

MODULAR EXHAUST DESIGN AND MANUFACTURING PROCESS FOR LOW COST LOW VOLUME RAPID BUILD TO ORDER SYSTEMS

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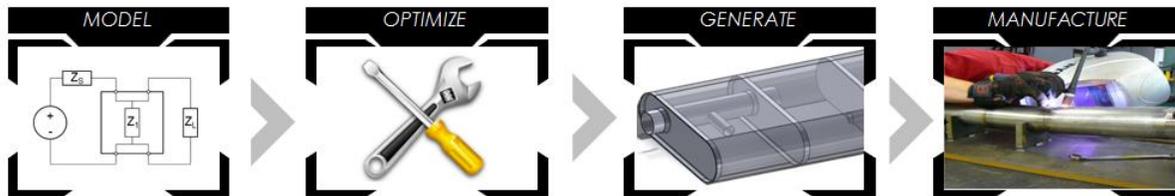
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Managing the sources of noise within military vehicles has become an increasing priority for the U.S. Armed Forces. Vehicle signature and human factors are largely affected by insufficient noise control. Excessive noise will directly result in increased detection distances, unacceptable crew compartment noise levels, and unacceptable exterior noise levels near the vehicle. High noise levels have a negative effect on speech intelligibility, which is critical for effective verbal and electronic communication. High noise levels decrease the awareness of the crew to other useful sounds related to the vehicle or the surrounding environment. Increased awareness through improved noise control is critical to the safety and effectiveness of the vehicle crew.

As the U.S. Army continues to procure ground vehicles, it becomes important that the vehicles are equipped with exhaust systems that attenuate the noise to acceptable levels without paying any price in loss of power or high costs. GLSV has developed a process to automate the design of customizable mufflers, and utilize 'modular' manufacturing techniques to target low volume manufacturing quantities commonly seen in military ground vehicle markets. This design and manufacturing process has a goal of reducing the price point of a custom designed muffler to an estimated \$500 per unit for a run size between 10 and 1000 units. Customers would not need to inventory mufflers because lead times would be fast and tightly managed. The challenges of this effort can be identified as reducing the engineering time per muffler through an automated modeling and design procedure, and reducing manufacturing costs through the development of general tool-less, fixture-less processes for manufacturing low-volume exhaust systems.

GLSV is developing a software tool to simplify the process of designing an exhaust muffler for ground vehicle applications, with plans to eventually expand to accommodate other markets. The software directs the user to develop an exhaust muffler design that prioritizes cost, weight, engine performance, and sound metrics. In order to provide the user with the ability to customize for an intended application, the software available inputs to calculate muffler outputs for weight, flow performance, and sound attenuation. The result is a tool that provides the level of accuracy and agility necessary to enable the user to design high performance, cost-effective exhaust systems in a negligible amount of engineering time.

GLSV has assembled a structured manufacturing process for low-rate production of exhaust mufflers. The manufacturing process is tightly integrated with the design process with the intent of eliminating up front non-recurring costs for low production volumes. Constraints in manufacturing are captured in the design process, resulting in an extremely short development cycle time for bringing a concept muffler to production.



GLSV anticipates that this innovative achievement in design and manufacturing will save costs associated with supplying high performance exhaust mufflers for all size-classes of military ground vehicles. The process will be effective in providing affordable add-on or replacement solutions to military ground vehicles that are currently procured and operated without high performing exhaust mufflers, or in some cases no muffler at all.