

Building a Safe, Optimally Robust, Mission-Critical Defence Vehicle Module in Record Time

Overview

Integrated Design and Engineering Solutions (IDES) is a Melbourne-based, wholly Australian-owned advanced Engineering Product Development and Systems Integration company. The company provides full “systems-life-cycle” tailored engineering solutions to suit demanding defence requirements. This includes initial research and capability evaluation through to concept generation, detailed design, prototype development, validation, integration, manufacturing, and project management services.

IDES specializes in outcome-focused solutions for defence, emergency services, and special multidisciplinary projects where on-time, deployable, supportable solutions save lives and also provide unmatched capabilities. Since 2009, the company has developed and delivered a wide range of complex solutions such as the National Broadband Network (NBN Co) communications demonstration semi-trailer, Communications and Force Protection – Electronic Countermeasures (FP-ECM) Vehicle Integration Kits (VIKs), Weapon Systems Integration, specialised vehicle design, emergency services communications vehicles, and trailers for transportation of special purpose equipment.

Accredited for Product Development, Project Management and Manufacturing services, IDES is ISO 9001:2015 compliant. They participate in development projects for multiple defence programs, assisting the Australian Department of Defence by providing solutions to complex and high-risk problems.

The Australian Defence Organization (ADO) is their primary customer, consisting of celebrated names such as the Capability Acquisition and Sustainment Group (CASG), Defence Science and Technology Group, Land Engineering Agency, Battlespace Communications and Operations Group, and the Joint Proof and Experimental Unit.

“The use of Altair HyperWorks™ early in the product development process allows for products to be delivered to the customer faster, whilst increasing in-service reliability. All products developed by IDES utilize extensive assessment with Altair HyperWorks”

Anatoly Kaganov
Senior Project Engineer, IDES

“Failure of physical testing by using prototypes used to incur a large time and cost penalty while the structure was redesigned, and another prototype built. The advantage of using Altair HyperWorks was that it saved us huge time, cost, and effort and yet delivered the desired results in terms of a robust ROPS design in record time”

Reymond Van Rensburg
Design Manager, IDES



Figure-1: G-Wagon Variant



Figure-2: Rollover Protection Structure (ROPS)

Building a Life-saving Defence Vehicle Module in Record Time

As IDES delivers unique solutions for the Australian Defence Organization, almost every product that they develop is completely bespoke. Typically, these products require rapid development to become operational while being safety-critical. In more cases than less, innovative design solutions and manufacturing processes are therefore required to deliver custom solutions in record time. One such challenging assignment that the IDES team worked on was the LAND 121 Phase 3A project, which involved the procurement of around 2,200 Mercedes-Benz G-Wagon light trucks by CASG for the Australian Army. The vehicles included a number of variants, with all mission modules to be designed, built, and fitted by IDES together with its parent company, G. H. Varley Pty. Ltd.

One of these Australian Army G-Wagon variants was intended to be used as the surveillance and reconnaissance (S&R) vehicle. The role of the S&R variant was to provide high-mobility transport to the Regional Force Surveillance Units for conducting wide-area surveillance tasks. The vehicle, when on patrol, is operated by three personnel—a driver, a co-driver, and a rear observer.

In the S&R module for this project, the rear observer was to be seated in the vehicle module. The IDES team was required to design the module with adequate protection for the rear observer in the event of a vehicle rollover. The team decided to build a vehicle rollover protection structure (ROPS)—a system that is aimed at protecting occupants in the event of a vehicle rollover. To make the module robust so that it provides maximum protection, the team wanted to build the ROPS in the form of a tubular roll cage structure.

This ROPS structure could be developed by using an iterative physical testing process such as a pendulum, which simulates the energy absorbed in a rollover event. But the team knew that physical testing would be inherently time, effort, and cost intensive because it meant building physical prototypes and destructively testing them to gain useful results. The challenge for the team was that the LAND 121 Phase 3A project did not allow for the time required to perform multiple physical tests to ensure best performance of the S&R module's ROPS. For this time-intensive critical project, the team wanted a solution that would enable them to deliver a high-quality, tough, and reliable ROPS within minimum time duration.

