Misc. FAA Updates:

1) ***FAA Innovation Centers Concept***
2) ***2016 CSTA AM Workshop Overview***

Presented at:

EASA AM Workshop

September 28-29, 2016

Cologne, Germany

Presented by:

Dr. Michael Gorelik

FAA Chief Scientist and Technical Advisor
for Fatigue and Damage Tolerance

Federal Aviation Administration

The Concept of FAA Innovation Center(s)

Slides courtesy of Mr. R. Ganley

Manager, E&PD Standards Staff

Innovation Center

- Key element of the new AIR Policy & Innovation function
- Provides robust mechanism to address new technologies and MOC
  - Late awareness can result in project delays
- Be more proactive prior to the initial project application
  - Identify new technology or MOCs beyond scope of the existing regulations and policy
- Supports FAA efforts to streamline certification process
- Success is dependent OEMs buying into the concept.
  - Early engagement
  - Company proprietary / intellectual property concerns

Innovation Center

- AIR developed a high-level standardized / phased process
  - Pre-Application Phases
    1. Discovery
    2. Selection & Prioritization
    3. Analysis
    4. Resolution & Output
  - Post-Application Phases
    5. Compliance

Innovation Center

- FY17 Activities
  - Develop implementation plan
  - Develop process / phase details
  - Pilot “Process” on specific projects
  - Develop and Implement Share Point site
  - Identify potential technologies for consideration by the FAA Innovation Center

Compliance Library

- Innovation Center's Compliance Library
  - Contains acceptable MOC
  - Two components (Public & Internal FAA-only)
- OEM MOCs contained in Compliance Library are accepted as approved
- AIR is developing a standardized process

Joint FAA – Air Force (CSTA) Workshop on Qualification / Certification of Additively Manufactured Parts

Co-sponsored by FAA Chief Scientist (Dr. M. Gorelik) and

AFRL / ManTech Division Chief (Dr. R. Dutton)

Aug. 30 – Sept. 1, 2016

Tec^Edge Facility

Dayton, OH

Workshop facilitator: Mr. Brad Cowles, *Cowles Consulting, LLC*

Embedded Agenda File:

2016 AM Workshop Agenda

Note: Proceedings of the 2015 FAA-AF AM Workshop were published as external FAA report:

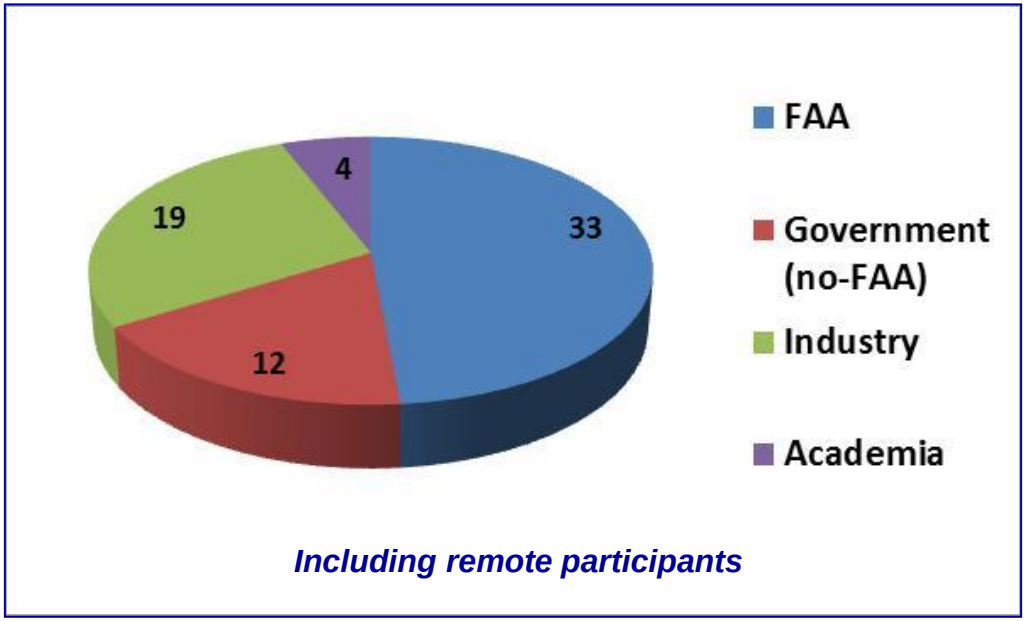
http://www.tc.faa.gov/its/worldpac/techrpt/tc16-15.pdf

CSTA Workshop Objectives

- ***Continue*** **educating FAA workforce in the area of AM technology** → *~ 75% overlap with 2015 attendees*
- **Benchmark *evolving* qualification / certification considerations and requirements across the regulatory agencies** → *Qual / Cert perspective from 7 agencies*
- **Benchmark *evolving* OEM AM qualification methodologies and best practices** → *Qual perspective from 9 companies*
- **Expand discussion to involve *supply chain* representatives**
- **Promote inter-agency collaboration and industry / academia / government *partnership***
- **Continue *dialogue* between the AMNT and regional offices (ACOs, MIDOs, FSDOs)** → *VoC discussion with sites*

- ***Build Upon the Outcomes of the 2015 AM Workshop***
- ***Tailored Presentations - Focus on Enablers for Qual & Cert***

2016 AM Workshop Demographics



Including remote participants

About 75% overlap with 2015 FAA attendance → promotes continuous learning process

14 FAA Sites Represented at the Workshop:

- **HQ**
- **Four Directorates:**
  - **Transport Airplane**
  - **Engine and Propeller**
  - **Small Airplane**
  - **Rotorcraft**
- **Tech Center**
- **LAACO**
- **Chicago ACO**
- **Denver ACO**
- **Atlanta ACO**
- **Wichita ACO**
- **Scottsdale FSDO / MIDO**
- **Vandalia MIDO**
- **Memphis FSDO**

