

2000

Chapter 13 – Industry Metrics

Revision 2014.1



ATA e-BUSINESS PROGRAM

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Highlights

Release History

Revision 2016.1 – divided specification into separate volumes related to different business functions

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First Issue: March 20, 1987

Revision 2016.1

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Introduction

Background

It has long been recognized by both airlines and aircraft material suppliers that significant productivity gains and cost reductions can be achieved through rapid, standardized communication of information. It is with these objectives in mind that ATA Spec 200 was developed in the late 50's for the electronic interchange of provisioning, order placement and shipment information.

Technology at that time dictated that ATA Spec 200 be developed in a punch card oriented environment. As the years went by, the limitations of 80-column cards created the need for "workarounds", resulting in a complex specification requiring constant revisions.

Maintenance of the Air Transport Association (ATA) SPEC 200 has been the responsibility of the Maintenance and Coordination Task Force of the ATA Inventory Planning and Supply Data Group. Meetings were held twice a year, where both airline and supplier representatives submitted, reviewed, and mutually agreed to questions and changes to the Spec.

ATA Spec 200 evolved to an international specification with participation from both international airlines and suppliers.

In 1984, a joint airlines/supplier ATA task force was formed to define the future direction the air transport industry should take in this area of material related information exchange.

Specification 2000, as described in the following pages, is the result of the efforts of many dedicated men and women representing the airline and manufacturer/supplier industries.

Over time, additional business functions have been included beyond Material Management, including bar-coding and RFID, Reliability Data Exchange, Industry Metrics, Warranty Claim Submittal, Delivered Parts Status, Authorized Release Certificates and Electronic Logbook.

In 2016, the business functions are being separated into separate volumes to better manage each function's revisions and release of changes. Note: In 2016, the business functions are being separated into separate volumes to better manage each function's revisions and release of changes. This front matter is being maintained as a single document which will be included with each separate volume. The volumes are listed below:

Spec 2000 – Provisioning (ch. 1)

Spec 2000 – Procurement Planning (ch. 2)

Spec 2000 – Materiel Management (ch. 3 – 4, 6)

Spec 2000 – Information and Data Exchange (ch. 5) discontinued 2016

Spec 2000 – Repair Order Administration (ch. 7)

Spec 2000 – Repair/Overhaul Planning (ch. 8) discontinued 2014

Spec 2000 – Automated Identification and Data Capture (ch. 9)

Spec 2000 – ASC X12 Implementation Guide (ch. 10) discontinued 2016

Spec 2000 – Reliability Data Collection and Exchange (ch. 11)

Spec 2000 – Airline Inventory Redistribution System - AIRS (ch. 12)

Spec 2000 – Industry Metrics (ch.13)

Spec 2000 – Warranty Claims (ch. 14)

Spec 2000 – Aircraft Transfer Parts List (ch. 15)

Spec 2000 – Authorized Release Certificate (ch. 16)

Spec 2000 – Electronic Logbook (ch. 17)



General Description

Chapter 1 - Provisioning

Provisioning is the process of selecting parts, equipment and related support materials necessary for the operation of aircraft or special equipment. Parts and materials also include those necessary for the repair and overhaul of repairable spare parts. This chapter specifies those data elements, formats and transmission procedures required of airframe, engine and equipment manufacturers in providing technical provisioning information to airlines.

Chapter 2 - Procurement Planning

The Procurement Planning chapter identifies the automated methods for the supplier to provide data for parts offered for sale, the quotation process for parts where insufficient or nonexistent data resides in the central procurement data base, and the capabilities of the Central Procurement Data Base System.

Chapter 3 - Order Administration

The Order Administration chapter describes the automated order placement process, the on-line inquiries to determine the order status, on-line order exception routines, and automated shipment advisories.

Chapter 4 - Customer Invoicing

The Customer Invoicing chapter describes the automated invoicing process, as well as the related exceptions pertaining to the process.

Chapter 5 - Information and Data Exchange

Discontinued

Chapter 6 - Communication Commands

The Acknowledgement and Communication Commands chapter describes the methods of communication common to all chapters, the simple acknowledgement of receipt command, the general requirements of initiating commands, and special features contained within the process of obtaining who-to contact information or broadcasting information to multiple participants through the capabilities of the communications system.

Chapter 7 - Repair Order Administration

The Repair Order Administration chapter describes the automated repair order process. This includes the on-line processes for quotations, repair orders and order-exception routines, tear-down reporting, shipment advisories (for both airline and repair agent), invoices and repair order status.

Chapter 8 – Discontinued

Discontinued

Chapter 9 - Automated Identification and Data Capture

This chapter identifies the AIDC requirements for receipts and permanent part marking. It also identifies the data requirements for RFID on Parts. Finally, it presents a framework for ensuring lifecycle part traceability.

Chapter 10 - SPEC2000/ASC X12 Implementation Guide

The Implementation Guide was developed as a companion to SPEC2000; it contains the format for electronically exchanging order administration, invoicing and payment order/remittance advice information between trading partners.

Chapter 11 - Reliability Data Collection & Exchange

The purpose of this chapter is to provide a set of standardized record formats for collecting and exchanging aircraft reliability data. This chapter defines standard record formats for collecting and exchanging aircraft reliability data. This will improve the collection, measurement, and exchange of this information in a consistent format – ultimately improving efficiency and reducing both costs and errors.

Chapter 12 - Airline Inventory Redistribution System (AIRS)

The AIRS program provides a means by which participants may publish worldwide in a single source data file a listing of their airframe, avionics, testing equipment, engine, expendables, rotables, tooling and ground equipment which are available for sale. Included are commands exchanged between purchasers and sellers regarding quotes and sale transactions.

Chapter 13 - Industry Metrics

This chapter creates a number of standard process performance metrics, beginning with six common business processes which are reliability, repair process, parts delivery process, technical issue resolution, product support data and warranty process. The definitions and data described in the chapter allow trading partners to measure each other's performance using consistent definitions of terms, allowing companies to improve processes in a more consistent manner.

Chapter 14 – Warranty Claims

The Warranty chapter defines XML formats for submitting Warranty Claims.

Chapter 15 - Aircraft Transfer Parts List

This chapter provides a standardized XML format for providing a list of major installed parts (typically serialized parts) from a manufacturer to an operator or from an operator to another operator or lessor.

Chapter 16 – Authorized Release Certificate

This chapter provides a standardized set of data formats and implementation guidelines for the electronic exchange of Authorized Release Certificates (e.g. 8130-3, Form 1, etc.) for aircraft products and parts.

Chapter 17 - Electronic Logbook

This chapter provides a standardized set of XML data formats for electronic logbook applications, primarily focused on data exchange between aircraft based electronic logbook applications and ground-based maintenance and reliability systems.

Purpose and Objectives

The purpose of SPEC2000 is to provide cost effective, state of the art techniques and standards which will be generally accepted by the Commercial Aviation Industry as the means for assuring optimum Communication/Data Exchange. It is important that this purpose and the following objectives be continually emphasized so that the specification will remain current to technology advancement in the future, as well as to adjust to Industry's requirements in an ever changing environment.

- To provide standards for the most cost effective exchange of information pertaining to aircraft related material and maintenance, between airlines, manufacturers, suppliers, MRO's and other related parties.
- To provide methods which are usable by the widest possible population of companies in the aviation industry.
- To provide a comprehensive and user friendly specification.
- To facilitate the identification and visibility of warranty items subject to repair by repair agencies.
- To attract a broad base of industry participation.
- To minimize reprogramming efforts in the transition from previous methods and standards to any new methods.
- To provide a framework upon which advancements can be made with future technological developments, while maintaining cost effectiveness, productivity gains, and standardization.

How to Implement

Implementation of SPEC2000 is most feasible by chapter or, in some cases, by parts of a chapter. Since the majority of the chapters describe information exchange formats between companies, you should work with your trading partners on what parts of the specification to implement.

Implementation of many chapters is facilitated by the use of software provided by third parties, or often as a part of internal ERP or Maintenance Planning or Material Management software. Often times the majority of the information being exchanged already exists within a company's systems, and the main part of implementation involves mapping the data to formats described in the chapters.

Maintenance

SPEC2000 is maintained by the ATA e-Business Program. Proposed changes may be submitted through the Change Request (CR) procedure within the ATA e-Business Program at www.ataebiz.org.

Any approved modifications to the specification shall be documented and included as revisions to the original specification. Implementation of revisions to the specification is left to each participant.

For more information about maintenance of the specification, contact:

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Chapter 13. Performance Metrics Standards

13-1. Overview

1. Purpose

Many companies are implementing continuous improvement programs which often involve implementing internal and external measurement systems. As these external measurement systems are being implemented, trading partners are finding many variations as to how companies define similar concepts and how they are demanding to be measured. This chapter is dedicated to performance metric standards that support contractual requirements, business needs, and ensure simplicity and consistency in the aerospace industry. The assumptions, parameters and definitions for the performance metrics outlined in this document establish a standard for measuring key processes.

This chapter creates a number of standard process performance metrics, beginning with six common business processes. It also includes new, modified, or existing Common Support Data Dictionary (CSDD) definitions that will enable common detailed language between trading partners.

The six key processes are shown below, along with the existing area of Spec 2000 which pertains to the corresponding process:

Table 13-1.1. Business Processes

Business Process	Spec 2000 Functional Area
Component Reliability	Chapter 11 - Reliability Data Collection/Exchange Chapter 11
Component Repair	Chapter 7 - Repair Order Administration Chapter 7 Chapter 8 - Repair/Overhaul Planning Chapter 8
Parts Delivery	Chapter 2 - Procurement Planning Chapter 2 Chapter 3 - Order Administration Chapter 3
Product Support Data	iSpec 2200 - Information Standards for Aviation Maintenance
Technical Issue Resolution	Not Applicable
Warranty Process	Chapter 14 - Warranty Chapter 14

Trading partners can implement any or all of the metrics listed as mutually agreed.

2. Benefits

Simplification and standardization of performance metrics will enable a common language between trading partners. Trading partners who choose to utilize these metrics will be better positioned to drive improvement of their processes by starting with consistent standards of measurement. These improvements can lead to:

- Reduced cost of ownership.
- Minimized schedule interruptions.

- Improved product design through data collection.
- Improved passenger perception.
- Improved future maintenance plans.
- Improved root cause analysis.
- Improved Industry benchmarking.

3. Process Section

The following describes the format of each process area within the chapter:

1. **Introduction** - Identifies what the sub-process is about.
2. **Purpose** - Identifies the purpose of the sub-process.
3. **Process Flow** - Identifies typical steps within the business process and splits these steps into customer processes, supplier processes, or transportation agent processes.
4. **Metrics** - Lists the definition and equation for all metrics within a sub-process.
5. **Summary Data** - Identifies the top level data elements required for the exchange of the calculated metric between trading partners.
6. **Detail Data** - Identifies all the data elements required to support the development and calculation of the metric.

