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Applications of ADS-B in General Aviation

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PREVIEW

ADS-B Facts and Requirements

Applications of ADS-B in GA operations

Challenges of ADS-B equipage in GA

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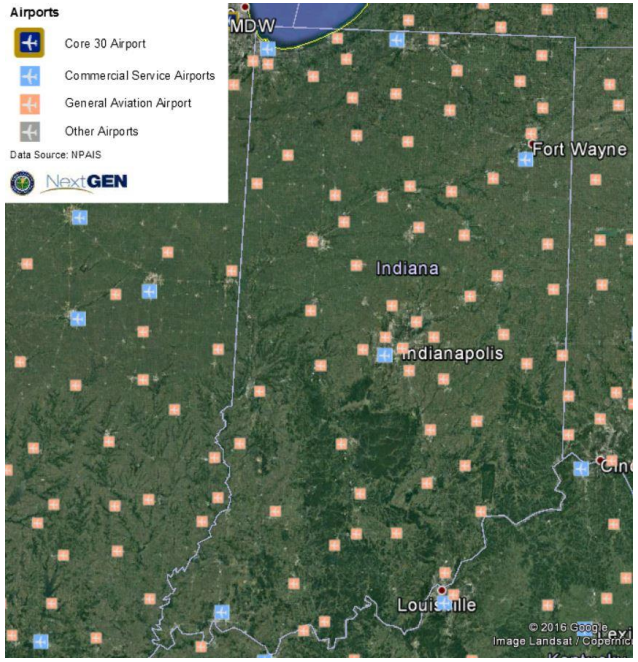
FACTS

- The 118 public-use airports, seaplane bases and heliports in Indiana contribute over $12 billion in annual economic output

  (based on the data of 2015 from Indiana State and FAA)

- To be effective January 1, 2020, the FAA requires all aircraft operating in most controlled airspace to have an ADS-B Out onboard

  (14 Code of Federal Regulations, Part 91.225, 2011, Part 91.227, 2014)



"There is no chance of delaying the mandate…"

