

ATA Spec 2000 Reliability Data Collection and Exchange / Reliability Metrics 2011 ATA e-Business Forum



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Outline

- **The Reliability Interest Group**
- **Overview of SPEC2000 Chapters 11/13**
- **SPEC2000 Chapter 11 – What is it?**
- **Reliability Data Records**
- **Chapter 13-2 Reliability Metrics – Those just included in the spec**
- **Reliability Metrics – Coming soon...**
- **Conclusion – The Challenge**
- **Conclusion – An Opportunity for Growth**

ATA Reliability Interest Group (RIG) Charter

- **Purpose**

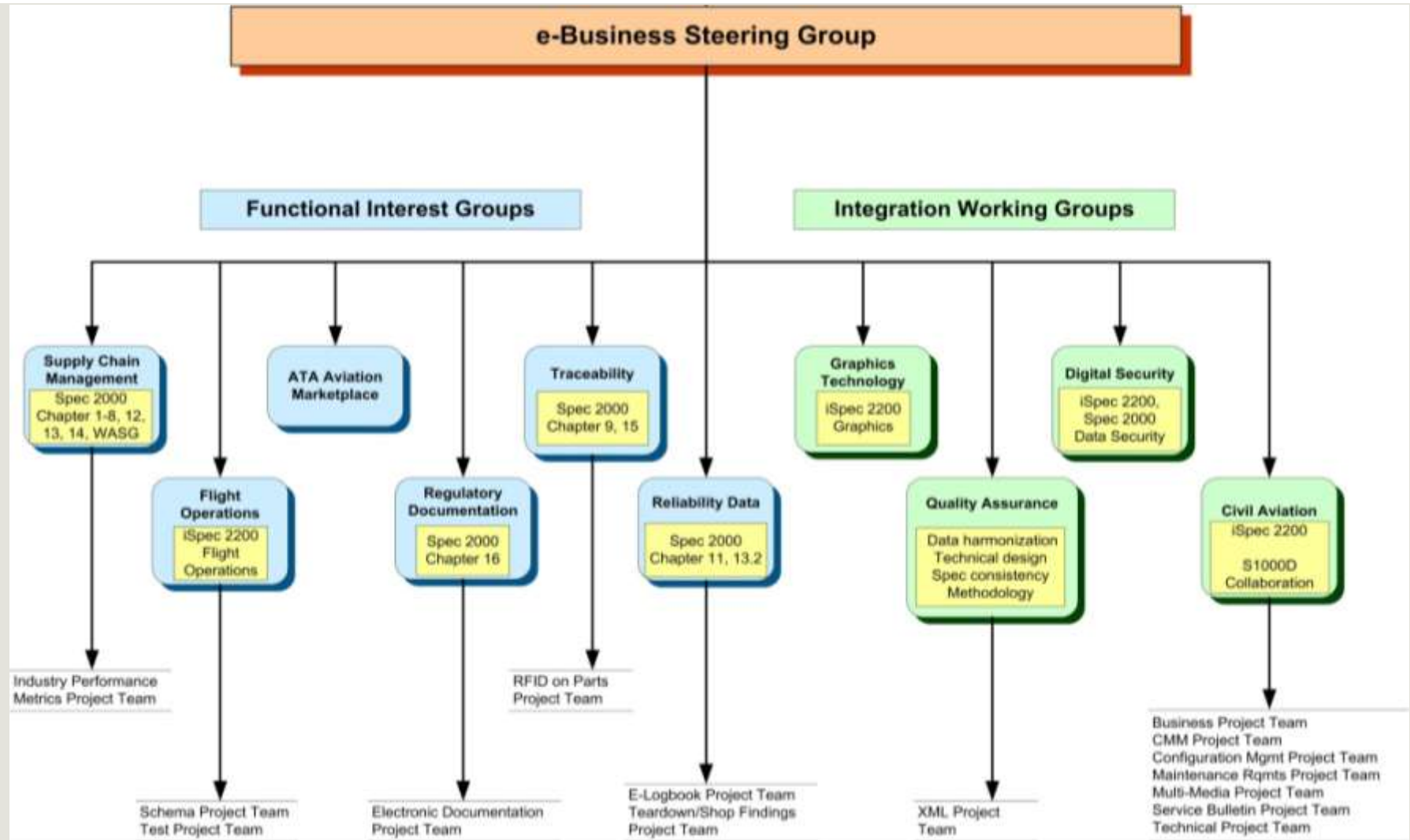
- To provide an industry forum for developing electronic data exchange standards related to aircraft reliability, maintenance and repair data

- **Responsibilities**

- Responsible for maintaining Spec2000 Chapter 11's, Reliability data collection/exchange records
- Spec2000 Chapter 13-2's Reliability metrics
- Recently the RIG has begun updating Spec2000 Chapter 15's, aircraft delivery record using data elements from Spec2000 Chapter 11
- The RIG has the following Project Teams
 - E-Logbook Project Team
 - Electronic Teardown Project Team

