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FORUM FOR ENHANCED RELIABILITY AND MAINTAINABILITY STANDARDS (FERMS)

Tools for Evaluating the Dispatch Reliability and
Operational Availability of Business Aircraft

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Introduction

The NBAA Forum for Enhanced Reliability and Maintainability Standards (FERMS) provides a framework for measuring the reliability of business aircraft. Strict formulas and definitions describe these measures in terms of dispatch reliability and operational availability. To use these formulas, operators should track relevant maintenance events for their aircraft, keeping data on the number of flight hours and landings at the time of each event. Using this information, and the dispatch reliability and operational availability formulas developed by NBAA, operators can evaluate the reliability and maintainability of their aircraft.

Dispatch Reliability

Dispatch Reliability is the percentage of scheduled departures that do not incur a delay, cancellation, turn back or diversion. Dispatch Reliability is calculated using the following formula:

$$\text{Dispatch Reliability} = \frac{(\text{Departures} - \text{Delays})}{(\text{Departures} + \text{Cancellations})} \times 100 \text{ (in percent)}$$

The following clarification applies to the general Dispatch Reliability formula:

- For ease of reporting by the operator, departures will be equal to the number of landings
- Air turn backs and diversions shall be considered to be a cancellation. Ground turn backs shall be considered to be either a delay or a cancellation
- A cancellation supersedes a delay (i.e., a flight which is canceled after having been delayed, is considered to be a cancellation only - not a delay and a cancellation)
- Cancellations shall include flights for which another aircraft was substituted
- Only delays of 30 minutes or more shall be included in the dispatch reliability calculations
- Only delays, or cancellations caused by maintenance or known or suspected mechanical malfunctions of the aircraft, its systems or components shall be included
- Only the initial cancellation or delay is counted for calculating Dispatch Reliability rate, even if several subsequent flights are canceled or delayed because of the initial cancellation or delay
- Delays or Cancellations will be identified as Chargeable or Nonchargeable. Only chargeable delays and cancellations shall be counted in the Dispatch Reliability rate calculations
- **Chargeable events** are defined as:
 - Delays, or cancellations caused by known or suspected mechanical malfunctions of the aircraft, its systems, or components not defined as nonchargeable

• **Non-chargeable events** are defined as:

- Malfunctions, delays, cancellations or failure of the aircraft, its systems or components, caused by accidental damage, foreign object damage (FOD), random events: (e.g. bird strikes, lightning strikes, weather), misuse, neglect or unauthorized repairs
- Malfunctions, delays, cancellations or failure of the aircraft, its systems or components, attributed to the use of non-approved spares or equipment
- Deferrable snags: which may be deferred within the terms of the MEL or CDL. Note that if the amount of time required to clear such a snag in accordance with the MEL/CDL makes it impossible to avoid a delay, then the delay would be counted as chargeable - but it is expected that the MEL/CDL would normally preclude a cancellation
- Replacement of Time Limited parts at their time limit or wearout parts at their wear limit will not be used as a reason for a delay or cancellation
- Prolonged Overnight Maintenance: When overnight maintenance is not completed in time for the first flight of the day.
- Modification Action: Where scheduled maintenance (including modification action) that could be performed during overnight maintenance is instead performed during daytime operational hours
- Post flight squawks not corrected prior to the next scheduled flight when time permitted

Operational Availability

Operational Availability is a measurement of the percentage of time the aircraft is available for flight. It is defined as the ratio of Aircraft Available Time versus Total Calendar Time in hours.

Aircraft Available Time is defined as the **Total Calendar Time** minus all scheduled, unscheduled and planned maintenance.

Operational Availability can be measured using the following formula:

$$\text{Operational Availability} = \frac{\text{Total Time} - \left(\begin{array}{l} \text{Scheduled Maintenance} + \\ \text{Unscheduled Maintenance} + \\ \text{Planned Maintenance Downtime} \end{array} \right)}{\text{Total Time}} \times 100 \text{ (in percent)}$$

Operational Availability is impacted by the operator's maintenance organization and the aircraft's utilization. In order to allow for comparisons, the average and standard deviation of the fleet's annual flying hours and the number of qualified mechanics per aircraft shall be specified when providing a fleet's operational availability.

Total Time and Downtime Measurement

- The total time is the elapsed calendar time and is based on a 24 hours/seven days per week calendar. Total time is measured in hours
- The downtime starts when:
 - The aircraft is not available due to maintenance
- The downtime shall end when
 - The aircraft is returned to service in accordance with regulations
- The downtime shall include administrative and logistics delays such as but not limited to:
 - Downtime due to lack of spare parts
 - Downtime due to lack of facilities (e.g. Service Center)
 - Downtime required to complete all regulatory paperwork
 - Downtime due to lack of qualified personnel
 - Downtime due to maintenance organization not operating on a 24 hours/seven day per week schedule
- When several maintenance tasks are conducted in parallel, the total downtime shall not exceed the elapsed time
- To ease reporting, downtime measurements may be made in blocks of 12 hours (half-day) or the operator may choose to report by the hour