Note:	Common XML data exchange formats will be released in or prior to the next revision of Spec 2000.
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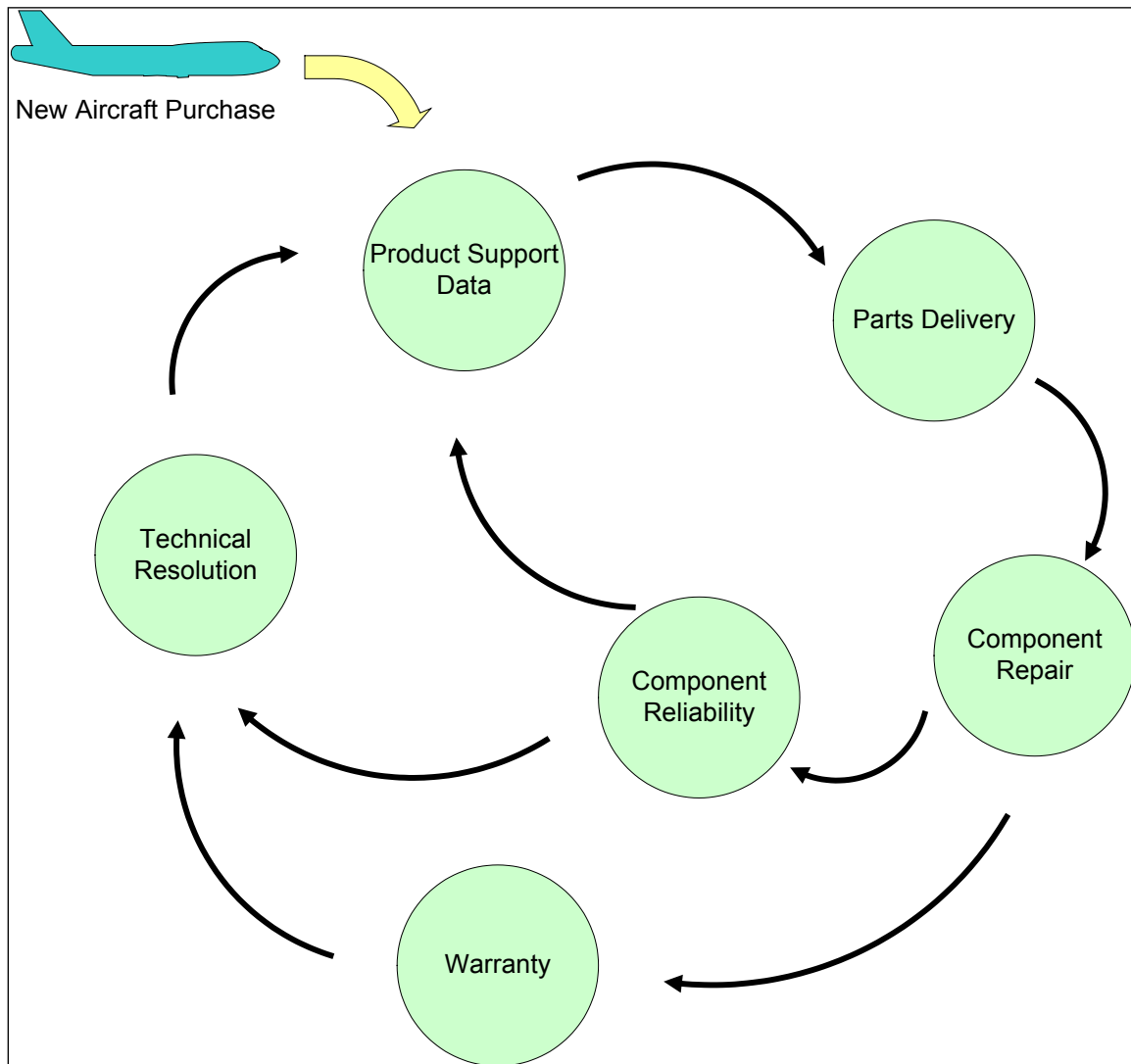
4. Ground Rules/Assumptions

Below are assumptions / ground rules that are incorporated into the data:

- Exchange of data is based on the agreement reached between Trading Partners.
- Reporting periods are in calendar days.
- Dates are reported in local time of supplier reporting.
- Dates are in [ISO 8601](#) format YYYY-MM-DD.

5. Key Process Integration

Figure 13-1.1. Key Process Integration



13-2. Reliability

1. Introduction

Reliability Process Metrics are a measurement that relates the performance of a component, system, aircraft or engine against an agreed upon customer expectation. The Reliability Process Metrics contained within this section are divided into five categories: Dispatch Metrics, Service Difficulty Metrics, Component Reliability Metrics, Logbook Metrics and Availability Metrics.

The detailed in-service reliability and maintenance data used to develop the **Reliability** Process Metrics are described in [Chapter 11](#). The data format and rules defined in [Chapter 11](#) are the inputs used to calculate the metrics (outputs) defined in this chapter. Historical data will be exchanged and retained per the agreements of [Chapter 11](#). The exchanged data can consist of components, systems, aircraft or engine.

The reporting period of data submittals will be agreed upon between trading partners.

Note: In this section where the terms “Flight Hours” or “flight-hours” are used, they shall mean “Hours between wheels-off to wheels on”, as is the convention in the field of Reliability and Maintainability.

2. Purpose

These reliability metrics provide measurements to assess the ability of the aircraft, system, subsystem or component to perform its required functions under stated conditions.

Note that other methods exist that calculate the metrics defined herein based on mathematical formulations in accordance with statistical Estimation Theory. However, the formulas herein are defined to facilitate the use of the data collected via Chapter 11 to calculate the metric values.

3. Process Flow

Figure 13-2.1. Reliability Flow

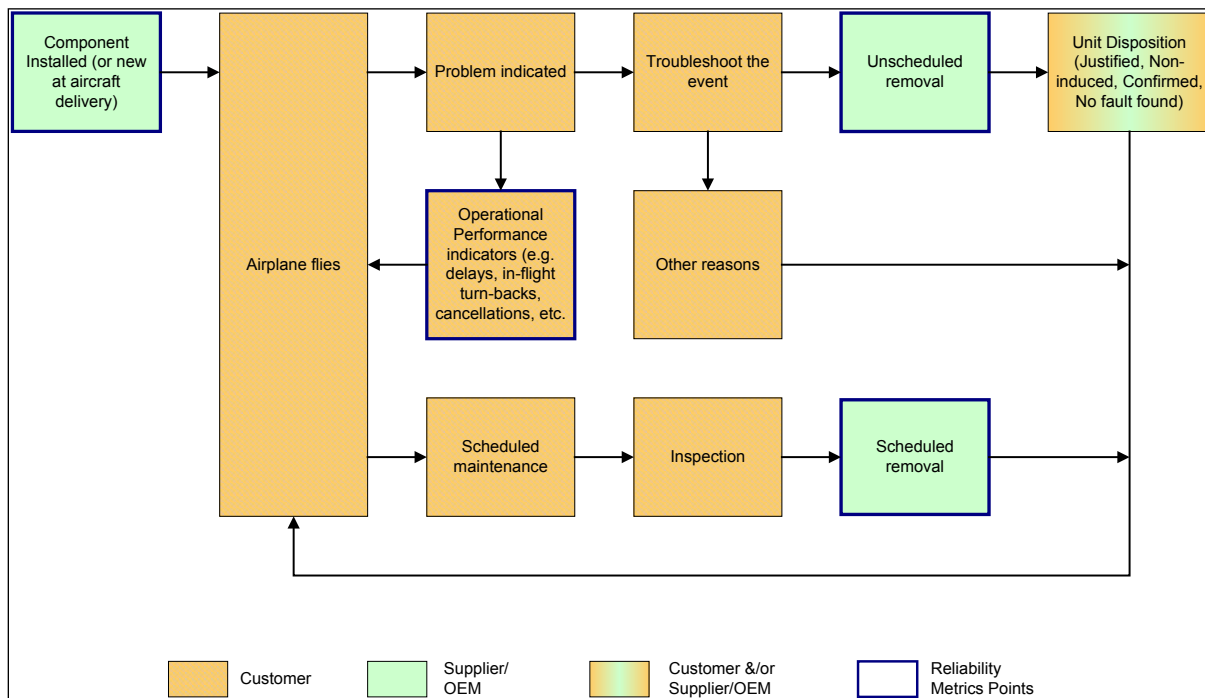
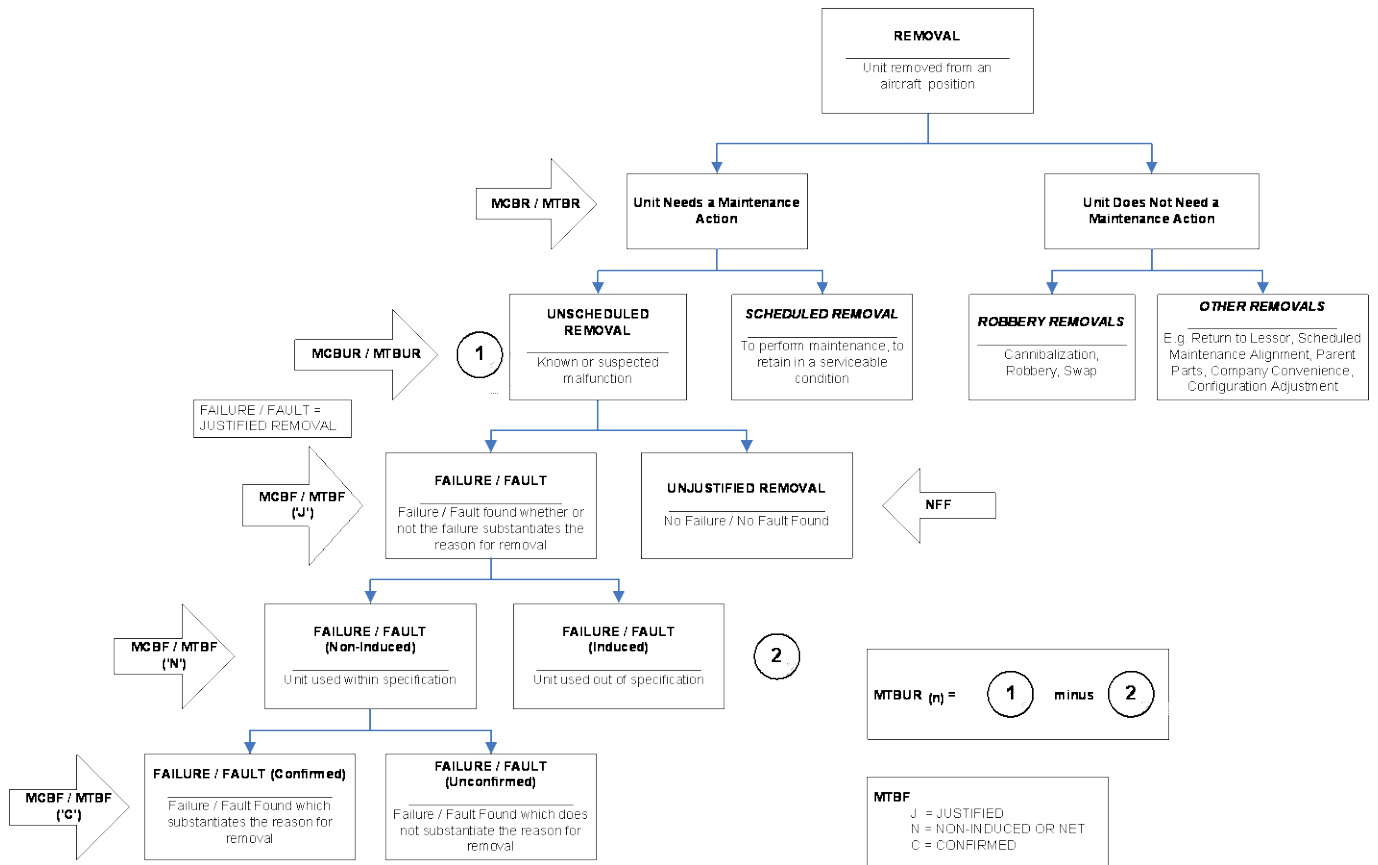


Figure 13-2.2. Removal Findings Decision Tree



4. Metrics

4.1 Dispatch Metrics

The metrics defined in this section are calculated with data from the [Aircraft Event Record](#) and [Hours & Landings Record](#) of Chapter 11.