- **Chair** – John Yakubowsky Boeing

Organizational Structure



Recent RIG Developments

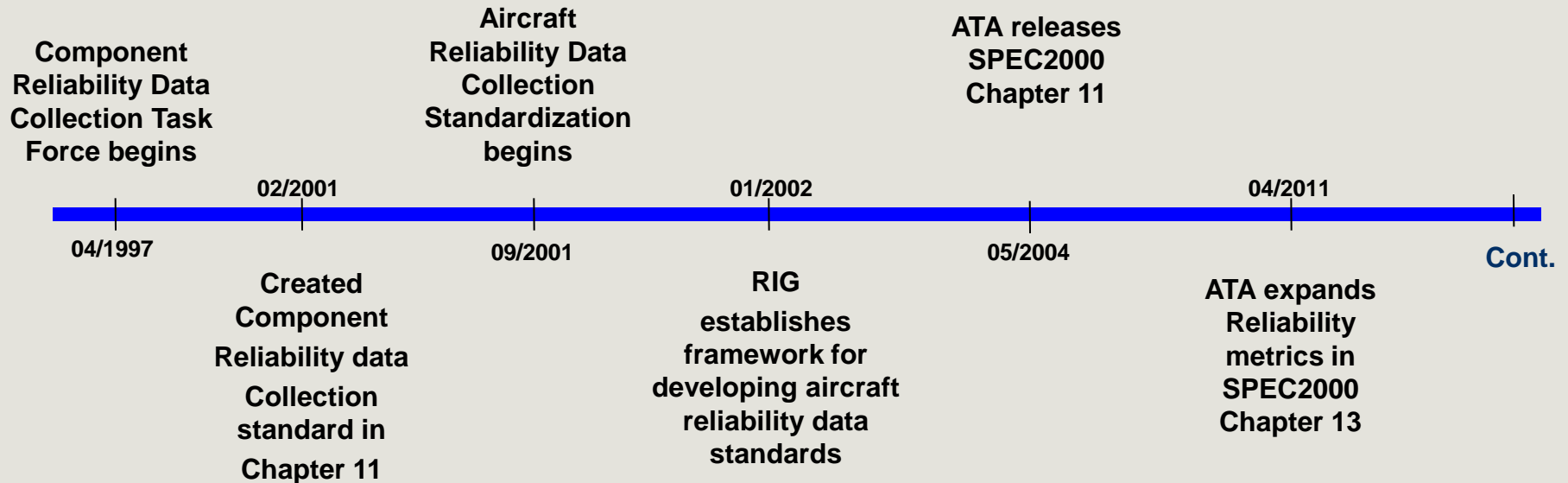
- The RIG has grown, with increased participants and issues
- To be able to address the large number of action items in a timely manner we have developed sub teams:
 - IT Implementation sub team led by John Yakubowsky, Boeing – acting
 - Reliability Metrics Development sub team led by John Nazareth, Bombardier
 - Delivery Configuration Record sub team led by Audrey Fauconnier, Airbus
 - Data Definitions sub team led by Sebastien Touzot, Airbus

SPEC2000 Chapters 11/13

Overview

Operators, suppliers and airframers needed to collect, organize and exchange reliability data between each other. An industry standard allows all parties to do this efficiently and cost effectively.

SPEC2000 Chapter 11/13, Overview & Evolution



Reliability Interest Group has the largest active participation within the SPEC2000 family.

SPEC2000 Chapter 11/13 - Overview

- SPEC2000 Chapter 11 – “Aircraft Reliability Data Collection and Exchange”, has been part of ATA Spec2000 since May 2004
 - It was endorsed by IATA for use by it’s members in January 2005
 - Called out in ISO STEP 10303 / AP 239 PLCS
 - It is now being refined as operators use it.
- SPEC2000 Chapter 13 - Performance Metrics Standards.
 - Section 13.2 – Reliability Metrics was significantly expanded in April 2011.

SPEC2000 Chapter 11 - What is it?

- It defines what events constitute the reliability & maintainability landscape of aircraft in the air transport business
- It identifies which elements within each event are important to capture
- It defines what each element identified means
- It is a common language that allows aviation industry partners to exchange detailed reliability data easily and cost effectively.
- It defines a protocol for exchanging data – XML

If your organization subscribes to SPEC2000 for standards such as material procurement, you already have access to the reliability data records in Chapter 11.



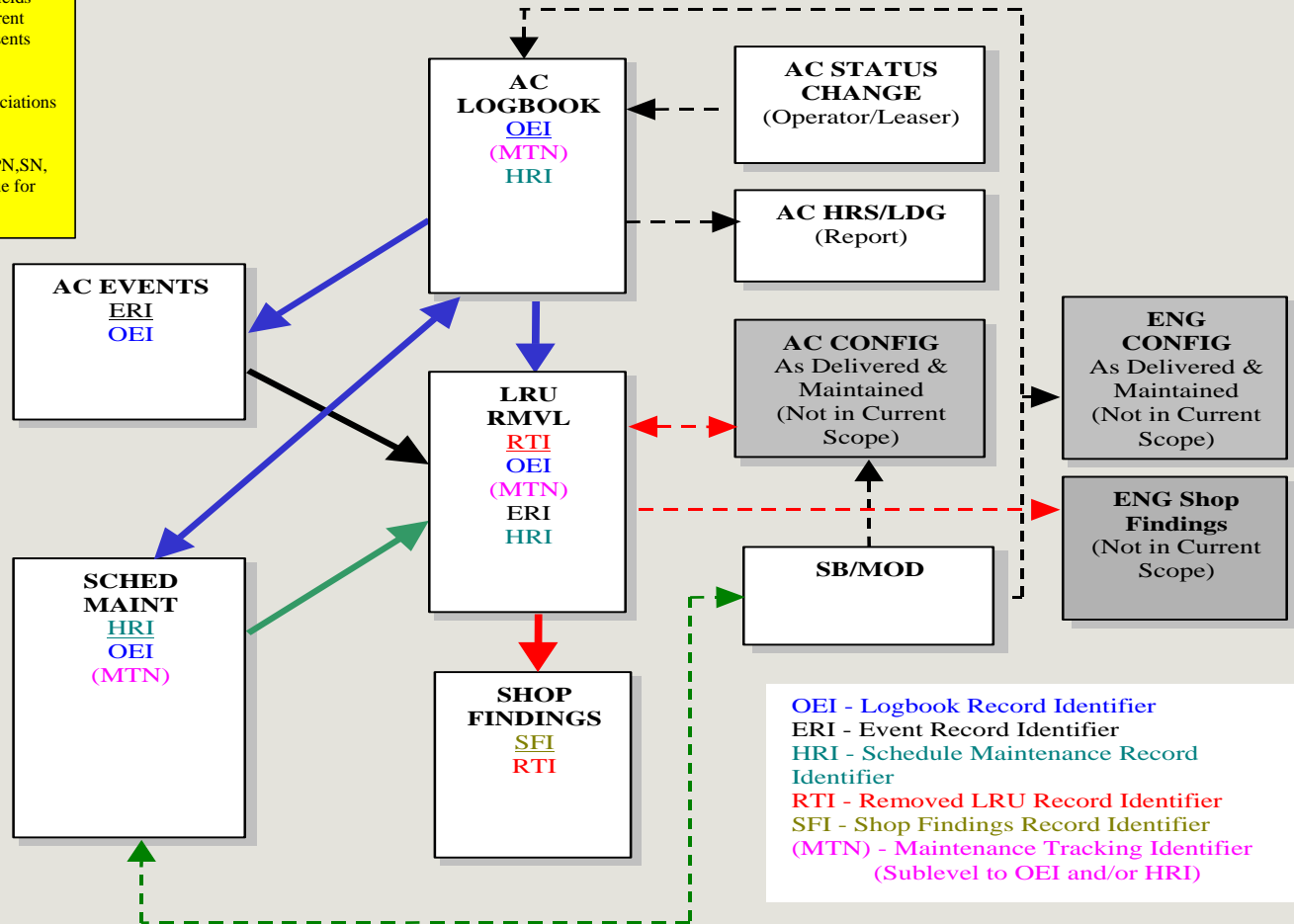
SPEC2000 Chapter 11 Reliability Data Records

