*International Civil Aviation Organization*

**FIFTEENH MEETING OF THE ADS-B STUDY AND IMPLEMENTATION TASK FORCE (ADS-B SITF/15)**

Bangkok, Thailand, 18 - 20 April 2016

---

**Agenda Item 4: Review States' activities and interregional issues on implementation of ADS-B and multilateration.**

# U.S. ADS-B AVIONICS PERFORMANCE REPORT

(Presented by United States/Federal Aviation Administration)

**SUMMARY**

This paper describes a new reporting capability that the FAA is fielding to assist operators in understanding their aircraft's ADS-B avionics performance relative to the requirements of the U.S. ADS-B mandate.

## 1. INTRODUCTION

1.1 This paper introduces a new ADS-B avionics performance report that FAA is making available to operators having aircraft equipped with DO-260B or DO-282B ADS-B Out equipment.

## 2. DISCUSSION

2.1 This paper refers to an Attachment, which is the "User's Guide" for a new ADS-B avionics performance report that FAA is making available to operators this month at the URL: http://www.compliancemonitor.faa.gov/Public/pcrRequest.aspx

2.2 This User's Guide both describes the report information available to an operator, and helps readers understand the scope of information that the FAA is collecting for all ADS-B Version 2 messages that are received by the FAA's ADS-B ground stations.

2.3 To obtain this information, the operator will need to know the aircraft's ICAO hexadecimal address and the date when their aircraft flew in U.S. airspace. If multiple flights occurred in a single day (as measured in the UTC date and time reference), then the information for the longest detected flight period will be returned to the requester.

## 3. ACTION REQUIRED BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matters as appropriate.

– – – – – – – – – – – – –

*Attachment*

# ADS-B

# Public Compliance Report (PCR) User's Guide

## Flight Standards Service

**Aircraft Maintenance Division,**

**Avionics Branch (AFS-360)**

**April 8, 2016**

# Background - ADS-B Public Compliance Report

The purpose of the ADS-B Public Compliance Report (PCR) is to provide requesting aircraft owners, operators, and avionics installers/maintainers with an additional method of verifying proper operation of ADS-B equipment.

The purpose of this user's guide is to provide information to aid in the interpretation of data associated with a PCR and to provide general guidance to help resolve avionics issues identified within a PCR.

PCR data provides information on the performance of an aircraft's ADS-B system for a specific flight and will verify proper ADS-B system operation or identify specific parameters received by the FAA's ground system which failed to comply with established standards. ADS-B system performance data identified within a PCR will be useful to aircraft avionics maintainers when performing post-installation compliance/configuration checks and fault isolation.

A PCR is typically available 1 hour after flight termination at the following web address: https://www.compliancemonitor.faa.gov/PCRrequest.aspx. However, the availability of a PCR may be delayed due to system maintenance or unexpected outages. In instances where a PCR is not available from the above web address the user should send an email to the following address 9-AWA-AFS-300-ADSB-AvionicsCheck@faa.gov and include the following information:

1. Aircraft registration number (N-number) in subject line;
2. In the email body include:
    a. Flight identification code;
    b. Flight date and time;
    c. Make/model of ADS-B transmitter and GPS; and
    d. Any ADS-B avionics operating abnormalities observed or reported during the associated flight.

Note: When multiple flights are flown in a day, the longest flight (based on time duration) will be provided.

# Part 1 - ADS-B Public Compliance Report Explanation

The FAA collects data in the following flight phases by ADS-B link type (See Figure 1):

1. 1090 - Airborne
2. 1090 - Surface[1] (Outside RWY/Taxi area)
3. 1090 - Surface RWY/Taxi
4. UAT - Airborne
5. UAT - Surface (Outside RWY/Taxi area)
6. UAT - Surface RWY/Taxi

