International Civil Aviation Organization
CAR/SAM Regional Planning and Implementation Group (GREPECAS)

INFORMATION PAPER

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CAR/SAM Planning and Implementation Regional Group (GREPECAS)
Twenty-Sixth Scrutiny Working Group Meeting (GTE/26)
Virtual Phase (Asynchronous, 9 – 25 September 2026)
In-Person Phase (Mexico City, Mexico, 12 – 16 October 2026)

Agenda Item 5: Other business

NAARMO ALTIMETRY SYSTEM ERROR REPORT (ASE-R) STATISTICS AND EXAMPLES

(Presented by NAARMO)

EXECUTIVE SUMMARY

The purpose of this paper is to provide a statistical summary of large ASE events observed by NAARMO during the period of 1 August 2025 through 31 July 2026. Processes employed to identify large ASE cases that require further action, notify stakeholders of significant large ASE events, and coordinate implementation of corrective actions are also detailed. In summary, 31 aircraft have been identified as having large ASE values during the reporting period, with 15 that are currently under evaluation.

Strategic Objectives:	• Every flight is safe and secure • Aviation delivers seamless, accessible, and reliable mobility for all • No country left behind • The International Civil Aviation Convention and Other Treaties, Laws and Regulations Address All Challenges
References:	• ICAO Annex 6, Operation of Aircraft, Part I - International Commercial Air Transport - Aeroplanes and Part II - International General Aviation - Aeroplanes • ICAO Annex 8, Airworthiness of Aircraft • ICAO Annex 11, Air Traffic Services • ICAO Doc 4444, Procedures for Air Navigation Services, Air Traffic Management • ICAO Doc 9574, Manual on Implementation of a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive • ICAO Doc 9937, Manual of Operating Procedures and Practices for Regional Monitoring Agencies in Relation to the Use of a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive

1. Introduction

1.1 The North American Approvals Registry and Monitoring Organization (NAARMO) serves as the Regional Monitoring Agency (RMA) for the airspace in the North America. These services are provided by the United States (U.S.) Federal Aviation Administration's William J. Hughes Technical Center for Advanced Aerospace and have been in operation since 2001.

1.2 As part of the duties of an RMA, outlined in ICAO Doc 9937, the NAARMO performs calculations of Altimetry System Error (ASE) for aircraft that fly in RVSM airspace within its area of responsibility. The purpose of calculating ASE is to measure the difference between an aircraft's displayed altitude and its actual, true pressure altitude to ensure safety, particularly for maintaining required separation in Reduced Vertical Separation Minima (RVSM) airspace. ASE is often considered "invisible" because flight crews, air traffic control, and onboard collision avoidance systems, such as TCAS, assume the instrument-displayed, and therefore broadcasted, altitude is true; meaning the error is undetected unless specialized measurement equipment is used to perform independent monitoring.

1.3 The purpose of this paper is to provide a statistical summary of large ASE events observed by NAARMO during the period of 1 August 2025 through 31 July 2026 and describe the process employed to notify stakeholders of significant large ASE events and coordinate implementation of corrective actions.

1.4 Furthermore, during the nineteenth meeting of the Regional Monitoring Agencies Coordination Group (RMACG/19), it was highlighted that there is an ASE reporting gap between RMAs and States, noting that there is no requirement for States to report the status of operators/aircraft detected to have large ASE back to the RMAs. This paper provides NAARMO's processes developed to bridge the gap.

2. Discussion

2.1 NAARMO completes daily ASE performance monitoring of all Automatic Dependent Surveillance-Broadcast (ADS-B)-equipped flights operating in RVSM airspace in the contiguous United States, Alaska, Guam, Hawaii and Puerto Rico. Monitoring data is also collected for flights operating in Canada and Mexico based on data availability (e.g., monitoring data for Canada is collected each Monday). ADS-B is used as the data source to perform ASE calculations. Availability of aircraft position data in ADS-B messages enables NAARMO use these data to produce ASE estimates. The processed ASE is then added to a database which is routinely scanned for large or unusual ASE events.

2.2 Maintaining a database of observed ASE measurements enables an RMA to identify performance trends and detect the onset of degraded aircraft performance. Aircraft with an ASE of +/- 245 ft. or more are added to a watchlist, a formal surveillance and notification mechanism developed by NAARMO used to closely monitor events that could potentially require corrective action. For each aircraft on the watchlist, altitude deviation plots are automatically generated, and trend analyses are performed to determine if further action is required.

