CASE STUDY

BOOSTING U.S. ARMY VEHICLE PAYLOADS

ALTAIR ENABLES DRAMATIC REDUCTIONS IN COMPONENT WEIGHT FOR THE GVSC

About the customer

The U.S. Army Ground Vehicle Systems Center (GVSC) has a track record for innovation that can be traced back as far as 1946. Headquartered at the Detroit Arsenal in Warren, Michigan, this engineering center of excellence is now part of the recently created Futures Command, which has a wide-ranging mission to modernize the U.S. Army. Within this, the GVSC seeks to develop, integrate, demonstrate, and sustain ground vehicle systems capabilities and improve readiness.

Their Challenge

Payload is a key performance measure for military vehicles, determining how many personnel and/or goods can be carried. Reflecting this, GVSC is engaged in a project to reduce the curb weight of vehicles, and thereby boost payloads, by redesigning and replacing existing components with lighter alternatives. Specifically, GVSC is combining topology optimization with additive manufacturing to realize significant weight savings, without compromising other critical requirements.

Initially, external expertise was needed to create new component designs. Going forward, the goal is to bring the required skills in-house, providing a platform for continuous improvement in the combat effectiveness of vehicles.

Our Solution

Over the past two decades, GVSC has forged a close working relationship with Altair, utilizing the company's simulation software and engineering services. Significantly for this project, Altair is recognized as an industry leader in topology optimization, pioneering the concept with the launch of Altair OptiStruct™ in 1994.

83% ▼
MASS REDUCTION

37+
POUNDS SAVED

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Left: Topology Driven Part Architecture **Right:** Part Consolidation of Wire Harness Support Brackets

Continuous development and leveraging the topology optimization technology within Altair Inspire™ software has delivered unrivalled levels of accuracy, speed, and usability. Building on this accumulated experience, Inspire is now helping numerous design teams to realize the full potential of additive manufacturing. Specifically, the marriage of these two technologies enables engineers to produce the highly efficient 'organic' 3D structures that are generated by topology optimization when it is freed from the limitations of traditional manufacturing methods.

Initially, three parts were selected for redesign: an alternator bracket, front-end accessory drive (FEAD) brackets, and a road arm track guard. For each one, the Altair team employed Inspire to determine the optimum load paths that meet the performance targets. PolyNURBS tools were then utilized to ensure smooth, accurate surface interpretation of the topology. Finally, Altair Inspire Print3D ensured the accuracy of the additive manufacturing process, minimizing the risk of distortion and the need for costly, time-consuming trial prints through simulation. This entire workflow is integrated within Altair's Inspire environment, ensuring a seamless journey from design to production.

Results

The weight savings realized have exceeded even the most optimistic expectations. Produced in aluminum rather than steel, the redesigned alternator bracket cuts weight from 19.59 lbs. to 6.66 lbs. The results of the FEAD bracket optimization are even more dramatic; the original five-piece assembly is reduced to two parts, with an 83% mass reduction. Across the three components, the total saving is more than 37 lbs.

Further components have now been identified for optimization and will be used for on-the-job training of GVSC engineers. Moreover, GVSC and Altair will be applying lessons learned, with a view to further automating and accelerating the workflow.