SPEC2000 Chapter 11 Records Types

Solid lines indicate matching fields tying associated records in current records. Underlined TEI represents key field for record.

Broken lines indicate data associations not directly linked.

Combination of CAGE code, PN,SN, Date and MSN is always unique for tracking components.



SPEC2000 Chapter 11 Record Tables

Chapter 11 has 10 records :

- **Aircraft Hours and Landings Record**
 - Purpose: Collect detailed hours, cycles and utilization data from operators. This data can also be used as the basis for MTBUR calculations, etc.
- **Aircraft Event Record**
 - Purpose : To capture aircraft event data such as delays, cancellations, incidents, etc.
- **LRU Removal Record**
 - Purpose : Collect details of the components removed from an aircraft as well as reasons for removal and details of component being installed.
- **Shop Findings Record**
 - Purpose: Collect detailed component tear down reports from an airline's shop or other repair facilities.
- **Piece Part Record**
 - Purpose: A supplement to the Shop Findings record, to find out the details of the failed part.

SPEC2000 Chapter 11 Record Tables

- **Aircraft Logbook Record**
 - Purpose : Collect technical/journey log entries such as pilot reports, maintenance corrective action, etc.
- **Scheduled Maintenance Record**
 - Purpose : Collect scheduled (heavy and line) maintenance data, findings and corrective action, and provide reference ability back to the operator's maintenance program.
- **Service Bulletin/Modification Record**
 - Purpose : Provide data on service bulletin/mod incorporation and unincorporation.
- **Aircraft Status Change Record**
 - Purpose : Capture changes in aircraft ownership, operator, long term storage disposition, engine model changes, etc.
- **Summary Counts Record**
 - Purpose : Collect summarized rate and count information on an operator's fleet, e.g. schedule interruption counts by ATA, etc.

SPEC2000 Chapter 11 Record Tables

Field Name

Field Type (Mandatory vs Conditional)

Nbr	Information Level	Data to be Collected (Business Terms)	Data Element (CSDD)	TEI	Condition	Data Type	Size: min/max	Example	Business rules / comments
1	Segment Header "HDR"								The Header Segment is Mandatory. This segment is sent only once per transmission of Aircraft Hours and Landing record.
2		Record Status	Change Code	CHG	Mandatory	AN	1/1		The valid codes are N=New; D=Delete; T = Total Replacement
3		Reporting Organization Code	Reporting Organization Code	ROC	Mandatory	AN	3/5	UAL	Should be CAGE or NCAGE code. Use code ZZZZZ if no CAGE/NCAGE is available OR use ICAO code for operator.
4		Reporting Organization Name	Reporting Organization Name	RON	Conditional	AN	1/55	United Airlines	Required if the reporting organization has no CAGE/NCAGE Code.
5		Operator Code	Operator Code	OPR	Mandatory	AN	3/5	UAL	This code should support ICAO 3-digit airline designator for reliability applications. Use ZZZZZ if no ICAO code is available. This element is a KEY field in the record.
6		Operator Name	Company Name	WHO	Conditional	AN	1/55	United Airlines	Represents the name of operator in reliability applications. Mandatory, if operator of the aircraft has no ICAO operator code.

Field Size

Field Definitions

Field Example

Aircraft Event Record

Reporting Organization Code	APU Cumulative Cycles	General Ground Interrupt Indicator
Operator Code	Interruption Code	Delay Time
Airframe Manufacturer Code	Total Number of Consequential Interruptions	Aborted Approach Indicator
Aircraft Model	Airline ATA System Code (Discrepancy/ Symptom)	Emergency Descent Indicator
Aircraft Series	Airline ATA System Code (Maintenance Action)	In-Flight Shutdown Indicator
Aircraft Manufacturer Serial Number	Aircraft Message Code	Substitute Aircraft Indicator
Aircraft Registration Number	Aircraft Message Text	Aircraft on Ground Indicator
Operator Aircraft Internal Identifier	Arrival Station Code	Service Interruption Chargeability Indicator
Aircraft Engine Type	Departure Flight Number	Suspected Maintenance Error Indicator
Engine Position Code	Scheduled Departure Time	Suspected Operational Error Indicator
Engine Serial Number	Actual Departure Time	Technical Incident Indicator
Aircraft Engine Model	Actual Arrival Date	READI Exclusion Indicator (Reference READI Group)
Aircraft Engine Manufacturer Code	Scheduled Arrival Time	Incident Cause Code
Aircraft APU Type	Actual Arrival Time	Consequential Incident Cause Code
Aircraft APU Serial Number	Maintenance Notified Time	Aircraft Event Text
Aircraft APU Model	Maintenance Released Time	Aircraft Event Text (Corrective Action)
Aircraft APU Manufacturer Code	Maintenance Total Downtime	Comment Text
Event Record Identifier	Delay Indicator	Logbook Record Identifier
Incident Occurrence Date	Cancellation Indicator	Install Date of Removed Part
Departure / Reporting Station Code	Diversion Indicator	Removed Part Manufacturer Code
Aircraft Cumulative Total Flight Hours	Air Turnback Indicator	Removed Part Manufacturer Name
Aircraft Cumulative Total Cycles	General Air Interrupts Indicator	Removed Manufacturer Full Length Part Number
Engine Cumulative Hours	Aborted Take-off Indicator	Removed Manufacturer Serial Number
Engine Cumulative Cycles	Return To Gate Indicator	
APU Cumulative Hours		

