



# USING ADDITIVE MANUFACTURING TO MITIGATE THE RISKS OF LIMITED KEY SHIP COMPONENTS OF THE ZUMWALT- CLASS DESTROYER

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# Background

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**Zumwalt-class destroyer (DDG 1000) is a three-ship program that represents the pinnacle of state-of-the-art technology.**

**Because of technologies, intellectual properties, and scale economies, DDG 1000 is in a sole-source, or limited sources, acquisition environment.**



# Research Questions

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- **How should the government structure PBL contracts that will incentivize the use of AM?**
- **If the government decides to insource, what are the considerations in make-or-buy decisions?**
- **How can the DDG 1000 program leverage the capabilities of AM for its existing and future requirements?**



# Analysis Conducted

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- **Current applications of additive manufacturing technology on military platform**
- **Future additive manufacturing capabilities**
- **Cost Effectiveness of Performance Based Logistic Contract**
- **Outcome based logistic contract**
- **Interface Management / Configuration Management to accommodate future system upgrade and expansion**

# State of AM

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## **GE is a leader in AM technology:**

- **The LEAP engine contains 3D-printed fuel nozzles**
- **The nozzle reduced the requirement from 18 subtractive manufactured parts to one**
- **Using AM in the Advanced Turboprop Engine eliminates 845 parts**





# State of AM

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- **AM technology is used for low-demand vehicle parts by Mercedes-Benz**
- **Traditional steel hatches on commercial ships have been approved for replacement with fiber reinforce plastic**
- **Raytheon accelerated its experiment using 3D-printed parts in the Trident II D5 missile**

# State of AM

## Sciaky's Electron Beam Additive Manufacturing:

- Manufacture parts from eight inches to 19 feet
- Alter material composition mid-process
- Lockheed Martin is using this technology (this figure is from their Littleton, CO facility)





# Proposed Solutions

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**In order to take advantage of the capabilities and potential that AM offers, the government needs to structure performance-based arrangements that will help to extract innovation, motivation, and collaboration from its contractors.**



# Proposed Solutions

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**Insourcing does not address all the challenges and complexity of supporting complex defense systems.**

**Government entities have certain limitations and constraints for ensuring that parts meet specifications.**



# Proposed Solutions

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**AM can improve competition and lower the risks associated with a limited supplier base by adding a second competitor, lowering the nonrecurring costs, eliminating the need for an economy order quantity, and achieving cost savings.**