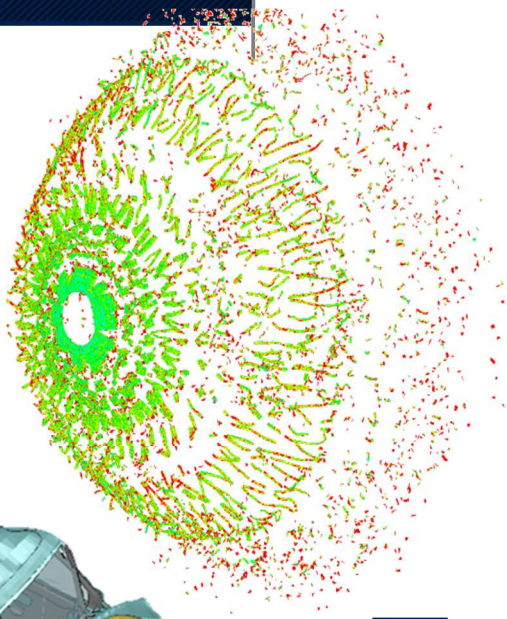
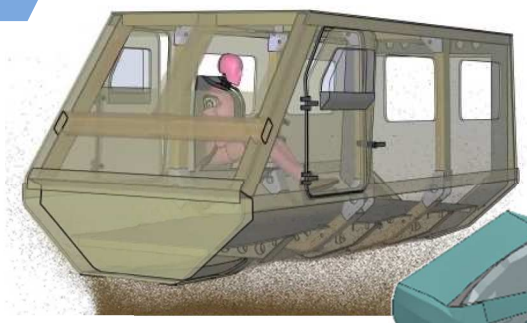
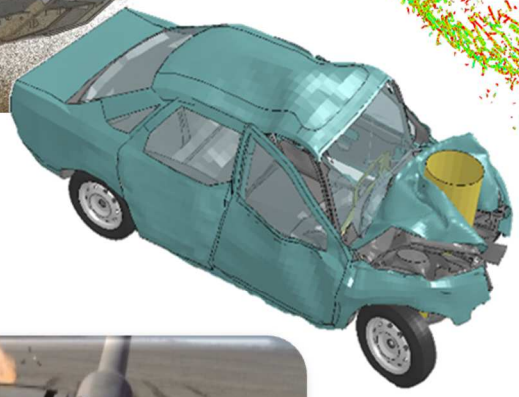
GDTECH
engineering

DEFENSE
AMMUNITION, PROTECTION, BLAST, ANTI-INTRUSION AND EMERGENCY SCENARIOS







SAMI engineering

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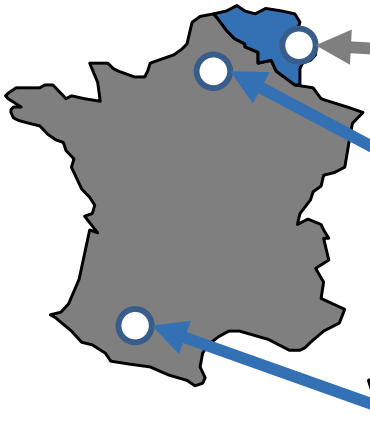
GENERAL PRESENTATION

LOCATIONS



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SOFTWARE & HARDWARE

SolidWorks

Autodyn

Altair RADIOSS

IMPETUS

Altair HyperWorks

LS-DYNA

Cluster #1
128 Cores
256 GB Ram
Intel Xeon E5-2670 @2,60Hz

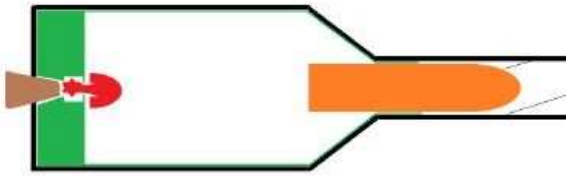
Cluster #2
128 Cores
512 GB Ram
Intel Xeon E5-2640 @2,60Hz

Cluster #3
160 Cores
768 GB Ram
Intel Xeon Silver 4114 @2,20Hz

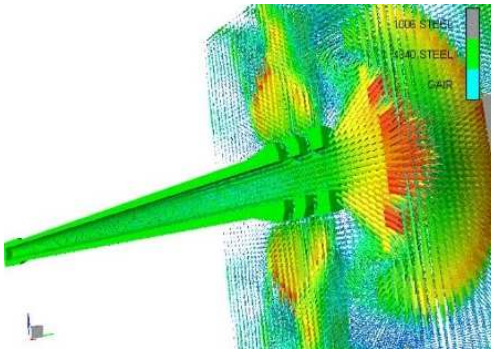
GENERAL PRESENTATION

BALLISTIC

1. Internal



2. Transitional & Exterior



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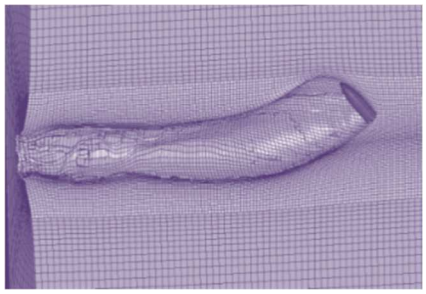
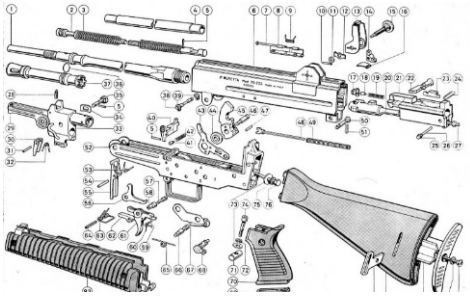
3. Terminal

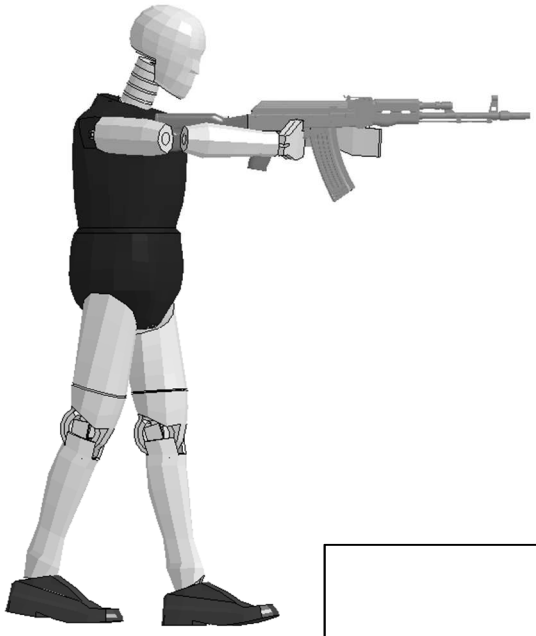


4. Internal Components & Gas System

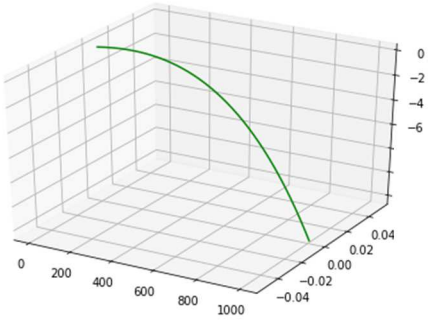


5. Personal Protections

6. Recoil Management

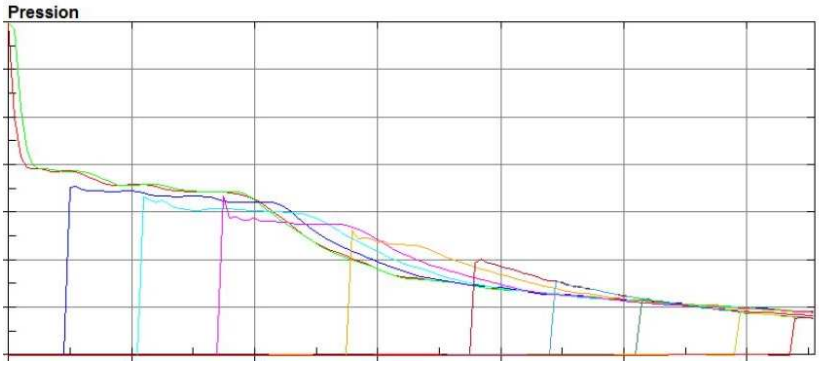


7. External

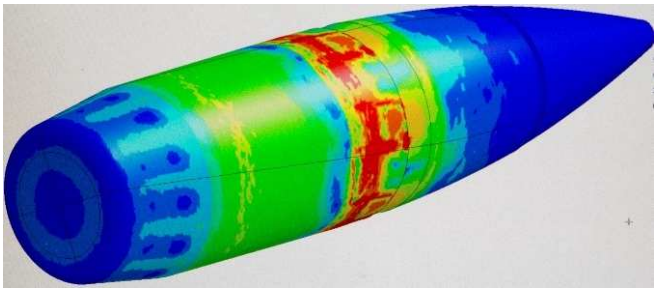


INTERNAL BALLISTICS

Determine pressures, temperatures and stresses in the chamber, the barrel and the projectile



Pressure in the barrel

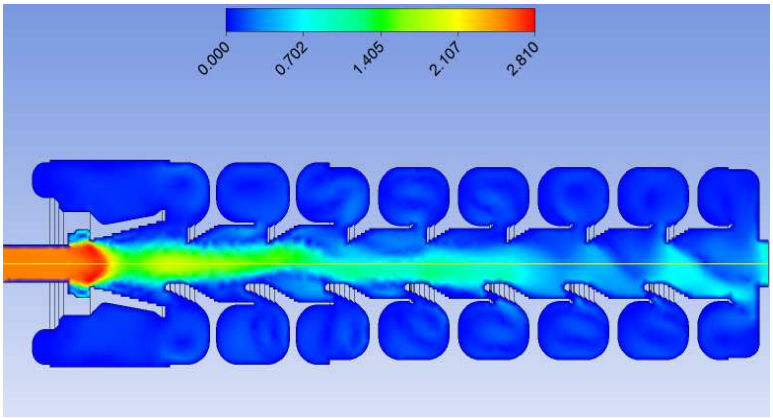


Stresses in the projectile

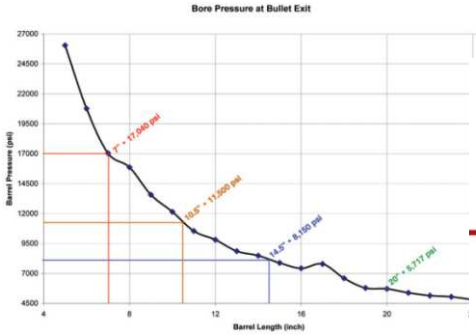
TRANSITIONAL & EXTERIOR BALLISTICS

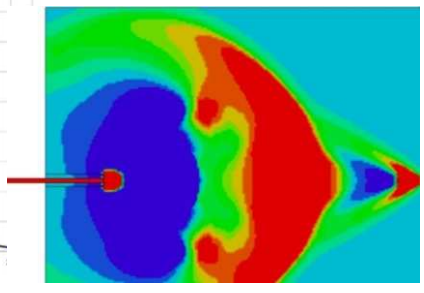
Structural & Fluid Dynamics: barrel, muzzle brake & suppressors:

- *Obtain maximum performance from bullet*
- *Decrease recoil*
- *Minimize sound signature*
- *Decrease muzzle climb and improve accuracy*
- *Pressure field at the muzzle and interaction with the surroundings*



