Developing and Certificating Aircraft for Use as Scientific Instrument Platforms

Centre for Earth Observation Instrumentation and Space Technology

Airborne Demonstrator Opportunities Workshop 7th October 2015

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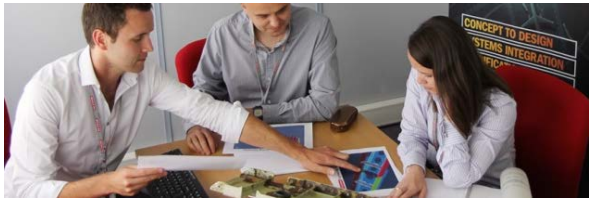


80 YEARS OF PRESTWICK AVIATION EXCELLANCE

BAE SYSTEMS
INSPIRED WORK

Introduction to Regional Aircraft

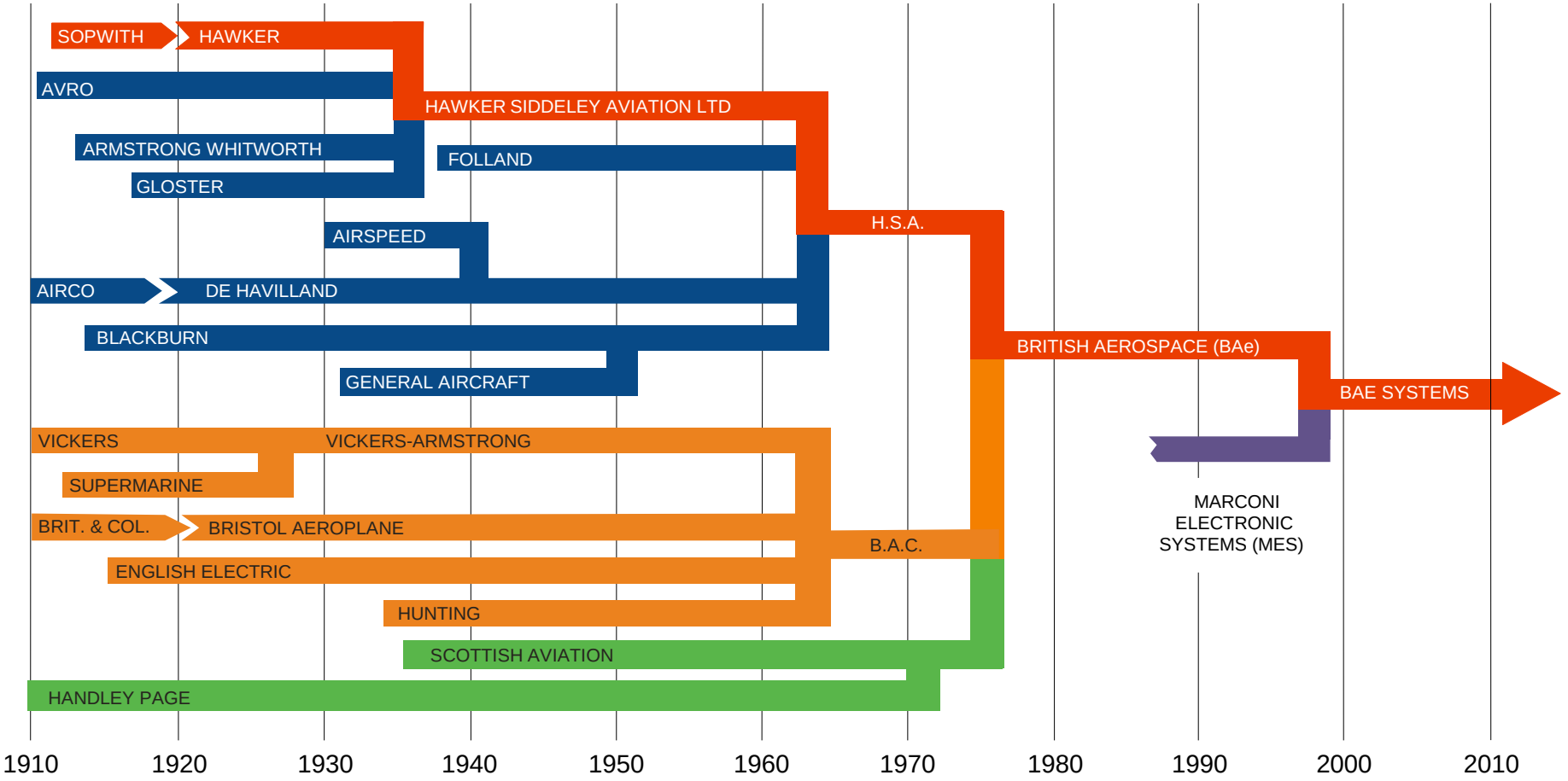
Introduction to Regional Aircraft

- Global aircraft fleet support capability
- Whole aircraft design and engineering expertise
- Premier supply chain capability and extensive in-service support experience
