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**BETA CAE**

**Predictive  
Engineering**

**LS-DYNA  
On Line**

**June 12 -14 2016**

**14<sup>th</sup> LS-DYNA International  
Users Meeting & Conference**



**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

FEA Information Engineering Journal

FEA Information China Engineering Solutions

**Livermore Software Technology, Corp. (LSTC)** Developer of LS-DYNA One Code Methodology.

LS-DYNA provides fully integrated, strongly coupled, solvers for extensive multiphysics capabilities. Integrated, at no additional cost. Optimized for shared and distributed memory for Unix, Linux, & Windows Based platforms.

**FEA Information Engineering Solutions – Dedicated To:**

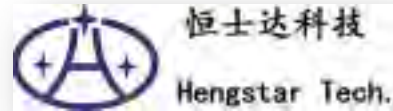
Finite Element Analysis \* Hardware \* Software \* Cloud \* Consulting \* CAD \* CAE  
Distribution\* \* Implicit \* Explicit \* Applications \* Press Releases \* Events \* Training



**FEA Information**  
Platinum Participants

logo courtesy - Lancemore





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## Announcements

**June 3, 2016** - BETA CAE Open Meeting in Turkey  
Byotell Hotel, Istanbul - hosted by A-Ztech

### **June 12- 14 – 14<sup>th</sup> International LS-DYNA Users Meeting & Conference**

More than 150 technical presentations;

#### **June 13<sup>th</sup> - Plenary and Keynote Addresses by:**

Kenneth J. Bonello, Senior Manager- Safety CAE and Pedestrian Protection  
Safety CAE and Pedestrian Protection, General Motors

Nand Kochhar, Global Safety Chief Engineering & Executive Technical Leader,  
CAE Ford Motor Company

David J. Benson, University of California, San Diego

Paul Du Bois, Consultant

Philip Ho, Developer, LSTC

Facundo Del Pin, Developer LSTC

#### **June 14<sup>th</sup> - Closing Session**

“Recent and Ongoing Developments in LS-DYNA®”

Speakers

John O. Hallquist	Thomas Borrvall	Thomas Klöppel
Chi-Hsien Wang	Cheng-Tang Wu	Inaki Caldichoury
Xinhai Zhu	Isheng Yeh.	

-

**See you at the Conference, Please stop by and say hello!!**

**Sincerely,**

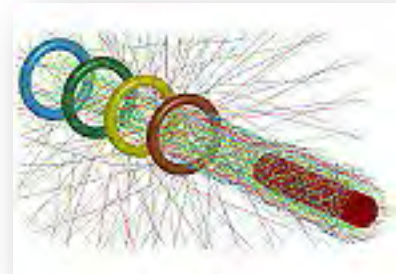
*Marsha Victory Trent Eggleston*

*Marnie Azadian Suri Bala Dilip Bhalsod Yanhua Zhao*

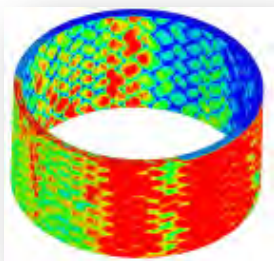
### MANUFACTURING PROCESSES



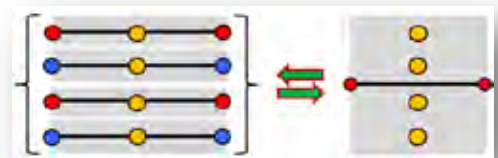
Multiple manufacturing processes can be simulated including draping, weaving, braiding, infiltration, Resin Transfer Molding (RTM)



### MAPPING



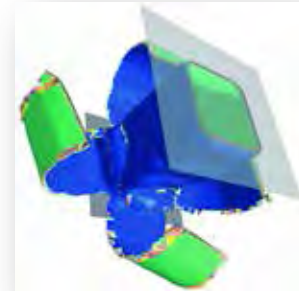
Tools are available to map between different scales



### CRASH ANALYSIS



Various failure modes are available to predict crash behavior of composite structures



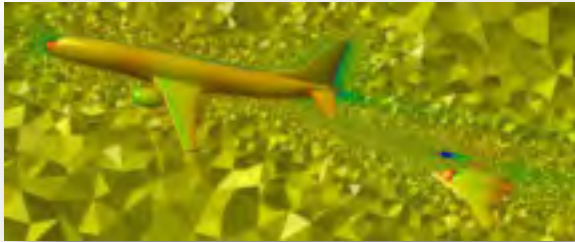
For additional information, email: [sales@lstc.com](mailto:sales@lstc.com)



[www.lstc.com](http://www.lstc.com)



Join us at Booth 201 – 14<sup>th</sup> LS-DYNA International Users



BETA CAE Systems S.A. announces the release of the version 16.2.0 of the ANSA / Epsilon / μETA suite

**About this release** - BETA CAE Systems S.A. announces the release of the version 16.2.0 of the ANSA / Epsilon / μETA suite with new tools and capabilities to further augment functionality and facilitate CAE processes. The most important additions and fixes implemented in v16.2.0 are listed below.

#### Enhancements in ANSA

- General - Undo/Redo is also available while selecting or deselecting model entities, either from working area or from lists. - Model entities chosen for Show Only can now be automatically fit to screen.
- CAD to ANSA Translators - The translation capabilities for reading neutral CAD files have been expanded with the option to select the CT library.
- Connections - The existing functionality of ANSA connections creation has been enriched with the conversion of NASTRAN CWELDS elements to seamlines. - The capabilities of ANSA connections' handling have been expanded in RBE3-CELAS1-RBE3 & RBE3-CBUSH-RBE3 representations, which can now generate zero-body elements as well.
- Meshing - Shell Mesh: The Grids[Align] function provides now the direct alignment on complex curved lines, when selecting more than 3 points. - Volume Mesh: The additional supported parameters of the script function AdvancedLayersParameters provide an efficient control of the layers generation. - Batch Meshing: CFD mesh generation with proximity areas is now further accelerated.
- Composites - Laminate Tool: Draping results can be accomplished with the Sliding algorithm as well.
- Checks - The Penetration>Intersections fix has been improved with the option to control the movement of nodes by freezing specific areas. - Processing time has been significantly reduced by using multiple cores for checking contacts and penetrations (property thickness, user thickness, distance range).
- NASTRAN - THERMAL: A new wizard-based assistant automates the Thermal analysis model set up.
- LS-DYNA - The substructuring analysis has been introduced for LS-DYNA.



- ANSYS - Multiple Control Cards can be handled in the same model.
- MORPH - A new function has been added to quickly modify the tubes' diameter through the enhanced Direct Morphing functionality.

### Known issues resolved in ANSA

- Topo - Scripting: Extraction of middle skin surfaces using the function Base.Skin() would stop when an already skinned part was found.
- Volume Mesh - Cavity: In certain cases the Hexa Dominant generator would fail to project on the seats.
- LS-DYNA - AIRBAG: The field NP of the \*AIRBAG\_PARTICLE would accept float values.
- NASTRAN - The selection of the second node set during the creation of line elements or MPCs would occasionally be unavailable after the first use.
- NVH Console - The performance of the Load Case Manager would occasionally be poor, when handling big models.
- Abaqus - DLOADs applied on continuum shells would not be drawn.