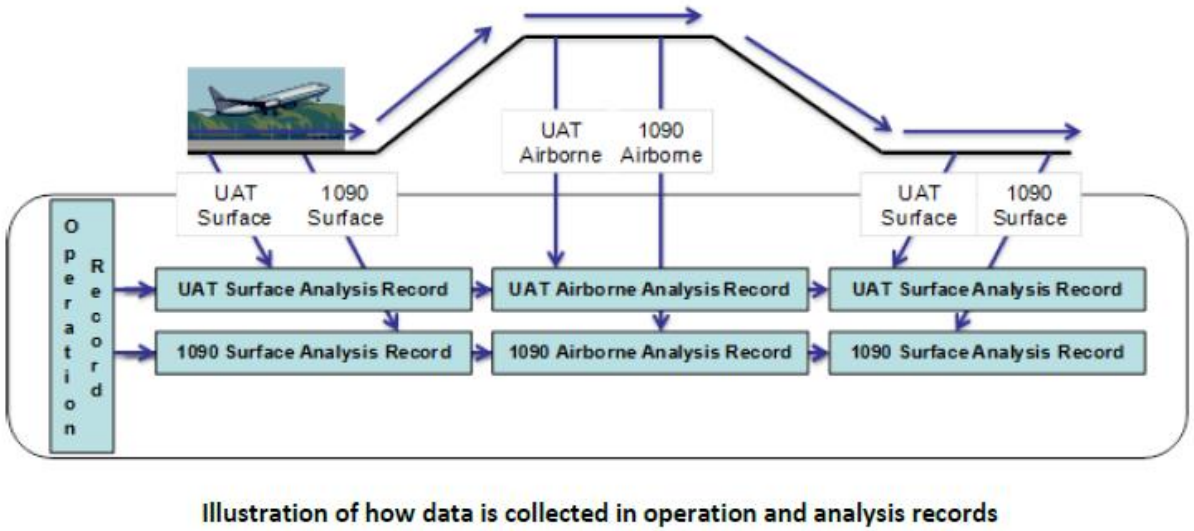


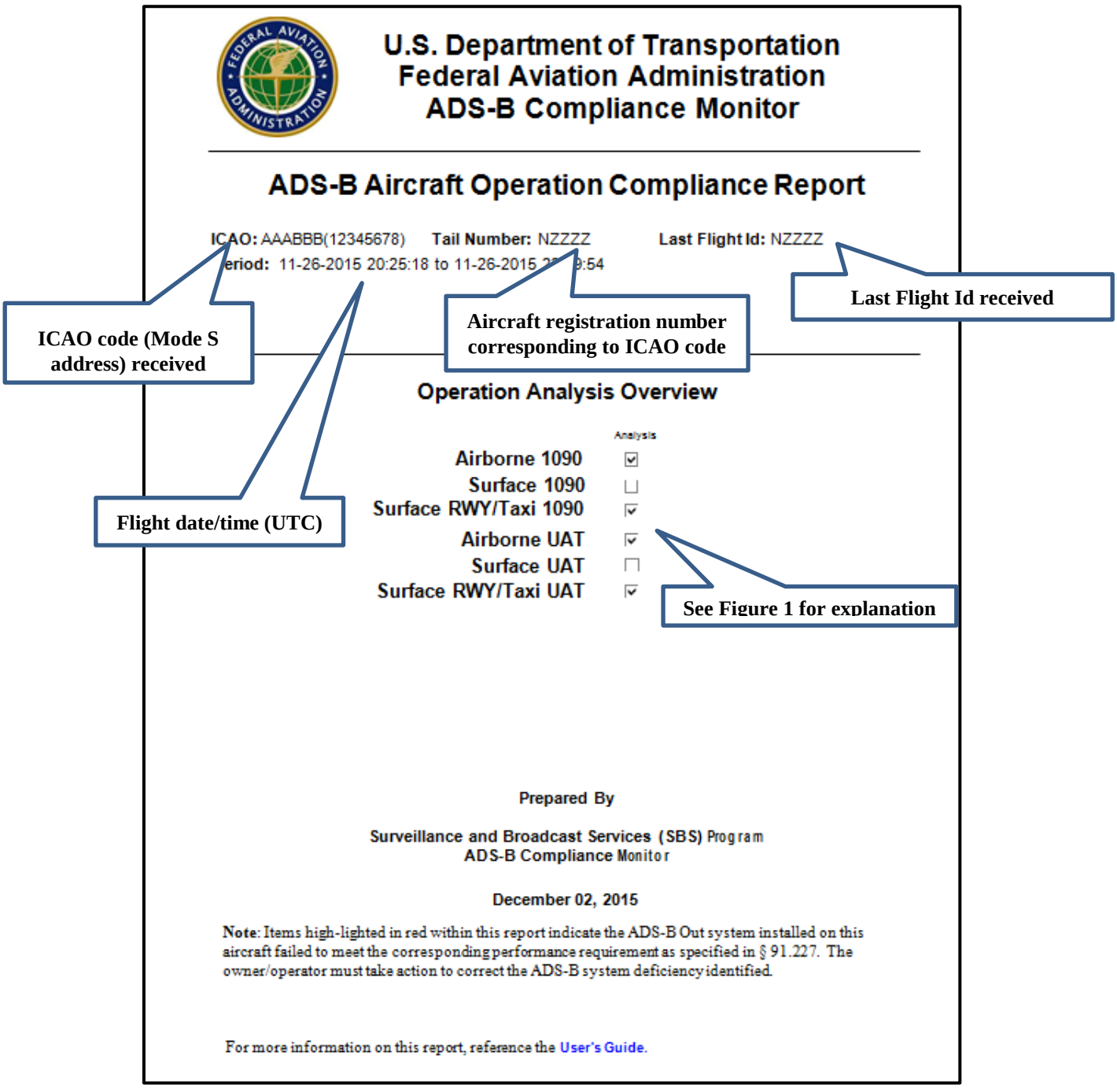

Illustration of how data is collected in operation and analysis records

**Figure 1**

[1] Surface information is only provided at U.S. locations where a surface service volume exists. As of this writing, this is limited to the 35 airports with an ASDE-X system and KSFO. Eight additional surface service volumes will be added as the Airport Surface Surveillance Capability (ASSC) is deployed.

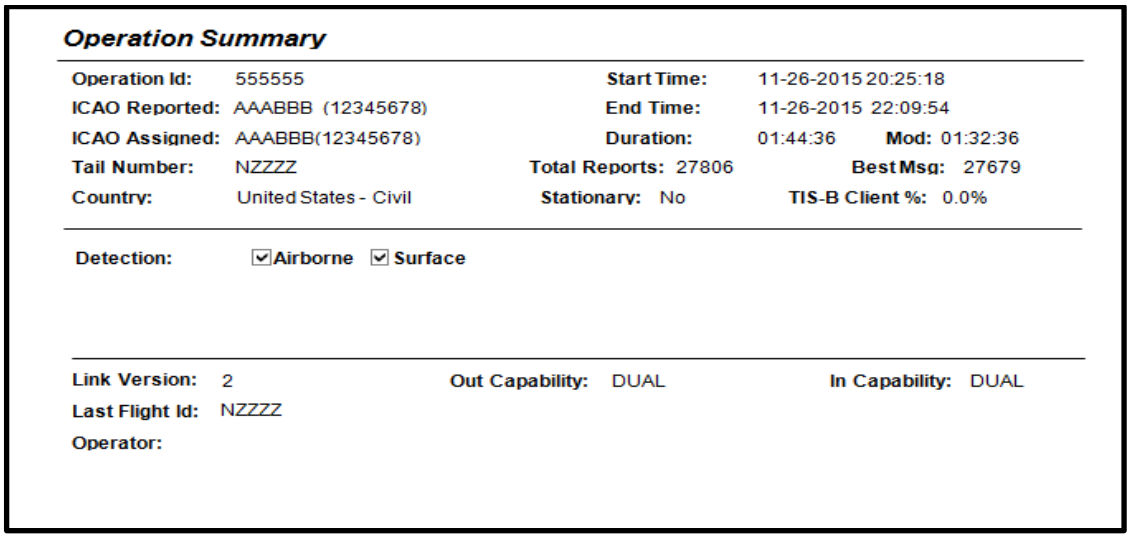
# Cover Page

The cover page contains basic information about the aircraft, flight date/time, and the type of ADS-B information received (1090, UAT, airborne/surface). Verify this information is correct.