Note that in each of the metrics described in this section there is a principle that for a single technical problem, there shall be only one event countable for the metric.

4.1.1 Technical Dispatch Reliability (TDRL)

4.1.1.1 Definition

Technical Dispatch Reliability is the percentage of scheduled revenue departures that do not incur a primary technical delay, or a primary technical cancellation.

$TDRL = \{1 - (\text{Primary Delays} + \text{Primary Cancellations}) / \{\text{Revenue Departures} + \text{Primary Cancellations}\}$

4.1.1.2 Formula

$$TDRL = \left\{1 - \frac{\sum x_i}{\sum \langle MDR_i \rangle + \sum \langle CNX_i \rangle}\right\} * 100\%$$

Where:

If ($\langle DLY \rangle = 1$ or $\langle CNX \rangle = 1$) and ($\langle ICD \rangle = P$ or $\langle ICD \rangle$ not provided) and ($\langle REI \rangle \neq Y$), $x_i = 1$

This formula yields TDRL Chargeable (see Paragraph 4.1.9). $[TDRL_c]$

- If the condition $\{\langle REI \rangle \neq Y\}$ were removed in calculating x_i , the formula would yield TDRL Chargeable+Non-Chargeable. $[TDRL_{cnc}]$
- If the condition $\{\langle REI \rangle \neq Y\}$ were removed in calculating x_i , but we excluded delays where $\langle TMD \rangle \leq 15$ the formula would yield TDRL Chargeable+Non-Chargeable > 15 Minutes. $[TDRL_{cnc>15}]$

4.1.2 Technical Dispatch Interruption Rate (TDIR)

4.1.2.1 Definition

Technical Dispatch Interruption Rate is the number of primary technical delays, and primary technical cancellations incurred per 100 scheduled revenue departures.

$TDIR = \{\text{Primary Delays} + \text{Primary Cancellations}\} / \{\text{Revenue Departures} + \text{Primary Cancellations}\}$

4.1.2.2 Formula

$$TDIR = \left\{ \frac{\sum x_i}{\sum \langle MDR_i \rangle + \sum \langle CNX_i \rangle} \right\} * 100 \quad \text{per 100 scheduled revenue departures}$$

Where:

If ($\langle DLY \rangle = 1$ or $\langle CNX \rangle = 1$) and ($\langle ICD \rangle = P$ or $\langle ICD \rangle$ not provided) and ($\langle REI \rangle \neq Y$), $x_i = 1$

This formula yields TDIR Chargeable (see Paragraph 4.1.9). $[TDIR_c]$

- If the condition $\{\langle REI \rangle \neq Y\}$ were removed in calculating x_i , the formula would yield TDIR Chargeable+Non-Chargeable. $[TDIR_{cnc}]$

- If the condition $\{<REI>\neq Y\}$ were removed in calculating x_i , but we excluded delays where $<TMD>\leq 15$ the formula would yield TDIR Chargeable+Non-Chargeable>15Minutes. [TDIR_{cnc}>15]

4.1.3 Schedule Reliability (SREL)

4.1.3.1 Definition

Schedule Reliability is the percentage of scheduled revenue departures that do not incur a primary technical delay, primary technical cancellation, diversion or air turn back.

$SREL = \{1 - (\text{Primary Delays} + \text{Primary Cancellations} + \text{Diversions} + \text{Air Turnbacks})\} / \{\text{Revenue Departures} + \text{Primary Cancellations}\}$

4.1.3.2 Formula

$$SREL = \left\{1 - \frac{\sum x_i}{\sum <MDR_i> + \sum <CNX_i>} \right\} * 100\%$$

Where

If ($<DLY> = 1$ or $<CNX> = 1$ or $<ATB> = Y$ or $<DIV> = Y$ or $<GAI>=Y$) and ($<ICD> = P$ or $<ICD>$ not provided) and ($<REI>\neq Y$), $x_i = 1$

This formula yields SREL Chargeable (see Paragraph 4.1.9). [SREL_c]

- If the condition $\{<REI>\neq Y\}$ were removed in calculating x_i , the formula would yield SREL Chargeable+Non-Chargeable. [SREL_{cnc}]
- If the condition $\{<REI>\neq Y\}$ were removed in calculating x_i , but we excluded delays where $<TMD>\leq 15$ the formula would yield SREL Chargeable+Non-Chargeable>15Minutes. [SREL_{cnc}>15]

4.1.4 Schedule Interruption Rate (SIRT)

4.1.4.1 Definition

Schedule Interruption Rate is the number of primary technical delays, primary technical cancellations, diversions and air turn backs incurred per 100 scheduled revenue departures.

$SIRT = \{\text{Primary Delays} + \text{Primary Cancellations} + \text{Diversions} + \text{Air Turnbacks}\} / \{\text{Revenue Departures} + \text{Primary Cancellations}\}$

4.1.4.2 Formula

$$SIRT = \left\{ \frac{\sum x_i}{\sum <MDR_i> + \sum <CNX_i>} \right\} * 100 \text{ per 100 scheduled revenue departures}$$

Where

If ($<DLY> = 1$ or $<CNX> = 1$ or $<ATB> = Y$ or $<DIV> = Y$ or $<GAI>=Y$) and ($<ICD> = P$ or $<ICD>$ not provided) and ($<REI>\neq Y$), $x_i = 1$

This formula yields SIRT Chargeable (see Paragraph 4.1.9). [SIRT_c]

- If the condition $\{<REI>\neq Y\}$ were removed in calculating x_i , the formula would yield SIRT Chargeable+Non-Chargeable. [SIRT_{cnc}]
- If the condition $\{<REI>\neq Y\}$ were removed in calculating x_i , but we excluded delays where $<TMD>\leq 15$ the formula would yield SIRT Chargeable+Non-Chargeable>15Minutes. [SIRT_{cnc}>15]

4.1.5 Technical Cancellation Performance (TCPF)

4.1.5.1 Definition

Technical Cancellation Performance is the percentage of scheduled revenue departures that do not incur a primary technical cancellation.

$$TCPF = \{1 - (\text{Primary Cancellations})\} / \{\text{Revenue Departures} + \text{Primary Cancellations}\}$$

4.1.5.2 Formula

$$TCPF = \left\{1 - \frac{\sum x_i}{\sum \langle MDR_i \rangle + \sum \langle CNX_i \rangle}\right\} * 100\%$$

Where

If ($\langle CNX \rangle = 1$) and ($\langle ICD \rangle = P$ or $\langle ICD \rangle$ not provided) and ($\langle REI \rangle \neq Y$), $x_i = 1$

This formula yields TCPF Chargeable (see Paragraph 4.1.9). [TCPF_c]

If the condition $\{\langle REI \rangle \neq Y\}$ were removed in calculating x_i , the formula would yield TCPF Chargeable+Non-Chargeable. [TCPF_{cnc}]

4.1.6 Technical Cancellation Rate (TCNR)

4.1.6.1 Definition

Cancellation Rate is the number of primary technical cancellations incurred per 100 scheduled revenue departures.

TCNR = $\{\text{Primary Cancellations}\} / \{\text{Revenue Departures} + \text{Primary Cancellations}\}$ per 100 scheduled departures.

4.1.6.2 Formula

$$TCNR = \left\{ \frac{\sum x_i}{\sum \langle MDR_i \rangle + \sum \langle CNX_i \rangle} \right\} * 100 \quad \text{per 100 scheduled revenue departures}$$

Where

If ($\langle CNX \rangle = 1$) and ($\langle ICD \rangle = P$ or $\langle ICD \rangle$ not provided) and ($\langle REI \rangle \neq Y$), $x_i = 1$

This formula yields TCNR Chargeable (see Paragraph 4.1.9). [TCNR_c]

If the condition $\{\langle REI \rangle \neq Y\}$ were removed in calculating x_i , the formula would yield TCNR Chargeable+Non-Chargeable. [TCNR_{cnc}]

4.1.7 Technical Completion Rate (TCRT)

4.1.7.1 Definition

Technical Completion Rate is the percentage of scheduled revenue departures that do not incur a primary technical cancellation, diversion or air turn back.

TCRT = $\{1 - (\text{Primary Cancellations} + \text{Diversions} + \text{Air Turnbacks})\} / \{\text{Revenue Departures} + \text{Primary Cancellations}\}$

4.1.7.2 Formula

$$TCRT = \left\{ 1 - \frac{\sum x_i}{\sum <MDR_i> + \sum <CNX_i>} \right\} * 100\%$$

Where

If (<CNX> = 1 or <ATB> = Y or <DIV> = Y or <GAI> = Y) and (<ICD> = P or <ICD> not provided) and (<REI> ≠ Y), $x_i = 1$

This formula yields TCRT Chargeable (see Paragraph 4.1.9). [TCRT_c]

If the condition {<REI> ≠ Y} were removed in calculating x_i , the formula would yield TCRT Chargeable+Non-Chargeable. [TCRT_{cnc}]

4.1.8 Technical Non-Completion Rate (TNCR)

4.1.8.1 Definition

Technical Non-Completion Rate is the number of primary technical cancellations, diversions or air turn backs incurred per 100 scheduled revenue departures.

$TNCR = \{\text{Primary Cancellations} + \text{Diversions} + \text{Air Turnbacks}\} / \{\text{Revenue Departures} + \text{Primary Cancellations}\}$

4.1.8.2 Formula

$$TNCR = \left\{ \frac{\sum x_i}{\sum <MDR_i> + \sum <CNX_i>} \right\} * 100 \quad \text{per 100 revenue departures}$$

Where

If (<CNX> = 1 or <ATB> = Y or <DIV> = Y or <GAI> = Y) and (<ICD> = P or <ICD> not provided) and (<REI> ≠ Y), $x_i = 1$

This formula yields TNCR Chargeable (see Paragraph 4.1.9). [TNCR_c]

If the condition {<REI> ≠ Y} were removed in calculating x_i , the formula would yield TNCR Chargeable+Non-Chargeable. [TNCR_{cnc}]

4.1.9 Aircraft Chargeable and Non-Chargeable Delays and Cancellations

4.1.9.1 Principles

The metrics Dispatch Reliability, Dispatch Interruption Rate, Schedule Reliability, Schedule Interruption Rate, Technical Cancellation Performance, Technical Cancellation Rate, Technical Completion Rate and Technical Non-Completion Rate may be calculate as a) Aircraft-chargeable rates, b) Chargeable+Non-chargeable rates.

