Additive Manufacturing Capabilities
NAVAIR Lakehurst

24 – JULY – 2014

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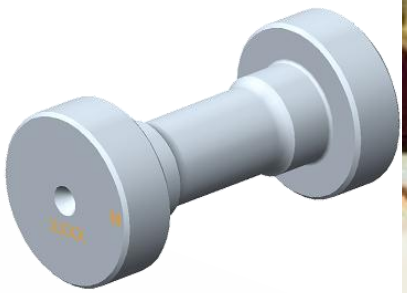
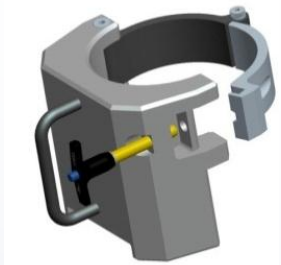
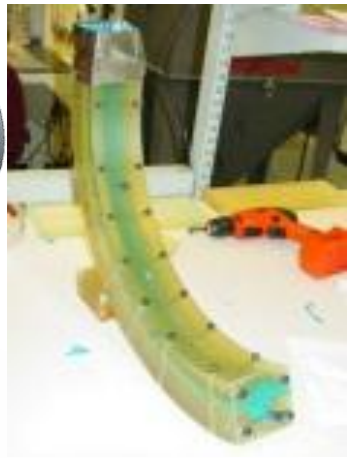
NAVAIR

NAVAIR Lakehurst Overview

- How & Why do we make a part for AM in the ALRE/SE/VLA world?







Fielding a Part for AM

New Requirement Identified

Existing Requirement Not Met

Engineering Activity

- AM Assessment
- Design & Engineering for AM Methods
  - Material Evaluation / Selection
  - Topological Optimization
- Model Based Definition

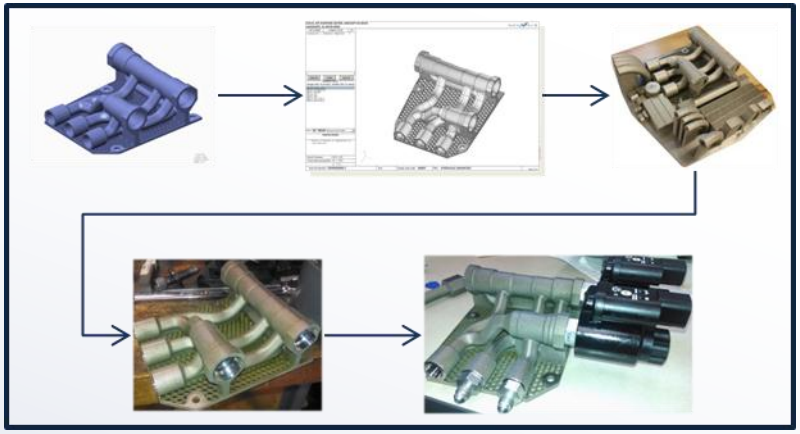
PLM

Prototype / Manufacturing / Quality Activity

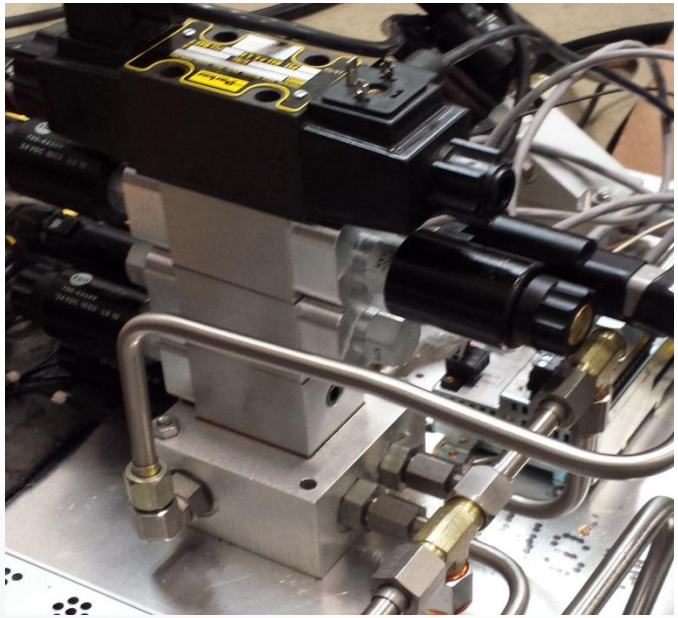
- Prototype / First Article Qualification
- Pre-Processing / Planning
- AM Fabrication
- Final Machining / Post-Processing
- Quality Inspection / Testing
- Documentation – Work Instruction