For more details about the new software features, enhancements and corrections please, refer to the Release Notes document.

### Enhancements and known issues resolved in μETA

#### Enhancements in μETA

### Supported Interfaces

- Support of the initial Ids of hierarchically structured geometries (Abaqus, PAM-CRASH and RADIOSS sub-structured by parts, modules and id pools respectively)
- **Abaqus** v2016.
- **ADINA** 10.2 Contact results from OP2 files.
- **ANSYS** COMBIN elements. - Support of the NLOC option of LS-DYNA \*PART\_COMPOSITE -
- Support of intermediate Stress results (NLOPRM OUTCTRL = INTERM) from NASTRAN OP2 files.
- **NASTRAN** 2016 results of Normal Velocity (NVELOCITY) and Vibration Intensity (VINTENSITY)
- **PAM-CRASH Implicit second order elements.** Support of the reading of Stiffness, Damping & Mass sensitivities as Curve results from NASTRAN OP2 files. Von Mises Bending and Von Mises Membrane results from PAM-CRASH ERF files. Support of RadTherm Thermal Links as SETs. Support of streamlines for Ensignt adaptive mesh.
- **Results Loading** -- New options have been added for loading Displacements / Velocities / Accelerations results on Cylindrical / Spherical local coordinate systems.
- **Drawing Styles** - Increased drawing performance when Entities mode is selected for model coloring. New Pcomp Zones drawing style

- **Queries** - Part properties are now read and displayed when identifying a part. Significant performance improvement of the Advanced Filter execution on big models.
- **NVH Calculators** - The performance of FRF Assembly tool has been improved.
- **Video post processing** - Improvements and new features for tracking results on videos such as, the capability to copy track points between videos in different windows, new options for plotting tracked results as curves, and context menu added on tracked points.
- **File Output** - Improved performance for saving compressed project files (both Lossy and Lossless).
- **Composites** -- Improvements and new features in CompositePost toolbar including the report generation for selected parts in Laminate Tool, the display of Material/Fiber orientation as continuous lines, and the support of ANSA LAMINATES.
- **Wing Deflection post processing** - A new toolbar, the WingDeflectionPost, to create Warping, Profile position, Profile position, Section deformation, and Force plots based on the deformation of the wing.
- **Results Loading** - Files located in folders with very long names could not be accessed on MS-Windows. MS-Windows filepaths with slashes and backslashes were considered to be different.
- **Units Conversion** - Wrong factor would be used for Units conversions from/to tons.
- **Curve Functions** - BrIC calculation was not correct when curves were not in SI unit system.
- **NVH Calculators** - Responses calculated from FRF Assembly for multiple frequency ranges might not be correct.
- For more details about the new software features, enhancements and corrections please, refer to the Release Notes document.

### Compatibility and Supported Platforms

- ANSA files saved by all the first and second point releases of a major version are compatible to each other. New major versions can read files saved by previous ones but not vice versa.
- μETA Project files saved from version 16.2.0 are compatible and can be opened by μETA version 16.0.0 or later. To be readable by μETA versions earlier than v16.0.0, they have to be saved selecting the option "Version <16.0.0".
- Support for 32-bit platform has been discontinued for all operating systems.

### Known issues resolved in μETA

- **Supported Interfaces** - Abaqus \*DISTRIBUTION for defining thickness was not supported correctly.

### **Download - Where to download from**

Customers who are served directly by BETA CAE Systems, or its subsidiaries, may download the new software, examples and documentation from their account on our server. They can access their account through the "user login" link at our web site.

Contact us if you miss your account details. The [ PublicDir ] link will give you access to the public downloads area.

Customers who are served by a local business agent should contact the local support channel for software distribution details.

### **What to download**

All files required for the installation of this version reside in the folder named "BETA\_CAE\_Systems\_v16.2.0" and are dated as of April 28, 2016. These files should replace any pre-releases or other files downloaded prior to that date.

The distribution of this version of our pre- and post-processing suite is packaged in one, single, unified installation file, that invokes the

respective installer and guides the procedure for the installation of the required components.

For the installation of the software on each platform type, the.sh installer file residing in the folder with respective platform name, for Linux and MacOS or the respective .msi installer file for Windows, 64bit, have to be downloaded.

In addition to the above, optionally, the μETA Viewer is available to be downloaded for each supported platform.

The tutorials and the example files reside in the folder named "TUTORIALS". This folder includes the complete package of the tutorials and example files, and a package with only the updated ones.

The Abaqus libraries required for the post-processing of Abaqus .odb files are included in the installation package and can be optionally unpacked.

Earlier software releases are also available in the sub-directory called "old" or in a folder named after the product and version number.

## Matereality® Version 10 Release

Marcia Swan - [swan@datapointlabs.com](mailto:swan@datapointlabs.com)

Join us at Booth 103 – 14<sup>th</sup> LS-DYNA International Users & Conference

Matereality® Version 10 Eases Data Import, Supports Enterprise Simulation Workflows, and Enables Roles Management



*Process Workflow for CAE*

Ithaca, NY USA - Matereality's Version 10 release provides new software components for its enterprise installations, including bulk data loading capabilities and enhanced material parameter conversion support for LS-DYNA® and Altair® RADIOSTM material models. The release delivers tools to manage the CAD/PLM/CAE materials workflow and customize role-specific user experiences, and expands the authorship layer for creating and disseminating technical documentation.

Company data is often contained in many isolated tables and databases which must be consolidated into the enterprise-wide system. This tedious process, a hurdle for enterprise-wide adoption, is greatly eased with the Simple Loader, a new app which enables bulk loading of tables of single-point property data from Excel, greatly speeding up the capture of large quantities of data. It is now possible to rapidly populate a materials database with relevant information of the enterprise. In addition to importing property data, bulk loaders are available to import lists of materials and specifications to Matereality's data libraries, making them more complete and meaningful.

### Material Model Parameter Conversion

Incorporating a new software framework, Matereality v10 handles increased demand for

material model parameter conversion. Support for LS-DYNA MAT\_089 and MAT\_019 is now available with graphical drag-and-drop capability to tune and extrapolate plasticity curves as well as rate-dependency parts of these models. Support for Altair's RADIOSTM explicit solver has also been initiated with a CAE Modeler module for its commonly used Law 36. "We continue to devote resources to this important task of incorporating materials into simulation, bringing years of DatapointLabs experience to simplify this complex and sometimes confusing process," says Hubert Lobo, DatapointLabs founder and Matereality CTO. "For those of our clients who perform their own parameter conversion, a standard export from our software allows them to locate the right data and supply it to their own macros for streamlined data processing."

"We continue to devote resources to this important task of incorporating materials into simulation, bringing years of DatapointLabs experience to simplify this complex and sometimes confusing process."

