fea INFORMATION Engineering Solutions

Volume 6, Issue 07, July 2017

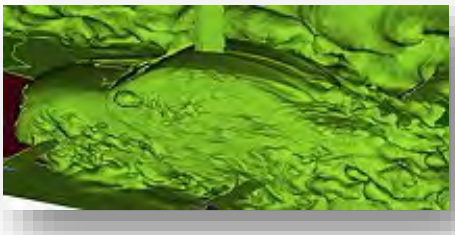
www.feainformation.com www.feaiej.com www.feapublications.com

LSTC Recent Developments In LS-DYNA (Editor: Yanhua Zhao)

Best Fit GUI for Metal Forming in LS-PrePost® 4.5

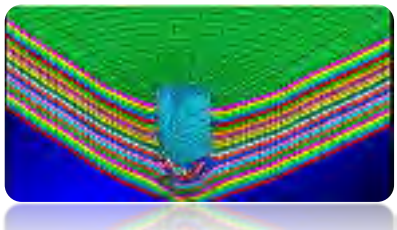
Modeling and Numerical Simulation of Afterburning of Thermobaric Explosives In a Closed Chamber

BETA CAE SYSTEMS



RESCALE

MATERIALS SCIENCES CORP.



ESI-GROUP

PREDICTIVE ENGINEERING

? Quiz ?

FEA Information Inc.

A publishing company founded April 2000 – published monthly since October 2000.
The publication's focus is engineering technical solutions/information.
FEA Information Inc. publishes:

FEA Information Engineering Solutions

www.feapublications.com
Contact: mv@feainformation.com

FEA Information Engineering Journal

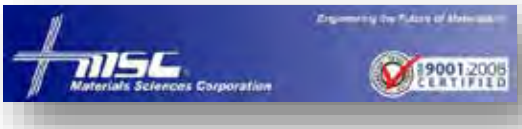
www.feaiej.com
Contact: yanhua@feainformation.com

FEA Information China Engineering Solutions

Simplified and Traditional Chinese
To receive this publication contact yanhua@feainformation.com

logo courtesy - Lancemore

logo courtesy - Lancemore



FEA Information News Sections

Articles – Blogs – News

Automotive News **Editor - Dilip Bhalsod**

Aerospace News **Editor - Marnie Azadian**

China FEA News –Events – Participants **Editor – Yahua Zhao**

Solutions

Participants	Distribution & Consulting	Cloud/On Demand/Subscription
ATD – Barrier - THUMS		

News Classes – Social Media **Editor - Aleta Hays**

Conferences – Events

LSTC Information & Apps **Editor - Yanhua Zhao**

Announcements

15th International LS-DYNA® Users Conference & Users Meeting
Abstract correction - Date Due is November 15, 2017

Reminder by Aleta: The following classes are confirmed and have a few additional places available

ALE/Eulerian/FSI confirmed Livermore, CA Aug. 21-23, 2017
SPH confirmed Livermore, CA Aug. 24-25, 2017
Instructor: Mhamed Souli

Reserve your class space aleta@lstc.com

Reminder by Andrea: Release of ESI Visual-Environment 13.0 available
For additional product information, contact any of the local ESI subsidiaries or contact Andrea Gittens, Product Marketing Manager for ESI Visual-Environment.
agi@esi-group.com

Reminder not to miss Jonathan Oakley Thursday, August 17, 2017
Presenter at the RESCALE webinar:

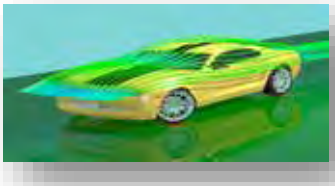
Left - My pony, Cody, with Vika

Middle - Quincy, miniature horse, and Jenna

Right - Dusty miniature horse, and Ky

Sincerely,
Marsha Victory Trent Eggleston
Marnie Azadian Suri Bala Dilip Bhalsod Yanhua Zhao Aleta Hays

15th International LS-DYNA® Users Conference & Users Meeting



June 10-12, 2018

Edward Hotel &
Convention Center
Dearborn, MI, USA

Welcome:

The conference will host a forum for engineers, professors, students, consultants, industry leaders, and interested parties to exchange their ideas, and listen to the latest in industry and academic presentations..

The presenter (1) One Presenter of the accepted paper will receive a complimentary (no fee) conference registration, when they register using the "LSTC Conference" group registration code at the Edward Hotel.

Conference Dates:

Sunday	06/10/2018	Registration	Exhibition Area	Reception
Monday	06/11/2018	Registration	Exhibition Area	Banquet
Tuesday	06/12/2018	Registration	Exhibition Area	Closing
Wednesday/Thursday	06/13-14/2018	Training Classes		

Information:

Abstracts & papers papers@lstc.com
Participation, Registration conference@lstc.com

Abstract Submission on line:
Deadline: November 15th, 2017
On line being processed by DYNAmore GmbH
www.dynamore.de/paper2018

Paper Submission: Deadline: February 14, 2018 FIRM

Notification and templates will be provided by DYNAmore
For any questions please write papers@lstc.com

Abstracts: www.dynamore.de/paper2018
Registration/Classes: www.ls-dynaconferences.com

Conference Call For Papers

- Acoustics
- Aerospace
- Automotive
  - Crashworthiness
  - Durability
  - NVH
- Ballistics and Penetration
- Biomechanics
- Civil Engineering
- Electromagnetics
- Fluid Dynamics
  - Compressible
  - ALE (Lagrangian, Eulerian)
  - CESE
  - Incompressible
- Granular Flow
- Heat Transfer
- HPC & Cloud Services
- Impact and Drop Testing
- Manufacturing Processes
- Material Parameter Identification
- Metal Forming
- Modeling Techniques
- Nuclear Power
- Occupant Safety
- Optimization
- Particle Method
  - Airbag Particle Method
  - Discrete Elements
  - Element Free Galerkin
  - Peradynamics
  - Smooth Particle Hydrodynamics
  - Smooth Particle Galerkin
- PrePost Processing
- Seismic Engineering
- Ship Building

LSTC California ALE/Eulerian/FSI & SPH Classes confirmed

Aleta Hays aleta@lstc.com

ALE/Eulerian/FSI confirmed Livermore, CA Aug. 21-23, 2017
SPH confirmed Livermore, CA Aug. 24-25, 2017
Instructor: Mhamed Souli

Register ASAP to reserve your class space aleta@lstc.com

ALE & SPH Classes to be held in Livermore, CA in August 2017 - Both Confirmed to take place

ALE - ALE provides new and experienced LS-DYNA users the ability to simulate a class of problems that cannot be solved using classical Lagrangian method.

The ALE course can be very useful for users dealing with multiphysics and multiflow applications that can be encountered in :

- Fluid structure interaction
- underwater explosion with structure impact
- Air Blast simulation with structure impact
- Flue tank sloshing
- High Impact velocity and penetration of structure in concrete and other complex materials
- Soil structure Interaction
- multiphase flows (fluids mixing,...

ALE Class description
www.lstc.com/sites/default/files/pictures/classes/17ALE_Eulerian_Mhamed.pdf

SPH Course - SPH (Smooth Particle Hydrodynamic) is mesh less method, where users do not have to define the mesh, and only particles can be defined. SPH is a a fully Lagrangian method. Whereas the FEM Lagrangian method suffers from high mesh distortion which causes the time step to decrease to an acceptable value, the SPH method does not have this problem, which the main strength of the SPH method. Difficulties associated with fluid flow and structural problems involving high mesh distortion that cannot be solved with Lagrangian FEM method, can be resolved using SPH method.

SPH and ALE methods in LS-DYNA are complementary. For some problems, like bird strike problems, it is more efficient for CPU time point of view, to use SPH than ALE, since no need of the large mesh required for the ALE method. For other problems the ALE method can be more efficient. Having knowledge of both methods helps engineers and designers to select the most efficient one to solve their problem.

The SPH class can be very useful for users dealing with high complex problems that cannot be solved by FEM method as:

- Fluid structure Interaction
- High impact velocity on structure
- Bird Strike problems
- Tire Hydroplaning

SPH Class description www.lstc.com/training/sph

ALE and SPH YouTube LS-DYNA® – YouTube Examples

Simulation process throwing the ball into the water using ALE / Eulerian method with FSI interaction in LS-DYNA (an abbreviated example of the tutorials).

www.youtube.com/watch?v=PA-ad90gAp4&t=115s
Published on Oct 20, 2016
Full tutorial – 25 minutes. The tutorials of ls-dyna on the www.lsdyna-tutorials.com

This video presents one of many ALE solutions for wave modelling in LS-DYNA.

https://www.youtube.com/watch?v=pObcA85SrmY
Published on Mar 2, 2017
The system i built is a simple piston-like behavior of the water domain. I used non slip boundary conditions on all sides of the domain. For more realism, either the domain should be enlarged, or pressure BC should be applied.
The current modelling contains about 2M solid elements, and takes about 20 hours to compute on 24 CPUs Intel.
Renderings are made with LS-PrePost.
Boat geometry is from grabcad.com

LSTC – DYNAmore ALE EXAMPLES - www.dynaexamples.com/ale

Simulation of machining process (cutting) by the SPH method in LS-DYNA.

www.youtube.com/watch?v=yD5E1UK5Cps&t=62s
Published on Oct 24, 2016
Full tutorial – 20 minutes. The tutorials of ls-dyna on the www.lsdyna-tutorials.com

Meteorite impact with LS-DYNA

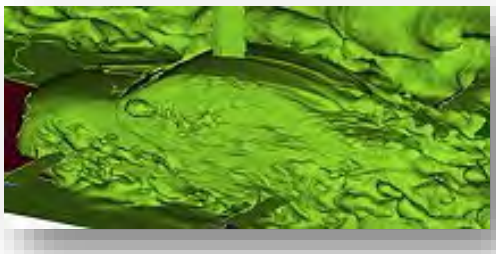
www.youtube.com/watch?v=bXzDkYBxECM
Published on Mar 15, 2016

LSTC – DYNAmore SPH EXAMPLES - www.dynaexamples.com/sph

LS-DYNA and LS-DYNA's fully integrated, strongly coupled, solvers for extensive Multiphysics capabilities are strongly coupled and integrated at no additional cost.

BETA CAE Systems releases the new ANSA/EPILYSIS/META suite v17.1.2.

(Excerpts) complete Article is at: www.beta-cae.com/news/20170719_announcement_suite_v17.1.2.htm



ANSA/EPILYSIS/META suite v17.1.2.

About this release: In this version new features have been added and corrections have been implemented for identified issues.

A new default column "MBContainer" has been added to all Database Browser lists to provide information on the Model Browser Container an entity belongs to. The Model Browser Container can be a Subsystem, a Simulation model, or a Loadcase.

Moreover, the ability to create a report for the selected Parts/Groups has been introduced in the Model Browser window through the Actions>Create Report function.

- **Compare -** New capabilities have been added to the SGRAPH functionality to enable the mapping of PIDs and Parts Hierarchy between two structures.
- **Data Management -** The "IsGroup" column has been added in the Part List tab of the Product Tree Editor, to facilitate the filtering of groups.
- **NASTRAN -** A new check Checks>Loadcase has been introduced in the Header's list, which detects whether a loadcase file has the requested entities or not.
- **NVH Console -** In addition to the new capability to open and edit the "Jobs Manager" window with any other NVHC window, Bush Sensitivity calculations support linking of symmetric connectors and DOFs.
- **LS-DYNA -** Materials *MAT_211/*MAT_SPR_JLR, *MAT_215/*MAT_4A_MICROMEC and *MAT_280/*MAT_GLASS are now supported.

BETA CAE Systems releases the new ANSA/EPILYSIS/META suite v17.1.2.

(Excerpts) complete Article is at: www.beta-cae.com/news/20170719_announcement_suite_v17.1.2.htm

Known issues resolved in ANSA

- **General -** The Utilities>Compress function would erroneously delete NASTRAN THERMAL related entities or parameters, such as SPOINTs, TEMPDs and nodes belonging to application region.
  The Database Browser>Save List option would erroneously save all entities of a list of the DBB, instead of only the selected ones.
- **CAD Import / Export -** Translating a CATProduct with Flatten assemblies option deactivated might lead to unexpected termination.
- **Model Browser -** In Subsystems and, especially, Model Set-Up Entities ANSA would fail to recognize and hence list SPCs and Forces.
- **Model Browser -** Changing the Type of a User Attribute through the drop-down menu in the respective window could lead to unexpected termination.
- **Compare -** Upon creating of a Comparison Report through the "Compare Tool", the identified differences in the Thickness of parts would not be reported properly.
- **Connections & Assembly -** Connectors in GEBs unexpectedly failed to be realized in case of Assembly Point search pattern, when the Assembly Points were created by Bolts.
- **FE Representations** - Selecting or typing a ROBSCAN pattern in Connection Manager could lead to unexpected termination.
- **Scripting** - Hot Points created by script function Base.HotPointsWeldSpot() would not be collected via the CollectNewModelEntities.report method. The IsolateSolidFlanges() script function might not work when the first argument was set to 'None'.
- **Volume Mesh -** Erroneous detection of inner volume with Volumes>Define [Auto-Detect] function, in certain cases with Layers in exclude or collapse mode. In certain cases, layers generation could lead to unexpected termination.
- **NASTRAN** - The check Checks>Penetration [Intersections] would not identify CWELD elements penetrating shells.
- **LS-DYNA** - The DATABASE_OPTION settings would be written twice (before and after the Includes), if Includes were also written in the output file (inline).

For complete details about the new software features, enhancements and corrections please visit the website: **www.beta-cae.com/news/20170719_announcement_suite_v17.1.2.htm**

ESI New Software Release of Visual-Environment 13.0 available

www.esi-group.com

ESI Visual-Environment is an open Computer-Aided Engineering (CAE) platform that addresses the simulation needs of multiple domains across major industries. It includes a comprehensive modeling tool to generate quality meshes on complex geometries for various engineering problems from Virtual Manufacturing to Virtual Performance: Heat Treatment, Welding, Casting, Flow, Crash, Safety, NVH (Noise, Vibration & Harshness), Electromagnetics, Fluid Dynamics (CFD), and more. An interactive post-processing module caters to the requirements of the CAE community through its multi-page / multi-plot environment.

Furthermore, a software development toolkit integrated inside Visual-Environment allows you to customize and extend this open architecture through process templates and macros. Visual-Environment incorporates the finest engineering knowledge & best practices with a process-oriented approach suited to the needs of a shop-floor user or a savvy software user alike.

ESI Visual Environment - Release Highlights across the platform

- Evolution of the platform in line with updates in various solvers supported by ESI Visual-Environment
- Geometry and meshing updates across the board including a new skin for Welding & Assembly
- Improvements in visualization, some CAE-domain specific and others generic. Notable among them being the enhanced contour animation and template layer management
- Access to ESI Virtual Performance Solution (VPS) reference manual from the entity creation Graphical User Interfaces (GUIs) of all keywords and properties in VPS modules
- Integrated processes to further enhance and ease Casting simulation
- New OpenFOAM versions supported for CFD
- Computational Manager introduced in the Visual-SYSTUS module (dedicated to the Energy sector) allowing linear and nonlinear computation runs for thermal, mechanical and thermomechanical analyses

Meshing (module: Visual-Mesh)

Geometry Simplification

Features a dedicated GUI to simplify CAD geometry quickly for better quality of mesh. Visual-Mesh supports the following simplification functions:

- Check surfaces whose area or edge length is smaller than specified value and delete edges to make bigger domains.
- Check and delete edges where the deviation of surfaces is smaller than specified value.
- Detect continuous fillets and simplify them by splitting it at its center and clearing other edges of original fillet.
- Identify small features and dents with a click of an edge and replace it with simpler surfaces.

Wrap GUI

The GUI allows for quickly creating a wrapped mesh on an assembly of a large number of parts, with the following functions:

- Close volume leaks, and leaks across volumes and extrude required elements.
- Wrap along the inside or outside of parts.
- Local control of mesh sizes with specific element sizes through patch definition.

Remesh Workflow

- Simple and interactive work flow is supported for remeshing components.

Shell Split

- New patterns, Quad-to-4Quads, Quad-to-3Quads and Tria-to-3-Trias are supported.
- 1D elements are split automatically, if it is connected with the 2D mesh that are split.

Solid Split

- 2D and 1D elements are split automatically, if they are connected to the 3D elements that are split.
- If the elements are part of Collectors and Sub-Models, the split elements are updated to their corresponding Collectors and Sub-Models.