2.3 If further action is required, an Altimetry System Error Report (ASE-R) is generated. This report is used to inform States, operators, and RMAs of ASE events of operational significance and to track implementation of successful corrective actions. When an ASE-R is issued and maintained, it is assigned a status category:

(1) **Performance monitoring in progress** – in this case, the aircraft ASE measurement is aberrant or is close to the threshold of requiring further action

(2) **Issued** – the ASE measurement is above RVSM requirements, an ASE-R has been issued to the operator and appropriate authorities and is pending action

(3) **Operator in progress** - the ASE-R has been issued to the operator and appropriate authorities, and identification of causal factors and implementation of corrective action(s) are in progress

(4) **Closed** – satisfactory corrective actions were implemented resulting in an ASE value within the acceptable threshold or the aircraft performance remained within the acceptable threshold

2.4 Once an ASE-R is created, if it is an "N" registered aircraft, the report is sent to the FAA Office of Safety Standards (AFS), the group fulfilling the role of State authority, and to its corresponding operator. Aircraft of foreign registry demonstrating anomalous or questionable performance are referred to the responsible RMA or State authority for follow-up action.

2.5 In addition to the watchlist, an ASE-R Tracker is maintained. The Tracker is an online tool developed by NAARMO to collaborate with State authorities and coordinate identification and implementation of corrective actions, assessment of post corrective action aircraft performance, and the status of each ASE-R.

2.6 The watchlist and ASE-R Tracker are reviewed routinely and enable FAA stakeholders involved in the review process to provide timely and relevant updates on each report. A key stakeholder involved in the review process is the U.S. State authority (AFS). The NAARMO meets weekly with AFS representatives to review recent performance observed for aircraft on the watchlist and the ASE-R tracker, review corrective actions and outcomes, and agree on the status of watchlist candidates and open ASE-Rs. A high-level overview is provided as **Figure 1**.

