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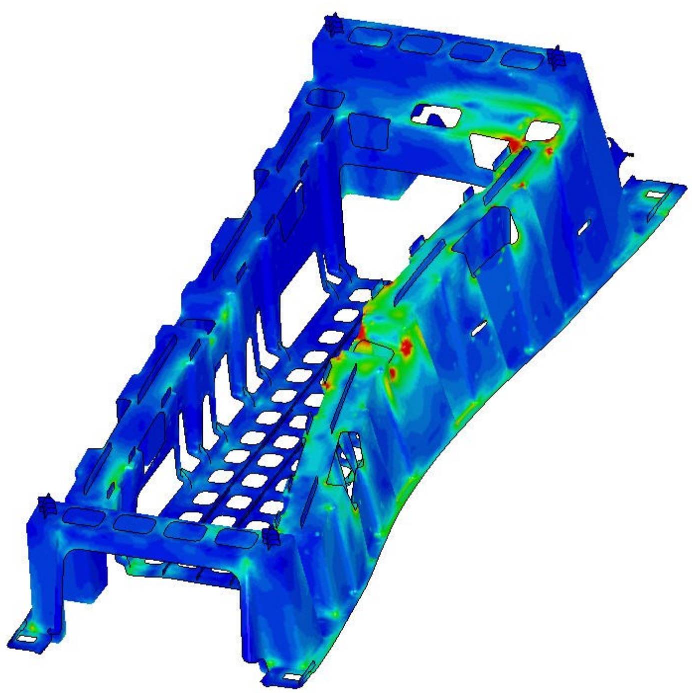

PROJECT MANAGEMENT
for
NEW PRODUCT DEVELOPMENT

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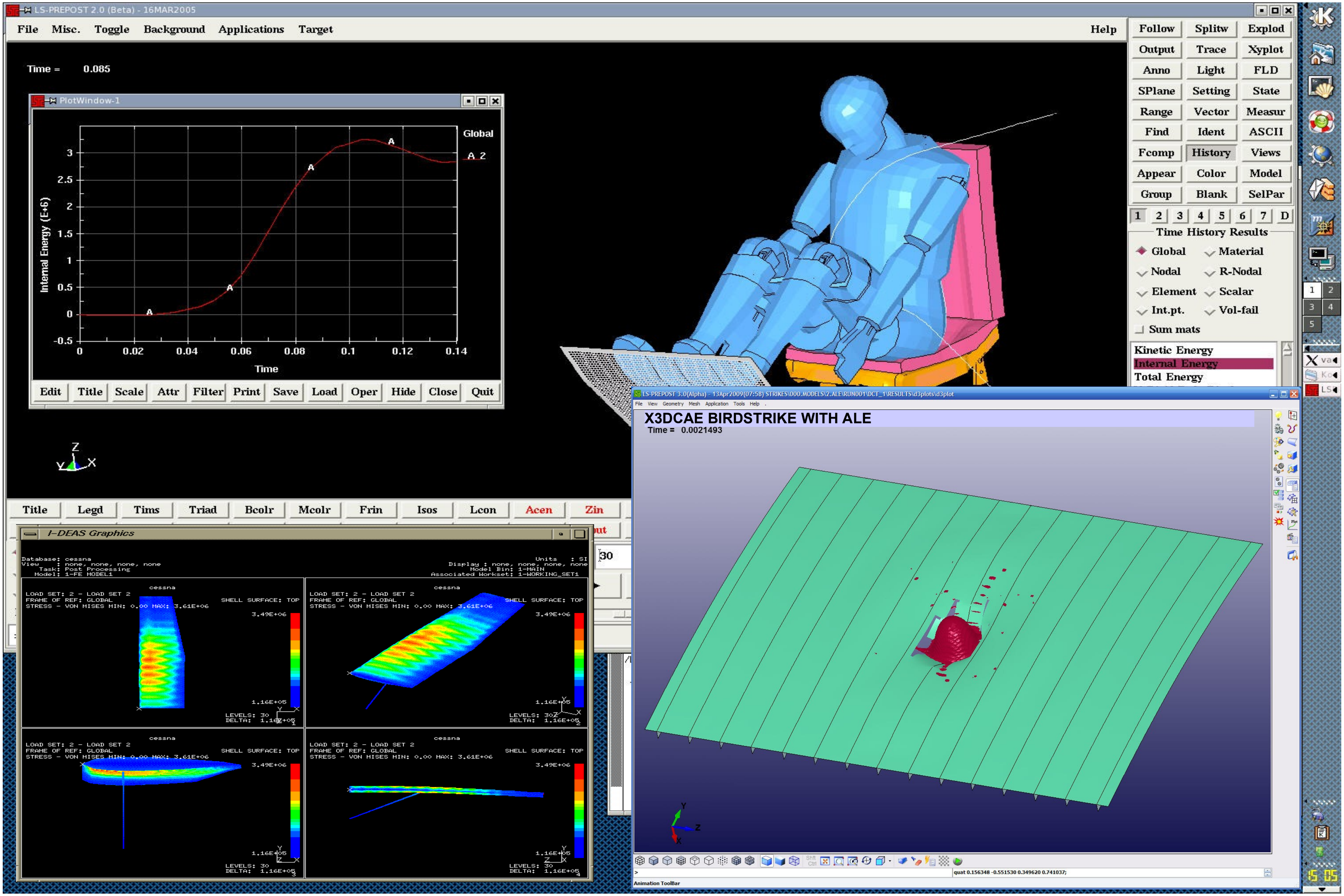