Crash/Safe/Impact (module: Visual-Crash DYNA)

Info: In addition to providing a crash module dedicated to ESI Virtual Performance Solution, Visual-Environment also supports LS-DYNA, MADYMO and RADIOSS users.

Create Collectors for Parts per Include

- This tool creates a collector/group for all parts in an include, for all the include files in a model.

Copy Coordinates is enhanced to read in nodal deformations from pre-simulation data (dynain file).

- The deformed coordinates are copied to the current model.
- User is given the option to import initial stress, strains. This information is added as a include file to the main model.

Automatic Resolve of Missing References in Keywords

- Use Case: A Rigid body, whose definition is seat and floor pan, cannot be realized if only the Vehicle is read into Visual-Crash DYNA (VCD). However, the missing "SET" of Seat is retained by VCD as the "Missing Entities Support' toggle, in the "Import/Export Options" section of File > Preference > VCD Preferences is checked ON

Improvements in File Append/Merge

- Flexibility to create *INCLUDE_TRANSFORM cards by entering the Offset IDs as desired. On selecting Include Trsfrm option, the ID clash resolving options, namely Automatic and Advanced, are greyed. The clash has to be resolved in this case by entering the proper offsets in the INCLUDE_TRANSFORM panel.

Controls and Database Management Release Notes

- Controls and Database definitions can be imported from a file into the current model, thereby providing a quick and easy way to compare and decide which controls should be kept.
- Controls or database entities imported from a file can be copied to the main model or to any include file.
- On reading in the file, the controls or database definitions in the file are compared against the corresponding entities of the current model through the Compare Controls

Post-Processing (module: Visual-Viewer)

Injury Report Updates

Visual-Viewer now supports Injury report creation for the following regulations:

For LS-DYNA simulation results (Binout):

- FMVSS208, USNCAP, EuroNCAP, IIHS Frontal Impact, USNCAP 2010 Frontal Impact

For Test result files (ABF):

- EuroNCAP, IIHS Frontal Impact, USNCAP 2010 Frontal Impact
- Template modifications

Enhancements in FMVSS208 and USNCAP injury reports:

- For MADYMO Simulation results:
  - Enhanced to support template loading with MADYMO solver result files, Version R7.5.
  - The following changes have been made to make the same settings across all solver result files:
    - § HIC36 curve is added (1st page)
    - § Femur Travel and Velocity plots are removed (4th page)
    - § HIC36 is added in bar chart (5th Page)
    - § HIC36, Chest 3ms computations are added in the summary table

For ABF result files: FMVSS208 and USNCAP regulation templates.

- The following changes have been made to make the same settings across all solver result files:
  - HIC36 curve is added (1st page)
  - Femur Travel and Velocity plots are removed (4th page)
  - HIC36 is added in bar chart (5th Page)
  - HIC36, Chest 3ms computations are added in the summary table

Note: The old MADYMO and ABF, FMVSS208 and USNCAP injury reports are deprecated in VE13.0. However, these can be accessed by defining the environment variables USE_VE125_ABF_TEMPLATES = 1, USE_VE125_MADYMO_TEMPLATES = 1.

Process Automation:

Visual-Process Executive refers to CAE Process Automation. Automate repetitive and cumbersome CAE tasks in your virtual product development. Engineers can capitalize, share and deploy their organization's best practices within their extended ecosystem, thanks to this versatile module. It is commonly used for regulatory test simulation such as FMVSS, IIHS, EURO NCAP, etc… Simulation setups are captured and automated in Visual-Environment and can be coupled with Simulation Data Management.

New Software Release of ESI Visual-Environment 13.0 available

www.esi-group.com

There are several process templates delivered by standard Visual-Environment distribution which help to achieve high productivity for standard regulation. Visual-Environment provides also a software development environment (Visual-SDK) which enables user to integrate their best practices.

Software Development Toolkit:
Visual-SDK is the software development toolkit available on demand. This module provides a complete tool set required for authoring, debugging and execution of process templates. Visual-SDK toolbox give user a comprehensive tool to design graphical user interface, integrate Python scripting and access to Visual API's online documentation.

Simulation Lifecyle Management:
Visual-Composer refers to the Multi-Domain Compute Model Management and is a Simulation Lifecycle Management tool that aims at providing end-to-end decision-making support for simulations. Engineers can smartly build and maintain the two-directional link between CAD data stored in PLM systems and simulation domains. Visual-Composer allows propagation of design and engineering changes across the virtual tests, while maintaining traceability of data throughout the virtual product development process.
It further provides a local data management, called "Simulation Content Manager (SCM)", in which it manages a single core model for multiple domains as well as CAE representations for each component. CAD and CAE representation are in sync. With Visual-Composer, versions and revisions, projects and studies plus corresponding content are manageable and supported. Visual-Composer enables concurrent engineering and realistic simulation, supports project and workflow management connecting simulation content, project schedules, applications, teams, suppliers and associated documents together.

System Modeling (module: Visual-Systems)
SimulationX Solver Integration

- Visual-Systems integrate SimulationX solver for simulations, this enhances significantly the performance and quality of simulations. Import of SimulationX result files (csv format) also supported.

Modelica Standard Library Version Upgrade

- Visual-Systems now packs 3.2.1 version of Modelica standard library.

Enhanced Co-Simulation Capabilities

- Co-Simulation package has been renamed as CosimVPS and enhanced with more sensors and actuators like Total displacement sensors, Force sensors, Torque actuators.

Model Exchange between SimulationX and Visual-Systems

- Models from SimulationX application can be exported and imported to Visual-Systems using FMI for Model Exchange 2.0 protocols. Imported models can be used as components to define co-simulation problems.

New Software Release of ESI Visual-Environment 13.0 available

www.esi-group.com

Computational Fluid Dynamics (CFD) (module: Visual-CFD)

General Usage:

– OpenFOAM Version Support: OpenFOAM 1612+ and 4.1 versions are supported

– Save project to be run later: Saves batch folder with scripts that can be taken to another machines/cluster to run later

CAD Handling:

– Wrapping & Hole Closing: ESI introduces next generation CAD Cleanup methods with this release. It will be fine-tuned in further releases

– Part Renaming: One could now rename parts

– Center/Axis Calculation: It's automated and particularly useful for MRF, Rotating Mesh cases. Now, user can pick 3 points to auto-feed center/axis

Meshing:

– Multidomain modeling with Domain Markers:

This is an extra-ordinary help provided by OpenFOAM+ version for multi-domain modeling

– Gap Detection: OpenFOAM+ version makes it easier to make mesh finer between two objects coming quite close to each other

– Boundary Layer on Interface Parts: Useful for multi-domain models where Boundary Layers could be generated on interfaces

Solver Setup:

– Unsupported Boundary Condition: Helps all those who use standard OpenFOAM Boundary Condition but find it missing in this Environment

– User Defined Numerical Schemes: Helps all those who feel their schemes are missing

– User Defined Solver: Helps all those who have customized an OpenFOAM solver. Please note there are some restrictions here which can be reviewed from our FAQ section in Setup Manual

– Thermal dependent Material Properties: Polynomial based Material Properties supported

– Profile support for BC: Supports point based boundary conditions; In this version, it requires users to create OpenFOAM folder for Profiles. Future versions would help creating those folders as well

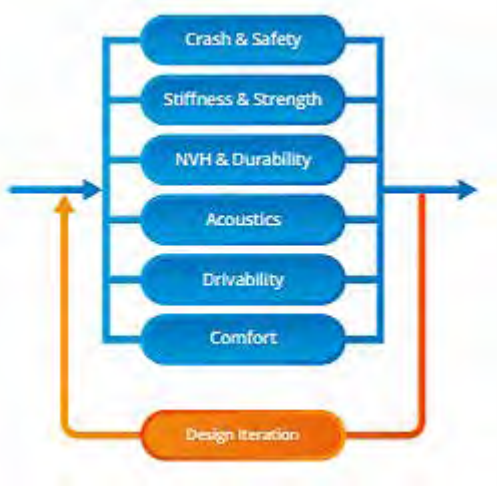
Post-Processing:

– CHT Cases: Multi-region post-processing is available now, but only for reconstructed data

ESI is continuously expanding the capabilities of Visual-Environment to support new physics in CAE, enabling customers to work with different physics in a single simulation environment, with the ability to virtually build and test a full Virtual Prototype, all around a single core model, delivering tremendous gains in productivity and accuracy.

New Software Release of ESI Visual-Environment 13.0 available

www.esi-group.com



1. Traditional working pattern in silos inefficiency in iterations

2. Working on single Core models efficient collaborator action

ESI's customer portal myESI is available for all ESI customers to access updated product information, tips & tricks, training information, and selected software downloads.

For additional product information, please feel free to visit our website, contact any of the local ESI subsidiaries or contact Andrea Gittens, Product Marketing Manager for ESI Visual-Environment.

For more ESI news, visit www.esi-group.com/press

ESI Group Media Relations: Delphine Avomo
delphine.avomoevouna@esi-group.com
+33 1 41 73 58 46

LinkedIn	www.esi-group.com/linkedin
Facebook	www.esi-group.com/facebook
Twitter	www.esi-group.com/twitter
YouTube	www.esi-group.com/youtube

Cloud 3.0: Big Compute & the Digital Transformation

http://info.rescale.com/cloud-3-0-webinar

Join us for this webinar to learn how cloud computing is fundamentally changing the IT landscape

In 2017, the enterprise software industry is at an inflection point in the trend towards ubiquitous cloud adoption. This transformation represents $4 trillion in enterprise IT market value.

Join us for this webinar to learn how cloud computing is fundamentally changing the IT landscape:

- What is big compute and why is it so important to industry?
- Why cloud adoption is getting investors so excited
- Compelling reasons for enterprise IT to adopt cloud
- What's in it for the end user?
- The current state of cloud adoption and future projections

DATE: Thursday, August 17, 2017
TIME: 8 AM PDT / 11 AM EDT / 5 PM CEST

In this webinar, we'll review the growth and increasing acceptance of cloud through version 1.0, SaaS (software as a service), where companies have redefined enterprise categories by innovation and frictionless delivery; through 2.0, IaaS (infrastructure as a service), where cloud scaling and connectivity has enabled big data analytics; and finally to 3.0, big compute, where heavy duty cloud resources are starting to eliminate constraints on high-performance computing and democratizing access across the enterprise.

PRESENTER: Jonathan Oakley has a BSc (Hons) in Electronic Engineering and Mathematics from the University of Reading, UK. In his early career he worked as a research scientist at BAE Systems and as an application engineer for Cobham and then CST. He later moved into sales, and sales and marketing management for CST. In March 2017 he joined Resale as VP of Marketing.

DEP CONCLAVE 2017

www.depusa.com/depconclave/

Presented by Detroit Engineered Products, is a platform to showcase the latest CAD and CAE technologies, and bring together the brightest minds in the engineering community.

- Date: September 8, 2017 |
- Time: 8.30 AM - 6.00 PM | - Venue: The Westin Southfield, Michigan

DEP Conclave 2017, the bi-annual conference from Detroit Engineered Products (DEP) will be held this year on September 8, 2017, and will showcase the latest CAD and CAE technologies, while bringing together the brightest minds in the engineering community. The conference will play host to VPs of engineering, engineering managers, design engineers, and anyone who uses CAD or CAE in their workflow.

It is a day-long event, packed with an exciting agenda and eminent speakers from the industry, with the below highlights:

- Two impressive keynote speakers- Kevin Miller, Director, Body CAE, General Motors and Randy Frank, Chief Engineer, Global Virtual Verification & CAE, Ford Motor Company.
- An interesting panel discussion where experienced industry speakers and leaders participate in a lively and informative discussion on the topic: CAE leads the way during product development- Are we there yet?
- Technical paper presentations in two parallel tracks in the afternoon sessions outlining the latest in CAE strategy, methodology, techniques and applications.
- Launch the latest version of DEP MeshWorks, through demos and an interactive MeshWorks zone. MeshWorkls 8 is an integrated CAE platform for pre and post processing, involving rapid concept CAE and CAD model generation, parameterization and optimization, advanced meshing, process automation, concept modeling and CAD morphing.
- A cocktail reception in the evening to wrap the day, which will provide a great networking opportunity with industry leaders, colleagues and partners.
-

The event promises to be an exciting opportunity to promote professional development, technology transfer, peer networking, and information exchange among industry professionals.

It is a complimentary event, with mandatory prior registration.

Read more about the event, and register at: www.depusa.com/depconclave/

Predictive Engineering FEA Quiz

www.predictiveengineering.com

? Quiz ? **Welcome to our Predictive Engineering FEA quiz.**

We have tried to make the questions relevant toward the evaluation of the engineer who has a background in finite element analysis. Saying that, knowing the answers to this quiz doesn't imply that one is capable of building accurate simulations, merely that one is heading in the right direction and has a good sense of humor.

Answers can be found at: www.predictiveengineering.com/content/fea-quiz

Question 1

If you had one steel and one aluminum cylinder of equal cross-sectional areas (1 sq-in) and both cylinders are loaded with a force of 100 lbf, which cylinder will have the higher stress? By how much would you expect the stress values to differ?

Questions 2

You have just meshed a solid CAD piece of geometry using 10-node Tetrahedral elements and have applied a fully fixed constraint (all translations (TX, TY, and TZ) and all rotations (RX, RY, and RZ) are fixed) to one node of the structure. What action is enforced by the RX, RY, and RZ constraints? Would you expect the structure to be sufficiently constrained for a static stress analysis? If not, how many nodes would have to be constrained to "fix" the model for a stress analysis?

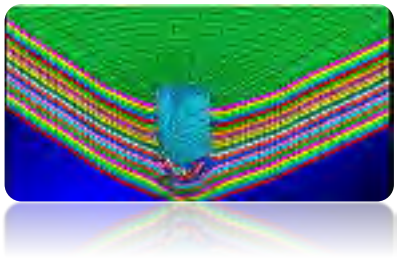
Question 3

What material property data is required for linear, elastic static analysis?

Question 4

You have applied a uniform internal pressure to a cylinder and would like to check your work. You then use your FEA pre-processor to perform a sum-of-forces calculation. What value would you expect to be returned by the sum-of-forces calculation?

Answers can be found at: www.predictiveengineering.com/content/fea-quiz



High Velocity Impact of Square Plate using MAT161/162

www.youtube.com/watch?v=NgjncjfLKGw

Center for Composite Materials - University of Delaware
www.ccm.udel.edu/software/mat162/

MAT162 is a material model for use in LS-DYNA that may be used to simulate the onset and progression of damage in unidirectional and orthotropic fabric composite continua due to 3D stress fields. This failure model can be used to effectively simulate fiber dominated failures, matrix damage, and includes a stress-based delamination failure criterion. This approach to predicting interlaminar failure is advantageous in cases when locations of delamination sites (i.e., interlaminar crack initiation surfaces) cannot be anticipated.

Examples are located at www.ccm.udel.edu/software/mat162/examples /

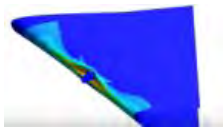
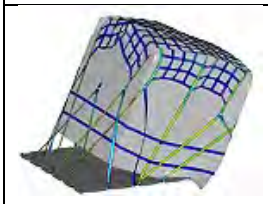
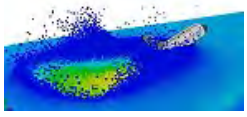
Example 1:
Sphere Impact on a Composite Laminate
Example 2:
Sphere Impact on a Perfectly Clamped Composite Plate
Example 3:
Sphere Impact on Elliptical Carbon/Epoxy Tube

Aerospace & LS-DYNA

July Showcase

	**SPH simulation - done with LS-DYNA** **BeenuZZ** - www.youtube.com/watch?v=npsSONtbWhg The birds are modelled with water formulation (MAT_NULL and EOS_GRUNEISEN) and impact the blades at 80m/s. Model contains

Previously showcased:

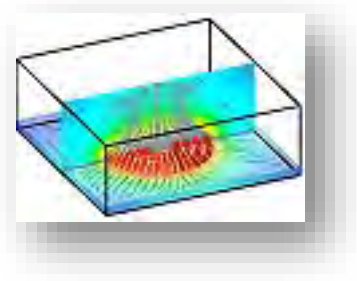
	**Bird Strike on an aircraft composite wing leading edge using LS-DYNA** **Husain Ansa**ri - www.youtube.com/watch?v=53vDJ4GSXl4 Bird numerical model created using SPH elements and null material with polynomial equation of state.
	**LS-DYNA Cargo Net Simulation during Airplane Crash Event.mov** **Predictive Engineering** - www.youtube.com/watch?v=k8ZVkFtNF9A LS-DYNA simulation of cargo net securing boxed-up cargo during an airplane crash event. The webbing, steel hardware and pallet were all successfully modeled and analyzed
	**Space shuttle landing - LS-DYNA discrete method (DEM)** **BeenuZz** - www.youtube.com/watch?v=Wr5B01NmgfU&list=PLXFT4P5W0f3-r_Rb3b3RkSj9oCOHvmWJb&index=3

LS-DYNA® Aerospace Working Group (AWG) http://awg.lstc.com

The LS-DYNA® Aerospace Working Group (AWG) is a partnership of federal agencies, corporations, and universities working together to develop and publish aerospace test cases and modeling guidelines for finite element analyses with LS-DYNA®.