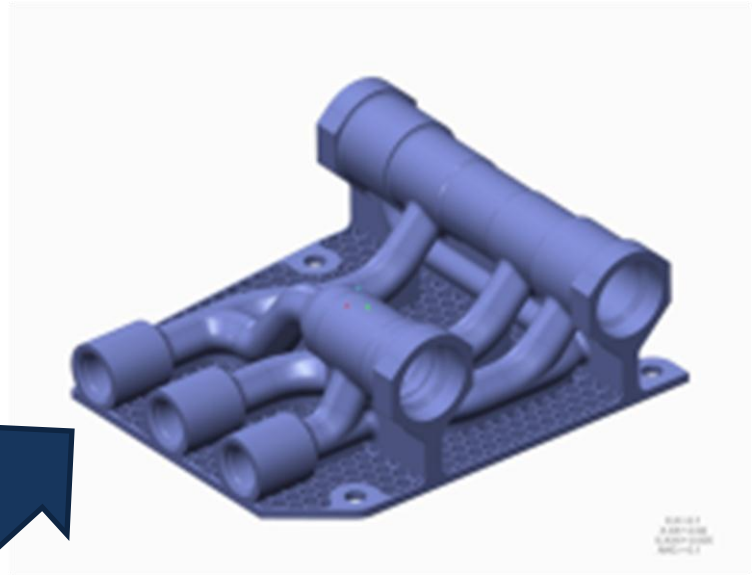
PLM

Controlled Release of MBD / Work Instruction

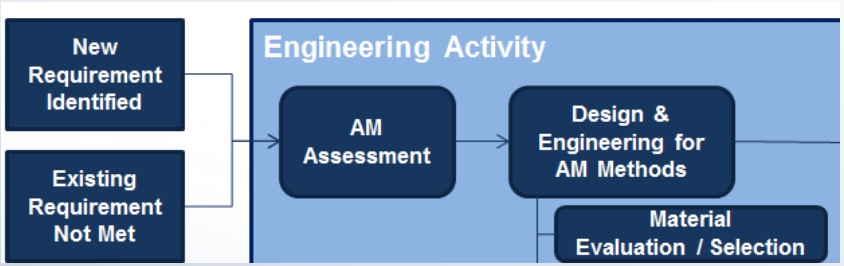


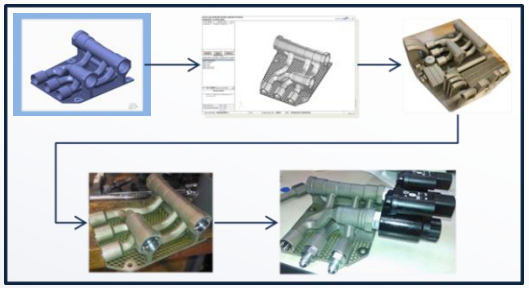
Leveraging Our Resources
Design for AM



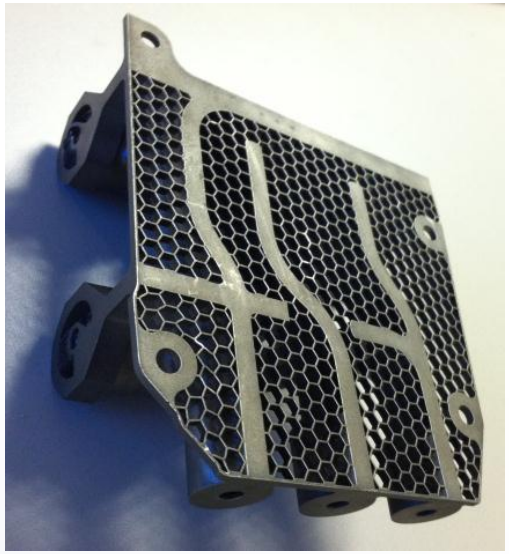


Designing for AM allows transitions of technology and to go from the above to newly innovative designs like on the right