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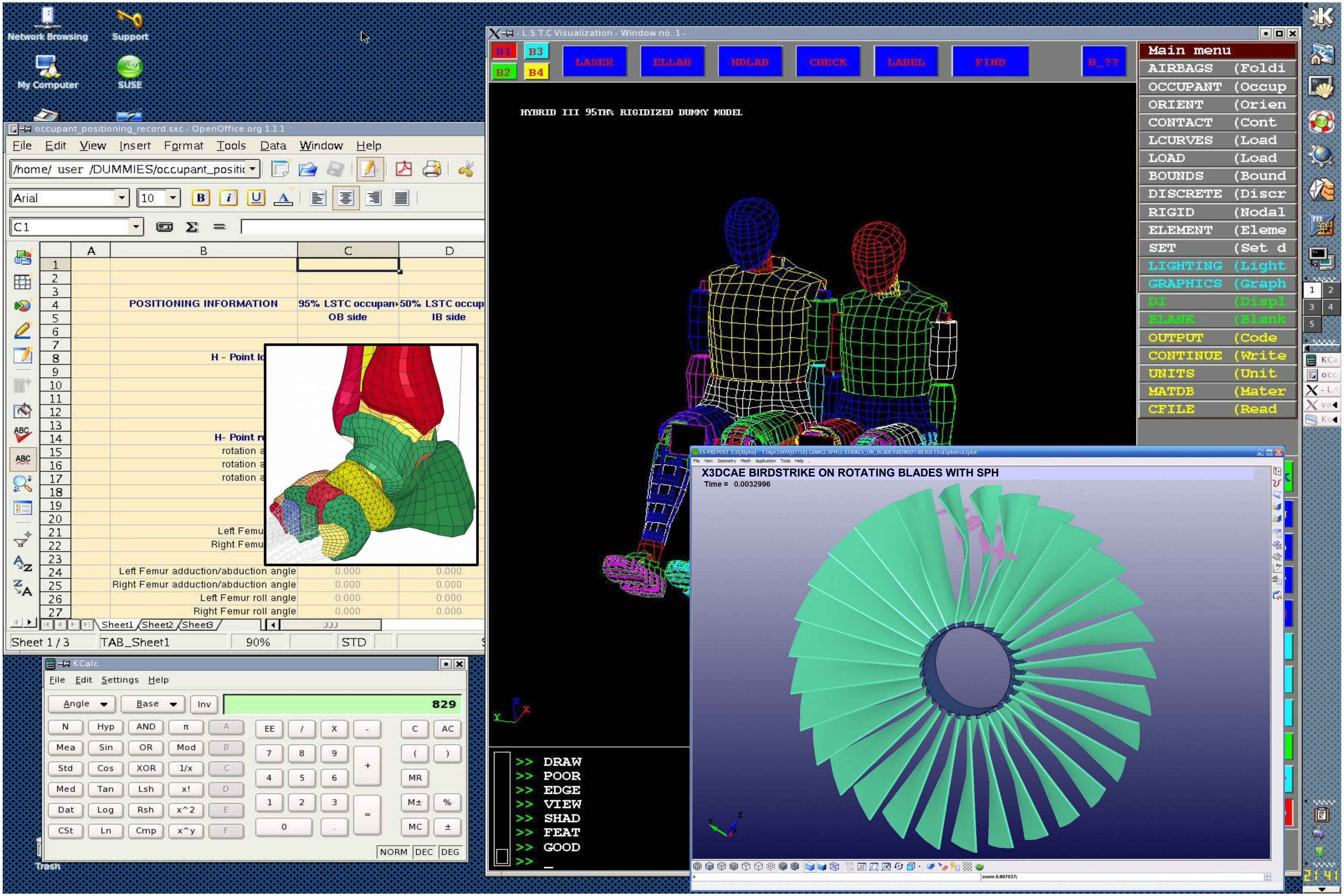