Component Removal Record

OPERATOR CODE	PART POSITION	OPERATING DAY COUNT
AIRFRAME MANUFACTURER CODE	REMOVED OPERATOR PART NUMBER	NHA PART MANUFACTURER CODE
AIRCRAFT MODEL	REMOVED OPERATOR SERIAL NUMBER	NHA MANUFACTURER PART NUMBER
AIRCRAFT SERIES	SUPPLIER CODE	NHA PART NAME
AIRCRAFT MANUFACTURER SERIAL NUMBER	AIRLINE ATA SYSTEM CODE	NHA OPERATOR PART NUMBER
AIRCRAFT REGISTRATION NUMBER	REMOVAL STATION CODE	NHA OPERATOR SERIAL NUMBER
OPERATOR AIRCRAFT INTERNAL IDENTIFIER	AIRCRAFT MESSAGE CODE	SUPPLIER CODE
EVENT RECORD IDENTIFIER	AIRCRAFT MESSAGE TEXT	INSTALLED DATE
AIRCRAFT ENGINE MODEL	MAINTENANCE ACTION TEXT	INSTALLED PART MANUFACTURER CODE
ENGINE SERIAL NUMBER	AIRCRAFT CUMULATIVE TOTAL FLIGHT HOURS	INSTALLED PART MANUFACTURER NAME
ENGINE POSITION CODE	AIRCRAFT CUMULATIVE TOTAL CYCLES	INSTALLED MANUFACTURER SERIAL NUMBER
AIRCRAFT APU MODEL	ENGINE CUMULATIVE HOURS	INSTALLED OPERATOR PART NUMBER
AIRCRAFT APU SERIAL NUMBER	ENGINE CUMULATIVE CYCLES	INSTALLED OPERATOR SERIAL NUMBER
REMOVED LRU RECORD IDENTIFIER	APU CUMULATIVE HOURS	SUPPLIER CODE
REMOVAL DATE	APU CUMULATIVE CYCLES	Time since new
REMOVAL TYPE CODE	LOGBOOK RECORD IDENTIFIER	Cycles since new
REMOVAL TYPE TEXT	MAINTENANCE ACTION	Time since overhaul
REMOVED PART MANUFACTURER CODE	EVENT RECORD IDENTIFIER	Cycles since overhaul
REMOVED MANUFACTURER PART NUMBER	SCHEDULED MAINTENANCE IDENTIFIER	Time since repair
REMOVED MANUFACTURER SERIAL NUMBER	TIME CYCLE REFERENCE CODE	Cycles since repair
REMOVAL REASON TEXT	OPERATING TIME	Time since last installation
ENGINE/APU POSITION IDENTIFIER	OPERATING CYCLE COUNT	Cycles since last installation

Scheduled Maintenance Record

OPERATOR CODE	INSPECTION METHOD DESCRIPTION	CORROSION TEMPORARY PROTECTION SYSTEM VISIBLE INDICATOR
AIRFRAME MANUFACTURER CODE	MAINTENANCE EMPLOYEE SKILL CODE	COMMENT TEXT
AIRCRAFT MODEL	TASK LABOR COUNT	NON ROUTINE TASK LABOR COUNT
AIRCRAFT SERIES	TASK TOTAL LABOR HOURS	NON ROUTINE TASK TOTAL LABOR HOURS
AIRCRAFT MANUFACTURER SERIAL NUMBER	TASK ELAPSED TIME	NON ROUTINE TASK ELAPSED TIME
AIRCRAFT REGISTRATION NUMBER	TASK MATERIAL COST	NON ROUTINE TASK MATERIAL COST
OPERATOR AIRCRAFT INTERNAL IDENTIFIER	TASK TOTAL COST	NON ROUTINE TASK TOTAL COST
SCHEDULED MAINTENANCE IDENTIFIER	INTERNATIONAL CURRENCY	CMR/ALI ITEM NUMBER
OPERATOR SPECIFIC TASK INDICATOR	MAINTENANCE FINDING INDICATOR	CMR/ALI ITEM TITLE
AIRFRAMER MAINTENANCE TASK NUMBER	MAINTENANCE FINDINGS DEFECT CODE	PASSED CMR/ALI ITEM INDICATOR
MAINTENANCE REVIEW BOARD DOCUMENT NUMBER	MAINTENANCE FINDINGS DEFECT DESCRIPTION	LOGBOOK RECORD IDENTIFIER
AIRFRAMER MAINTENANCE TASK TITLE	MAINTENANCE FINDINGS DEFECT TEXT	MAINTENANCE ACTION TRACKING NUMBER
AIRFRAMER TASK CARD/AMM REFERENCE NUMBER	NON ROUTINE TASK REFERENCE	MAINTENANCE ACTION LABOR COUNT
AIRFRAMER TASK CARD TITLE	NON ROUTINE TASK REFERENCE DESCRIPTION	MAINTENANCE ACTION TOTAL LABOR HOURS
OPERATOR MAINTENANCE TASK NUMBER	NON ROUTINE CORRECTIVE ACTION TAKEN TEXT	MAINTENANCE ACTION ELAPSED TIME
OPERATOR MAINTENANCE TASK NUMBER TITLE	MAINTENANCE TASK OUT-OF-SCOPE FINDING INDICATOR	MAINTENANCE ACTION MATERIAL COST
TASK START DATE	MAINTENANCE TASK OUT-OF-SCOPE FINDING DESCRIPTION	MAINTENANCE ACTION TOTAL COST
TASK END DATE	CORROSION LEVEL	INTERNATIONAL CURRENCY
OPERATOR MAINTENANCE CHECK IDENTIFIER	CORROSION TYPE CODE	REMOVAL DATE
OPERATOR MAINTENANCE CHECK INTERVAL	CORROSION TYPE DESCRIPTION	REMOVED PART MANUFACTURER CODE
OPERATOR MAINTENANCE TASK INTERVAL NUMBER	REPAIR APPROVAL REFERENCE	REMOVED MANUFACTURER PART NUMBER
AIRCRAFT CUMULATIVE TOTAL FLIGHT HOURS	AIRFRAME MANUFACTURER MAINTENANCE ZONE	REMOVED MANUFACTURER SERIAL NUMBER
AIRCRAFT CUMULATIVE TOTAL CYCLES	OPERATOR UNIQUE MAINTENANCE ZONE	REMOVED PART POSITION RELATIVE TO POWER PLANT OR
ENGINE CUMULATIVE HOURS	AIRFRAME LEFT HAND/RIGHT HAND POSITION CODE	PART POSITION
ENGINE CUMULATIVE CYCLES	AIRCRAFT FRAME IDENTIFIER	REMOVAL REASON TEXT
APU CUMULATIVE HOURS	AIRCRAFT RIB IDENTIFIER	REMOVED OPERATOR PART NUMBER
APU CUMULATIVE CYCLES	AIRCRAFT SPAR IDENTIFIER	REMOVED OPERATOR SERIAL NUMBER
OPERATING TIME	AIRCRAFT MODEL STRINGER IDENTIFIER	SUPPLIER CODE
OPERATING CYCLE COUNT	AIRFRAME STATION IDENTIFIER	INSTALLED DATE
OPERATING DAY COUNT	AIRFRAME STATION DESCRIPTION	INSTALLED PART MANUFACTURER CODE
PREVIOUS INSPECTION DATE	AIRFRAME VERTICAL REFERENCE NUMBER	INSTALLED MANUFACTURER PART NUMBER
OPERATOR JOB CARD NUMBER	AIRFRAME LONGITUDINAL REFERENCE NUMBER	INSTALLED MANUFACTURER SERIAL NUMBER
OPERATOR JOB CARD TITLE	REPAIR STRUCTURAL MATERIAL TYPE DESCRIPTION	INSTALLED OPERATOR PART NUMBER
INSPECTION METHOD CODE	CORROSION TEMPORARY PROTECTION SYSTEM INDICATOR	INSTALLED OPERATOR SERIAL NUMBER