- FAA administrator, Michael Huerta

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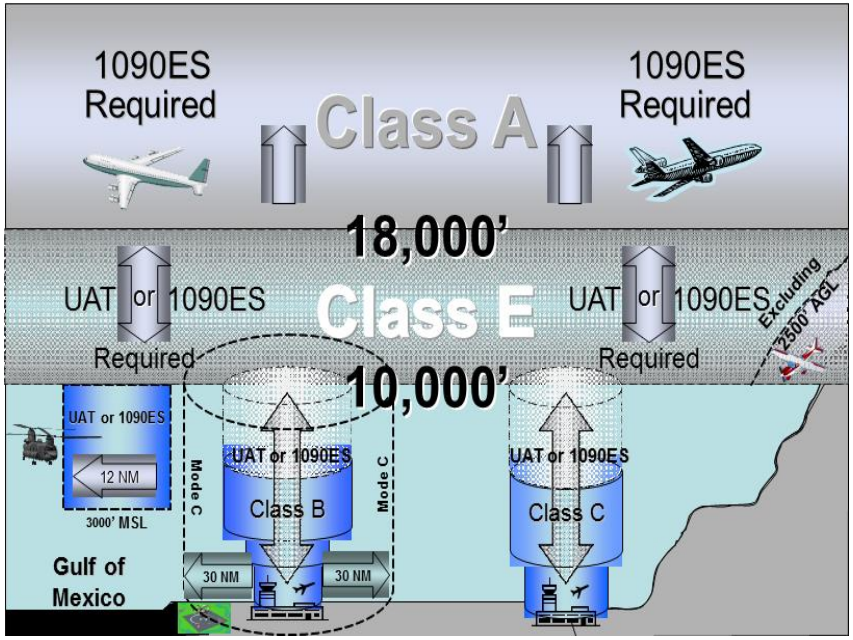
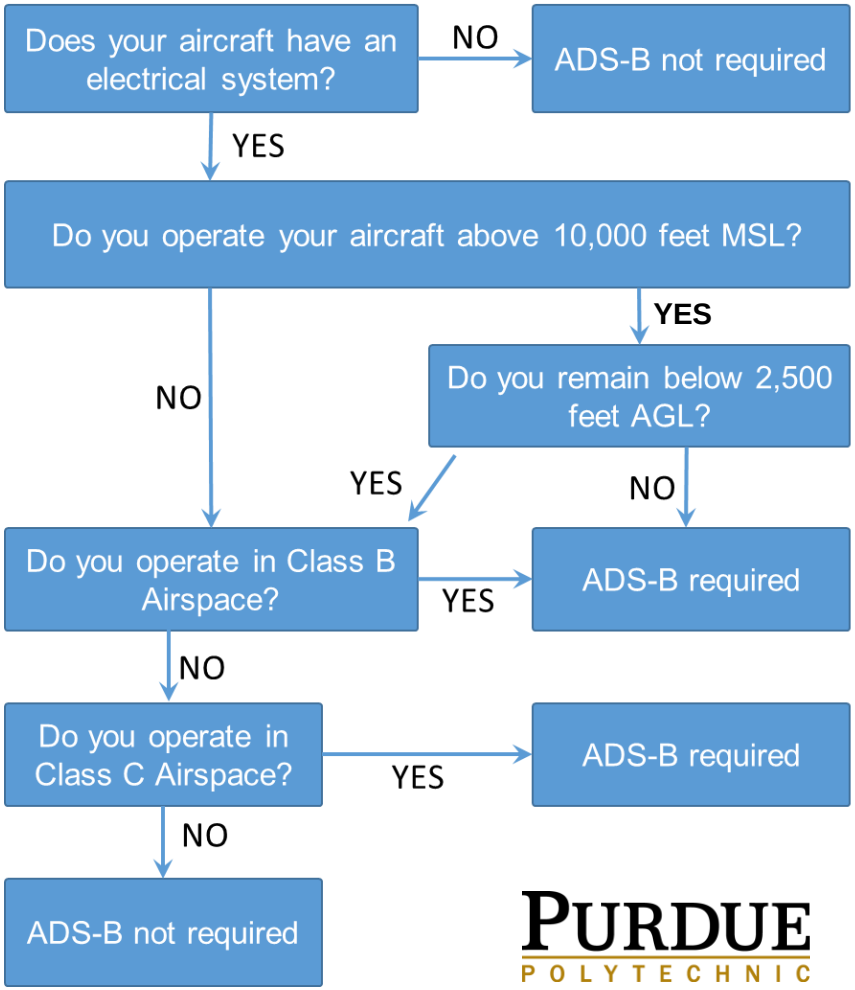
Sources: http://www.in.gov/indot/2806.htm
https://www.faa.gov/air_traffic/publications/media/2015-economic-impact-report.pdf

FACTS