LS-DYNA Multiphysics Solvers Web Page

www.lstc.com/applications/new_multiphysics



LS-DYNA includes three solvers for multiphysic purposes: Incompressible CFD (ICFD), Electromagnetics (EM), CESE/ Compressible CFD and Chemistry

Multiphysics Solvers

On the site you will find Information Links

ICFD

- Features
- Test Cases
- Gallery
- Documentation

Electromagnetics

- Features
- Test Cases
- Gallery
- Documentation

CESE

- Features
- Test Cases
- Gallery
- Documentation

www.eta.com

www.flotrend.com.tw

恒士达科技 Hengstar Tech.

www.hengstar.com

AutoCAE really customer focused

www.autocae.cn

ARUP

www.oasys-software.com/dyna

Dynawe

www.dynawe.com

AgileSim

www.agilesim.com.tw

PAN-i

www.pan-i.com

DUFK

http://dalianfukun.com

FEA Information China - For Sign Up or to offer Articles Contact:
Editors: Yanhua Zhao - Yanhua@feainformation.com
Grace Su, Marsha Victory

YouTube Choices for the Month & Gallery

Author: Marsha Victory mv@feainformation.com

July Favorite from the LSTC Multiphysics Channel

	**LS-DYNA SPH : Earth-moving simulation** https://www.youtube.com/watch?v=GvShD3nnM2c **[1] An accelerated, convergent, and stable nodal integration in Galerkin meshfree methods for linear and nonlinear mechanics** **[2] A quasi-linear reproducing kernel particle method**

Previously showcased

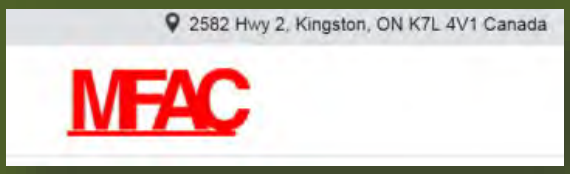
	**LS-DYNA Steel Profile Stamping Analysis - Video Tutorial** Ahmet OKUDAN - Published on Jun 10, 2017 www.youtube.com/watch?v=F5b5Uiw9aFs
	**LS-DYNA CFD : Flow through a funnel** LS-DYNA Multiphysics Published on Jun 2, 2017 www.youtube.com/watch?v=1ijUDN2yK4k
	**LS-DYNA - Thermal Stress Analysis** Sercan Devrim - Published on Jun 13, 2017 www.youtube.com/watch?v=apzGJdDEGGw

Website Month Showcase – Sites to Visit for Information

www.hengstar.com

www.lsdyna.co.kr /

www.mfac.com



www.esi-group.com /

www.terrabyte.co.jp/english/index.htm

www.lsdyna.ru

www.engineering-eye.com/

AUTOMOTIVE NEWS & EVENTS

Editor: Dilip Bhalsod

The purpose of this section is to provide a place, for our automotive readers, to share news and events relative to their company and/or products.

The criteria for submitting information is as follows:

- It has to be public information
- Published on the Internet
- Be automotive informational, or human interest.
- We do not accept financial quarterly information

We would welcome the opportunity to share information about your company with our readership.

You may send Title to your information and the accompanying URL to agiac99@aol.com - Subject Line please use " Automotive News"

Submissions should be received by the 15th of each month, of the month you want your article placed

Submission publications is at the sole discretion of FEA Information Inc.

GM Produces First Round of Self-Driving Chevrolet Bolt EV Test Vehicles

First Company to Use Mass-Production Methods for Autonomous Vehicles Test Bolt EVs Feature Company's Latest Generation of AV Technology GM's Self-Driving Test Fleet Will Grow to 180

DETROIT — General Motors today announced that it completed production of 130 Chevrolet Bolt EV test vehicles equipped with its next generation of self-driving technology at its Orion Assembly Plant located in Orion Township, Michigan. The vehicles will join the more than 50 current-generation self-driving Bolt EVs already deployed in testing fleets in San Francisco; Scottsdale, Arizona; and metro Detroit.

"This production milestone brings us one step closer to making our vision of personal mobility a reality," said GM Chairman and CEO Mary Barra. "Expansion of our real-world test fleet will help ensure that our self-driving vehicles meet the same strict standards for safety and quality that we build into all of our vehicles."

GM became the first company to assemble self-driving test vehicles in a mass-production facility when its next generation of self-driving Chevrolet Bolt EV test vehicles began rolling off of the line at Orion Township in January.

The self-driving Chevrolet Bolt EVs feature GM's latest array of equipment, including LIDAR, cameras, sensors and other hardware designed to accelerate development of a safe and reliable fully autonomous vehicle.

"To achieve what we want from self-driving cars, we must deploy them at scale," said Cruise Automation CEO Kyle Vogt. "By developing the next-generation self-driving platform in San Francisco and manufacturing these cars in Michigan, we are creating the safest and most consistent conditions to bring our cars to the most challenging urban roads that we can find."

GM and Cruise Automation engineers have been testing Chevrolet Bolt EVs equipped with self-driving technology on public roads in San Francisco and Scottsdale, Arizona, since June 2016 and on public roads in Warren, Michigan, since January 2017.

General Motors Co. (NYSE: GM, TSX: GMM) and its partners produce vehicles in 30 countries, and the company has leadership positions in the world's largest and fastest-growing automotive markets. GM, its subsidiaries and joint venture entities sell vehicles under the Chevrolet, Cadillac, Baojun, Buick, GMC, Holden, Jiefang, Opel, Vauxhall and Wuling brands. More information on the company and its subsidiaries, including OnStar, a global leader in vehicle safety, security and information services, can be found at http://www.gm.com.

Kevin Kelly - GM Advanced Technology Communications - kevin.m.kelly@gm.com
Patrick Sullivan - GM Autonomous Technology Communications - patrick.1.sullivan@gm.com

AEROSPACE NEWS & EVENTS

Editor: Marnie Azadian

The purpose of this section is to provide a place, for our aerospace readers, to share news and events relative to their company and/or products.

The criteria for submitting information is as follows:

- It has to be public information
- An internet URL
- Be technical, informational, or human interest.
- We do not accept financial quarterly information

We would welcome the opportunity to share information about your company with our readership.

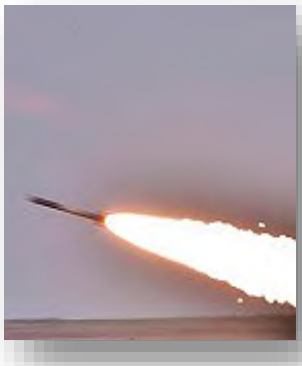
You may send Title to your information and the accompanying URL to agiac99@aol.com - Subject Line please use "Aerospace News"

Submissions should be received by the 15th of each month, of the month you want your article placed. For example: We would need the title of the news or event by December 15th, 2015 to be featured in the December 2015 FEA newsletter.

Submission publications is at the sole discretion of FEA Information Inc.

Lockheed Martin Receives Contract for Guided MLRS Rocket Production

(Source: Lockheed Martin; issued July 12, 2017)



Guided MLRS is an all-weather rocket designed for fast deployment that delivers precision strike beyond the reach of most conventional weapons; the GMLRS Alternative Warhead complies with the ban on cluster munitions. (LM photo)

DALLAS --- Lockheed Martin received a $471 million contract from the U.S. Army for Lot 12 production of Guided Multiple Launch Rocket System (GMLRS) rockets.

A Lockheed Martin GMLRS practice round blasts away from a HIMARS launcher during U.S. Army exercises at Fort Riley, Kansas.

The contract calls for the production of GMLRS Alternative Warhead rockets, GMLRS Unitary rockets, Reduced-Range Practice Rockets (RRPRs) and integrated logistics support for the U.S. Army and Foreign Military Sales.

Work will be performed at the Lockheed Martin facilities in Camden, Arkansas, and Dallas. All production deliveries are anticipated to be completed by the summer of 2019.

GMLRS is an all-weather rocket designed for fast deployment that delivers precision strike beyond the reach of most conventional weapons. The new GMLRS Alternative Warhead was the first munition developed to service area targets without the effects of unexploded ordinance, complying with DoD cluster munitions policy.

GMLRS Unitary rockets greatly exceed the required combat reliability rate and have established a reputation for affordability. The RRPR allows users to train with realistic, full-motored rockets with limited flight range, making them ideal for smaller testing ranges.

In combat operations, each GMLRS rocket is packaged in an MLRS launch pod and is fired from the Lockheed Martin High Mobility Artillery Rocket System HIMARS or M270 family of launchers. GMLRS was established as an international cooperative program among the U.S. and allied nations.

Lockheed Martin has produced more than 30,000 GMLRS rockets at its facility in Camden. The company's Camden Operations has received more than 60 awards over the last decade, including the 2012 Malcolm Baldrige National Quality Award and the Shingo Silver Medallion Award for Operation Excellence.

Headquartered in Bethesda, Maryland, Lockheed Martin is a global security and aerospace company that employs approximately 97,000 people worldwide and is principally engaged in the research, design, development, manufacture, integration and sustainment of advanced technology systems, products and services.

BETA CAE Systems. www.beta-cae.com

BETA CAE Systems - ANSA

An advanced multidisciplinary CAE pre-processing tool that provides all the necessary functionality for full-model build up, from CAD data to ready-to-run solver input file, in a single integrated environment. ANSA is a full product modeler for LS-DYNA, with integrated Data Management and Process Automation. ANSA can also be directly coupled with LS-OPT of LSTC to provide an integrated solution in the field of optimization.

BETA CAE Systems µETA

Is a multi-purpose post-processor meeting diverging needs from various CAE disciplines. It owes its success to its impressive performance, innovative features and capabilities of interaction between animations, plots, videos, reports and other objects. It offers extensive support and handling of LS-DYNA 2D and 3D results, including those compressed with SCAI's FEMZIP software

Solutions for:

Process Automation - Data Management – Meshing – Durability - Crash & Safety NVH - CFD - Thermal analysis - Optimization - Powertrain

Products made of composite materials - Analysis Tools -

Maritime and Offshore Design - Aerospace engineering - Biomechanics

DatapointLabs **www.datapointlabs.com**

Testing over 1000 materials per year for a wide range of physical properties, DatapointLabs is a center of excellence providing global support to industries engaged in new product development and R&D.

The compary meets the material property needs of CAE/FEA analysts, with a specialized product line, TestPaks®, which allow CAE analysts to easily order material testing for the calibration of over 100 different material models.

DatapointLabs maintains a world-class testing facility with expertise in physical properties of plastics, rubber, food, ceramics, and metals.

Core competencies include mechanical, thermal and flow properties of materials with a focus on precision properties for use in product development and R&D.

Engineering Design Data including material model calibrations for CAE Research Support Services, your personal expert testing laboratory Lab Facilities gives you a glimpse of our extensive test facilities Test Catalog gets you instant quotes for over 200 physical properties.

ETA – Engineering Technology Associates **www.eta.com**

etainfo@eta.com

Inventium Suite™

Inventium Suite™ is an enterprise-level CAE software solution, enabling concept to product. Inventium's first set of tools will be released soon, in the form of an advanced Pre & Post processor, called PreSys.

Inventium's unified and streamlined product architecture will provide users access to all of the suite's software tools. By design, its products will offer a high performance modeling and post-processing system, while providing a robust path for the integration of new tools and third party applications.

PreSys

Inventium's core FE modeling toolset. It is the successor to ETA's VPG/PrePost and FEMB products. PreSys offers an easy to use interface, with drop-down menus and toolbars, increased graphics speed and detailed graphics capabilities. These types of capabilities are combined with powerful, robust and accurate modeling functions.

VPG

Advanced systems analysis package. VPG delivers a unique set of tools which allow engineers to create and visualize, through its modules--structure, safety, drop test, and blast analyses.

DYNAFORM

Complete Die System Simulation Solution. The most accurate die analysis solution available today. Its formability simulation creates a "virtual tryout", predicting forming problems such as cracking, wrinkling, thinning and spring-back before any physical tooling is produced

Latest Release is ESI Visual-Environment 12.0

ESI Group **www.esi-group.com**

Visual-Environment is an integrative simulation platform for simulation tools operating either concurrently or standalone for various solver. Comprehensive and integrated solutions for meshing, pre/post processing, process automation and simulation data management are available within same environment enabling seamless execution and automation of tedious workflows. This very open and versatile environment simplifies the work of CAE engineers across the enterprise by facilitating collaboration and data sharing leading to increase of productivity.

Visual-Crash DYNA provides advanced preprocessing functionality for LS-DYNA users, e.g. fast iteration and rapid model revision processes, from data input to visualization for crashworthiness simulation and design. It ensures quick model browsing, advanced mesh editing capabilities and rapid graphical assembly of system models. Visual-Crash DYNA allows graphical creation, modification and deletion of LS-DYNA entities. It comprises tools for checking model quality and simulation parameters prior to launching calculations with the solver. These tools help in correcting errors and fine-tuning the model and simulation before submitting it to the solver, thus saving time and resources.

Several high productivity tools such as advanced dummy positioning, seat morphing, belt fitting and airbag folder are provided in **Visual-Safe,** a dedicated application to safety utilities.

Visual-Mesh is a complete meshing tool supporting CAD import, 1D/2D/3D meshing and editing for linear and quadratic meshes. It supports all meshing capabilities, like shell and solid automesh, batch meshing, topo mesh, layer mesh, etc. A convenient Meshing Process guides you to mesh the given CAD component or full vehicle automatically.

Visual-Viewer built on a multi-page/multi-plot environment, enables data grouping into pages and plots. The application allows creation of any number of pages with up to 16 windows on a single page. These windows can be plot, animation, video, model or drawing block windows. Visual-Viewer performs automated tasks and generates customized reports and thereby increasing engineers' productivity.

Latest Release is ESI Visual-Environment 12.0

ESI Group **www.esi-group.com**

Visual-Process provides a whole suite of generic templates based on LS-DYNA solver (et altera). It enables seamless and interactive process automation through customizable LS-DYNA based templates for automated CAE workflows.

All generic process templates are easily accessible within the unique framework of Visual-Environment and can be customized upon request and based on customer's needs.

Visual*DSS* is a framework for Simulation Data and Process Management which connects with Visual-Environment and supports product engineering teams, irrespective of their geographic location, to make correct and realistic decisions throughout the virtual prototyping phase. Visual*DSS* supports seamless connection with various CAD/PLM systems to extract the data required for building virtual tests as well as building and chaining several virtual tests upstream and downstream to achieve an integrated process. It enables the capture, storage and reuse of enterprise knowledge and best practices, as well as the automation of repetitive and cumbersome tasks in a virtual prototyping process, the propagation of engineering changes or design changes from one domain to another.

JSOL

JSOL Corporation **www.jsol.co.jp/english/cae/**

HYCRASH

Easy-to-use one step solver, for Stamping-Crash Coupled Analysis. HYCRASH only requires the panels' geometry to calculate manufacturing process effect, geometry of die are not necessary. Additionally, as this is target to usage of crash/strength analysis, even forming analysis data is not needed. If only crash/strength analysis data exists and panel ids is defined. HYCRASH extract panels to calculate it's strain, thickness, and map them to the original data.

JSTAMP/NV

As an integrated press forming simulation system for virtual tool shop the JSTAMP/NV meets the various industrial needs from the areas of automobile, electronics, iron and steel, etc. The JSTAMP/NV gives satisfaction to engineers, reliability to products, and robustness to tool shop via the advanced technology of the JSOL Corporation.

