Outcomes from the Fatigue Testing of Seventeen Centre Fuselage Structures

L. Molent, S.A. Barter, B. Dixon, G. Swanton

PII: S0142-1123(18)30060-4
DOI: https://doi.org/10.1016/j.ijfatigue.2018.02.018
Reference: JIJF 4583

To appear in: *International Journal of Fatigue*

Received Date: 12 December 2017
Revised Date: 5 February 2018
Accepted Date: 12 February 2018

Please cite this article as: Molent, L., Barter, S.A., Dixon, B., Swanton, G., Outcomes from the Fatigue Testing of Seventeen Centre Fuselage Structures, *International Journal of Fatigue* (2018), doi: https://doi.org/10.1016/j.ijfatigue.2018.02.018

Outcomes from the Fatigue Testing of Seventeen Centre Fuselage Structures

L. Molent*, S.A. Barter, B. Dixon and G. Swanton

Aerospace Division, 506 Lorimer Street Fishermans Bend Victoria 3207
AUSTRALIA

ABSTRACT

This paper summarises some of the significant outcomes of a fatigue test program for ex-service aircraft structure. Seventeen F/A-18 Hornet aircraft aluminium alloy 7050-T7451 centre fuselages (referred to as centre barrels (CBs)) were tested, torn down and inspected in this program. Significant results of the test program included the demonstration of the repeatability of service fatigue cracking locations, the collection of data to characterise the types of defects that typically nucleate fatigue cracks in aircraft components and a more accurate assessment of the safe operating life of this structure. The results of the program also enhanced the existing understanding of fatigue cracking in aluminium alloy 7050-T7451. Furthermore, the improved understanding of the fatigue cracking that occurred in service F/A-18 CBs and the damage tolerance of this structure allowed increased aircraft availability and reduced maintenance costs in the Royal Australian Air Force (RAAF) F/A-18 fleet.

Keywords: Fatigue crack growth; Full-scale fatigue tests; F/A-18 Hornet aircraft; fatigue lifing

List of Acronyms

a	Current crack depth
a_0	Initial crack depth per exponential crack growth model, equivalent to the EPS.
AA	Aluminium Alloy
a_{Crit}	Crack depth at fracture
AFHRS	Airframe Hours
$a_{max\ FT55}$	Maximum crack depth that occurred on FT55
a_{RST}	Largest crack depth that can safely sustain RST loading
ASLMP	Aircraft Structural Life Monitoring Program
b	Geometry factor
b_{FT55}	Geometry factor for cracking in FT55
b_{RST}	Geometry factor for a_{RST}
CB	Centre Barrel
CBR	Centre Barrel Replacement
DIL	Damage Item Location
DLL	Design Limit Load
DST	Defence Science and Technology
EOS	End of Service
EPS	Equivalent Pre-Crack Size
FALSTAFF	Fighter Aircraft Loading Standard For Fatigue evaluation
FC	Fracture Critical

* Corresponding author. E-mail address: Loris.Molent@dst.defence.gov.au (L. Molent)