- Trusted provider of complex managed solutions
- 250 employees based at Prestwick and Weybridge

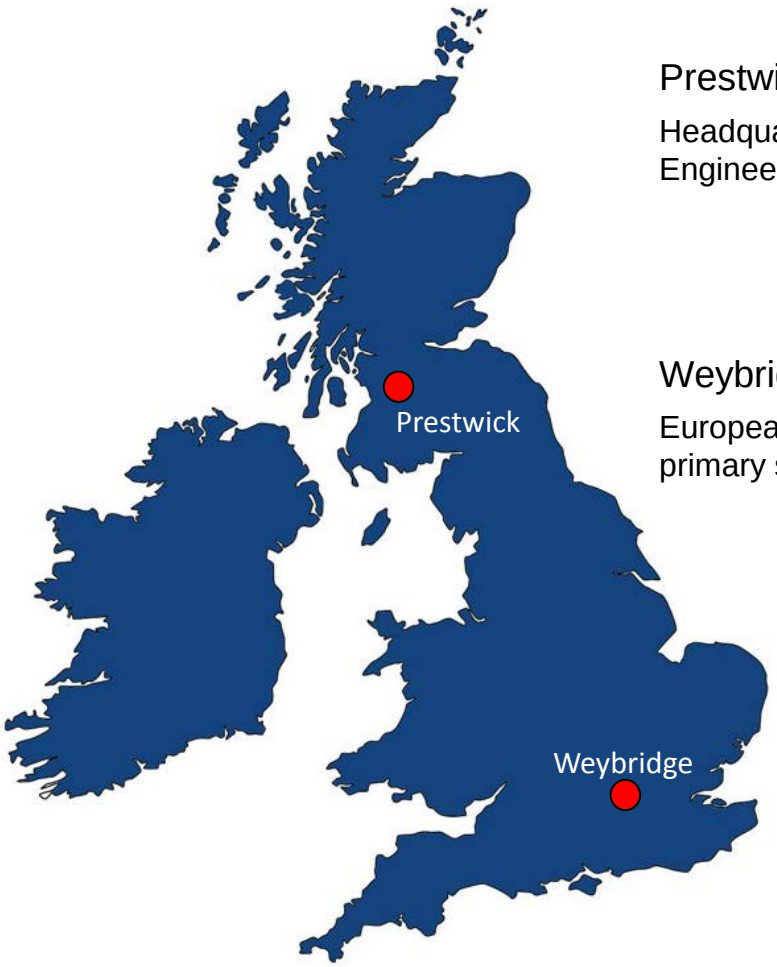
80 YEARS OF PRESTWICK AVIATION EXCELLANCE

BAE SYSTEMS
INSPIRED WORK

Regional Aircraft History



Regional Aircraft Contacts and Locations



Prestwick

Headquarters, Operations and Engineering Support

Weybridge

European Logistics Centre (ELC) primary spares distribution centre

Contacts

www.regional-services.com

New Customer enquiries: rasales@baesystems.com
Modifications: ramodifications@baesystems.com
Technical Publications: rapublications@baesystems.com
Engineering: raengineeringsales@baesystems.com