—Hubert Lobo, DatapointLabs founder and Matereality CTO

Many enterprises have initiatives to bring simulation into the product development mainstream. An important process step is to ensure that the correct material models are used in the simulations. Matereality's CAE Materials library documents and stores material model files linked to the correct material or specification names used in PLM software. These stored material model files can be organized into Master Material files for export into Altair HyperWorks® and Beta CAE's ANSATM pre-processors. There, the files can be assigned to parts based on material IDs assigned from the bill of materials (BOM), ensuring consistent use of material models, even across globally distributed design teams.

### **Dashboards and Roles Management**

Because of the diversity of users who need to interact with material information, it is important to create user experiences that correspond to their roles within the enterprise.

The new roles manager framework allows system administrators to individualize dashboards, to present data and software tools of specific value to materials engineers, CAE experts, designers, and other professionals in their enterprise.

### **Expanded Authoring Capabilities**

For added traceability, the new release provides text editing capabilities for documentation of the test methods used for property measurement. Test methods are displayed alongside properties and data certificates, so that engineers have all the information related to a piece of data available at their fingertips. Additionally, enterprise installations can author their own technical documentation, including instructions, how-to videos, and technical papers related to materials. A Knowmats app has been added to provide open access to a knowledge repository that has been set up to collect and disseminate knowledge related to the topic of "materials in simulation."

### About Matereality

Matereality® Software for Materials gives manufacturing enterprises the means to build a centralized, secure materials knowledge core to store properties, CAE material files, specifications, and material information on any material. The built-in suite of web-based software helps engineers visualize and understand material data, create CAE models and manage materials information. The company also operates private and public material databases on the cloud. Matereality's ready-for-deployment, patented technology provides material databases and solutions for different needs, budgets and company sizes: a Personal Database for the single user, a

Workgroup Database for small groups, and Material Data Servers for the enterprise.

Matereality is the software arm of DatapointLabs Technical Center for Materials, which provides accurate material testing, material parameter conversion and validation services for CAE, allowing companies to populate their databases with high-quality, application-ready data for design and new product development. Together, the companies form a comprehensive resource to strengthen the materials core of manufacturing enterprises.

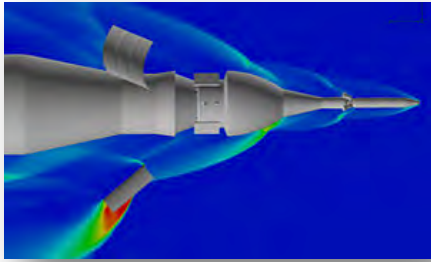
For more information, visit [www.matereality.com](http://www.matereality.com), telephone +1-607-257-1784, or send email to [info@matereality.com](mailto:info@matereality.com).

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Email: [leichtenstern@datapointlabs.com](mailto:leichtenstern@datapointlabs.com)

## CRM Solutions was featured in NASA's SLS Highlights newsletter



CRM Solutions was featured in NASA's SLS Highlights newsletter

See the feature on page 5 –

[http://crmsolutionsinc.com/sls\\_highlights\\_august\\_2015.pdf](http://crmsolutionsinc.com/sls_highlights_august_2015.pdf)

**EDITOR'S NOTE: Every month, Space Launch System Highlights turns the spotlight on one of the many industry partners helping to create the largest rocket ever built for human space exploration. In this issue, we profile CRM Solutions Inc. of Huntsville, Alabama.**

Headquartered in Huntsville, Alabama, CRM Solutions Inc. is a small business providing engineering services since 1997 in support of NASA and Department of Defense launch vehicles. CRM began with a group of subject-matter experts in computational fluid dynamics (CFD), all with strong backgrounds in commercial CFD-code development. CFD uses mathematics, physics and computational software to predict how a gas or liquid flows, as well as how the gas or liquid affects objects as it flows past them.

In the years since its inception, company expertise has evolved to encompass almost all technical areas required for launch vehicle engineering analysis. CRM helped pioneer computational studies for multiple, moving-body problems such as stage and separation events.

For NASA's Space Launch System, CRM has recently partnered with Teledyne Brown Engineering of Huntsville, providing and leading a systems analysis team for the Launch Vehicle Stage Adapter (LVSA). Current

contributions span a large technical spectrum, including simulation of the shared-volume environment between the Interim Cryogenic Propulsion Stage (ICPS) and the LVSA from roll-out through core stage separation. The shared-volume environment is the space the LVSA shares with the ICPS.

CRM also models internal pressures during ascent to provide a map of the differences in skin pressure along the primary structure. CFD models have been created to determine how hazardous gasses are distributed within the interior of the structure, to ensure that mixture flammability is not a possibility. The team additionally provides external thermal analysis for LVSA in all phases of flight, and also performs vibration and acoustic analysis and internal acoustic predictions. Finally, CRM performs debris impact analysis to assess and mitigate structural damage.

Finally, in addition to creating a coupled loads model, the team assists in structural and stress analysis of the primary and secondary structures. These types of modeling and analyses are critical to ensuring the structural integrity and performance of the SLS launch vehicle stage adapter.

help@crmsolutionsinc.com 4092 Memorial Pkwy SW, Huntsville, AL 35802

Company website: [www.crmsolutionsinc.com](http://www.crmsolutionsinc.com)

## FEA Information Participants - Exhibiting at the 14<sup>th</sup> LS-DYNA Int'l Conference

Booth 401 – Visit Us!

Sponsoring the conference - Please visit their booths!

Booth	Company	URL
100	Engineering Technologies Associates (ETA)	<a href="http://www.eta.com">www.eta.com</a>
101	ARUP	<a href="http://www.oasys-software.com/dyna/en/">www.oasys-software.com/dyna/en/</a>
103	DataPoint Labs	<a href="http://www.datapointlabs.com">www.datapointlabs.com</a>
105	Rescale	<a href="http://www.rescale.com">www.rescale.com</a>
107	JSOL	<a href="http://www.jsol.co.jp/english/cae">www.jsol.co.jp/english/cae</a>
201	BETA CAE Systems USA, Inc.	<a href="http://www.beta-cae.gr">www.beta-cae.gr</a>
301	Predictive Engineering Associates	<a href="http://www.predictiveengineering.com">www.predictiveengineering.com</a>
303	LS-DYNA On Line	<a href="http://www.lsdyna-online.com">www.lsdyna-online.com</a>
304	CRAY	<a href="http://www.cray.com">www.cray.com</a>
305	ESI North America	<a href="http://www.esi-group.com">www.esi-group.com</a>
400	LSTC & DYNAmore	<a href="http://www.lstc.com">www.lstc.com</a> <a href="http://www.dynamore.de">www.dynamore.de</a>
401	FEA Information Inc.	<a href="http://www.feainformation.com">www.feainformation.com</a>
403	Penguin Computing	<a href="http://www.penguincomputing.com">www.penguincomputing.com</a>
404	Dell	<a href="http://www.dell.com">www.dell.com</a>



## FEA Information & Distributors hosting the Reception at the Conference

FEA Information Inc. – D3View and below distributors are hosting the on June 12<sup>th</sup>.

Appetizers, Soda/Beer/Wine will be served.