Suppressor fluid dynamic analysis

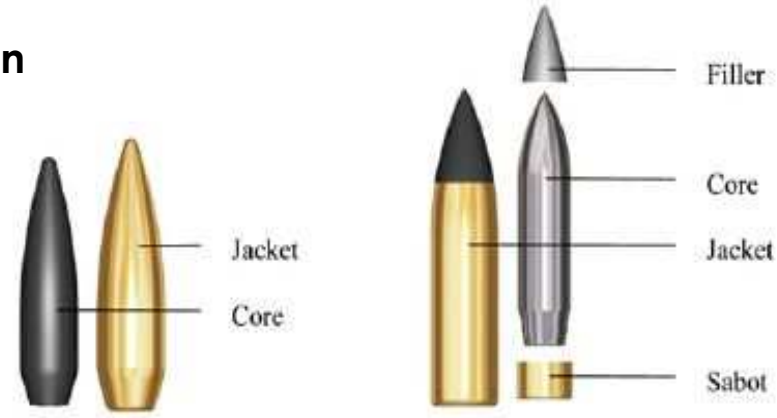




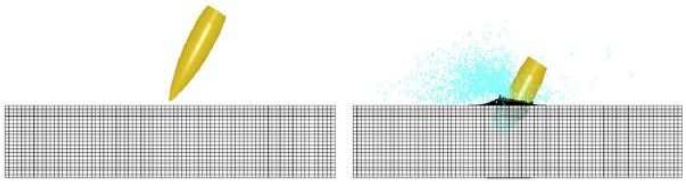
TERMINAL BALLISTICS

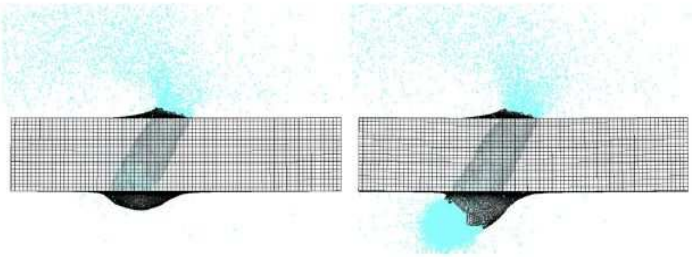
Carbine, rifle and pistol ammunition

Assess performance of standard lead & full metal jacket ammunition as anti-material, anti-personnel & penetrating rounds



Standard 7,62 NATO rounds

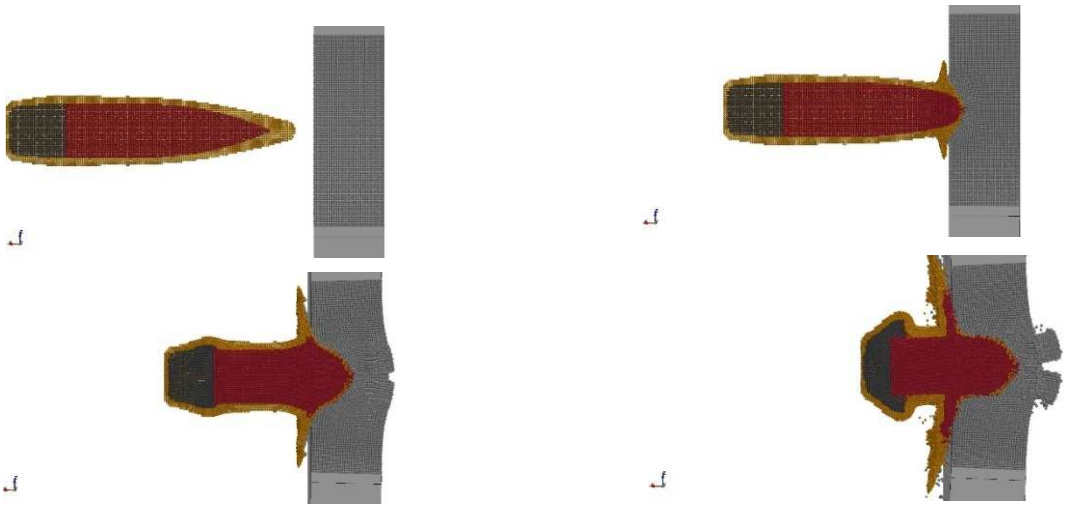




Lead core FMJ against aluminium plate

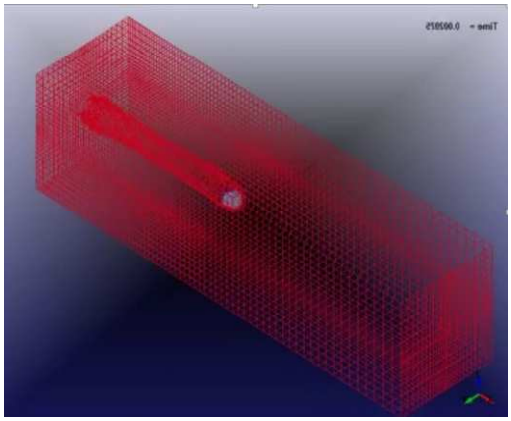
Develop new penetrating ammunition

- Case material
- Bullet mass and energy
- Penetrator's geometry
- Penetrator's material



AP ammunition against hardened ballistic steel plate

TERMINAL BALLISTICS

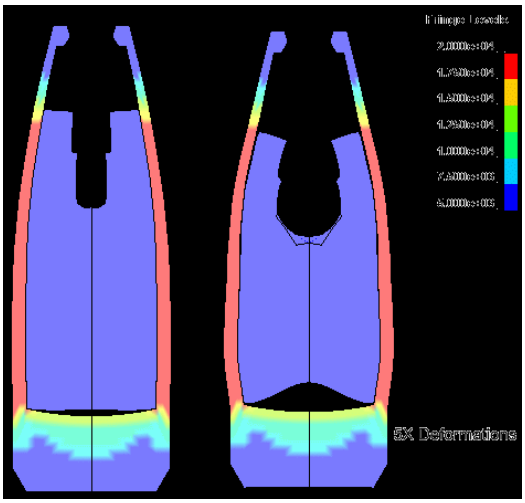


Simulated impact against ballistic gel

Simulation of lead core ammunition and controlled expansion rounds against soft targets

- Energy delivered at the target
- Estimate penetration and wound channel
- Impact of the design on the bullet expansion
- Design of the aerodynamic tip, improve ballistic coefficient and expansion

Controlled expansion rounds



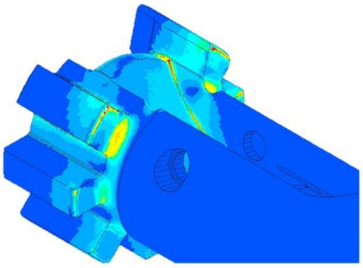
2D simulation of 9mm bullet

INTERNAL MECHANISM

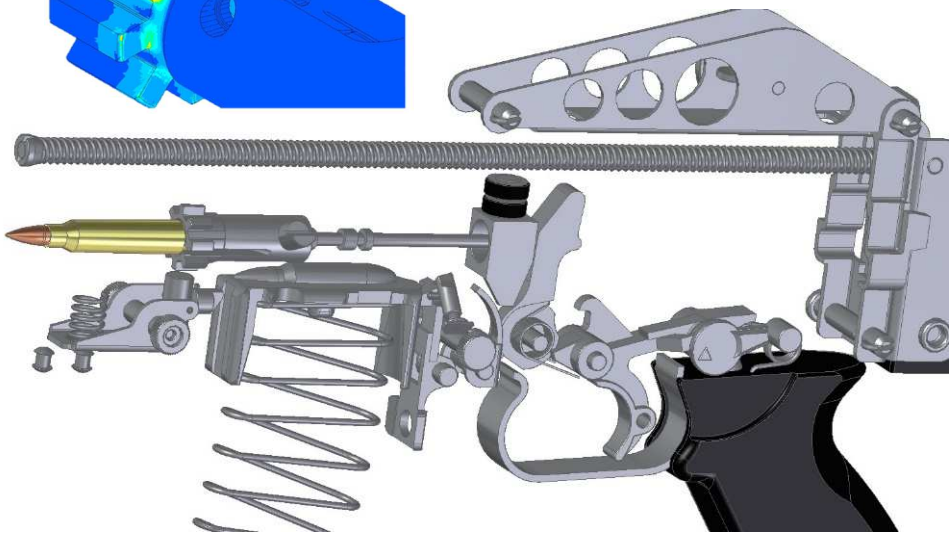
FE analysis of small arms components, improve the design and the efficiency:

- *Lighter weight*
- *Higher reliability and durability*
- *Response frequencies, modify the barrel design to reduce displacement and improve accuracy*

Mode 2: 406 Hz



Mode 3: 1050 Hz

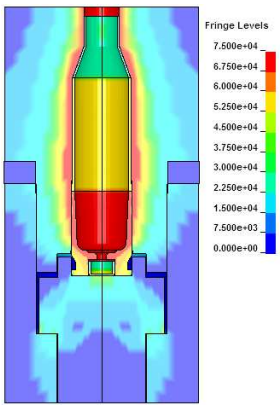


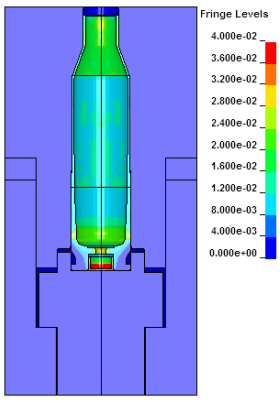
Mode 5: 1984 Hz

GAS SYSTEM

Design and improvement of gas system:

- *Simulate ignition of cartridge in chamber*
- *Recover stresses in the gas system*
- *Increase overall reliability*
- *Study modifications of the gas system to accept different ammunitions*





PERSONAL PROTECTION

Metallic material

Simulation of surface hardened material, bullet's fragmentation and impact of high speed fragments

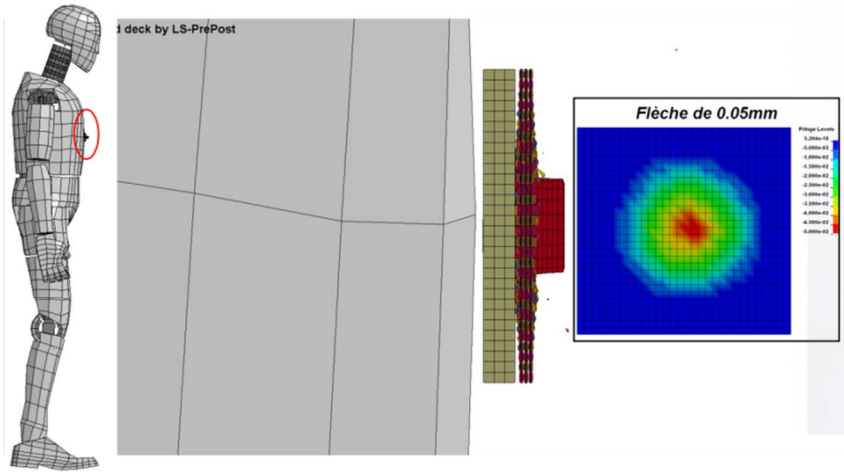
- *Choosing appropriate thickness, material and heat treatment accordingly to the threat level*
- *Effects of the geometry of the strike plate*
- *Design spall liner coatings*

Police special operation shield

Ceramic material

Simulations are a support to the design of new vest and rigid inserts

- *Lightweight*
- *Ability to resist to multiple hits*
- *Conformal rigid insert to increase users' comfort*



