Chapter 14
Identification of Major FOD Contributors in Aviation Industry

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ABSTRACT
Aviation safety is considered of paramount importance, and the Foreign Object Debris and the resulting Foreign Object Damage (FOD) is one of the major causes that put aviation safety at risk. FOD Prevention is thus a continual challenge for all aircraft operators and maintenance crew. It costs the aviation industry millions of dollars every year. This financial effect is a result of direct costs, such as harm to aircraft structures or damage of aircraft engines, as well as the indirect costs, which include flight schedule delays, cancellations, disruptions, and additional effort for the employees. In addition, on occasion, more critical than the financial impact, is the safety impact and potential loss of human life associated with occurrences caused by FOD. It is therefore ranked as the most likely potential ground-based cause that can lead to a catastrophic aviation event. The present chapter is based on statistical analysis of aircraft occurrences attributed to various types of FOD during the last ten years of operations in an aviation organization. Eight major cause factors contributing towards these cases have been identified. A broad FOD prevention and control plan is thus proposed to address the foremost cause factors and improve organizational response to FOD. The objective of the research is to promote ground and flight safety and the preservation of assets by reducing FOD.

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INTRODUCTION

Aviation maintenance is a complex organization in which individuals perform varied tasks in an environment with time pressures, minimal feedback, and sometimes difficult ambient conditions. Aircraft, as well as inspection and maintenance equipment are thus becoming more complex. As the commercial aviation fleet ages, and work force of maintenance personnel diminishes, maintenance workload is increasing (Latorella & Prabhu, 2000). Air transport policies have aimed at increasing system capacity on the one hand and reducing acceptable risk and safety thresholds on the other (Netjasov & Janic, 2008). The term FOD is an aviation term. Typically, it is used to describe any small item, particle or debris that does not belong on an airport pavement surface and has the capability to cause harm or damage to an aircraft that passes by. It includes a wide range of materials such as loose hardware, pavement fragments, catering supplies, building material, rocks, sand, pieces of luggage, and even wildlife. Besides airport runway, FOD can also be found at aircraft hangers, terminal gates, cargo aprons, taxiways and flight decks. The sources of FOD include many kinds. The characteristic and feature of FOD may vary obviously depending on the attribute and size of foreign object. According to the nature of foreign object and potential damnification to engine, foreign object can be as diverse as sand particles, metal materials and soft materials, such as birds or verts (Chen, Lu, Li, Fu, Wang, Chai, & Xu, 2009). Recently, Foreign Object Debris (FOD) detection on airport runways has become of increasing interest. A basic motivation for this is the fatal accident with a Concorde aircraft a few years ago due to a metal part lost by an aircraft on the runway some time before (Feil, Menzel, Nguyen, Pichot, & Migliaccio, 2008).

Each year commercial, private and military aircraft jet engines are damaged by the ingestion of foreign objects. Annual engine repair costs for ingestion damage is in the tens of millions of dollars (Greneker, 1999). There is no simple way of ensuring that FOD incidents and accidents do not occur. However, an important step towards industry wide and maintenance crew awareness is the recognition that maintenance quality errors, omission, and lapses may be indicators of wider organizational problems (Mason, Kraus, Johnson, & Watson, 2001). FOD has become of increasing international interest, with many countries initiating their own research to FOD studying (Xu, Ning, & Chen, 2009).

This chapter is focused on establishing the classification, error analysis and finalization of FOD related occurrences of an aviation organization along with identifying the areas requiring attention of the management to limit and address further losses incurred through FOD. A prevention plan consisting of appropriate proactive and protective measures is also discussed, which will also be beneficial in improving organizational responses against FOD.

METHODOLOGY

The FOD related occurrences data for last ten years of an aviation organization was collected. This data was used to identify the month wise classification of FOD cases along with relationship of FOD cases with the hours flown by the organization. Moreover classification of FOD cases with respect to either air or ground was established. Similarly the error analysis of the FOD occurrences was made to identify if the occurrences were unavoidable or could be evaded through improved practices or workmanship. The finalization analysis of data was made to categorize the FOD cases of last ten years into following major groups:

1. Engine FOD Ingestion Cases
2. Miscellaneous Cases
3. Material Factor Cases
4. IOD Cases
5. Human Factor (Ground Crew) Cases
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