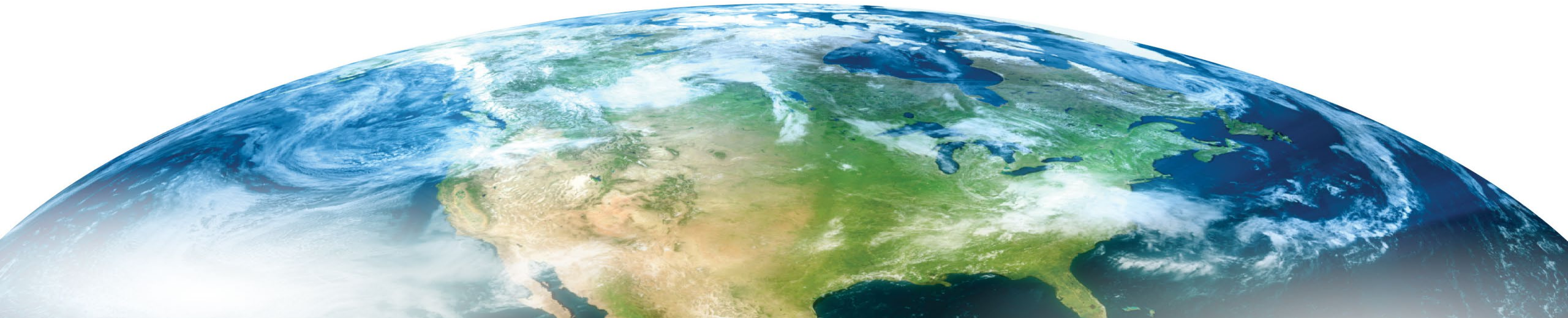
Section 9 Approval and ASE Examples

September 2023



Alternative to Specific Approval

- The requirement for specific RVSM operational approval was developed in 1997
  - At that time, aircraft were not being manufactured to comply with RVSM requirements, and many needed significant modification to meet the standard
- Since then there have been improvements in aircraft RVSM design, stability in RVSM operating procedures, and an overall increase in the maturity of RVSM standards
- In addition, wider mandatory use of Automatic Dependent Surveillance-Broadcast (ADS-B) provided the opportunity to improve altitude-keeping performance monitoring programs, increasing the availability of RVSM performance verification tools.

- In an effort to efficiently use regulatory resources has implemented an alternative to RVSM specific approval identified as Section 9.

Section 9 Regulation

- Title 14 of the Code of Federal Regulations (14 CFR) part 91, Appendix G contain the RVSM requirements
- There were no proposed changes to RVSM altitude-keeping equipment standards for RVSM aircraft,
- An alternative provision was added to Appendix G of part 91 under Section 9 – "Aircraft Equipped with Automatic Dependent Surveillance-Broadcast Out"
  - In order to take advantage of the of ADS-B Out aircraft position data, the aircraft must be equipped with a qualified ADS-B Out system.
  - The FAA would consider a qualified ADS-B Out system to be one that meets the requirements of 14 CFR § 91.227, Automatic Dependent Surveillance-Broadcast (ADS-B) Out equipment performance requirements.
  - The amendments to Appendix G provide more emphasis on the operator's and pilot's responsibilities. Operators/pilots continue to be responsible for knowing the requirements, policies and procedures sufficient for the conduct of operations in RVSM airspace, including all areas where they intend to operate

Access and Oversight

- Operators of US registered aircraft who intend to operate solely within US ADS-B rule airspace can take advantage of this provision and gain access to RVSM airspace without a specific approval.
- Experienced RVSM aircrews can also gain immediate access to the applicable airspace in new RVSM-capable aircraft while their specific approval authorizations are being processed.
- Section 9 approvals are not posted to the RMA KSN as these aircraft without a specific approval should not be operating in RVSM airspace outside the US.

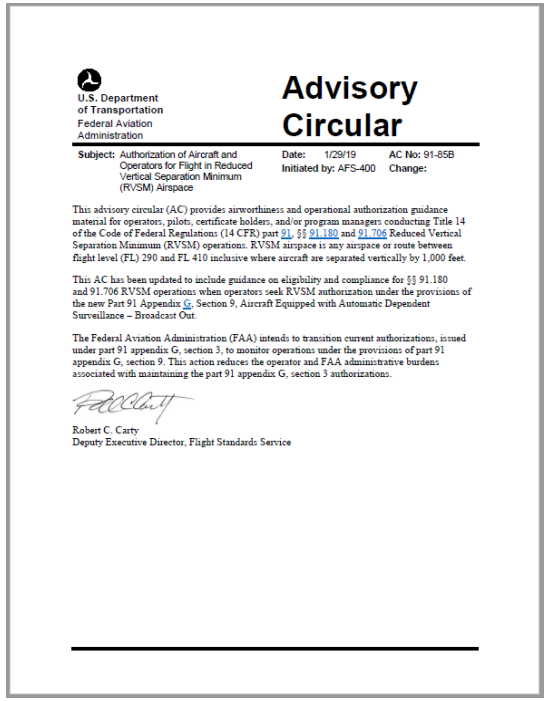
Section 3 Approvals

- Currently, US operators must continue to apply for a specific approval under Operations Specification (OpSpec), Management Specification (MSpec) or Letters of Authorization (LOA) B046 Operations in RVSM Airspace when:
  - the aircraft is not equipped with qualified ADS-B Out systems;
  - the operator does not operate in RVSM airspace where the FAA can successfully monitor the aircraft's height-keeping performance; or
  - the operator intends to conduct RVSM operations in foreign airspace where the State authority requires a specific RVSM operational approval.

ASE Monitoring and Containment

- Section 9, the FAA regulation provides a single ASE containment requirement for aircraft equipped with ADS-B Out.
  - The operator is authorized to conduct flight in airspace in with RVSM is applied provided: …(b) the ASE of the aircraft does not exceed 200ft.
  - This requirement corresponds to limits for ASE containment when RVSM was first established and is consistent with RVSM performance criteria used for aircraft approval in Section 2 of Appendix G.
- It allows performance monitoring to be applied to each aircraft without relying on aggregated data collected from many aircraft of the same RVSM monitoring group.
- For these operations, the FAA can rapidly detect when individual aircraft performance has deteriorated outside the proposed ASE tolerance.
- The regulation stipulates aircraft continually meet this requirement to be eligible for RVSM operations under the provisions of this section.

Monitoring Support for Section 9



U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Authorization of Aircraft and Operators for Flight in Reduced Vertical Separation Minimum (RVSM) Airspace

Date: 1/29/19 AC No: 91-85B
Initiated by: AFS-400 Change:

This advisory circular (AC) provides airworthiness and operational authorization guidance material for operators, pilots, certificate holders, and/or program managers conducting Title 14 of the Code of Federal Regulations (14 CFR) part 91, §§ 91.180 and 91.706 Reduced Vertical Separation Minimum (RVSM) operations. RVSM airspace is any airspace or route between flight level (FL) 290 and FL 410 inclusive where aircraft are separated vertically by 1,000 feet.

This AC has been updated to include guidance on eligibility and compliance for §§ 91.180 and 91.706 RVSM operations when operators seek RVSM authorization under the provisions of the new Part 91 Appendix G, Section 9, Aircraft Equipped with Automatic Dependent Surveillance – Broadcast Out.

The Federal Aviation Administration (FAA) intends to transition current authorizations, issued under part 91 appendix G, section 3, to monitor operations under the provisions of part 91 appendix G, section 9. This action reduces the operator and FAA administrative burdens associated with maintaining the part 91 appendix G, section 3 authorizations.