US	DYNAMAX	Bruce Zhang	<a href="mailto:bruce@dynamax-inc.com">bruce@dynamax-inc.com</a>
Canada	MFAC	Chris Gailbrath	<a href="mailto:galb@mfac.com">galb@mfac.com</a>
France	DynaS+	Vincent Lapoujade	<a href="mailto:v.lapoujade@dynasplus.com">v.lapoujade@dynasplus.com</a>
Germany	DYNAmore GmbH	Uli Franz	<a href="mailto:Uli.franz@dynamore.de">Uli.franz@dynamore.de</a>
Germany	CADFEM GmbH	Uli Stelzman	<a href="mailto:ustelzmann@cadfem.de">ustelzmann@cadfem.de</a>
China	Dalian Fukun Tech. Dev. Corp	Yanhua Zhao	<a href="mailto:yanhua@lstc.com">yanhua@lstc.com</a>
China	Hengstar	Honsheng Lu	<a href="mailto:hongsheng@hengstar.com">hongsheng@hengstar.com</a>
China	Arup		
India	Kaizenat Technologies Pvt. Ltd.	Ramesh Venkatesan	<a href="mailto:ramesh@kaizenat.com">ramesh@kaizenat.com</a>
India	Oasys Ltd. India	Lavendra Singh	<a href="mailto:Lavendra.singh@arup.com">Lavendra.singh@arup.com</a>
S. Korea	THEME Engineering	Woosik Chung	<a href="mailto:wschung@kornet.net">wschung@kornet.net</a>
S. Korea	KOSTECH	Hyung-Joo Lee (James Lee)	<a href="mailto:leehjoo@kostech.co.kr">leehjoo@kostech.co.kr</a>
Sweden	DYNAmore Nordic	Marcus Redhe	<a href="mailto:marcus.redhe@dynamore.se">marcus.redhe@dynamore.se</a>
UK	Oasys, Ltd.		

**Early discounted registration through June 30<sup>th</sup>**

**Aug 15-17 Mon-Wed**

ALE/Eulerian, Fluid/Structure Interaction in LS-DYNA CA

**Aug 18-19 Thur-Fri**

SPH: Smoothed Particle Hydrodynamics in LS-DYNA CA

## **Introduction to Eulerian and Lagrangian Formulations**

- ALE smoothing algorithms
  - Simple Average
  - Volume Weighting
  - Equipotential
- Advection Algorithms
  - First order donor SALE algorithm
  - Second order Van Leer
  - Second order + Half Index shift
- Material and void
  - Advection algorithm in voided material
- Multi-material formulation
  - Advection in multi-material formulation
  - Pressure equilibrium
- Fluid/Structure Coupling
  - The ALE Fluid/Structure coupling
  - The automatic Fluid/Structure coupling
  - The momentum coupling
  - The penalty coupling

## Cray Targets Enterprise Big Data With New Open Agile Analytics System



Cray Urika-GX System Harnesses Supercomputing Performance to Tackle Big Data Analytics. The Cray® Urika®-GX system -- the first agile analytics platform that fuses supercomputing technologies with an open, enterprise-ready software framework for big data analytics.

**Booth 304 - Join Cray at the 14<sup>th</sup> Int'l LS-DYNA Users Meeting & Conference**

SEATTLE, WA -- (Marketwired) -- 05/24/16 -- Global supercomputer leader Cray Inc. (NASDAQ: CRAY) today announced the launch of the Cray® Urika®-GX system -- the first agile analytics platform that fuses supercomputing technologies with an open, enterprise-ready software framework for big data analytics. The Cray Urika-GX system gives customers unprecedented versatility for running multiple analytics workloads concurrently on a single platform that leverages the speed of a Cray supercomputer.

The size, scope, and complexity of big data analytics is exploding and creating problems for customers who are already struggling with cluster sprawl, a torrent of new applications, and increasing pressure to deliver faster insights. The Cray Urika-GX system is designed to eliminate these challenges of big data analytics. Cray's new agile analytics platform combines the unique scale and

throughput capabilities of Cray supercomputers with the convenience of an appliance, the flexibility of industry-standard hardware, and an open software framework that enables customers to innovate as they run existing and emerging analytics workloads. The Cray Urika-GX system gives customers a powerful tool for delivering high-frequency insights.

Optimized for demanding analytics workloads, the Cray Urika-GX system is pre-tested and pre-integrated with the Hortonworks Data Platform providing Hadoop® and Apache Spark®, as well as the Cray Graph Engine, designed for solving the largest and most complex graph analytics problems. The system includes enterprise tools, such as OpenStack for management and Apache Mesos for dynamic configuration -- all designed to protect customers' investments in the rapidly-changing big data software landscape.

## Cray Targets Enterprise Big Data With New Open Agile Analytics System

"The Urika-GX is a dynamic analytics solution that brings out the best of Cray's decades of expertise in providing our customers with world-class systems for data-intensive computing," said Peter Ungaro, president and CEO of Cray. "Customers have asked us to blend the unique features of our product lines into a single platform for data analytics.

We took the Aries system interconnect from our supercomputers, the industry-standard architecture of our clusters, the scalable graph engine from the Urika-GD appliance, and the pre-integrated, open infrastructure of our Urika-XA system and combined them into one agile analytics platform. The Urika-GX gives our customers the tool they need to overcome their most advanced analytics challenges today, and the platform to bridge to tomorrow."

Cray Urika-GX systems are currently being used by multiple Cray customers across the life sciences, healthcare, and cybersecurity industries. The Broad Institute of MIT and Harvard, a non-profit research institute aimed at advancing the understanding and treatment of disease, is currently using the Cray Urika-GX system for analyzing high-throughput genome sequencing data.

"With the Cray Urika-GX, we had quality score recalibration results from our Genome Analysis Toolkit (GATK4) Apache Spark pipeline in nine minutes instead of forty minutes," said Adam Kiezun, GATK4 Project Lead at the Broad Institute. "This highlights the potential to accelerate delivery of genomic insights to

researchers who are making breakthroughs in the fight against disease."

An exclusive feature of the Cray Urika-GX system is the Cray Graph Engine for fast, complex iterative discovery. Graph analytics has long been understood to pose some of the most difficult scaling and performance challenges for modern analytics systems. The Cray Graph Engine on the Urika-GX system, originally developed for the Cray Urika-GD Graph Discovery appliance, is typically ten to 100 times faster than current graph solutions for complex analytics operations. The Cray Graph Engine can run at any scale from a single processor to thousands of processors without compromising performance. With the Cray Graph Engine, customers can tackle multi-terabyte datasets comprised of billions of objects. The Cray Graph Engine can run in conjunction with open analytics tools such as Hadoop and Spark, enabling customers to build complete end-to-end analytics workflows and avoid unnecessary data movement.

"Analytics workflows are becoming increasingly sophisticated with businesses looking to integrate analytics such as streaming, graph, and interactive," says James Curtis, Senior Analyst, Data Platforms & Analytics at 451 Research. "An agile analytics platform that can eliminate many of the challenges data scientists face, as well as reduce the time it takes to get an integrated environment up and running has become a requirement for many enterprises."