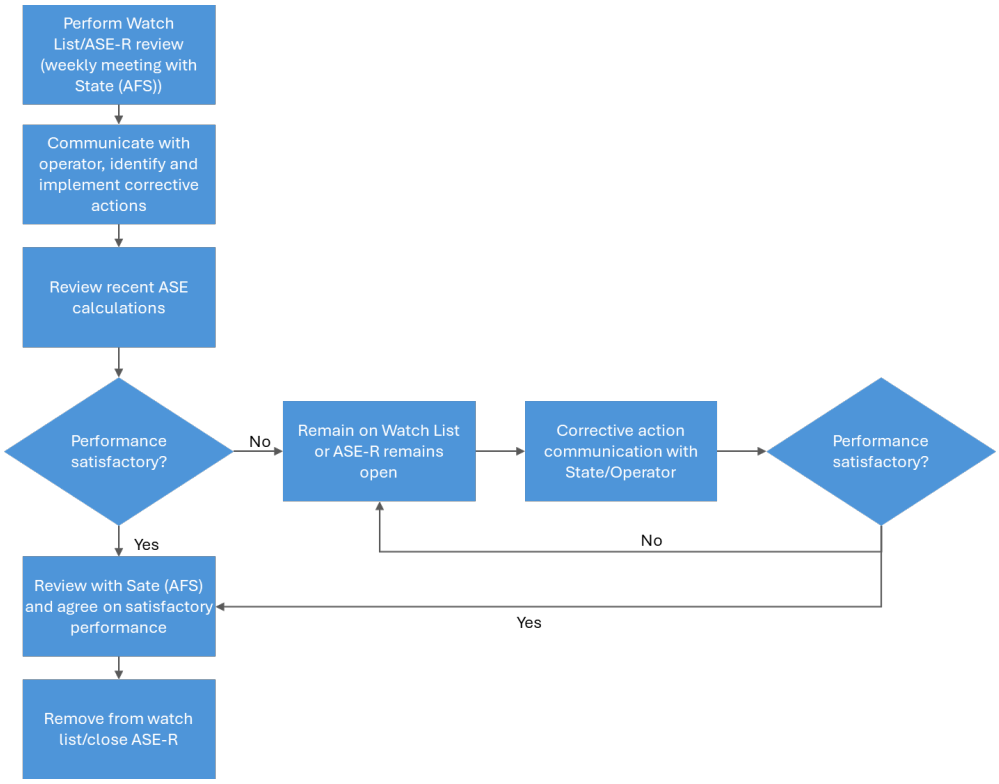


***Figure 1**. NAARMO Watchlist and ASE-R Tracker review process*

2.7 **Figure 2** provides a summary of Large ASE-R statistics. As can be seen in the figure, for the evaluation period of 1 August 2025 through 31 July 2026, 31 aircraft have been subjected to large ASE analysis resulting in an average of 2.58 ASE-Rs generated per month. As of July 2026, 16 ASE-Rs remain active with 4 assigned to the Performance Monitoring Category, 8 to the Issued category, 3 to the Operator in Progress category, and 16 have been closed.

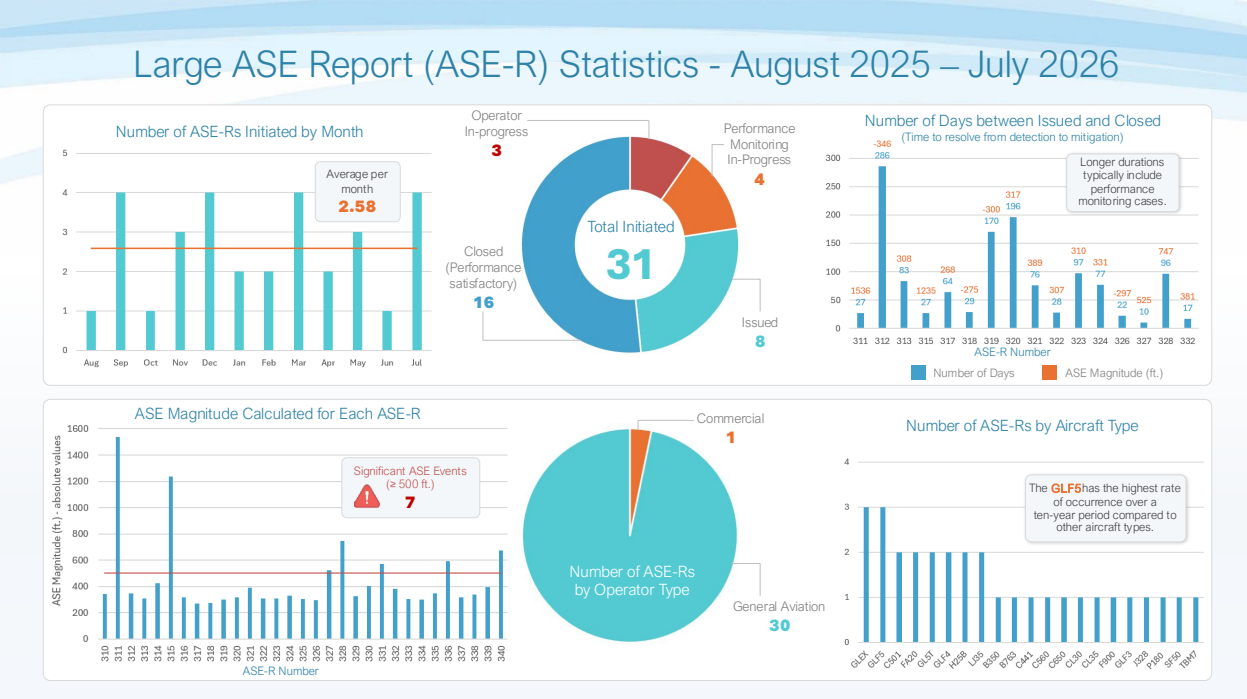


***Figure 2**. NAARMO Large Altimetry System Error Report (ASE-R) Statistics*

2.8 Another ASE-R statistic monitored is the number of days between the date issued and the date the report was closed. Depending on the ASE-R status category, this number can widely vary for many reasons. For example, if an ASE-R is assigned the “performance monitoring in progress” category, this type of ASE-R could be open for a long period of time if the ASE measurement value does not warrant immediate action. Or, in some cases, the delay could be based on time spent troubleshooting or operational demand. However, it is important to note that high severity ASE cases are typically resolved in a relatively short period of time – within a few days and, in some cases, immediate action is taken.

2.9 Regarding aircraft types included in the reports, there is a notable trend in the number of IGA type aircraft compared to commercial aircraft. IGA aircraft account for 20 of the 21 aircraft types with the GLEX and the GLF5 assigned the largest number of individual ASE-Rs.

