USE OF CFD/CSD CAPABILITY FOR DESIGN OF BLAST DEFELCTORS FOR A MINE RESISTANT VEHICLEF

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Results of a successful effort to significantly improve resistance of the land vehicle to mine detonation are reported. The design methodology is based on a comprehensive use of numerical simulation for blast/structure interaction and structure deformation as a result of blast load. Both Computational Fluid and Structural Dynamic (CFD and CSD) simulations are performed in three dimensions for the most comprehensive representation of the land vehicle geometry. Detailed three dimensional simulations of interaction of the blast waves generated by mine detonations against full configurations of land vehicles were validated by dedicated experiments. Validated numerical capability was used for the analysis of blast structure interaction. Results of this analysis were used to design blast deflectors for placement in key locations to reduce structural damage, and to prevent injuries and loss of life. Three main scenarios for mine detonation were considered: command detonation of a mine under the truck cabin, detonation of the mine under the front wheel, and detonation under the aft wheel.

CFD simulations were performed with the AUGUST-3D code, using the Second Order Godunov method on adaptive unstructured tetrahedral grids. The BKW equation of state was used for accurate simulation of the initial phases of blast expansion. The DYNA3D code was used for structural dynamic simulations. A comparison between numerical simulations with the AUGUST-3D code and experimental data will be given.

Blast deflectors, designed using this comprehensive CFD/CSD methodology, were built and tested for blast loads generated by 16 pound high explosive detonations. Results of these tests demonstrate a remarkable level of blast protection achieved by low cost deflectors of very simple geometry placed in key locations. The study demonstrates the advantages of including high level CFD/CSD simulations in blast deflectors design.