## Cray Targets Enterprise Big Data With New Open Agile Analytics System

The Cray Urika-GX system features Intel® Xeon® Broadwell cores, 22 terabytes of memory, 35 terabytes of local SSD storage capacity, and the Aries supercomputing interconnect, which provides the unmatched network performance necessary to solve the most demanding big data problems. Three initial enterprise-accessible configurations featuring 16, 32, or 48 nodes delivered in an industry standard 42U 19-inch rack will be available in Q3 2016, and larger configurations will be available in the second half of 2016.

For more information on the Cray Urika-GX system, please visit the Cray website at [www.cray.com](http://www.cray.com).

About Cray Inc.: Global supercomputing leader Cray Inc. (NASDAQ: CRAY) provides innovative systems and solutions enabling scientists and engineers in industry, academia and government to meet existing and future simulation and analytics challenges. Leveraging more than 40 years of experience in developing and servicing the world's most advanced supercomputers, Cray offers a comprehensive portfolio of supercomputers and big data storage and analytics solutions delivering unrivaled performance, efficiency and scalability. Cray's Adaptive Supercomputing vision is focused on delivering innovative next-generation products that integrate diverse processing technologies into a unified architecture, allowing customers to meet the market's continued demand for realized performance. Go to [www.cray.com](http://www.cray.com) for more information.

Safe Harbor Statement: This press release contains forward-looking statements within the meaning of Section 21E of the Securities Exchange Act of 1934

and Section 27A of the Securities Act of 1933, including, but not limited to, statements related to its product development plans, including the timing of availability of Cray Urika-GX systems, the sales prospects of Cray Urika-GX systems and the ability of Cray Urika-GX systems to perform as expected. These statements involve current expectations, forecasts of future events and other statements that are not historical facts. Inaccurate assumptions and known and unknown risks and uncertainties can affect the accuracy of forward-looking statements and cause actual results to differ materially from those anticipated by these forward-looking statements. Factors that could affect actual future events or results include, but are not limited to, the risk that Cray is not able to successfully complete its planned product development efforts related to the Cray Urika-GX within the planned timeframes or at all, the risk that Cray Urika-GX systems do not perform as expected or as required by customers or partners, the risk that Cray will not be able to sell Cray Urika-GX systems as expected and such other risks as identified in the Company's quarterly report on Form 10-Q for the quarter ended March 31, 2016, and from time to time in other reports filed by Cray with the U.S. Securities and Exchange Commission. You should not rely unduly on these forward-looking statements, which apply only as of the date of this release. Cray undertakes no duty to publicly announce or report revisions to these statements as new information becomes available that may change the Company's expectations.

Cray, the stylized CRAY mark and URIKA are registered trademarks of Cray Inc. in the United States and other countries. Other product and service names mentioned herein are the trademarks of their respective owners.

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[pr@cray.com](mailto:pr@cray.com)

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[ir@cray.com](mailto:ir@cray.com)

Source: Cray Inc.

## CAE Associates - May News & Insights

: Christina Capasso Jamerson, Marketing Coordinator



News – Insights – May 2016

Christina Capasso Jamerson, Marketing Coordinator

<https://caei.com/news-insights>

### Our ANSYS Software Sales & Support Area Has Grown!

May 26, 2016 / Christina Capasso Jamerson, Marketing Coordinator

CAE Associates is proud to announce that our ANSYS Software sales and support region has expanded!

- **Andy Hughes** now covers: all of Massachusetts, Rhode Island, Connecticut and the Hudson Valley.
- **Tony Solazzo** now covers: New Jersey, NYC, Long Island, Eastern Pennsylvania and Northern Delaware.

### CAE Associates Releases Improved rotateView ACT Extension!

May 17, 2016 / Christina Capasso Jamerson, Marketing Coordinator

The technical team at CAE Associates recently updated our extremely popular rotateView ACT extension to allow for rotations about all 3 screen axes. This extension provides the user with precise control over how they want to rotate and view their model. The improved extension now allows the user to rotate about

the screen X and Y axes as well as the previously available Z rotation. We hope you find this app useful and would love to hear your comments!

You can download the extension here.

<https://caei.com/resources/rotateviewwbex>

**TRAINING NOTICE** : USA software in Europe with T. LITTLEWOOD



## METI-09 : Underwater Shock Analysis with USA / LS-DYNA

### Heading

#### METI-09

**Underwater Shock Analysis with USA / LS-DYNA**



#### Goal

To be able to achieve underwater explosions calculations with USA software and understand the theory of the software

#### Location

Toulouse, FRANCE

#### Dates

From 26<sup>th</sup> to 28<sup>th</sup> of October, 2016

#### Trainer

Tom LITTLEWOOD – LSTC

#### Registration information

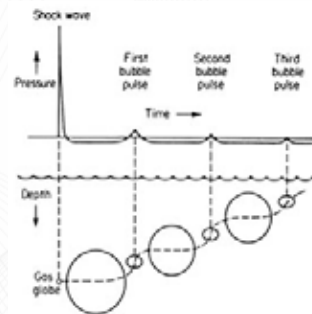
Please contact Mr Thomas BEAL  
[t.beal@dynasplus.com](mailto:t.beal@dynasplus.com) or +33638759799

*English training, written support in English*

### Contents of training

### METI-09

1. Background
2. Doubly Asymptotic Approximation (DAA) Field Solver
3. Nonreflecting Boundary (NRB) Solver
4. Cavitating Acoustic Fluid (CAFÉ) Field Solver (Time Permitting)
5. Miscellaneous Topics



Detailed contents

METI-09

**I. Background**

- 1- Review of physics of underwater explosion (UNDEX) phenomena,
- 2- Overview of USA with respect to UNDEX physics
- 3- Available manuals and other resources

**II. Doubly Asymptotic Approximation (DAA) Field Solver**

- 1- Fluid-structure interaction and DAA background,
- 2- USA/LS-DYNA execution procedure and required inputs,
- 3- Fluid boundary mass model development
- 4- Fluid Boundary mass modeling procedures
- 5- Selection of the DAA Approximation
- 6- Time-integration of DAA solution with LS-DYNA

**III. Nonreflecting Boundary (NRB) Solver**

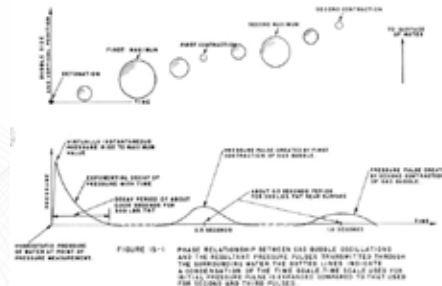
- 1 - LS-DYNA acoustic fluid volume elements
- 2 - Review of \*mat\_acoustic, stability and meshing requirements
- 3 - Discussion and examples of boundary\_acoustic\_coupling\_mismatch
- 4 - Boundary conditions and initial conditions
- 5 - Using USA to initialize and load the \*mat\_acoustic domain
- 6 - Exercises