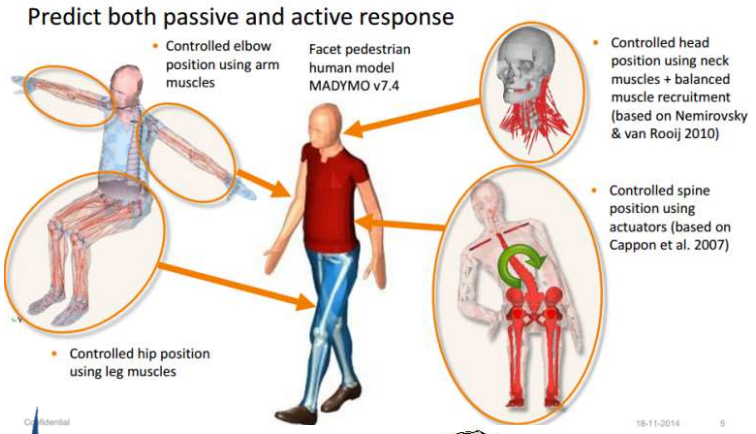
Complete body armour

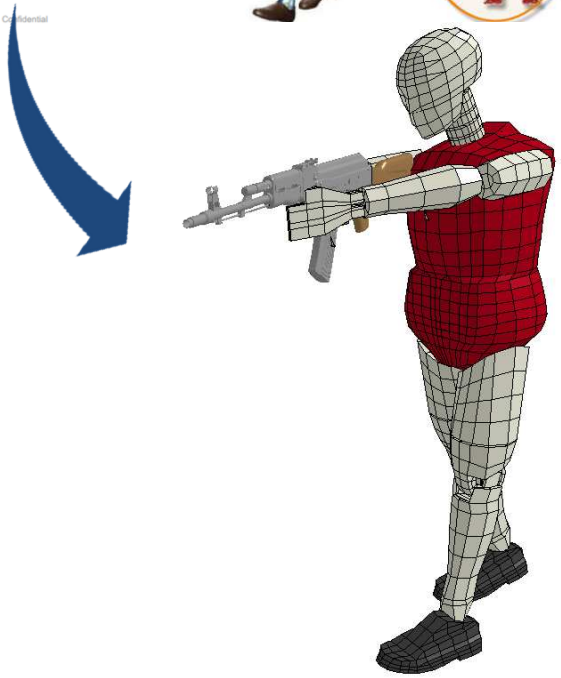
RECOIL MANAGEMENT

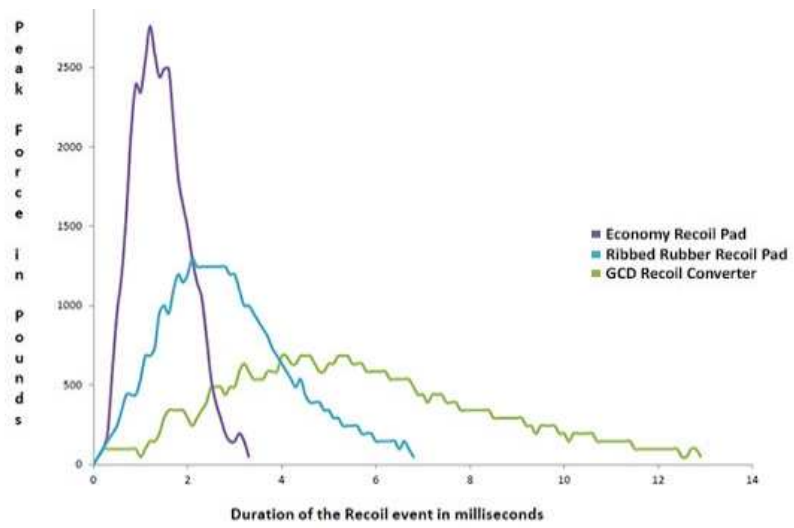
Possibility to assess recoil considering a full scale simulation with a numerical equivalent of the human body such as :

- *Recover forces transmitted to the shooter*
- *Design integrated or add-on solution to reduce recoil*
- *Increase user comfort*
- *Higher effectiveness in engaging targets*

Active Human Model Design



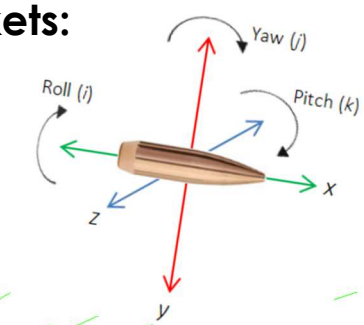


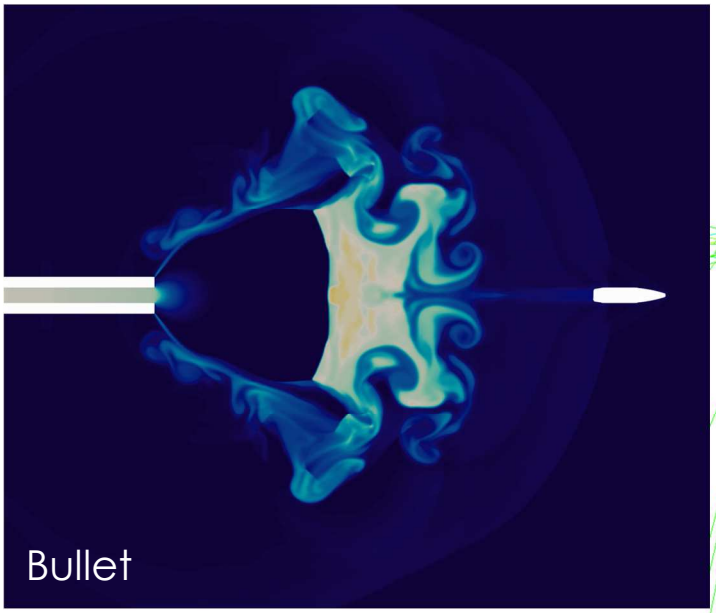


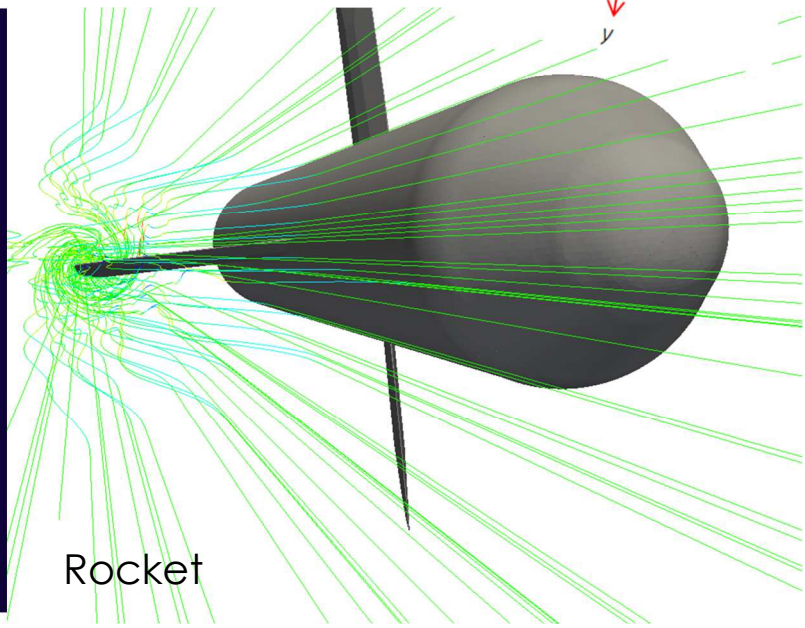
EXTERNAL BALLISTIC

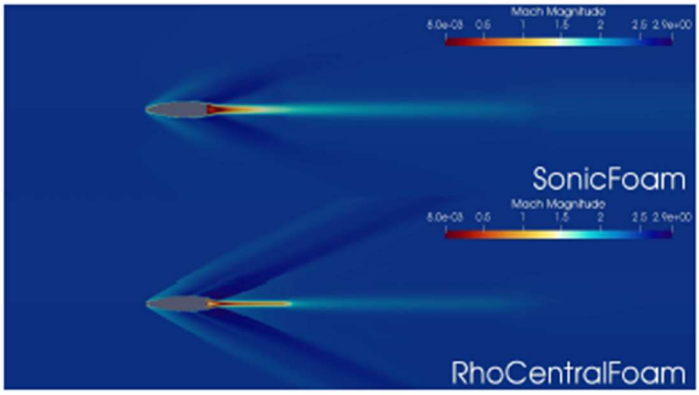
Possibility to predict the trajectory of bullets and rockets:

- *6-DOF model & CFD analysis*

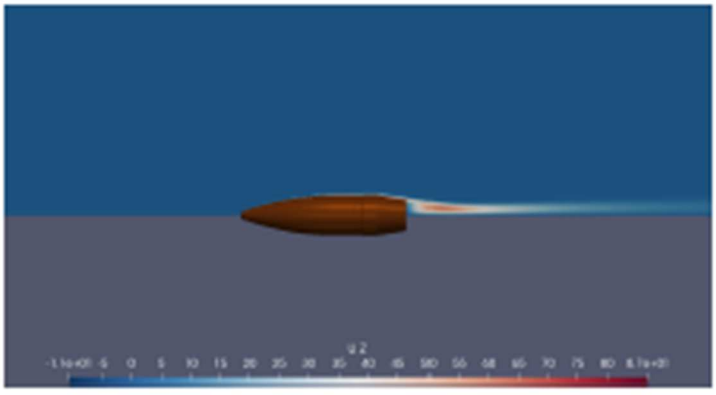



Bullet


Rocket



2D

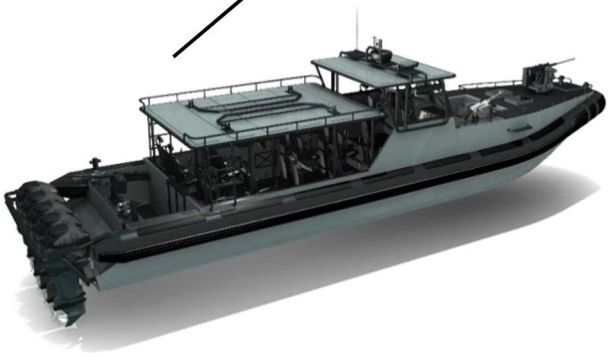


3D

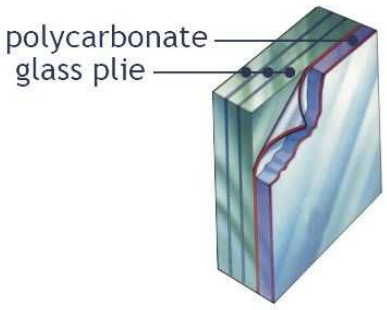
VEHICLES & HEAVY EQUIPMENT

1. Large Caliber Ammunition

2. Blast Protection



3. Armour and Bulletproof Glass

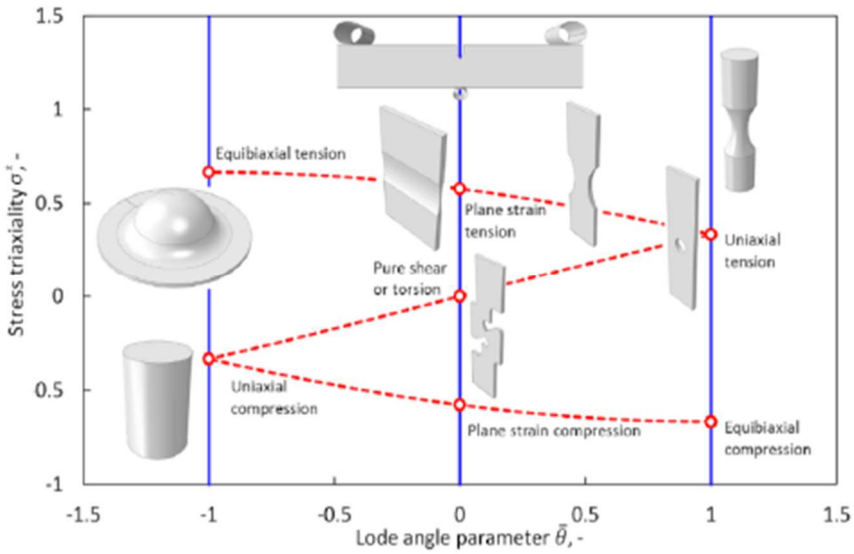


5. Logistics & Transportation

4. Vehicle Upgrading

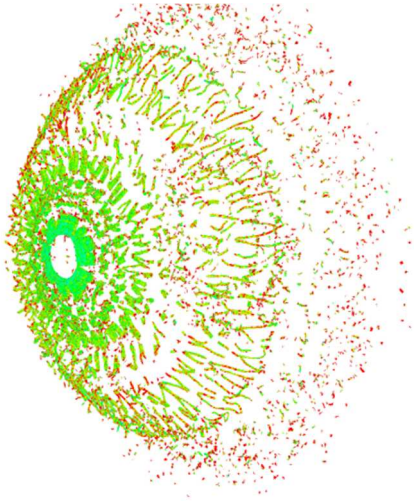
LARGE CALIBER AMMUNITION

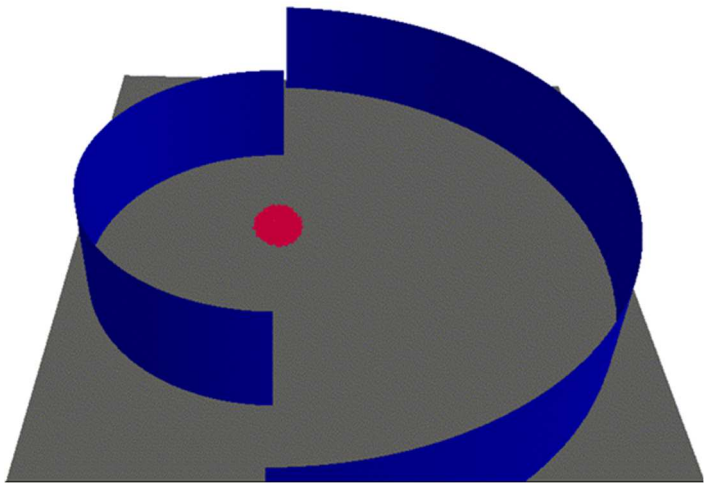
Obtain the desired effective area choosing the right:



- *Material*
- *Explosive*
  - *TNT, c4, m46, petn, HMX, CompA, CompB, Octol*
- *Geometry*

Number of experimental tests decreased





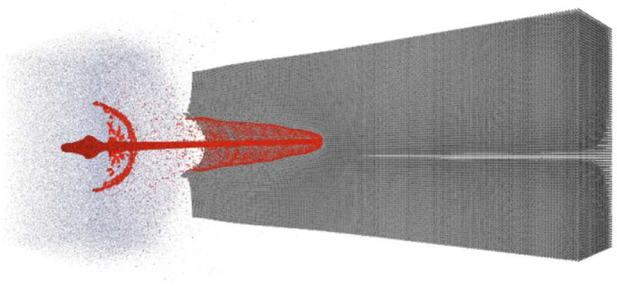
LARGE CALIBER AMMUNITION

High explosive

- *Blast impact on structures*
- *Numerical simulations of the fragmentation process, predict number of splinters and their distribution*
- *Anti-personnel and bunker-busting capabilities*

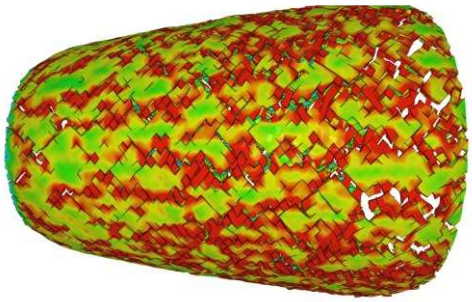
Hesh

- *Fragmentation of the casing*
- *Anti-vehicle use*



Heat

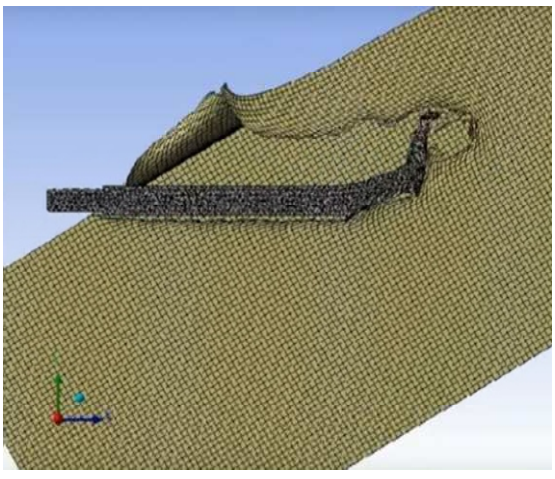
- *Penetrating performances against armored vehicles and in bunker-busting role*



Fragmentation and pre-fragmented munitions

Develop controlled fragmentation round:

- *Use in urban and sensitive areas*
- *In anti-aircraft and anti-missile role*
- *Against lightly armoured vehicles and boats*
- *Area denial*



BLAST PROTECTION

Testing armoured vehicle against :

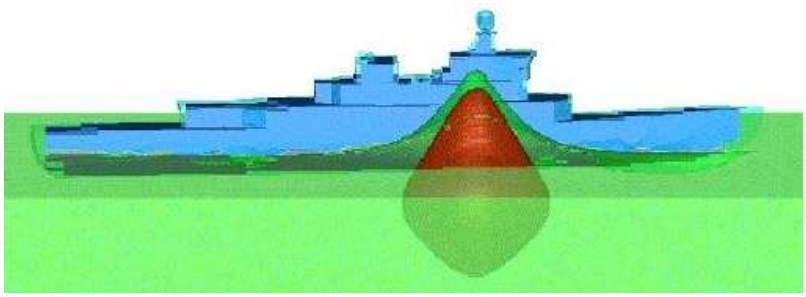
- *Explosive ammunition blast*
- *Shaped charge ammunition*
- *Mine and IED blast*

*Evaluate ability of the vehicle to **resist blast loading** due to both in air explosion and under ground explosions.*
*Recover stresses on the structure, **acceleration imparted to the occupants** of the vehicle, fragments generated by the **spalling of the armor.***

APC under IED blast loading

Under water mine explosion:

- *Simulate pressure profile*
- *Loading on the hull and superstructure*



Underwater explosion
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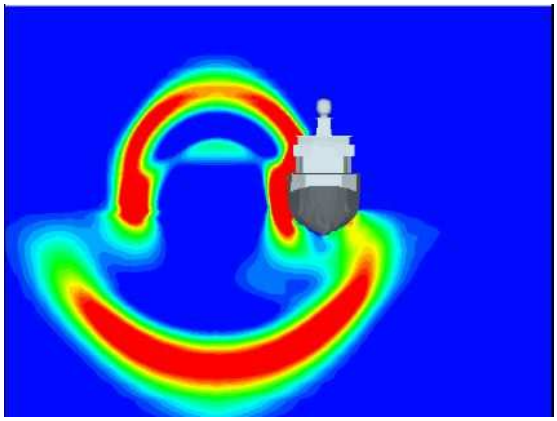

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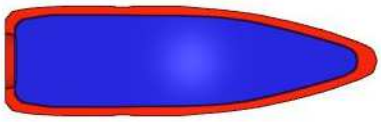
ARMOUR & BULLETPROOF GLASS

Reproducing test described in standards such as:

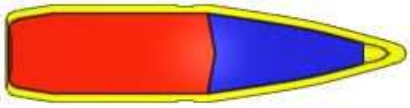
- ***STANAG 4569***
  Protection Level of Logistic and Light Armored Vehicles
- ***STANAG 2920***
  Protection Level Armor Materials and Combat Clothing

Impacts due to small arms fire, for example:

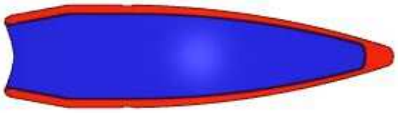
- ***5.56x45*** *M193*



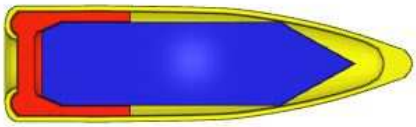
- ***5.56x45*** *M855*



- ***7.62x51*** *M80*



- ***7.62x51*** *M993*



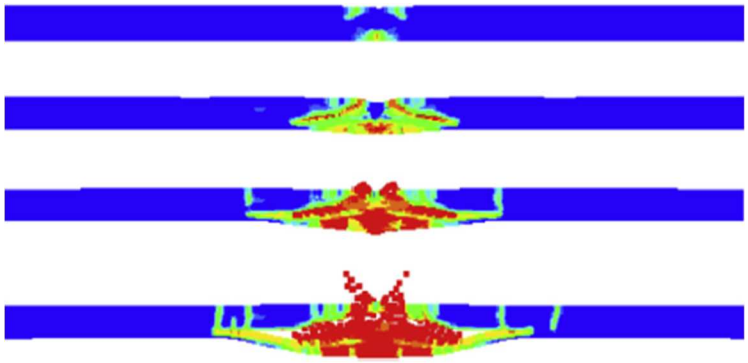
- ***14.5x114*** *B32*

- ***20*** *mm FSP*

Small artillery fragments on a mild steel plate

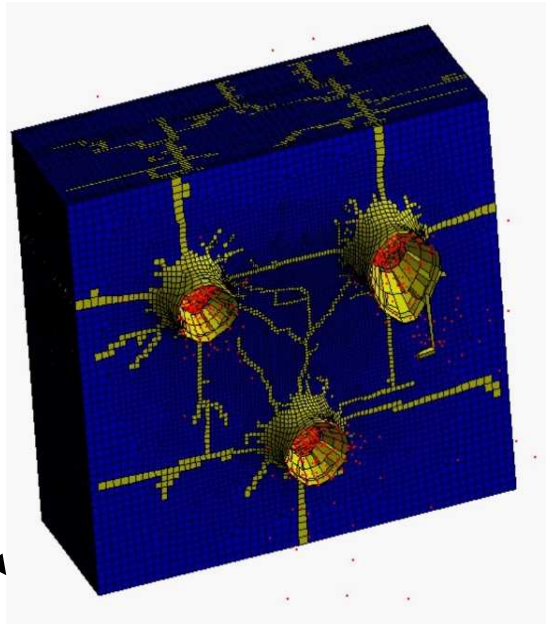
ARMOUR & BULLETPROOF GLASS

Simulations of different armor plating material:



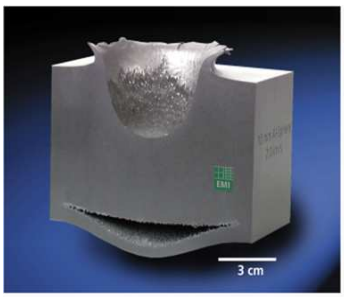
Damage evolution in armor plating

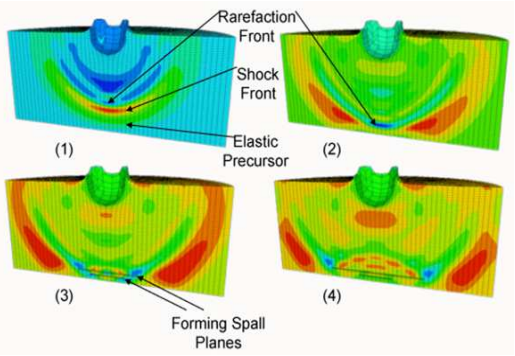
- *Mild steel*
- *Surface hardened steel*
- *Lightweight aluminum and titanium alloys*
- *Ceramic and brittle materials*
- *Composite materials such as laminated glass*



Simulation of multiple impacts

Spalling effect of non-penetrating rounds





ARMOUR & BULLETPROOF GLASS

Develop flexible amour solution for civilian, police and military use

- *Bullet-proof glass*
- *Metal ballistic plates*
- *Composite armor solutions*

Additional armoring

- *Modularity, in accordance to the threat level*
- *Take into account field installation*
- *Easier to transport and air-lift*