Each PCR begins with an Operation Summary with specific information about the aircraft and flight. An example of an Operation Summary Table and definitions are provided below.

## Operation Summary Table Example



**Operation Summary**

| | | | | | |
|---|---|---|---|---|---|
| **Operation Id:** | 555555 | **Start Time:** | 11-26-2015 20:25:18 | | |
| **ICAO Reported:** | AAABBB (12345678) | **End Time:** | 11-26-2015 22:09:54 | | |
| **ICAO Assigned:** | AAABBB(12345678) | **Duration:** | 01:44:36 | **Mod:** | 01:32:36 |
| **Tail Number:** | NZZZZ | **Total Reports:** | 27806 | **Best Msg:** | 27679 |
| **Country:** | United States - Civil | **Stationary:** | No | **TIS-B Client %:** | 0.0% |

**Detection:** ☑ **Airborne** ☑ **Surface**

| | | | | | |
|---|---|---|---|---|---|
| **Link Version:** | 2 | **Out Capability:** | DUAL | **In Capability:** | DUAL |
| **Last Flight Id:** | NZZZZ | | | | |
| **Operator:** | | | | | |

## Operation Summary Explanation Table

| | | |
|---|---|---|
| **Operation Id:** Unique number assigned to the flight record. | | **Start Time:** Time flight was first monitored. |
| **ICAO Reported & ICAO Assigned:** The 24-bit ICAO address (hexadecimal & octal formats) received from the aircraft. | | **End time:** Time flight was last monitored. |
| **Tail Number:** The N-number associated with the aircraft's reported ICAO code. | **Duration:** Duration of the monitored flight in hours, minutes, and seconds. | **Mod:** Flight duration minus any data gaps greater than 36 seconds. |
| **Country:** Country associated with aircraft registration (identified via received ICAO hexadecimal code). | **Total reports:** Number of ADS-B downlinks received during this operation. | **BestMSG**: Total reports minus any duplicate reports. |
| **Detection:** Flight mode(s) where aircraft was monitored (airborne and/or surface). | **Stationary Only:** "No" indicates aircraft was not stationary. "Yes" indicates aircraft was stationary for duration of this operation. | **TIS-B Client %:** Percentage of operation time TIS-B data was provided to the aircraft by the ADS-B ground system. |
| **Link Version:** Link version of ADS-B transmitter. Link Version 2 is required by 14 CFR 91.225 and 14 CFR 91.227. | | |
| **Last Flight Id:** Last flight identification code received. This should be identical to the aircraft call sign used by ATC. | **Out Capability** Frequency used to transmit ADS-B data (i.e. 1090, 978/UAT, or Dual) or ADS-B OUT system type (UAT or 1090) | **In Capability:** Indication of capability to receive ADS-B data on specified link |
| **Operator**: Unique air operator identification code. | | |

## Dual-Out Inconsistencies

If an aircraft is equipped with a 1090 and a UAT system and transmitting on both frequencies (referred to as Dual-Out) the following table will be provided to identify any differences in the data received from each system. In the table below, the FAA ground system is receiving length/width codes from the 1090 and UAT avionics that do not match (LWC field is highlighted in red) for a Dual-Out equipped aircraft. See Part 3 of this report for table header definitions.

**Dual Out Inconsistencies:**

| Category | Emit Cat | Flight ID | Mode 3A | SAF | LWC | GPS Pos |
|---|---|---|---|---|---|---|
| % Fail | 0.00% | 0.00% | 0.03% | 0.00% | 100.00% | 100.00% |
| Max dT | 00:00:00 | 00:00:00 | 00:00:04 | 00:00:00 | 00:02:56 | 00:02:56 |
| MCF | 0 | 0 | 4 | 0 | 338 | 338 |

## Performance Analysis Summary Tables

Analysis Summary tables are presented in the PCR for some, or all, of the following categories depending on the installed ADS-B avionics configuration (1090 only, UAT only, or Dual-Out), areas of operation, and availability of ADS-B coverage:

- Airborne - **1090**
- Surface - **1090** (Outside RWY/Taxi area)
- Surface RWY/Taxi - **1090**
- Airborne - **UAT**
- Surface - **UAT** (Outside RWY/Taxi area)
- Surface RWY/Taxi **UAT**

The following definitions apply to all tables in each performance assessment category:

| Category | Definitions |
|---|---|
| **% Fail** | **Percentage of flight that corresponding category element failed compliance assessment.** |
| **Max dT** | **Total time during flight the message element failed compliance assessment.** |
| **MCF** | **Maximum number of consecutive received ADS-B messages in which the element failed compliance assessment.** |

An example of a Performance Analysis Summary table and summary term definitions are below.