When rates are published by airframers without qualification, they are deemed to be Aircraft-chargeable rates. When rates are published by an individual operator without qualification, they are deemed to be Chargeable+non-chargeable rates.

For those operators that use the READI Exclusion List, when the TEI “REI” in the Aircraft Event Record is coded “Y”, the respective delays and cancellations shall be considered non-chargeable. For operators that do not use this READI code, the airframers will assign this code in accordance with the criteria outlined in this Section 4.1.9.2.

For the purpose of benchmarking, we count technical delays of less than 16 minutes as non-chargeable. But it is known that many airlines account for delays as little as 1 minute. Therefore, all delays, regardless of the

length of time, need to be accounted for.

4.1.9.2 READI Exclusion List

As stated in Section 4.1.9.1 The READI Exclusion List will be used in cancellation chargeable rates. Section 4.1.9.2 provides a sample of the READI Exclusion List. For the latest READI Exclusion List contact a READI member or your airframer.

- A. Servicing - No corrective maintenance performed. All 'servicing' activities that do not require the mechanic to physically adjust or replace or defer structural repairs and replace hardware/software.
 - 1. Struts (exclude only if corrective action is addition of fluid.)
 - 2. Oil
 - 3. Hydraulic Fluid
 - 4. Lubrication - (No access required)
 - 5. All 'Servicing' activities that do not require the mechanic to physically adjust or replace or defer structural repair and replace hardware/software.
 - 6. Fueling related
 - 7. Deicing
 - 8. Water & waste (exclude if problem is result of clogged dump valves &/or drains.)
 - 9. Sanitizing/flushing
 - 10. Moisture & condensation
 - 11. Printer paper replacement
 - 12. Routine cleaning, i.e. cabin &/or windows
 - 13. Tire pressure servicing
 - 14. Oxygen (Servicing)
 - 15. Navigation database routine update
 - 16. Photo Luminescent Emergency Exit Strip Lighting charging
- B. Precautionary Maintenance - No corrective maintenance performed
 - 1. Installing/continuing placard items, i.e. MEL
 - 2. Hydraulic leaks - within limits
 - 3. Fuel leaks - within limits
 - 4. Manual closing or cycling passenger/crew/cargo door
- C. Normal Wear Maintenance
 - 1. All re-lamping
 - 2. Tires - worn past limits
 - 3. Brakes - worn past limits
 - 4. Decals/paint/appearance items
 - 5. Normal battery replacement (pilot lap-top, smoke detectors, diagnostic computer programs.
- D. Scheduled Maintenance Activities
 - 1. Completion of planned work content of scheduled:
 - A. Maintenance checks
 - B. Maintenance set-up
- E. Parts Availability Delays and Cancellations
- F. External Force Damage (Aircraft damage/Lightning Strikes, FOD, etc.)
- G. Known Personnel Error and/or Known damage by Passenger
- H. Secondary or Downline Delays and Cancellations:

A previous delay(s) or cancellation(s) of subsequent scheduled flights on the same day caused by the same problem that caused the primary delay(s) or cancellation(s)

4.1.10 Schedule Completion Rate - SCR(/Technical Regularity Rate-TRR)

4.1.10.1 Definition

Schedule Completion Rate is the percentage of scheduled revenue departures that do not incur a primary technical cancellation or a follow-on cancellations thereof.

$SCR = \{1 - (\text{Primary and Consequential Cancellations}) / \{\text{Revenue Departures} + \text{Primary and consequential Cancellations}\}$

4.1.10.2 Formula

$$SCR = \left\{1 - \frac{\sum x_i}{\sum <MDR_i> + \sum y_i}\right\} * 100\%$$

Where

If ($<CNX> = 1$) and ($<ICD> = P$ or C) and ($<REI> \neq Y$), $x_i = 1$

If ($<CNX> = 1$), $y_i = 1$

This formula yields SCR Chargeable (see Paragraph 4.1.9). $[SCR_c]$

If the condition $\{<REI> \neq Y\}$ were removed in calculating x_i , the formula would yield SCR Chargeable+Non-Chargeable. $[SCR_{cnc}]$

4.1.11 Total Cancellation Rate (ToCNR)

4.1.11.1 Definition

Total Cancellation Rate is the number of primary or consequential technical cancellations incurred per 100 scheduled revenue departures.

$ToCNR = \{\text{Primary or consequential Cancellations}\} / \{\text{Revenue Departures} + \text{Primary or consequential Cancellations}\}$ per 100 scheduled departures.

4.1.11.2 Formula

$$ToCNR = \left\{\frac{\sum x_i}{\sum <MDR_i> + \sum y_i}\right\} * 100\%$$

Where

If ($<CNX> = 1$) and ($<ICD> = P$ or C) and ($<REI> \neq Y$), $x_i = 1$

If ($<CNX> = 1$), $y_i = 1$

This formula yields ToCNR Chargeable (see Paragraph 4.1.9). $[ToCNR_c]$

If the condition $\{<REI> \neq Y\}$ were removed in calculating x_i , the formula would yield ToCNR Chargeable+Non-Chargeable. $[ToCNR_{cnc}]$

4.1.12 On-Time Departure Performance (OTDP)

4.1.12.1 Definition

On-Time Performance is the percentage of performed revenue departures that do not incur a primary technical delay.

$$OTP = \{1 - (\text{Primary X Minute Delays})\} / \{\text{Completed Revenue Departures}\}$$

4.1.12.2 Formula

$$OTP = \left\{1 - \frac{\sum y_i}{\sum <MDR_i>}\right\} * 100\%$$

Where:

If (<DLY> = 1 and (<ICD> = P or <ICD> not provided), $y_i = 1$

Discussion: Users may choose to define the minimum length of delay to be considered. Some users consider any delay more than 0 minutes. The resulting OTP would be OTP-0min. If only delays greater than 15 mins are considered the metric would be OTP-15min.

4.2 Service Difficulty Metrics

The metrics defined in this section are calculated with data from the [Aircraft Event Record](#) and [Hours & Landings Record](#) of Chapter 11.

Note that in each of the metrics described in this section there is a principle that for a single technical problem, there shall be only one event countable for the metric.

4.2.1 General Definition

Aircraft Incidents are events that cause technical service difficulties such as aborted takeoffs, air turn-backs, emergency landings, etc. All such incidents that are required to be reported to the operators' respective aviation authorities are to be reported via [Chapter 11 Aircraft Event Records](#). The metrics herein are based on such incidents

The metrics are a count of technical incident occurrences by a particular parameter (such as 2-digit ATA) per 1000 cycles, for the following event types:

Diversion (TEI -> DIV)

Air Turnback (TEI -> ATB)

Aborted Takeoff (TEI -> RTO)

Return to Gate (TEI -> GTB)

Aborted Approach (TEI -> ABT)

Emergency Descent (TEI -> EMD)

General Air Interruption (TEI -> GAI)

General Ground Interruption (TEI -> GGI)

Inflight Shutdown (TEI -> IFD)

$$\text{Incident Rate} = 1000 \left\{ (\text{Incident Count}) / (\text{total actual departures for the same period}) \right\}$$

In the formulas that follow below, we wish to calculate incident rates between Date-1 and Date-2.

$n = \text{Date-2}$ and $m = (\text{Date-1 less a day})$

And the index “i” in y_i covers the period between Date-1 and Date-2

$\langle \text{CTY} \rangle_n$ provides the cumulative cycles as point n

4.2.2 Formula – Diversion Rate (DVRT)

$$\text{Diversion Rate} = \left\{ \frac{\sum y_i}{\langle \text{CTY} \rangle_n - \langle \text{CTY} \rangle_m} \right\} * 1000 \text{ per 1000 departures, where } y_i = 1 \text{ if } \langle \text{DIV} \rangle = Y$$

4.2.3 Formula – Air Turnback Rate (ATBR)

$$\text{Air Turnback Rate} = \left\{ \frac{\sum y_i}{\langle \text{CTY} \rangle_n - \langle \text{CTY} \rangle_m} \right\} * 1000 \text{ per 1000 departures, where } y_i = 1 \text{ if } \langle \text{ATB} \rangle = Y$$

4.2.4 Formula – Aborted Takeoff Rate (ABTR)

$$\text{Aborted Takeoff Rate} = \left\{ \frac{\sum y_i}{\langle \text{CTY} \rangle_n - \langle \text{CTY} \rangle_m} \right\} * 1000 \text{ per 1000 departures, where } y_i = 1 \text{ if } \langle \text{RTO} \rangle = Y$$

4.2.5 Formula – Return to Gate Rate (RTGR)

$$\text{Return to Gate Rate} = \left\{ \frac{\sum y_i}{\langle \text{CTY} \rangle_n - \langle \text{CTY} \rangle_m} \right\} * 1000 \text{ per 1000 departures, where } y_i = 1 \text{ if } \langle \text{GTB} \rangle = Y$$

4.2.6 Formula – Aborted Approach Rate (ABAR)

$$\text{Aborted Approach Rate} = \left\{ \frac{\sum y_i}{\langle \text{CTY} \rangle_n - \langle \text{CTY} \rangle_m} \right\} * 1000 \text{ per 1000 departures, where } y_i = 1 \text{ if } \langle \text{ABT} \rangle = Y$$

4.2.7 Formula – Emergency Descent Rate (EMDR)

$$\text{Emergency Descent Rate} = \left\{ \frac{\sum y_i}{\langle \text{CTY} \rangle_n - \langle \text{CTY} \rangle_m} \right\} * 1000 \text{ per 1000 departures, where } y_i = 1 \text{ if } \langle \text{EMD} \rangle = 1$$

4.2.8 Formula – Inflight Shutdown Rate (IFSDR)

$$\text{Inflight Shutdown Rate} = \left\{ \frac{\sum y_i}{\langle \text{CTY} \rangle_n - \langle \text{CTY} \rangle_m} \right\} * 1000 \text{ per 1000 departures, where } y_i = 1 \text{ if } \langle \text{IFD} \rangle = 1$$

4.2.9 Formula – Total Air Incident Rate (TAIR)

$$\text{Total Air Incident Rate} = \left\{ \frac{\sum y_i}{\langle \text{CTY} \rangle_n - \langle \text{CTY} \rangle_m} \right\} * 1000 \text{ per 1000 departures,}$$

where $y_i = 1$ if $\langle \text{DIV} \rangle = Y$ or $\langle \text{ATB} \rangle = Y$ or $\langle \text{ABT} \rangle = Y$ or $\langle \text{EMD} \rangle = 1$ or $\langle \text{GAI} \rangle = Y$ or $\langle \text{IFD} \rangle = 1$

4.2.10 Formula – Total Incident Rate (TINR)

$$\text{Total Incident Rate} = \left\{ \frac{\sum y_i}{<CTY>_n - <CTY>_m} \right\} * 1000 \text{ per 1000 departures,}$$

where $y_i = 1$ if $<DIV>=Y$ or $<ATB>=Y$ or $<ABT>=Y$ or $<EMD>=1$ or $<GAI>=Y$ or $<RTO>=Y$ or $<GTB>=Y$ or $<GGI>=Y$ or $<IFD>=1$

4.3 Component Reliability Metrics

The metrics defined in this section are calculated with data from the [LRU Removal Record](#), [Shop Findings Record](#), and [Aircraft Hours & Landings Record](#) of Chapter 11. Many follow the Removal Findings Decision Tree shown in [Figure 13-2.2](#)

In this section the various MTBR, MTBUR, MTBF, MTTF and MTTUR metrics have been defined in terms of **unit flight-hours**. These units may be defined in terms of **unit operating-hours OR APU operating hours** (for components on the APU that function only when the APU is in operation) if the trading partners agree on the ratio between unit operating-hours and unit-flight-hours for specified components.