Shop Report Record

OPERATOR CODE	INCOMING INSPECTION TEXT
AIRFRAME MANUFACTURER CODE	SHOP ACTION TEXT
AIRCRAFT MODEL	SHOP REPAIR LOCATION CODE
AIRCRAFT SERIES	MOD (S) INCORPORATED (THIS VISIT) TEXT
AIRCRAFT MANUFACTURER SERIAL NUMBER	SHOP ACTION CODE
AIRCRAFT REGISTRATION NUMBER	SHOP DISCLOSURE INDICATOR
OPERATOR AIRCRAFT INTERNAL IDENTIFIER	SHIPPED DATE
SHOP FINDINGS RECORD IDENTIFIER	SHIPPED PART MANUFACTURER CODE
SHOP RECEIVED DATE	SHIPPED MANUFACTURER PART NUMBER
RECEIVED PART MANUFACTURER CODE	SHIPPED MANUFACTURER SERIAL NUMBER
RECEIVED MANUFACTURER PART NUMBER	SHIPPED OPERATOR PART NUMBER
RECEIVED MANUFACTURER SERIAL NUMBER	SHIPPED OPERATOR SERIAL NUMBER
SUPPLIER REMOVAL TYPE CODE	SHIPPED MODIFICATION LEVEL
SUPPLIER REMOVAL TYPE TEXT	REMOVAL DATE
FAILURE/ FAULT FOUND	REMOVAL TYPE CODE
FAILURE/ FAULT INDUCED	REMOVAL TYPE TEXT
FAILURE/ FAULT CONFIRMS REASON FOR REMOVAL	REMOVED PART MANUFACTURER CODE
FAILURE/ FAULT CONFIRMS AIRCRAFT MESSAGE	REMOVED MANUFACTURER PART NUMBER
FAILURE/ FAULT CONFIRMS AIRCRAFT PART BITE MESSAGE	REMOVAL REASON TEXT
HARDWARE/ SOFTWARE FAILURE	REMOVED OPERATOR PART NUMBER
RECEIVED OPERATOR PART NUMBER	REMOVED OPERATOR SERIAL NUMBER
RECEIVED OPERATOR SERIAL NUMBER	REMOVAL TRACKING IDENTIFIER
SUPPLIER CODE	SHOP TOTAL LABOR HOURS
INCOMING MODIFICATION LEVEL	SHOP FLOW TIME
SHOP FINDINGS CODE	SHOP MATERIAL COST
RELATED SHOP FINDING RECORD IDENTIFIER	REPAIR PRICE AMOUNT
REPAIR LOCATION NAME	INTERNATIONAL CURRENCY

Logbook Record (Pireps/Mareps)

