Enhanced Teardown of a PC-9/A Wing Main Spar Cap with Miss-drills

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In 2003, 142 production miss-drill indications were identified, via x-ray inspection, in the wing main spar lower caps of 42 Royal Australian Air Force (RAAF) PC-9/A aircraft. These indications were thought to arise from the time of manufacture. The ensuing RAAF program to manage this issue included the rework of some assets with smaller indications left in situ. Continuing airworthiness of the fleet was assured via a full scale fatigue test (FSFT) correlated damage tolerance analysis. The imminent planned withdrawal date (PWD) of the RAAF PC-9/A fleet has led to the age retirement of some of the most affected wing sets thereby providing an opportunity to investigate these indications and the effectiveness of RAAF policy.

This paper describes a joint Defence Science Technology (DST), Royal Melbourne Institute of Technology (RMIT) and Defence Aviation Safety Authority (DASA) 'enhanced teardown' of a RAAF PC-9/A retired wing. For this project, DST elected to use electromagnetic shakers in lieu of hydraulic power, to expedite the identification and characterisation of production discontinuities by growing fatigue cracks from them. The use of a dynamic loading scheme at full scale expands on DST's pioneering work in the field of enhanced teardowns for ageing aircraft structural management. The effectiveness and consequences of production discontinuities as causes of fatigue degradation in modern aircraft structures has also been explored. As a key outcome, the level of safety achieved under RAAF's management strategy for these wings has been confirmed through forensic analysis of test findings. The results of this project continue to mitigate the risk of structural failure in the RAAF fleet So Far As is Reasonably Practicable (SFARP) in the limited time remaining prior to PWD.

Figure 1. PC-9/A Enhanced Teardown Article and Load Reaction Fixture

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