2.10 **Figures 3 through 7** illustrate significant or notable ASE-R reports produced during the reported period. The figures contain the date(s) when the large ASE events were identified, the aircraft type, the estimated ASE measurement, the aircraft flight path, all calculated ASE values plotted on a graph, a summary of the corrective actions implemented, and the number of days between the ASE-R notification day and when the ASE-R was closed.

2.11 **Figure 3** provides an overview of a large ASE case observed during September 2025. The aircraft involved in this event was a C560 with a calculated ASE value of 1536 ft. In this case, the operator was approved for Section 9, Domestic RVSM Authorization, Part 91-Appendix G operations and was observed operating in the U.S. national airspace system (NAS); however, there was an Oceanic Transmittal Sheet filed during May 2025. An ASE-R was generated and, given the severity of this case, immediate action was initiated. The aircraft was grounded and tests were performed. It was determined that there was a leak in the pitot static system. The leaks were repaired and the aircraft's ASE performance returned to an acceptable range, meeting RVSM requirements. This case was resolved in five days.



Figure 3. *Large ASE report case #311, a C560 airframe with a measured ASE value of 1536 ft*

2.12 **Figure 4** provides a summary of another severe large ASE case. A Learjet 35 was observed with an ASE value of 1235 ft. during October 2025. This operator was also approved for Section 9, Domestic RVSM Authorization and was observed operating in the U.S. and Canada. Like the previous event, immediate action was taken and the aircraft was grounded. It was determined that there was a leak in the pitot static system. The repairs were made and the aircraft's ASE performance returned to acceptable levels. This case was resolved in three days.

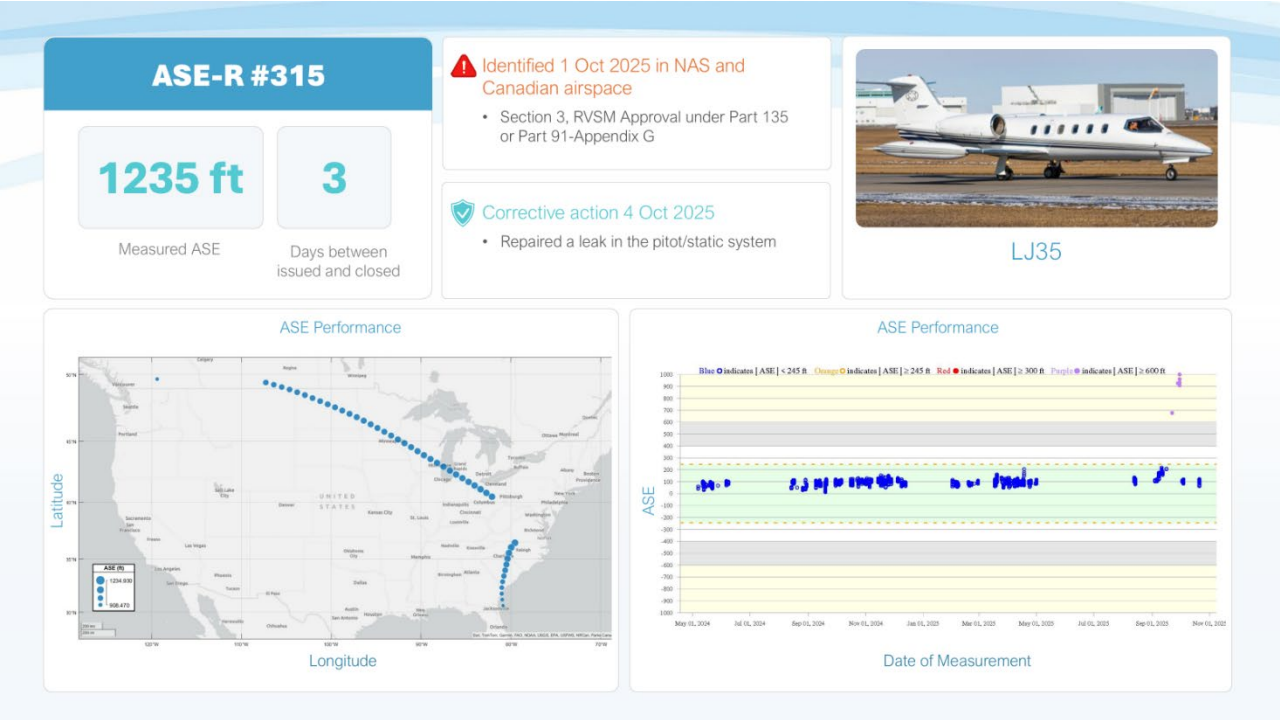


Figure 4. *Large ASE report case #315, an LJ35 airframe with a measured ASE value of 1235 ft*

