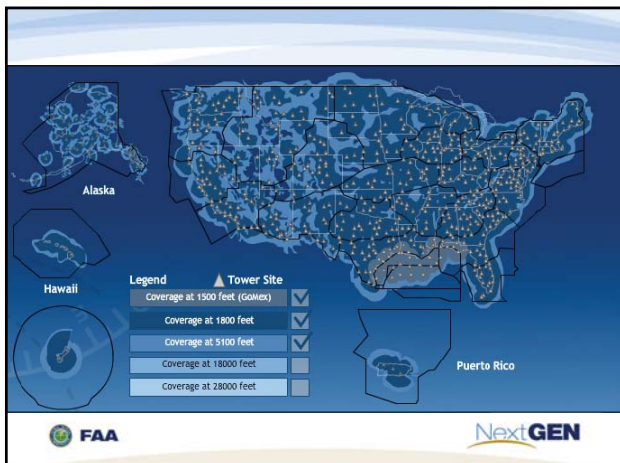
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NextGEN



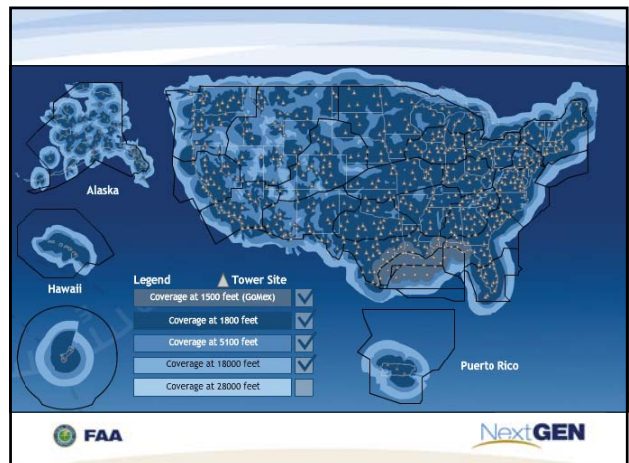
FAA

NextGEN



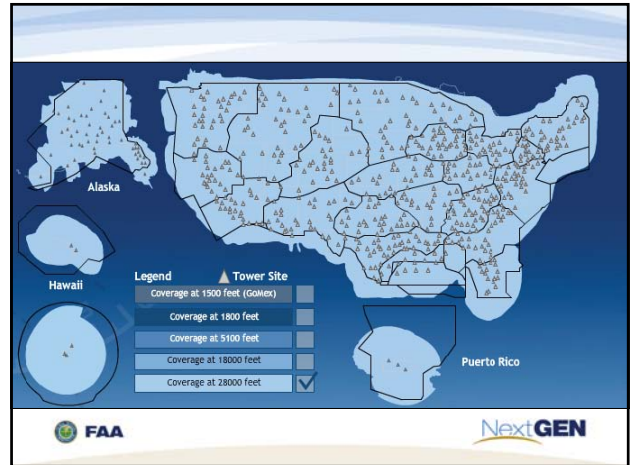
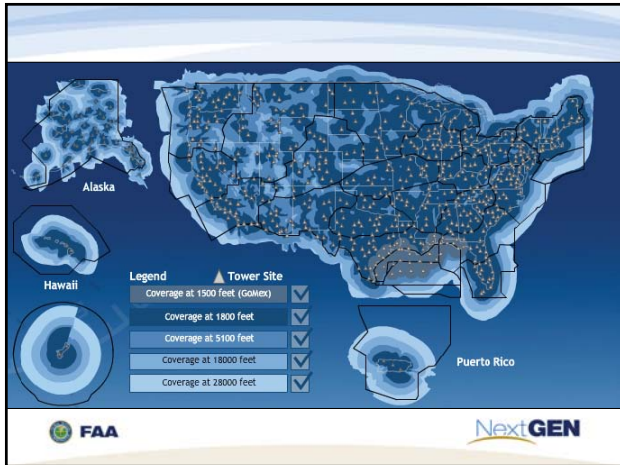
FAA

NextGEN



FAA

NextGEN



Currently Not Mandated

ADS-B In

Pros

- You can see other traffic (ADS-B and, if you are within line-of-sight of a ground station, non-ADS-B transponder-equipped traffic).
- If you choose a UAT solution, you can receive FIS-B services.

Cons

- It is more costly than just ADS-B-Out (since you will need to add a receiver and a display, and not all Multi-Function Displays (MFD) are ADS-B compatible).

FAA NextGEN

The Fine Print

Keep in mind that traffic and weather displays are for situational awareness only. Having an in-cockpit display of traffic does not relieve you of visually seeing and avoiding other aircraft or obstructions, and it is not to be used as the sole means for maneuvering to avoid other aircraft. That said, research has shown that visual acquisition of traffic is significantly improved with a traffic information service such as TIS-B.

FAA NextGEN

Why is this important to you?

By January 1, 2020, you will need to have installed ADS-B Out equipment to fly in airspace that currently requires a transponder.

FAA NextGEN

1090 Out Only

Pros

- Conforms to mandate
- Appropriate for all altitudes (required above FL180)
- Interoperable internationally

Cons

- Does not see traffic
- Does not receive weather and other aeronautical info

1090 In and Out

UAT Out Only

UAT In and Out

Hybrid: 1090 Out/UAT In

* Assumes the aircraft is not currently equipped with any datalink or TIS/TCAS service (i.e., a C172 with no GPS). Some aircraft configurations currently allow pilots to see traffic and weather, but are not ADS-B compliant.