Robert C. Carty
Deputy Executive Director, Flight Standards Service

- Advisory Circular, Authorization of Aircraft and Operators for Flight in RVSM Airspace, AC 91-85B, provides guidance on operating under the provisions of 14 CFR Part 91, Appendix G.
  - AC 91-85B, published Jan 29, 2019, is posted on the following FAA website: AC 91-85B - Authorization of Aircraft and Operators for Flight in Reduced Vertical Separation Minimum (RVSM) Airspace (faa.gov)
- The AC States: "ADS-B OUT provides the necessary aircraft information for the FAA to perform altitude-keeping performance monitoring on a continual basis during normal RVSM aircraft operators whenever the aircraft is operating at RVSM altitudes in airspace where sufficient ADS-B data is available to determine RVSM performance."

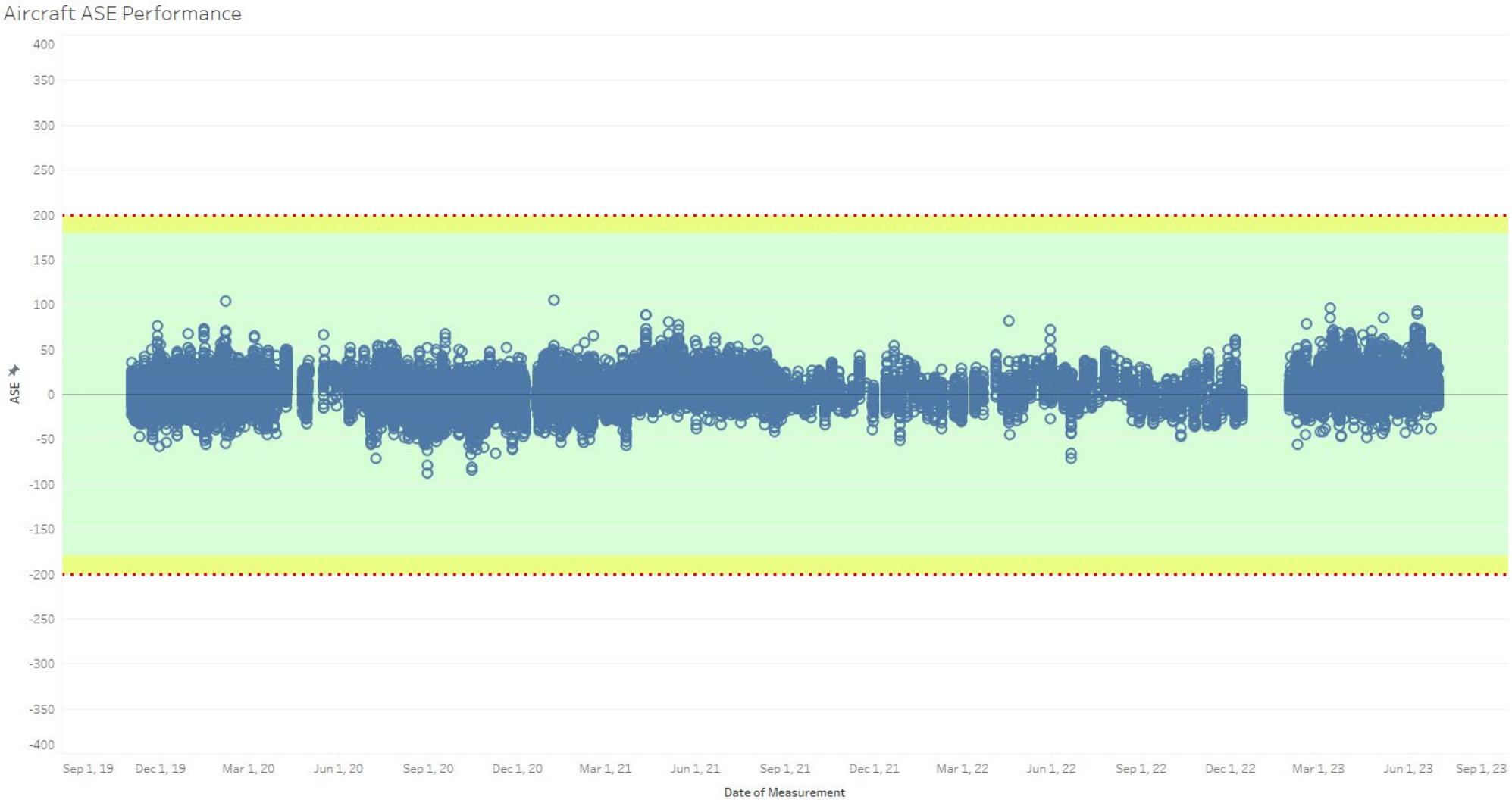
Detection of Large ASE Cases

- Processed ASE is added to the database which NAARMO scans for large or unusual ASE events.
  - Manual checks of each aircraft to be added to a Watch List
  - Operators or responsible RMAs get notified of large ASE cases
- Watch List process identifies aircraft having mean plus standard deviation greater than 200 ft. during a 6-month period.
- NAARMO uses daily ADS-B monitoring to process ASE.
  - From late 2021 to early 2023, budgetary constraints resulted in monitoring only once a week.
- The following cases were chosen to show instances of large ASE detected using the NAARMO Watch List process.