2.13 The ASE-R shown in **Figure 5** illustrates a case where an erroneous air data sensor was the cause of an FA20's large ASE performance. The aircraft was observed with an ASE value of 525 ft. The air data sensors were replaced and the aircraft's performance returned to satisfactory.

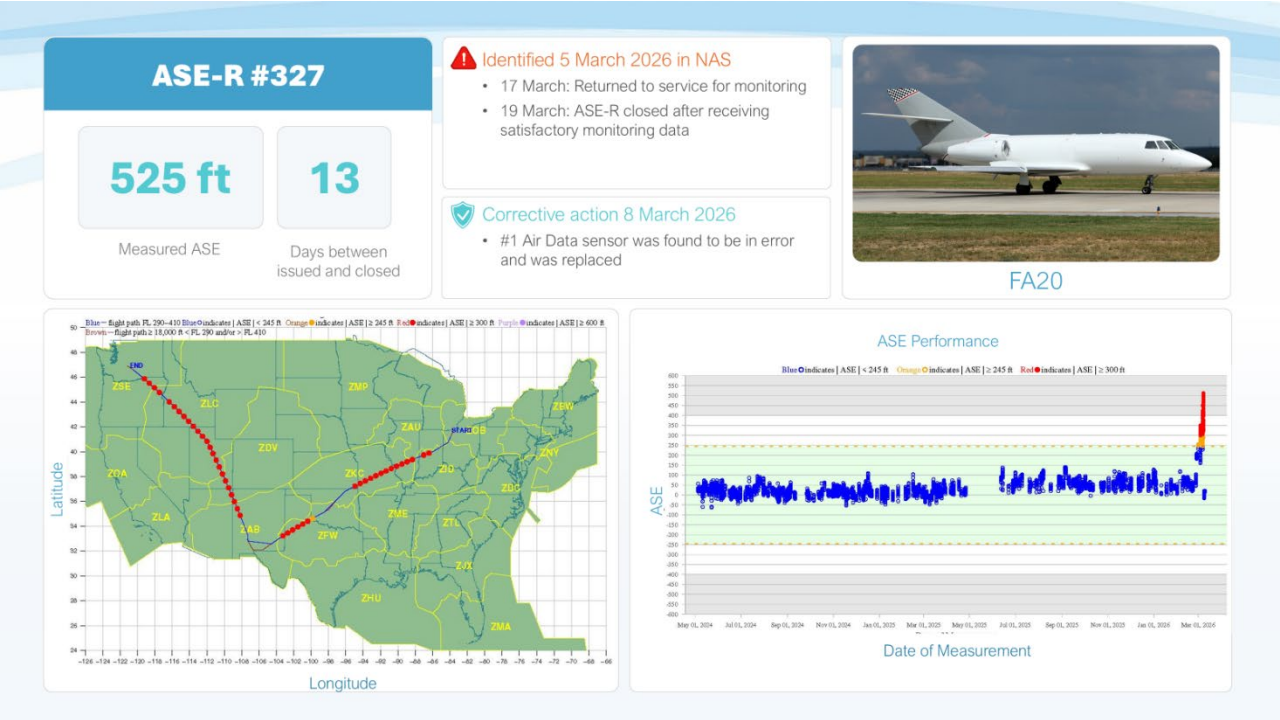


***Figure 5**. Large ASE report case #327, an FA20 airframe with a measured ASE value of 525 ft*

2.14 **Figure 6** illustrates an example of a large ASE case with a significantly high value. In this case, the aircraft was taken out of service for a period of time and corrective action was completed 52 days after discovery of the abnormal performance. The longer duration between ASE detection and remediation was most likely due to the time dedicated to troubleshooting and determining the cause of the error.