ACO – *Aircraft Certification Office*
FSDO – *Flight Standards District Office*
MIDO – *Manufacturing Inspection District Office*

2016 AM Workshop Observations

- **Strong participation by the government agencies, industry and academia highlights sustained high interest in AM qualification / certification**
- **Presentations by Airbus and EASA suggest the level of maturity and challenges of AM are generally consistent between US and Europe**
- **Progressive increase in the level of parts criticality across the industry**
  - Safety-critical part for V-22 Osprey (NAVAIR)
  - AM Medical implants
  - A variety of space and satellite parts, including human-rated flights
- **Industry is moving towards full-scale production of AM parts**
  - **e.g. GE fuel nozzle production ramping up from 1,000 to 40,000 parts per year (within 5 years)**
- **Broad efforts to develop AM standards, specifications, and guidelines, but current level of maturity is still relatively low**
  - America Makes and ANSI are identifying and addressing “gaps”
- **Initial FAA “checklists” - MIDO “Job Aide” and AM Engineering Memorandum**
- **Strong positive feedback from multiple workshop attendees**

Industry Trends in AM (*next few years*)

based in part on Workshop outcomes

- **Increase in the number of certification requests**
- **AM expanding to Aftermarket and MROs**
- **Moving to full scale production**
- **Increase in AM parts complexity**
- **Increase in AM parts criticality (see pp. 8-9)**
- **Moving from full vertical integration to external AM supply chain**
- **Evolving specs and standards landscape**
- **Evolving from point design to part families qualification**
- **Development of material and processes modeling frameworks (ICME)**
- **…**

2016 Workshop Preliminary Conclusions

courtesy of Brad Cowles

- **AM is a tool, not a solution for everything: Industry consensus is to proceed on a "thoughtful and deliberate" basis**
- **Potential for high variation in AM processes requires rigorous attention:**
  - **Machine and supplier qualification**
  - **Frozen processes with feedback and monitoring mechanisms established**
  - **Software and hardware version control and protection**
  - **Personnel development and training – especially machine operators**

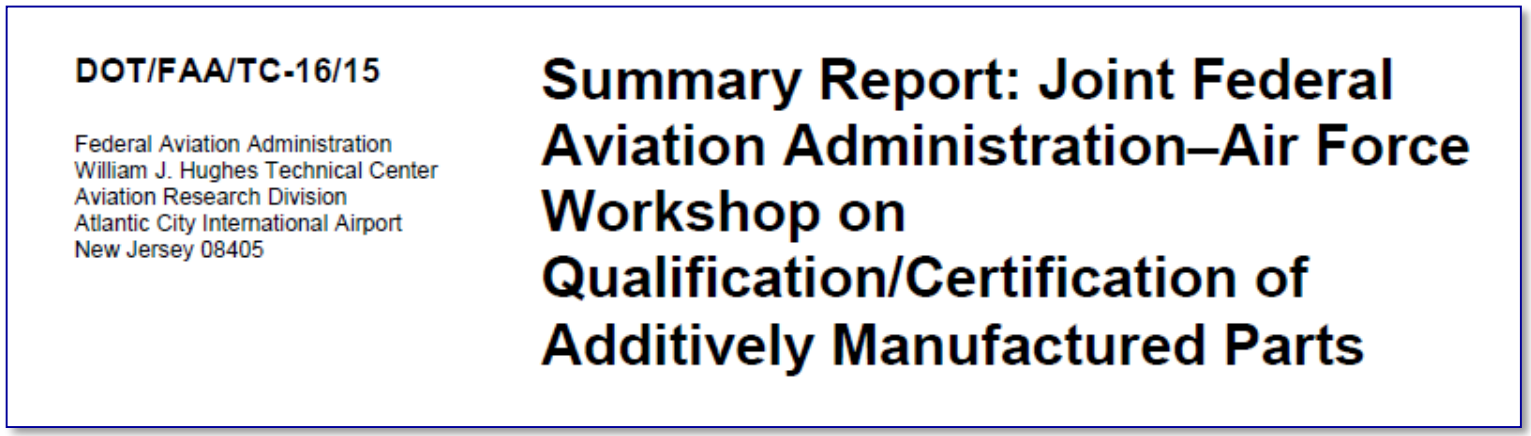
2016 Workshop Preliminary Conclusions *(cont.)*

courtesy of Brad Cowles

- **Significant quality and manufacturing issues for AM processes must be rigorously addressed for qualification and certification, including:**
  - Process variation, controls, and in-process monitoring
  - Characterization and control of process-related defects and anomalies
  - Post-deposit processing such as stress-relief, HIP, and heat treatment
  - Quality and control of input powder metal
  - Revert and re-use of input powder
  - Surface finish and post-deposit finishing processes
  - NDE
- **Potential methods and approaches for zoning parts should be considered – to address defects, variation and risk**
- **Qualification and certification must address the manufacturing process, the specific part, and the potential system impact**

Workshop Proceedings

- ***2015*** **FAA-AF Workshop proceedings published as an external FAA report:**
  - http://www.tc.faa.gov/its/worldpac/techrpt/tc16-15.pdf



DOT/FAA/TC-16/15

Federal Aviation Administration
William J. Hughes Technical Center
Aviation Research Division
Atlantic City International Airport
New Jersey 08405

Summary Report: Joint Federal Aviation Administration–Air Force Workshop on Qualification/Certification of Additively Manufactured Parts

- ***2016*** **FAA-AF Workshop proceedings are *to be published* in early 2017**