www.ata-e.com
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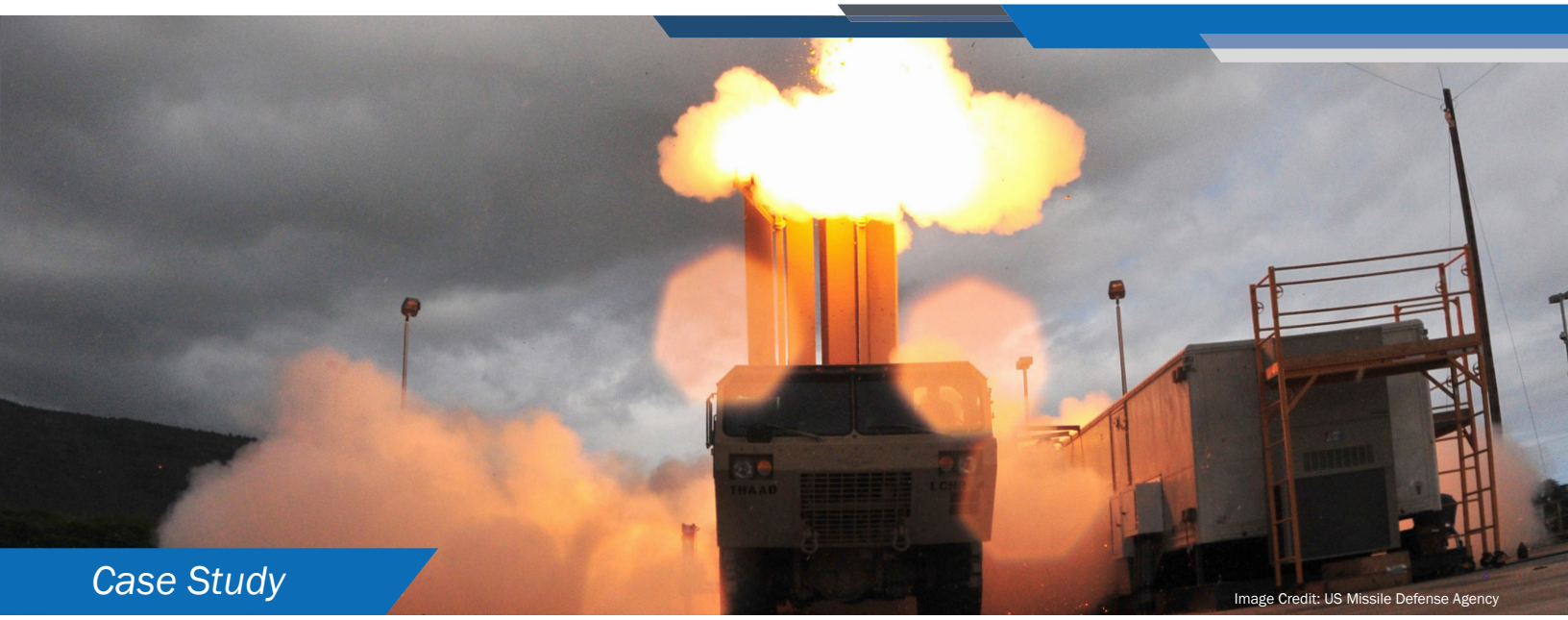


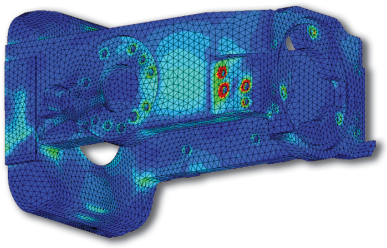
Case Study

Image Credit: US Missile Defense Agency

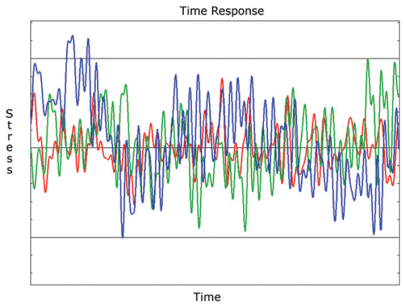
Dynamic Stress Analysis of THAAD Seeker IGA

OVERVIEW

The Terminal High Altitude Area Defense (THAAD) missile system is a transportable defensive weapon that uses precision targeting to protect against hostile incoming threats such as tactical and theater ballistic missiles. BAE Systems (BAE) is responsible for providing the infrared (IR) seeker subsystem, stabilized on a two-axis integrated gimbal assembly (IGA), which is subjected to severe static, random vibration, shock, and thermal loads in operation and transportation. BAE asked ATA Engineering to analytically qualify the IGA structural design for all load cases and identify any required design modifications. A superelement analysis approach was used to balance accuracy and speed, and the system modal response was used in a forced response analysis to predict dynamic stresses on the components under various loads. This allowed design issues to be identified early so improvements could be implemented cost-effectively.



THAAD stress plot



THAAD stress time history

TASKS PERFORMED & KEY OUTCOMES

- Simplified geometry of individual IGA parts and created detailed finite element models for stress analysis.
- Created Nastran superelement models of IGA subassemblies and predicted the natural frequencies of the total system for the frequency range of interest.
- Predicted stress response and fatigue life for parts under shock and random vibration.
- Developed a custom MATLAB algorithm to generate envelope functions to define the vibration environment at various critical interfaces to the IGA.
- Performed detailed analysis of all fastener interfaces.
- Assisted BAE with redesign of components to reduce predicted stress response.