Using Altair HyperWorks to Build, Test, and Accomplish an Optimum Product Design

IDES is known for their expertise in the vehicle development industry; they follow a very structured Product Development Process for all their projects. As a key part of the process, the company utilizes CAD and CAE tools during the concept and systems development stages. The sole objective of this approach is to optimize product structures and minimize physical prototyping and testing required for product verification and validation. To this end, IDES has been using Altair HyperWorks for many years; in fact, the tool has been the only CAE package that they have been using for a number of years. The company relies on the software suite as it offers all functions required for quality product development. In case of the LAND 121 Phase 3A project too, the IDES team decided to use Altair HyperWorks to develop the ROPS and simulate the testing process.

The team began by creating a finite element model of the pendulum test rig, base vehicle chassis, and S&R module using Altair HyperMesh™. Physical testing was simulated using the physical testing process by using Altair Radioss™ and processed the results in Altair HyperView™.

Developing a High-priority Product within a Stringent Deadline

Altair HyperWorks was instrumental in enabling IDES to quickly, efficiently, and accurately develop an optimum design for the ROPS. The IDES team saved invaluable time by using HyperWorks for the LAND 121 Phase 3A project. By performing this simulation, IDES saved valuable time while revising and significantly improving the structures' strength and safety.

Finally, within the allocated time and budget, the team developed a virtual ROPS design that had adequate strength to protect the vehicle occupant. They verified the final design through a physical test, which demonstrated a good correlation to the simulation results.

The G-Wagon S&R Module is now in service with the Australian Army. The IDES team is very enthusiastic about leveraging the capabilities of the Altair HyperWorks suite to enable rapid, reliable, accurate, and safe development of mission and safety-critical systems.



Figure-3: Rollover Protection Structure (ROPS)

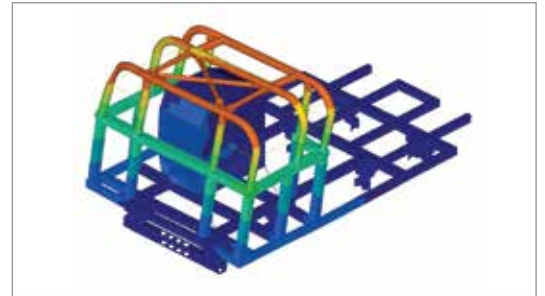


Figure-4: Deformation Contour Plot (Isometric-1)



Figure-5: Deformation Contour Plot (Isometric-2)

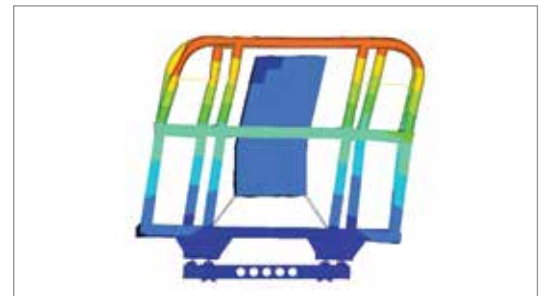


Figure-6: Deformation Contour Plot (Along Length)

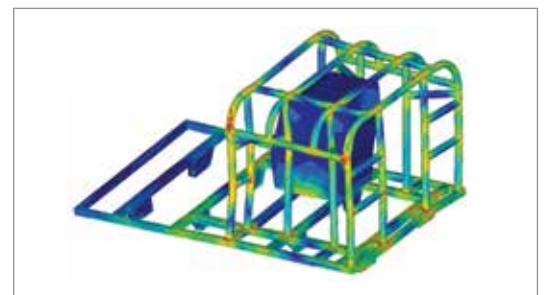


Figure-7: Stress Contour Plot

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