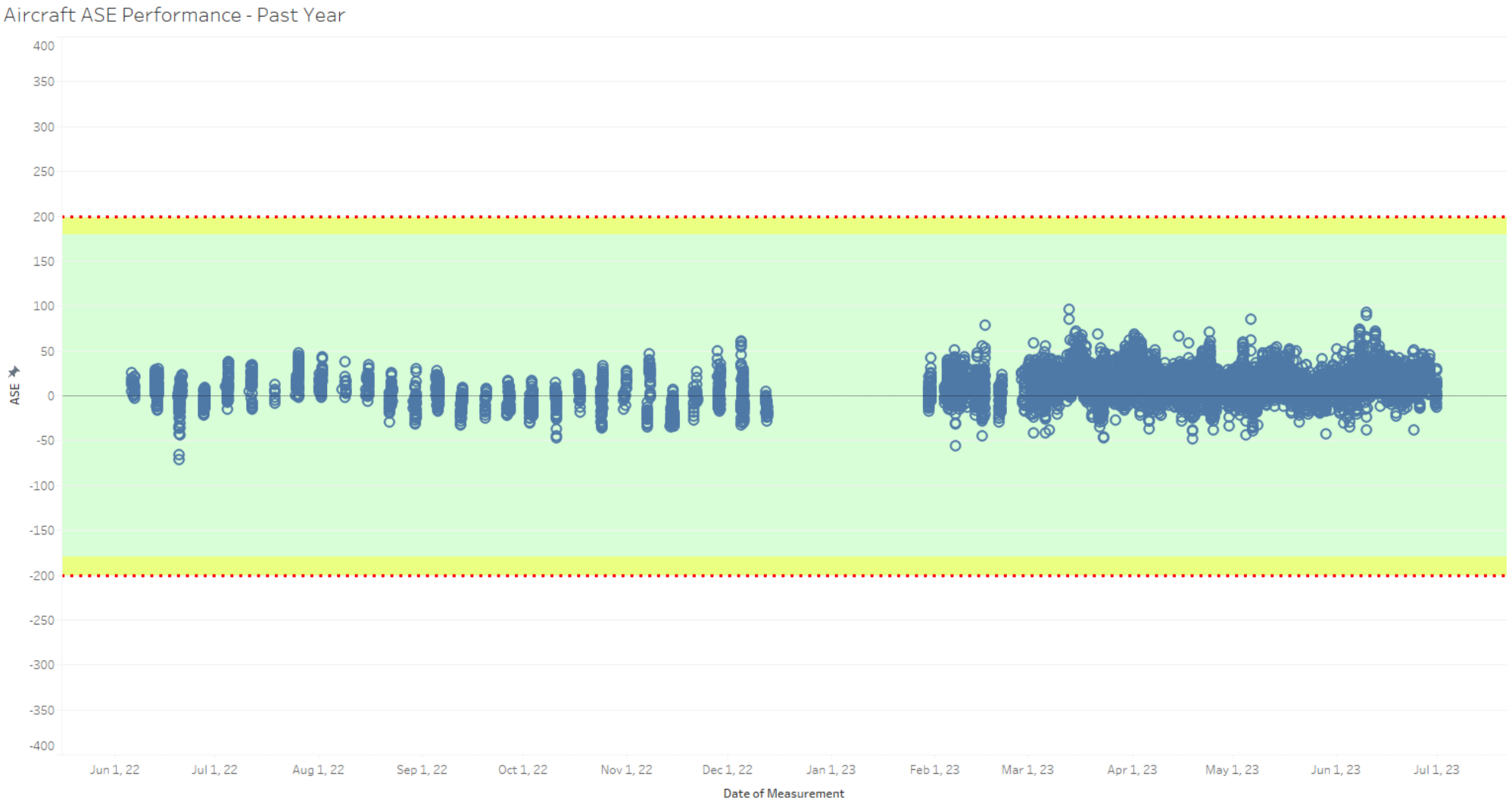
ASE Examples

- Expected Aircraft ASE Performance
- Case 1: Altimetry System Disagreement
- Case 2: Sudden Increase in ASE
- Case 3: Gradual Increase in ASE
- Case 4: Delayed Detection of Poor ASE
- Case 5: Aircraft Repaired – ASE Performance Restored

Expected Aircraft ASE Performance over 4 years



Expected Aircraft ASE Performance – 1 Year

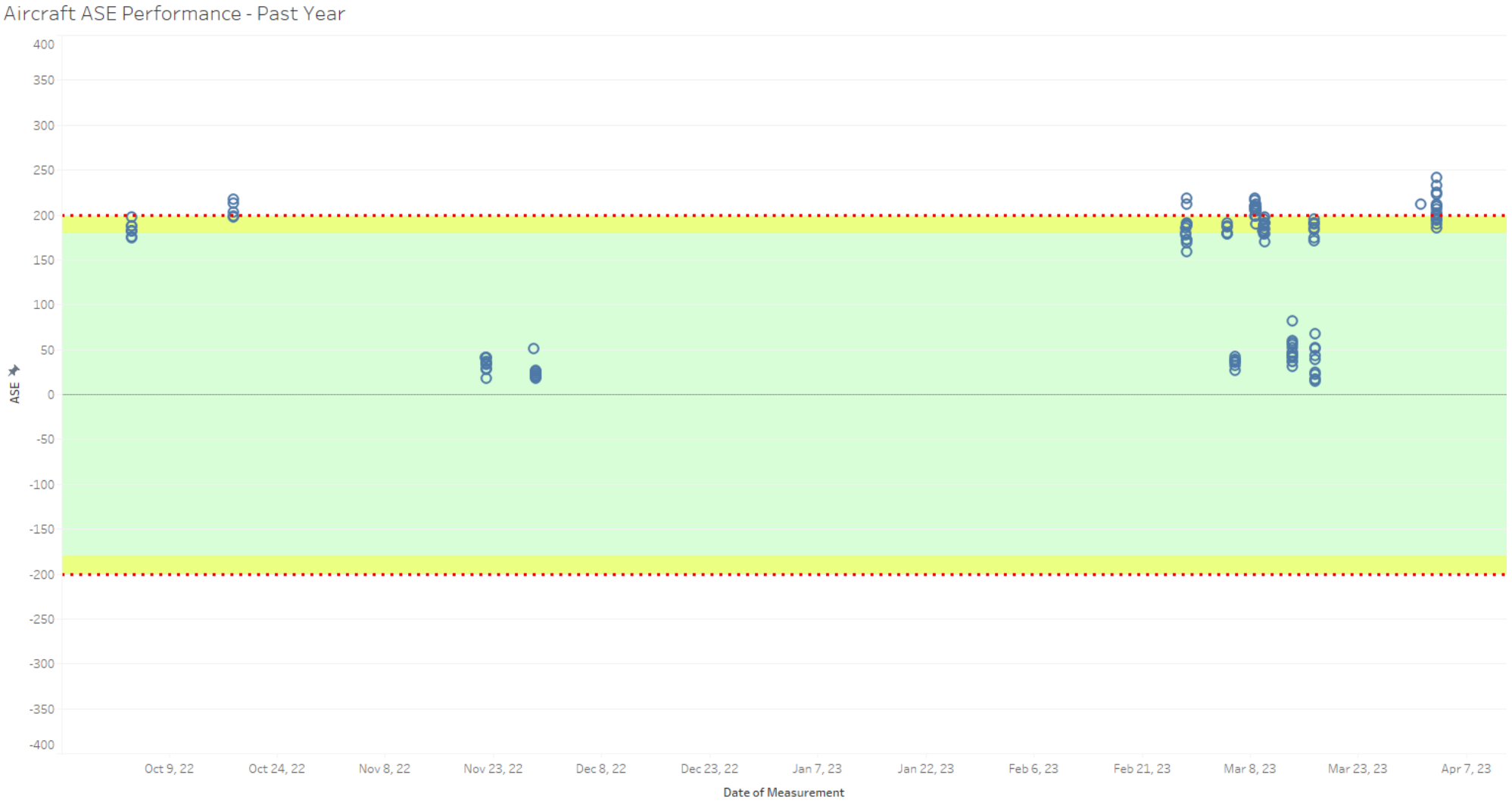


Expected ASE Performance

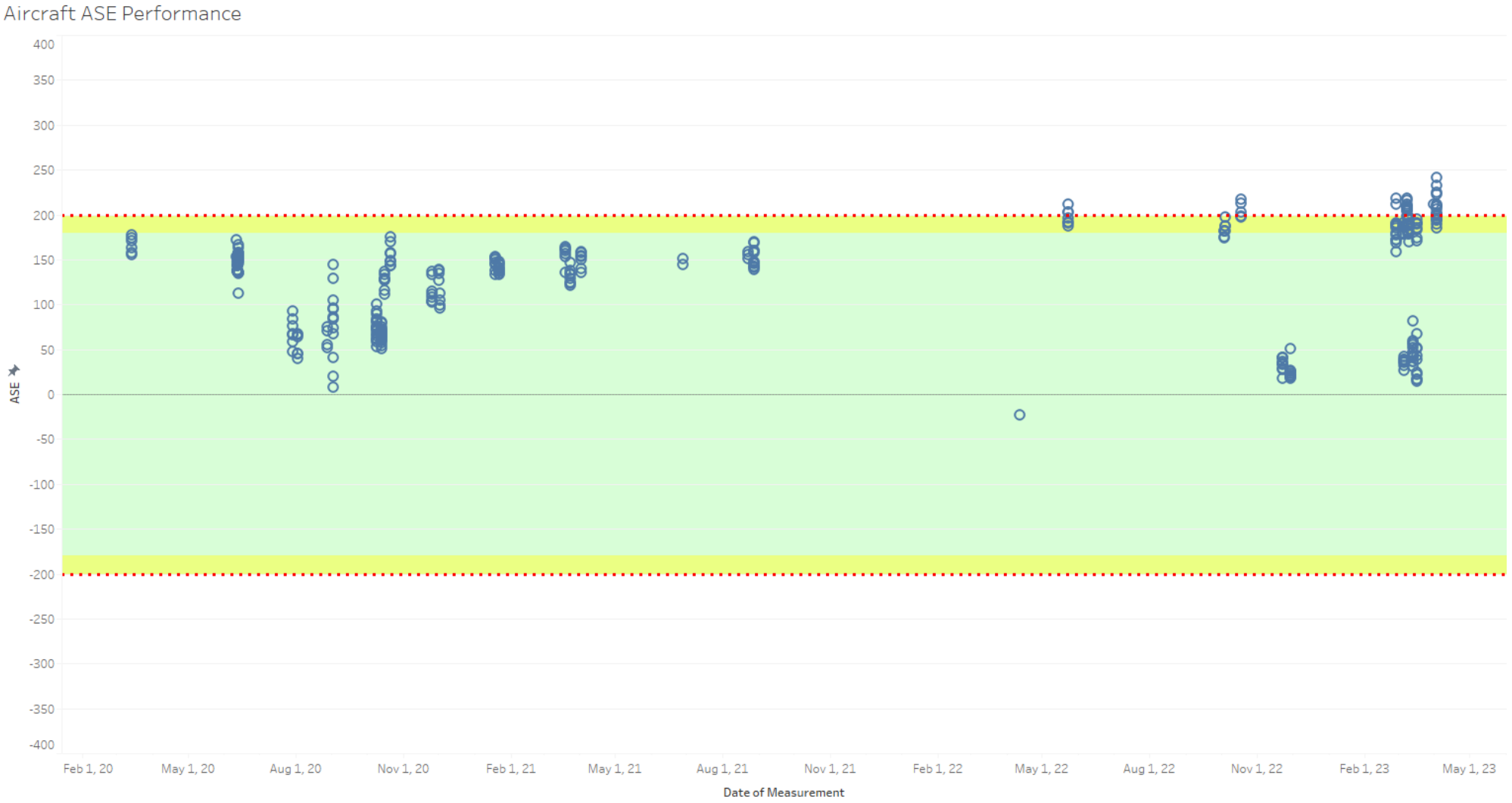
- This example showed an aircraft that flies frequently with very good ASE performance.
- The 1-year view shows the period of time in which NAARMO only calculated ASE once per week.
  - Previous to 2023, the ASE is displayed in vertical lines, depicting only one day of data per week.
  - 2023 shows the full dataset with daily monitoring.
  - The break in measurements is due to maintenance or down time only, not an actual lack of data.
- No difference in ASE between the 4-year view and 1-year view.
  - Ideal performance for all aircraft !

