Military Certification - An Industry Perspective

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Topics

- Market Indicators
- Differences in Certification for Military Programs
- Industry Benchmarks
- Industry Agility is Necessary
- Recommendations
The Market is Changing

- *For unrestricted airspace access*, military aircraft must ensure performance & maintenance of the aircraft separation requirements in a reduced airspace.
- As a result the market demands airworthiness certification, e.g.:
  - US Military self-certification or UK Def Stan 00-56 combined with MIL-HDBK-516B / JSP 553
  - Increasing CNS performance requirements
    - *All customers*
- Foreign sales require established pedigrees of aircraft approvals
  - Airworthiness certifications
## Military Market Indicators
- Movement towards Civil Requirements Compliance

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*requires support/justification for alternatives
Why the Market is Changing...

- Airspace is being restricted IAW CNS aircraft capability:
  - CNS avionics performance criteria per RTCA/EUROCAE requirements
- The International Civil Aviation Organization (ICAO), the global treaty aviation organization
  - Sets the international airspace aviation standards
  - Is addressing critical aviation issues
    - Air traffic control is being restructured over the next 20 - 30 years
- All aircraft must now comply – negotiate on a “state by state” for unrestricted airspace access
- Foreign customers are requiring civil certificability in contracts...and in some cases, full aircraft certification
# Certification Requirement Origins/Drivers

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<th>Origin</th>
<th>Role / Purpose</th>
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<tr>
<td><strong>Commercial Air Operations</strong>&lt;br&gt;International Civil Aviation Org. (ICAO)**</td>
<td>Treaty org. that establishes global “harmonized” aviation rules &amp; standardization of air/ground/space criteria</td>
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<td><strong>EUROCAE / RTCA</strong>&lt;br&gt;development of required system/application performance for aircraft</td>
<td>State aircraft have MOA for “self certification”&lt;br&gt;a. Legal liability for safety in airspace&lt;br&gt;b. If self-certified, <em>not recognized by FAA, no harmonization</em> with foreign state certification</td>
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<td><strong>Eurocontrol or FAA Air Traffic Control</strong>&lt;br&gt;<strong>EASA / Transport Canada / FAA Air Traffic Safety / CAA / DGAC, etc.</strong></td>
<td>US/European industry body that creates definition of acceptable performance criteria IAW ICAO rules supporting Industry compliance &amp; implementation</td>
</tr>
<tr>
<td><strong>BCA, Airbus, Cessna, Bell Helicopters, etc. / Users</strong></td>
<td>Governing body identifying timetable of ICAO rule criteria</td>
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<td><strong>State Air Operations</strong>&lt;br&gt;Army, Navy, USAF, SOCOM, UK MOD, etc. “sovereign state entities”&lt;br&gt;MIL-STDs, DEF-STANS &amp; Handbooks etc.&lt;br&gt;Safety Risk Acceptance</td>
<td>Governing bodies creating state policies, rules, processes IAW ICAO rules</td>
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<td><strong>Requirement Flow</strong>&lt;br&gt;Compliance with&lt;br&gt;applicable civil air regulation in controlled airspace – service policy in unregulated airspace / war</td>
<td>Industry entities purchasing / building aircraft for operation in global airspace IAW ICAO rules</td>
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Differences in Certification for Military Programs
Certification

- It is the relationship of ...

Focus of early certification efforts

Technical Airworthiness Clearance

Operational Airworthiness Clearance

System Safety

Balancing of safety, regulatory and operational suitability requirements throughout lifecycle

Focus of user testing programs
Differences in Safety Risk Acceptance: 3 examples

**MIL-STD-882***
- Identify Hazards
- Assess Residual Risk
- Accept risk at appropriate level
- Safety Center as independent opinion

**Civil Approach**
- Define acceptable risk
- Prove system compliance to acceptable risk
- DER as independent expert

**UK Approach**
- Identify Hazards
- Assess Risk
- “Argue” residual risk is as low as reasonably practicable (ALARP)
- Hired 3rd party as independent Auditor

* Does not include Software DAL
What is Military Certification?

- It’s *not equivalent* to Civil Certification (e.g., FAA)
  - Operation in Civil Airspace requires compliance to *relevant* Civil Certification Requirements
    - Airworthiness
      - Design
      - Performance
      - Processes
    - Continued Airworthiness
      - Maintenance of the certification status of an aircraft throughout its lifecycle to retirement
- Governments “Self-Certify” their state aircraft as airworthy & compliant to controlled airspace performance requirements
  - Operation risk is defined and accepted by the service, risk levels can vary with aircraft purpose / type
Airworthiness

- A demonstrated capability of an aircraft to function satisfactorily within established limits
- Approval builds up in a building block method
  - First it’s foundation is built from each components’ compliance evidence
  - Then systems’ performance compliance evidence is added
  - Then aircraft performance compliance evidence
  - A library is the key program asset capturing the evidence, producing a customer data package
- Military certifications differ on the degree and coverage of the evidence needed
  - May be limited by contract, budget, reduced requirements, lack of past legal liability
  - Aircraft type and legacy
Differences - Scope and Coverage -

CNS: US Military Scope
- Not well known,
- Requires domain knowledge,
- High risk potential