Integrally armored vehicles

- *Lightweight*
- *Protection optimized*
- *High threat environments*

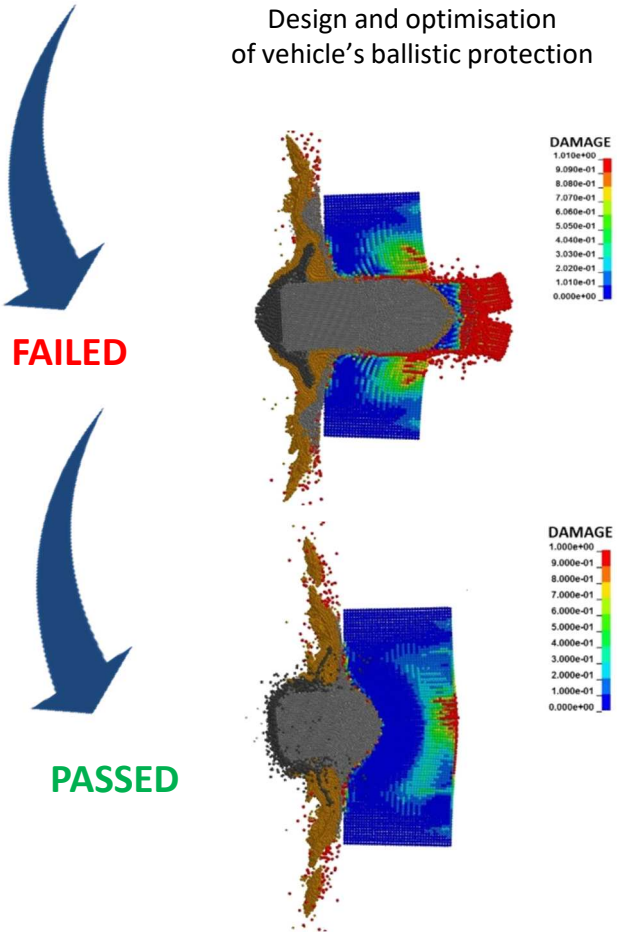
Aircrafts and Helicopters

- *Military Transport in war-zones*
- *Close air support mission*
- *Combat search and rescue operations*
- *Special operations*

Naval Vessels

- *Harbor and river patrols*
- *Special operations*
- *Anti-piracy*
- *Collision with small boats or large vessels*

Design and optimisation of vehicle's ballistic protection



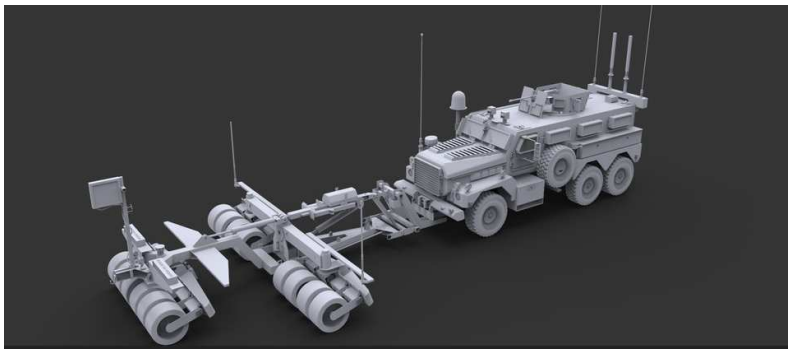
VEHICLE UPGRADING

Extend service life, respond to new threats and overall increase in efficiency

- *CAD development*
- *Static and dynamic structural analysis, recover the stresses on the structure and the new center of gravity*
- *Design the additional components taking into account ease of installation and transportation*
- *Increase modularity of the platform*

Ground forces

- *Increase crew survivability in asymmetric warfare and urban combat*
- *Protection against small arms fire, RPGs and IEDs.*
- *Retain mobility and off-road capabilities*
- *Increase firepower by installing turrets and remotely controlled pods*



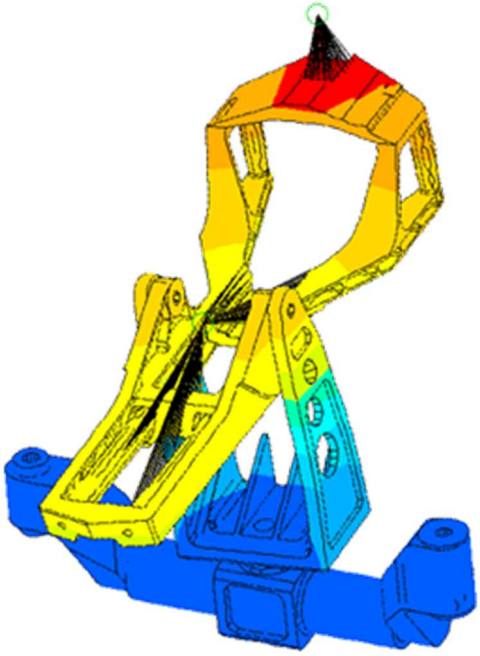
Vessels

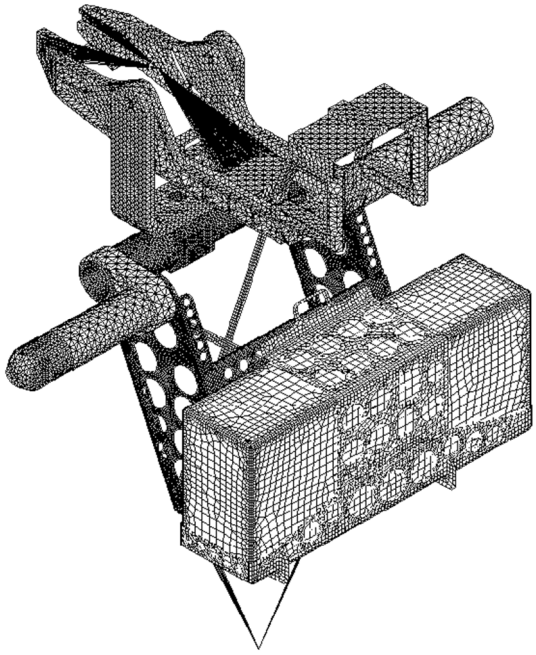
- *Develop armoring and armament packages for RIHBS and small boats to use in anti-piracy, anti-terrorism, river and costal patrol operations and special operations*

VEHICLE UPGRADING

Aircraft and helicopters

- *Design and develop support and pods to increase firepower of air based platforms*
- *Modal analysis and dynamic response to guarantee the compatibility with the platform*
- *Fluid dynamics analysis for externally mounted pods and auxiliary fuel tanks*





OIL & GAS PROTECTION

In the hazardous industries, safety studies are mandatory to document a safe design, so called DAL spec (Dimensioning Accidental Loads specifications).

↓

e.g. NORSOK Z-013,2010 standard in Oil and Gas Industry

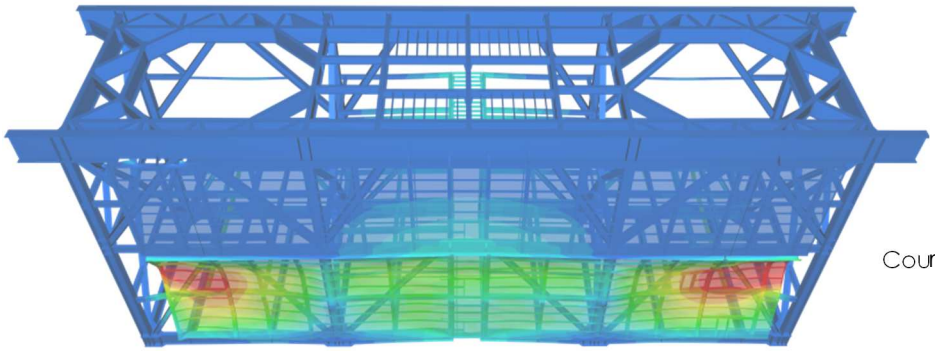
↓

Advanced and innovative methodology for risk-based structural response assessment against accidental explosion

↓

Latest improvement in fire and heat load simulation solver and the most predictive behavior of the ductile damage model by taking into account stress triaxiality for the steel material.

Blast Action



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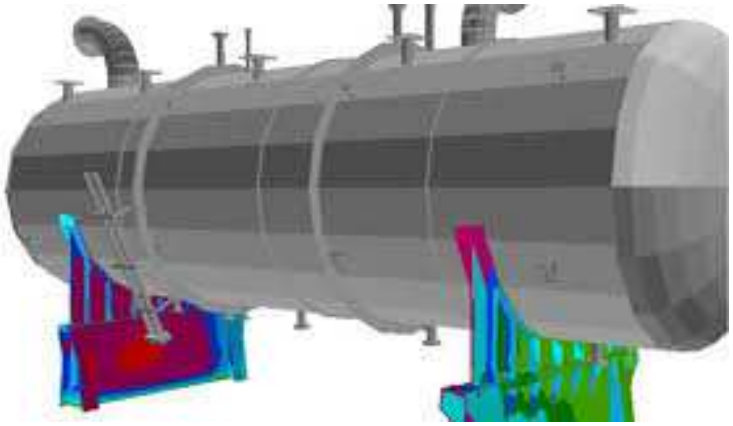
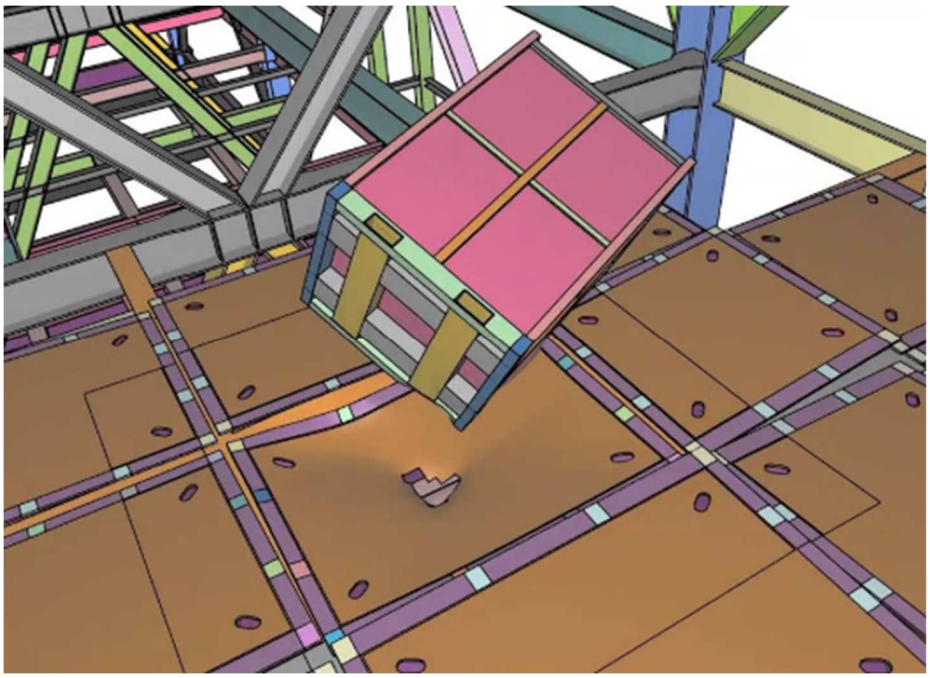
OIL & GAS PROTECTION