Case 1: Altimetry System Disagreement or “Split”

Appears to improve in 2022
Identified as a split in 2023



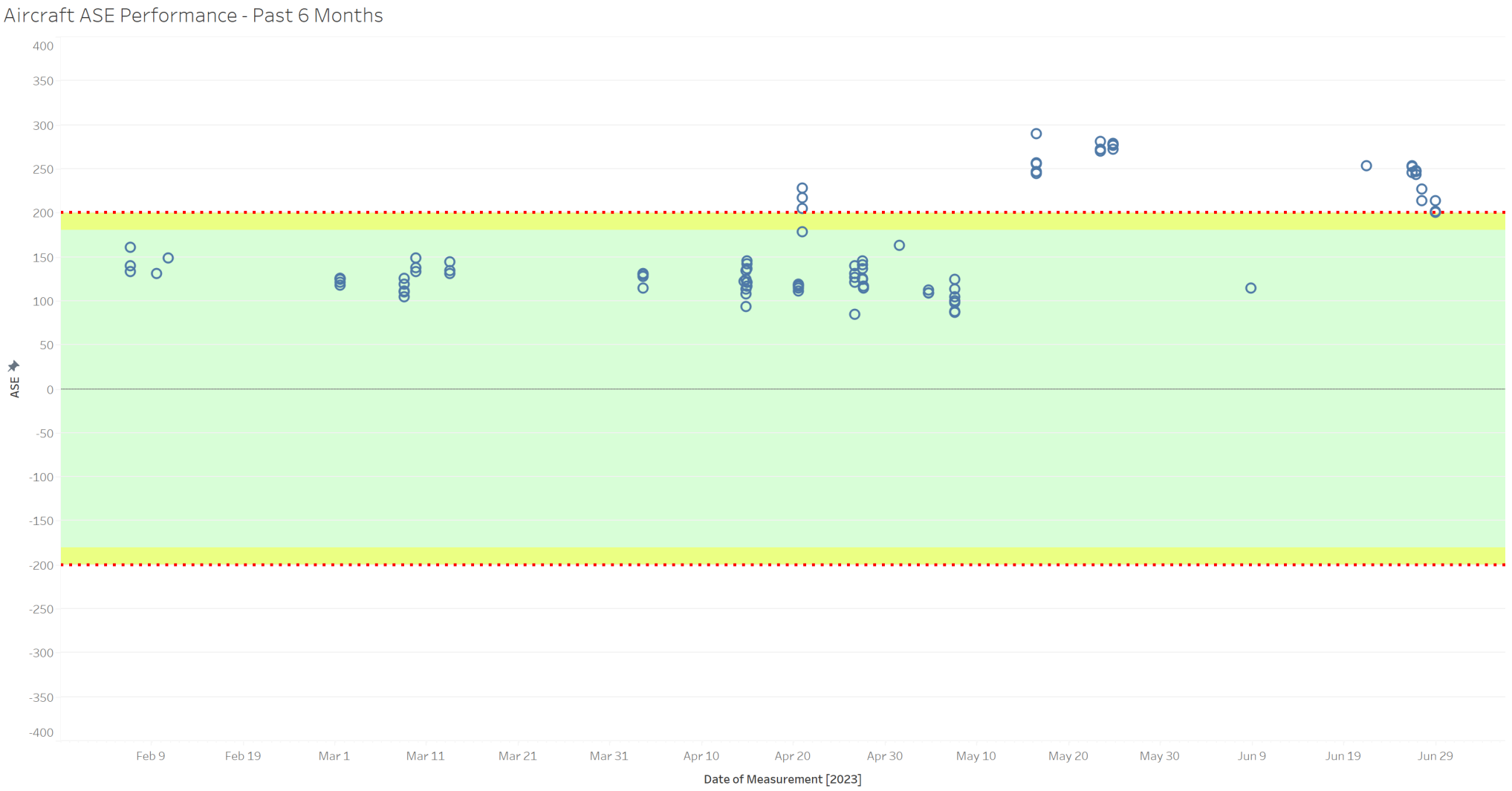
Case 1: Altimetry System Disagreement or "Split" – 3 year history



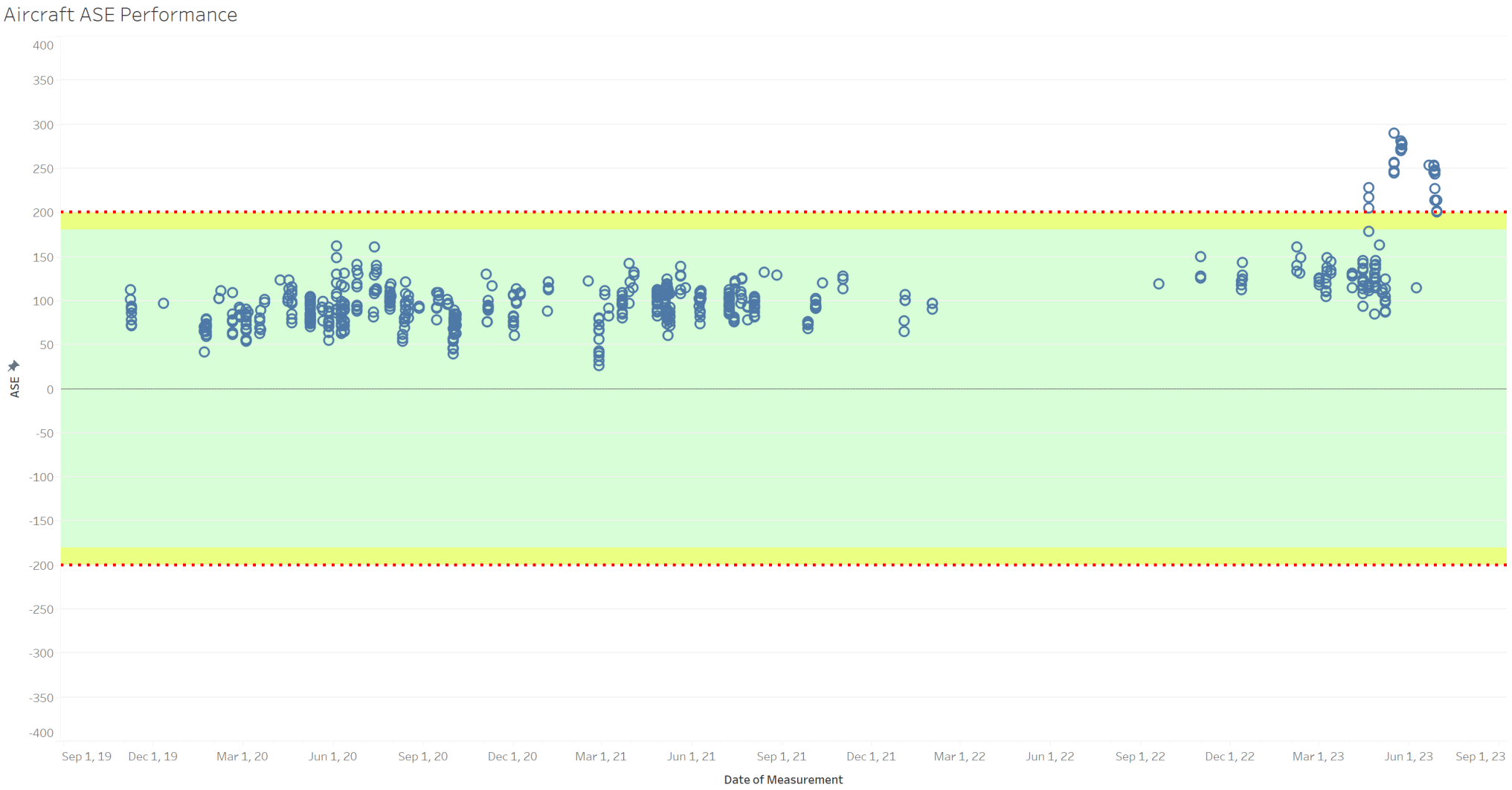
Case 1: Altimetry System Disagreement ("Split")