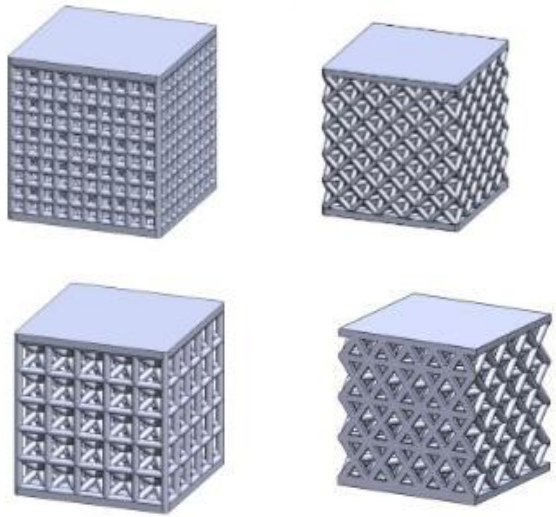




Leveraging Our Resources
Design for AM

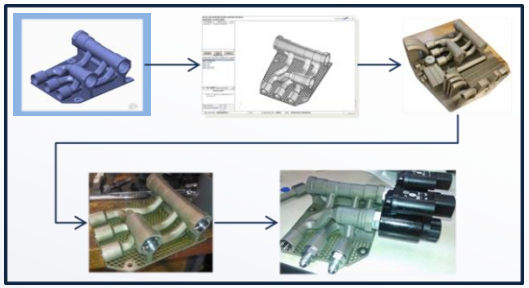


Bottom View of Hydraulic Manifold, showcasing Honeycomb Pattern Design

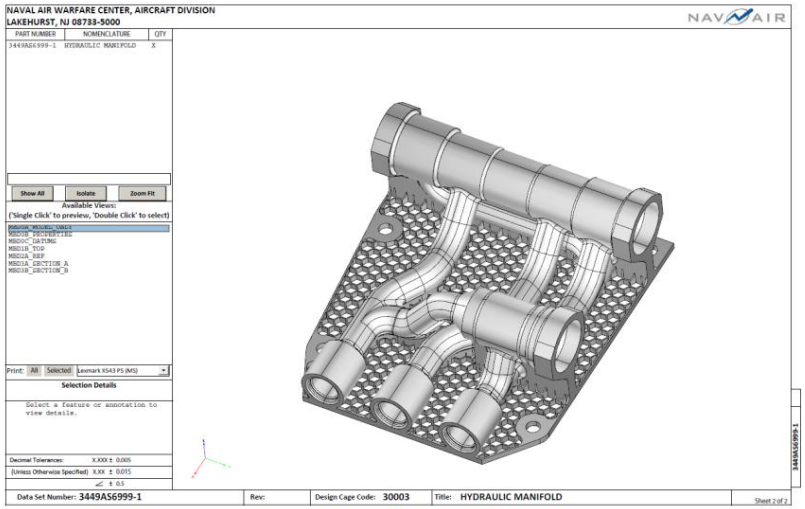


Potential Future Topology Structure

Consideration of new Topologies/Different metals not previously available/considered

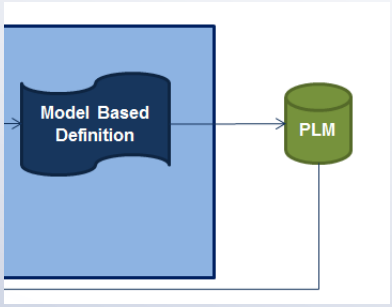


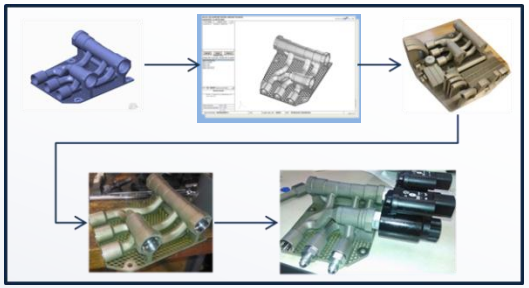
Leveraging Our Resources
Infrastructure/MBE