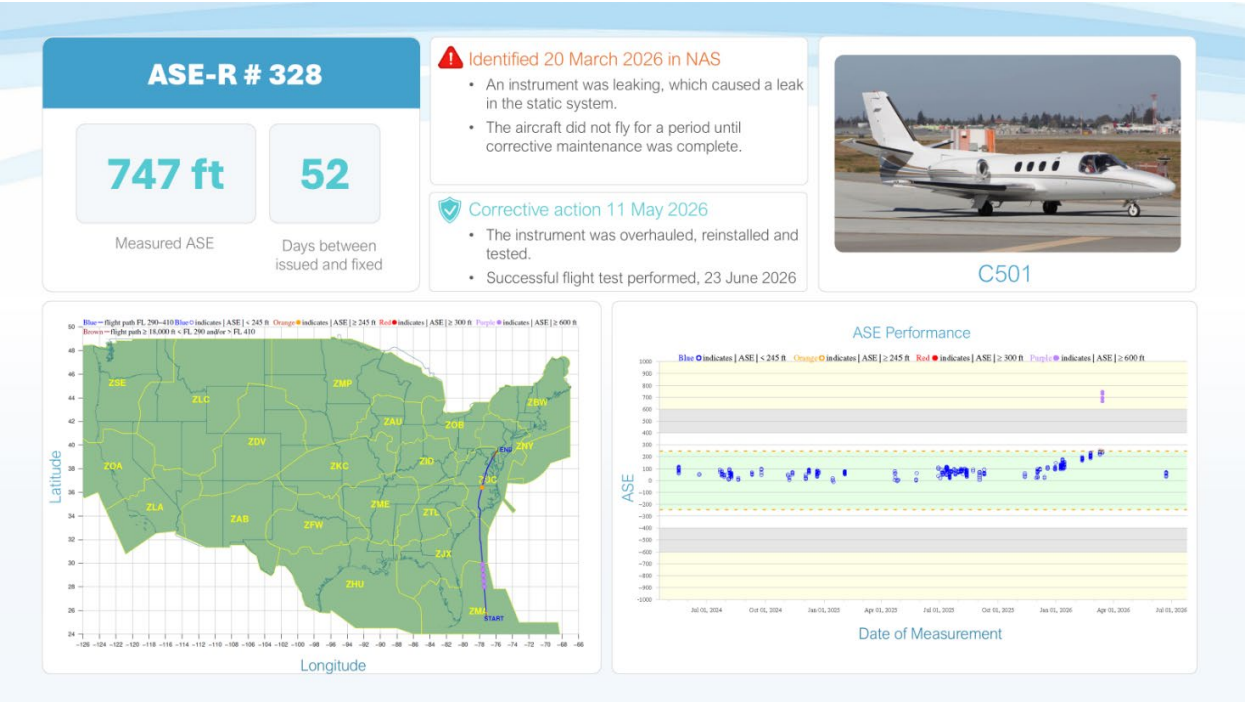


***Figure 6**. Large ASE report case #328, an C501 airframe with a measured ASE value of 747 ft*

2.15 As shown in the previous figures (figures 3-6), large ASE events are often caused by mechanical and physical defects in the aircraft's pressure-sensing infrastructure. However, there are many other causes of large ASE. In some instances, even the most unsuspecting abnormality or modification could affect an aircraft's ASE performance. This was the case for the event shown in **Figure 7**. This event involves a Vision Jet G2 (SF50) with an ASE value of 310 ft. A maintenance review revealed that a damaged door hinge located on the baggage door was disturbing the airflow over the static pressure ports. The operator replaced the baggage door and a follow-up flight test confirmed that the aircraft's ASE performance returned to satisfactory.