- Aircraft appeared to be performing well prior to November 2022.
  - It may have been performing well, or there may not have been enough data to detect a split.
  - The magnitude of the split increased in 2023, triggering the detection.
- This aircraft did not trigger the Watch List threshold because there was so little data, and half of that data was good, during that 6-month review.
- More monitoring in 2023 helped make it clear that there was a split in the altimetry system.
  - Missed perception of ASE improvement with a 6-month view.

Case 2: Sudden Increase in ASE



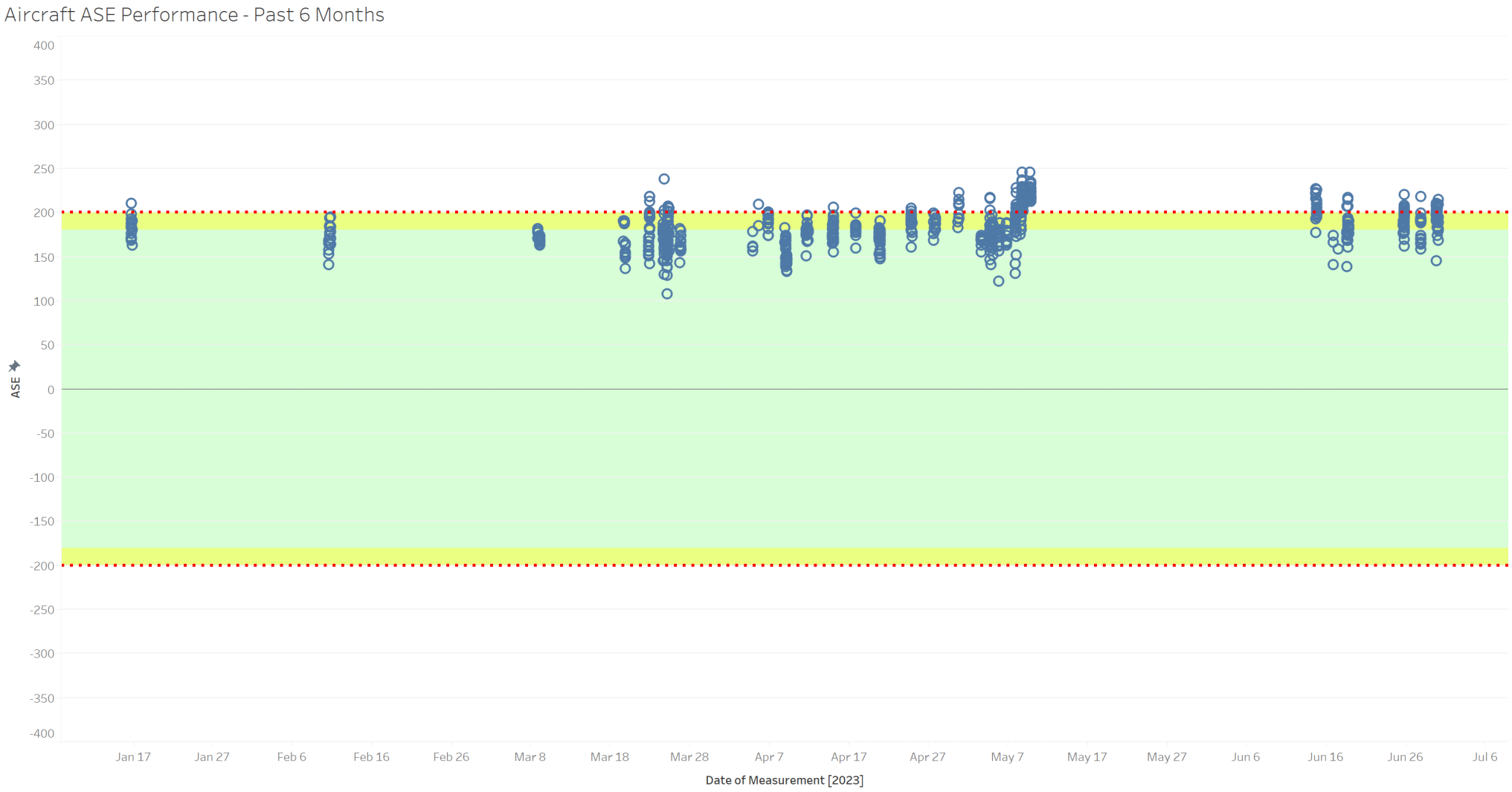
Case 2: Sudden Increase in ASE – 4 year history