FAA: ADS-B Out is required for all aircraft if flying above 10,000 feet and/or around some airports with a control tower beginning from Jan 1, 2020





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Source: FAA (2016), ADS-B Requirements per Airspace. http://www.faa.gov/nextgen/equipadsb/airspace/requirements/

FACTS

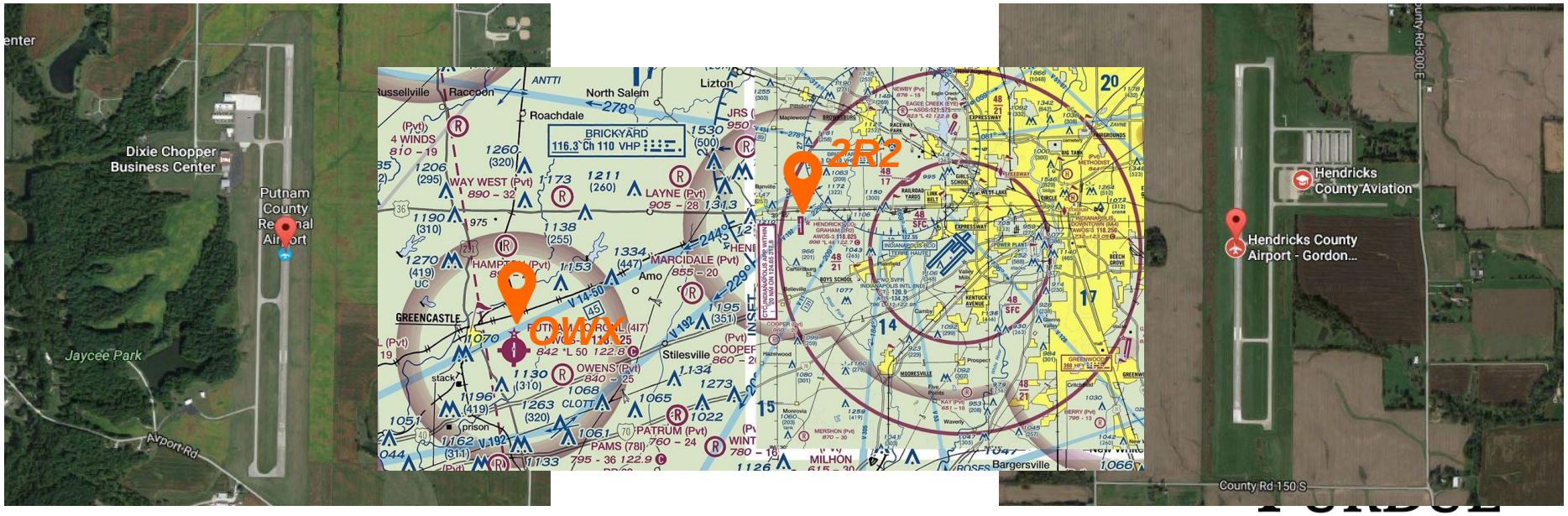
Putnam County Airport (KOWX)