JMAG

JMAG uses the latest techniques to accurately model complex geometries, material properties, and thermal and structural phenomena associated with electromagnetic fields. With its excellent analysis capabilities, JMAG assists your manufacturing process

Livermore Software Technology Corp. **www.lstc.com**

LS-DYNA

A general-purpose finite element program capable of simulating complex real world problems. It is used by the automobile, aerospace, construction, military, manufacturing, and bioengineering industries. LS-DYNA is optimized for shared and distributed memory Unix, Linux, and Windows based, platforms, and it is fully QA'd by LSTC. The code's origins lie in highly nonlinear, transient dynamic finite element analysis using explicit time integration.

LS-PrePost: An advanced pre and post-processor that is delivered free with LS-DYNA. The user interface is designed to be both efficient and intuitive. LS-PrePost runs on Windows, Linux, and Macs utilizing OpenGL graphics to achieve fast rendering and XY plotting.

LS-OPT: LS-OPT is a standalone Design Optimization and Probabilistic Analysis package with an interface to LS-DYNA. The graphical preprocessor LS-OPTui facilitates definition of the design input and the creation of a command file while the postprocessor provides output such as approximation accuracy, optimization convergence, tradeoff curves, anthill plots and the relative importance of design variables.

LS-TaSC: A Topology and Shape Computation tool. Developed for engineering analysts who need to optimize structures, LS-TaSC works with both the implicit and explicit solvers of LS-DYNA. LS-TaSC handles topology optimization of large non-linear problems, involving dynamic loads and contact conditions.

LSTC Dummy Models:

Anthropomorphic Test Devices (ATDs), as known as "crash test dummies", are life-size mannequins equipped with sensors that measure forces, moments, displacements, and accelerations.

LSTC Barrier Models: LSTC offers several Offset Deformable Barrier (ODB) and Movable Deformable Barrier (MDB) model.

Material Sciences Corporation **info@materials-sciences.com**

Materials Sciences Corporation has provided engineering services to the composites industry since 1970. During this time, we have participated in numerous programs that demonstrate our ability to: perform advanced composite design, analysis and testing; provide overall program management; work in a team environment; and transition new product development to the military and commercial sectors. MSC's corporate mission has expanded beyond basic research and development now to include transitioning its proprietary technologies from the research lab into innovative new products. This commitment is demonstrated through increased staffing and a more than 3-fold expansion of facilities to allow in-house manufacturing and testing of advanced composite materials and structures

Materials Sciences Corporation (MSC) MAT161/162 - enhanced features have been added to the Dynamic Composite Simulator module of LS-DYNA.

This enhancement to LS-DYNA, known as MAT161/162, enables the most effective and accurate dynamic progressive failure modeling of composite structures to enable the most effective and accurate dynamic progressive failure modeling of composite structures currently available.

MSC/LS-DYNA Composite Software and Database -

Fact Sheet: http://www.materials-sciences.com/dyna-factsheet.pdf

- MSC and LSTC have joined forces in developing this powerful composite dynamic analysis code.
- For the first time, users will have the enhanced ability to simulate explicit dynamic engineering problems for composite structures.
- The integration of this module, known as 'MAT 161', into LS-DYNA allows users to account for progressive damage of various fiber, matrix and interply delamination failure modes.
- Implementing this code will result in the ability to optimize the design of composite structures, with significantly improved survivability under various blast and ballistic threats.

MSC's LS-DYNA module can be used to characterize a variety of composite structures in numerous applications—such as this composite hull under blast

Oasys Ltd. LS-DYNA Environment **www.oasys-software.com/dyna**

The Oasys Suite of software is exclusively written for LS-DYNA® and is used worldwide by many of the largest LS-DYNA® customers. The suite comprises of:

Oasys PRIMER

Key benefits:

- Pre-Processor created specifically for LS-DYNA®
- Compatible with the latest version of LS-DYNA®
- Maintains the integrity of data
- Over 6000 checks and warnings – many auto-fixable
- Specialist tools for occupant positioning, seatbelt fitting and seat squashing (including setting up pre-simulations)
- Many features for model modification, such as part replace
- Ability to position and depenetrate impactors at multiple locations and produce many input decks automatically (e.g. pedestrian impact, interior head impact)
- Contact penetration checking and fixing
- Connection feature for creation and management of connection entities.
- Support for Volume III keywords and large format/long labels
- Powerful scripting capabilities allowing the user to create custom features and processes

www.oasys-software.com/dyna

Oasys D3PLOT

Key benefits:

- Powerful 3D visualization post-processor created specifically for LS-DYNA®
- Fast, high quality graphics
- Easy, in-depth access to LS-DYNA® results
- Scripting capabilities allowing the user to speed up post-processing, as well as creating user defined data components

Oasys T/HIS

Key benefits:

- Graphical post-processor created specifically for LS-DYNA®
- Automatically reads all LS-DYNA® results
- Wide range of functions and injury criteria
- Easy handling of data from multiple models
- Scripting capabilities for fast post-processing

Oasys REPORTER

Key benefits:

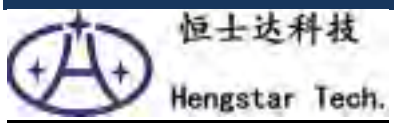
- Automatic report generation tool created specifically for LS-DYNA®
- Automatically post-process and summarize multiple analyses
- Built-in report templates for easy automatic post-processing of many standard impact tests

Predictive Engineering provides finite element analysis consulting services, software, training and support to a broad range of engineering companies across North America. We strive to exceed client expectations for accuracy, timeliness and knowledge transfer. Our process is both cost-effective and collaborative, ensuring all clients are reference clients.

Our mission is to be honest brokers of information in our consulting services and the software we represent.

Our History

Since 1995, Predictive Engineering has continually expanded its client base. Our clients include many large organizations and industry leaders such as SpaceX, Nike, General Electric, Navistar, FLIR Systems, Sierra Nevada Corp, Georgia-Pacific, Intel, Messier-Dowty and more. Over the years, Predictive Engineering has successfully completed more than 800 projects, and has set itself apart on its strong FEA, CFD and LS-DYNA consulting services.



Shanghai Hengstar

www.hengstar.com

Center of Excellence: Hengstar Technology is the first LS-DYNA training center of excellence in China. As part of its expanding commitment to helping CAE engineers in China, Hengstar Technology will continue to organize high level training courses, seminars, workshops, forums etc., and will also continue to support CAE events such as: China CAE Annual Conference; China Conference of Automotive Safety Technology; International Forum of Automotive Traffic Safety in China; LS-DYNA China users conference etc.

On Site Training: Hengstar Technology also provides customer customized training programs on-site at the company facility. Training is tailored for customer needs using LS-DYNA such as material test and input keyword preparing; CAE process automation with customized script program; Simulation result correlation with the test result; Special topics with new LS-DYNA features etc..

Distribution & Support: Hengstar distributes and supports LS-DYNA, LS-OPT, LS-Prepost, LS-TaSC, LSTC FEA Models; Hongsheng Lu, previously was directly employed by LSTC before opening his distributorship in China for LSTC software. Hongsheng visits LSTC often to keep update on the latest software features.

Hengstar also distributes and supports d3View; Genesis, Visual DOC, ELSDYNA; Visual-Crash Dyna, Visual-Process, Visual-Environment; EnkiBonnet; and DynaX & MadyX etc.

Consulting

As a consulting company, Hengstar focuses on LS-DYNA applications such as crash and safety, durability, bird strike, stamping, forging, concrete structures, drop analysis, blast response, penetration etc with using LS-DYNA's advanced methods: FEA, ALE, SPH, EFG, DEM, ICFD, EM, CSEC..

Lenovo www.lenovo.com

Lenovo is a USD39 billion personal and enterprise technology company, serving customers in more than 160 countries.

Dedicated to building exceptionally engineered PCs, mobile Internet devices and servers spanning entry through supercomputers, Lenovo has built its business on product innovation, a highly efficient global supply chain and strong strategic execution. The company develops, manufactures and markets reliable, high-quality, secure and easy-to-use technology products and services.

Lenovo acquired IBM's x86 server business in 2014. With this acquisition, Lenovo added award-winning System x enterprise server portfolio along with HPC and CAE expertise.

Canada	**Metal Forming Analysis Corp MFAC** galb@mfac.com www.mfac.com			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	eta/VPG	
	eta/DYNAFORM	INVENTIUM/PreSys		
Mexico	**COMPLX** Armando Toledo **www.complx.com.mx /** armando.toledo@complx.com.mx			
	LS-DYNA LS-OPT		LS-PrePost LS-TAsc Barrier/Dummy Models	
United States	**CAE Associates Inc.** info@caeai.com www.caeai.com			
	ANSYS Products	CivilFem	Consulting ANSYS Consulting LS-DYNA	
United States	**DYNAMAX** sales@dynamax-inc.com www.dynamax-inc.com			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models		LSTC Barrier Models	

United States	**ESI Group N.A** **info@esi-group.com** www.esi-group.com			
	PAM-STAMP			
	QuikCAST	SYSWELD	PAM-COMPOSITES	CEM One
	VA One	CFD-ACE+	ProCAST	
		Weld Planner	Visual-Environment	IC.IDO

United States	**Engineering Technology Associates – ETA** etainfo@eta.com www.eta.com			
	INVENTIUM/PreSy	NISA	VPG	LS-DYNA
	LS-OPT	DYNAform		

United States	**Livermore Software Technology Corp** sales@lstc.com **LSTC** www.lstc.com			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	TOYOTA THUMS	

United States	**Predictive Engineering** george.laird@predictiveengineering.com www.predictiveengineering.com			
	FEMAP	NX Nastran	LS-DYNA	LS-OPT
	LS-PrePost	LS-TaSC	LSTC Dummy Models	
			LSTC Barrier Models	

France	**DynaS+**		v.lapoujade@dynasplus.com	
	www.dynasplus.com		Oasys Suite	
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	DYNAFORM	VPG	MEDINA	
	LSTC Dummy Models		LSTC Barrier Models	

France	**DYNAmore France SAS**		sales@dynamore.eu	
	www.dynamore.eu			
	LS-DYNA, LS-PrePost	LS-OPT	Primer	DYNAFORM
	DSDM Products		LSTC Dummy Models	FEMZIP
	LSTC Barrier Models		DIGIMAT	

Germany	**CADFEM GmbH**		lsdyna@cadfem.de	
	www.cadfem.de			
	ANSYS	LS-DYNA	optiSLang	
	ESAComp	AnyBody		
	ANSYS/LS-DYNA			

Germany	**DYNAmore GmbH**		uli.franz@dynamore.de	
	www.dynamore.de			
	PRIMER	LS-DYNA	FTSS	VisualDoc
	LS-OPT	LS-PrePost	LS-TaSC	DYNAFORM
	Primer	FEMZIP	GENESIS	Oasys Suite
	TOYOTA THUMS		LSTC Dummy & Barrier Models	

The Netherlands	**Infinite Simulation Systems B.V**		j.mathijssen@infinite.nl	
	www.infinite.nl			
	ANSYS Products	CivilFem	CFX	Fluent
	LS-DYNA	LS-PrePost	LS-OPT	LS-TaSC

Russia	**STRELA**		info@dynarussia.com	
	LS-DYNA	LS-TaSC	LS-OPT	LS-PrePost
	LSTC Dummy Models		LSTC Barrier Models	

Spain	**DYNAmore France SAS**		sales@dynamore.eu		
	www.dynamore.eu				
	LS-DYNA, LS-OPT	LS-PrePost	Primer	DYNAFORM	
	DSDM Products		LSTC Dummy Models	FEMZIP	
	LSTC Barrier Models		DIGIMAT		
Sweden	**DYNAmore Nordic**		marcus.redhe@dynamore.se		
	www.dynamore.se		Oasys Suite		
	ANSA	µETA	LS-DYNA	LS-OPT	
	LS-PrePost	LS-TaSC	FastFORM	DYNAform	
	FormingSuite		LSTC Dummy Models		
			LSTC Barrier Models		
Switzerland	**DYNAmoreSwiss GmbH**		info@dynamore.ch		
	www.dynamore.ch				
	LS-DYNA		LS-OPT	LS-PrePost	
	LS-TaSC		LSTC Dummy Models &	Barrier Models	
UK	**Ove Arup & Partners**	dyna.sales@arup.com			
	www.oasys-software.com/dyna		TOYOTA THUMS		
	LS-DYNA		LS-OPT	LS-PrePost	
	LS-TaSC		PRIMER	D3PLOT	T/HIS
	REPORTER	SHELL	FEMZIP	HYCRASH	
	DIGIMAT	Simpleware	LSTC Dummy Models		
			LSTC Barrier Models		

China	**ETA – China**		lma@eta.com.cn	
	www.eta.com/cn			
	Inventium	VPG	DYNAFORM	NISA
	LS-DYNA	LS-OPT	LSTC Dummy Models	LS-PrePost
			LSTC Barrier Models	LS-TaSC
China	**Oasys Ltd. China**		de-long.ge@arup.com	
	www.oasys-software.com/dyna			
	PRIMER D3PLOT	HYCRASH	T/HIS REPORTER	SHELL
	LS-DYNA	LS-OPT	LSTC Dummy Models	LS-PrePost
	DIGIMAT	FEMZIP	LSTC Barrier Models	LS-TaSC
China	**Shanghai Hengstar Technology**		info@hengstar.com	
	www.hengstar.com			
	LS-DYNA	LS-TaSC	LSTC Barrier Models	D3VIEW
	LS-PrePOST	LS-OPT	LSTC Dummy Models	
	Genesis	VisualDoc		ELSDYNA
	Visual-Crahs DYNA	Visual-Proeces		DynaX & MadyX
	Enki Bonnet	Visual Environement		

India	**Oasys Ltd. India**		lavendra.singh@arup.com	
	www.oasys-software.com/dyna			
	PRIMER	D3PLOT	T/HIS	
			LS-OPT	LSTC Dummy Models	LS-PrePost
			LS-DYNA	LSTC Barrier Models	LS-TaSC

India	**CADFEM Eng. Svce**		info@cadfem.in	
	www.cadfem.in			
	ANSYS	VPS	ESAComp	optiSLang
	LS-DYNA	LS-OPT	LS-PrePost	

India	**Kaizenat Technologies Pvt. Ltd**		support@kaizenat.com	
	http://kaizenat.com /			
	LS-DYNA	LS-OPT	LSTC Dummy Models	LS-PrePost
	Complete LS-DYNA suite of products		LSTC Barrier Models	LS-TaSC

Japan	**CTC**	LS-dyna@ctc-g.co.jp		
	www.engineering-eye.com			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	CmWAVE	
Japan	**JSOL**			
	www.jsol.co.jp/english/cae		Oasys Suite	
	JSTAMP	HYCRASH	JMAG	
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	TOYOTA THUMS	
Japan	**FUJITSU**			
	http://www.fujitsu.com/jp/solutions/business-technology/tc/sol/			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	CLOUD Services	
Japan	**LANCEMORE**	info@lancemore.jp		
	www.lancemore.jp/index_en.html			
	Consulting			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models		
Japan	**Terrabyte**	**English:**		
	www.terrabyte.co.jp	www.terrabyte.co.jp/english/index.htm		
	Consulting			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	AnyBody	

Korea	**THEME**	wschung7@gmail.com		
	www.lsdyna.co.kr		Oasys Suite	
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	eta/VPG	Planets
	eta/DYNAFORM	FormingSuite	Simblow	TrueGRID
	JSTAMP/NV	Scan IP	Scan FE	Scan CAD
	FEMZIP			

Korea	**KOSTECH**	young@kostech.co.kr		
	www.kostech.co.kr			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	eta/VPG	FCM
	eta/DYNAFORM	DIGIMAT	Simuform	Simpack
	AxStream	TrueGrid	FEMZIP	

Taiwan **AgileSim Technology Corp.**

www.agilesim.com.tw

LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
LSTC Dummy Models	LSTC Barrier Models	eta/VPG	FCM

Taiwan **Flotrend**

www.flotrend.com.tw

LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
LSTC Dummy Models	LSTC Barrier Models	eta/VPG	FCM

Taiwan **SiMWARE Inc..**

www.simware.com.tw

LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
LSTC Dummy Models	LSTC Barrier Models	eta/VPG	FCM

Contact: JSOL Corporation Engineering Technology Division cae-info@sci.jsol.co.jp

Cloud computing services
for
JSOL Corporation LS-DYNA users in Japan

JSOL Corporation is cooperating with chosen cloud computing services

JSOL Corporation, a Japanese LS-DYNA distributor for Japanese LS-DYNA customers.

LS-DYNA customers in industries / academia / consultancies are facing increased needs for additional LS-DYNA cores

In calculations of optimization, robustness, statistical analysis, we find that an increase in cores of LS-DYNA are needed, for short term extra projects or cores.