**IV. Cavitating Acoustic Fluid (CAFÉ) Field Solver (Time Permitting)**

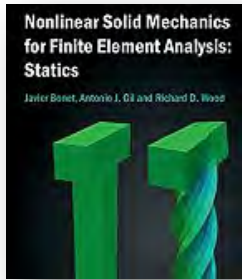
- 1- What is USA CAFÉ solver and how does it differ from LS-DYNA \*mat\_acoustic
- 2- Usage procedure with LS-DYNA
- 3- USA CAFÉ instructions
- 4- Examples and exercises

**V. Miscellaneous Topics**

- 1- In-fluid natural frequency analysis with USA / LS-DYNA
- 2- Exercise
- 3- Hydrostatic loading with DAA, NRB, and CAFÉ solutions
- 4- Exercise
- 5- Resilient mounts and user material models
- 6- Shared memory and massively parallel solutions







**[Nonlinear Solid Mechanics for Finite Element Analysis: Statics Hardcover – September 16, 2016](#)**

by Javier  
Bonet (Author),  
Antonio J. Gil (Author),  
Richard D. Wood (Author)

Designing engineering components that make optimal use of materials requires consideration of the nonlinear static and dynamic characteristics associated with both manufacturing and working environments. The modeling of these characteristics can only be done through numerical formulation and simulation, which requires an understanding of both the theoretical background and associated computer solution techniques. By presenting both the nonlinear solid mechanics and the associated finite element techniques together, the authors provide, in the first of two books in

this series, a complete, clear, and unified treatment of the static aspects of nonlinear solid mechanics. Alongside a range of worked examples and exercises are user instructions, program descriptions, and examples for the FLaGSHyP MATLAB computer implementation, for which the source code is available online. While this book is designed to complement postgraduate courses, it is also relevant to those in industry requiring an appreciation of the way their computer simulation programs work.

**Book Description**

This book provides a clear and complete postgraduate introduction to the theory and computer programming for the complex simulation of material behavior. It will also

appeal to those in industry wishing to appreciate the way their computer simulations work.

**Excerpts About the Authors:**

**Javier Bonet** is a Prof. of Engineering & Head of the College of Engineering at Swansea University, Dir. of the Welsh 'Sêr Cymru' Nat'l Research Network in Adv. Engineering & Materials, - Deputy Vice-Chancellor, Research and Enterprise, at the University of Greenwich.

**Antonio J. Gil** is an Associate Professor in the Zienkiewicz Centre for Computational Engineering at Swansea University..

**Richard D. Wood** is an Honorary Research Fellow in the Zienkiewicz Centre for Computational Engineering at Swansea University.

## The 2016 THUMS USA Users' Meeting

[http://ls-dyna.jsol.co.jp/en/thums/thums\\_um2016.html](http://ls-dyna.jsol.co.jp/en/thums/thums_um2016.html)



JSOL is delighted to announce The 2016 THUMS USA Users' Meeting.

THUMS, the Total Human Model for Safety for use with LS-DYNA® is being rapidly adopted by users worldwide. A Finite Element model (FEM) jointly developed by Toyota Motor Corporation and Toyota Central R&D Labs., Inc. The model aims to simulate "human body kinematics" and "injury on human body" in response to a large impact in a car crash and so on.

We invite you to join us and share in THUMS technical information.

"The 2016 THUMS USA Users' Meeting" Being held after, The 14th LS-DYNA® International Users' Conference

Organizer: JSOL Corporation  
Date: June 15th(Wed), 2016  
Location: Detroit (Michigan, USA )  
Participation: THUMS users. Customers who are interested in THUMS.  
Venue: Edward Village Michigan  
(Formerly Adoba Hotel  
Dearborn / Detroit )  
600 Town Center Dr.  
Dearborn, MI 48126  
URL: [www.hotel-dearborn.com/](http://www.hotel-dearborn.com/)  
Reg. Fee: Free  
Expected number of participants: Apprx. 50

**What is THUMS?** A Finite Element model (FEM) jointly developed by Toyota Motor Corporation and Toyota Central R&D Labs.,

Inc. The model aims to simulate "human body kinematics" and "injury on human body" in response to a large impact in a car crash and so on.

The Total Human Model for Safety ("THUMS") is the human body model for injury analysis.. The geometries of the structurally complex human body parts including the head, torso, joints and organs are represented by FE meshes. Their material properties refer the list in papers or documents and are compared with component tests listed in papers or documents for validation. THUMS is used by engineers the world over and contribute to the safety improvement of human body.

### One Day Pre Conference - Airbag Folding and Morphing Class

Sunday, June 12<sup>th</sup> - Limited Space - fee \$300

Reserve now! Contact [class@lstc.com](mailto:class@lstc.com)

Subject line: Airbag Folding and Morphing

Registration on line will be available Monday, March 7th

### Airbag Folding and Morphing

Airbags come in different shapes and sizes and are utilized to prevent injury to occupants in a vehicle. Some of the bags are currently standard in Vehicles are, Driver, Passenger, Side, Roof Rail and Knee Airbags. Bags have to meet both performance and packaging criteria to be fit into interior trim compartments. Folding of these bags into tight spaces without affecting their behavior is important for both OEMs and Airbag manufacturers. Folding can be carried out using PreProcessors or by running a LS-Dyna simulation. Simulation based folding is gaining foothold in complex folding patterns and crush folding of bags. LS-Prepost has both Pre-Processor based folding and has recently added an interface for Simulation based folding called DynFold.

Folding using either of these methods can cause some elements to shrink or get severely distorted. To avoid this and to make sure the

bag shape and volume is retained LS-Dyna utilizes reference geometry. By changing the reference geometry of the bag its volume and shape can be changed. This can help in making quick studies on bag deployment and interaction with the Occupant. LS-Prepost has morphing capabilities that have been adapted to change the Shape of reference geometries.

Length of class will be 1 day. Introduction of folding methods followed by hands-on workshops. Prior knowledge of LS-DYNA and LS-PREPOST will help students focus on learning folding techniques.

This class will introduce

- Preprocessor Based Folding
  - o Thin, Thick, Tuck and Spiral Folding Patterns
- DynFold for Simulation Based folding
  - o SPC, Rollers, Tuck folds, Crush Folding, Zig-Zag folding
- Morphing methods
  - o RRAB and PAB

### Recent white papers:

- ANSA &  $\mu$ ETA for Fatigue analyses
- The  $\mu$ ETA ASAM ODS Browser
- Multivariant / Multidiscipline Modeling
- Modeling for Nastran Embedded Fatigue

### Case Studies:

- Honda R&D: Exterior Acoustics full vehicle model generation
- Opel: ANSA in Pedestrian Safety Analysis
- Selected cases from the
- Automotive Industry

### **BETA CAE Open Meeting Korea**

May 10, 2016  
InterContinental Seoul COEX  
Seoul, S. Korea  
hosted by Hankook AAC

### **BETA CAE Open Meeting Turkey**

June 3, 2016  
Byotell - Istanbul, Turkey  
hosted by A-Z Tech

### **BETA CAE Open Meeting - Italy**

June 28, 2016  
NH Torino Lingotto Tech  
Torino, Italy  
hosted by BETA CAE Italy

### **BETA CAE Open Meeting NA**

October 11, 2016  
The Inn at St. John's  
Plymouth, MI, USA  
hosted by BETA CAE Systems USA

### **BETA CAE Open Meeting Japan**

November 8, 2016  
Nagoya, Japan  
hosted by TOP CAE Corp.