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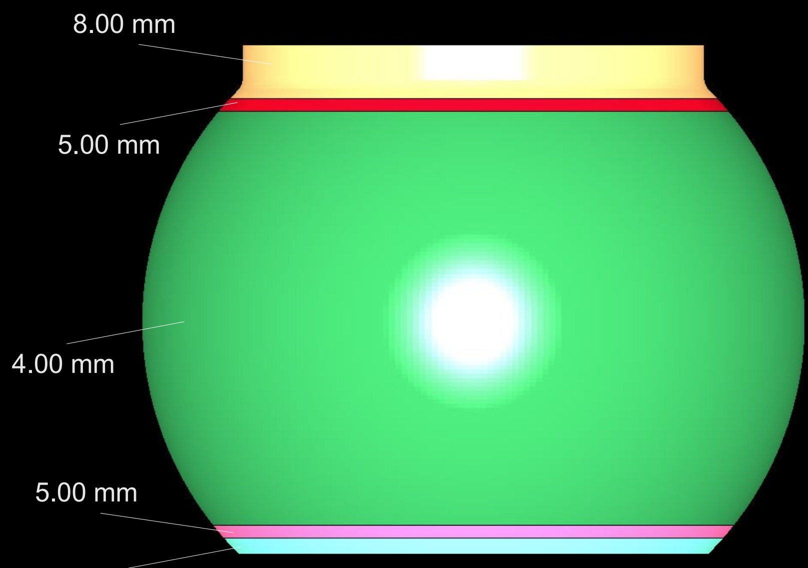
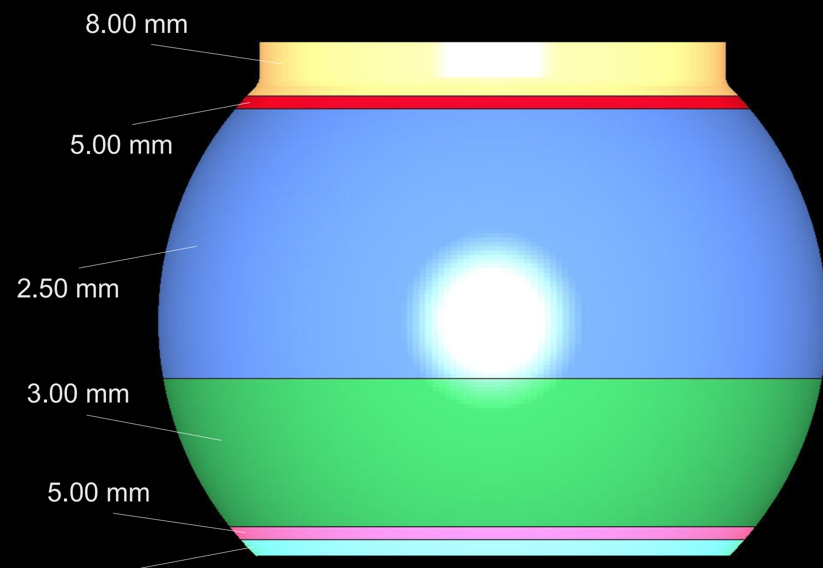


design 1



design 2

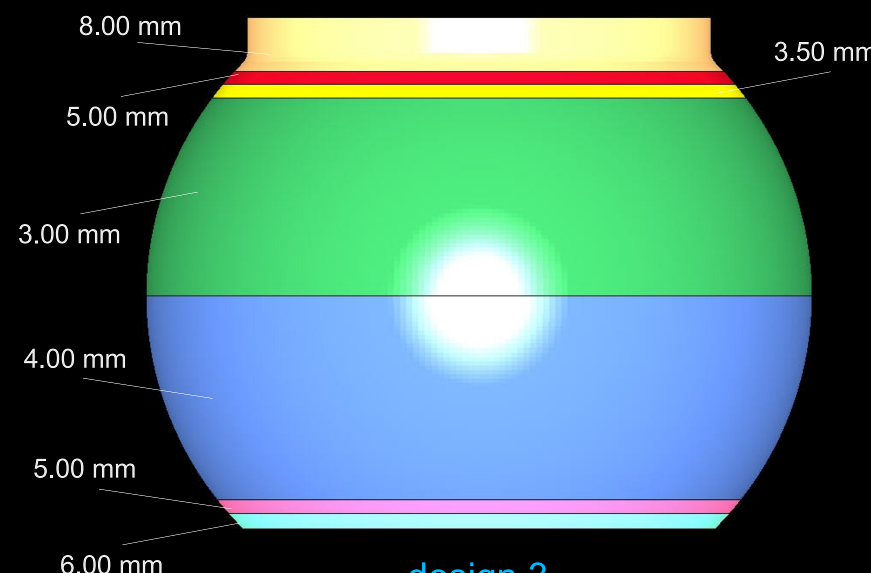
three explosion containment tank designs have been analyzed
the material is steel SAE950
the wall thickness assignments are shown next to the tanks