- Runway 9/27
- Dimensions: 4,504 x 75 ft
- Publicly-owned
- Based aircraft: 21
- Operations: avg 33/day

Hendricks County Airport (K2R2)

- Runway 18/36
- Dimensions: 4,400 x 100 ft
- Publicly-owned
- Based aircraft: 49
- Operations: avg 39/day

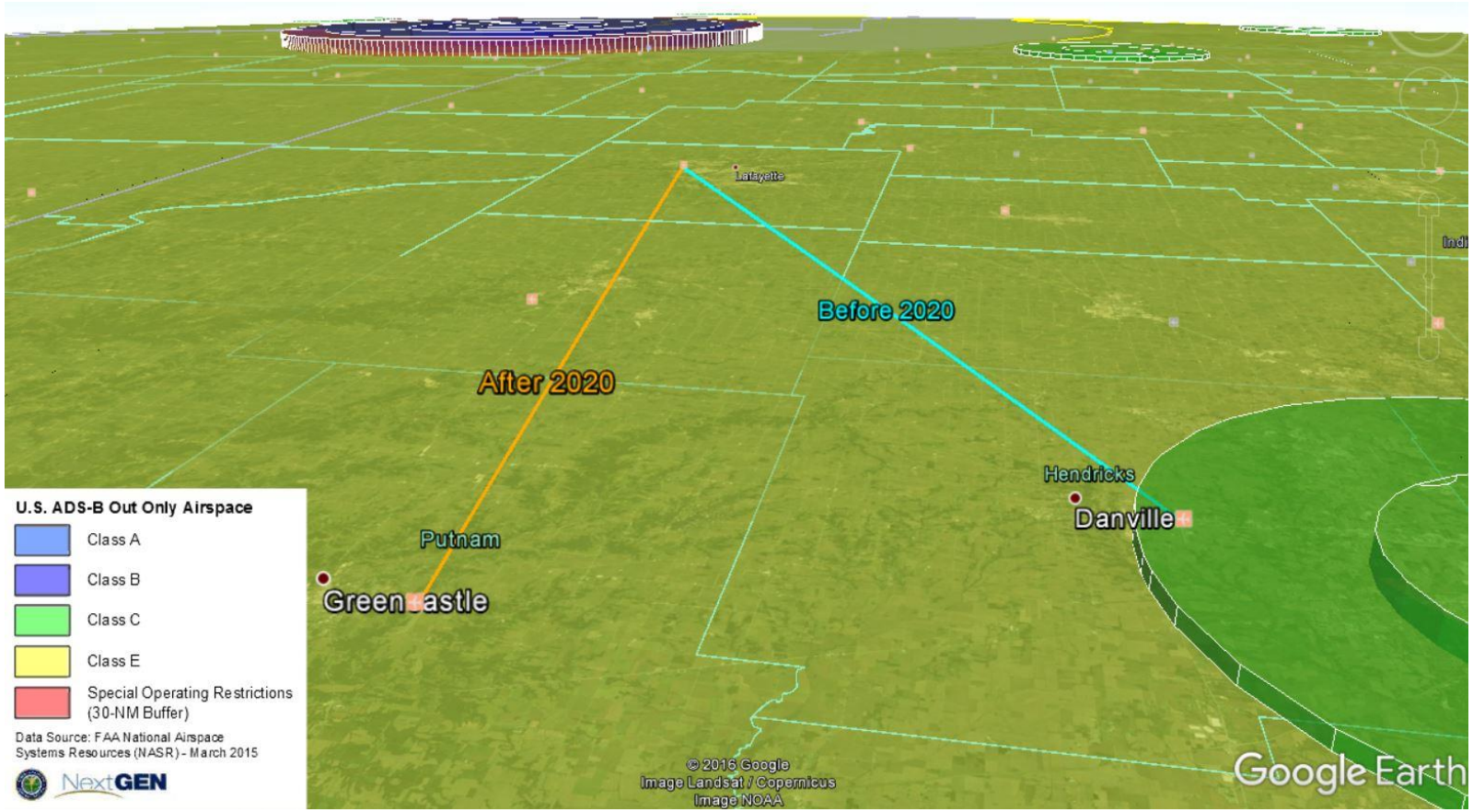
ADS-B Out Required



Source: FAA (2016), ADS-B Requirements per Airspace. http://www.faa.gov/nextgen/equipadsb/airspace/requirements/

FACTS

Flying from KLAF to K2R2 before and after 2020



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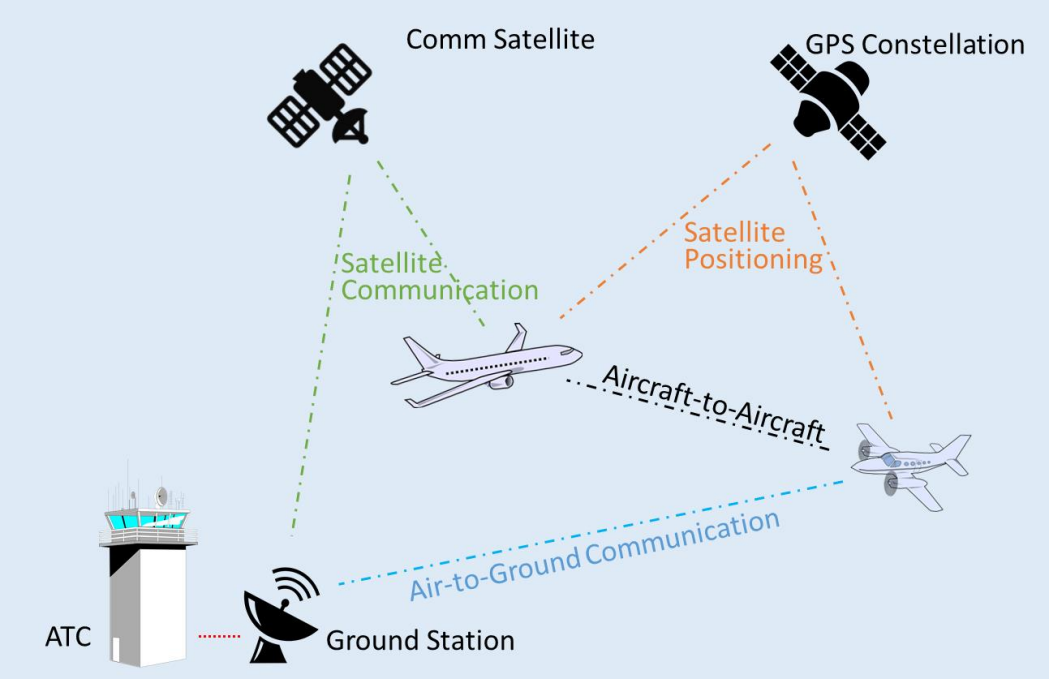
Source: FAA (2016), ADS-B Requirements per Airspace. http://www.faa.gov/nextgen/equipadsb/airspace/requirements/

WHAT IS ADS-B?

Automatic Dependent Surveillance Broadcast

- ADS-B Out broadcasts aircraft position and velocity, and other information derived from on-board systems.
- ADS-B In receives data from ADS-B Out data sources.