If for a particular component $r = \{\text{unit operating-hours}\} / \{\text{unit flight-hours}\}$, then:

MTBR in unit operating-hours = r multiplied by MTBR in unit flight-hours

That is

$$\begin{aligned} \text{MTBR}_{\text{UOH}} &= r (\text{MTBR}_{\text{UFH}}) \\ \text{MTBUR}_{\text{UOH}} &= r (\text{MTBUR}_{\text{UFH}}) \\ \text{MTBF}_{\text{UOH}} &= r (\text{MTBF}_{\text{UFH}}) \\ \text{MTTF}_{\text{UOH}} &= r (\text{MTTF}_{\text{UFH}}) \\ \text{MTTUR}_{\text{UOH}} &= r (\text{MTTUR}_{\text{UFH}}) \end{aligned}$$

Where UOH=unit operating-hours and UFH= unit flight-hours

Likewise, if $R = \{\text{APU operating-hours}\} / \{\text{Aircraft flight-hours}\}$, then:

MTBR in unit operating-hours = R multiplied by MTBR in unit flight-hours

That is

$$\begin{aligned} \text{MTBR}_{\text{AOH}} &= R (\text{MTBR}_{\text{UFH}}) \\ \text{MTBUR}_{\text{AOH}} &= R (\text{MTBUR}_{\text{UFH}}) \\ \text{MTBF}_{\text{AOH}} &= R (\text{MTBF}_{\text{UFH}}) \\ \text{MTTF}_{\text{AOH}} &= R (\text{MTTF}_{\text{UFH}}) \\ \text{MTTUR}_{\text{AOH}} &= R (\text{MTTUR}_{\text{UFH}}) \end{aligned}$$

Where AOH=APU operating-hours and UFH= unit flight-hours

If MTBR, MTBUR, MTBF, MTTF or MTTUR are specified without qualification, it shall be understood that they are in unit-flight-hours.

4.3.1 Mean Time Between Removal - MTBR

4.3.1.1 Definition

A performance figure calculated by dividing the total unit flying hours (airborne) accrued in a period by the number of unit removals (scheduled & unscheduled) that occurred during the same period.

$$\begin{aligned} \text{MTBR} &= \{\text{Unit Flying Hours}\} / (\text{Total Scheduled \& Unscheduled Removals}) \\ &= \{(\text{Quantity Per Aircraft}) * (\text{total Flight Hours for the same period})\} / (\text{Total Scheduled \& Unscheduled Removals}) \end{aligned}$$

4.3.1.2 Formula

$$\text{MTBR} = \left\{ \frac{\text{QPA} * (< CTH >_n - < CTH >_m)}{\sum y_i} \right\}$$

Where:

We wish to calculate the MTBR of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day) and the index “ i ” in y_i covers the period between Date-1 and Date-2

If ($\langle TTY \rangle = U$ or S), $y_i = 1$

$\langle CTH \rangle_n$ provides the cumulative hours as point n

$\langle CTH \rangle_m$ provides the cumulative hours as point m

QPA = Average Quantity per Aircraft of the component

4.3.2 Mean Cycles Between Removals - MCBR

4.3.2.1 Definition

A performance figure calculated by dividing the total unit flight cycles (a complete takeoff and landing sequence) accrued in a period by the number of unit removals (scheduled & unscheduled) that occurred during the same period.

MCBR = {Unit Flight Cycles} / (Total Scheduled & Unscheduled Removals)
 = {(Quantity Per Aircraft) * (total Aircraft Flight Cycles for the same period)} / (Total Scheduled & Unscheduled Removals)

4.3.2.2 Formula

$$MCBR = \left\{ \frac{QPA * (\langle CTY \rangle_n - \langle CTY \rangle_m)}{\sum y_i} \right\}$$

Where:

We wish to calculate the MCBR of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day) and the index “ i ” in y_i covers the period between Date-1 and Date-2

If ($\langle TTY \rangle = U$ or S), $y_i = 1$

$\langle CTY \rangle_n$ provides the cumulative cycles as point n

$\langle CTY \rangle_m$ provides the cumulative cycles as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

4.3.3 Mean Time Between Unscheduled Removals - MTBUR

There are two types of MTBUR's – Mean time between [all] unscheduled removals, and Mean time between non-induced unscheduled removals.

4.3.3.1 Mean Time Between [All] Unscheduled Removals - MTBUR

4.3.3.1.1. Definition

A performance figure calculated by dividing the total unit flying hours (airborne) accrued in a period by the number of unscheduled unit removals that occurred during the same period.] CSDD Definition: Mean Time Between Unscheduled Removals

MTBUR = {Unit Flying Hours} / (Total Unscheduled Removals)
 = {(Quantity Per Aircraft) * (total Aircraft Flight Hours for a period)} / (Total Unscheduled Removals in the same period)

4.3.3.1.2. Formula

$$MTBUR = \left\{ \frac{QPA * (< CTH >_n - < CTH >_m)}{\sum y_i} \right\}$$

Where:

We wish to calculate the MTBUR of a component between Date-1 and Date-2.
n = Date-2 and m = (Date-1 less a day)

And the index “i” in y_i covers the period between Date-1 and Date-2

If (<TTY> = U), $y_i = 1$

<CTH>_n provides the cumulative hours as point n

<CTH>_m provides the cumulative hours as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

■ Note: $MTBUR = 1000/URR_H$

4.3.3.2 Mean Time Between [Non-induced] Unscheduled Removals – MTBUR(N)**4.3.3.2.1 Definition**

A performance figure calculated by dividing the total unit flying hours (airborne) accrued in a period by the number of non-induced unscheduled unit removals that occurred during the same period. [Figure 13-2.2]

$MTBUR(N) = \{ (Quantity\ Per\ Aircraft) * (total\ Flight\ Hours\ for\ the\ same\ period) \} / (Total\ non-induced\ Unscheduled\ Removals)$

4.3.3.2.2 Formula

$$MTBUR(N) = \left\{ \frac{QPA * (< CTH >_n - < CTH >_m)}{\sum y_i - \sum z_i} \right\}$$

Where:

We wish to calculate the MTBUR of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day) and the index “i” in y_i covers the period between Date-1 and Date-2

If in LRU removal Record, <TTY> = U, $y_i = 1$

If in the subsequent Shop Report, <FFI> = I, $z_i = 1$

<CTH>_n provides the cumulative hours as point n

<CTH>_m provides the cumulative hours as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

4.3.4 Mean Cycles Between Unscheduled Removals - MCBUR

There are two types of MCBUR's – Mean cycles between [all] unscheduled removals, and Mean cycles between non-induced unscheduled removals.

4.3.4.1 Mean Cycles Between [All] Unscheduled Removals - MCBUR

4.3.4.1.1. Definition

A performance figure calculated by dividing the total unit flight cycles (a complete takeoff and landing sequence) accrued in a period by the number of unscheduled unit removals that occurred during the same period.

$$\text{MCBUR} = \frac{\{\text{Unit Flight Cycles}\}}{\{\text{Total Unscheduled Removals}\}} \\ = \frac{\{(\text{Quantity Per Aircraft}) * (\text{total Aircraft Flight Cycles for the same period})\}}{\{\text{Total Unscheduled Removals}\}}$$

4.3.4.1.2. Formula

$$\text{MCBUR} = \left\{ \frac{\text{QPA} * (<CTY>_n - <CTY>_m)}{\sum y_i} \right\}$$

Where:

We wish to calculate the MCBUR of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day) and the index "i" in y_i covers the period between Date-1 and Date-2

If ($<TTY> = U$), $y_i = 1$

$<CTY>_n$ provides the cumulative cycles as point n

$<CTY>_m$ provides the cumulative cycles as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

■ Note: $\text{MCBUR} = 1000/\text{URR}_C$

4.3.4.2 Mean Cycles Between [Non-induced] Unscheduled Removals – MCBUR(N)

4.3.4.2.1 Definition

A performance figure calculated by dividing the total unit flight cycles (a complete takeoff and landing sequence) accrued in a period by the number of non-induced unscheduled unit removals that occurred during the same period. [Figure 13-2.2]

$$\text{MCBUR(N)} = \frac{\{(\text{Quantity Per Aircraft}) * (\text{total Aircraft Cycles for the same period})\}}{\{\text{Total non-induced Unscheduled Removals}\}}$$

4.3.4.2.2 Formula

$$MCBUR(N) = \left\{ \frac{QPA * (<CTY>_n - <CTY>_m)}{\sum y_i - \sum z_i} \right\}$$

Where:

We wish to calculate the MCBUR of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day) and the index "i" in y_i covers the period between Date-1 and Date-2

If in LRU removal Record, <TTY> = U, y_i = 1

If in the subsequent Shop Report, <FFI> = I, z_i = 1

<CTY>_n provides the cumulative cycles as point n

<CTY>_m provides the cumulative cycles as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

4.3.5 Mean Time Between Failure - MTBF

There are three types of MTBF's – Mean time between failure – justified; Mean time between failure – non-induced; and Mean time between failure – confirmed.

4.3.5.1 Mean Time Between Failure - Justified – MTBF(J)

4.3.5.1.1. Definition

A performance figure calculated by dividing the total unit flying hours (airborne) accrued in a period by the number of justified unit failures that occurred during the same period. [Figure 13-2.2]

$$\begin{aligned} \text{MTBF(J)} &= \{ \text{Unit Flying Hours} \} / \{ \text{Total Justified Failures} \} \\ &= \{ (\text{Quantity Per Aircraft}) * (\text{total Flight Hours for the same period}) \} / \{ \text{Total Justified Failures} \} \end{aligned}$$

This metric addresses those components for which a failure is found.

