



Large Military Aircraft E3 Certification and a Description of the Fixed Facilities Based at MOD Boscombe Down

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About the presenter

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Luke Heritage joined QinetiQ in 2008 from university, and has worked in the Electromagnetic Environmental Effects (E3) discipline for almost 15 years. Luke has worked primarily on military heavy fixed-wing aircraft, rotary platforms as well as fast jets covering all aspects of E3 including practical trials activities.

Introduction

- Applicable E3 standards, test levels and test facilities
- Focus on challenges of HIRF testing large military aircraft
 - Test setup
 - Aircraft lifecycle
 - In-service demands



Standards and Test Levels (1)

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- Civil and Military standards
 - Defence Standard 59-411; Electromagnetic Compatibility
 - Defence Standard 59-114; Electro-explosive devices
 - Defence Standard 59-113; Lightning
 - Mil-Std-464; E3
 - NATO AECTP-250 series
 - EUROCAE ED107
- Safety critical, mission critical, armaments
- Safety margins

Standards and Test Levels (2)

- Internal and External RF environment
- UK HIRTA scheme
- SRAD/TRAD for ships

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Test Facilities – Overview

- Farnborough
 - High Level Radiated Susceptibility
 - Low Level Swept Field
 - Transmitting Portable Electronic Devices (TPEDs)
- Boscombe Down
 - Radio Frequency Environment Generator Fixed Facility
 - Anechoic Test Facility
 - Low Level Swept Coupling / Bulk Current Injection

Test Facilities – REG (1)



- Dedicated shielded amplifier room for all amplifiers (2007) – 5 MHz to 1 GHz
- 30kW AR Amplifier (installed in 2016) – 5 to 90 MHz



- 1kW AR Amplifier – 80 to 1000 MHz
- 10kW AR Amplifier (installed 2007) 5 to 220 MHz
- CW, 1 Hz and 1 kHz modulation

Test Facilities – REG (2)

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HF Horizontal



HF Vertical

Test Facilities – REG (3)



UHF antenna



VHF antenna

Test Facilities – REG (4)



Over Focused, Double Parabolic Dish (Circular/Elliptical Polarisation)

- 1.305 to 34.8 GHz over 23 licensed frequencies
- 1 μ S PW, Variable PRF 200 Hz to 1 KHz
- Mean power density – over 1,000 W/m² (614 V/m)
- Peak power density – over 1,000,000 W/m² (19,416 V/m)
- Magnetron based system (4 transmitters / 8 magnetrons)

Test Facilities – ATF

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- ATF measures 31m (L) x 17.5m (W) x 7.6m (H) – lozenge shaped
- Designed primarily for EW and Radar testing (cooled test target)
- At least 100dB of isolation 500 MHz to 40 GHz from outside environment
- Fume extraction for vehicle running (but not jet engines)
- Can be configured with a GPS constellation or Electronic Warfare (EW) simulations
- Useful for whole platform EMC emissions testing and transmissions on difficult to licence frequencies