Two types of FAA-compliant physical layers:

- 1090ES (extended squitter) transponder
  - Traffic Information Service
- Universal Access Transceiver
  - Traffic Information Service
  - Flight Information Service

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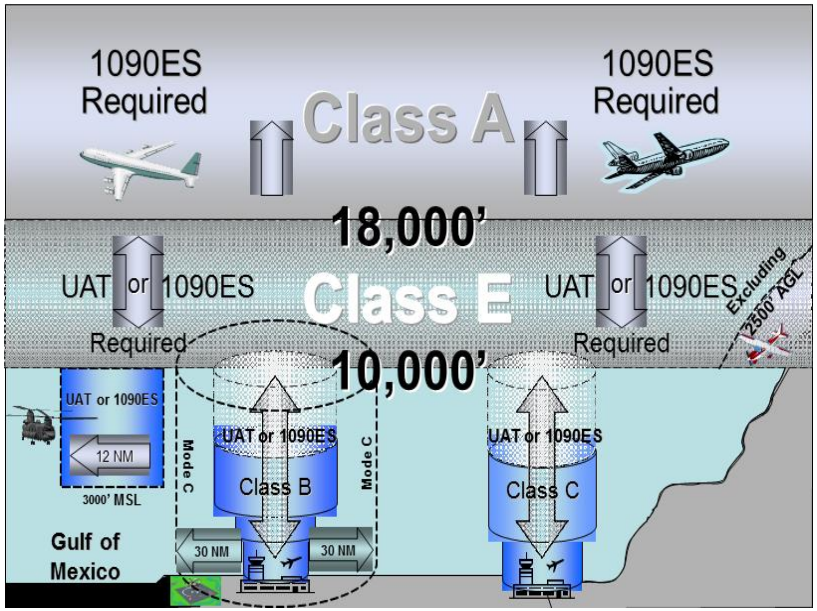
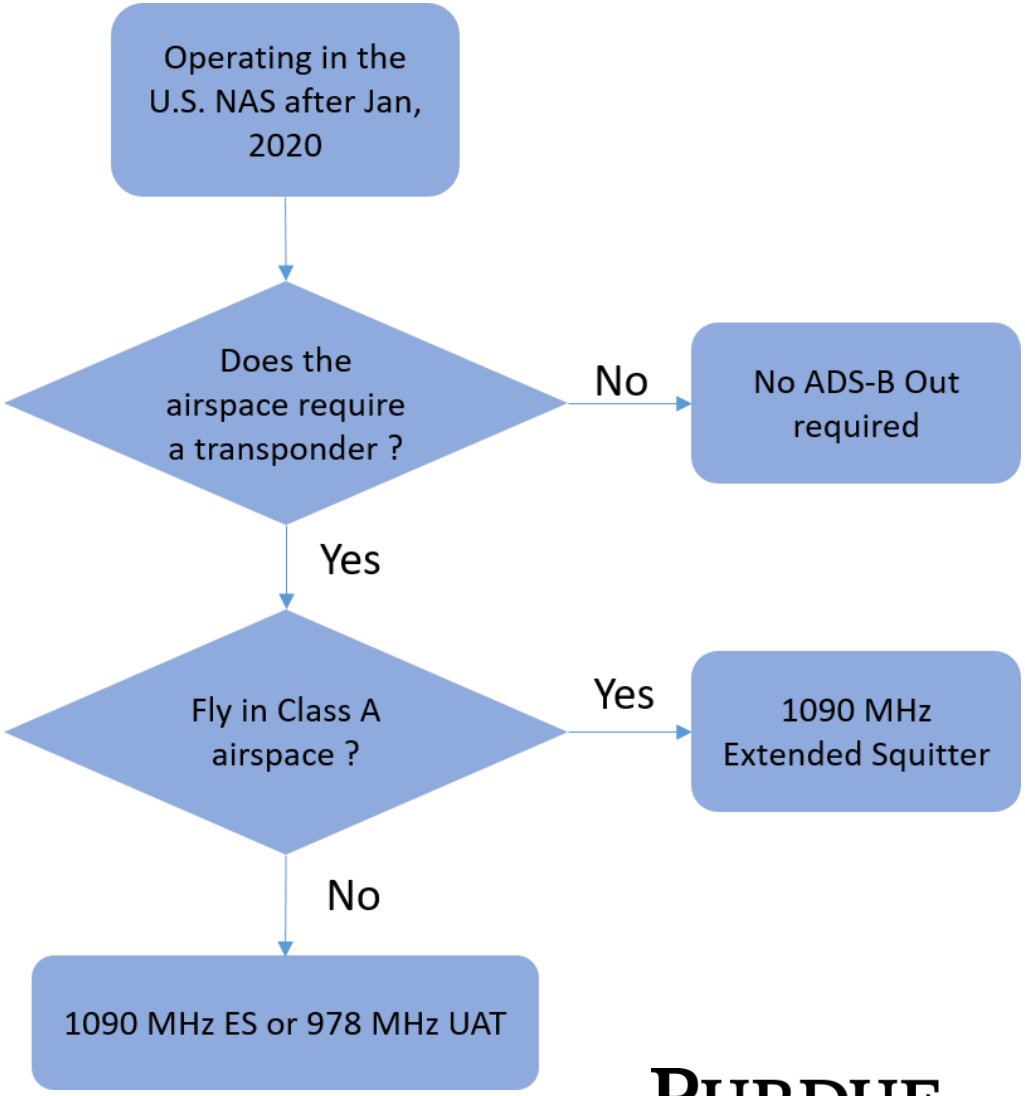
1090 ES OR UAT?