6 kg of C-4 explosive have been placed inside each tank

design 1 was created so that it would contain the explosion
design 2 was created with weight savings as the only criterion
design 3 was created so that it would contain the explosion while being lighter than design 1

design 1 mass: 185.4 kg
design 2 mass: 139.4 kg
design 3 mass: 168.3 kg

the analysis was carried out with LS-DYNA version 970 on a Linux box with AMD Opteron processors



design 3

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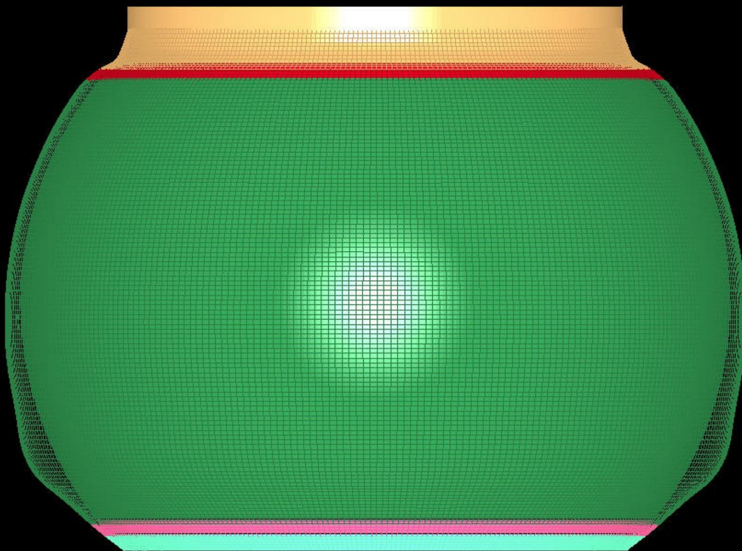
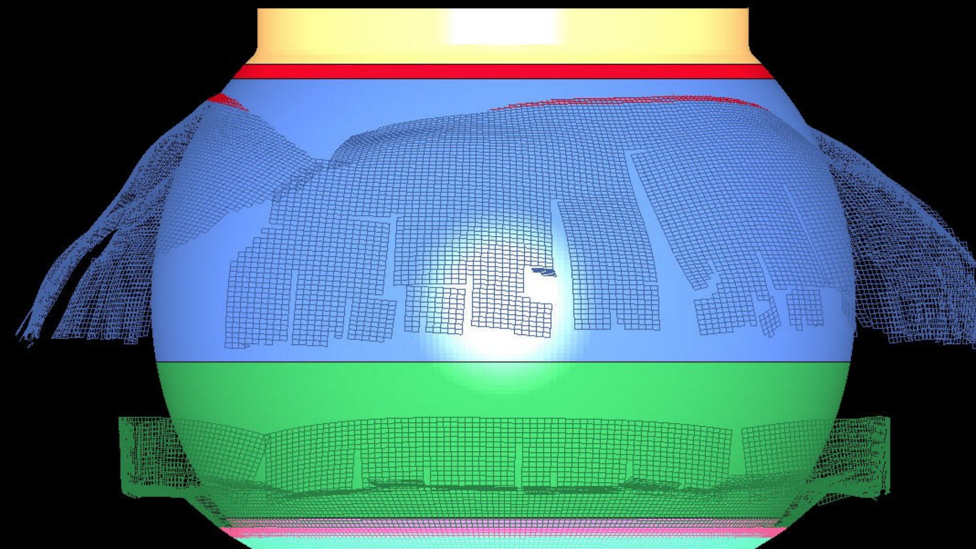