4.3.5.1.2. Formula

$$\text{MTBF(J)} = \left\{ \frac{QPA * (<CTH>_n - <CTH>_m)}{\sum y_i} \right\}$$

Where:

We wish to calculate the MTBF_j of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day) and the index "i" in y_i covers the period between Date-1 and Date-2

If <TTY> = U (LRU Removal Record) and <FFC>=FT (in the follow-up Shop Finding Record), y_i = 1

<CTH>_n provides the cumulative hours as point n

<CTH>_m provides the cumulative hours as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

4.3.5.2 Mean Time Between Failure – Non-Induced – MTBF(N)

4.3.5.2.1 Definition

A performance figure calculated by dividing the total unit flying hours (airborne) accrued in a period by the number of non-induced unit failures that occurred during the same period. [Figure 13-2.2]

$$\begin{aligned}\text{MTBF(N)} &= \{\text{Unit Flying Hours}\} / (\text{Total Non-induced Failures}) \\ &= \{(\text{Quantity Per Aircraft}) * (\text{total Flight Hours for the same period})\} / (\text{Total Non-induced Failures})\end{aligned}$$

This metric addresses the case when a failure is found and it is ascertained that the failure was not induced by a condition beyond the specified limits of the component.

4.3.5.2.2 Formula

$$\text{MTBF(N)} = \left\{ \frac{\text{QPA} * (<CTH>_n - <CTH>_m)}{\sum y_i} \right\}$$

Where:

We wish to calculate the MTBF_n of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day) and the index “i” in y_i covers the period between Date-1 and Date-2

If <TTY> = U (LRU Removal Record), <FFI>=NI (in the follow-up Shop Finding Record), y_i = 1

<CTH>_n provides the cumulative hours as point n

<CTH>_m provides the cumulative hours as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

4.3.5.3 Mean Time Between Failure – Confirmed – MTBF(C)

4.3.5.3.1 Definition

A performance figure calculated by dividing the total unit flying hours (airborne) accrued in a period by the number of confirmed unit failures that occurred during the same period. [Figure 13-2.2]

$$\begin{aligned}\text{MTBF(C)} &= \{\text{Unit Flying Hours}\} / (\text{Total Confirmed Failures}) \\ &= \{(\text{Quantity Per Aircraft}) * (\text{total Flight Hours for the same period})\} / (\text{Total Confirmed Failures})\end{aligned}$$

Occasionally, there are failures present in a component that are benign, and do not affect the ability of the component to perform its intended function; MTBF_c is similar to MTBF_n but excludes such failures.

4.3.5.3.2 Formula

$$\text{MTBF(C)} = \left\{ \frac{\text{QPA} * (<CTH>_n - <CTH>_m)}{\sum y_i} \right\}$$

Where:

We wish to calculate the MTBF(C) of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day) and the index “i” in y_i covers the period between Date-1 and Date-2

If <TTY> = U (LRU Removal Record), <FCR>=CR (in the follow-up Shop Finding Record), y_i = 1

<CTH>_n provides the cumulative hours as point n
 <CTH>_m provides the cumulative hours as point m
 QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

4.3.6 Mean Cycles Between Failure - MCBF

There are three types of MCBF's – Mean cycles between failure – justified; Mean cycles between failure – non-induced; and Mean cycles between failure – confirmed.

4.3.6.1 Mean Cycles Between Failure - Justified – MCBF(J)

4.3.6.1.1. Definition

A performance figure calculated by dividing the total unit flight cycles accrued in a period by the number of justified unit failures that occurred during the same period. [Figure 13-2.2]

MCBF(J) = {Unit Flight Cycles} / (Total Justified Failures)
 = {(Quantity Per Aircraft) * (total Flight Cycles for the same period)} / (Total Justified Failures)

This metric addresses those components for which a failure is found.

4.3.6.1.2. Formula

$$MCBF(J) = \left\{ \frac{QPA * (<CTY>_n - <CTY>_m)}{\sum y_i} \right\}$$

Where:

We wish to calculate the MCBFj of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day) and the index "i" in y_i covers the period between Date-1 and Date-2

If <TTY> = U (LRU Removal Record) and <FFC>=FT (in the follow-up Shop Finding Record), y_i = 1

<CTY>_n provides the cumulative cycles as point n

<CTY>_m provides the cumulative cycles as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

4.3.6.2 Mean Cycles Between Failure – Non-Induced – MCBF(N)

4.3.6.2.1 Definition

A performance figure calculated by dividing the total unit flight cycles accrued in a period by the number of non-induced unit failures that occurred during the same period. [Figure 13-2.2]

MCBF(N) = {Unit Flight Cycles} / (Total Non-induced Failures)
 = {(Quantity Per Aircraft) * (total Flight Cycles for the same period)} / (Total Non-induced Failures)

This metric addresses the case when a failure is found and it is ascertained that the failure was not induced by a condition beyond the specified limits of the component.

4.3.6.2.2 Formula

$$MCBF(N) = \left\{ \frac{QPA * (<CTY>_n - <CTY>_m)}{\sum y_i} \right\}$$

Where:

We wish to calculate the MCBF_n of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day) and the index “i” in y_i covers the period between Date-1 and Date-2

If <TTY> = U (LRU Removal Record), <FFI>=NI (in the follow-up Shop Finding Record), y_i = 1

<CTY>_n provides the cumulative cycles as point n

<CTY>_m provides the cumulative cycles as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

4.3.6.3 Mean Cycles Between Failure – Confirmed – MCBF(C)

4.3.6.3.1 Definition

A performance figure calculated by dividing the total unit flight cycles accrued in a period by the number of confirmed unit failures that occurred during the same period. [Figure 13-2.2]

$$\begin{aligned} MCBF(C) &= \{ \text{Unit Flying Cycles} \} / (\text{Total Confirmed Failures}) \\ &= \{ (\text{Quantity Per Aircraft}) * (\text{total Flight Cycles for the same period}) \} / (\text{Total Confirmed Failures}) \end{aligned}$$

Occasionally, there are failures present in a component that are benign, and do not affect the ability of the component to perform its intended function; MCBF_c is similar to MCBF_n but excludes such failures.

4.3.6.3.2 Formula

$$MCBF(C) = \left\{ \frac{QPA * (<CTY>_n - <CTY>_m)}{\sum y_i} \right\}$$

Where:

We wish to calculate the MCBF(C) of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day) and the index “i” in y_i covers the period between Date-1 and Date-2

If <TTY> = U (LRU Removal Record), <FCR>=CR (in the follow-up Shop Finding Record), y_i = 1

<CTY>_n provides the cumulative cycles as point n

<CTY>_m provides the cumulative cycles as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

4.3.7 No Fault Found Rate

4.3.7.1 Definition

The rate of unscheduled removals determined to have no fault for a particular component. [Figure13-2.2]-
CSDD Definition: No Fault Found Rate

4.3.7.2 Equation for use with Summary Data

This formula is to be used with data from the Summary Data Records.

NFF = (Total Number of Unscheduled Removals Returned to Shop Determined to have No Fault) divided by
(Total Unscheduled Removals Returned to Shop).

When there are no removals in a reporting period, use NoRem to report the metric.

$$\text{NFF Rate} = (\text{<CUC>} - \text{<TOJ>}) / \text{<CUC>}$$

4.3.7.3 Equation for Use With Shop Findings Record

$$\text{NFF Rate} = \left\{ \frac{\sum x_i}{\sum y_i} \right\} * 100\%$$

Where:

If (<FFC>=NT and <RRC>=U), $x_i = 1$

If (<RRC>=U), $y_i = 1$

4.3.8 Fault Found Ratio (FFRT)

4.3.8.1 Definition

The proportion of unscheduled removals determined to have a fault for a particular component.

There are three types of fault found ratios:

FFRTj : justified fault found ratio

FFRTn : non-induced fault found ratio

FFRTc : confirmed fault found ratio

4.3.8.2 Equations for Use With Shop Findings Record

$$\text{FFRT}_j = \left\{ \frac{\sum x_i}{\sum y_i} \right\} * 100\%$$

Where:

If (<FFC>=FT), $x_i = 1$

If (<RRC>=U), $y_i = 1$

$$\text{FFRT}_n = \left\{ \frac{\sum x_i}{\sum y_i} \right\} * 100\%$$

Where:

If (<FFI>=NI), $x_i = 1$

If (<RRC>=U), $y_i = 1$

$$FFRT_c = \left\{ \frac{\sum x_i}{\sum y_i} \right\} * 100\%$$

Where:

If (<FCR>=CR), $x_i = 1$

If (<RRC>=U), $y_i = 1$

4.3.8.3 Application of Fault Found Rates to calculate MTBF from MTBUR

$$MTBF_j = hq / \sum F_i$$

where h = flt-hours, q = qpa and $\sum F_i$ = failures in h flt-hours (whether or not the failures are induced, and whether or not the failures confirm the reason for removal)

$$MTBUR = hq / \sum U_i$$

where h = flt-hours, q = qpa and $\sum U_i$ = Unscheduled removals in h flt-hours

$$FFRT_j = \sum F_i / \sum U_i$$

$$\sum F_i = \sum U_i * FFRT_j$$

$$\begin{aligned} \text{Thus, } MTBF_j &= hq / \sum F_i \\ &= hq / (\sum U_i * FFRT_j) \\ &= (hq / \sum U_i) / FFRT_j \\ &= MTBUR / FFRT_j \end{aligned}$$

Summary: $MTBF_j = MTBUR / FFRT_j$

Note that MTBUR and $FFRT_j$ can be calculated independently from two separate samples of data. Typically, MTBUR is calculated from a large sample of data, but MTBF's are difficult to calculate because it is not easy to get Shop Reports on the majority of units removed. By calculating the $FFRT_j$ on a smaller sample of data (say, 40%), the newly estimated metric can be used to calculate $MTBF_j$.

Likewise

$$\begin{aligned} MTBF_n &= MTBUR / FFRT_n \\ MTBF_c &= MTBUR / FFRT_c \end{aligned}$$

4.3.9 Mean Time To Failure (MTTF)

4.3.9.1 Definition

A component performance rate calculated by dividing the sum of on-aircraft flying hours of each unit which has experienced a failure by the total number of failed units.

$$MTTF = (\text{Sum of failed component unit flight hours}) / (\text{total quantity of failed units})$$

4.3.9.2 Formula

$$MTTF(J) = \left\{ \frac{\sum x_i}{\sum y_i} \right\} \quad \text{Mean Time To Failure, justified}$$

Where

If (<TRF> = R and <FFC> = FT), $x_i = <OTT>$

If (<FFC> = FT), $y_i = 1$

$$MTTF(N) = \left\{ \frac{\sum x_i}{\sum y_i} \right\} \quad \text{Mean Time To Failure, non-induced}$$

Where

If (<TRF> = R and <FFI> = NI), $x_i = <OTT>$

If (<FFI> = NI), $y_i = 1$

$$MTTF(C) = \left\{ \frac{\sum x_i}{\sum y_i} \right\} * 100\% \quad \text{Mean Time To Failure, confirmed}$$

Where

If (<TRF> = R and <FCR> = CR), $x_i = <OTT>$

If (<FCR> = CR), $y_i = 1$

4.3.10 Mean Cycles To Failure (MCTF)

4.3.10.1 Definition

A component performance rate calculated by dividing the sum of on-aircraft flight cycles of each unit which has experienced a failure by the total number of failed units.