Find Equipment

FAA Certified Equipment

A list of FAA-certified equipment installations that meet the performance requirements of the ADS-B equipage rule, 14 CFR 91.225 and 91.227

Equipment Search Tool

Search by aircraft make and model in this database of equipment designed to meet the requirements of 14 CFR 91.225 and 91.227, either as separate components or complete installation solutions. The database includes both FAA-certified equipment and equipment in process.

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Source: FAA (2016), Equip ADS-B Research. https://www.faa.gov/nextgen/equipadsb/research/
AOPA (2016), ADS-B Out Selector. https://www.aopa.org/go-fly/aircraft-and-ownership/ads-b/ads-b-selector

APPLICATIONS OF ADS-B IN GA OPERATIONS

- Enhanced GA Operations
- UAS Operations
- Reduce Environmental Impact

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ENHANCED GA OPERATIONS

Enhanced Visual Acquisition

- Provides the pilots with enhanced traffic situational awareness in controlled and uncontrolled airspace/airports.
- Enhances successive approaches for aircraft cleared to maintain visual separation from another aircraft on the approach.

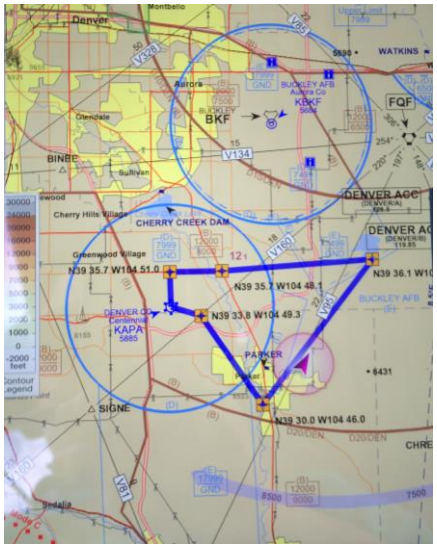
FIS/TIS

Source: FAA (2014). http://www.faa.gov/nextgen/ga

ENHANCED GA OPERATIONS

Airport Surface Situational Awareness

- Reduces the likelihood of pilots errors associated with runway occupancy.
- Conflict Detection: reduces the potential for deviations, errors, and collisions through an increase in pilot situational awareness while operating an aircraft on the airport movement area.