Regional Aircraft OEM Fleet

North America
70 aircraft in service
30 operators

Europe
245 aircraft in service
50 operators

Africa & Middle East
60 aircraft in service
30 operators

Asia
45 aircraft in service
20 operators

South America
90 aircraft in service
40 operators

Australasia
30 aircraft in service
10 operators

180 Operators, 540 Aircraft In Service
Type Certificate Holder for BAe146/RJ, ATP, J41, J31/32 and 748

Regional Aircraft Approvals

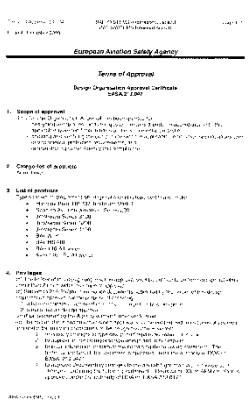
- EASA Part 21J Organisation Approval – Design and Flight Test
- EASA Part 21G Organisation Approval – Production
- UK CAA Approval AD/1852/05 – Design, Production and Flight test of non-EASA types
- AS EN 9100 - Aerospace Specific Quality Management Requirements


European Aviation Safety Agency

APPROVAL CERTIFICATE

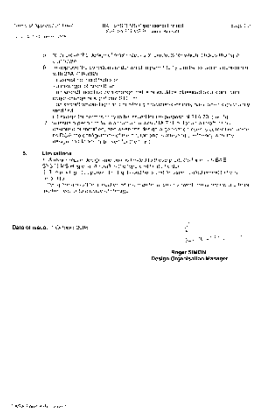
EASA.21J.047

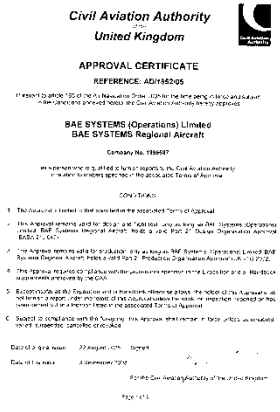
BAE SYSTEMS (OPERATIONS) LIMITED
BAE SYSTEMS REGIONAL AIRCRAFT
Prestwick International Airport
Prestwick
Ayrshire, KA9 2RW
United Kingdom


European Aviation Safety Agency

Terms of Approval

Design Organisation Approved Certificate
EASA.21J.047




Civil Aviation Authority
United Kingdom

APPROVAL CERTIFICATE

REFERENCE: AD/1852/05

BAE SYSTEMS (Operations) Limited
BAE SYSTEMS Regional Aircraft

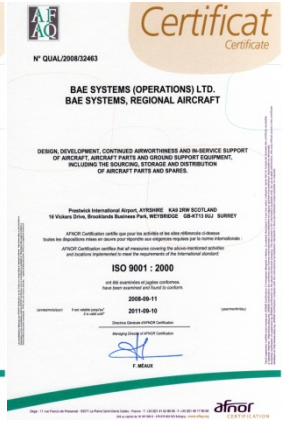

Certificat
Certificate

N° AERO/2008/32462

BAE SYSTEMS (OPERATIONS) LTD.
BAE SYSTEMS, REGIONAL AIRCRAFT

AS9100B, EN9100:2003/S1, JISQ9100:2004

2008-09-11
2011-09-10


Certificat
Certificate

N° QUAL/2008/32463

BAE SYSTEMS (OPERATIONS) LTD.
BAE SYSTEMS, REGIONAL AIRCRAFT

ISO 9001 : 2000

2008-09-11
2011-09-10

Regional Aircraft

- We apply
  - Whole aircraft engineering capability
  - Through lifecycle knowledge and experience

- To provide customers with integrated solutions for
  - Design
  - Supply
  - Repair
  - Change
  - Upgrade/conversion
  - Customer support services

Special Role Aircraft Conversions

Jet and turboprop platform conversions to meet all your special mission role requirements:

- Surveillance and reconnaissance
- Coast Guard, Search and Rescue
- Research
- Crew training
- Navigation Aids Calibration
- Water Bomber / Oil dispersant
- Passenger / Freight / Combi and quick change
- Range Extension – Additional tanks
- Medevac
- VIP finish