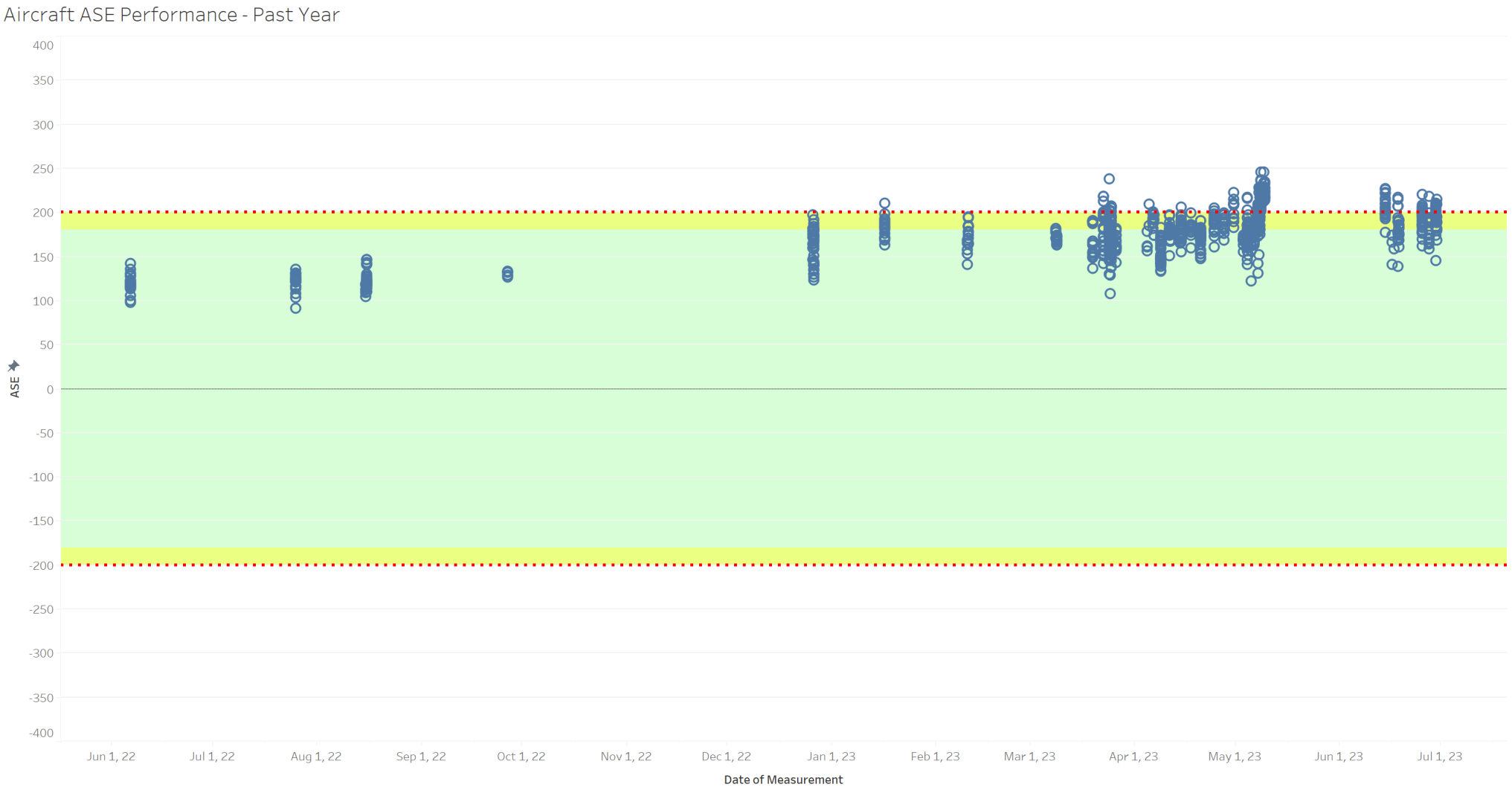
Case 2: Sudden ASE Increase

- Without daily monitoring, the ASE increase may have been more difficult to detect.
- This sudden ASE increase was detected during the 6-month review.
- Extended averaging may have taken longer to detect an ASE jump because of infrequent flights during recent months.
  - Using 1 year of data rather than 6 months to detect large ASE would not have identified this aircraft for a large ASE case.