OPERATOR CODE	AIRCRAFT MESSAGE CODE
AIRFRAME MANUFACTURER CODE	AIRCRAFT MESSAGE TEXT
AIRCRAFT MODEL	AIRLINE ATA SYSTEM CODE (MAINTENANCE ACTION)
AIRCRAFT SERIES	MAINTENANCE ACTION COMPLETION TIME
AIRCRAFT MANUFACTURER SERIAL NUMBER	MAINTENANCE ACTION DEFERRAL REASON TEXT
AIRCRAFT REGISTRATION NUMBER	AUTHORITY DOCUMENT REFERENCE NUMBER
OPERATOR AIRCRAFT INTERNAL IDENTIFIER	DELAY TIME (TECHNICAL DELAYS)
AIRCRAFT ENGINE TYPE	MAINTENANCE ACTION CODE
ENGINE POSITION CODE	DISCREPANCY SYMPTOM CODE
ENGINE SERIAL NUMBER	FINDINGS TYPE CODE
AIRCRAFT ENGINE MODEL	PHASE OF FLIGHT
AIRCRAFT APU TYPE	WORK REQUESTED DESCRIPTION
AIRCRAFT APU SERIAL NUMBER	DISCREPANCY TEXT
AIRCRAFT APU MODEL	MAINTENANCE ACTION TEXT
AIRCRAFT APU MANUFACTURER CODE	COMMENT TEXT
LOGBOOK RECORD IDENTIFIER	Scheduled Maintenance Identifier
MAINTENANCE TRACKING IDENTIFIER	MAINTENANCE ACTION LABOR COUNT
MAINTENANCE ACTION SEQUENCE NUMBER	MAINTENANCE ACTION TOTAL LABOR HOURS
DISCREPANCY OCCURRENCE DATE	MAINTENANCE ACTION ELAPSED TIME
DISCREPANCY ORIGATION TYPE CODE	MAINTENANCE ACTION MATERIAL COST
MAINTENANCE TYPE CODE	MAINTENANCE ACTION TOTAL COST
DEPARTURE / REPORTING STATION CODE	INTERNATIONAL CURRENCY
MAINTENANCE ACTION DATE	SERVICE BULLETIN/ LETTER NUMBER
MAINTENANCE ACTION COMPLETION DATE	MAINTENANCE CHECK IDENTIFIER
MAINTENANCE ACTION STATION CODE	MAINTENANCE CHECK INTERVAL
MAINTENANCE ACTION STATUS CODE	NON ROUTINE TASK REFERENCE
TECHNICAL INCIDENT INDICATOR	NON ROUTINE TASK REFERENCE DESCRIPTION
ETOPS FLIGHT INDICATOR	OPERATOR MAINTENANCE TASK NUMBER
DEPARTURE FLIGHT NUMBER	OPERATOR JOB CARD NUMBER
DEPARTURE DATE	AIRFRAMER MAINTENANCE TASK (MPD ITEM) NUMBER
DEPARTURE TIME	MAINTENANCE REVIEW BOARD DOCUMENT NUMBER
ARRIVAL STATION CODE	AIRFRAMER TASK CARD/AMM REFERENCE NUMBER
AIRLINE ATA SYSTEM CODE (DISCREPANCY/SYMPTOM)	AIRWORTHINESS DIRECTIVE NUMBER

Companies that Intend to Comply with SPEC2000 Chapter 11 by 2011

- Airbus
- Boeing
- Bombardier
- Dassault
- Embraer

- Air Canada
- Continental
- Delta
- FedEx (plus or minus mid 2008)
- Lufthansa Technik
- SAS
- Turkish Airlines
- Virgin Atlantic Airways
- WestJet

- BAE Systems
- C&D Aerospace
- Goodrich Wheels and Brakes
- Hamilton Sundstrand
- Honeywell
- Moog
- Nabtesco
- Panasonic
- Parker
- Rockwell Collins
- Smiths
- Thales

- Edatasystems
- EmpowerMX
- MIRO
- Maintenix (MXi)
- RussellAdams
- SAP (2010)
- Swiss Aviation Software (AMOS)
- Teradata
- TRAX
- Ultramain

It is the goal of SPEC2000 Chapter 13 to standardize the definitions of reliability metrics and so as to indicate the use of reliability data as collected in Chapter 11

SPEC2000 Chapter 13-2 Reliability Metrics

Chapter 13-2 Reliability Metrics

4.1 Dispatch Metrics

- **Technical Dispatch Reliability (TDRL)**
 - **Technical Dispatch Interruption Rate (TDIR)**
- **Schedule Reliability (SREL)**
 - **Schedule Interruption Rate (SIRT)**
- **Technical Cancellation Performance (TCPF)**
 - **Technical Cancellation Rate (TCNR)**
- **Technical Completion Rate (TCRT)**
 - **Technical Non-Completion Rate (TNCR)**

Chapter 13-2 Reliability Metrics

4.2 Service Difficulty Metrics

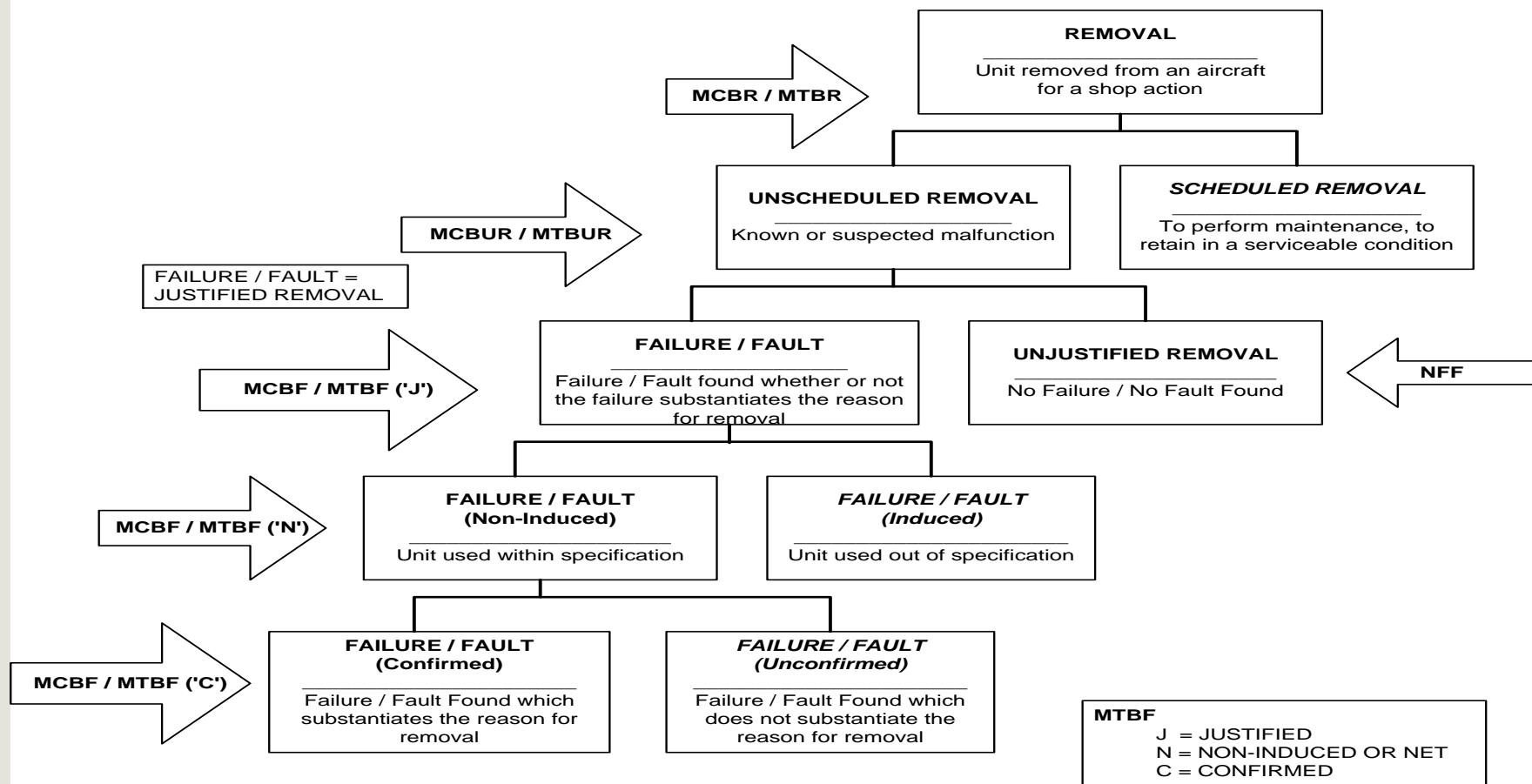
Aircraft Incidents are events that cause technical service difficulties such as aborted takeoffs, air turn-backs, emergency landings, etc. The metrics herein are based on such incidents

