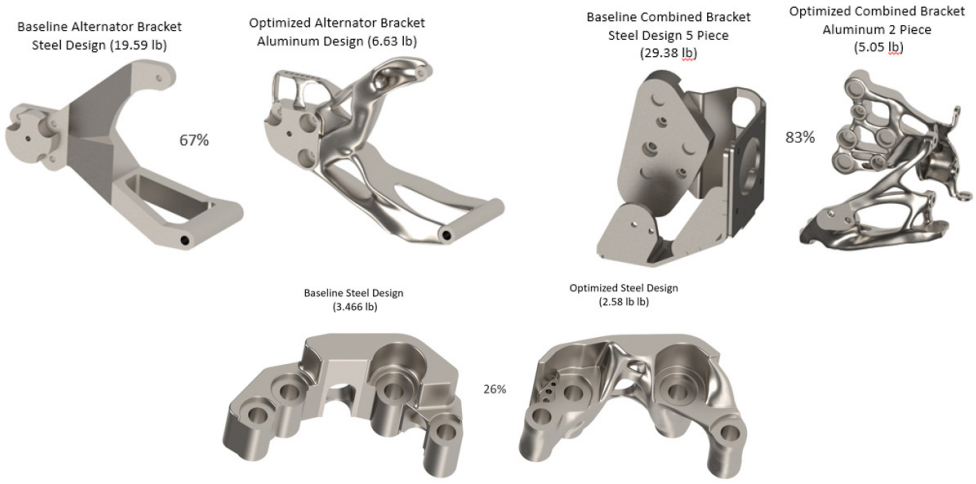
PROJECT SUMMARY 5510.001

Optimization of Ground Vehicle Components for Weight Reduction



Examples of traditional designs which benefit from a redesign to reduce the weight of the component.

PROBLEM

One of the main advantages of additive manufacturing (AM) lies in the ability to produce parts which have been designed for optimal functionality rather than machinability. AM components are not constrained by traditional manufacturing techniques. Many components on current Army ground vehicles could benefit from the freedoms realized with AM, reducing the weight of the vehicle and thus increasing its load carrying capacity. Utilizing the advantages of AM to create organic shapes through topology optimization that can increase the part's performance while decreasing its overall weight would be a significant improvement for U.S. ground vehicles offering better performance than traditionally manufactured parts, decreased sustainment burden, increased readiness, reduced costs, and alternative sources of supply.

OBJECTIVE

The objective of this effort is to demonstrate the advantages of AM through the redesign of a group of Army ground vehicle components to reduce weight. The redesign seeks to meet all other performance criteria requirements of the traditionally manufactured part. Additional objectives are to provide documentation and training for Army personnel on software technologies and methodologies for design for additive manufacturing (DfAM) that allow for efficient repetition of the manufactured parts.

AMERICA MAKES TECHNOLOGY DEVELOPMENT ROADMAP

This project aligns to:

DESIGN

ASTM PROCESS CATEGORY
Binder Jetting,
Powder Bed Fusion,

EQUIPMENT
EOS L-PBF Machines,
GE Binder
Sinter Machines

MATERIAL
AlSi10Mg,
17-4PH,
316L

TECHNICAL APPROACH

ALTAIR is working with Army Ground Vehicle System Center (GVSC) to strategically select three or four parts for optimization by utilizing a matrix of various components identified by GVSC. The part matrix includes an array of parameters such as part size, material, complexity, functionality, interaction with neighboring components, etc. The parts selected within the project are being redesigned to meet all performance criteria requirements of the traditionally manufactured parts.

Four areas in the primary work stream are focusing on identifying, redesigning, and virtual testing of the parts using previously developed methodologies to develop additional use cases demonstrating the overall value to Army-GVSC leadership. For strategic part selection, the group is using industry developed methods to identify and pre-qualify Army vehicle components and parts which have the highest opportunity for success using AM. Second, the team is applying the DfAM workflow, previously developed, to redesign the top three or four parts identified from the list in the strategic part selection task and dependent upon the design complexity of the selected parts. Third, 'virtual testing' is being leveraged to minimize the amount of physical testing that is required to achieve engineering sign-off with modeling, simulation, and testing approaches that minimize physical prototypes and performance testing. Finally, training and training guides outlining DfAM workflows are being developed. As the DfAM workflow matures during the project it is being formalized; technologies and methodologies in managing the workflow are being explored. Also, additive part costing technologies and methods for cost per concept efforts are being addressed.

PROJECT START/END DATE

October 2020 - October 2021

EXPECTED DELIVERABLES

- Report on 3 (or 4) AM components identified for optimal weight reduction
- Test plan for each of the 3 or 4 redesigned components
- New designs for Part 1, Part 2, and Part 3 weight reduction (Part 4 option)
- Training guides/Training
- Test plan for parts
- Test report for virtual testing of the parts
- Business case analysis/Cost report for the redesigned parts
- Project data via data management plan (DfAM workflow)
- Final report

FUNDING

$220K total project budget
($220K public funding/$0 private funding)

PROJECT PARTICIPANTS

Project Principal:
ALTAIR

Other Project Participants:
U.S. Army DEVCOM-GVSC

Public Participants:
U.S. Department of Defense

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