- When this method of reporting downtime is used, downtime of less than 12 hours shall be reported as 12 hours. No fraction of 12 hours can be used. In order to allow for comparisons, it shall be specified that this methodology be used when providing a fleet's operational availability
- Downtime shall be reported as Scheduled, Unscheduled, Planned and Other Maintenance Downtime
 - **Scheduled Maintenance Downtime** is defined as the downtime due to maintenance performed at defined intervals to retain an item in a serviceable condition by systematic inspection, detection, replacement or wearout items, adjustment, calibration, etc. (e.g., Chapters 4 and 5 Maintenance Tasks and Chapter 12 Servicing tasks). It also includes any unscheduled downtime resulting from carrying out this maintenance
 - **Unscheduled Maintenance Downtime** is defined as the downtime due to maintenance performed to restore an item to a satisfactory condition by providing correction of a known or suspected malfunction and/or defect. It also includes the downtime for deferred snags
 - **Planned Maintenance Downtime** is defined as the downtime due to required modifications (i.e., A/D, Alert and Recommended S/B)
 - **Other Maintenance Downtime:** When several maintenance tasks are conducted simultaneously, the maintenance downtime shall be reported under the category "Other"
- The following downtime are excluded from the Operational Availability calculations:
 - Downtime of less than two hours
 - Performing miscellaneous tasks, such as replacing light bulbs, of less than two hours each but that collectively took more than two hours shall also be excluded
 - Downtime out of the OEM's control such as random events (e.g., bird strikes, lightning strikes, weather events, etc.), FOD, aircraft misuse, neglect, non-OEM STC, modifications, unauthorized repairs, use of non-approved parts, incidents or accidents (e.g. towing incidents, hard/overweight landings, etc.) or damage (e.g., tire cuts)
 - Discretionary A/C Servicing (e.g., A/C washing); however, Chapter 12 maintenance servicing tasks are included
 - Optional Maintenance Downtime (i.e. Incorporation of STC, optional S/B, interior remodeling, A/C painting, etc.)
 - All non-aircraft related downtime: weather, lack of flight personnel, etc.

Frequently Asked Questions

What maintenance events should not be calculated?

The following categories of non-chargeable maintenance event should not be used in the calculation:

- Malfunctions, delays, cancellations or failure of the aircraft, its systems or components, caused by accidental damage, foreign object damage (FOD), random events: (e.g. bird strikes, lightning strikes, weather), misuse, neglect or unauthorized repairs
- Malfunctions, delays, cancellations or failure of the aircraft, its systems or components, attributed to the use of non-approved spares or equipment
- Deferrable snags: which may be deferred within the terms of the MEL or CDL. Note that if the amount of time required to clear such a snag in accordance with the MEL/CDL makes it impossible to avoid a delay, then the delay would be counted as chargeable - but it is expected that the MEL/CDL would normally preclude a cancellation
- Replacement of Time Limited parts at their time limit or wearout parts at their wear limit will not be used as a reason for a delay or cancellation
- Prolonged Overnight Maintenance: When overnight maintenance is not completed in time for the first flight of the day.
- Modification Action: Where scheduled maintenance (including modification action) that could be performed during overnight maintenance is instead performed during daytime operational hours
- Post flight squawks not corrected prior to the next scheduled flight when time permitted

Can I track multiple entries with the same date, hours and landings?

Yes, however, regardless of how much time taken to resolve each item, only the total accumulated time for aircraft out-of-service is measured. The combined downtime for all maintenance events on a particular day should not exceed the aircraft's total time out of service for that day. FERMS measures operational availability, not total man-hours.

For example, if two maintenance actions are accomplished concurrently in a six-hour period and each takes four hours, two individual maintenance event can be tracked, each with three hours of downtime. Or, if a particular maintenance event has higher priority than the other, and needs to be tracked closely, the actual time to resolve the item can be logged for the primary maintenance event, and the remaining balance of the overall downtime can be used for the second event.

When should the trip impact of "Cancellation" be chosen for maintenance events?

Cancellations should not be included for maintenance events that meet any of the following conditions:

- Malfunctions, delays, cancellations or failure of the aircraft, its systems or components, caused by accidental damage, foreign object damage (FOD), random events (e.g., bird strikes, lightning strikes, weather), misuse, neglect or unauthorized repairs
- Malfunctions, delays, cancellations or failure of the aircraft, its systems or components, attributed to the use of non-approved spares or equipment
- Deferrable snags, which may be deferred within the terms of the MEL or CDL. Note that if the amount of time required to clear such a snag in accordance with the MEL/CDL makes it impossible to avoid a delay, then the delay would be counted as chargeable. However, it is expected that the MEL/CDL would normally preclude a cancellation
- Replacement of time-limited parts at their time limit or wear-out parts at their wear limit will not be used as a reason for a delay or cancellation

What is the definition of "Downtime Hours"?

Downtime starts when the aircraft is not available due to maintenance. Downtime shall end when the aircraft is returned to service in accordance with regulations. Downtime shall include administrative and logistics delays such as but not limited to:

- Downtime due to lack of spare parts
- Downtime due to lack of facilities (e.g. Service Center)
- Downtime required to complete all regulatory paperwork
- Downtime due to lack of qualified personnel
- Downtime due to Maintenance Organization not operating on a 24 hours/7 day per week schedule

When several maintenance tasks are conducted in parallel, the total downtime shall not exceed the elapsed time.

What is the definition of "No Impact"?

"No Impact" is selected for all maintenance entries that do not meet the criteria for a delay or cancellation (i.e., scheduled maintenance events)

What is the definition of "Total Time"?

The total time is the elapsed calendar time, in hours, from the aircraft's "Starting Date" and the date of the most recent maintenance event



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ABOUT NBAA

Founded in 1947 and based in Washington, DC, the National Business Aviation Association (NBAA) is the leading organization for companies that rely on general aviation aircraft to help make their businesses more efficient, productive and successful. Contact NBAA at 800-FYI-NBAA or info@nbaa.org. Not a member? Join today by visiting www.nbaa.org/join.