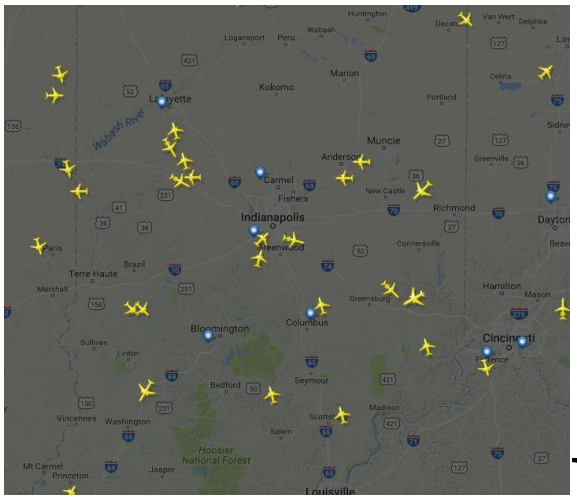


ENHANCED GA OPERATIONS

Company/Online Flight Tracking

- ADS-B enables aircraft to be identified more readily. This would help operators or companies to improve fleet scheduling.
- ADS-B enables airports or FBO to receive flight information from capable aircraft and use the data to optimize allocation of ground infrastructure and operations.

FlightAware



FlightRadar24

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Source: FlightAware, http://flightaware.com/; FlightRadar, https://www.flightradar24.com/39.62,-85.04/8

UAS OPERATIONS

- Lightweight ADS-B Out system

  MITRE Corporation (2007): Lightweight, low-cost UAT Beacon Radio.

- UAS Built-in ADS-B Receiver

  DJI claims that Matrice 200 UAS is embedded with an ADS-B receiver.

Source: MITRE Corporation (2007), A Lightweight, Low-Cost ADS-B System for UAS Applications, Retrieved from https://www.mitre.org/sites/default/files/pdf/07_0634.pdf
DJI (2017), Matrice 200, http://www.dji.com/matrice-200-series/payloads

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REDUCE ENVIRONMENTAL IMPACT

Reduce Environmental Impact

- A more accurate report of an aircraft's position.
- *Reduces the time* spent on waiting for clearances, being vectored for spacing and holding.
- Estimates show that this is already having a beneficial impact by *reducing pollution and fuel consumption*.

Inputs for Emissions Estimation

- *Airport operations*
  - Muia & Johnson. (2015). ACRP Report 129 – Evaluating Methods for Counting Aircraft Operations at Non-Towered Airports.
  - Mott, McNamara, Bullock. (2017). Accuracy Assessment of Aircraft Transponder-Based Devices for Measuring Airport Operations. Journal of Transportation Research Board.
  - McNamara, Mott, Bullock. (2016). Leveraging Aircraft Avionics for Fleet and Airport Management. Journal of Transportation Research Board.
- *Airport-specific LTO cycles*

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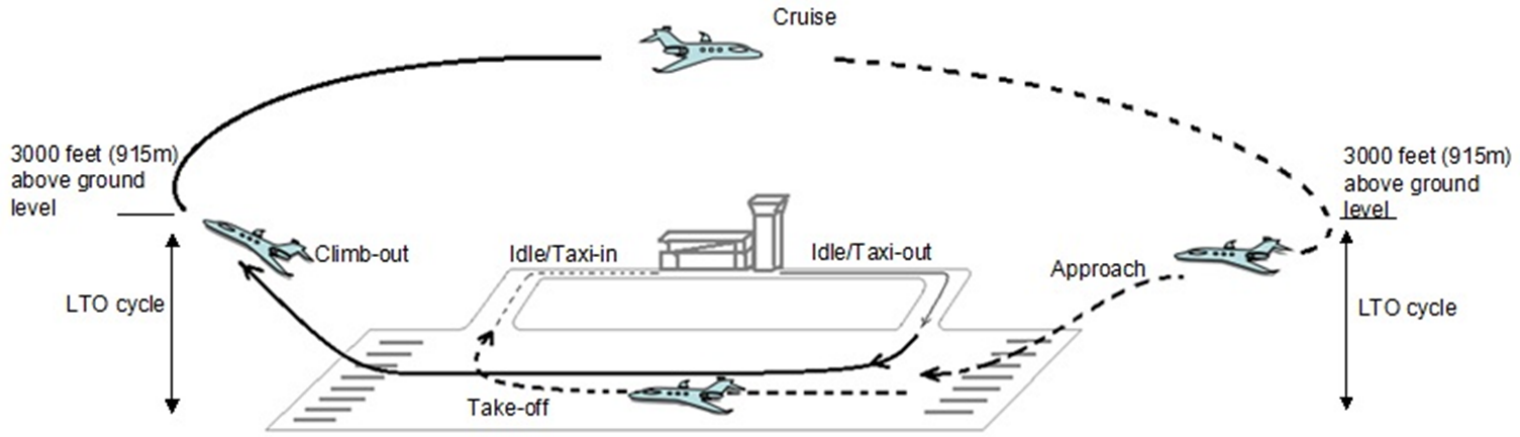
REDUCE ENVIRONMENTAL IMPACT