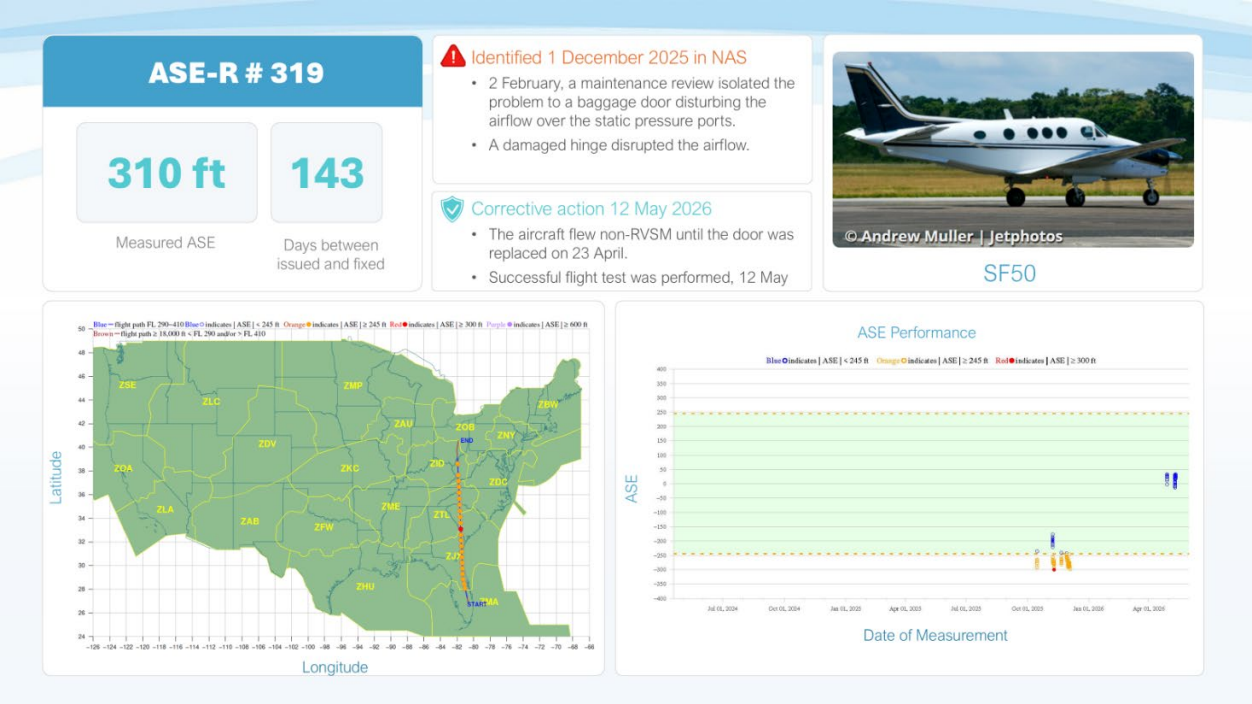


***Figure 7**. Large ASE report case #319 caused by a damaged luggage door hinge.*

2.16 **Figure 8** presents the monitoring and follow-up status of ASE-R #292, involving an LJ35 aircraft identified in the U.S. NAS between June 2024 and September 2026. The aircraft was identified as not RVSM approved while operating at RVSM flight levels with a high ASE value on 46 occasions. NAARMO notified the State of the Operator of the non-compliant operations. The most recent operation was reported as a medical evacuation flight; however, the operator had not filed RVSM in the corresponding flight plan. The ASE performance plot indicates multiple measurements exceeding the ±245 ft ASE monitoring threshold, with several measurements above 300 ft and a maximum recorded value of 460 ft. The geographic plot shows the identified operations primarily within the contiguous U.S. (CONUS), with additional activity near the U.S.–Mexico border. Corrective action remains pending. The appropriate State authorities are coordinating with the operator regarding resolution, and the operator has been advised not to operate in RVSM airspace until the matter is resolved.