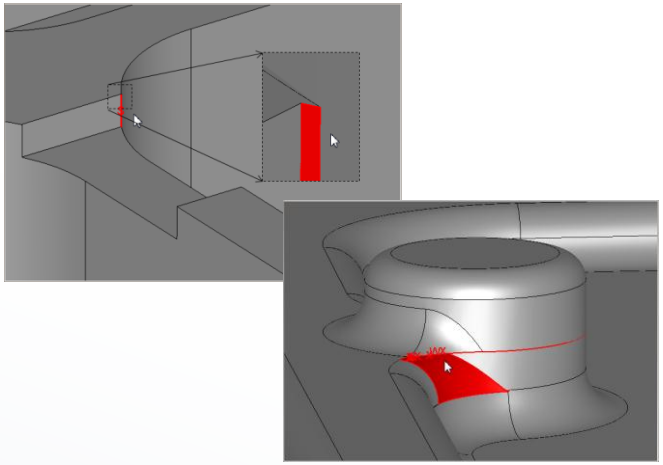
NAVAIR Lakehurst 3-D PDF Example

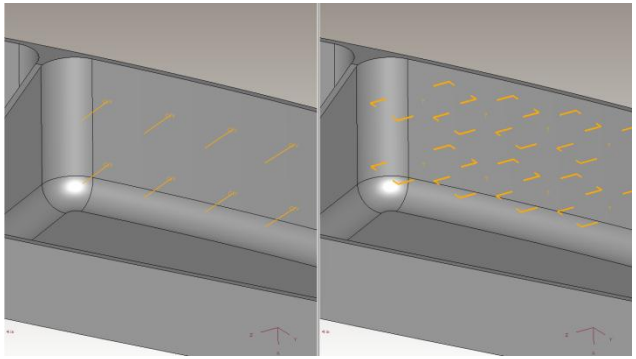
Utilization of PLM to control design and design release, Finalized product in 3D via 3D PDF

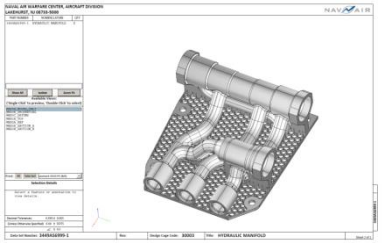




Leveraging Our Resources
Infrastructure/MBE Validation/Translation

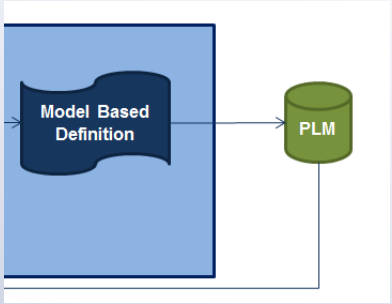


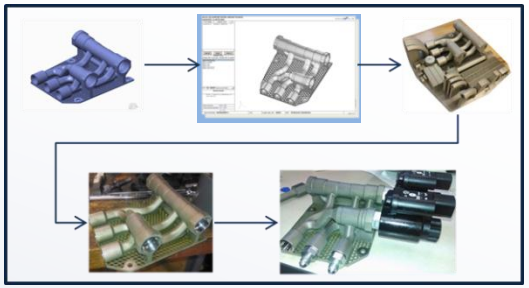




Wireframe curves indicating fastener locations were not exported into STEP file.

A need to validate the Producibility of design and ensure any translation issues are recognized