JSOL Corporation is cooperating with some cloud computing services for JSOL's LS-DYNA users and willing to provide short term license.

This service is offered to customers using Cloud License fee schedule, the additional fee is less epensive than purchasing yearly license.

The following services are available (only in Japanese). HPC OnLine:

NEC Solution Innovators, Ltd.
http://jpn.nec.com/manufacture/machinery/hpc_online/

Focus
Foundation for Computational Science
http://www.j-focus.or.jp

Platform Computation Cloud
CreDist.Inc.

PLEXUS CAE
Information Services International-Dentsu, Ltd. (ISID) https://portal.plexusplm.com/plexus-cae/

SCSK Corporation
http://www.scsk.jp/product/keyword/keyword07.html

Rescale Cloud Simulation Platform

www.rescale.com

Rescale: Cloud Simulation Platform

The Power of Simulation Innovation
We believe in the power of innovation. Engineering and science designs and ideas are limitless. So why should your hardware and software be limited? You shouldn't have to choose between expanding your simulations or saving time and budget.

Using the power of cloud technology combined with LS-DYNA allows you to:
· Accelerate complex simulations and fully explore the design space
· Optimize the analysis process with hourly software and hardware resources
· Leverage agile IT resources to provide flexibility and scalability

True On-Demand, Global Infrastructure
Teams are no longer in one location, country, or even continent. However, company data centers are often in one place, and everyone must connect in, regardless of office. For engineers across different regions, this can cause connection issues, wasted time, and product delays.

Rescale has strategic/technology partnerships with infrastructure and software providers to offer the following:
· Largest global hardware footprint – GPUs, Xeon Phi, InfiniBand
· Customizable configurations to meet every simulation demand
· Worldwide resource access provides industry-leading tools to every team
· Pay-per-use business model means you only pay for the resources you use
· True on-demand resources – no more queues

ScaleX Enterprise: Transform IT, Empower Engineers, Unleash Innovation
The ScaleX Enterprise simulation platform provides scalability and flexibility to companies while offering enterprise IT and management teams the opportunity to expand and empower their organizations.

ScaleX Enterprise allows enterprise companies to stay at the leading edge of computing technology while maximizing product design and accelerating the time to market by providing:

- Collaboration tools
- Administrative control
- API/Scheduler integration
- On-premise HPC integration

Industry-Leading Security

Rescale has built proprietary, industry-leading security solutions into the platform, meeting the needs of customers in the most demanding and competitive industries and markets.

- Manage engineering teams with user authentication and administrative controls
- Data is secure every step of the way with end-to-end data encryption
- Jobs run on isolated, kernel-encrypted, private clusters
- Data centers include biometric entry authentication
- Platforms routinely submit to independent external security audits

Rescale maintains key relationships to provide LS-DYNA on demand on a global scale. If you have a need to accelerate the simulation process and be an innovative leader, contact Rescale or the following partners to begin running LS-DYNA on Rescale's industry-leading cloud simulation platform.

LSTC - DYNAmore GmbH JSOL Corporation

Rescale, Inc. - 1-855-737-2253 (1-855-RESCALE) - info@rescale.com

944 Market St. #300, San Francisco, CA 94102 USA

ESI Cloud Based Virtual Engineering Solutions

www.esi-group.com

ESI Cloud offers designers and engineers cloud-based computer aided engineering (CAE) solutions across physics and engineering disciplines.

ESI Cloud combines ESI's industry tested virtual engineering solutions integrated onto ESI's Cloud Platform with browser based modeling,

With ESI Cloud users can choose from two basic usage models:

- An end-to-end SaaS model: Where modeling, multi-physics solving, results visualization and collaboration are conducted in the cloud through a web browser.
- A Hybrid model: Where modeling is done on desktop with solve, visualization and collaboration done in the cloud through a web browser.

Virtual Performance Solution:

ESI Cloud offers ESI's flagship Virtual Performance Solution (VPS) for multi-domain performance simulation as a hybrid offering on its cloud platform. With this offering, users can harness the power of Virtual Performance Solution, leading multi-domain CAE solution for virtual engineering of crash, safety, comfort, NVH (noise, vibration and harshness), acoustics, stiffness and durability.

In this hybrid model, users utilize VPS on their desktop for modeling including geometry, meshing and simulation set up. ESI Cloud is then used for high performance computing with an integrated visualization and real time collaboration offering through a web browser.

The benefits of VPS hybrid on ESI Cloud include:

- Running large concurrent simulations on demand
- On demand access to scalable and secured cloud HPC resources
- Three tiered security strategy for your data
- Visualization of large simulation data sets
- Real-time browser based visualization and collaboration
- Time and cost reduction for data transfer between cloud and desktop environments
- Support, consulting and training services with ESI's engineering teams

ESI Cloud Based Virtual Engineering Solutions

www.esi-group.com

VPS On Demand

ESI Cloud features the Virtual Performance Solution (VPS) enabling engineers to analyze and test products, components, parts or material used in different engineering domains including crash and high velocity impact, occupant safety, NVH and interior acoustics, static and dynamic load cases. The solution enables VPS users to overcome hardware limitations and to drastically reduce their simulation time by running on demand very large concurrent simulations that take advantage of the flexible nature of cloud computing.

Key solution capabilities:

- Access to various physics for multi-domain optimization
- Flexible hybrid model from desktop to cloud computing
- On demand provisioning of hardware resources
- Distributed parallel processing using MPI (Message Passing Interface) protocol
- Distributed parallel computing with 10 Gb/s high speed interconnects

Result visualization

ESI Cloud deploys both client-side and server-side rendering technologies. This enables the full interactivity needed during the simulation workflow along with the ability to handle large data generated for 3D result visualization in the browser, removing the need for time consuming data transfers. Additionally ESI Cloud visualization engine enables the comparisons of different results through a multiple window user interface design.

Key result visualization capabilities:

- CPU or GPU based client and server side rendering
- Mobility with desktop like performance through the browser
- 2D/3D VPS contour plots and animations
- Custom multi-window system for 2D plots and 3D contours
- Zooming, panning, rotating, and sectioning of multiple windows

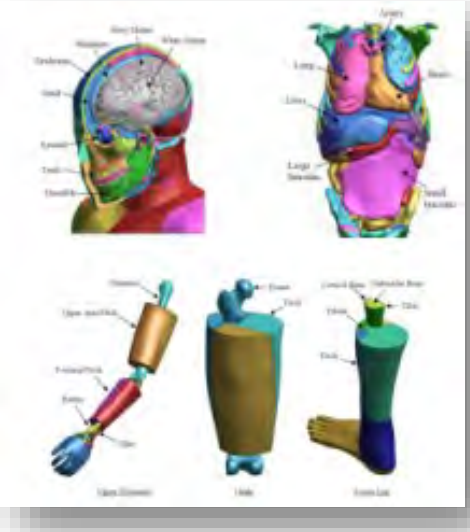
Collaboration

To enable real time multi-user and multi company collaboration, ESI Cloud offers extensive synchronous and asynchronous collaboration capabilities. Several users can view the same project, interact with the same model results, pass control from one to another. Any markups, discussions or annotations can be archived for future reference or be assigned as tasks to other members of the team.

Key collaboration capabilities:

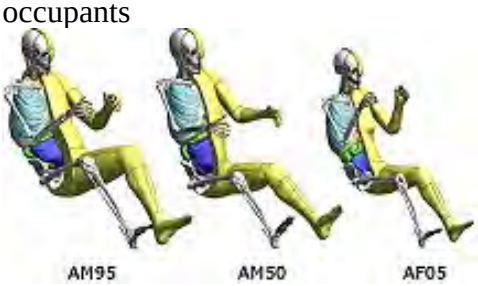
- Data, workflow or project asynchronous collaboration
- Multi-user, browser based collaboration for CAD, geometry, mesh and results models
- Real-time design review with notes, annotations and images archiving and retrieval
- Email invite to non ESI Cloud users for real time collaboration

TOYOTA - Total Human Model for Safety – THUMS

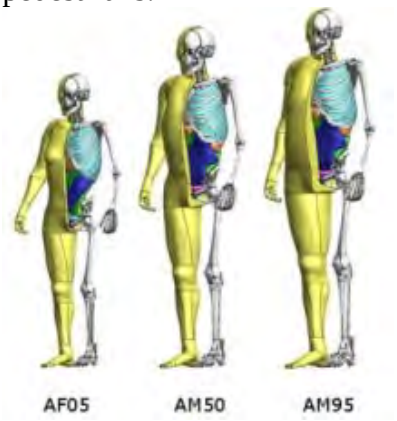


The Total Human Model for Safety, or THUMS®, is a joint development of Toyota Motor Corporation and Toyota Central R&D Labs. Unlike dummy models, which are simplified representation of humans, THUMS represents actual humans in detail, including the outer shape, but also bones, muscles, ligaments, tendons, and internal organs. Therefore, THUMS can be used in automotive crash simulations to identify safety problems and find their solutions.

Each of the different sized models is available as sitting model to represent vehicle occupants



and as standing model to represent pedestrians.



The internal organs were modeled based on high resolution CT-scans.

THUMS is limited to civilian use and may under no circumstances be used in military applications.

LSTC is the US distributor for THUMS. Commercial and academic licenses are available.

For information please contact: THUMS@lstc.com

THUMS®, is a registered trademark of Toyota Central R&D Labs.

LSTC – Dummy Models

LSTC Crash Test Dummies (ATD)

Meeting the need of their LS-DYNA users for an affordable crash test dummy (ATD), LSTC offers the LSTC developed dummies at no cost to LS-DYNA users.

LSTC continues development on the LSTC Dummy models with the help and support of their customers. Some of the models are joint developments with their partners.

e-mail to: atds@lstc.com

Models completed and available (in at least an alpha version)

- Hybrid III Rigid-FE Adults
- Hybrid III 50th percentile FAST
- Hybrid III 5th percentile detailed
- Hybrid III 50th percentile detailed
- Hybrid III 50th percentile standing
- EuroSID 2
- EuroSID 2re
- SID-IIs Revision D
- USSID
- Free Motion Headform
- Pedestrian Legform Impactors

Models In Development

- Hybrid III 95th percentile detailed
- Hybrid III 3-year-old
- Hybrid II
- WorldSID 50th percentile
- THOR NT FAST
- Ejection Mitigation Headform

Planned Models

- FAA Hybrid III
- FAST version of THOR NT
- FAST version of EuroSID 2
- FAST version of EuroSID 2re
- Pedestrian Headforms
- Q-Series Child Dummies
- FLEX-PLI

LSTC – Barrier Models

Meeting the need of their LS-DYNA users for affordable barrier models, LSTC offers the LSTC developed barrier models at no cost to LS-DYNA users.

LSTC offers several Offset Deformable Barrier (ODB) and Movable Deformable Barrier (MDB) models:

•ODB modeled with shell elements
•ODB modeled with solid elements
•ODB modeled with a combination of shell and solid elements

•MDB according to FMVSS 214 modeled with shell elements
•MDB according to FMVSS 214 modeled with solid elements
•MDB according to ECE R-95 modeled with shell elements
•AE-MDB modeled with shell elements

•IIHS MDB modeled with shell elements
•IIHS MDB modeled with solid elements
•RCAR bumper barrier

•RMDB modeled with shell and solid elements

e-mail to: atds@lstc.com.

Conference – Events – Users Meetings

Keep up to date on upcoming

Conferences

Meetings

Events

if you have a new event to be listed please send to agiac99@aol.com

Conference/Events/User Forums

Sep 26-27	**ESI Forum in North America 2017** Birmingham, MI , US	www.esi-group.com
Oct. 11-13	**The 7th GACM Colloquium on Computational Mechanics (GACM 2017)**	www.gacm2017.uni-stuttgart.de
Oct. 23-25	**3rd China LS-DYNA User's conference** Shanghai, China	http://www.lsdyna.cn
Oct 31-Nov 1	**LS-DYNA&JSTAMP Forum 2017** Tokyo, Japan	http://ls-dyna.jsol.co.jp/en
Nov 15-16	**PUCA FORUM 2017** Tokyo, Japan	www.esi-group.com

7th GACM Colloquium on Computational Mechanics 2017

The 7th GACM Colloquium on Computational Mechanics (GACM 2017) will take place on October 11-13 2017 in Stuttgart, Germany. The colloquium is hosted by the Institute of Structural Mechanics and the Institute of Applied Mechanics of the University of Stuttgart in cooperation with DYNAmore GmbH.

The GACM Colloquium on Computational Mechanics is intended for young scientists who are engaged in academic and industrial research on Computational Mechanics and Computer Methods in Applied Sciences. It provides a platform to present and discuss results from recent research efforts and industrial applications.

Thematically arranged sessions and organized mini-symposia as well as social events will provide an environment for lively discussions in an informal atmosphere.

Young scientists from Europe and all other continents are welcome to this colloquium. Presentations will be given in English.

www.gacm2017.uni-stuttgart.de

LS-DYNA & JSTAMP Forum 2017 in Tokyo, Japan

http://ls-dyna.jsol.co.jp/en/event/uf2017/

Welcome to the LS-DYNA & JSTAMP Forum 2017

JSOL Corporation holds an annual LS-DYNA & JSTAMP Forum to provide our users a wide range of information including the latest simulation technologies and case studies and also to offer the opportunity for information exchange among our users.

This year the venue of the LS-DYNA & JSTAMP Forum 2017 moves from Nagoya to Tokyo. It will be held at Tokyo Conference Center Shinagawa, from Tuesday 31 October to Wednesday 1 November 2017. Our engineers will showcase the latest simulation technologies and poster sessions will be held. We welcome any inquiry, consultation and discussion about your day-to-day work.

We encourage our users to take advantage of this once a year opportunity. We look forward to your attendance in the event.

JSOL Corporation - Engineering Technology Division

LS-DYNA&JSTAMP Forum 2017 - Organizer: JSOL Corporation

Dates: Tuesday 31 October to Wednesday 1 November 2017.
Venue: Tokyo Conference Center Shinagawa (Tokyo, Japan)

ESI Group User Forums

www.esi-group.com

ESI User Forums

26 Sep 2017 - 27 Sep 2017
ESI Forum in North America 2017
Birmingham, Michigan, United States

26 Sep 2017 - 27 Sep 2017
VPS User Conference 2017
Czech Republic

17 Oct 2017 - 19 Oct 2017
5th OpenFOAM User Conference 2017
Frankfurt/Main, Germany

7 Nov 2017 - 9 Nov 2017
ESI Forum in Germany 2017
Weimar, Germany

15 Nov 2017 - 16 Nov 2017
PUCA FORUM 2017
Hilton Hotel Tokyo, Japan

22 Nov 2017
ESI Forum in India 2017
Pune, India

2017 3rd China LS-DYNA User's conference Oct. 23rd-25th, Shanghai, China

Yanhua Zhao & China Conference Team - chinaconf@lstc.com

The 3rd China LS-DYNA conference will echo the success of the well-participated 1st and 2nd China User's Conference, in 2013 and 2015.

Accompanied by the rapid growth of CAE applications in China, LS-DYNA is highly recognized as one of the most widely used finite element analysis software by Chinese users.

China is gaining momentum and recognition in Finite Element Analysis. In the past years, the continuing expansion of application areas has been gaining more users in automotive, die and mold, aerospace and aeronautics industries in China.

In China LS-DYNA is fast becoming the software of choice, by all engineers, students, professors and consulting companies. It is recognized that LS-DYNA, LS-PrePost, LS-OPT and the LSTC ATD and Barrier Models, developed by LSTC, are setting standards for the finite element simulation industry. At the conference LSTC software new features will be introduced and helpful techniques will be shared.

The conference will be attended by experienced users from different industries, LSTC technical support engineers and software developers. Additionally, it will be attended by academic researchers, hardware vendors and software vendors.

With the popularity and attendance of the 1st and 2nd conference and demand from users it has been decided that the conference will be held regularly. One of the goals is to serve as a convenient platform for people in this field to exchange their ideas, share their findings and explore new software functions.

