

Technology Exchange on the Coordination of U.S. Standards Development for Additive Manufacturing  
Coordination of Standards Collaboration Session Notes

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- Safety is definitely important
- F42.06 New area for AM safety
- File formats are important
  - Configuration control
  - CalRAM will only accept STEP files (no other types)
    - Use Cubotec software to check the STEP file for errors
  - Digital thread needs to be standardized
    - Mike Treadwell- Northrop Grumman, G33 committee of SAE:
      - Consolidation of configuration management is important
      - Not part of AS9100 currently
      - “Digital Thread” used as configuration management
      - Look across all of industry (not just DOD)
      - EIA 649 is what we are using for configuration management
    - People are looking into putting more info into the STEP file
    - Marianne - ASME:
      - we have a standard for verification and validation
    - Designers are altering the hatching, etc. on their own and that needs to be included in the file
    - Microsoft 3DF file uses NETFAB to check files
    - Which file format is emerging?!
      - Put together a committee to figure out which one
    - Dave Flinch- Materialize:
      - Widgets, easy objects don’t necessarily require as much info for digital thread
        - Production vs non production printers (Shane Collins)
    - John Schmelzle – NAVAIR:
      - File formats don’t support support structures
      - Include all other machine settings in a file? Laser power
        - Include this into the CAD system
        - Shane Collins– nothing out there exists now, but it may get there one day
        - Designers need to know more about the manufacturing process (Shane Collins)
          - This is a challenge because each machine is different
            - Each process is different (polymer to material)
            - Process is evolving
          - Need for a design guide

- Bechtel Marine Propulsion- operators have to demonstrate that they can perform a weld, AM designers will need to be educated about AM. This way we can make sure that we know when something is made, we have confidence it is acceptable.
- Becky Wise Alcoa- hard to get rid of things that are already duplicated
  - We need to focus on the gaps
  - Need for test methods
    - Spreadability
    - Test Methods – ASTM
    - We need organizations to step in
  - AWS – process control
  - Shane Collins:
    - CalRAM uses a method for spreadability
      - Instrument used to measure soil properties, ASTM may use
      - Becky Wise- ASTM could use this to create a standard
    - America Makes should do a study to see what SDO's are doing what and publish it
- Which file format are we going to move forward with?
  - Right now we are stuck with STL
  - What do we want out of this format?
    - Cloud based approach?
  - Shane Collins – AMF from ASTM has been brought forward
    - No one is adopting it! But it exists
    - STL was driven forward by OEM's
      - We need to drive AMF to the OEM's
      - Machines don't accept it – shane
- We need to focus on the 'what' we want, not the 'how'
  - The competitive environment will spit out the method ,the how
  - We need to focus on what we want
- Kevin Slattery – Boeing:
  - Use the fish bone diagram to break into groups to find the gaps, come up with lists/architecture
- There was a disagreement with what diagram to work off of
- F42 TC261 agreed format slide
  - Brian Doves – GE:
    - Equipment is definitely an important area that needs to be included
      - Machine standard that isn't vendor specific
      - Process standard
  - Doug – AWS:
    - Welding qualifications to follow and then if something is changed, there are things to follow
    - To cut out having to completely re-qualify everything, just find something similar and modify it

- Shane Collins - CalRAM:
  - One row of tables will come up with a list of answers for one of the questions
    - 1) Near term needs for AM
    - 2) How do we move forward in US standards for Additive
    - 3) Who is currently developing various standards
  - Near Term Goals (my group)
    - Find what is out there
      - Equipment, software, methods
      - Raw materials, process, post process, design
    - Issues with internal standards
    - Modeling and simulation
    - Repeatability of microstructure
      - Is looking at one small part of an object enough to cover the whole part?
        - Same thing for surface metrology
        - How much is enough??
        - Lots of unique features with AM
    - In-process inspection vs post-process inspections
      - NDI post-process is more near term than other in-process methods
    - ASTM has guidelines for powder bed processes
    - Process stability
      - How to determine it
      - How to control it
      - How accurate the machine settings are to reality
        - Laser power, layer thickness
      - Certain number of tests to qualify an individual machine

Presenting the three groups perspectives:

- Trevor Hicks- How do we move forward?
  - 5 step process
    - Establish an agreed upon list of things we need to address and satisfy
    - Detail the focus areas of the first step that need to be covered
    - Who is doing what, who normally does it, who are the industry accepted orgs for doing various things
    - Do a gap analysis from the high level and the detailed levels to see what's missing and what needs to be covered
    - America Makes would look to SDO's and industry to get things done
  - Consider \$\$ - can't overlook business interests
    - We can't make the business decisions for the stds orgs
  - Needs to be a willingness to move to different SDO's in order to get a standard done
- Jeff - America Makes:

- Will have a meeting with SDO's to figure out who is doing what to try to avoid overlap or to harmonize
- Will report back to everyone to let them know how things will move forward
- Shane Collins – CalRAM:
  - NASA has a powder bed fusion standard coming out soon that might help shape the way
    - Trying not to get it to fall under ITAR control
  - If we separate the applications from the standards, we may be able to avoid ITAR issues (Ed America makes)
  - Maybe congress needs to get involved to release ITAR content restrictions in this area
- Near term needs:
  - Need to fill in the gaps before we worry about overlap
  - Standards for input to the process
    - Powder standards – need to make sure we cover everything
    - Recycling materials standard
    - Technical data packages (digital thread)
    - Standard for shrinkage/distortion
    - Certs and quals for machines and operators
    - Standards on in-process sensing
    - Post Processing
      - NDI/DI methods standards
      - Surface finishing
    - Repair standard
  - Material data –how to get to A and B basis values
  - How to make public what has been made by gov't agencies
  - Can we co-locate meetings to help
  - Designation scheme for an additive part
    - To tell what has happened to the material (heat treat, etc.)
  - How do we determine if an alloy change was unique?
- Electro-mechanical AM