FOR FURTHER INFORMATION:
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Structural Integrity of New & Aging Metallic Aircraft

10 – 14 OCTOBER 2016
LEVEL 4, 210 KINGS WAY, SOUTH MELBOURNE VIC 3205
At a glance
The Millennium Falcon might be shabby and old, but it can still travel at lightspeed. We speculate it’s because Hans Solo did the Star Wars universe equivalent of the “Structural Integrity of New and Ageing Metallic Aircraft” training course for engineers offered by QinetiQ Technology Training in Melbourne.

About this course
This course presents both fundamental concepts and practical instruction in methods for fatigue, durability, and damage tolerance analysis/testing of metallic aircraft structures. The lectures emphasise the use of modern fatigue and fracture mechanics technology in the design of durable, damage-tolerant aircraft structures and the extended safe use of aging aircraft.

The lectures detail the structural methods used in the aircraft industry to develop fatigue loading spectra, and calculate fatigue life, crack growth, and residual strength. The course explores the application of this technology to verify the structural integrity and longevity of new aircraft, along with life monitoring, maintenance, and life extension of aging aircraft. Topics also include basic fatigue and fracture behavior of structural metallic materials, structural reliability analysis, and historic aircraft failures that redefined structural integrity analysis.

Details
DATE: 10-14 October, 2016
8am - 4pm
VENUE: Level 4, 210 Kings Way, South Melbourne VIC 3205
COST: $5400 per person + GST
REGISTRATION CLOSES: 24 August, 2016
STUDENTS RECEIVE: Course materials, morning tea, light lunch, afternoon tea and course certificate.
REGISTRATION Register online at www.QTTraining.com.au

In partnership with

About the instructors
THOMAS R. BRUSSAT, PHD, AIRCRAFT STRUCTURAL INTEGRITY CONSULTANT, ATLANTA, GEORGIA
Dr. Brussat has dedicated 47 years to the development and application of durability and damage tolerance technology to the Aircraft Structural Integrity Program (ASIP). With Lockheed Martin Aeronautics Company he served 21 years as the Contractor Team Lead for durability and damage tolerance for the F-22 “Raptor,” covering all phases of its ASIP, from initial design requirements and design analysis, through full-scale testing, to the implementation of its 21st-century Force management program. From 1966 to 1986 Dr. Brussat was engaged in cutting-edge research supporting the initial development of USAF and USN damage tolerance analysis methodology and criteria. Since 2008, he has continued to support ASIP as a private consultant. He co-authored the USAF Aircraft Structural Risk & Reliability Analysis Handbook in 2010 and proposed several significant advances in risk analysis methodology at the 2012 ASIP Conference. Dr. Brussat was the invited keynote speaker at the 2013 ASIP Conference and received the Lincoln Award for career achievement in Aircraft Structural Integrity. He has published numerous technical papers on fracture mechanics and crack growth analysis and test.

PAUL N. CLARK, PH.D., SOUTHWEST RESEARCH INSTITUTE, SAN ANTONIO, TEXAS – HILL AIR FORCE BASE EXTENSION AND ADJUNCT PROFESSOR, DEPARTMENT OF MECHANICAL ENGINEERING, UNIVERSITY OF UTAH, SALT LAKE CITY, UTAH.
Dr. Clark is considered a subject matter expert in the areas of fatigue and corrosion of aging aircraft, crack growth mechanisms, damage tolerance and fracture mechanics. Life prediction, risk analysis, failure evaluation, failure prevention, experimental protocol development and test planning are other areas of expertise. He works in concert with the United States Air Force ASIP (Aircraft Structural Integrity Program) managers to provide engineering services and continuity to continually evolving programs. Fleet-wide trending and risk projections as well as failure investigations pave the way for new structural inspections as well as repair designs, modifications and analyses.

Additionally, Dr. Clark serves as an Adjunct Professor for the Department of Mechanical Engineering at the University of Utah in Salt Lake City. Currently, he teaches courses focusing on Fatigue, Fracture and Corrosion as well as Design for Reliability and the Prevention of Failures.
Course outline

DAY ONE
Introduction: Course overview, historical background, design criteria, design philosophies, aging aircraft issues.
Fracture Mechanics Basics: Crack tip stress fields, stress intensity factor, small-scale yielding, plane stress and plane strain.
Failure of Cracked Structures: Failure theories, failure prediction, fracture toughness, crack growth resistance curves, damage tolerance analysis of redundant structures.
Cyclic Stresses & Loading Spectra: Basics of cyclic stresses and spectra development including usage spectra, mission profiles, and load exceedance curves.

DAY TWO
Fundamental Fatigue Analysis: Fundamental fatigue design approaches and technical approaches including, S-N (Wohler) curves, stress ratio effects, Goodman diagrams, fatigue limit estimation, stress-life, strain-life, cyclic stress-strain curves, strain hardening and softening. Specific fatigue analysis examples.
Fatigue Analysis Rules and Challenges: Stress concentrations and notches, stress flow, local strain analysis, Neuber's rule, residual stresses, cold-expansion, Palmgren-Miner rule, specific example aircraft challenges applied to fleet management. A broad discussion of fatigue mechanisms, fatigue variables, and fatigue nucleation mechanisms.

DAY THREE
Material Fatigue Behavior: Materials characterization, material discontinuities, initial discontinuity state and modified (evolving) discontinuity state and small fatigue cracks. Material behaviors for fatigue nucleation and fatigue crack growth. Influence from corrosion fatigue and fretting fatigue with examples. Material testing and interpretation of test results, experimental test protocol development; full-scale fatigue testing, interpretation and implementation of results into fleet management and inspection, with case study examples.
Fatigue Crack Growth Analysis: Fundamentals of crack growth prediction; crack growth testing; variables affecting da/dN; load spectrum effects; crack retardation models; truncation, clipping and cycle counting; crack growth computer programs.

DAY FOUR
Fatigue Crack Growth and ASIP: Stress intensity estimation; spectrum crack growth rate; damage tolerance testing and analysis of airframe structure (lugs, bolted joints, and stiffened panels); continuing damage; crack growth durability and EIFS concept; applications of crack growth analysis in the USAF ASIP including in-service inspection, maintenance, and individual aircraft tracking.
Aircraft Structural Risk & Reliability Analysis: Limitations of deterministic life analysis; probability of failure criteria; Single Flight Probability of Failure; risk analysis data requirements; inspection and repair effects; calculation methods; examples.

DAY FIVE
Aircraft Structural Failures: Hard Lessons of History: Five events that redefined aircraft structural integrity analysis and verification requirements.
Structural Integrity Considerations of Lap Joints: The evaluation of a series of lap joint designs including geometry, bonding, corrosion, and fatigue failure considerations and methods to improve their structural integrity.
Fleet Wide Fatigue Cracking in Primary Structure: A case study in failure analysis, fatigue crack growth analysis, repair design and fleet inspection and risk management.
Various Structural Integrity Topics for Discussion: A series of topics designed to summarise and finalise the course.

Bookings and cancellations
Registration is confirmed when a booking is made through our website. You will receive a Registration Confirmation Email.
Confirmation of the course going ahead will be received either on attainment of class capacity, or 6-7 weeks before the course start date in a Course Confirmation Email. Further course information will be sent directly to the participants within this email. QinetiQ Technology Training advises attendees not to book travel and accommodation until receipt of the course confirmation email.
Should you book a course you are unable to attend a suitable substitute is always welcome. Refunds will not be given after the a course has been confirmed in the Course Confirmation Email, however for exceptional circumstances some credit may be given towards another QinetiQ Technology Training course.