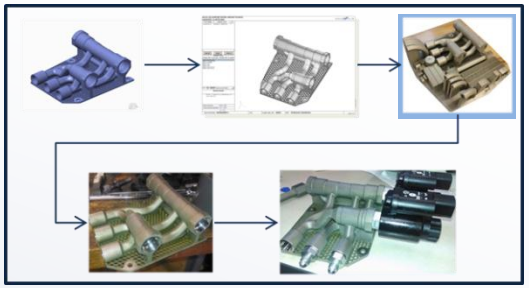


Leveraging Our Resources
Prototyping/Production

Polymer Based Prototype produced in-house for fit/form/function

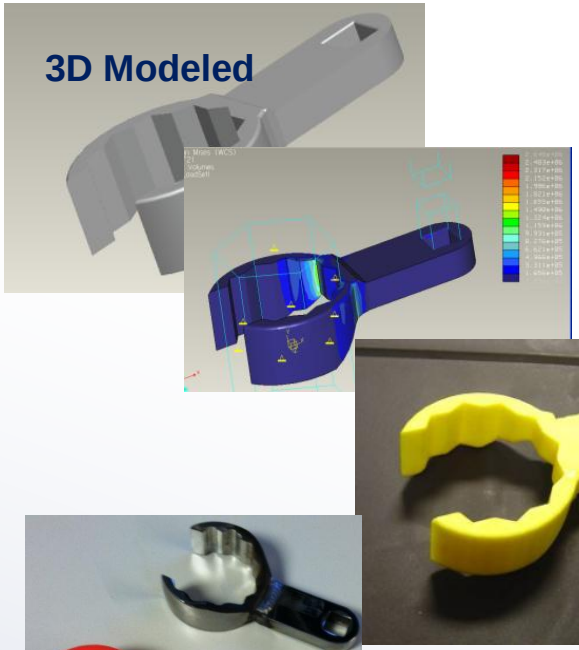
Metallic Build of Part along with test coupons

Partnered with ARL Penn St. to accomplish this

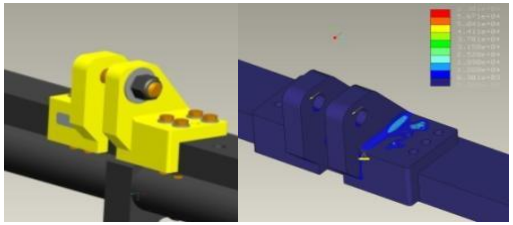


Polymer Prototyping examples

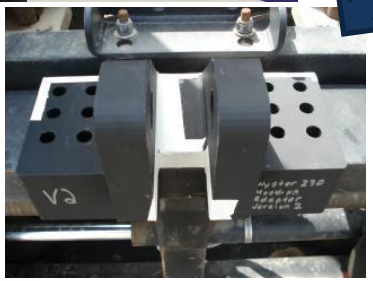
Development Cycle Utilizing 3-D Printer



Finite Element Analysis (FEA) Performed



Fit Check Performed in Theater



Prototype created in 3-D Printer at LKE

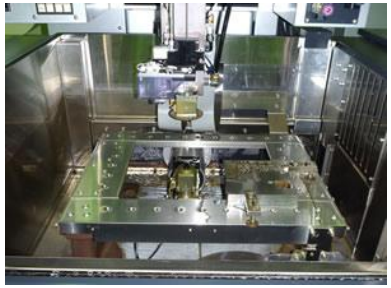
MH-60R Oil Line Nut Wrench

Prototype Val/Verified by Fleet

Hyster H230HD Lift Truck Adapter

Distribution Statement A – Approved for public release; distribution is unlimited

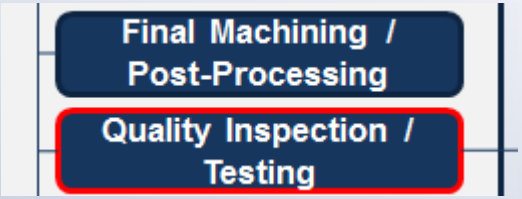
Leveraging Our Resources
Post Processing

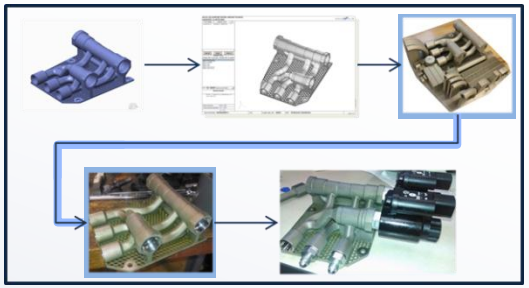


Currently many steps needed to complete an AM produced part, supporting them:

- Vacuum Furnace
- Wire EDM
- Materials Equipment
  - Spectrometer
- QA (CMM, etc.)