Hosts: Livermore Software Technology Corp. & Dalian Fukun Technology Development Corp.
Date: Oct. 23rd -25th, 2017
Location: InterContinental Shanghai Pudong, Shanghai, China
Website: http://www.lsdyna.cn
Contact: chinaconf@lstc.com

Training and Social Media Section

Aleta Hays

Training

Classes

Webinars

On Site – On Line

We will be adding to this section monthly – if you have a new event to be listed please send to Aleta ayh225@aol.com and cc Anthony agiac99@aol.com

Participant's Training Classes

Webinars

Info Days

Class Directory

Participant Class Directory

Arup **(corporate)**	www.oasys-software.com/dyna/en/training
BETA CAE Systems **(corporate)**	www.beta-cae.com/training.htm
DYNAmore **(corporate)**	www.dynamore.de/en/training/seminars
ESI-Group **(corporate)**	https://myesi.esi-group.com/trainings/schedules
ETA **(corporate)**	www.eta.com/support2/training-calendar
KOSTECH	www.kostech.co.kr/
LSTC - (corporate)	www.lstc.com/training
LS-DYNA OnLine - (Al Tabiei)	www.LSDYNA-ONLINE.COM

ARUP Visit the website for complete listings/changes/locations

www.oasys-software.com/dyna/en/training

Arup offers a wide range of training for new and existing users of the Oasys LS-DYNA Environment software who are seeking to improve their understanding and application of these powerful analysis tools. New users will benefit from our introductory courses and can quickly become effective in other areas of application through the range of courses on offer. The courses will also provide existing users with knowledge of how to use the latest features in Oasys and LS-DYNA.

BETA CAE SYSTEMS Visit the website for complete listings/changes/locations

www.beta-cae.com/training.htm

Basic and advanced training courses can be scheduled upon request. A variety of standard or tailored training schedules, per product or per discipline, are being offered to meet customers needs.

A number of recommended training courses offered are described below. The list is not exhaustive and more courses can be designed according to your needs.
Please, contact ansa@beta-cae.com for further details.

Recommended Training Courses (Complete information on website)

- SPDRM
- ANSA / μETA Basics
- ANSA / μETA for CFD
- ANSA / μETA for Crash & Safety simulation
- ANSA / μETA for Durability simulation
- ANSA / μETA for NVH analyses
- Multi-Body Dynamics
- Laminated Composites
- Morphing and Optimization
- Automation
- Additional special sessions

Author: Christian Frech christian.frech@dynamore.de

DYNAmore Visit the website for complete overview and registration

www.dynamore.de/seminars

Seminar dates offered by DYNAmore – September 2017

Download full seminar brochure (pdf): www.dynamore.de/seminars2017

Selection of trainings from September

Introduction	
Introduction to LS-PrePost	11 September (Tr)
Introduction to LS-DYNA	12-14 September (Tr)
Crash/Short-Term Dynamics	
Contact Definitions in LS-DYNA	15 September
Passive Safety	
Introduction to Passive Safety Simulation with LS-DYNA	28-29 September
Implicit	
Implicit Analysis with LS-DYNA	25-26 September
Particle Methods	
Smoothed Particle Hydrodynamics (SPH) in LS-DYNA	21-22 September
Discrete Element Method (DEM) in LS-DYNA	27 September
Multiphysics/Biomechanics	
ALE and Fluid-Structure Interaction in LS-DYNA	19-20 September
Optimization	
LS-OPT – Optimization and Robustness	12-14 (G)/19-21 (V) September

Information days (free of charge)

Possibilities with LS-DYNA/Implicit	18 September
Optimization/DOE/Robustness	25 September

Support/Webinar series (free of charge) – Registration via www.dynamore.de

Support day: LS-DYNA	15 September

If not otherwise stated, the event location is Stuttgart, Germany. Other event locations are:
G = Gothenburg, Sweden; L = Linköping, Sweden V = Versailles, France; T = Turin, Italy, Sb = Salzburg, Austria, Tr = Traboch, Austria

We hope that our offer will meet your needs and are looking forward to welcoming you at one of the events.

Author: Christian Frech christian.frech@dynamore.de

Information day Welding and Heat Treatment with LS-DYNA,

17 October, Aachen

Due to the increasing importance of simulations with welding processes and other heat treatments, numerous extensions have been implemented in LS-DYNA. It is now possible to calculate the complete process chain in several stages.

LS-DYNA furthermore offers special heat source functions for shells and solids with energy input control and special welding contacts such that all welding processes can be captured.

This information day aims at simulation engineers who want to obtain an overview of the available tools in LS-DYNA, DynaWeld and SimWeld that can used for model building as well as simulation of welding and heat treatment processes.

Registration:
www.dynamore.de/info-welding-e

Contact

DYNAmore GmbH
Industriestr. 2, D-70565 Stuttgart, Germany
Tel. +49 (0) 7 11 - 45 96 00 - 0
E-Mail: conference@dynamore.de
www.dynamore.de

Among the many classes held during the year are the following:

September

11-12	LS-DYNA ALE/Euler
18-19	Intro LS-OPT – Funcunality & Standard
20	LS-DYNA Discrete Element Method
25-17	Intro to LS-DYNA Explicit

October

09	Intro to LS-DYNA Implicit
10	LS-DYNA Implicit - Advanced
16-17	LS-DYNA CFD Incompressible - ICFD
18	LS-DYNA CFD Compressible - CESE
19-20	LS-DYNA Electromagnetism - EM

https://myesi.esi-group.com/trainings/schedules

Basic OpenFOAM training for application engineers
10 Aug 2017 to 11 Aug 2017

PAM-DIEMAKER for CATIA V5
16 Aug 2017 to 18 Aug 2017

Basic PAM-STAMP
16 Aug 2017 to 17 Aug 2017

Introduction to ProCAST
22 Aug 2017 to 24 Aug 2017

VPS Explicit - PAM-CRASH I - Grundlagen (Basics)
5 Sep 2017 to 7 Sep 2017

Please visit the website for complete information on all the classes and locations

https://myesi.esi-group.com/trainings/schedules

KOrea Simulation TECHnology Co., Ltd. Training

www.kostech.co.kr/

Anna Choi, Assistant Manager - choian@kostech.co.kr
KOrea Simulation TECHnology Co.,Ltd [Kostech]
Rm. 804 Nam-Jung City Plaza 1th, 760 Janghang-dong
Ilsandong-gu, Goyang-si, Gyeonggi-do, 410-380, Korea

August

***Concrete and Geomaterial Modelling in LS-DYNA**

Date: August 17~18

Lecturer: Dr. Len Schwer(We invited him as a guest speaker)

LSTC 2017 Training

For Pricing Please visit www.lstc.com

August			
1-2	CA	Rubber, Foam & Viscoelastic Materials	A. Tabiei
3-4	CA	Plasticity, Plastics, Visco-plastic Materials	A. Tabiei
8-9	CA	Fracture, Failure, Damage	A. Tabiei
10-11	CA	Composite LS-DYNA	A. Tabiei
14-15	CA	Implicit LS-DYNA	A. Tabiei
21-23	CA	ALE/Eulerian & FSI Interaction in LS-DYNA	M. Souli
24-25	CA	Smoothed Particle Hydrodynamics (SPH)	M. Souli
28	CA	Intro to LS-PrePost	P. Ho / Q. Yan
Aug29-Sep1	CA	Intro to LS-DYNA	A. Nair
September			
12-13	MI	Airbag Modeling	A. Nair
13	CA	Material Characteristics for Metals, Plastics, and Polymers - Test Data to Material Model	S. Bala
14-15	CA	Contact	S. Bala
October			
10-13	MI	Optimization and Probalistic Analysis using LS-OPT	A. Basudhar
16	MI	Intro to LS-PrePost	P. Ho / Q. Yan
17-20	MI	Intro to LS-DYNA	A. Nair
17-18	CA	NVH and Frequency Domain Analysis	Y. Huang
November			
6	CA	Intro to LS-PrePost	P. Ho / Q. Yan
7-10	CA	Intro to LS-DYNA	A. Nair
13-14	CA	LS-DYNA Advanced	S. Bala
Nov 30-Dec 1	CA	Advanced Metal Forming	L. Zhang / X.Zhu
December			
11	MI	Intro to LS-PrePost	P. Ho / Q. Yan
12-15	MI	Intro to LS-DYNA	A. Nair

LS-DYNA Visit the website for complete listings/changes/locations

On Line www.LSDYNA-ONLINE.COM

For Information contact: courses@lsdyna-online.com or 513-331-9139

Composite Materials In LS-DYNA

This course will allow first time LS-DYNA users to use composite materials. The most important elements to start using all the composite material models in LS-DYNA will be presented in the 8 hours.

Foam & Viscoelastic Materials in LS-DYNA

Objective of the course: Learn about several foam material models in LS-DYNA to solve engineering problems. Detailed descriptions are given of the data required to use such material in analysis. Examples are used to illustrate the points made in the lectures

Plasticity, Plastics, and Viscoplastics Materials in LS-DYNA

Objective of the course: Learn about several plasticity based material models in LS-DYNA to solve engineering problems. Detailed descriptions are given of the data required to use such material in analysis. Examples are used to illustrate the points made in the lectures.

Rubber Materials in LS-DYNA

Objective of the course: Learn about several rubber material models in LS-DYNA to solve engineering problems. Detailed descriptions are given of the data required to use such material in analysis. Examples are used to illustrate the points made in the lectures.

 **FACEBOOK**

BETA CAE Systems

CADFEM

ESI Group

Lenovo

 **TWITTER**

BETA CAE Systems

ESI Group

ETA

CADFEM

Lenovo

 **LINKEDIN**

BETA CAE Systems

CADFEM

DYNAmore Nordic

ETA

ESI Group

YOUTUBE

YOUTUBE Channel	WebSite URL
BETA CAE Systems	www.beta-cae.com
CADFEM	www.cadfem.de
ESI Group	www.esi-group.com
ETA	www.eta.com
Lancemore	www.lancemore.jp/index_en.html
Lenovo	

GOOGLE+

BETA CAE Systems	

LS-DYNA Resource Links

LS-DYNA Multiphysics YouTube Facundo Del Pin

https://www.youtube.com/user/980LsDyna

FAQ LSTC Jim Day

ftp.lstc.com/outgoing/support/FAQ

LS-DYNA Support Site

www.dynasupport.com

LS-OPT & LS-TaSC

www.lsoptsupport.com

LS-DYNA EXAMPLES

www.dynaexamples.com

LS-DYNA CONFERENCE PUBLICATIONS

www.dynalook.com

ATD –DUMMY MODELS

www.dummymodels.com

LSTC ATD MODELS

www.lstc.com/models www.lstc.com/products/models/mailinglist

AEROSPACE WORKING GROUP

http://awg.lstc.com/tiki/tiki-index.php

	**LS-DYNA®, LS-OPT®, LS-PrePost, LS-TASC®,** **LSTC ATD and Barrier Models** · 12 – 6 - 3 months/1 or 2 core license available · Students, Engineers. · NON-COMMERICAL USE For Information contact: sales@lstc.com
	**LS-Run – A standalone application** - a new graphical control center to start LS-DYNA simulations with either SMP or MPP - LS-Run has a parametric LS-DYNA command line builder making it easy to create the command and change the most common arguments such as ”memory”, ”ncpu” and the solver executable. For information contact: nik@dynamore.de
	A mobile & web application which is built to help LS-DYNA Users to get instant answers for technical query from global experts. For information contact: ramesh@kaizenat.com

LSTC Recent Developments, Features, Updates, News, Presentations

Editor: Yanhua Zhao

Best Fit GUI for Metal Forming in LS-PrePost® 4.5
Q. Yan, Xinhai Zhu, Philip Ho, Li Zhang, Yuzhong Xiao - LSTC

Modeling and Numerical Simulation of Afterburning of Thermobaric Explosives In a Closed Chamber
Kyoung su Im, Grant Cook, Jr., and Zeng-Chan Zhang - LSTC

Previously Presented: **For a copy write to yanhua@feainformation.com**

June

Improvement of Sandwich Structure Part Adaptivity in LS-DYNA
Xinhai Zhu, Houfu Fan, Li Zhang and Yuzhong Xiao - LSTC

New Inflator Models in LS-DYNA®
Kyoung-Su Im, Zeng-Chan Zhang, and Grant O. Cook, Jr. - LSTC

May

Improvement of Mesh Fusion in LS-DYNA
Houfu Fan, Xinhai Zhu, Li Zhang and Yuzhong Xiao - LSTC

Representative Volume Element (RVE) analysis using LS-DYNA
C.T. Wu, W. Hu LSTC

April

New features of 3D adaptivity in LS-DYNA -
W. Hu LSTC

New Feature: Defining Hardening Curve in LS-DYNA® -
X. Zhu, L. Zhang, Y. Xiao

March

Improvements toOne-Step Simulation in LS-DYNA
Xinhai Zhu, Houfu Fan, Li Zhang,

February

LS-DYNA Smooth Particle Galerkin (SPG) Method
C.T. Wu, Y. Guo, W. Hu - LSTC

January

Lancing features in LS-DYNA
Quanqing Yan, Li Zhang, Yuzhong Xiao, Xinhai Zhu, Philip Ho - LSTC

LSTC Recent Developments, Features, Updates, News, Presentations

2016

December

Thermal Coupling Method Between SPH Particles and Solid Elements in LS-DYNA
Jingxiao Xu, Jason Wang, LSTC

November

Introduction to second order Lagrangian elements in LS-DYNA
Hailong Teng - Livermore Software Technology Corp.

October

*An Introduction to *CONSTRAINED_BEAM_IN_SOLID*
Hao Chen - Livermore Software Technology Corp

September:

Introduction to the new framework for User Subroutine Development of LS-DYNA
Zhidong Han and Brian Wainscott

*New Features in *ELEMENT_LANCING*
Xinhai Zhu, Li Zhang, Yuzhong Xiao

August :

Equivalent Radiated Power calculation with LS-DYNA
Yun Huang, Zhe Cui - Livermore Software Technology Corporation

July:

Recent Developments for Laminates and TSHELL Forming
Xinhai Zhu, Li Zhang, Yuzhong Xiao - LSTC

Best Fit GUI for Metal Forming in LS-PrePost® 4.5

Q. Yan, Xinhai Zhu, Philip Ho, Li Zhang, Yuzhong Xiao
LSTC

INTRODUCTION

Best fit technique is frequently used in sheet metal forming to assess springback accuracy. This has been done for quite a while with LS-DYNA's keyword *CONTROL_FORMING_BESTFIT_*OPTION*. The keyword requires a few entries, for example, target and source node sets, target and source mesh files, etc., which could become quite easily mixed up if done manually. In addition, one has to execute LS-DYNA to get the best fit results.

LS-PrePost Best Fit GUI:

Since the target and source node sets need to be defined in LS-PrePost, it makes sense to output the entire required keyword input from LS-PrePost, and better yet, with a single click of a button in LS-PrePost one should be able to execute the LS-DYNA run in the background and then, when the results are available, directly read into LS-PrePost for analysis, etc. It is possible to include all these functions within a GUI. A Graphical User Interface (GUI) is thus created in LS-PrePost 4.5 to do just that.

In this paper, we only showcase the features in the GUI since the best fit function in LS-DYNA has been QA'ed for quite a while and deemed very robust and reliable.

As shown in Figure 1, the GUI can be invoked by accessing the APPLICATION menu at the top left corner of the menu bar. Once the source and target parts (refer to Keyward Manual I) are imported into LS-PrePost, one can define the target part (PID 100) by selecting it from the main graphics window; similarly source part (PID 2) can be defined, shown in Figure 2. Also, there is an optional check box to output the separation distances between the two parts in vectors (*CONTROL_FORMING_BESTFIT_VECTOR), for optional vector display in LS-PrePost. The "Apply" button will write out the LS-DYNA output files required and start executing LS-DYNA for best fit calculation in the background. Once the best fit calculation is finished, one can get the results from LS-DYNA run by clicking on "Load Results" under the "Results" tab (Figure 4). Once the results are loaded, the "Load Results" button will turn green indicating the results are available for viewing. At this point, one can choose either display in fringe color contours the separation distances between the source and target part after the best fit (Figure 5) or display it in vectors (Figure 6). Various plot options also exist both in "Contour" or "Vector", and to turn on/off either target or source part.

There are two convenient buttons for a more detailed analysis of the best fit results. As shown in Figure 4, the "Identify" button takes you directly to *Eletol/Ident menu* so the nodes can be picked on the main screen and their separation distances displayed (Figure 7), which saves a number of

clicks. The “Section Plane” feature (Figure 4) takes you directly to *Model/Section* menu so section plane cuts can be made (Figure 8).

Note although it is transparent to the users, the necessary input files written out for LS-DYNA run are created in the running folder as shown in Figure 9, where bestfitcontrol.k is the main input file, which includes bestfitcontrol_source.k (source part mesh file in keyword format) and bestfitcontrol_target.k (target part mesh file in keyword format) files and bestfit.out is LS-DYNA result file after a best fit calculation.
Note also there is a small program (which does not require a license) called lsdyna_bestfit.exe must be added in the LS-PrePost4.5 installation folder, typically in C:\Program Files\LSTC\LS-PrePost 4.5.