Incident Rate = $1000 * (\text{Incident Count}) / (\text{total actual departures for the same period})$ → gives incidents per 1000 departures.

- **Diversion Rate (DVRT)**
- **Air Turnback Rate (ATBR)**
- **Aborted Takeoff Rate (ABTR)**
- **Return to Gate Rate (RTGR)**
- **Aborted Approach Rate (ABAR)**
- **Emergency Descent Rate (EMDR)**
- **Inflight Shutdown Rate (IFSDR)**
- **Total Air Incident Rate (TAIR)**
- **Total Incident Rate (TINR)**

Chapter 13-2 Reliability Metrics

Component Reliability



Chapter 13-2 Reliability Metrics

4.3 Component Reliability Metrics

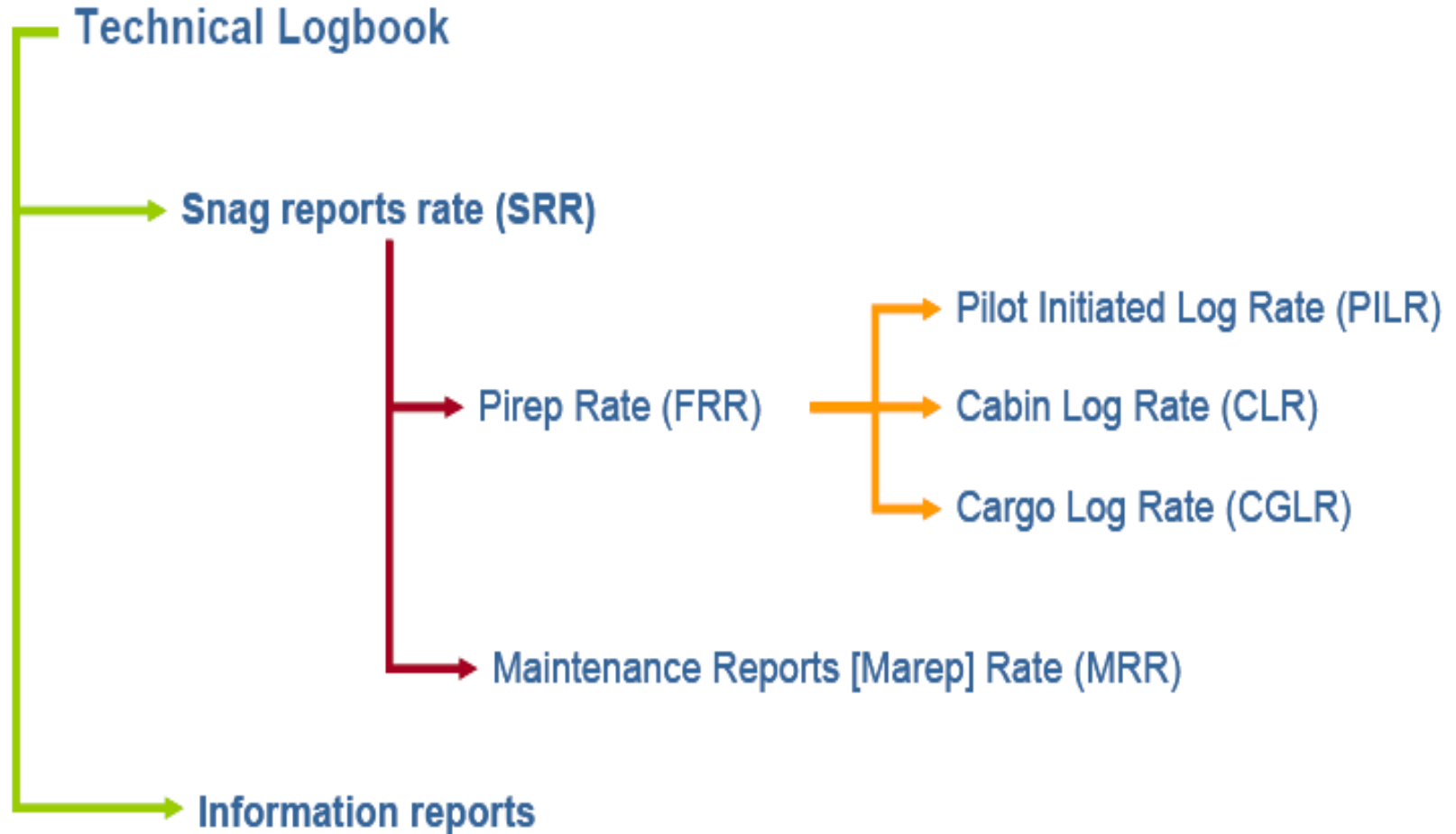
- Mean Time Between Removal - MTBR
- Mean Time Between Unscheduled Removals - MTBUR
 - Mean Time Between [All] Unscheduled Removals - MTBUR
 - Mean Time Between [Non-induced] Unscheduled Removals – MTBUR(N)
- Mean Time Between Failure - MTBF
 - Mean Time Between Failure - Justified – MTBF(J)
 - Mean Time Between Failure – Non-Induced – MTBF(N)
 - Mean Time Between Failure – Confirmed – MTBF(C)
- Mean Cycles Between Removals – MCBR
- Mean Cycles Between Unscheduled Removals - MCBUR
 - Mean Cycles Between [All] Unscheduled Removals - MCBUR
 - Mean Cycles Between [Non-induced] Unscheduled Removals – MCBUR(N)
- Mean Cycles Between Failure - MCBF
 - Mean Cycles Between Failure - Justified – MCBF(J)
 - Mean Cycles Between Failure – Non-Induced – MCBF(N)
 - Mean Cycles Between Failure – Confirmed – MCBF(C)