### **BETA CAE Open Meeting Beijing China**

November 22, 2016  
Beijing, China  
hosted by Beijing E&G Software

### **BETA CAE Open Meeting Shanghai China**

November 25, 2016  
Shanghai, China  
hosted by Shanghai Turing Info. Tech.

## LS-DYNA Recommendations - LS-DYNA Group

Author: James Kennedy, KBS2 [jmk@kbs2.com](mailto:jmk@kbs2.com)

*Please note below is a short excerpt of an internet thread – an excerpt does not reflect the full information, or explanation. Further solutions or corrections may have been posted after this excerpt.*

**Some examples -**

### **Heat Transfer Analysis (problem th01.k):**

LS-DYNA can solve steady state and transient heat transfer problems. Steady state problems are solved in one step, while transient problems are solved using an implicit method.

<http://www.dynasupport.com/tutorial/getting-started-with-ls-dyna/the-next-step>

### **Coupled thermal-stress analysis (problem cp01.k):**

In this problem, the cube is allowed to expand due to the temperature increase from internal heat generation. Keywords from the mechanical problem defined in section 4.1 and the thermal problem defined in section 4.3 are combined to define this thermal-stress problem.

<http://www.dynasupport.com/tutorial/getting-started-with-ls-dyna/the-next-step>

### **Thermal:**

The examples in this section present examples about the thermal capabilities of LS-DYNA. The examples are provided by Dr. Art Shapiro. Art is working since decades on topics related to DYNA3D, LS-DYNA and TOPAZ. Prior to retiring December 2015, He was the key developer for the thermal capabilities of LS-DYNA. You may access the examples separately by using the menu on the left.

<http://www.dynaexamples.com/thermal>

### **Example input files for thermal LS-DYNA applications:**

<http://www.lsdyna.eu/index.php?id=5095>

Sincerely,  
James M. Kennedy  
KBS2 Inc.  
April 14, 2016

## DYNAmore 14th German LS-DYNA Forum

Author: Albert Oswald [albert.oswald@werbos.de](mailto:albert.oswald@werbos.de)

Conference Contact: [forum@dynamore.de](mailto:forum@dynamore.de)



### Announcement and invitation to present a paper

#### 14th GERMAN LS-DYNA® FORUM 2016

October 10 - 12 2016, Bamberg, Germany

Conference website - [www.dynamore.de/forum2016-e](http://www.dynamore.de/forum2016-e)

DYNAmore kindly invites you to participate at the 14<sup>th</sup> German LS-DYNA Forum and encourages you to actively contribute to the conference agenda by submitting a presentation about your experience with the LSTC product range. Participation without a presentation is also worth-while to exchange your knowledge and discuss new solution approaches with other users.

Besides presentations from users, there will be also selected keynote lectures of renowned speakers from industry and universities as well as developer presentations from LSTC and DYNAmore. The popular workshops on various topics will also be continued.

We hope that we have stimulated your interest and are looking forward to receiving your abstract and to seeing you in Bamberg.

#### Attending

In user presentations from industry and academia you will learn more about the software packages LS-DYNA®, LS-OPT®, LS-TaSC™ und LS-PrePost® as well as their application possibilities for virtual product design.

#### Presenting

Communicate your work with international colleagues to share

knowledge and to stimulate discussions with other users about new solution approaches.

**Exhibiting and sponsoring** - If you want to contribute, please request additional exhibitor and sponsoring information.

**Venue** - Welcome Kongresshotel Bamberg  
Mußstraße 7, 96047 Bamberg, Germany

**Conference language** - German and English

#### Participant fees

Industry speaker:	€ 360 -
Academic speaker:	€ 260
Industry:	€ 510 <sup>1)</sup> / € 580
Academic:	€ 360 <sup>1)</sup> / € 410

<sup>1)</sup> Registration before 27 June 2016.

All prices excluding VAT.

#### Important dates

Presentation submission:	30 May
Author notification:	17 June
Two-page abstract:	5 Sept.
Conference dates:	10-12 Oct.

#### To Submit A Presentation:

Please send us title, author(s) and short description of approximately 300 words

E-Mail to [forum@dynamore.de](mailto:forum@dynamore.de)

or submit it online - [www.dynamore.de/forum2016](http://www.dynamore.de/forum2016)

**Contact and registration** - DYNAmore GmbH,

Industriestr. 2, D-70565 Stuttgart, Germany

E-Mail: [forum@dynamore.de](mailto:forum@dynamore.de)

## 14<sup>th</sup> International LS-DYNA Users Conference



**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..

**Corporate Participation:** Platinum, Gold, Silver, Bronze

### Conference Dates

#### Sunday, June 12th

- Pre Conference Classes
- Registration
- Exhibition Area,
- Reception

#### Monday, June 13<sup>th</sup>

- Registration,
- Conference,
- Banquet

#### Tuesday, June 14, 2016.

- Registration,
- Conference
- Closing session - about 3pm

#### Wednesday, June 15 & Thursday, June 16

- 1& 2-day Training at U-M Dearborn

### Contact Information

Abstracts & papers:  
[papers@lstc.com](mailto:papers@lstc.com)

Participation, Registration:  
Marsha Victory  
[vic@lstc.com](mailto:vic@lstc.com)

## **AUTOMOTIVE NEWS & EVENTS**

### **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 [aqiac99@aol.com](mailto:aqiac99@aol.com) - Subject Line please

use "Automotive News"

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

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

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## Holy Shift! A Look inside GM's new 10-Speed Automatic

Advanced design, GM control system support capability, enhanced efficiency



The all-new 10 speed automatic transmission is the first 10 speed automatic for a volume production car. The performance 10 speed transmission transfers power and torque with quick shifts and maintains more engine power after each shift.

DETROIT – Engineers for the new 10-speed automatic transmission available in the 2017 Chevrolet Camaro ZL1 built on the experience of previous, critically acclaimed Hydra-Matic multispeed transmissions to push its performance, refinement and efficiency advantages to a new threshold.

The 10-speed is an all-new design – and the first-ever application in a car – with a wider, 7.39 overall gear ratio spread, that enables the ZL1's supercharged engine to remain at optimal engine speeds during upshifts.

“With world-class shift times on par with the world's best dual-clutch transmissions and the refinement that comes only from a true automatic, the 10-speed delivers incomparable performance on and off the track,” said Dan Nicholson, vice-president, GM Global

Propulsion Systems. “It also leverages the experience of our other multispeed transmissions to deliver that performance with greater efficiency as its use expands into other vehicles.”

The wider overall ratio enables a lower numerical top gear ratio – an attribute that reduces engine speed on the highway, which contributes to greater fuel efficiency than a comparable eight-speed transmission. Improvements in spin loss complement the optimized gearing, further enhancing efficiency.