REFERENCE:

LS-DYNA User’s Manual (draft).

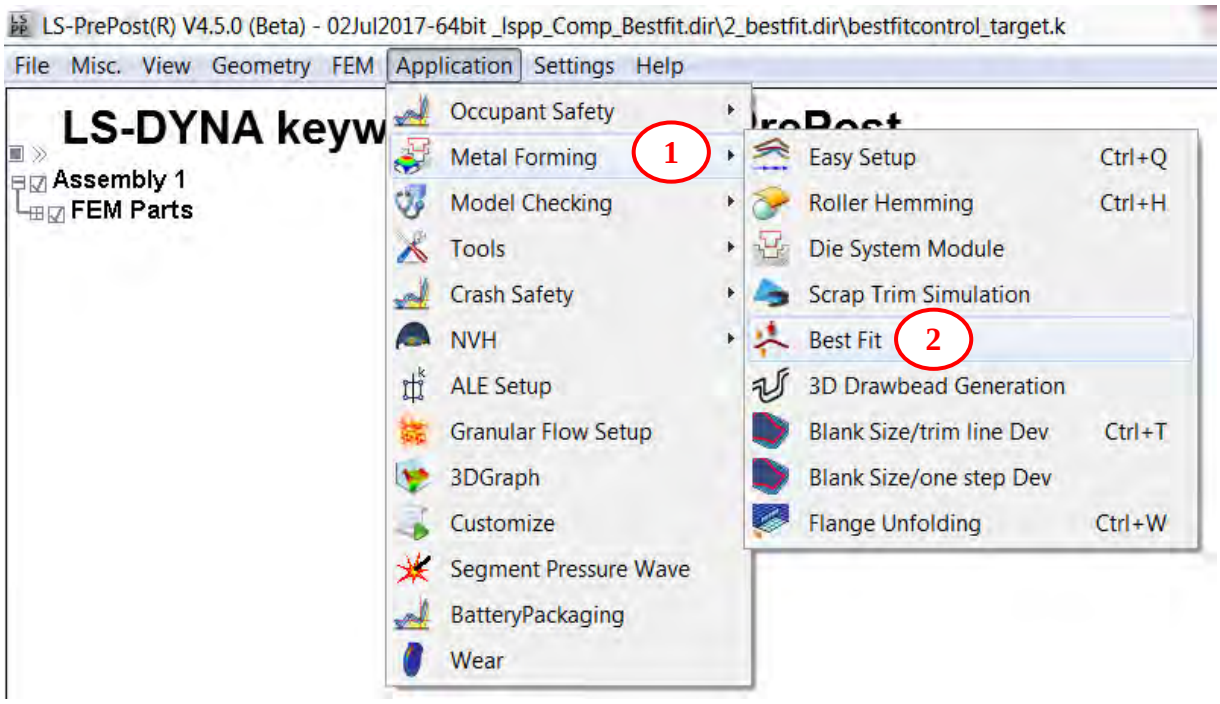


Figure 1. Activating the Best Fit GUI in LS-PrePost 4.5

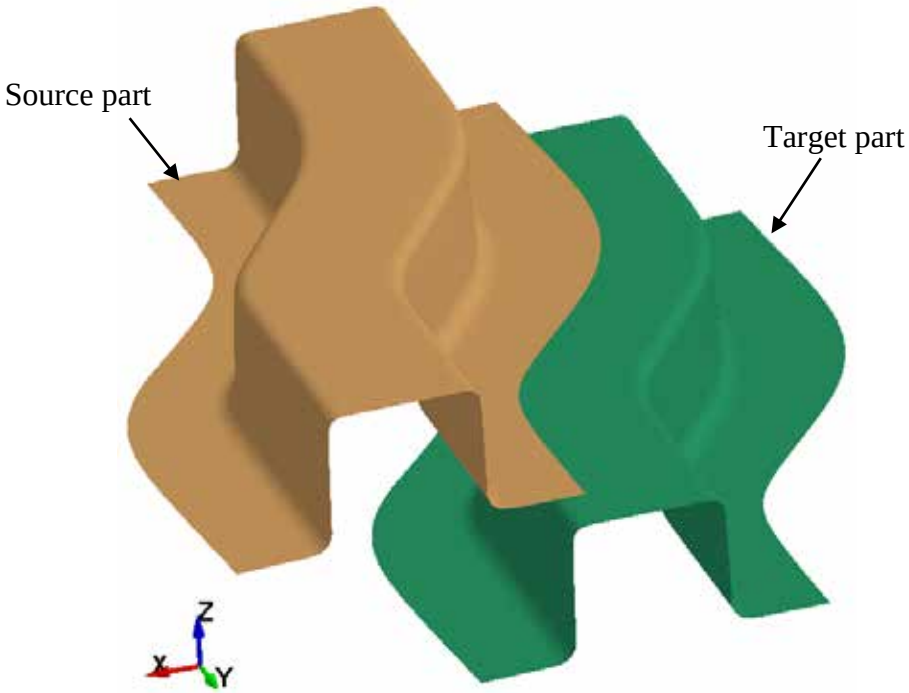


Figure 2. Target and Source Parts.

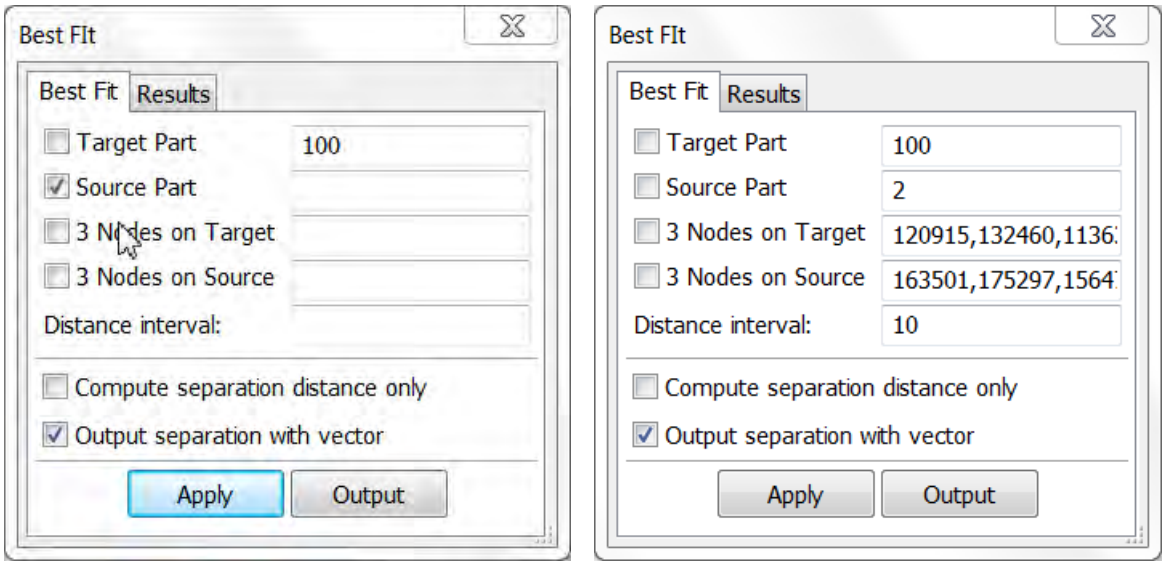


Figure 3. Define target and source parts' PIDs.

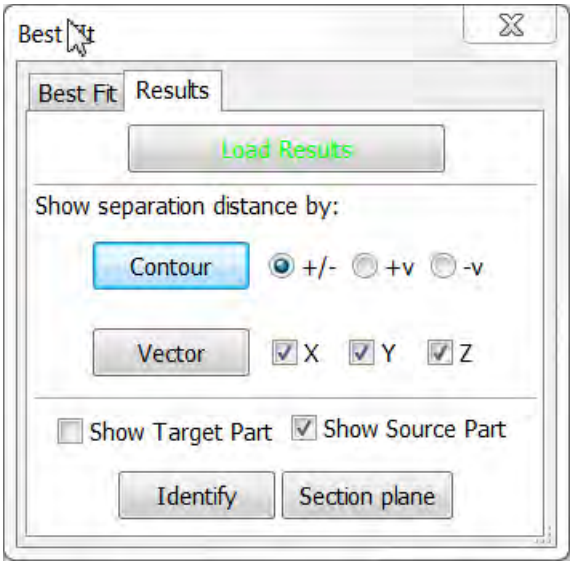


Figure 4. Loading LS-DYNA results into the GUI.

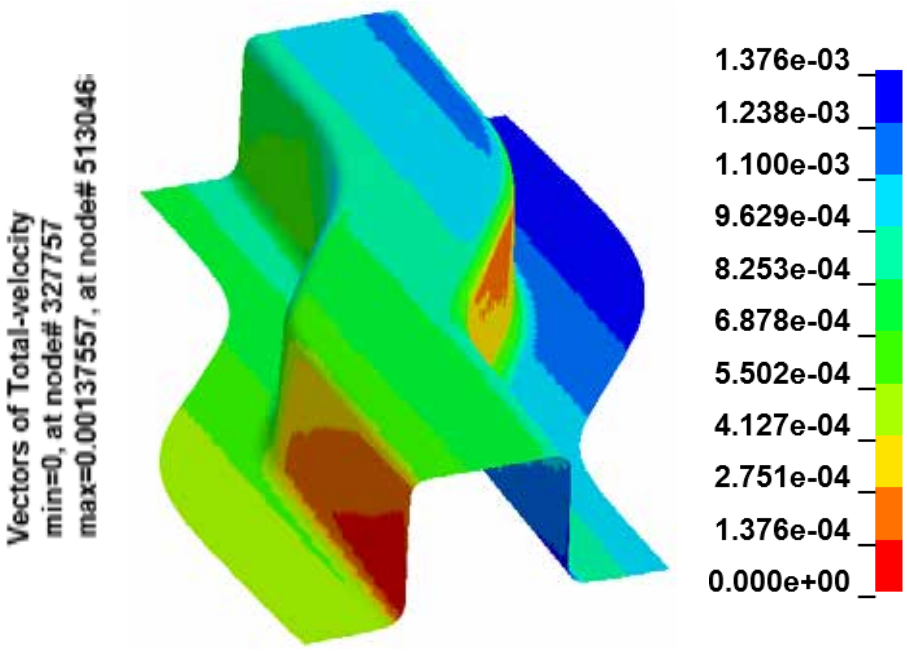


Figure 5. Color contour display of separation distances after best fitting.

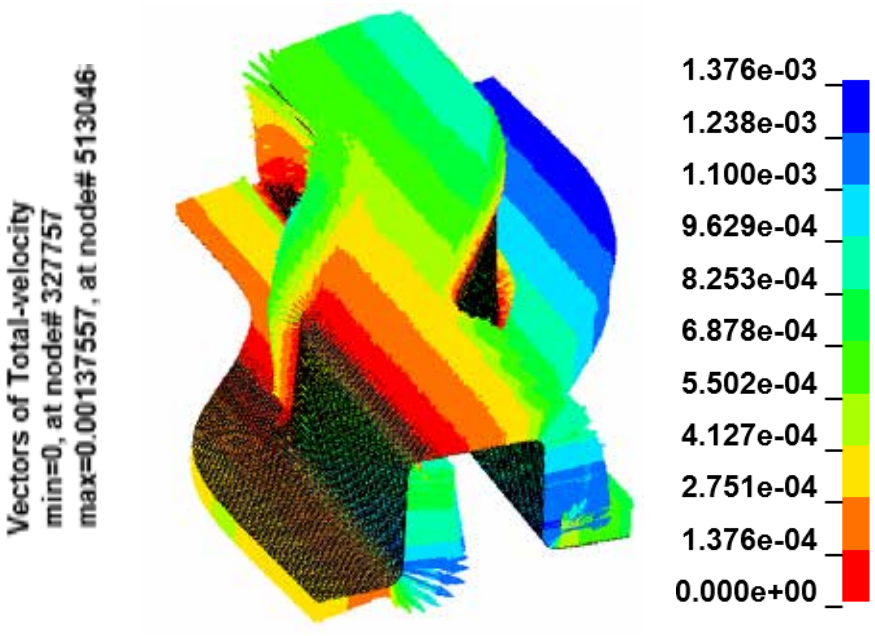


Figure 6. Vector display of separation distances after best fitting.

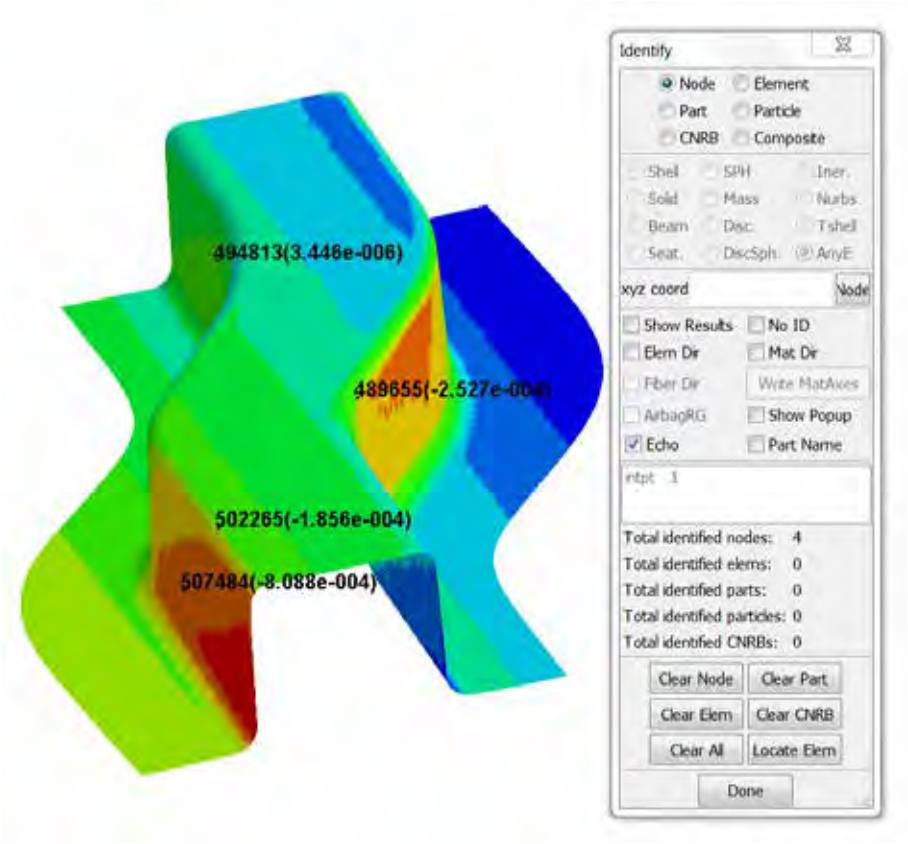


Figure 7. “Identify” separation distances between source and target parts.