## Analysis Summary Example (Airborne 1090)

*Airborne 1090 Analysis Summary*

**Start Time:** 11-26-2015 20:25:18 **End Time:** 11-26-2015 22:06:55

**Duration(s):** 01:41:37 **Mod:** 01:24:47 **Processed Reports:** 13444 **Total Reports:** 13491

**Link Version:** 2 **Out Capability:** 1090 **In Capability:** UAT

**Emitter Category:** 1 - Light (<15,500lbs) **Antenna(s):** 1 - Single

**Last Flight Id:** NZZZZ

**Last Mode 3A:** 4511

**Exceptions:**

| NIC | NACp | NACv | SIL | SDA |
|---|---|---|---|---|
| Yes | Yes | Yes | Yes | No |

## Analysis Summary Explanation

| | | | |
|---|---|---|---|
| **Start Time:** The start time of the flight as observed by ground monitoring. | | | **End Time:** The end time of the flight as observed by ground monitoring |
| **Duration(s):** Duration of flight in hours, minutes, and seconds | **Mod**: Duration minus any data gaps greater than 36 seconds. | **Processed Reports:** Number of reports processed by the ADS-B ground system. | **Total Reports:** Total reports including duplicates. |
| **Link Version:** Indicates which 1090/UAT standard the ADS-B equipment complies with e.g., for 1090 DO-260 = 0, DO-260A = 1, DO-260B = 2, etc) | **Out Capability:** ADS-B OUT system type (UAT or 1090) | | **In Capability:** ADS-B IN system type (UAT or 1090) |
| **Emitter Category:** Code associated with the aircraft's size, weight, or performance characteristics. | **Antenna(s):** Single or Dual (top and bottom) ADS-B antenna installed | | |
| **Last Flight Id:** The last reported Flight ID received from the aircraft. | | | |
| **Last Mode 3A:** Last discrete Mode 3/A code received. | | | |
| **Exceptions:**<br>**NIC/NAC/NACp/SIL/SDA Value:** Indicates if aircraft failed to meet performance requirements of identified parameter:<br>**Yes = Fail** **No = Pass** | | | |

## Performance Assessment Tables

Following the Analysis Summary Table(s) are Performance Assessment Tables. ADS-B performance is divided into 4 major avionics assessment categories:

1. **Required Message Elements Checks (Missing Elements):** Check of 14 CFR §91.227 (d) specified message elements required for broadcast by ADS-B Out avionics.
2. **Integrity and Accuracy Checks:** Check of ADS-B Out NIC/NACp/NACv/SDA/SIL performance requirements specified by 14 CFR §91.227(c) (Ref. latest version of Advisory Circular (AC) 20-165 for additional information).
3. **Kinematics:** Includes reasonableness checks of changes in Baro/Geo altitude, horizontal position, and velocity.
4. **Other Checks:** Checks of specific message parameters for values outside an expected range or fields that are improperly formatted (ICAO address, Mode 3A, emitter category, etc).

See Part 3 of this report for table header definitions.

1. **Missing Elements:** Missing elements will be highlighted in red by category if aircraft failed to meet performance requirements.

### Missing Elements

| Category | NACp | NACv | Vel | Flight Id | Mode 3A | Emit Cat | Baro Alt | Geo Alt |
|---|---|---|---|---|---|---|---|---|
| % Fail | 0.00% | 0.00% | 0.00% | 0.04% | 0.00% | 0.04% | 0.00% | 0.00% |
| Max dT | 00:00:00 | 00:00:00 | 00:00:00 | 00:00:00 | 00:00:00 | 00:00:00 | 00:00:00 | 00:00:00 |
| MCF | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |

2. **Integrity & Accuracy:** Failed Integrity & Accuracy categories will be highlighted in red if aircraft failed to meet performance requirements.

### Integrity & Accuracy

| Category | NIC | NACp | NACv | SIL | SDA |
|---|---|---|---|---|---|
| % Fail | 100.00% | 100.00% | 100.00% | 100.00% | 0.00% |
| Max dT | 01:36:25 | 01:36:25 | 01:36:25 | 01:36:25 | 00:00:00 |
| MCF | 13444 | 13444 | 13444 | 13444 | 0 |

| Category | NIC | NACp | NACv | SIL | SDA |
|---|---|---|---|---|---|
| Avg | 0.0 | 0.0 | 0.0 | 1.0 | 2.0 |
| Min | 0 | 0 | 0 | 1 | 2 |
| Max | 0 | 0 | 0 | 1 | 2 |

***Note: If using an uncertified GPS (or portable transmitter) the system must report as SIL = 0 (zero). SIL=0 transmitters do not meet the requirements to become a TIS-B service Client.***

3. **Kinematics:** A reasonableness check is made of changes in Baro/Geo Altitude, Position, and Velocity. Items highlighted in red were identified with position changes outside the range expected for normal aircraft performance.

## Kinematics

| | Velocity | Position Δ |
|---|---|---|
| % Fail | 0.00% | 0.00% |
| MCF | 0 | 0 |

| Baro Alt | Baro Alt Δ | Geo Alt | Geo Alt Δ |
|---|---|---|---|
| 0.00% | 0.00% | 0.00% | 0.00% |
| 0 | 0 | 0 | 0 |

4. **Other Checks:** A percentage of the total operation (% Fail) and the maximum consecutive failures (MCF) that the ADS-B avionics failed to correctly broadcast these message elements.

## Other Checks

| | Emitter Cat | Mode 3A |
|---|---|---|
| % Fail | 0.00% | 0.00% |
| Max dT | 00:00:00 | 00:00:00 |
| MCF | 0 | 0 |

| | Flight ID | Mismatch | Non-US | No "N" | Only "N" | Partial | Spaces | All Spaces | Illegal Char | Unavail Char |
|---|---|---|---|---|---|---|---|---|---|---|
| % Fail | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Max dT | 00:00:00 | 00:00:00 | 00:00:00 | 00:00:00 | 00:00:00 | 00:00:00 | 00:00:00 | 00:00:00 | 00:00:00 | 00:00:00 |
| MCF | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | Air on Ground |
|---|---|
| % Fail | 0.35 |
| Max dT | 00:00:29 |
| MCF | 25 |

Other Checks table header definitions (See Part 3 of this guide):

**Emitter Category:** Percent, total time, and max consecutive reports aircraft reported an Emitter Category = 0.

**Mode 3A:** Percent, total time, and max consecutive reports aircraft was flagged as having an invalid Mode 3/A. In the majority of cases, this indicates if the aircraft did not report Mode 3/A via ADS-B for some or all of the flight.

