Capability Statement
Impact Analysis

MMI personnel have extensive experience in the analysis of structures subject to impactive and blast loading, gained in projects for nuclear power, petrochemical and aero-astro applications. Analyses are typically carried out using either LS-DYNA or ABAQUS / Explicit finite element software and their explicit dynamics time integration algorithms.

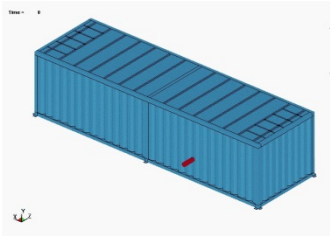

Figure 1: Modular steel building subject to blast

Blast Missile Effects

Modular blast resistant buildings constructed of corrugated steel plate with steel tube framing are used in petrochemical facilities as control rooms. Capacity of this type of building to resist missiles, such as a fire extinguisher or a valve body, ejected by the blast pressure wave, was evaluated using LS-DYNA. Figures 1 and 2 illustrate the analysis of a 40'x12'x10' high building subject to a fire extinguisher missile impact. Deformation of both the extinguisher and the corrugated wall panel is evident in Figure 2.

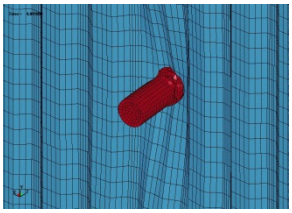

Figure 2: Impact on steel building subject to blast missile

Aircraft Impact

In the aftermath of the 9/11 attacks on the World Trade Center, MMI has performed numerous analyses of both existing and planned nuclear power plant buildings subject to aircraft impact. Figure 3 illustrates an impact of a Boeing 747 to a VVER type nuclear plant.

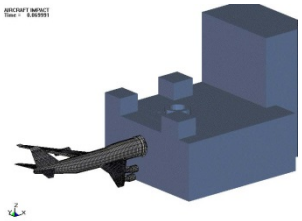

Figure 3: A Boeing 747 impacting a VVER type

To investigate the protection of a nuclear facility against aircraft attack with an earth berm, MMI performed analyses with LS-DYNA, with the berm soil material represented with the smooth particle hydrodynamics approach, as illustrated in Figure 4.

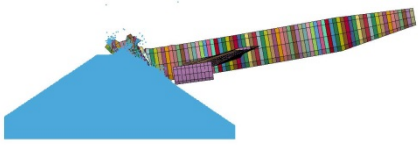

Figure 4: A plane hitting an earth berm used as protection of a nuclear facility – LS-DYNA smooth particle hydrodynamics representation for the soil material of the berm

Live Ordnance Detonation Effects on a Floating Target Platform

Analyses were performed of live ordnance detonation effects on a planned US Air Force live fire target platform, a large floating structure consisting of pre-stressed and reinforced concrete hull segments and sacrificial steel decks, which were mounted on the hull segments. The key objective was to determine the extent of damage due to different postulated ordnance blast scenarios and specifically (a) whether the platform may sustain damage to the extent that it might sink and (b) whether the damage is repairable. The global response analysis was performed with ANSYS and the local panel response/damage analysis was carried out using LS-DYNA.

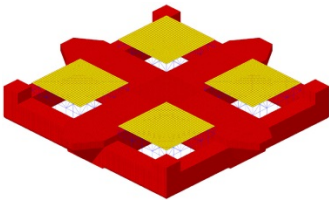

Figure 5: ANSYS plot of the planned US Air Force live fire target platform - 550 x 550ft overall plan dimension

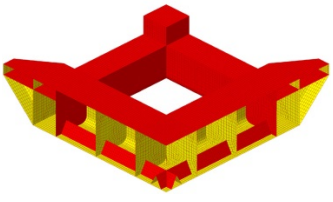

Figure 6: Cutout view, through the compartmentalized main hulls of the planned US Air Force live fire target platform - hull dimensions 105ft wide and 65ft high

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