

Recurring Defect Clustering

submitted by Air Canada

Context

Transport Canada mandates per the Canadian Aviation Regulation (CAR 706.05 and STD 726.05) that an Air Operator Certificate (AOC) holder must include in its maintenance control system procedures for recording and rectification of defects, including the identification of recurring defects. Defects can be classified into two distinct categories: Safety/Airworthy related defects and Non-Safety/Airworthy related defects.

1. Safety/Airworthy defects are covered under the **Minimum Equipment List (MEL)**, a document approved by the Minister pursuant to CAR 605.07 (3) that authorizes an operator to operate an aircraft with aircraft equipment that is inoperative under the conditions specified therein; the MEL may specify that certain equipments must be operative. Each MEL has its own unique identifier and each MEL-type defect has an Air Transport Association (ATA) technical classification.

2. **Non-MEL defects** are defects that are raised for items that are not Safety/Airworthy related, such as scratches or gauges on surfaces, amongst many more designated classes. Each defect has an Air Transport Association (ATA) technical classification.

Recurring defects are the focus of the current problem.

1. Pursuant to section 706.05 of the CARs, the defect recording system has to include a method to highlight defects that recur, so that they are readily identifiable by flight crews and the maintenance organization at all bases where the aircraft is operated. The air operator is responsible for identifying defects as recurring defects to maintenance personnel in order to avoid the duplication of unsuccessful attempts at rectification. (amended 2008/12/30)

2. Pursuant to section 706.05 of the CARs, the defect control system has to ensure that the rectification of a defect identified as a recurring defect will take into account the methodology used in previous repair attempts. (amended 2008/12/30)

3. For the purposes of these standards, defects are recurring defects if a failure mode is repeated three times, on a particular aircraft, within 15 flight segments of a previous repair made in respect of that failure mode. (amended 2008/12/30)

*The **ATA Classification** is a numerical technical classification of all the systems and subsystems on an aircraft that is universally used in aircraft engineering and aircraft maintenance. It was developed by the former Air Transport Association (ATA), which has been renamed Airlines for America (A4A). Following its first issue in 1956, the classification has been adopted industry-wide in aircraft engineering and maintenance documentation. It is based on 100 numbered categories grouped into 'Chapters,' within which there are numbered sections and subsections (an example of such a category is 25-00-00).*

The Problem

The ATA classification of defects, when defects are reported, is carried out manually by the engineer, flight attendant, or pilot who originally reported the defect. The ATA classification tables have generic identifiers such as the example shown above (i.e., 25-00-00), which is labeled “Cabin General.” This means that any defect that occurs in the cabin can technically be classified as such, making the efforts to track recurring non-MEL defects very onerous. Since there are hundreds of combinations in ATA classification categories and thousands of employees who report defects, there is a very low probability of defects being reported with the precise ATA classification required (apart from the generic classifications). Thus the ATA category cannot be considered as a unique identifier for the purposes of tracking recurring non-MEL defects. The other problem we face is that synonyms and acronyms are widely used when describing defects: for example, “Nose Landing Gear,” “Nose Gear,” or even “NLG” may refer to the same defect. Hence the classification is carried out manually on the basis of the defect descriptions, which is time consuming and onerous.

Desired Solution

Air Canada Maintenance wishes to detect recurring defects automatically, thereby meeting and exceeding Transport Canada requirements for both MEL and non-MEL defects. Defects are considered recurring if a failure mode is repeated 3 times, on an aircraft, within 15 flight segments of a previous repair made with respect to that failure mode. For this workshop, the goal will be to detect automatically recurring intervals of 3 defects in 30 days, 4 in 40 days, and 5 in 50 days. Additionally Air Canada desires to relabel reports with ATA Chapter/Section labels in a more exact way, in an effort to sanitize the dataset. To carry out these tasks, Air Canada will provide a large dataset of defect reports, including MEL, textual defect description, ATA labels, aircraft tail number, etc. Auxiliary data will also be provided, including reference tables of acronyms and synonyms used in the airline industry.