**Flight Id:** The received Flight ID code is assessed in the following ways:

1. **Flight ID** = Percent, total time, and max consecutive reports aircraft reported an incorrect Flight ID (any flight ID error)
2. **Mismatch** = Percent, total time, and max consecutive reports aircraft reported a N-Number Flight ID that doesn't match the N-Number derived from the ICAO (U.S. aircraft only) code.
3. **No-US** = Percent, total time, and max consecutive reports aircraft reported an N-Number Flight ID with an ICAO 24-bit address outside the U.S. block.
4. **No "N"** = Percent, total time, and max consecutive reports aircraft reported a N Number Flight ID without the leading "N".
5. **Only "N"** = Percent, total time, and max consecutive reports aircraft reported just "N" for flight ID.
6. **Partial** = Mostly for Air Carriers, percent, total time, and max consecutive reports aircraft reported a Flight ID missing the leading three letter identifier (e.g. 1234 vs JBU1234).
7. **Spaces** = Percent, total time, and max consecutive reports aircraft including a space within a Flight ID.
8. **All Spaces** = Percent, total time, and max consecutive reports aircraft reported a Flight ID with eight spaces.
9. **Illegal Character** = Percent, total time, and max consecutive reports aircraft reported a Flight ID with an Illegal Character.
10. **Unavail Character** = Percent, total time, and max consecutive reports aircraft reported a Flight ID with an Unavailable Character

**Air on Ground:** Percent, total time, and max consecutive reports the FAA ground system received airborne messages while the aircraft was on the ground.

# Part 2 – Guidance for PCR Faults

This section provides general guidance on common ADS-B performance issues and their possible causes. The information in this section is based on observations and feedback from avionics manufacturers, repair stations, and individual aircraft owner/operators. While the information is not specific to any make/model of ADS-B transmitter or GPS, users may find it helpful in determining a course of action to resolve issues identified within a PCR.

## PCR Fault Table

| PCR Fault (red) | Possible Causes |
|---|---|
| **Missing Elements and Integrity & Accuracy Category Problems** | |
| NIC, NACv, NACp, SIL and/or SDA (100% fail) | • Component and/or software compatibility with position source<br>• Improper system configuration |
| NIC, NACv, NACp, SIL and/or SDA (partial failure) | • Intermittent loss of GPS service<br>• Antenna masking caused by maneuvering<br>• Portion(s) of flight at fringe of ADS-B coverage<br>• Component software issue |
| Flight Id (100% fail) | • Flight Id not configured in avionics |
| Flight Id missing (partial fail) | • Flight at fringe of ADS-B coverage |
| Mode 3/A (100% fail) | • Because the FAA ground system auto-populates ADS-B messages with 1200 when the Mode 3/A code is missing to prevent risk associated with potential ATC conflict alerts this field will always show as passed. Refer to "Other Checks" below for guidance on Mode 3/A issues. |
| Mode 3/A (partial failure) | • See "Other Checks" below |
| Baro Alt | • Loss of data from barometric pressure altitude source |
| Geo Alt | • Loss of geometric altitude data from GPS |
| Emitter Category (Missing and Other) | • Emitter category not configured into avionics |
| Flight Identification Code errors | • Flight Id not properly entered |
| **Kinematics** | |
| All parameters | • Component and/or software (version) compatibility |
| **Other Checks** | |
| Air on Ground (ADS-B system transmitting in Air mode while on the ground) | • Squat switch issue<br>• GPS stall speed setting incorrect<br>  ○ Too low a stall speed will result in avionics transitioning to Air mode during high speed taxi or takeoff-roll<br>  ○ Avionics initializing in Air mode at startup |

| PCR Fault Table (cont.) | |
|---|---|
| **PCR Fault (red)** | **Possible Causes** |
| **Other Checks (cont)** | |
| Emitter Cat | • Inappropriate emitter category transmitted. e.g., many "Light" aircraft (<15,500 lbs) incorrectly transmit as "Small" aircraft (15,500 – 75K lbs). |
| Mode 3A (100% fail) | • Mode 3/A or Call-sign logic transmit function disabled (UAT specific)<br>• Mode 3/A code input device not providing data to UAT system |
| Mode 3A (partial failure) | • Portion(s) of flight at fringes of ADS-B coverage<br>• Improper pilot input (late turn on/early turn off of transponder) |
| No flight data found for specified date | • Aircraft transmitting wrong ICAO 24-bit address<br>• Late day flight (flight times are recorded in UTC)<br>• Flight with UAT system operated in anonymous mode.<br>• Possible ADS-B service outage<br>• Aircraft not transmitting ADS-B data |