Chapter 13-2 Reliability Metrics

4.3 Component Reliability Metrics – cont.

- No Fault Found Rate
- Fault Found Ratio (FFRT) – FFRT_j, FFRT_n, FFRT_c
- Mean Time To Failure (MTTF) – MTTF(J), MTTF(N), MTTF(C)
- Mean Time To Unscheduled Removal (MTTUR)
- Unscheduled Removal Rate (URR):
 - URRH (in FH), URRC (in cycles)
- Time Since Installation at Removal (TSR)
- Time Since Repair (TSRP)
- Time Since Overhaul (TSO)
- Time Since New (TSNW)
- Mean Cycles To Failure (MCTF) – MCTF(J), MCTF(N), MCTF(C)
- Mean Cycles To Unscheduled Removal (MCTUR)
- Cycles Since Installation at Removal (CSI)
- Cycles Since Repair (CSRP)
- Cycles Since Overhaul (CSO)
- Cycles Since New (CSNW)

Chapter 13-2 Reliability Metrics Logbook



Chapter 13-2 Reliability Metrics

4.4 Logbook Rates

- **Snag Report Rate (SRRT)**
 - $\text{SRRT}_{\text{h}} = 1000 \{ (\text{logbook count for all snags}) / (\text{total flight-hours for the same period}) \}$
 - $\text{SRRT}_{\text{c}} = 100 \{ (\text{logbook count for all snags}) / (\text{total actual departures for the same period}) \}$
- **Pirep Rate (PRRT)**
 - $\text{PRRT}_{\text{h}}, \text{PRRT}_{\text{c}}$
- **Pilot Initiated Log Rate (PILR)**
 - $\text{PILR}_{\text{h}}, \text{PILR}_{\text{c}}$
- **Cabin Log Rate (CLRT)**
 - $\text{CLRT}_{\text{h}}, \text{CLRT}_{\text{c}}$
- **Cargo Log Rate (CGLR)**
 - $\text{CGLR}_{\text{h}}, \text{CGLR}_{\text{c}}$
- **Maintenance Reports [Marep] Rate (MRRT)**
 - $\text{MRRT}_{\text{h}}, \text{MRRT}_{\text{c}}$

Chapter 13-2 Reliability Metrics - What's Next?

Dispatch Availability (DA)

Purpose: To measure the percentage of time that an aircraft is available for use.

It takes into account all downtime due to unscheduled maintenance even if a substitute aircraft is used to cover for the aircraft with technical problems.

Example: An aircraft is planned for use 16 hours a day for a month. In that time it has technical problems which keep it unavailable for use for a total of 20 hours in the month.

$$DA = \{16 * 30 - 20\} / \{16 * 30\} = 95.8\%$$

******Metric still in development******

Chapter 13-2 Reliability Metrics - What's Next?

- **Schedule Completion Rate - SCR(/Technical Regularity Rate-TRR)**
 - Schedule Completion Rate is the percentage of scheduled revenue departures that do not incur a primary technical cancellation or a follow-on cancellations thereof.
- **On-Time Departure Performance (OTDP)**
 - On-Time Performance is the percentage of performed revenue departures that do not incur a primary technical delay.
- **Failure Hours Rate - FHR**
 - There are three types of FHR's : FHR-justified; FHR-non-induced; and FHR-confirmed.
 - Note: $FHR = 1000/MTBF$
- **Failure Cycles Rate – FCR**

******Metrics still in development******

Chapter 13-2 Reliability Metrics - What's Next?

- **Mean Time Since Installation (MTSI)**
 - A component performance rate calculated by taking the average hours on components when they were removed for scheduled or unscheduled reasons.
- **Mean Cycles Since Installation (MCSI)**
- **Mean Time To Repair (MTTR)**
- **Average Flight-Hours Per Aircraft Per Day (AFHPAC)**
- **Average Cycles Per Aircraft Per Day (ACPAC)**
- **Average Duty Hours Per Aircraft Per Day (ADHPAC)**
 - Duty-Hours is defined as:
 - Flight-Hours + Taxi Time+ Active Turned Around Time

******Metrics still in development******

Conclusion – The Challenge

- **This specification indicates the direction of the industry.**
- **The expanded set of data elements will improve the quality of the response that the airframer and supplier can provide to operators.**
- **Operators do not change their systems frequently. The challenge is to make operators see the value of using SPEC2000 Ch 11 at their next update.**
- **Airframers have jointly championed the rapid implementation of SPEC2000 Chapter 11 throughout industry.**
- **The RIG has worked with several software companies to ensure specification will be incorporated in whichever software third-party provider operators may choose. The challenge is for software companies to see the value in incorporating Ch 11 in their standard software.**
- **Many suppliers have taken part in developing these specs. Their challenge is to spread the news within their own companies.**

Conclusion - An Opportunity for Growth

- **Chapter 11 was a large step in helping the industry grow.**
 - **The definitions of important data provided reliability and maintenance engineers/analysts with some clues as to how to improve their aircraft productivity and how to optimize/evolve maintenance.**
- **With Chapter 13 the industry has explored and developed metrics that differentiate between aircraft reliability, component reliability and aircraft productivity.**
 - **These metrics help understand the problems that cause delays and those that cause large downtime.**
 - **Another strength of Ch 13 is that it will assist academic institutions to understand the industry better and so to develop analysis methods to improve service.**
- **The ultimate beneficiary is the traveller who obtains more reliable and cheaper service.**



Questions?