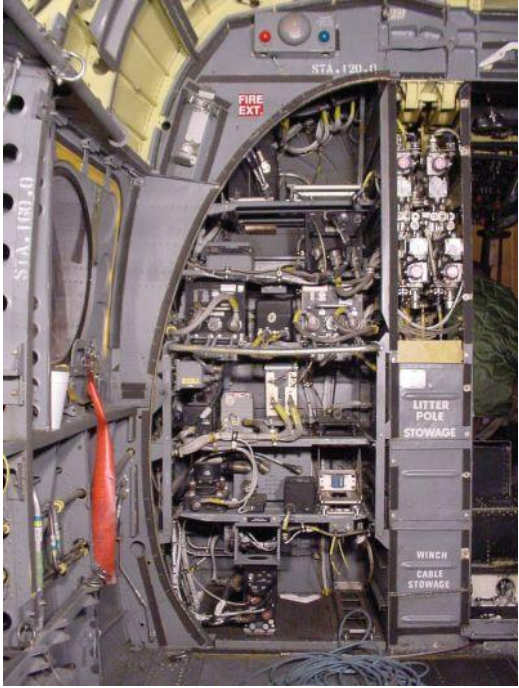
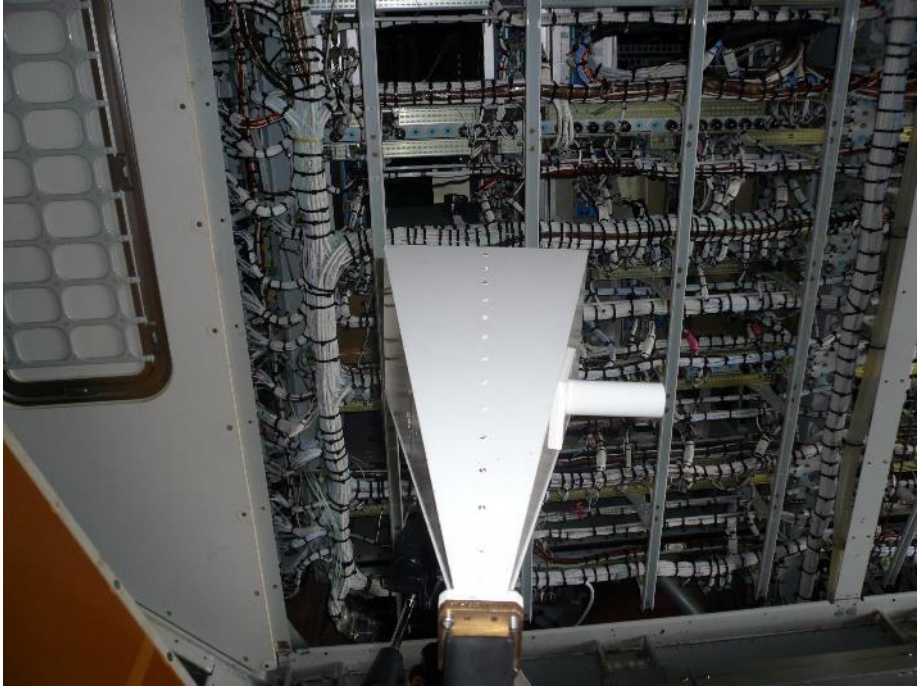
Test setup (1)

- Large open-air test site required
 - LLSC antennas typically 70 metres from aircraft under test
 - REG facility located on an airfield with taxiway access
- Size of test article
 - Whole airframe illumination
 - Multiple targets as frequency increases
 - Test duration
- Targeting of system under test
 - Proximity to antenna; wing span and antenna size, achievable test level
 - Multiple angles of test; aircraft orientation and apertures such as windows
 - On-aircraft test; access to avionics cabinets, cooling issues, proximity to LRIs

Test setup (2)

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Test setup (3)

- Operation of system under test
 - Ground power, Auxiliary Power Unit (APU), engine running
 - Crewed/un-crewed testing; personnel RF exposure considerations
 - ‘Flight-mode’
- SQEP support
 - Aircraft knowledge; aircrew and/or other specialists
 - Maintenance support
 - Support equipment provision and operation

Other factors (1)

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- Legacy aircraft
 - Initial test may not have been to latest standard
 - EMC may not have been thought about in initial design
 - Design does not provide EMC shielding, segregation
 - Impact on clearance level that can be achieved
- Modifications and mid-life updates
 - Mixture of legacy and new/modified systems
 - Assessment may be limited to a documentation review or similarity statement
 - Tailored whole aircraft EMC testing
 - Overall clearance may be limited by legacy aspects of an aircraft

Other factors (2)

- COTS products
 - Not typically tested to military test levels
 - Engagement with manufacturer / supplier to reduce whole aircraft level test requirements
- In-service demands
 - For first of type, and some in-service aircraft types, an airframe is typically dedicated to EMC testing
 - However, availability may be limited
 - Test asset may be recalled before or during activity
 - Scheduling and resourcing issues, cost impacts

Summary

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- Applicable standards, selection of test levels and safety margins
- Available test facilities
- Challenges of testing military heavy aircraft
- Other factors that influence and impact EMC testing

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Questions?