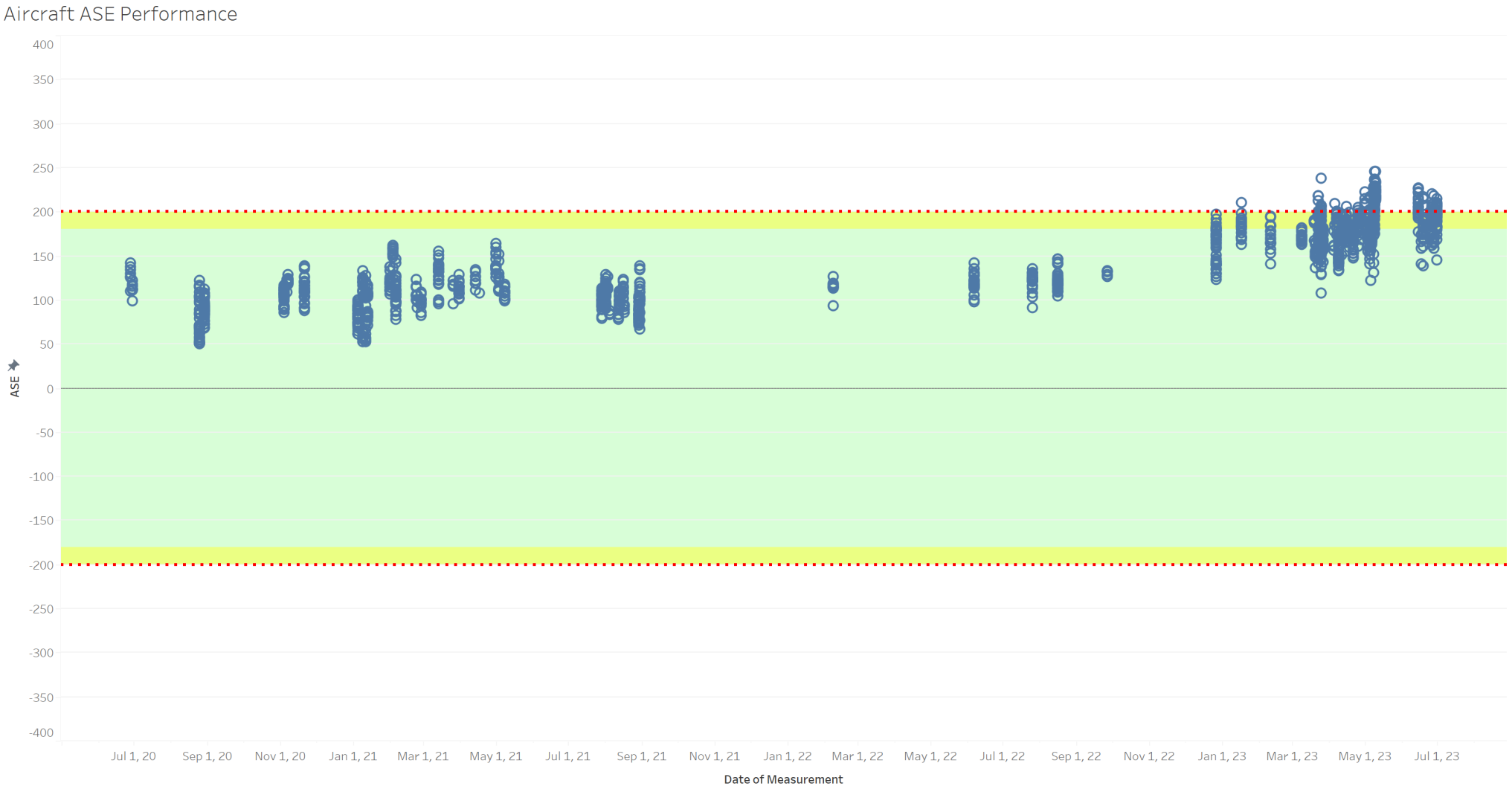
Case 3: Gradual Increase in ASE



Case 3: Gradual Increase in ASE – 1 year history



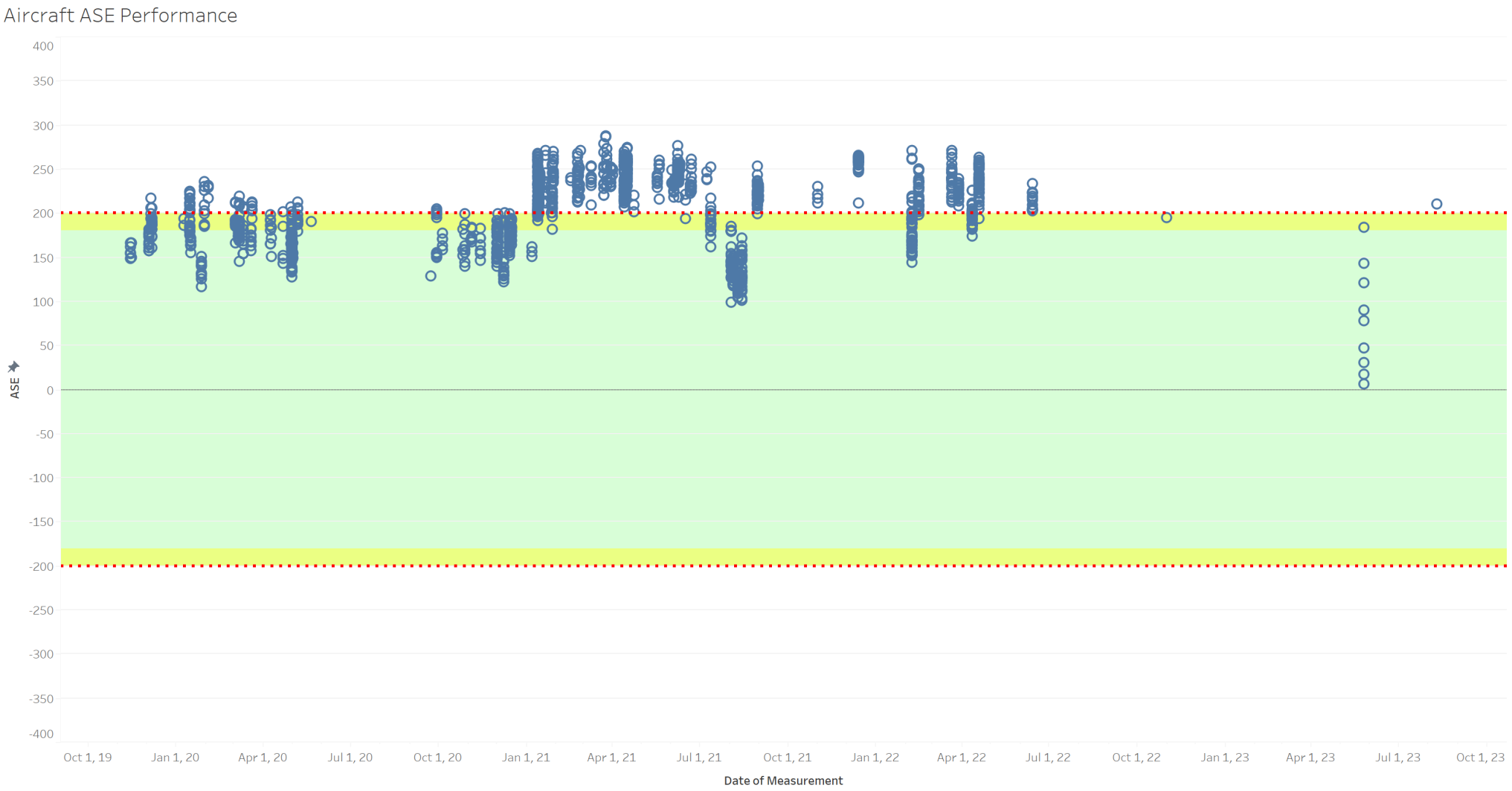
Case 3: Gradual Increase in ASE – 3 year history



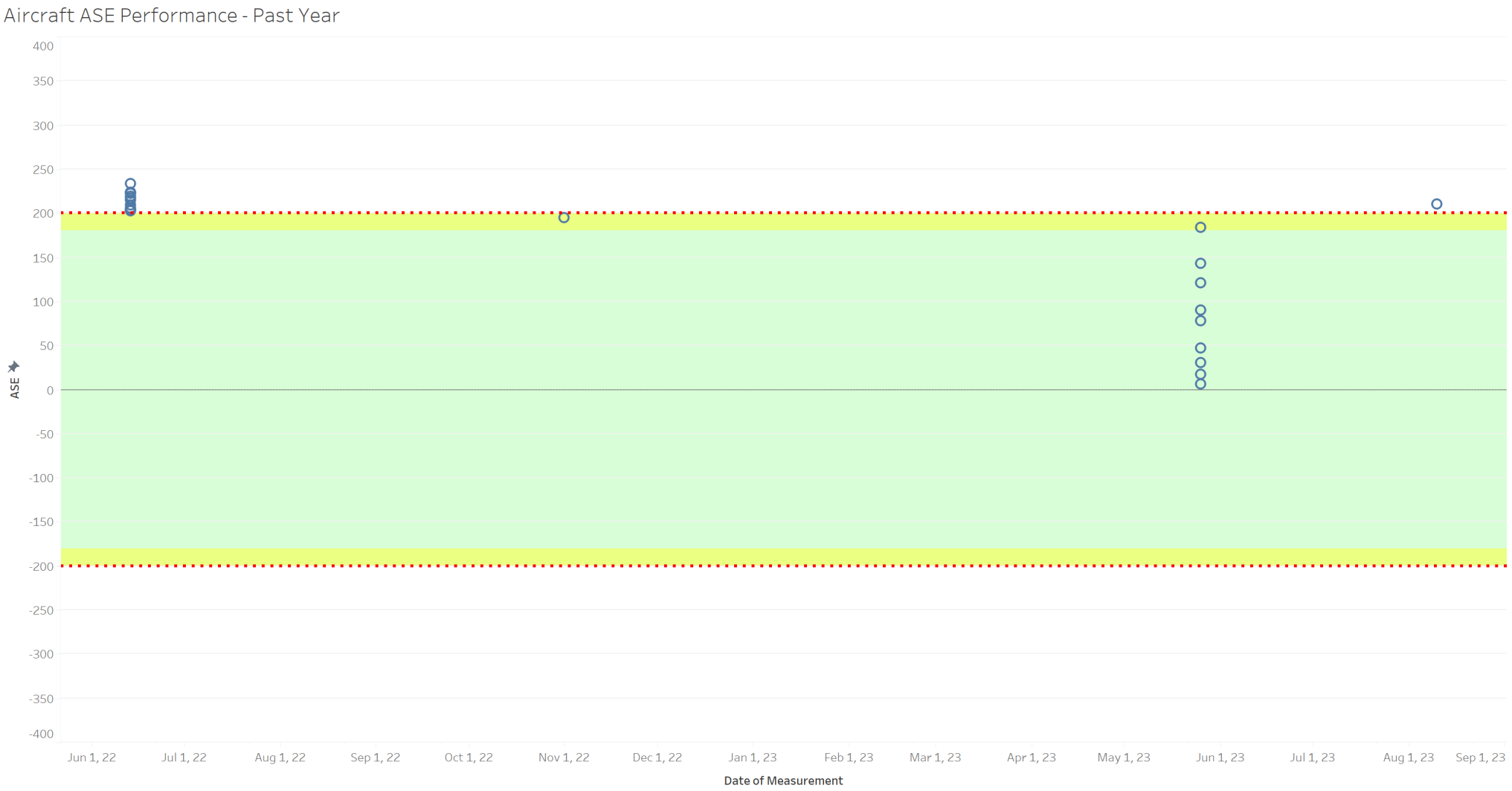
Case 3: Gradual Increase in ASE

- The 6-month Watch List review detected the large ASE.
- Reviewing more data from 1 year and 3 years shows the gradual increase in ASE.
  - No increase had been shown with only 6 months of data.
- Observing the longer 1-year and 3-year periods confirmed the large ASE, and verified the practice of using 6 months of data for the Watch List.
  - More data reinforced the recent poor performance by showing that earlier performance was good.
  - If a longer period were used for the Watch List, averaging might have resulted in this case going undetected.