# Part 3 - ADS-B TERMS, DESCRIPTIONS AND REFERENCES

| Field Name | Full name | Description |
|---|---|---|
| Airborne Msgs on Surface | | Indication that airborne specific messages were received by the FAA ground system while aircraft was on the surface |
| All Spaces | Flight Id | Flight identification code contains all spaces |
| Anonymous | | Indicates whether the unit is in Anonymous mode or not. |
| Baro Alt/ Baro Alt Δ | Barometric Altitude | Barometric altitude is sent and checked against aircraft performance criteria and flagged as invalid if determined to be incorrect or unreasonable. In general if the reported baro or geo alt is greater than 20,000 meters (65,616ft) or less than -200 meters (-656ft), the report is flagged for investigation. If there's a change in baro alt greater than 656 feet/sec (200m/s), then the report is flagged for investigation |
| Class A | | Field marks classes of airspace the aircraft operated in during the flight. Part 91 Appendix D is a special class of airspace for certain airports. |
| Class B | | |
| Class C | | |
| Class D | | |
| Class E | | |
| Part 91AppD | | |
| Country | | Field Identifies the country of origin for the aircraft and the type of registration (e.g. United States- Civil, Military, etc) |
| Dup ICAO | Duplicate ICAO | Each aircraft is assigned a unique ICAO 24-bit address. When two or more aircraft are monitored operating simultaneously with the same ICAO address both aircraft (correct & incorrect ICAO) will be flagged for Dup ICAO. |
| Dup ICAO Duration | Duration Dup ICAO operation occurred | This field marks the duration that a duplicate ICAO address is observed. |
| Duration | | Total flight time measured in hours, minutes, and seconds. |
| Emitter Category | | Indication of aircraft characteristics (type/size/weight/performance. Used by future ADS-B IN applications e.g., wake avoidance.<br>Set A<br>0 = No ADS-B Emitter Category Information<br>1 = Light (< 15500 lbs)<br>2 = Small (15500 to 75000 lbs)<br>3 = Large (75000 to 300000 lbs)<br>4 = High Vortex Large (aircraft such as B-757)<br>5 = Heavy (> 300000 lbs)<br>6 = High Performance (> 5g acceleration and 400 kts)<br>7 = Rotorcraft |
| Flight ID | Flight Identification Code | This should match the aircraft call sign used in ATC communication. Must match the aircraft call sign in any filed flight plan. |
| Geo Alt/Geo Alt Δ | Geometric Altitude | Received geometric altitude is checked against aircraft performance criteria and flagged as invalid if determined to be incorrect or unreasonable. In general if the reported baro or geo alt is greater than 20,000 meters (65,616ft) or less than -200 meters (-656ft), the report is flagged. If there's a change in geo alt greater than 656 feet/sec (200m/s), this field will also be flagged. |
| ICAO Assigned | | Unique six character ICAO 24-bit address assigned to an aircraft at registration. ICAO code is the same as the Mode S address. |
| ICAO Reported | | Unique six character ICAO address transmitted by the aircraft. |
| Illegal Char | Flight ID | Flight ID contains an incorrect character (e.g., letter O in place of the |

<table>
<tr><td></td><td>illegal character</td><td>number zero, etc)</td></tr>
<tr><td>In capability</td><td></td><td>Indicates the link type transmitted for the ADS-B IN capability (1090/UAT).</td></tr>
<tr><td>Int/Acc</td><td>Integrity and Accuracy</td><td>Category of values including NIC, NACp, and NACv.</td></tr>
<tr><td>Kin</td><td>Kinematics</td><td>Category of exceptions that includes Baro Alt, Baro Alt Δ, Geo Alt, Geo Alt Δ, Velocity, Position Δ. Position error checks.</td></tr>
<tr><td>Length/Width Code</td><td></td><td>Code received that indicates the length and width of the aircraft.</td></tr>
<tr><td>Link Version</td><td></td><td>Field marking what version of ADS-B the transponder is using. §91.225 and §91.227 require Link Version 2.</td></tr>
<tr><td>MCF</td><td>Maximum Consecutive Failures</td><td>The number of non-compliant reports received that occur in a row (consecutively). If an MCF exceeds its threshold, an MCF exception is identified for that parameter.</td></tr>
<tr><td>Mismatch</td><td></td><td>Percent, total time, and max consecutive reports aircraft reported a N-Number Flight ID that doesn’t match the N-Number derived from the ICAO 24-bit address.</td></tr>
<tr><td>Missing report duration</td><td></td><td>Time period of flight segment that ADS-B data was not received from the aircraft. This can be caused by failure of the avionics or transiting in and out of ADS-B coverage.</td></tr>
<tr><td>Mode 3/A</td><td></td><td>Four digit code (ATC assigned or 1200) set by the pilot</td></tr>
<tr><td>NACp</td><td>Navigation Accuracy Category for Position</td><td>This field indicates the accuracy of the aircraft position being transmitted. §91.227 requires a minimum NACp of 8. An PCR will be flagged red if the NACp of <8 duration exceeds the allowable threshold.<br>Table A-13: Encoding of Navigation Accuracy Category for Position ($NAC_P$)
<table>
<tr><th colspan="2">Coding</th><th rowspan="2">Meaning = 95% Horizontal Accuracy Bounds (EPU)</th></tr>
<tr><th>(Binary)</th><th>(Decimal)</th></tr>
<tr><td>0000</td><td>0</td><td>EPU ≥ 18.52 km (10 NM) - Unknown accuracy</td></tr>
<tr><td>0001</td><td>1</td><td>EPU < 18.52 km (10 NM) - RNP-10 accuracy</td></tr>
<tr><td>0010</td><td>2</td><td>EPU < 7.408 km (4 NM) - RNP-4 accuracy</td></tr>
<tr><td>0011</td><td>3</td><td>EPU < 3.704 km (2 NM) - RNP-2 accuracy</td></tr>
<tr><td>0100</td><td>4</td><td>EPU < 1852 m (1NM) - RNP-1 accuracy</td></tr>
<tr><td>0101</td><td>5</td><td>EPU < 926 m (0.5 NM) - RNP-0.5 accuracy</td></tr>
<tr><td>0110</td><td>6</td><td>EPU < 555.6 m ( 0.3 NM) - RNP-0.3 accuracy</td></tr>
<tr><td>0111</td><td>7</td><td>EPU < 185.2 m (0.1 NM) - RNP-0.1 accuracy</td></tr>
<tr><td>1000</td><td>8</td><td>EPU < 92.6 m (0.05 NM) - e.g., GPS (with SA)</td></tr>
<tr><td>1001</td><td>9</td><td>EPU < 30 m - e.g., GPS (SA off)</td></tr>
<tr><td>1010</td><td>10</td><td>EPU < 10 m - e.g., WAAS</td></tr>
<tr><td>1011</td><td>11</td><td>EPU < 3 m - e.g., LAAS</td></tr>
<tr><td>1100 - 1111</td><td>12 - 15</td><td>Reserved</td></tr>
</table>
NACp values < 8 will be flagged red.</td></tr>
<tr><td>NACv</td><td>Navigation Accuracy Category for velocity</td><td>
<table>
<tr><th colspan="3">Navigation Accuracy Category for Velocity</th></tr>
<tr><th colspan="2">Coding</th><th rowspan="2">Horizontal Velocity Error</th></tr>
<tr><th>(Binary)</th><th>(Decimal)</th></tr>
<tr><td>000</td><td>0</td><td>≥ 10 m/s</td></tr>
<tr><td>001</td><td>1</td><td>< 10 m/s</td></tr>
<tr><td>010</td><td>2</td><td>< 3 m/s</td></tr>
<tr><td>011</td><td>3</td><td>< 1 m/s</td></tr>
<tr><td>100</td><td>4</td><td>< 0.3 m/s</td></tr>
</table>
Navigation Accuracy Category for Velocity (NACv). NACv is based on design data provided by the position source manufacturer. The NACv may be updated dynamically from the position source, or set statically based on qualification of the position source.<br>(a) A NACv = 1 (< 10 m/s) may be permanently set at</td></tr>
</table>