FAA NextGEN

1090 In and Out

Close X

Pros

- Conforms to mandate
- Appropriate for all altitudes (required above FL180)
- Interoperable internationally
- Sees other 1090 traffic (at all altitudes)
- Sees UAT and other transponder-only equipped traffic (within service volume of ground station)

Cons

- Does not receive weather and other aeronautical info
- Requires more equipment than just ADS-B Out

1090 Out Only

1090 In and Out

UAT Out Only

UAT In and Out

Hybrid: 1090 Out/UAT In

* Assumes the aircraft is not currently equipped with any datalink or TIS/TCAS service (i.e., a C172 with no GPS). Some aircraft configurations currently allow pilots to see traffic and weather, but are not ADS-B compliant.

UAT Out Only

Close X

Pros

- Conforms to mandate

Cons

- Does not see traffic
- Does not receive weather and other aeronautical info
- Does not meet MOST international ADS-B standards
- Not authorized above FL180

1090 Out Only

1090 In and Out

UAT Out Only

UAT In and Out

Hybrid: 1090 Out/UAT In

* Assumes the aircraft is not currently equipped with any datalink or TIS/TCAS service (i.e., a C172 with no GPS). Some aircraft configurations currently allow pilots to see traffic and weather, but are not ADS-B compliant.

UAT In and Out

Close X

Pros

- Conforms to mandate
- Sees other UAT traffic (at all altitudes)
- Sees 1090 and other transponder-only equipped traffic (within service volume of ground station)
- Receives free weather information (within service volume of ground station)
- Receives free aeronautical information (within service volume of ground station)

Cons

- Requires more equipment than just ADS-B Out
- Services (FIS-B and TIS-B) limited above FL180
- Does not meet MOST international ADS-B standards
- Not authorized above FL180

1090 Out Only

1090 In and Out

UAT Out Only

UAT In and Out

Hybrid: 1090 Out/UAT In

* Assumes the aircraft is not currently equipped with any datalink or TIS/TCAS service (i.e., a C172 with no GPS). Some aircraft configurations currently allow pilots to see traffic and weather, but are not ADS-B compliant.

Hybrid: 1090 Out/UAT In

Close X

Pros

- Conforms to mandate
- Appropriate for all altitudes
- Interoperable internationally
- Sees other UAT traffic (at all altitudes)
- Sees 1090 and other transponder-only equipped traffic (within service volume of ground station)
- Receives free weather information (within service volume of ground station)
- Receives free aeronautical information (within service volume of ground station)

Cons

- Services (FIS-B and TIS-B) limited above FL180
- Requires more equipment than just ADS-B Out

1090 Out Only

1090 In and Out

UAT Out Only

UAT In and Out

Hybrid: 1090 Out/UAT In

* Assumes the aircraft is not currently equipped with any datalink or TIS/TCAS service (i.e., a C172 with no GPS). Some aircraft configurations currently allow pilots to see traffic and weather, but are not ADS-B compliant.

Know Your Options

- Some implementations may be as simple as a software update to your existing equipment.
- Others may be an "all-in-one" solution that won't add too much in terms of real estate to your panel. The main point is:

Research Your Options!

Next Steps: DECIDE

- Should you implement just what is mandated? (ADS-B Out), or a solution that gives you both ADS-B In and ADS-B Out capability?
- Which data link frequency do you want (1090ES or UAT)?
- Will a hybrid (1090ES Out and UAT In) solution work for you based upon where you fly?
- Is any of your existing equipment compatible with the ADS-B requirements?

Then

- Don't make this decision alone. Look at different solutions offered by avionics manufacturers, and talk to your avionics shop about reasonable solutions for your aircraft.
- Consult with experts from various organizations and type clubs.



Points to Keep in Mind

- If you intend to fly in airspace that requires a transponder today, you will need to equip with at least ADS-B Out by 01-01-2020.
- ADS-B in gives the added benefit of in-cockpit display of traffic and potentially weather.
- ADS-B uses two different links each with its own benefits.
- New products are continuously being certified as ADS-B solutions. Keep up to date with avionics manufacturers and solutions, and discuss your thoughts with your local avionics shop before making any commitment.



NextGen Works for GA

- These four NextGen initiatives directly affect the GA community:
 - + Improved situational awareness with ADS-B
 - + Fuel savings with RNAV GPS
 - + Safety and airport access with WAAS LPV
 - + Easier access to information with Electronic Flight Bag



Find Out More About How NextGen Works www.faa.gov/nextgen

The screenshot shows the NextGen website interface. On the left, there is a navigation menu with links for Performance Snapshots, NextGen Implementation, Why NextGen Matters, Performance Based Navigation (PBN) Dashboards, NextGen for airports, Questions, NextGen videos, Links, Career Opportunities, and Contact Us. The main content area features a large 'NextGEN' logo and a featured article titled 'The NextGen Experience' with a sub-heading 'Episode 02: Wheels Up'. Below the article is a graphic with the text '8-12 MORE DEPARTURES PER HOUR' and an image of an airport runway.

NextGen and GA 2014

Presented by Thomas Gorski CFI



Break
15
Minutes Remaining