Fire Action



Impact Condition



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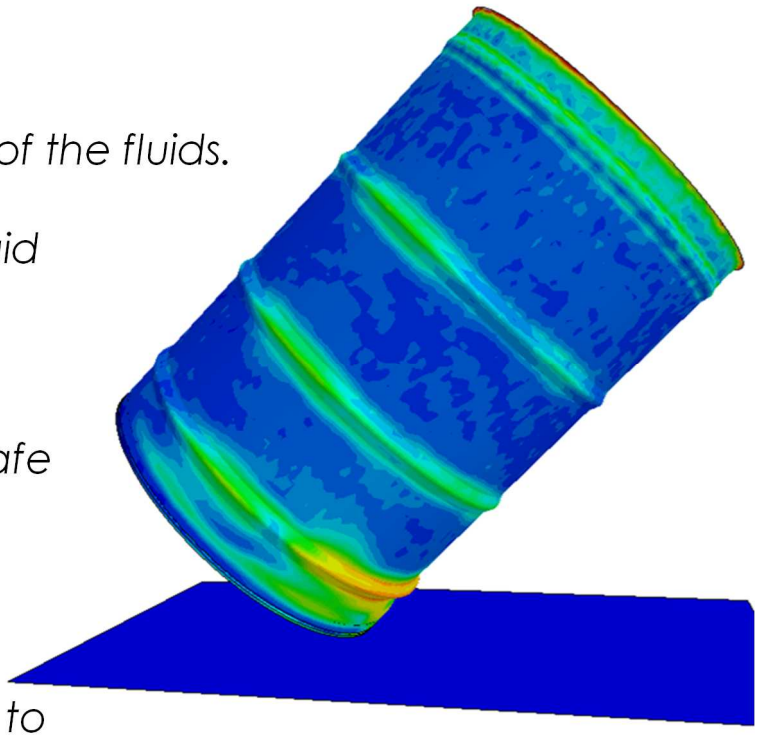
LOGISTICS & TRANSPORTATION

Liquid material

Dynamic simulation of the behavior of the fluids.
Design containers able to:

- *Minimize sloshing action of the fluid*
- *Resist impacts or perforation*



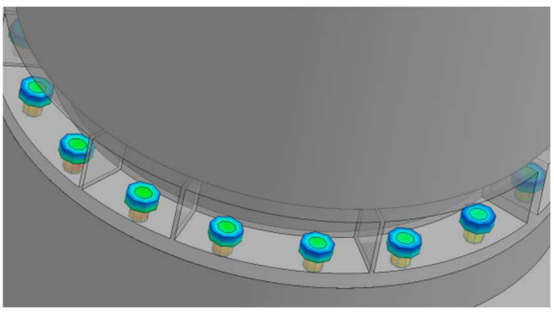
Hazardous material

Custom solution to guarantee the safe transport of toxic, radioactive or explosive material

Air transport

Design anchorages and containers to airlift vehicles, equipment and supplies

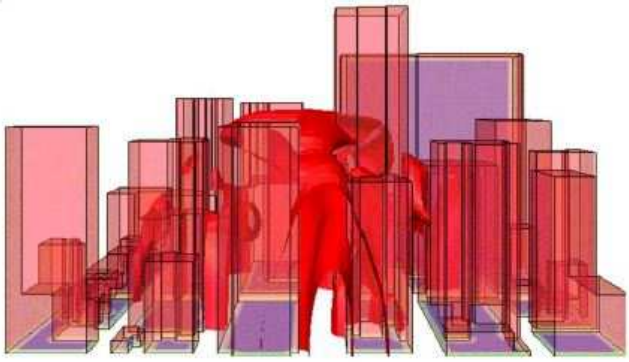
- *Verify the ability of the container and anchorages to retain the cargo under dynamic loads*
- *Evaluate the stresses and loads transmitted to the airframe during each phase of the flight*



BLAST PROTECTION

Building external blast loading:

- *Effects on façade, simulate **stresses and rupture of steel** and glass façades*
- *Simulate blast wave reflections in complex urban environment*



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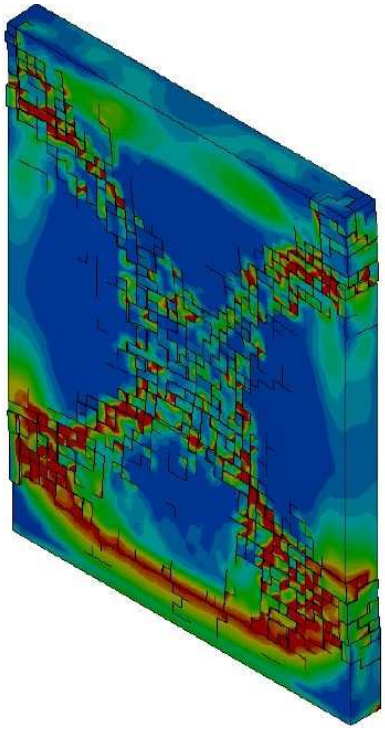
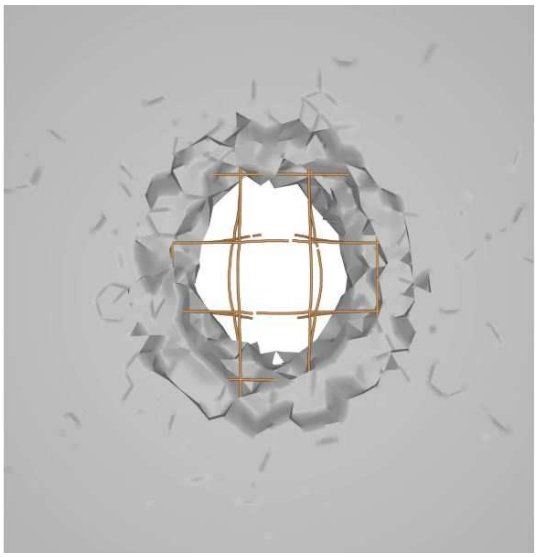
Experimental (top) and numerical (bottom) damage on concrete structure of a charge at distance

- ***Blast loading and damage to reinforced concrete structure**, both for explosive charges at distance and in direct contact with the structure*



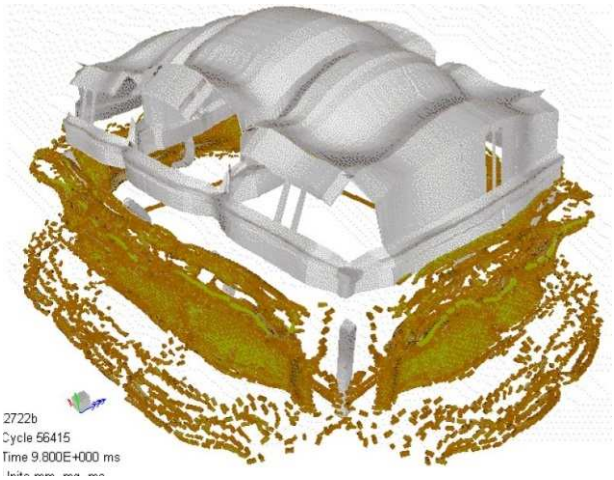


Experimental (left) and numerical (right) damage on concrete structure of a charge in direct contact

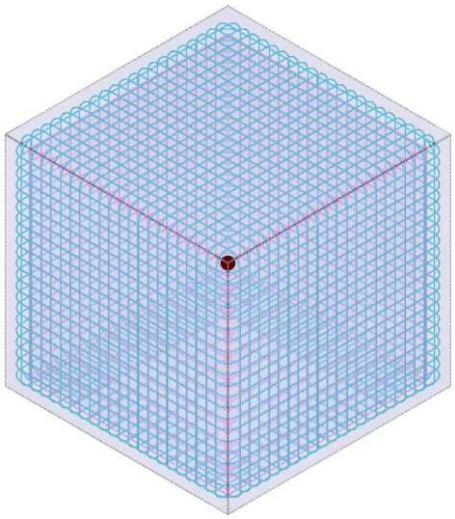
BLAST PROTECTION

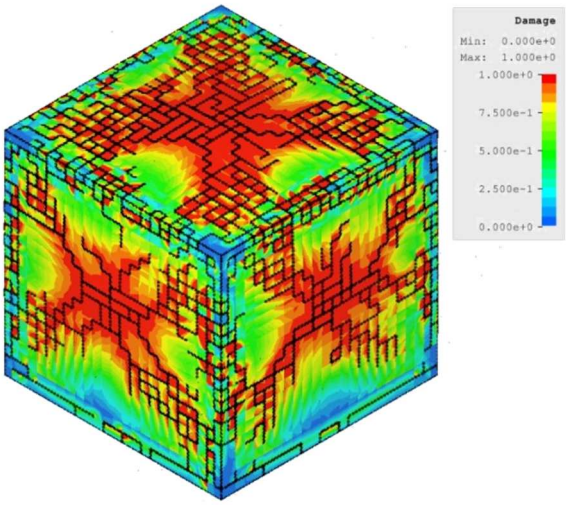
Building internal blast loading :

- *Simulate effects on the building derive from an internal explosion*
- *Available numerical models for **brick, concrete and steel reinforced building***
- *Evaluate damage to the structure and fragments projected to the outside*



Brick and steel building
Courtesy and copyright of ANSYS



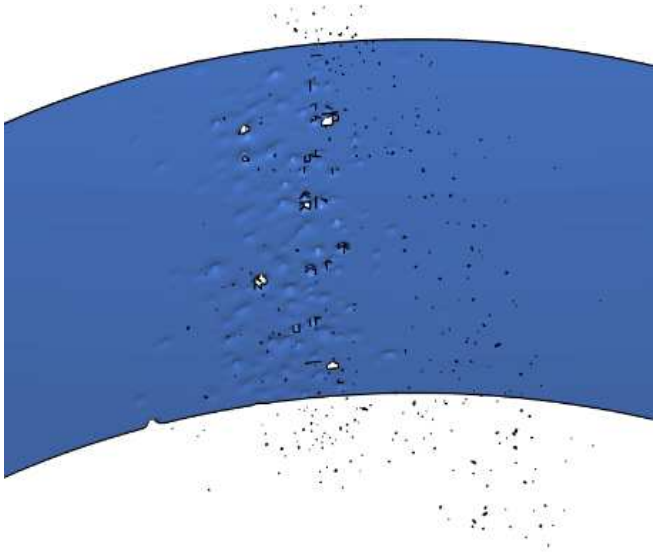


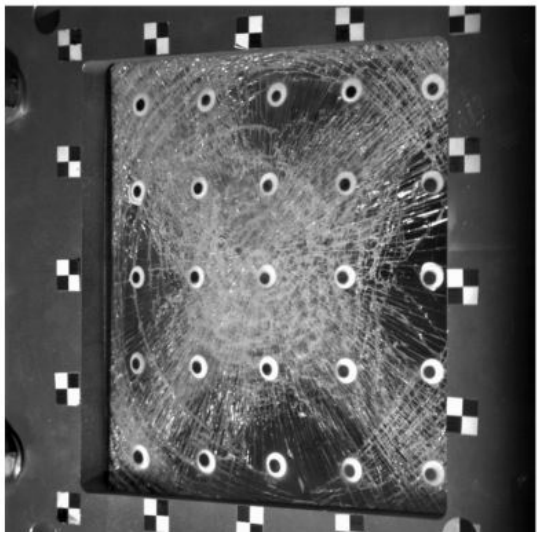
Damage comparison to a reinforced concrete chamber, experimental (top) and numerical (right)

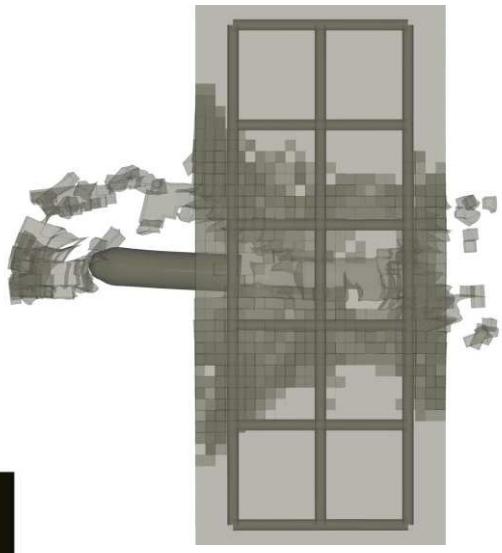
BLAST & FRAGMENTS PROTECTION

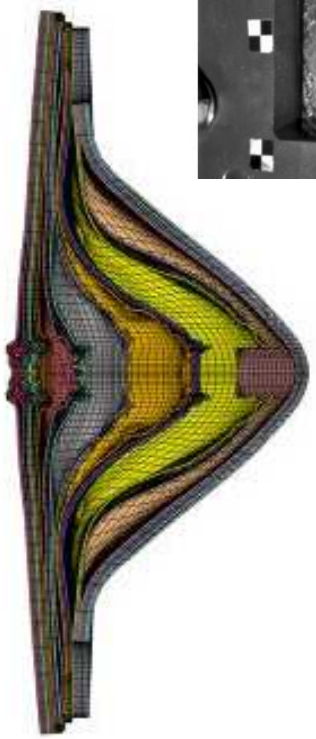
Blast effect in confined spaces:

