International Military Airworthiness Regulation Conference

Improving Military Airworthiness through Engagement and Collaboration

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Outline

• Introduction
• Office of Independent Airworthiness
• Engagement and Collaboration
• Emerging Airworthiness Challenges
Ensuring airworthy products is key to building trust

Northrop Grumman Vision

Be the most trusted provider of systems and technologies that ensure the security of our nation and its allies.
Office of Independent Airworthiness (OIAW)

- Established in 2014 under Director Doug Davis
- Independent of program execution
- Enforcing airworthiness practices and policies
- Key investment area for Northrop Grumman
Key OIAW Roles

- Strategic coordination with external stakeholders in developing policy and standards to enable Unfettered Global Airspace Access for all Northrop Grumman aircraft systems
- Engaging internal stakeholders as voice of the customer to improve tools and stay accountable to airworthiness requirements
• Variety of aircraft configurations / missions / environments require use of tailored airworthiness standards and methods of compliance

• Military and civil airworthiness authorities endorsing performance and/or risk-based approaches
  – FAA Part 23 Notice of Proposed Amendment – “The proposed standards would also replace the current weight and propulsion divisions in part 23 with performance- and risk-based divisions for airplanes with a maximum seating capacity of 19...”

• Early coordination needed to agree on tailoring of standards to support level of risk
Tailoring for Remotely Piloted Aircraft Systems (RPAS)

- RPAS standards continue to evolve
- General considerations include:
  - Safety target
    - Can vary with operational risks
  - Level of automation
    - Lost command and control link
    - Human-in-the-system
  - Detect and Avoid
Engagement and Collaboration

- Engagement and collaboration in policy, regulations, and standards bodies are critical to meeting current and future airworthiness challenges
- Promoting harmonization of standards
Engagement and Collaboration – RPAS Standards

CASA Unmanned Aircraft Systems Standards Subcommittee

RPAS Panel Standards and Recommended Practices (SARPs) - Airworthiness; Operations; Detect and Avoid; Air Traffic Management

International Organization for Standardization SC-20/TC-6: Product Systems Working Group

ASTM F38 Airworthiness Subgroup - F3201-16 Standard Practice for Ensuring Dependability of Software Used in Unmanned Aircraft Systems

Efforts ongoing

SARPs expected post-2020

Standards expected 2019

Standard published 2016

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Engagement and Collaboration – Airspace Integration

NATO Industry Advisory Group SG-205 on Sense and Avoid

RTCA SC-228 on Detect and Avoid Minimum Operational Performance Standards (MOPS)

CANSO RPAS and Emerging Technologies Working Group (Guide to RPAS training program)

Recommendations expected 2017

Detect and Avoid MOPS expected 2017

Training materials available 2017

European Organization for Civil Aviation Equipment and Joint Authorities for Rulemaking on Unmanned Systems also active in airspace integration and airworthiness

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Engagement and Collaboration – Education

Embry-Riddle Aeronautical University Graduate Certificate Program
Two new custom airworthiness graduate courses using a military airworthiness approach
First graduate airworthiness program in the U.S., inspired by programs in Australia, UK, and France
Begins January 2017
Emerging challenges - cybersecurity

- Military and civil authorities including cybersecurity considerations in airworthiness process

- ASTM Software Dependability Standard for UAS includes software cybersecurity best practices

- Adds complexity to “1309” assessments

“The aircraft and system safety assessments (as described in AC 25.1309) should certainly consider the impact of security vulnerabilities on aircraft safety and the capabilities of the aircraft's systems to satisfy reliability and integrity requirements.” - Boeing 787-8 Special Condition for protection of airplane systems and data
Emerging challenges – additive manufacturing

• Demonstrated benefits of additive manufacturing

• Design allowables, factors of safety for additive manufacturing production need to be defined to support airworthiness determinations

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Emerging challenges – cognitive autonomy

“Autonomy delivers significant military value, including opportunities to reduce the number of warfighters in harm’s way, increase the quality and speed of decisions in time-critical operations, and enable new missions that would otherwise be impossible.”

“Establishing trustworthiness at design time and providing adequate capabilities so that inevitable variations in operational trustworthiness can be assessed and dealt with at run time is essential...”

• Challenges: Verification and validation of complex adaptive algorithms

• ASTM F38 developing run-time assurance standard to bound behavior of complex algorithms used to enable autonomy
Conclusions

• Northrop Grumman Office of Independent Airworthiness is engaging community to enable unfettered global airspace access for military aircraft systems
• Early stakeholder coordination is essential to maximize the benefits of tailored performance standards and methods of compliance
• We are collaborating with internal and external stakeholders to promote military airworthiness and address emerging challenges
Questions?

THE VALUE OF PERFORMANCE.

NORTHROP GRUMMAN

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