$MCTF = (\text{Sum of failed component unit flight cycles}) / (\text{total quantity of failed units})$

4.3.10.2 Formula

$$MCTF(J) = \left\{ \frac{\sum x_i}{\sum y_i} \right\} \quad \text{Mean Time To Failure, justified}$$

Where

If (<TRF> = R and <FFC> = FT), $x_i = <OPC>$

If (<FFC> = FT), $y_i = 1$

$$MCTF(N) = \left\{ \frac{\sum x_i}{\sum y_i} \right\} \quad \text{Mean Time To Failure, non-induced}$$

Where

If (<TRF> = R and <FFI> = NI), $x_i = <OPC>$

If (<FFI> = NI), $y_i = 1$

$$MCTF(C) = \left\{ \frac{\sum x_i}{\sum y_i} \right\} * 100\% \quad \text{Mean Time To Failure, confirmed}$$

Where

If (<TRF> = R and <FCR> = CR), $x_i = <OPC>$

If (<FCR> = CR), $y_i = 1$

4.3.11 Mean Time To Unscheduled Removal (MTTUR)

4.3.11.1 Definition

A component performance rate calculated by dividing the sum of on-aircraft flying hours of each unit which has experienced an unscheduled removal by the total number of unscheduled removed units.

MTTUR = (Sum of unscheduled removed component unit flight hours) / (total quantity of unscheduled removed units)

4.3.11.2 Formula

$$MTTUR = \left\{ \frac{\sum x_i}{\sum y_i} \right\} * 100\%$$

Where:

If (<TRF> = V and <TTY> = U), x_i = <OTT>

If (<TTY> = U), y_i = 1

4.3.12 Mean Cycles To Unscheduled Removal (MCTUR)

4.3.12.1 Definition

A component performance rate calculated by dividing the sum of on-aircraft flight cycles of each unit which has experienced an unscheduled removal by the total number of unscheduled removed units.

MCTUR = (Sum of unscheduled removed component unit flight cycles) / (total quantity of unscheduled removed units)

4.3.12.2 Formula

$$MCTUR = \left\{ \frac{\sum x_i}{\sum y_i} \right\} * 100\%$$

Where:

If (<TRF> = V and <TTY> = U), x_i = <OPC>

If (<TTY> = U), y_i = 1

4.3.13 Unscheduled Removal Rate (URR):

This metric may be defined per 1000 Flight-Hours (URR_H) or per 1000 Flight Cycles (URR_C). If not specified, the former shall be assumed.

4.3.13.1 Definition

The URR of a particular component type (or group of components) is defined as the number of unscheduled removals performed per 1000 flight-hours or per 1000 flight-cycles flown by that component type (or group of components).

URR_H = 1000 (Total Unscheduled Removals) / {(Quantity Per Aircraft) * (total Flight Hours for the same period)}

URR_C = 1000 (Total Unscheduled Removals) / {(Quantity Per Aircraft) * (total Flight Cycles for the same period)}

4.3.13.2 Formula

$$URR_H = \left\{ \frac{\sum y_i}{QPA * (<CTH>_n - <CTH>_m)} \right\} * 1000 \quad \text{per 1000 unit flight-hours}$$

$$URR_C = \left\{ \frac{\sum y_i}{QPA * (<CTY>_n - <CTY>_m)} \right\} * 1000 \quad \text{per 1000 unit flight-cycles}$$

Where:

We wish to calculate the URR of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day) and the index "i" in y_i covers the period between Date-1 and Date-2

If (<TTY> = U), $y_i = 1$

<CTH>_n provides the cumulative hours as point n

<CTH>_m provides the cumulative hours as point m

<CTY>_n provides the cumulative cycles as point n

<CTY>_m provides the cumulative cycles as point m

QPA = Average Quantity per Aircraft of the component

4.3.13.3 NOTES

- If the URR is being calculated for an ATA system, or subsystem, the QPA=1.
- $URR_H = 1000/MTBUR$
- $URR_C = 1000/MCBUR$

4.3.14 Time Since Installation at Removal (TSR)

4.3.14.1 Definition

The time accumulated on a given item at the time of removal since the item was last installed.

4.3.14.2 Equation

(Total aircraft flight hours accumulated at removal) minus (Total aircraft flight-hours accumulated at installation)

<TSR> = (<OTT> when <TRF> = I) in the LRU Removal Record.

4.3.14.3 NOTES

- For data quality check, the sum of all <TSI>s for a specific unit should equal Time Since New (<TSN>).
- Time Since Repair (<TSR>) and Time Since Last Shop Visit (<TSV>) will continue accumulating time on the next installation of the part if the part is removed for convenience reasons.

4.3.15 Cycles Since Installation at Removal (CSI)

4.3.15.1 Definition

The number of cycles accumulated on a given item at the time of removal since the item was last installed.

4.3.15.2 Equation

(Total aircraft cycles accumulated at removal) minus (Total aircraft cycles accumulated at installation)

<CSI> = (<OPC> when <TRF> = I) in the LRU Removal Record.

4.3.15.3 NOTES

- For data quality check, the sum of all <CSI>s for a specific unit should equal <CSN>.
- <CSR> and <CSV> will continue accumulating time on the next installation of the part if the part is removed for convenience reasons.

4.3.16 Time Since Repair (TSRP)

4.3.16.1 Definition

The time accumulated on an item at the time of removal since the item was last repaired.

4.3.16.2 Equation

(Total component flight hours since new accumulated at current removal) minus (Total component flight hours since new accumulated at the last removal for repairs of this part).

$$TSRP = (<OTT> \text{ when } <TRF> = R)$$

This information come from the LRU Removal Record, the Installed Part Section.

4.3.16.3 NOTES

- Time Since Repair will continue accumulating time if a part is removed for convenience reasons.
- TSRP's shall be provided through the LRU Record of Chapter 11 in a manner that satisfy this condition:

$$\sum TSRP = <TSN>$$

4.3.17 Cycles Since Repair (CSRP)

4.3.17.1 Definition

The cycles accumulated on an item at the time of removal since the item was last repaired.

4.3.17.2 Equation

(Total component flight cycles since new accumulated at current removal) minus (Total component flight cycles since new accumulated at the last removal for repairs of this part)

$$CSRP = (<OPC> \text{ when } TRF = R)$$

This information comes from the LRU Removal Record, the Installed Part Section.

4.3.17.3 NOTES

- Cycles Since Repair will continue accumulating cycles if a part is removed for convenience reasons.
- CSRP's shall be provided through the LRU Record of Chapter 11 in a manner that satisfy this condition:

$$\sum CSRP = <CSN>$$

4.3.18 Time Since Overhaul (TSO)

4.3.18.1 Definition

The time accumulated on an item at the time of removal since the item was last overhauled.

4.3.18.2 Equation

(Total component flight hours since new accumulated at current removal) minus (Total component flight hours since new accumulated at the last overhaul of this part).

TSO = (<OTT> when <TRF> = O) in the LRU Removal Record.

4.3.18.3 NOTES

NOTE: TSO's shall be provided through the LRU Record of Chapter 11 in a manner that satisfy this condition:

$$\sum TSO = < TSN >$$

4.3.19 Cycles Since Overhaul (CSO)

4.3.19.1 Definition

The cycles accumulated on an item at the time of removal since the item was last overhauled.

4.3.19.2 Equation

(Total component flight cycles since new accumulated at current removal) minus (Total component flight cycles since new accumulated at the last overhaul of this part).

CSO = (<OPC> when <TRF> = O) in the LRU Removal Record.

4.3.19.3 NOTES

CSO's shall be provided through the LRU Record of Chapter 11 in a manner that satisfy this condition:

$$\sum CSO = < CSN >$$

4.3.20 Time Since New (TSNW)

4.3.20.1 Definition

The time accumulated on an item at the time of removal since the item was new.

4.3.20.2 Equation:

TSNW = (<OTT> when <TRF> = N) in the LRU Removal Record.

4.3.21 Cycles Since New (CSNW)

4.3.21.1 Definition

The cycles accumulated on an item at the time of removal since the item was new.

4.21.2 Equation:

CSNW = (<OPC> when <TRF> = N) in the LRU Removal Record.

4.3.22 Time Since Last Shop Visit (TSLV)

4.3.22.1 Definition

The time accumulated on an item at the time of removal since the item was last sent to a shop for repairs.

4.3.22.2 Equation:

$TSLV = (<OTT> \text{ when } <TRF> = V)$ in the LRU Removal Record.

NOTE: For reliability reasons this metric is used when a part is sent to a shop for repair even if a repair is not actually performed.

4.3.23 Cycles Since Last Shop Visit (CSLV)

4.3.23.1 Definition

The cycles accumulated on an item at the time of removal since the item was last sent to a shop for repairs.

4.3.23.2 Equation

$CSLV = (<OPC> \text{ when } <TRF> = V)$ in the LRU Removal Record.

4.3.24 Time Since Last Check (TSCK)

4.3.24.1 Definition

The time accumulated on an item at the time of removal since the item was last subjected to a maintenance check.

4.3.24.2 Equation:

$TSCK = (<OTT> \text{ when } <TRF> = C)$ in the LRU Removal Record.

NOTE: Used for on-wing functional check.

4.3.25 Cycles Since Last Check (CSCK)

4.3.25.1 Definition

The cycles accumulated on an item at the time of removal since the item was last subjected to a maintenance check.

4.3.25.2 Equation:

$CSCK = (<OPC> \text{ when } <TRF> = C)$ in the LRU Removal Record.

|

4.3.26 Failure Hours Rate – Justified – FHR(J)

4.3.26.1. Definition

A performance figure calculated by dividing the number of justified unit failures that occurred in a period the total unit flying hours (airborne) accrued during the same period and multiplying by 1000.

This metric addresses those components for which a failure is found.

4.3.25.2 Equation:

$$FHR(J) = \left\{ \frac{\sum y_i}{QPA * (<CTH>_n - <CTH>_m)} \right\} * 1000$$

Where:

We wish to calculate the FHRj of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day)

And the index “i” in y_i covers the period between Date-1 and Date-2

If <TTY> = U (LRU Removal Record) and <FFC>=FT (in the follow-up Shop Finding Record), $y_i = 1$

<CTH>_n provides the cumulative hours as point n

<CTH>_m provides the cumulative hours as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

Note: $FHR(J) = 1000/MTBF(J)$

4.3.27 Failure Hours Rate - Non-Induced – FHR(N)

4.3.27.1. Definition

A performance figure calculated by dividing the number of non-induced unit failures that occurred in a period the total unit flying hours (airborne) accrued during the same period and multiplying by 1000.

This metric addresses the case when a failure is found and it is ascertained that the failure was not induced by a condition beyond the specified limits of the component.