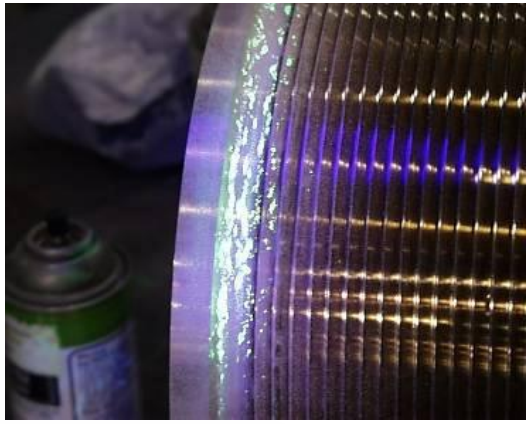
[redacted]

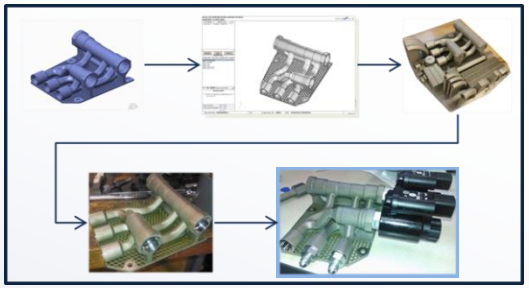




Leveraging Our Resources
Flight Safe Inspection

- Flight Safe Program Documented in NAVAIR Instruction 13800.18
- Called out to OEMs under DCMA-Inst317





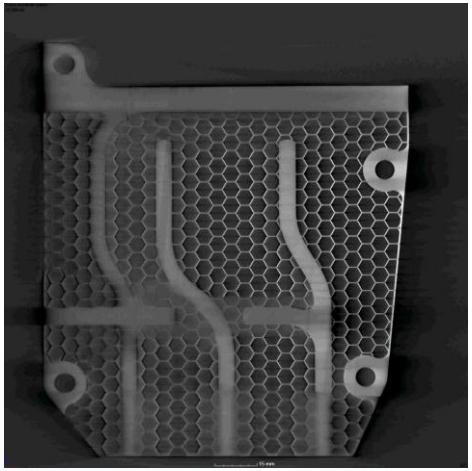
Quality Inspection / Testing

Documentation – Work Instruction

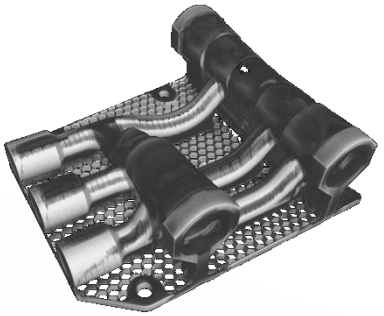
Leveraging Our Resources
Finalizing Parts and Distribution

Testing of the Build Design is critical

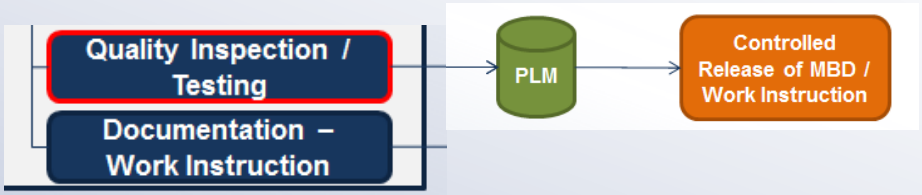
Our inspection facilities are certified for ALRE Flight-Safe activities.

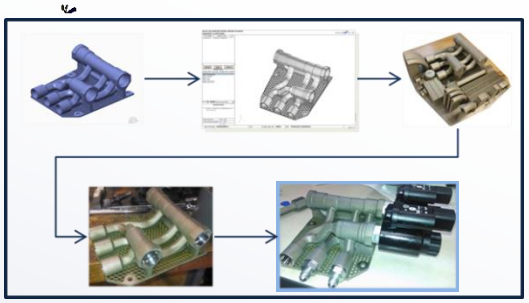


Content provided by CIMP-3D at Penn State



Challenge: Extending AM Designed parts into Downstream Deliverables (Work Instructions, IETMS, etc.)





What's Next

- Develop an AM Scoring Rubric
  - Identify which items are most suitable for AM
- Conduct a Design of Experiments for AM Materials
- Establish an AM Design Guide
- Establish Non-Destructive Inspection Requirements for AM Tooling
- Create Training Guides for AM Tooling:
  - Design, Manufacture, Qualification
- Publish an Standard Work Package for AM Tooling

*** The Above products will be leveraged for use in other AM commodities.**
*** NAVAIR AM SE & Tooling group leads: John Schmelzle and Eric Kline**

Thank you.

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