Research


Maritime Patrol


Military Transport


Air to Air Refueling

Water Bomber


VIP Transport

Special Role Aircraft Conversions

Research

Maritime Patrol

Military Transport

Air to Air Refueling

Water Bomber

VIP Transport

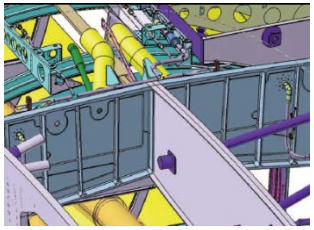
Role Change Engineering Services

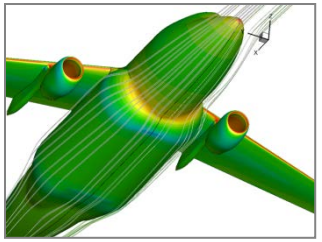
Integrated Design Services

- Modification development
  - Specific installations
  - Integrated packages
- Whole ATA coverage
- Certificated STCs or work packages
- Test equipment design

Analysis Services

- Finite Element Analysis
- Static Analysis
- Check Stress
- Fatigue and Damage Tolerance
- CFD Analysis
- Performance Analysis
- Stability and Control
- Loads
- Icing Assessment
- Systems Safety Assessment
- V&V
- Particular Risk Analysis
- Test Analysis





Scientific Instrument Platforms

BAe146-301 ARA

BAe146-301 ARA

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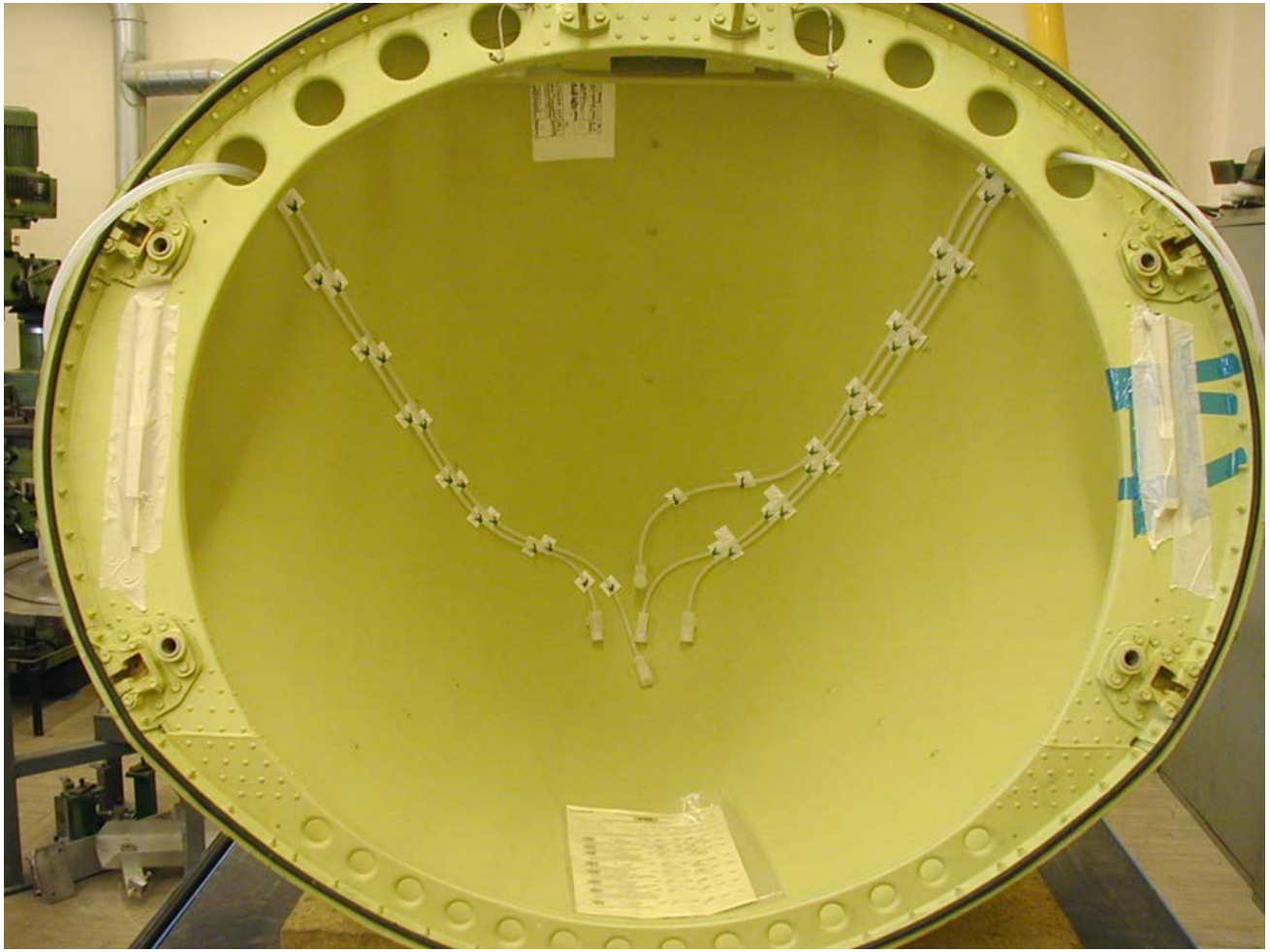