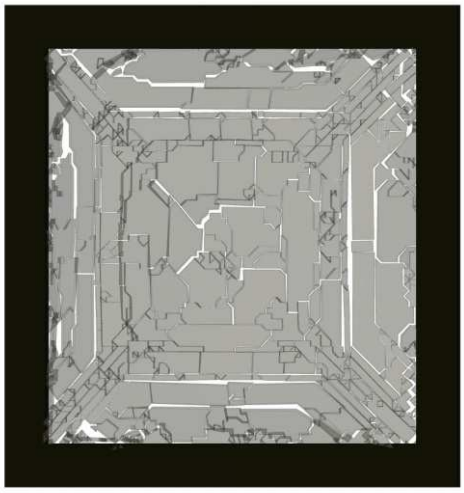
- *Design blast proof steel structure and containers*
- *Design containments wall to protect from blast and fragments*
- *Advanced **calibrated material models** available for **steels , reinforced concrete ,glass and fiber reinforced composite.***











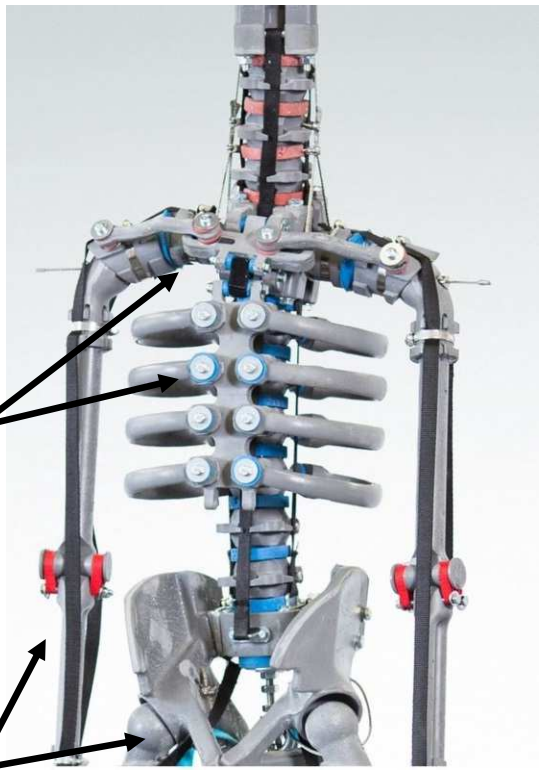
BIOFIDELIC DUMMY

PURCHASE

Real biofidelic dummies for real testing purposes.

This new human analouge offers numerous advantages over the traditional dummies:

- *Biofidelic dummies are the best cost effective solution when the destruction of the dummy is probable*
- *Reproduce accurately the behavior of the human body:*
  - *Movements of the articulations*
  - *Soft tissues*
  - *Skeleton and bones*
- *Can be fitted with extensive measurement technology*
- *Available in standard sizes or individual dummy could be produced*



SIMULATIONS

GDTech is developing a numerical model of the biofidelic dummy to be included in the full scale simulation of blast, collision, etc…

HANDLING TOOLS

In the field

- *Robotic arms and attachments to manipulate mines and IEDs.*

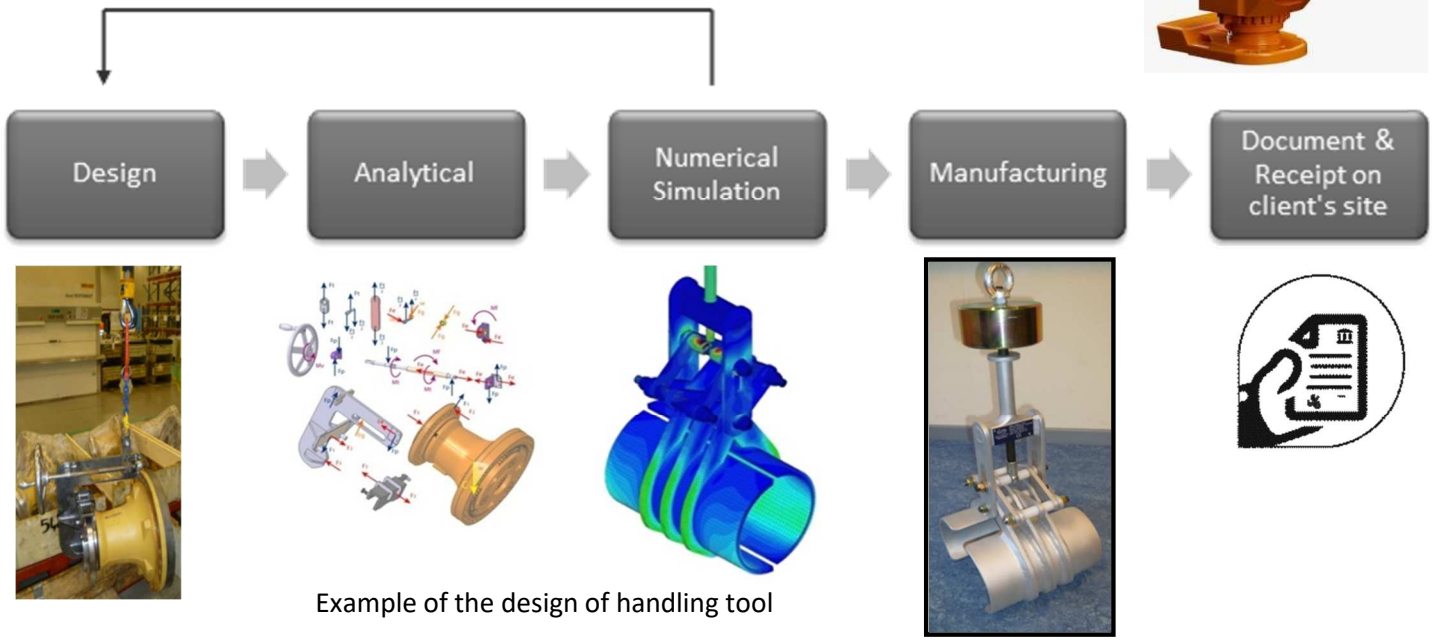
Ground and Naval vehicles

- *Robotic arms and attachments to manipulate mines and IEDs.*
- *Auto-loading mechanism and automated munitions magazin for tanks and artillery*

Industry

Custom made solutions to:

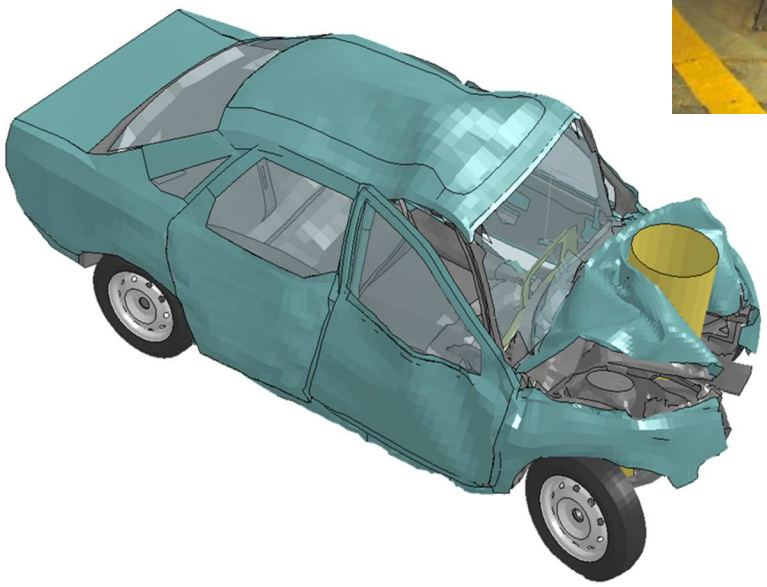
- *Handle munitions or equipment*
- *Move hazardous and toxic material*
- *Manipulate toxic and radioactive waste*
- *Assembly of small components*
- *Lift of heavy and bulky components*
- *Robot's arm attachments for dedicated tools*



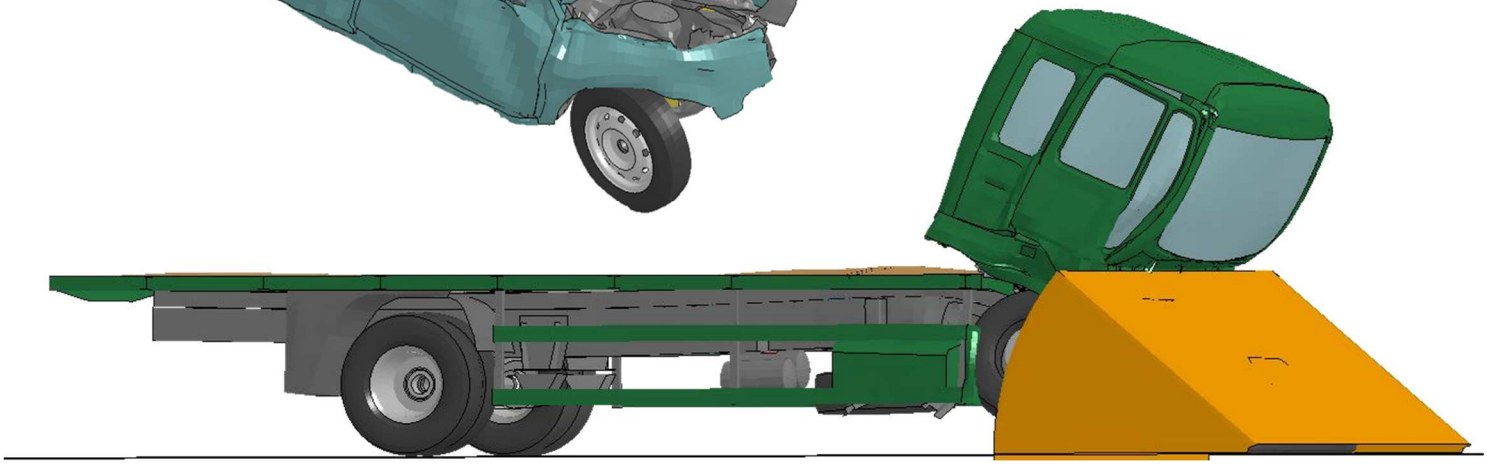
Example of the design of handling tool

PROTECTION OF SENSIBLE BUILDING AND EVENTS

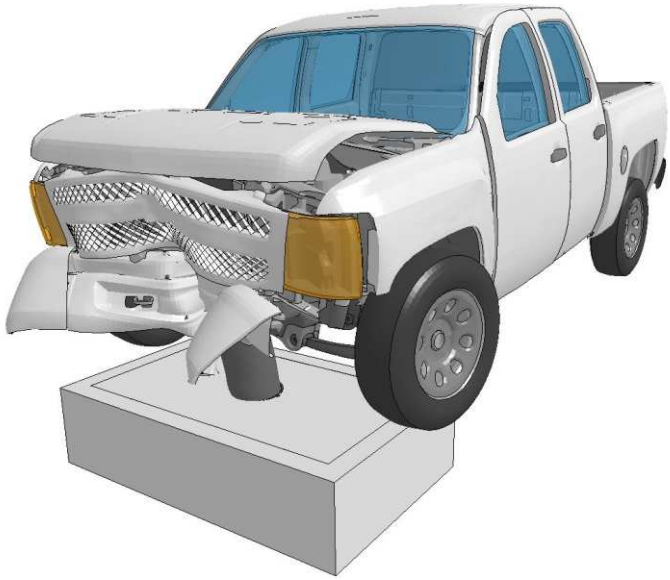
Protect sensible buildings and events against unauthorized vehicle