design 1



design 2

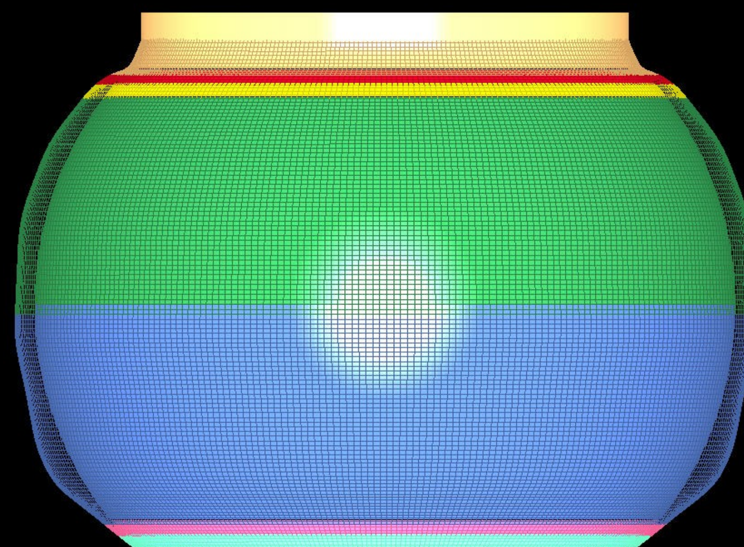
SAMPLE NPD

the deformation pattern for the three containment tank designs is shown here at 5 msec after the explosion

design 1 is the baseline design for this study and it was assigned such wall thickness so that it would contain the explosive shock anyway

design 2 was created only with weight savings in mind and it has erupted
the failure pattern initiated at the thickness transition area, below the equator of the containment tank

design 3 was created so that it would be lighter than design 1 without compromising the goal of containing the nominal explosive force



design 3

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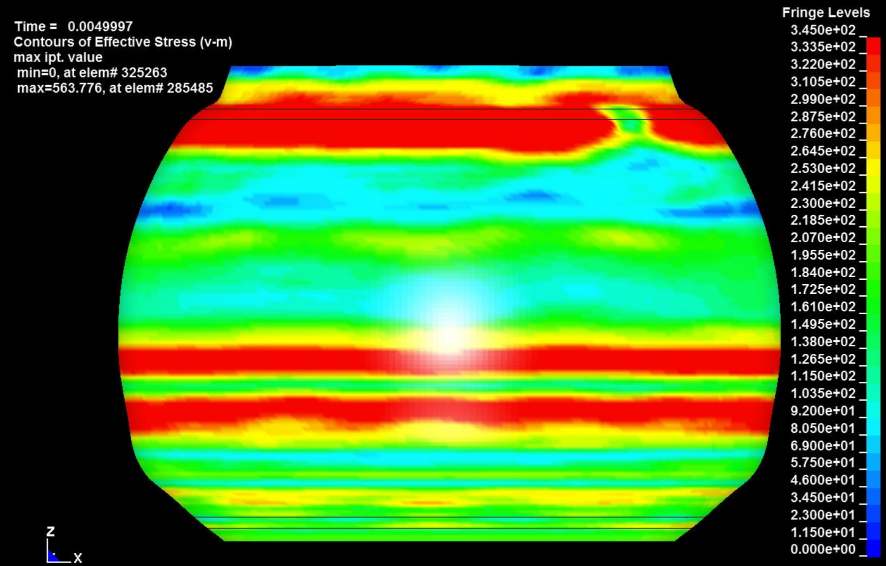
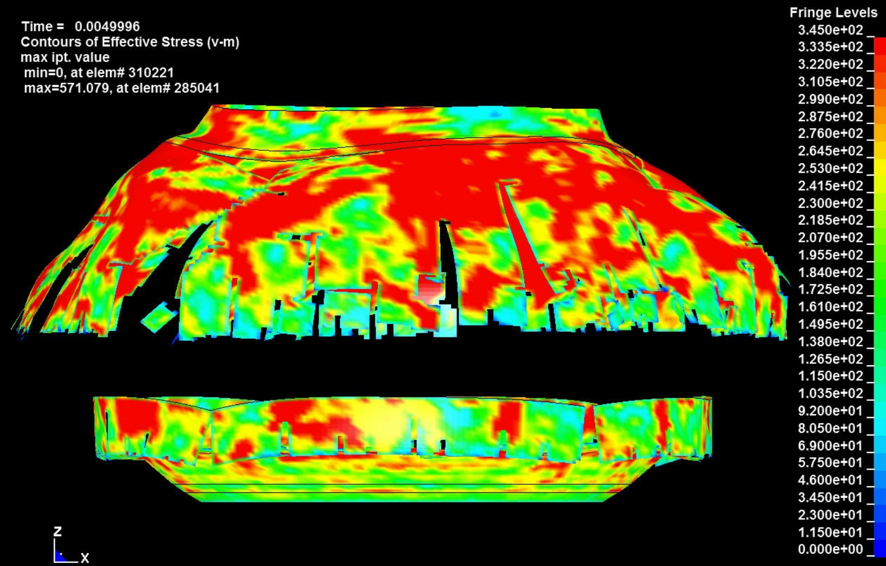