<table>
<tr><td></td><td></td><td>installation for GNSS equipment passing the tests identified in appendix 2, or may be set dynamically from velocity accuracy output of a position source qualified in accordance with the AC 20-165B appendix B guidance.<br>(b) A NACv = 2 (< 3 m/s) may be set dynamically from velocity accuracy output of a position source qualified in accordance with the appendix 2 guidance. NACv = 2 should not be permanently preset at installation, even if the position source has passed the tests identified in AC 20-165B appendix B.<br>A NACv = 3 or NACV = 4 should not be set based on GNSS velocity accuracy unless you can demonstrate to the FAA that the velocity accuracy actually meets the requirement.</td></tr>
<tr><td>NIC</td><td>Navigation Integrity Category</td><td>NIC encoding is used to indicate the radius of containment around the aircraft. §91.227 requires a minimum NIC of 7. NIC values of <7 will be flagged red within a PCR when the MCF threshold is exceeded.
<table>
<tr><th rowspan="2">NIC Value</th><th rowspan="2">Radius of Containment ($R_C$)</th><th colspan="3">Airborne</th><th colspan="3">Surface</th></tr>
<tr><th>Airborne Position TYPE Code</th><th>NIC Supplement Codes</th><th></th><th>Surface Position TYPE Code</th><th>NIC Supplement Codes</th><th></th></tr>
<tr><th></th><th></th><th></th><th>A</th><th>B</th><th></th><th>A</th><th>C</th></tr>
<tr><td>0</td><td>$R_C$ unknown</td><td>0, 18 or 22</td><td>0</td><td>0</td><td>0, 8</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>$R_C$ < 20 NM (37.04 km)</td><td>17</td><td>0</td><td>0</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>2</td><td>$R_C$ < 8 NM (14.816 km)</td><td>16</td><td>0</td><td>0</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>3</td><td>$R_C$ < 4 NM (7.408 km)</td><td>16</td><td>1</td><td>1</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>4</td><td>$R_C$ < 2 NM (3.704 km)</td><td>15</td><td>0</td><td>0</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>5</td><td>$R_C$ < 1 NM (1852 m)</td><td>14</td><td>0</td><td>0</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td rowspan="3">6</td><td>$R_C$ < 0.6 NM (1111.2 m)</td><td>13</td><td>1</td><td>1</td><td>8</td><td>0</td><td>1</td></tr>
<tr><td>$R_C$ < 0.5 NM (926 m)</td><td>13</td><td>0</td><td>0</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>$R_C$ < 0.3 NM (555.6 m)</td><td>13</td><td>0</td><td>1</td><td>8</td><td>1</td><td>0</td></tr>
<tr><td>7</td><td>$R_C$ < 0.2 NM (370.4 m)</td><td>12</td><td>0</td><td>0</td><td>8</td><td>1</td><td>1</td></tr>
<tr><td>8</td><td>$R_C$ < 0.1 NM (185.2 m)</td><td>11</td><td>0</td><td>0</td><td>7</td><td>0</td><td>0</td></tr>
<tr><td>9</td><td>$R_C$ < 75m</td><td>11</td><td>1</td><td>1</td><td>7</td><td>1</td><td>0</td></tr>
<tr><td>10</td><td>$R_C$ < 25m</td><td>10 or 21</td><td>0</td><td>0</td><td>6</td><td>0</td><td>0</td></tr>
<tr><td>11</td><td>$R_C$ < 7.5m</td><td>9 or 20</td><td>0</td><td>0</td><td>5</td><td>0</td><td>0</td></tr>
<tr><td>12</td><td colspan="7">Reserved</td></tr>
<tr><td>13</td><td colspan="7">Reserved</td></tr>
<tr><td>14</td><td colspan="7">Reserved</td></tr>
<tr><td>15</td><td colspan="7">Reserved</td></tr>
</table></td></tr>
<tr><td>NIC Baro</td><td></td><td>NIC baro is a one bit field that is used to report if the altitude is being checked against another source of pressure altitude.
<table>
<tr><th>Coding</th><th>Meaning</th></tr>
<tr><td>0</td><td>The barometric altitude that is being reported in the Airborne Position Message is based on a Gilham coded input that has not been cross-checked against another source of pressure altitude</td></tr>
<tr><td>1</td><td>The barometric altitude that is being reported in the Airborne Position Message is either based on a Gilham code input that has been cross-checked against another source of pressure altitude and verified as being consistent, or is based on a non-Gilham coded source</td></tr>
</table></td></tr>
<tr><td>No “N”</td><td></td><td>Percent, total time, and max consecutive reports aircraft reported a N Number Flight ID without the leading “N”</td></tr>
<tr><td>Non-US</td><td></td><td>Percent, total time, and max consecutive reports aircraft reported a N Number Flight ID and a ICAO 24-bit address outside the U.S. block</td></tr>
<tr><td>Operation Id</td><td></td><td>Unique flight identification number that is shown in the report to allow users to return to that operation to look at it again.</td></tr>
<tr><td>Other Checks</td><td></td><td>Category of checks that looks at assorted issues such as illegal characters in your flight ID, improper/missing Mode 3/A code, and Duplicate ICAO addresses. See Other Checks section in Part 1 of this document.</td></tr>
<tr><td>Only “N”</td><td></td><td>Percent, total time, and max consecutive reports aircraft reported just “N” for flight ID</td></tr>
<tr><td>Out Capability</td><td></td><td>Indicates the type of ADS-B Out link the transmitter operates on i.e., 1090, UAT, Dual (both links)</td></tr>
</table>