Airworthiness fundamentals

- Civil aircraft are certificated to international airworthiness standards
  - EASA CS23 / JAR 23 / FAA Part 23 for small aircraft up to 19 seat commuter class (including small business jets)
  - EASA CS25 / JAR 25 / FAA Part 25 for large commercial aircraft

- CS25 at Amendment 17 has 1023 pages of requirements and advisory material.
- Requirements run up to CS25.1583
- Compliance must be demonstrated, and that demonstration substantiated, for every line in every section of each requirement to obtain type certification.

- Every commercial aircraft has a number of approved documents which define its structure, systems and performance
  - Structural Type Record
  - Airplane Flight Manual (AFM)
  - Etc…..

- Any change to the aircraft must be assessed and compliance with the relevant requirements demonstrated.

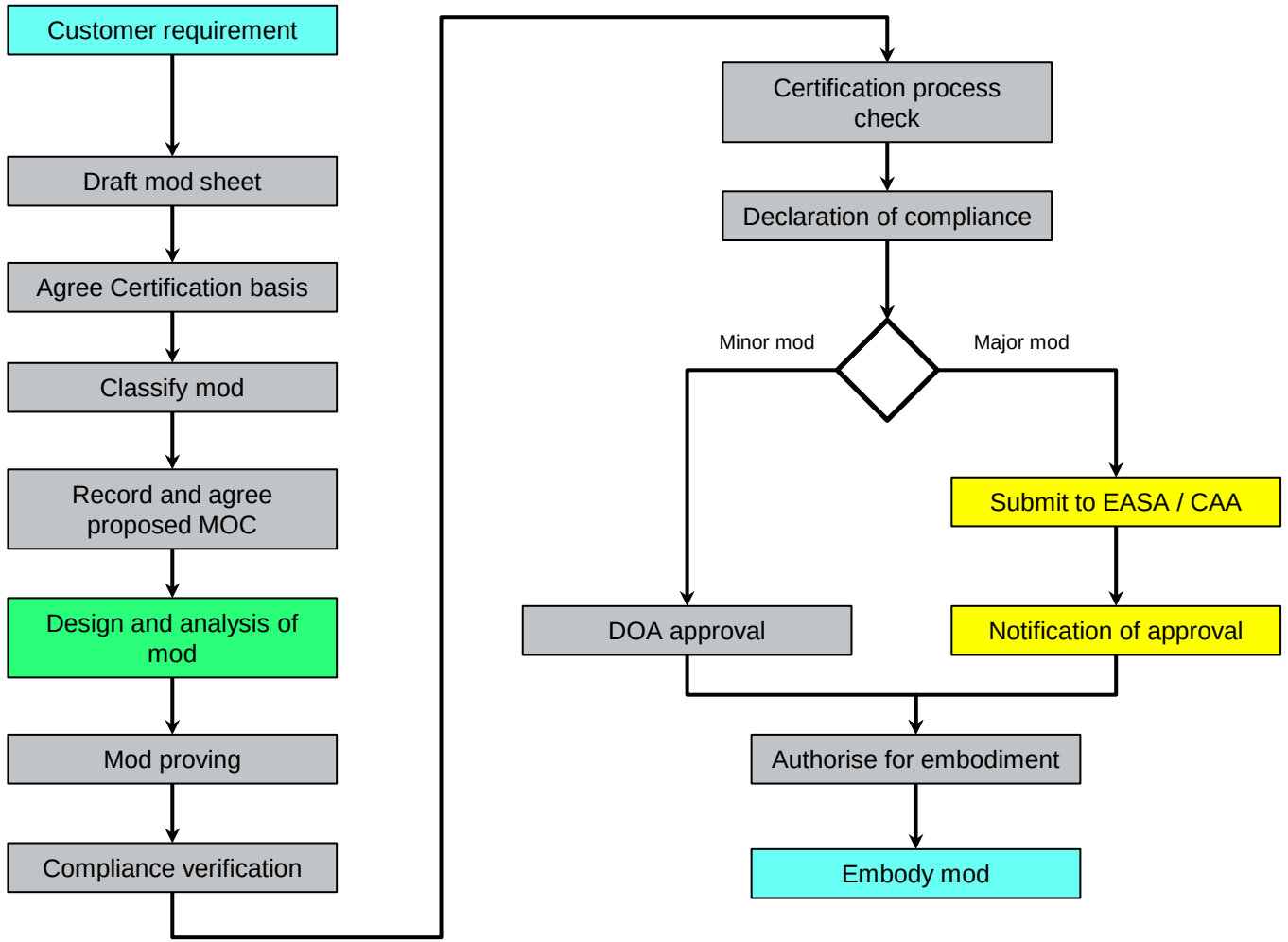
Airworthiness fundamentals

- Changes to an aircraft are introduced via the modifications (mods) process.
- BAE Systems mods process requires us to sign off against the following statement:
- “Relevant means of compliance have been determined and compliance established against the referenced certification basis of the described Change. The design of the aircraft with the described Change incorporated contains no unsafe features and complies with the relevant Authority design requirements and environmental requirements, and the procedures specified in the Authority approved design organisation handbook (Exposition) have been followed.”





Modification process



IRD

- This gives useful initial background to the instrument / modification and also allows the integrator (BAE Systems or A.N.Other) to provide an estimate against the work involved.
- Typically this covers:
  - Introduction – document history, contact details etc
  - Background – what is it for, is it new, has it flown before?
  - Project timetable
  - Supply and division of work – who is certificating it (BAE Systems or an STC), who is making it etc
  - Technical requirements – schematic, components, interface details, EMC, aero etc