Army - new program

Navy
USAF

Aircraft
- Structure & hardware is understood, well defined, & planned

Software

Maintains Certified Status in Follow-on Programs (USAF, Army only)

Foreign military/ Air Force One & military derivatives/ Civil

Emerging trend indicates expanding use of civil CNS & Software performance requirements and/or standards
Civil–Military Risk Acceptance Comparison

- CFR / EASA performance requirements
- ICAO Operating Standards
- User Requirements
- Military Standards & Handbooks
- Risk / benefit deemed acceptable by Acceptance Authority
- Acceptable risk by regulation (Min performance)
- CNS/ATM Req’s
- Compliance verified by Regulator / designee (DER)
- Risk level concur by working group / independent assessor
- High Risk / non-compliance
- Non-compliance
- Type classified airworthy
- Airspace / Operational Restrictions
- Operational Limitations
- CNS/ATM Req’s
- Access ICAO Compliant Airspace

- Acceptable risk by regulation
- CFR / EASA performance requirements
Industry Benchmarks
- Watch the Indicators -
Recent Industry Benchmark

- **International Military Airworthiness Authorities Committee (IMAAC)**
  - Recently formed in Europe
  - Purpose: to establish set of standards for use in military certification
  - Modeling requirement, methods, and processes based on a reduced customized set of civil regulations
## Survey of Aircraft Programs

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### Military Market Indicators
- Watch the trends -

**Yesterday's procurements**

**Today's procurements**

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Industry Agility is Necessary
Know the Safety Relationship to Airborne Development

- System User / Functional Requirements
- Functional Hazard Analysis
- Functional Allocations
- Software Functional Allocations
- Derived requirements for language / processor
- Detailed Hazard Mitigation Requirements
- Integration Testing
- Development Item Test Realm
- COTS/GOTS Modified - White Box Testing Required
- COTS/GOTS Black Box Testing Capability
- Test Requirements / Scenarios (Hazard Mitigation Verification)
- CSC / CSCI Testing

System Safety Program
ARP 4754 / 4761 activities
DO-178B Requirements
Military certification requires industry to have a “foot in both camps”
A means of defining acceptable risk

Know and Use Standards

- **Consensus standards**
  - These are often regulatory when enacted by law
    - (e.g., NFPA 70; NEC, NFPA 100; Life Safety Code, RTCA/EUROCAE)

- **You accept the liability**
  - When you do not follow consensus and company standards you demonstrate you did not follow “reasonable industry practice”

- **Selecting appropriate standards is important**

Note: For USAF aircraft, 853dELSG/NT provides generic performance matrices that extract civil requirements for each CNS function to facilitate CNS/ATM performance assessment required as a part of airworthiness certification.
Know Your Liability

- Internationally, most military agencies are now legally liable for public safety
  - Limited state immunity may exist (e.g. contractor defense) - proofs required to exercise immunity when available
- Liability requires evidence that’s available for the operational life of the aircraft
- Evidence is traceable proof of compliance to requirements
- Don’t forget that liability is not limited to the customer
- Legal systems, including mishap investigations, operate under the maxim: “If it is not in writing, it did not happen”
Recommendations

- Goal: Build and operate aircraft to fly with unrestricted access to airspace
  - Keep up with international direction
  - Assure aircraft-wide traceability of parts
  - Provide traceable compliance to airspace requirements, standards / specifications, particularly CNS
  - Provide demonstrated proof bridging the multi-standard environment for international airspace and market
Navigate the Standards Mixing Bowl

Customer Defines Primary Standard

Negotiate Secondary Standards

Perform Gap Analysis Between Standards

Get Customer Agreement on Cost – Benefit for Closing Gaps

Commonalities

Similarities

Differences

Execute To Plan

Note: gaps cannot be ignored when the primary standard is a regulatory standard

Work Agreement into SSPP and other Program Plans
Questions?
More Information

- ICAO
- FAA Regulations
- Eurocontrol
- USAF GATM

http://www.icao.int/
http://www.faa.gov/regulations_policies/
http://www.eurocontrol.int/corporate/public/subsite_homepage/index.html
Acronyms, Terms, etc.

- **ALARP**  As low as reasonably practical
- **ARP**  Aviation Recommended Practice
- **ATM**  Air Traffic Management
- **CNS**  Communication, Navigation, Surveillance
- **COTS**  Commercial Off-the-shelf
- **DAL**  Design Assurance Level
- **DER**  Designated Engineering Representative
- **EASA**  European Aviation Safety Agency
- **EUROCAE**  European Organization of Civil Aviation Equipment
- **FAA**  Federal Aviation Agency
- **FARs**  Federal Aviation Regulations (now Code of Federal Regulations (CFRs))
- **GOTS**  Government Off-the-shelf
- **ICAO**  International Civil Aviation Organization
- **IMAAC**  International Military Airworthiness Authority Committee
- **MIL STD**  Military Standard
Acronyms, Terms, etc.

- **RTCA**: Organization name, not an acronym, was Radio Technical Commission Agency
- **SOCOM**: Special Operations Command
- **SRS**: Software Requirements Specification
- **SSPP**: System Safety Program Plan
- **TSO**: Technical Standard Order
- **UK MOD**: United Kingdom Ministry of Defence