design 1



design 2

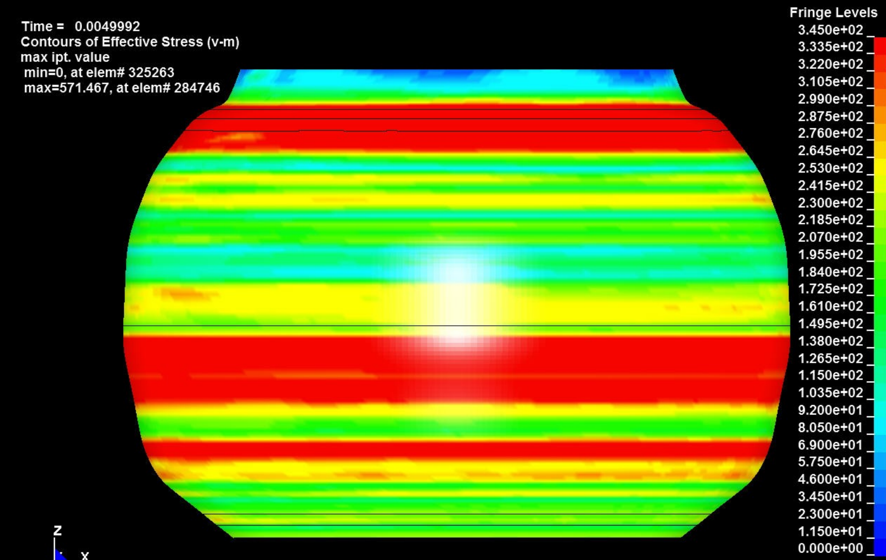
SAMPLE NPD

the contour plots on this page represent the distribution of von Mises stresses in the walls of the three containment tanks at 5 msec after the explosion
the red areas represent stress levels that are equal to or higher than the yield stress for steel SAE950

LS-DYNA is an Explicit Finite Element Analysis code and therefore it can simulate Transient Dynamics phenomena with nearly the same accuracy as closed-form mathematical solutions

avi movie files animating the complete progress of the stress contour and deformation propagation in the three containment tanks (from 0 to 120 msec) are also available

in addition, the time histories of energy (strain energy, kinetic, etc.), node displacement, velocities and accelerations as well as several other types of results are available for review and evaluation in the form of "X-Y" graphs



design 3

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High Speed Impact and Drop Test Simulations
pendulum tests, free and platform mounted drop tests, birdstrikes with classic Lagrangian methods as well as with Smoothed Particle Hydrodynamics (SPH) and Arbitrary Lagrangian Eulerian (ALE) analysis

Fluid Structure Interaction
with Smoothed Particle Hydrodynamics (SPH) and the Arbitrary Lagrangian Eulerian (ALE) method

Composite Laminates and PA6 Nylons
glass/epoxy and graphite/epoxy panels, PA6 glass reinforced nylon parts

High Secondary (Base) Explosives
TNT, RDX (C-4), HMX, PETN
protection shields and energy absorbing mechanisms for anti-personnel / anti-tank mines and roadside bombs, controlled explosion containers (containment tanks) etc.

Automotive Crashworthiness and Occupant Safety
FMVSS and UN/ECE Safety Regulations with LS-DYNA
FMVSS 201, 202, 203, 207, 208, 210, 213, 214, 216, 225
ECE R-12, R-14, R-17, R-25, R-32, R-33, R-42, R-44, R-95

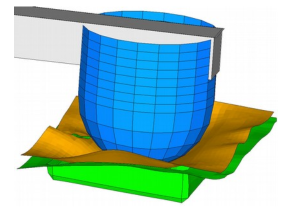
Correlation Studies
correlation of FEA models to lab test results