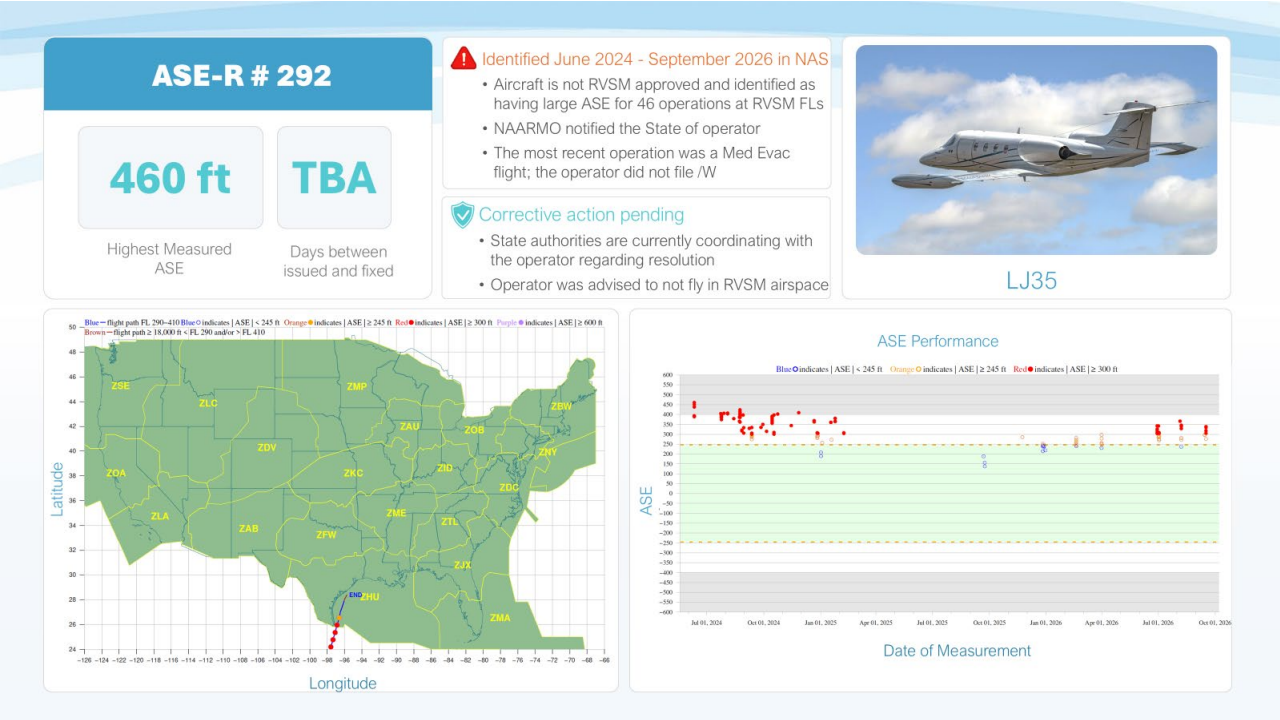


Figure 8. *Large ASE report case #292 has been open ASE-R since 2024.*

2.17 Over the years of performing ASE performance monitoring, to assist in troubleshooting, the NAARMO has accumulated a list of known causes of large ASE. The following issues have been known to cause non-compliant ASE performance:

- Damage or corrosion to static ports and pitot tubes
- Debris in static ports and static tubes
- Humidity or pressure leaks in pitot/static pipes
- Air data computer drift or out of tolerance
- Pressure variation caused by skin waviness effects
- Non-RVSM approved airframe modification
- Flying an aircraft outside of the speed limits defined for RVSM operations

2.18 The following **Figures 9 & 10** illustrate examples of a few common causes of large ASE.



Probe corrosion | Damage near the static port | Debris found in the static tube

Figure 9. *Common causes of large ASE - Probe corrosion, damage near the static port, and debris found in the static tube*

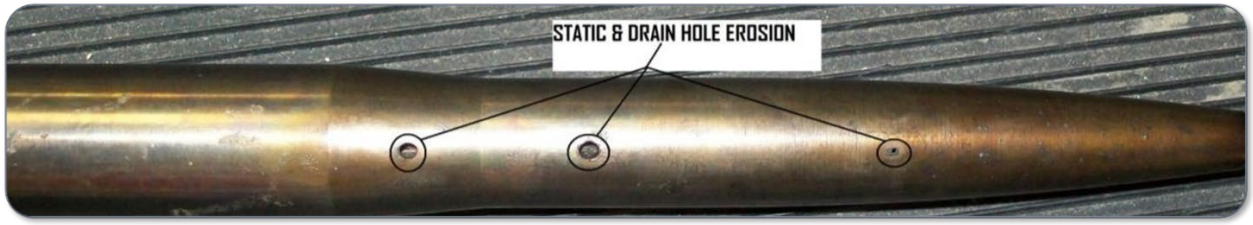


Figure 10. *Example of static and drain hole corrosion that contributed to large ASE*

2.19 In summary, large ASE is an invisible risk only detectable by specialized monitoring systems and can be caused by several factors. The large ASE detection and monitoring process employed by NAARMO has been effective in identifying large ASE events and notifying the appropriate stakeholders so that, when necessary, immediate corrective action is implemented. Furthermore, the availability and use of ADS-B data significantly increased the ability to routinely monitor a large portion of the aircraft population resulting in early detection and quicker response to large ASE events.

3. Action by the Meeting

3.1 The Meeting is invited to note and review the contents of the NAARMO Large ASE-R Statistics and procedures developed to liaise with State authorities regarding large ASE resolutions presented in this paper.

— END —