<table>
<tr><td>Partial</td><td></td><td>Mostly for Air Carriers, percent, total time, and max consecutive reports aircraft reported a Flight ID missing the leading three letter identifier</td></tr>
<tr><td>Processed reports</td><td></td><td>Number of ADS-B reports actually processed by the FAA ground system</td></tr>
<tr><td>Rule</td><td></td><td>This overall category fails is you fail any of the categories mandated. If this box is labeled no, the test was a success.</td></tr>
<tr><td>SDA</td><td>System Design Assurance</td><td>Measures the likelihood of bad data being sent. Pass for values 2 and 3
<table>
<tr><th colspan="2">SDA Value</th><th rowspan="2">Supported Failure Condition Note 2</th><th rowspan="2">Probability of Undetected Fault causing transmission of False or Misleading Information Note 3,4</th><th rowspan="2">Software & Hardware Design Assurance Level Note 1,3</th></tr>
<tr><th>(decimal)</th><th>(binary)</th></tr>
<tr><td>0</td><td>00</td><td>Unknown/ No safety effect</td><td>$> 1x10^{-3}$ per flight hour or Unknown</td><td>N/A</td></tr>
<tr><td>1</td><td>01</td><td>Minor</td><td>$\leq 1x10^{-3}$ per flight hour</td><td>D</td></tr>
<tr><td>2</td><td>10</td><td>Major</td><td>$\leq 1x10^{-5}$ per flight hour</td><td>C</td></tr>
<tr><td>3</td><td>11</td><td>Hazardous</td><td>$\leq 1x10^{-7}$ per flight hour</td><td>B</td></tr>
</table></td></tr>
<tr><td>SIL</td><td>Source Integrity Level</td><td>Measurement of the probability of not being within the containment radius. Pass for value 3 only
<table>
<tr><th colspan="2">SIL Coding</th><th rowspan="2">Probability of Exceeding the NIC Containment Radius ($R_C$)</th></tr>
<tr><th>(Binary)</th><th>(Decimal)</th></tr>
<tr><td>00</td><td>0</td><td>Unknown or $> 1 \times 10^{-3}$ per flight hour or per sample</td></tr>
<tr><td>01</td><td>1</td><td>$\leq 1 \times 10^{-3}$ per flight hour or per sample</td></tr>
<tr><td>10</td><td>2</td><td>$\leq 1 \times 10^{-5}$ per flight hour or per sample</td></tr>
<tr><td>11</td><td>3</td><td>$\leq 1 \times 10^{-7}$ per flight hour or per sample</td></tr>
</table></td></tr>
<tr><td>SILs</td><td>Source Integrity Level Supplement</td><td>This is a one bit field that informs the system if the SIL is being given on a per hour or a per sample basis, assigned as 0 or 1 respectively</td></tr>
<tr><td>SQL</td><td>Signal Quality Level</td><td>Measure of integrity of data sent. Not used to determine if an operation makes it onto the exception list</td></tr>
<tr><td>Stationary only</td><td></td><td>Field that marks if the recorded flight was stationary (ground only)</td></tr>
<tr><td>Tail Number</td><td></td><td>Number assigned to the aircraft at registration (N-number)</td></tr>
<tr><td>TIS-B Client %</td><td></td><td>% of flight time that the aircraft was provided TIS-B data.</td></tr>
<tr><td>Total reports</td><td></td><td>Total reports broadcast by the ADS-B transmitter</td></tr>
<tr><td>Type Registration</td><td></td><td>Type of registration associated with aircraft e.g. civil, military, etc</td></tr>
<tr><td>UAT Only above 18k</td><td></td><td>When flagged, indicates UAT-Only equipped aircraft operating in Class A airspace (above 18K feet) where 1090 ADS-B equipment is required by 91.225.</td></tr>
<tr><td>Unavail Char</td><td></td><td>Percent, total time, and max consecutive reports aircraft reported a Flight ID with an Unavailable Character</td></tr>
<tr><td>Vel/ Position Δ</td><td>Velocity & Position delta</td><td>Velocity is encoded in ADS-B messages. The compliance monitor checks these values against aircraft performance and flags a PCR if the velocity is greater than 300 meters/sec (583 knots or a position is greater than 1,312 feet/sec (400m/s).</td></tr>
<tr><td>Vertical Velocity</td><td></td><td>Vertical Velocity is encoded in ADS-B messages. The compliance monitor checks these values against aircraft performance and flags any unusual or unreasonable values</td></tr>
</table>