Bioengineering
impact analysis of bone / cartilage / ligament assemblies

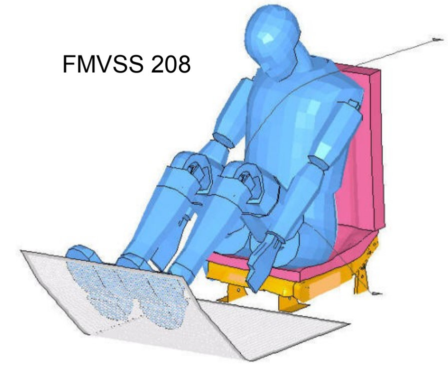
Implicit Analysis
non-linear static analysis with loadsteps and non-linear materials,
thermal expansion stresses, standard modal analysis / NVH

FE Meshing with Ansa
high quality fast mesh generation with **ANSA**, including plastic molds with multiple intersecting ribs, bosses, variable thickness walls, metal stampings, cushion and other energy absorbing foams, unloaded or prestressed, air intake manifolds, oil pans, dashboards, seats, doors, passenger airbag canisters, glovebox compartments, A/B pillar inserts, bumpers, clutch and transaxle housings, windshields

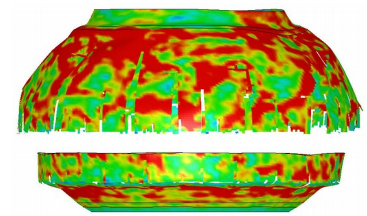
pendulum impact test



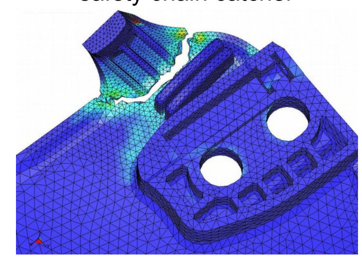
FMVSS 208

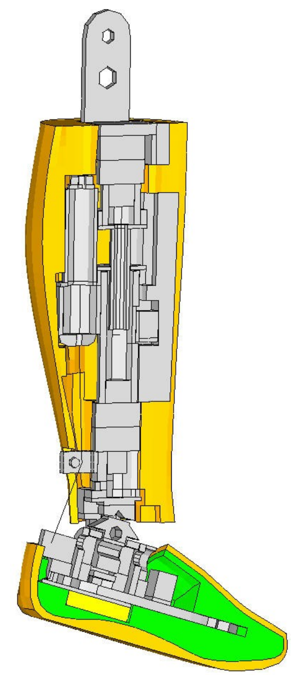


failure of explosives