  - Safety and hazards – lasers, chemicals, pressurised gases, radiation etc
  - Operational requirements – how will you use it, service it etc





TSSE

- Typically for a scientific instrument fit BAE Systems would require you to complete a TSSE (Technical Specification of Scientific Equipment) document.
- This forms the basis of a number of systems related certification tasks.
- Contents typically include:
  - Overview
  - Main Equipment Fitted
  - Layout (including drawings and images as appropriate)
  - Equipment List
  - Instrument Location, Function and Operation
  - Technical Requirements for Installation of Rack Mounted Equipment (responding to BAE Systems technical requirements) – this includes structural, mechanical, fluids and electrical design aspects
  - Hazards (responding to BAE Systems hazard assessment requirements)
  - Scientific Equipment Approval – Conformity Statements (responding to BAE Systems conformity requirements)
  - Failure Analysis (responding to BAE Systems identified failure modes list)
  - Gas flow schematics
  - Power Distribution
  - Electrical Schematics
  - Nominal Power Use summary table
  - Weight and balance
  - Appendices

Compliance demonstration

- Instrument integration typically 500 - 1000 engineering hours producing the following output:
  - Aerodynamics Note covering Subpart B plus air data systems and icing
  - Structures Report covering Subpart C and elements of Subpart D
  - Systems Reports covering Subparts D , F and H (EWIS)
  - Design Reports covering Subparts D, F, G and H e.g. cabin survey



Summary

- Installing a scientific instrument on a Part 23 or Part 25 aircraft can be a sizeable task, depending on the instrument.
- Allow time and budget to cover the integration and certification aspects.
- Talk to your aircraft OEM or STC house early to avoid performance shortfalls or the need to redesign your instrument.
- Provide as much information about the instrument and the mission as you can in order to get the optimal installation.
- **Don't panic** – it's usually doable.