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
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

Sources: http://www.in.gov/indot/2806.htm
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.

Facts

Putnam County Airport (KOWX)  Hendricks County Airport (K2R2)

- Runway 9/27
- Dimensions: 4,504 x 75 ft
- Publicly-owned
- Based aircraft: 21
- Operations: avg 33/day
- Runway 18/36
- Dimensions: 4,400 x 100 ft
- Publicly-owned
- Based aircraft: 49
- Operations: avg 39/day

ADS-B Out Required

Flying from KLAF to K2R2 before and after 2020

**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
**1090 ES OR UAT?**

- **1090ES Required**
- **Class A**
- **18,000’**
- **Class E**
- **10,000’**

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**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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**Operating in the U.S. NAS after Jan, 2020**

- **Does the airspace require a transponder?**
  - **No**
    - No ADS-B Out required
  - **Yes**
    - **Fly in Class A airspace?**
      - **No**
        - 1090 MHz ES or 978 MHz UAT
      - **Yes**
        - 1090 MHz Extended Squitter

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APPLICATIONS OF ADS-B IN GA OPERATIONS

- Enhanced GA Operations
- UAS Operations
- Reduce Environmental Impact
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.

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.

UAS OPERATIONS

• Lightweight ADS-B Out system


• UAS Built-in ADS-B Receiver

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

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*

• *Airport-specific LTO cycles*
REDUCE ENVIRONMENTAL IMPACT

- **Airport-specific LTO cycles**

[Diagram showing the LTO cycle with phases like Climb-out, Idle/Taxi-in, Cruise, and Approach]

<table>
<thead>
<tr>
<th>Operating Mode</th>
<th>Thrust setting (% of maximum sea level static thrust)</th>
<th>Time-in-Mode (min)</th>
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</thead>
<tbody>
<tr>
<td>Take-off</td>
<td>100%</td>
<td>0.7</td>
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<tr>
<td>Climb-out</td>
<td>85%</td>
<td>2.2</td>
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<tr>
<td>Approach-landing</td>
<td>30%</td>
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<tr>
<td>Taxi/idle</td>
<td>7%</td>
<td>26.0</td>
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ICAO standard LTO cycle, adapted from ICAO
### FUEL FLOW RATE

<table>
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<th>Time (s)</th>
<th>FUEL FLOW RATE (gph)</th>
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<td>4000</td>
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<tr>
<td>4500</td>
<td>9</td>
</tr>
</tbody>
</table>

### Inputs for Emissions Estimation

#### ADS-B Messages
- PU1234
- SR CS20
- FL080
- KLAF-KIND

#### Modeling the LTO & Fuel Flow Rate

No Cooperation from Pilots

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**Cross-country flight profile**

- Pro-flight
- Taxi-out
- Take-off/Climb-out
- Cruise/Out of LTO
- Approach
- Taxi-in
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
Questions? Comments?