containment tank

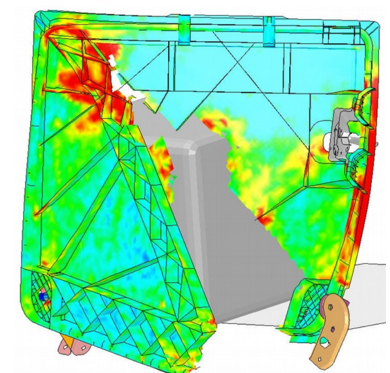


chain saw
safety chain catcher





NHTSA THOR crash test dummy
Lower Extremity



block impact on a
PA6 glass reinforced Nylon panel

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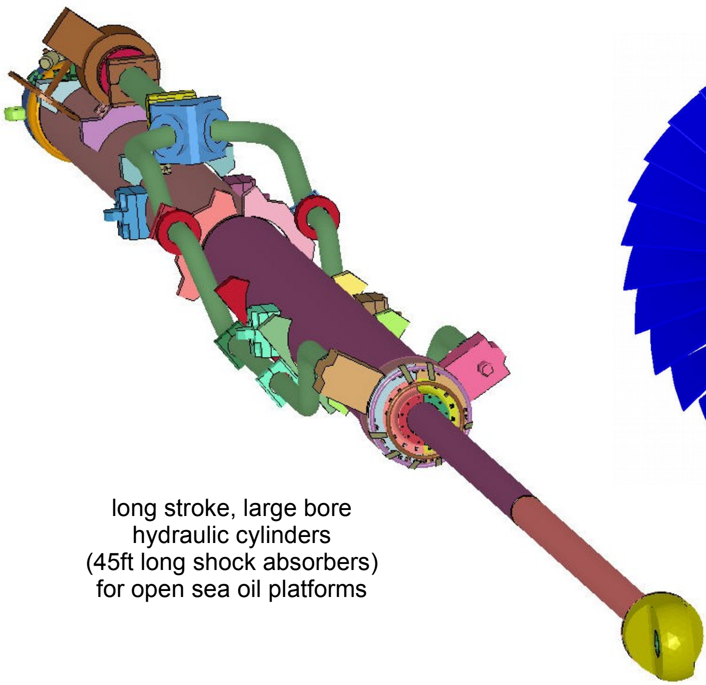
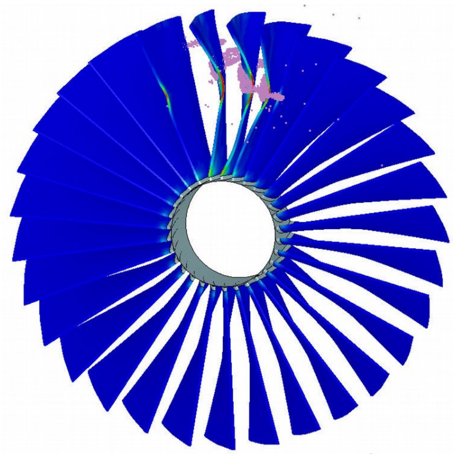
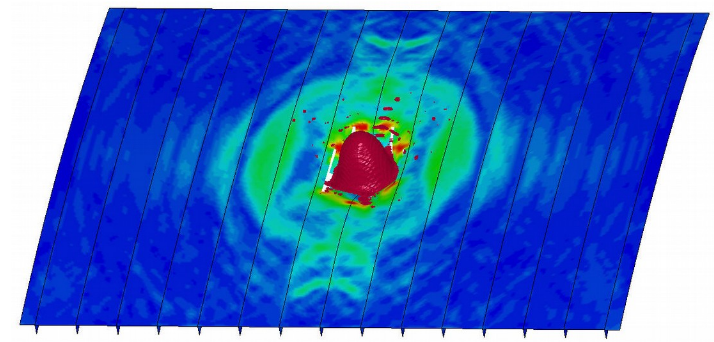


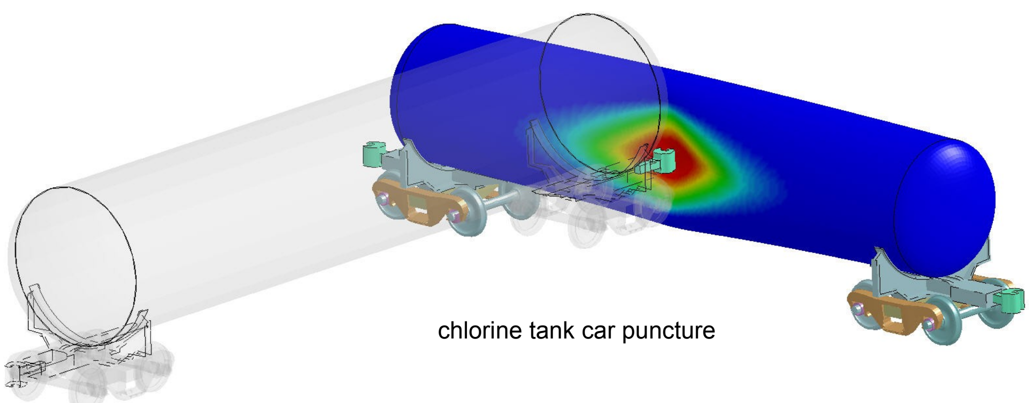
long stroke, large bore
hydraulic cylinders
(45ft long shock absorbers)
for open sea oil platforms



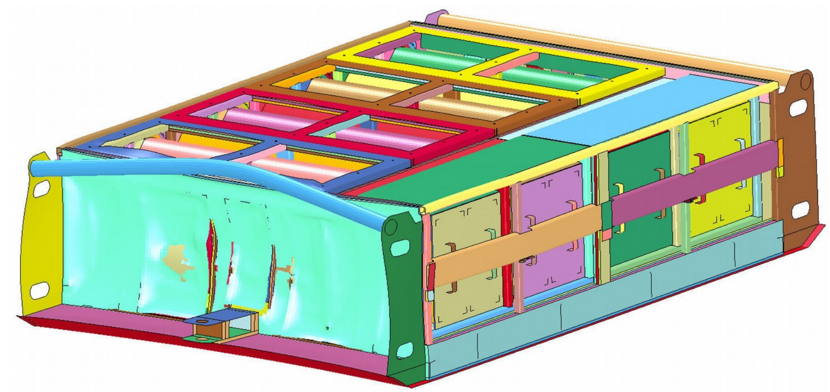
SPH birdstrike
at 500km/h on spinning
Ti6Al4V turbine blades



ALE birdstrike at 500km/h
on a PA6 glass reinforced Nylon panel



chlorine tank car puncture



coal mine safety
blast load on a protective enclosure
for compressed breathing air bottles

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