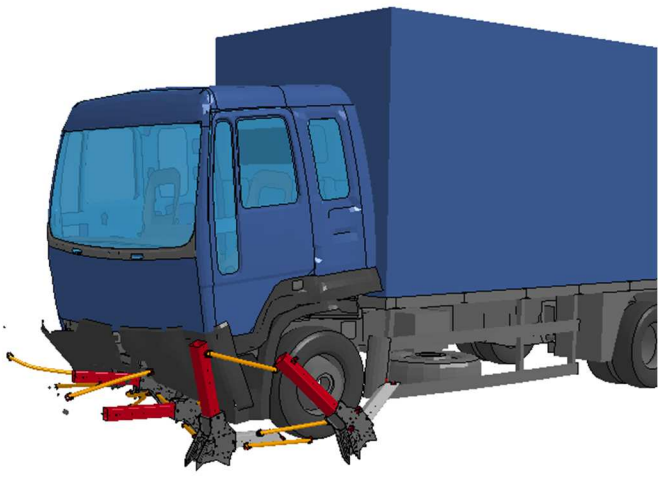


PAS 68
PAS 69
ASTM F2656
IWA 16221



PROTECTION OF SENSIBLE BUILDING AND EVENTS

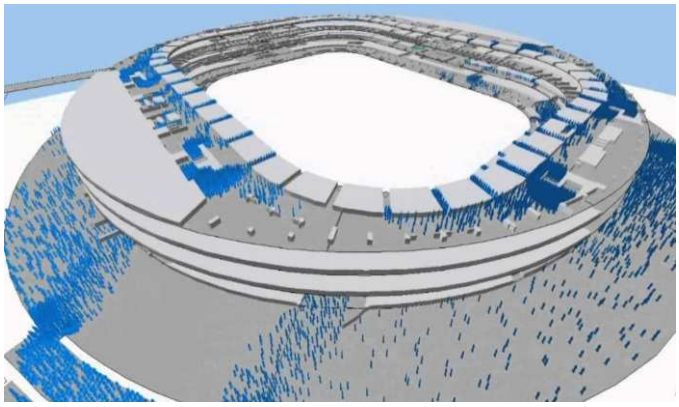




TRAFFIC & CROWD ANALYSIS

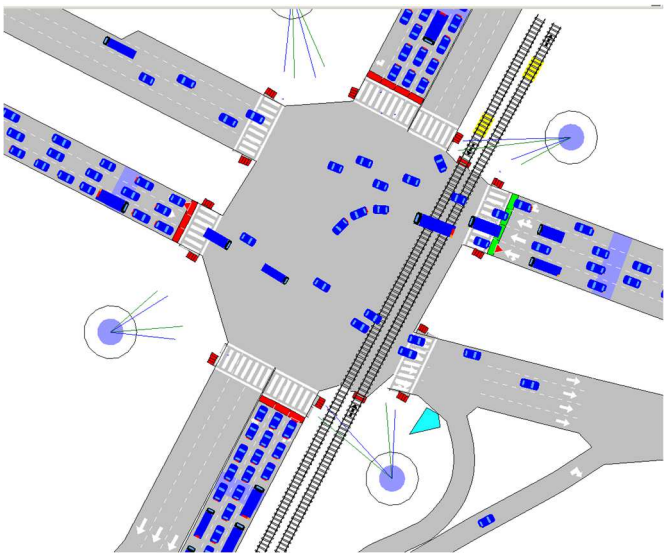
Pedestrians

- *Crowd simulations*
- *Manage crisis scenarios*
- *Design emergency exits to guarantee the quickest and safest evacuation of large buildings and events*



Vehicles

- *Traffic simulations*
- *Plan safe routes for VIPs*
- *Plan routes for large convoys, both civilian and military*



3D Scanning

3D Scanning of mechanicals components

Reverse engineering, from a prototype or a production model to the cad files and blueprints

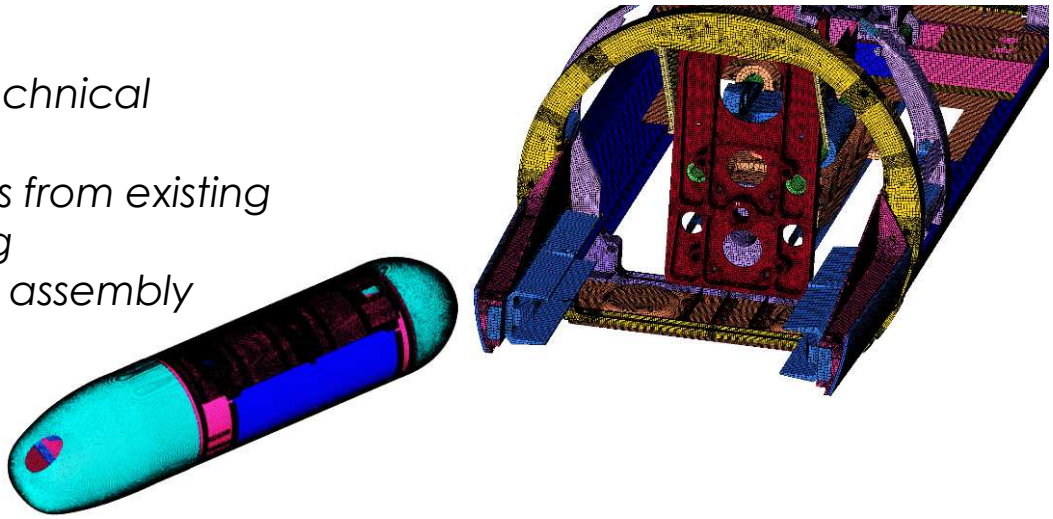
3D Printing

3D Printing with industrial plastics and metallic materials

CAD Services

CAD support

- *Create a set of technical drawings*
- *Create 3D models from existing technical drawing*
- *Animations of the assembly*

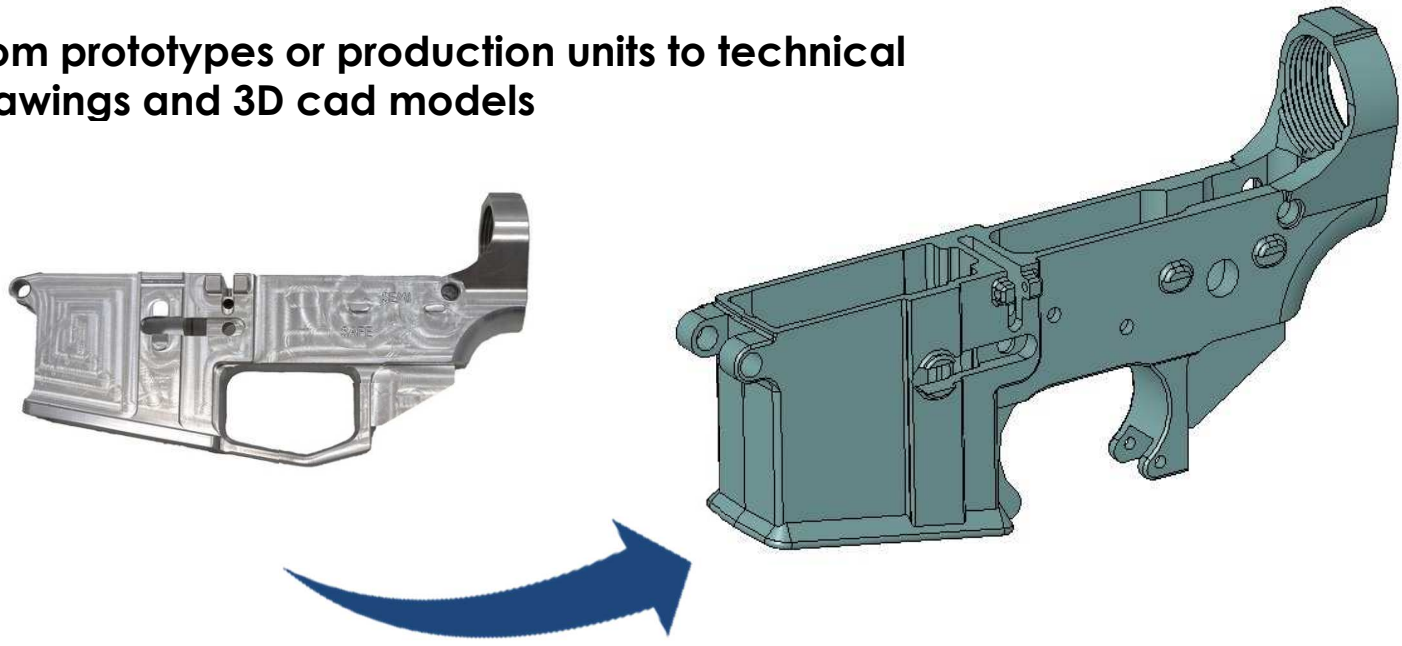


Training

Provide training in the most widespread CAD software

Reverse Engineering

From prototypes or production units to technical drawings and 3D cad models



VEHICLES

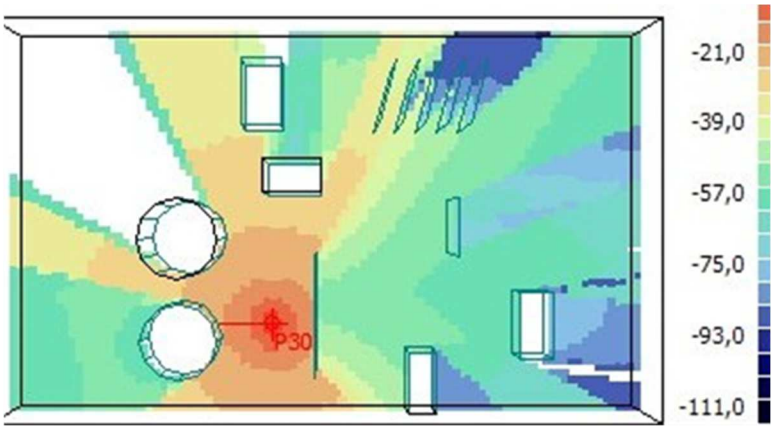
External sound insulation and optimization of the entertainment system for luxury armoured vehicles

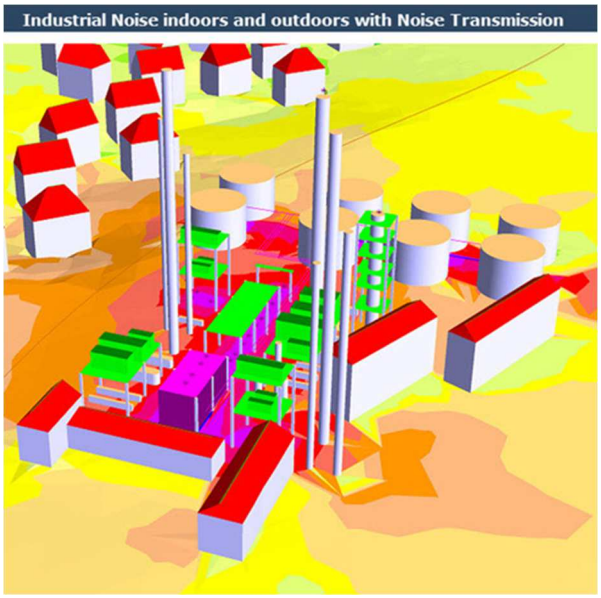
BUILDINGS

Reduction / management of industrial noise

Simulation of sound propagation and reflection in confined spaces

- *Design of shooting ranges*
- *Studies for the emplacement of machinery confined spaces such as naval vessels and submarines*





GDTECH engineering

DEFENSE
AMMUNITION, PROTECTION, BLAST, ANTI-INTRUSION AND EMERGENCY SCENARIOS

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