Case 4: Delayed Detection of Poor ASE

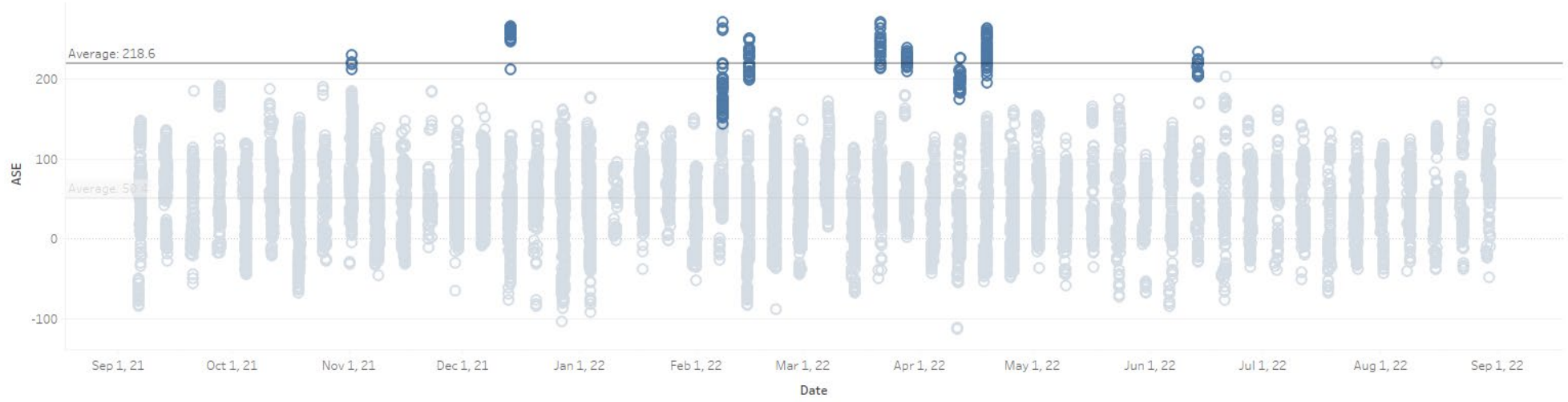


Case 4: Delayed Detection of Poor ASE – 1 year history



Case 4: Aircraft Performance Compared to Group

ASE Performance by Date

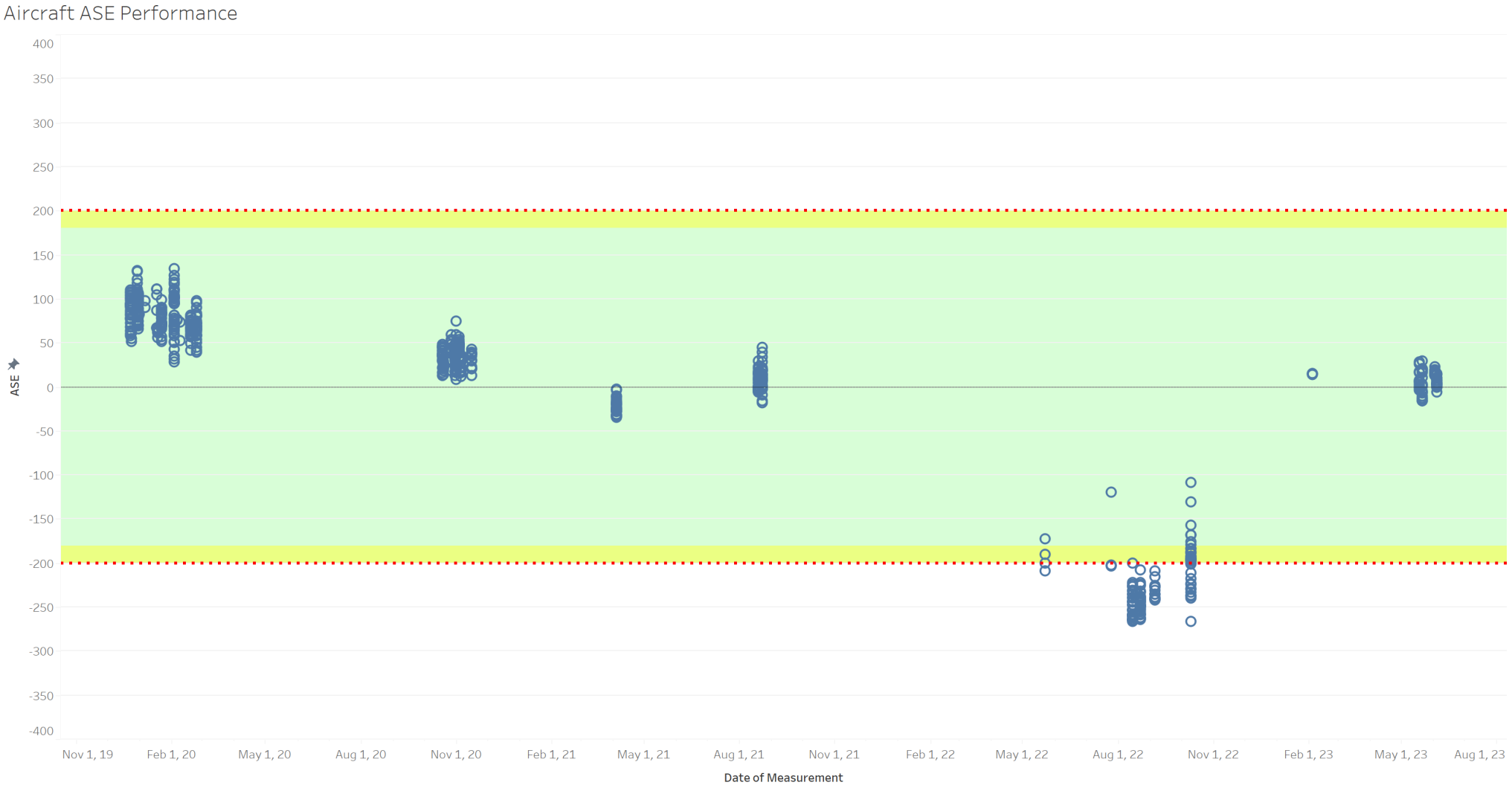


ASE Performance by Aircraft

Case 4: Missed detection

- 2019 data shows moderate performance.
- 2020 measurements show an apparent improvement, however it was likely only measurements from one altimeter were being detected.
- For an unknown reason, NAARMO started seeing more data from the other altimeter in early 2021.
- Around August 2021, NAARMO detected the large ASE, but it appeared to have improved.
- After that brief period, more poor performance was detected and the operator was notified of the large ASE.
  - the operator reported that they had been perceiving a split in the cockpit for a long time.
- Maintenance was completed and the operator reported that the split in the cockpit was reduced, but it appears the good altimeter actually got worse.
- Large ASE was detected in June 2022 and data in 2023 continues to be poor as the operator works on the aircraft.

Case 5: Aircraft Repaired – ASE Performance Restored



Case 5: ASE Performance Restored

- After large ASE was detected, operator was notified.
  - In early 2022, an issue during maintenance caused the large ASE.
- In late 2022, maintenance was performed that put the aircraft back into the correct configuration.
  - The installation of Garmin avionics for use in RVSM requires aircraft specific software including the loading of RVSM enablement cards. The operator reported that one of the corrective actions for this aircraft was reloading of the RVSM enablement feature per the supplement type certificate (STC).
- While this aircraft did fly in RVSM, most flights did not align with the previous monitoring policy to monitor once a week, so there were no flights monitored for some time before NAARMO could confirm that the aircraft was repaired.
- In early 2023, all measurements indicated that the aircraft performance had been restored, with an ASE near 0 feet.

Large ASE Cases & Increased Monitoring

- ADS-B is continually detecting flights daily for ASE in the US airspace.
- ASE monitoring only once a week was not sufficient for detecting all large ASE cases.
  - Daily monitoring is preferred in order to promptly detect all cases of large ASE.
- As shown in these examples, insufficient data can lead to missed detections or perceived improvements that are incorrect.
- The NAARMO Watch List process continues to be refined to efficiently detect large ASE cases.
  - Challenges include aircraft which do not regularly fly in RVSM airspace, generating limited data.
  - All large ASE cases detected automatically for the Watch List are verified manually.
  - The return to daily monitoring is improving the reliability of the Watch List process.
  - Increased cooperation with FAA Flight Standards, FAA inspectors, and operators has brought more awareness to the issue of large ASE and more data on how to resolve it.