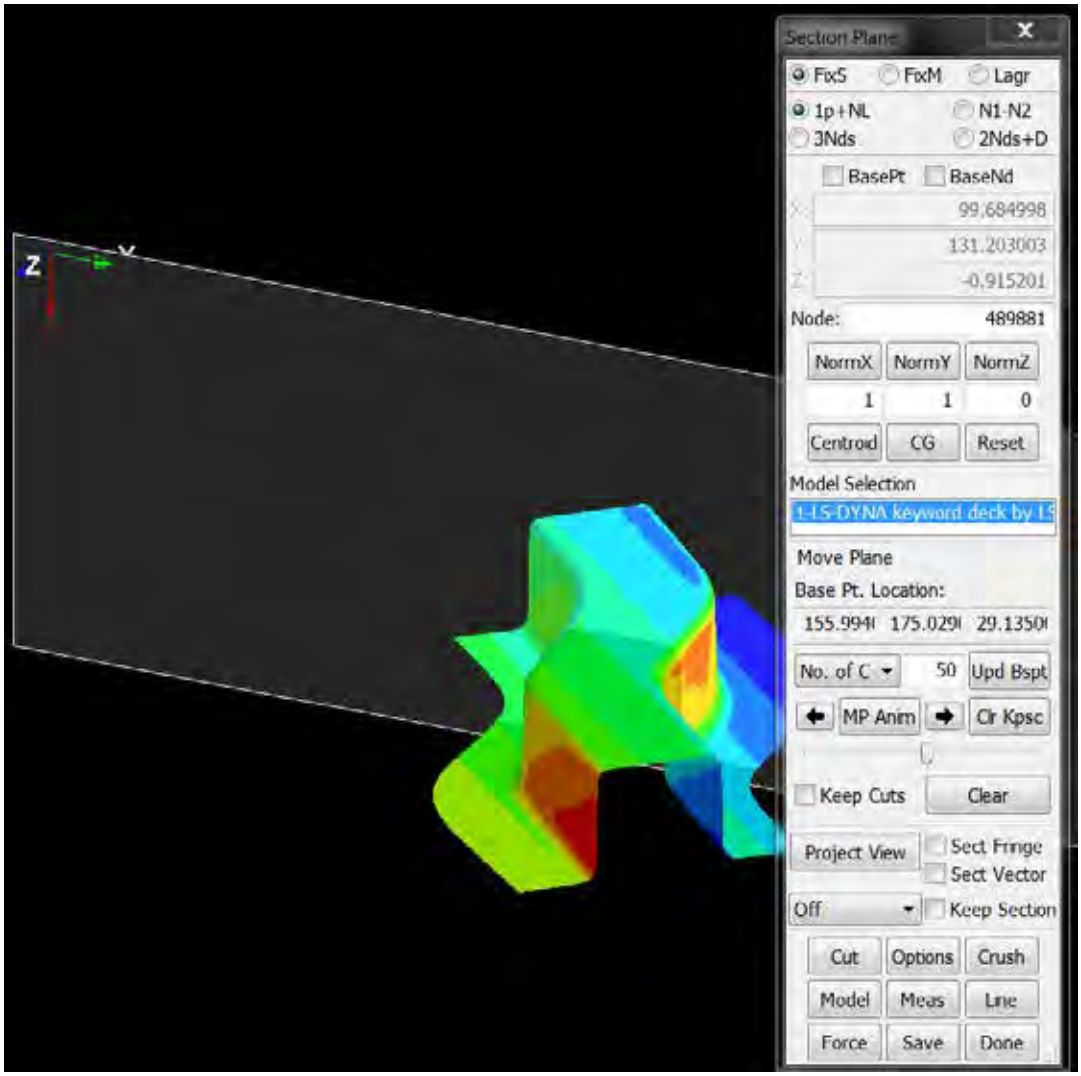


Figure 8. “Section Plane” takes you directly to the menu option for section cuts.

bestfit.out	7/7/2017 5:30 PM	OUT File	9,608 KB
bestfitcontrol.k	7/7/2017 5:29 PM	K File	1 KB
bestfitcontrol_source.k	7/7/2017 5:29 PM	K File	6,376 KB
bestfitcontrol_target.k	7/7/2017 5:29 PM	K File	6,376 KB

Figure 9. Input files generated by LS-PrePost for LS-DYNA best fit execution.

Modeling and Numerical Simulation of Afterburning of Thermobaric Explosives In a Closed Chamber

Kyoung su Im, Grant Cook, Jr., and Zeng-Chan Zhang
Livermore Software Technology Corp.

INTRODUCTION

Heterogeneous combustion (i.e., solid and gas or liquid and gas) has a wide range of applications such as solid rocket propulsion, combustion instability control, underwater explosion, and high energy explosion [1-4]. Among several possible combinations, the thermobaric explosive (TBX) composed of trinitrotoluene (TNT) and energetic metal particles (typically aluminum) is a widely used explosive and is of great importance in the safety, mining, and defense industries.

TBX (a thermobaric explosive) is defined as "a partially detonating energetic material with excess fuel (gas, solid or liquid) dispersed and mixed into air with subsequent ignition and reaction achieved in time and in place for added gain of energy, blast and heat." As such, TBX has greatly enhanced thermal and blast effects compared to conventional high explosives [5].

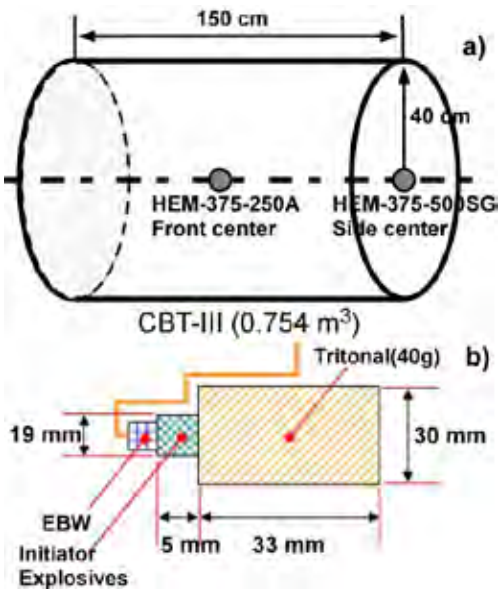
In TBX flow, thermobaric effects are obtained by long-duration overpressure and heating due to the afterburning of detonation products in air. Since the afterburning process is controlled by turbulent mixing and combustion in air after detonation or dispersion by a bursting charge, even the identical explosive composition may yield different thermal and blast performance with different targets. Therefore, the detailed understanding of the afterburning mechanism is required to optimally design warheads for various operational environments. To this end, TBX module has been implemented in in LS-DYNA®

MODEL VALIDATION WITH EXPERIMENT

Experiments in present investigation were carried out using a closed bomb test (CBT) chamber for model validation of the TBX afterburning processes. Figure 1 shows the schematics of the experimental chamber and an initial charge of TBX. The CBT chamber has a dimension of 40 cm in radius (r) and 150cm in longitudinal length (x) so that the total volume of the chamber is 0.754 m^3. Two pressure gauges (Kulite; HEL-375-250A, and HEL-375-500A) having different sensing capacities were installed: one at the front enter of the cylinder (x=750cm, r= 40cm) and the other at the side center of the cylinder base surface (x=150cm, r= 0cm), respectively. The measured pressure data from the sensors were logged using the data acquisition system, DEWE-500, for analysis of the blast performance.

The cylindrical (30 mm in diameter and 33mm in length) Tritonal TBX charge weighs 40g and consists of well mixed TNT (80%) and aluminum particles (20%, with an average diameter of 10μm). The main charge, combined with the blast cap (5g booster explosives of TNT compounds) and the exploding bridge wire (EBW) shown in Fig. 1(b) was initially located at the CBT center (x=75cm, r=0cm) of the CBT chamber for each experiment. Several experiments were conducted to obtain reliable data sets, and three data sets were collected with less than 10% standard relative error (SRE) from the average at each time instant. The pressure histories after explosion are illustrated in Fig. 2 at the side (a) and front center (b) of the CBT chamber.

Figure 2 shows the TBX validations with the pressure data sets for the side and front center position between the simulation results and averaged experimental data. Figure 2(a) and (b) illustrate the pressure history at the side and front center, respectively, and Figure 2(c) and (d) show the corresponding impulse, which is defined as pressure integrated over time. It is clear that the simulation results are in excellent agreement with the experimental data over the time ranges. At earlier time, the peak pressures slightly overshoot the measured data. In general, when the metal particles contribute to the afterburning in TBX, the peak pressure becomes lower but the impulse tends to be higher as the chamber pressure lasts longer than that of normal high explosives.



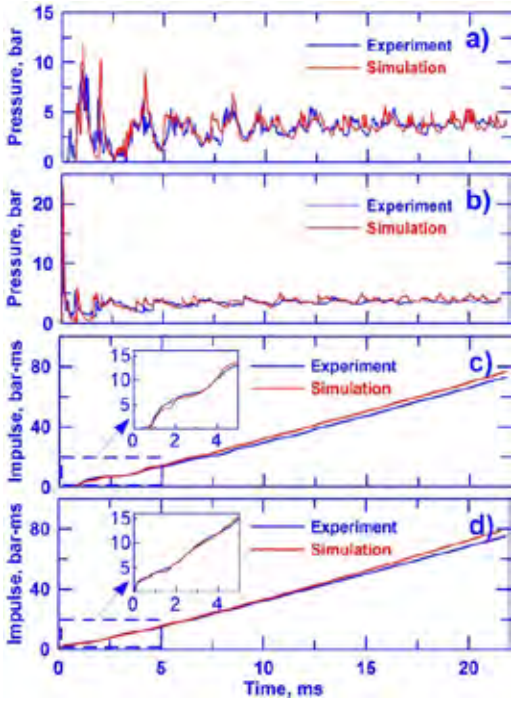


Figure 1 **Figure 2**

Figure 1 Schematics of the experimental closed bomb test chamber and the structure of the initial TBX: a) closed bomb test chamber with volume of 0.754 m^3 with two pressure sensing positions at front and side center, and b) the TBX charge structure consists of 40g of Tritonal and a blasting cap (initiator explosives, and an exploding bridge wire (EBW)).

Figure 2 Comparisons between measured data and simulation at the side and front center positions: a) and b) are the pressure histories, c) and d) are the impulses versus time.

BLAST PERFORMANCE

Prior to TBX simulation, the homogeneous calculation with only TNT explosive was conducted to better understand blast wave propagation and also to validate the developed code. Detailed geometrical setups and initial conditions can be found in Ref. [6]. Although the results are not provided, the over pressure histories in time [6] was validated as a preliminary calculation.

Figure 3 shows consecutive snapshots of the temperature distributions at different time instants showing the blast wave propagation procedures. After symmetric propagation and flame separation from a leading shock in Fig. 3(a) and (b), the shock wave hits the side walls and is reflected (Fig. 3(c)). Then, the flame starts to randomly mix as shown in Fig. 3(d)~3(f). At later times, the flames become more chaotically mixed as seen in Fig. 3(g)~3(i).

When the blast waves arrives at the side center, the pressure immediately peaks to its maximum value, and the reflected wave from the cylinder wall results in the subsequent peaks as the process repeats, conjugates, and dissipates until the pressure converges to an elevated value, but still with considerably noisy patterns after 5ms from the initial explosion.

PARTICLE DYNAMICS

Figure 4 illustrates the effects of particle dynamics on aluminum vaporization by varying the initial conditions such as mono-dispersed and Rosin-Rammler distributions, and different particle mean diameters, 10μm, 20μm, and 40μm. The mono-dispersed distributions show a higher rate of vaporization in all cases. The deviations from the vaporization curves between the distributions are reduced with increasing diameter and eventually, there is little difference in the 40μm cases, in which the size distribution is no longer important in confined explosions. It is also obvious that the vaporization rates decrease almost linearly with increasing diameter. At 10 μm, the particle

vaporization is about 80% of the initial aluminum particle mass. With doubled diameter, it is approximately reduced by factor of two. At 40 μm, it is cut down another half, much less than 20%. From these observations, the maximum contribution of metal combustion to the afterburning performance occurred at small particle diameter. But there might be a critical diameter to optimize the afterburning performance. Therefore, the proper selection of the particle diameter is of paramount importance in the manufacturing process of TBX.

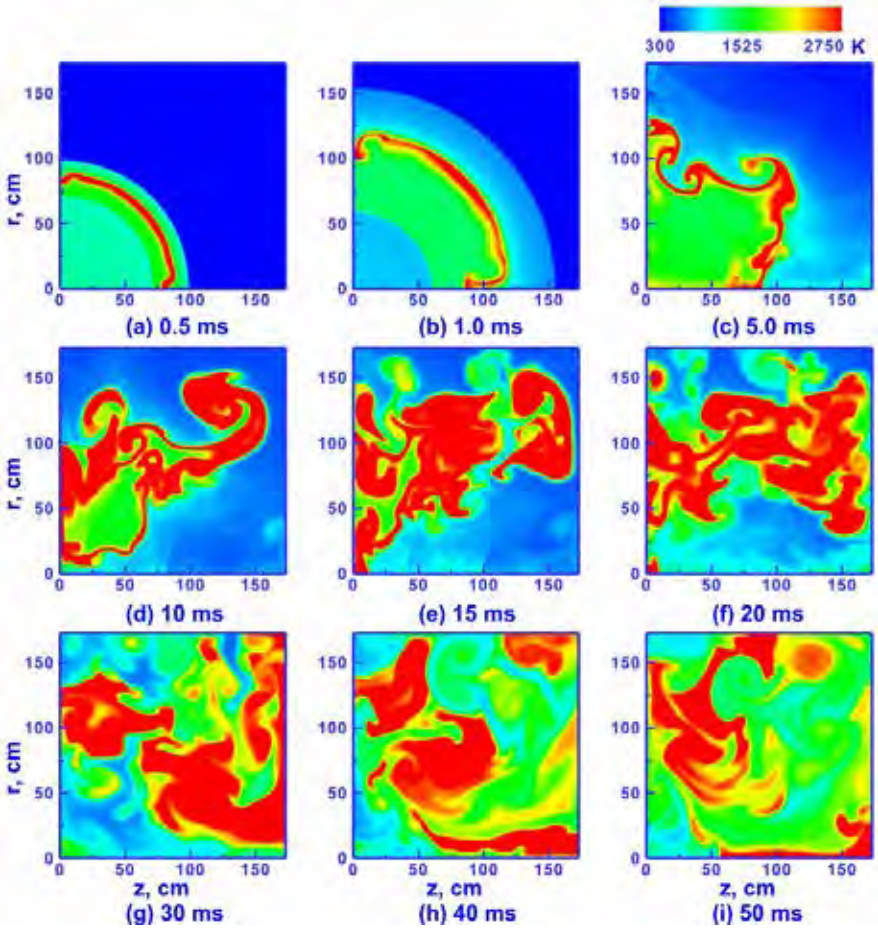


Figure 3 Consecutive snapshots of the temperature distributions at different time for the blast propagation.

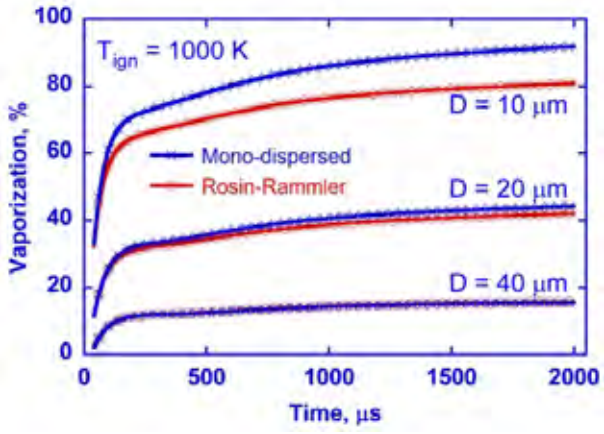


Figure 4 Aluminum vaporization rate according to particle distribution and different particle diameters.

INFORMATION: HOW TO USE

1. Prepare the chemistry input file (*.inp) and thermodynamics data files (thermo.dat) participated combustion species in the calculation.
2. Select the metal partice and set the initial condition using *STOCHASTIC_TBX_PARTICLES.
3. Set initial conditions and chemistry composition for the calculations.
4. Run the code to get the blast performance or TBX flow properties.

CONCLUSION

The present investigation has demonstrated an accurate and concrete model developed for the afterburning process of TBX combustion in conjunction with experimental validation in a confined chamber. The simulation for the afterburning of TBX, validated by the experimental data, clearly revealed the importance of the blast performance and particle dynamics, which should find broader applications in related industries by using the CE/SE and Chemistry solver in LS-DYNA.

REFERENCE

1. K. Kim, W. Wilson, J. Colon, T. Kreitinger, C. Needham, et. al., “Non-ideal explosive performance in a building structure,” WIT Transaction on The Built Environment, 87, pp. 515-524, 2006.
2. J. Massoni, R. Saurel, A. Lefrancois, and G. Baudin, “Modeling spherical explosions with aluminized energetic materials,” Shock Waves, Vol. 16, pp. 75-92, 2006.
3. E. W. Price, K. J. Kraeutle, J. L. Prentice, T. L. Boggs, J. E. Crump, and D. E. Zurn, “Behavior of Aluminum in Solid Propellant Combustion,” NWC TP 6120, 1982.
4. C.-K. Kim, J. G. Moon, J.-S. Hwang, M.-C. Lai, and K.-S. Im , “Afterburning of TNT Explosive Products in Air with Aluminum Particles”, AIAA Paper 2008-1029, 2008
5. A. L. Kuhl, R. E. Ferguson, and A. K. Oppenheim, "Gasdynamics Model of Turbulent Exothermic Fields in Explosions," Progress in Astronautics and Aeronautics Series, 173,AAA, Washington, D.C, pp. 251-261, 1997.
6. D. Schwer, and K. Kailasanath, “Blast Mitigation by Water Mist (1) Simulation of Confined Blast Waves,” Technical Report NRL/MR/6410-02-8636, 2002.