Lockheed Martin
Additive Manufacturing

Introduction to Engineering Design
EDGSN 100 Section 001

The Dream Team/Team 1
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Presented to: Prof. Bereziak
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Purpose

- Redesign a heat exchanger for additive manufacturing
  - Used to cool circuit card assemblies
- Use optimal materials with high heat transfer rates
- Optimize interior design using thin fin structures
Background
Sponsor

- Lockheed Martin was the sponsor of this year’s EDSGN project
- LM is headquartered in Bethesda, Maryland
- Specialize in aerospace, defense, security, and advanced technology
- Employ 126,000 people
Project Description

- Heat exchangers are used to cool electronic components
- LM asked for a new design that would cool components faster
- Team looked for design with highest heat exchange rate
Procedures (1 of 2)

- Opportunity for improvement by increasing internal surface area
- Altered internal geometry to increase heat exchange rate
  - Overlapping cylinders
- Designed and tested in Solidworks
- A direct correlation was found between the surface area and the heat exchange rate

\[
q = \int_0^L hP(T - T_{\infty}) \, dx = \int_0^L hP\theta \, dx
\]
Procedures (2 of 2)

- Created ridges on the fins to increase surface area
- Made fins thinner to accommodate more fins
- Aluminum 1060 was used
  - Lightweight, cheap, high heat transfer rate
Results and Discussion

- Surface Area increased by 42.38%
- “eddies”

![Diagram of airflow with arrows and text](image)

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Part  Internal SA (in²)
Original  887.25
Improved  1267.23

1267.23 - 887.25 = 379.98

379.98 / 887.25 = 0.4283

42.83%`
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Conclusions and Recommendations

- Overall goal: increase surface area
- Methods for accomplishing this can vary
- Additive or subtractive?
Closing

- Contact us with questions
- Thank you!