4.3.27.2. Equation

$$FHR(N) = \left\{ \frac{\sum y_i}{QPA * (<CTH>_n - <CTH>_m)} \right\} * 1000$$

Where:

We wish to calculate the FHR(N) of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day)

And the index “i” in y_i covers the period between Date-1 and Date-2

If <TTY> = U (LRU Removal Record), <FFI>=NI (in the follow-up Shop Finding Record), $y_i = 1$

<CTH>_n provides the cumulative hours as point n

$\langle CTH \rangle_m$ provides the cumulative hours as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

Note: $FHR(N) = 1000/MTBF(N)$

4.3.28 Failure Hours Rate - Confirmed – FHR(C)

4.3.28.1 Definition

A performance figure calculated by dividing the number of confirmed unit failures that occurred in a period the total unit flying hours (airborne) accrued during the same period and multiplying by 1000.

Occasionally, there are failures present in a component that are benign, and do not affect the ability of the component to perform its intended function; $MTBF_c$ is similar to $MTBF_n$ but excludes such failures.

4.3.28.2 Equation

$$FHR(C) = \left\{ \frac{\sum y_i}{QPA * (\langle CTH \rangle_n - \langle CTH \rangle_m)} \right\} * 1000$$

Where:

We wish to calculate the FHR(C) of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day)

And the index “i” in y_i covers the period between Date-1 and Date-2

If $\langle TTY \rangle = U$ (LRU Removal Record), $\langle FCR \rangle = CR$ (in the follow-up Shop Finding Record), $y_i = 1$

$\langle CTH \rangle_n$ provides the cumulative hours as point n

$\langle CTH \rangle_m$ provides the cumulative hours as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

Note: $FHR(C) = 1000/MTBF(C)$

4.3.29 Failure Cycles Rate - Justified – FCR(J)

4.3.29.1 Definition

A performance figure calculated by dividing the number of justified unit failures that occurred in a period the total unit flying cycles accrued during the same period and multiplying by 1000.

This metric addresses those components for which a failure is found.

4.3.29.2. Equation

$$FCR(J) = \left\{ \frac{\sum y_i}{QPA * (\langle CTY \rangle_n - \langle CTY \rangle_m)} \right\} * 1000$$

Where:

We wish to calculate the FCR_j of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day)

And the index “i” in y_i covers the period between Date-1 and Date-2

If <TTY> = U (LRU Removal Record) and <FFC>=FT (in the follow-up Shop Finding Record), y_i = 1

<CTY>_n provides the cumulative cycles as point n

<CTY>_m provides the cumulative cycles as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

Note: FCR(J) = 1000/MCBF(J)

4.3.30 Failure Cycles Rate - Non-Induced – FCR(N)

4.3.30.1 Definition

A performance figure calculated by dividing the number of non-induced unit failures that occurred in a period the total unit flying cycles accrued during the same period and multiplying by 1000.

This metric addresses the case when a failure is found and it is ascertained that the failure was not induced by a condition beyond the specified limits of the component.

4.3.30.2 Formula

$$FCR(N) = \left\{ \frac{\sum y_i}{QPA * (<CTY>_n - <CTY>_m)} \right\} * 1000$$

Where:

We wish to calculate the FCR(N) of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day)

And the index “i” in y_i covers the period between Date-1 and Date-2

If <TTY> = U (LRU Removal Record), <FFI>=NI (in the follow-up Shop Finding Record), y_i = 1

<CTY>_n provides the cumulative cycles as point n

<CTY>_m provides the cumulative cycles as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

Note: FCR(N) = 1000/MCBF(N)

4.3.31 Failure Cycles Rate - Confirmed – FCR(C)

4.3.31.1 Definition

A performance figure calculated by dividing the number of confirmed unit failures that occurred in a period the total unit flying cycles accrued during the same period and multiplying by 1000.

Occasionally, there are failures present in a component that are benign, and do not affect the ability of the component to perform its intended function; FCR(C) is similar to FCR(N) but excludes such failures.

4.3.31.2 Formula

$$FCR(C) = \left\{ \frac{\sum y_i}{QPA * (<CTY>_n - <CTY>_m)} \right\} * 1000$$

Where:

We wish to calculate the FCR(C) of a component between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day)

And the index “i” in y_i covers the period between Date-1 and Date-2

If <TTY> = U (LRU Removal Record), <FCR>=CR (in the follow-up Shop Finding Record), $y_i = 1$

<CTY>_n provides the cumulative cycles as point n

<CTY>_m provides the cumulative cycles as point m

QPA = Average Quantity per Aircraft of the component

Applicable Aircraft: The aircraft that the specified component (with a common form, fit and function) is installed on.

Note: $FCR(C) = 1000/MCBF(C)$

4.3.32 Mean Time Since Installation (MTSI)

4.3.32.1 Definition

A component performance rate calculated by taking the average hours on components when they were removed for scheduled or unscheduled reasons.

$MTSI = (\text{Sum of unscheduled or scheduled removed component unit flight hours}) / (\text{total quantity of unscheduled or scheduled removed units})$

4.3.32.2 Formula

$$MTSI = \left\{ \frac{\sum x_i}{\sum y_i} \right\}$$

Where:

If (<TRF> = I and <TTY> = U or S), $x_i = <OTT>$

If (<TTY> = U or S), $y_i = 1$

4.3.33 Mean Cycles Since Installation (MCSI)

4.3.33.1 Definition

A component performance rate calculated by taking the average cycles on components when they were removed for scheduled or unscheduled reasons.

MCTR = (Sum of unscheduled or scheduled removed component unit cycles) / (total quantity of unscheduled or scheduled removed units)

4.3.33.2 Formula

$$MCSI = \left\{ \frac{\sum x_i}{\sum y_i} \right\}$$

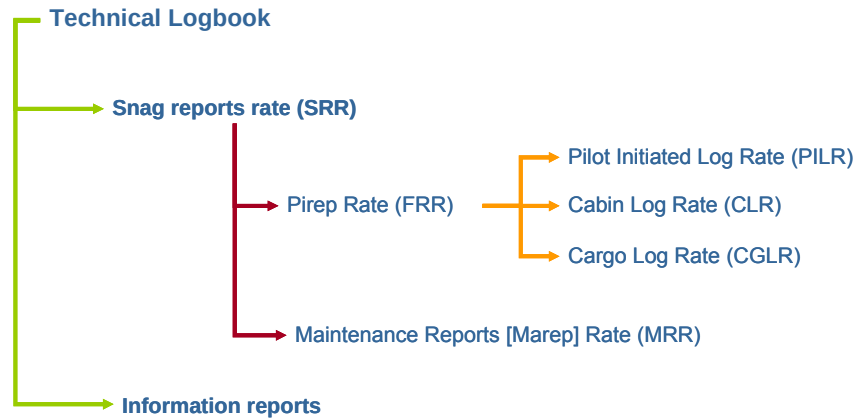
Where:

If (<TRF> = I and <TTY> = U or S), $x_i = \text{<OPC>}$

If (<TTY> = U or S), $y_i = 1$

4.4 Logbook Rates

The metrics defined in this section are calculated based on data from the [Logbook Record](#) and [Aircraft Hours & Landings Record](#) found in Chapter 11.



4.4.1 Definition

There are 2 broad classes of logbook technical notes and another 2 subgroups as follows:

- Pilot Reports (Pireps) consisting of:
 - o Pilot initiated logs
 - o Cabin Crew Initiated Logs
 - o Cargo Logs
- Maintenance Staff initiated logs (Marep)

Logbook rates are count of technical logbook write-ups (pilot, cabin, cargo) by a particular parameter (such as 2-digit ATA) per 1000 flight-hours or per 100 cycles.

4.4.1.1 Snag Report Rate (SRRT)

$$SRRT_h = 1000 \{ (\text{logbook count for all snags}) / (\text{total flight-hours for the same period}) \}$$

$$SRRT_c = 100 \{ (\text{logbook count for all snags}) / (\text{total actual departures for the same period}) \}$$

4.4.1.2 Pirep Rate (PRRT)

$$PRRT_h = 1000 \{ (\text{Pilot logbook count}) / (\text{total flight-hours for the same period}) \}$$

$$PRRT_c = 100 \{ (\text{Pilot logbook count}) / (\text{total actual departures for the same period}) \}$$

4.4.1.3 Pilot Initiated Log Rate (PILR)

$$PILR_h = 1000 \{ (\text{Pilot Initiated logbook count}) / (\text{total flight-hours}) \}$$

$$PILR_c = 100 \{ (\text{Pilot Initiated logbook count}) / (\text{total departures}) \}$$

4.4.1.4 Cabin Log Rate (CLRT)

$$CLRT_h = 1000 \{ (\text{Cabin logbook count}) / (\text{total flight-hours}) \}$$

$$CLRT_c = 100 \{ (\text{Cabin logbook count}) / (\text{total departures}) \}$$

4.4.1.5 Cargo Log Rate (CGLR)

$$CGLR_h = 1000 \{ (\text{Cargo logbook count}) / (\text{total flight-hours}) \}$$

$$CGLR_c = 100 \{ (\text{Cargo logbook count}) / (\text{total departures}) \}$$

4.4.1.6 Maintenance Report Rate (Marep Rate = MRRT)

$$MRRT_h = 1000 \{ (\text{Maintenance initiated log entry count}) / (\text{total flight-hours}) \}$$

$$MRRT_c = 100 \{ (\text{Maintenance initiated log entry count}) / (\text{total departures}) \}$$

4.4.2 Equations

In the following formulas we wish to calculate a snag rate between Date-1 and Date-2.

n = Date-2 and m = (Date-1 less a day)

CTH_n provides the cumulative flight-hours as point n

CTH_m provides the cumulative flight-hours as point m

CTY_n provides the cumulative cycles as point n

CTY_m provides the cumulative cycles as point m

And the index "i" in y_i covers the period between Date-1 and Date-2

4.4.2.1 Snag Report Rate (SRRT)

$$SRRT_h = \left\{ \frac{\sum y_i}{<CTH>_n - <CTH>_m} \right\} * 1000 \text{ per thousand flight-hours}$$

$$SRRT_c = \left\{ \frac{\sum y_i}{<CTY>_n - <CTY>_m} \right\} * 100 \text{ per hundred departures}$$

Where $y_i = 1$ if (<DOC> = PL or CD or CL or ML)

4.4.2.2 Pirep Rate (PRRT)

$$PRRT_h = \left\{ \frac{\sum y_i}{<CTH>_n - <CTH>_m} \right\} * 1000 \text{ per thousand flight-hours}$$

$$PRRT_c = \left\{ \frac{\sum y_i}{<CTY>_n - <CTY>_m} \right\} * 100 \text{ per hundred departures}$$

Where $y_i = 1$ if (<DOC> = PL or CD or CL)

4.4.2.3 Pilot Initiated Log Rate (PILR)

$$PILR_h = \left\{ \frac{\sum y_i}{<CTH>_n - <CTH>_m} \right\} * 1000 \text{ per thousand flight-hours}$$

$$PILR_c = \left\{ \frac{\sum y_i}{<CTY>_n - <CTY>_m} \right\} * 100 \text{ per hundred departures}$$

Where $y_i = 1$ if <DOC> = PL