- *Airport-specific LTO cycles*

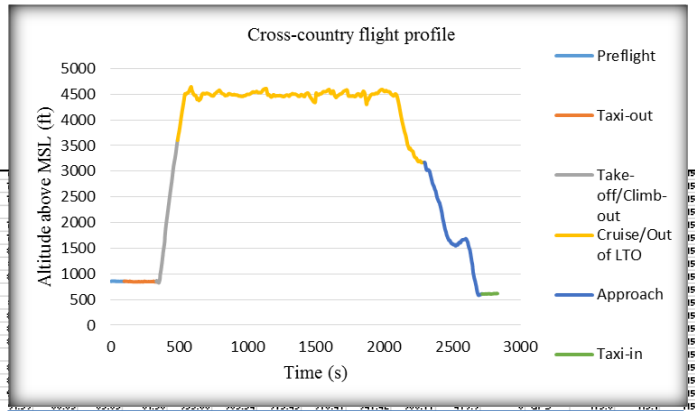


ICAO standard LTO cycle, adapted from ICAO

Operating Mode	Thrust setting (% of maximum sea level static thrust)	Time-in-Mode (min)
Take-off	100%	0.7
Climb-out	85%	2.2
Approach-landing	30%	4.0
Taxi/idle	7%	26.0

REDUCE ENVIRONMENTAL IMPACT

Inputs for Emissions Estimation



ADS-B Messages

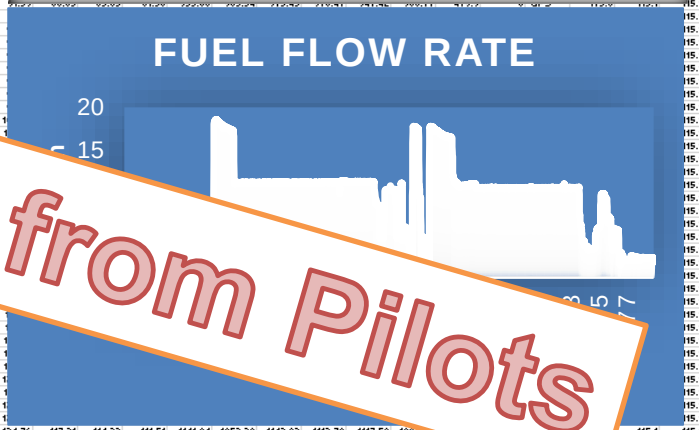
PU1
SR
FL
KL

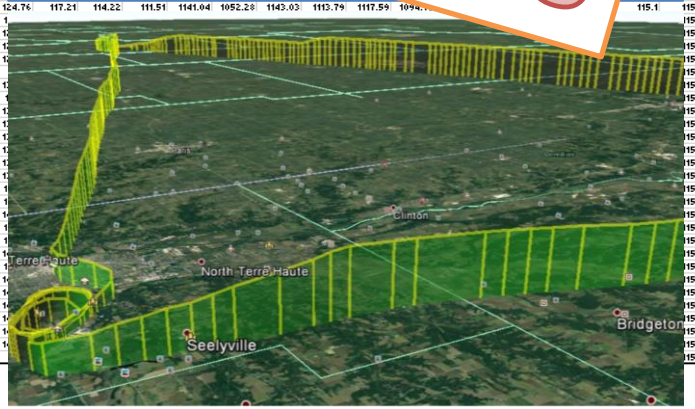
PU1234
SR CS20
FL080
KLAF-KIND

PU1234
SR CS20
FL080
KLAF-KIND

Modeling the

No Cooperation from Pilots





CHALLENGES

- High cost of the necessary avionics

The current cost to install mandated ADS-B Out equipment is at least $5,000 to $6,000

- Perception of direct benefits

- Collision risk

ADS-B is implemented on two independent, non-compatible frequencies

- Privacy

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Questions? Comments?

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