And while the Camaro ZL1 will be the first GM vehicle to offer the new 10-speed automatic, designed for rear-wheel-drive applications, it will be available in eight additional vehicles by 2018.

## Holy Shift! A Look inside GM's new 10-Speed Automatic

### Additional highlights:

- Creative packaging – The 10-speed is approximately the same size as the six- and eight-speed transmissions, minimizing changes to vehicle interfaces.
- Quicker shifts than a dual-clutch transmission – Testing has shown faster upshift times than the Porsche PDK dual-clutch transmission. In fact, the 1-2 upshift is 36-percent quicker than the PDK, while the 2-3 and 3-4 upshifts are 27-percent and 26-percent quicker, respectively.
- Reduced spin losses – Thanks to only two non-applied clutches – the same number as the eight-speed – as well as other design features, the 10-speed automatic has lower friction that contributes to greater fuel efficiency over GM's six- and eight-speed automatics. New ultra-low viscosity transmission fluid also reduces friction, while an internal thermal bypass allows the transmission to warm up faster – attributes that enhance fuel efficiency
- GM-developed controller – It is the latest transmission to use an all-new, GM-developed control system, with performance calibrations tailored specifically for different vehicles.

### Architectural features and packaging

Thousands of hours of computer-aided engineering analyses were made during the development of the Hydra-Matic 10-speed transmission, driving a comparatively compact design envelope comparable to the eight-speed automatic.

A one-piece aluminum case with an integral bell housing helps reduce weight and enhance powertrain stiffness, while a unique 260mm, integral turbine clutch torque converter design reduces complexity and helps make the converter thinner, which contributes to the transmission's packaging.

The 10-speed has four simple gearsets and six clutches: two brake clutches and four rotating clutches. That's only one more clutch than the eight-speed, despite having two more forward gears, contributing further to the compact packaging, while also improving spin losses to enhance fuel efficiency.

A unique triple-clutch assembly in the middle of the 10-speed's architecture is a primary enabler for packaging 10-speed content in the same space as GM's six- and eight-speed transmissions.

The 10-speed also features a variable-displacement vane pump, which optimizes transmission fluid pressure, based on speed and load, to enhance efficiency.

### 7.39 ratio spread and faster upshifts

The new 10-speed's greater overall performance and efficiency are due primarily to its wider 7.39 overall gear ratio spread, which enhances off-the-line performance with a more aggressive first gear ratio than GM's eight-speed automatic. Smaller steps between the gears also help the engine maintain the optimal speed for maximum power at almost all speeds, especially when exiting a corner on a track.

Adaptive shift controls such as Performance Algorithm Shifting and Driver Shift Control enhance performance driving. Performance Algorithm Shifting (PAS) monitors how assertively the driver is using engine output to determine at what engine speed to upshift or downshift. Driver Shift Control allows the driver to shift the transmission via the steering wheel-mounted paddle shifters. Electronic safeguards prevent over-revving if the wrong

gear position is selected, but relies on the driver to make upshifts or downshifts.

Gear changes are mainly executed with clutch-to-clutch action, where an "on-coming" clutch is engaged and an "off-going" clutch is released in a precise manner to achieve the ratio change. Certain key shifts, however, are made with a freewheeling action, such as 3-1 downshifts, where a plate clutch is actively disengaged while a mechanical freewheeler clutch automatically engages with optimum synchronization.

The torque converter is 260mm in diameter and features a lock-up clutch. It also uses electronic controlled capacity clutch (ECCC) technology, which employs a small, regulated amount of slip to dampen out engine pulses for a smoother running drivetrain, especially during shifting.

## Holy Shift! A Look inside GM's new 10-Speed Automatic

GM Hydra-Matic 10-speed vs. eight-speed gear ratios

Type:	10-speed automatic	eight-speed automatic
Gear ratios (:1)		
First:	4.70	4.56
Second:	2.99	2.97
Third:	2.15	2.08
Fourth:	1.80	1.69
Fifth:	1.52	1.27
Sixth:	1.28	1.00
Seventh:	1.00	0.85
Eighth:	0.85	0.65
Ninth:	0.69	--
Tenth:	0.64	--
Reverse:	4.87	3.82

**Reduced spin losses and new transmission fluid:** Friction-reducing design features, including all-new ultra-low viscosity transmission fluid, internal thermal bypass, minimal number of non-applied clutches and other lower mechanical spin losses, contribute to the 10-speed's effect on improved vehicle efficiency.

The low-viscosity fluid helps reduce friction across the full temperature operating range, which enhances fuel efficiency. Additionally, the internal thermal bypass allows the transmission to warm up faster to its optimal operating temperature, further contributing to fuel efficiency.

**GM control system:** World-class shift time quickness and responsiveness are accomplished by leveraging the base transmission hardware in concert with GM exclusively developed algorithms, software and calibrations. An

externally mounted electronic control module executes millions of controls instructions every second.

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>

Tom Read - Global Propulsion Systems Communications - [tom.read@gm.com](mailto:tom.read@gm.com)  
Tara Kuhnen - Assistant Communications Manager - [tara.kuhnen@gm.com](mailto:tara.kuhnen@gm.com)

# AEROSPACE NEWS & EVENTS

## **Marnie Azadian**

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
- 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 Marnie Azadian at [agiac99@aol.com](mailto:agiac99@aol.com) - Subject Line please use "Aerospace News"

Submissions should be received by the 15<sup>th</sup> 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 15<sup>th</sup>, 2015 to be featured in the December 2015 FEA newsletter.

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

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## NASA's Kepler Mission Announces Largest Collection of Planets Ever

© All Rights Reserved - NASA



NASA's Kepler mission has verified 1,284 new planets – the single largest finding of planets to date.

This artist's concept depicts select planetary discoveries made to date by NASA's Kepler space telescope.

Credits: NASA/W. Stenzel

“This announcement more than doubles the number of confirmed planets from Kepler,” said Ellen Stofan, chief scientist at NASA Headquarters in Washington. “This gives us hope that somewhere out there, around a star much like ours, we can eventually discover another Earth.”

Analysis was performed on the Kepler space telescope’s July 2015 planet candidate catalog, which identified 4,302 potential planets. For 1,284 of the candidates, the probability of being a planet is greater than 99 percent – the minimum required to earn the status of “planet.” An additional 1,327 candidates are more likely than not to be actual planets, but they do not meet the 99 percent threshold and will require additional study. The remaining 707 are more likely to be some other astrophysical phenomena. This analysis also validated 984 candidates previously verified by other techniques.

"Before the Kepler space telescope launched, we did not know whether exoplanets were rare or common in the galaxy. Thanks to Kepler and

the research community, we now know there could be more planets than stars,” said Paul Hertz, Astrophysics Division director at NASA Headquarters. "This knowledge informs the future missions that are needed to take us ever-closer to finding out whether we are alone in the universe."

Kepler captures the discrete signals of distant planets – decreases in brightness that occur when planets pass in front of, or transit, their stars – much like the May 9 Mercury transit of our sun. Since the discovery of the first planets outside our solar system more than two decades ago, researchers have resorted to a laborious, one-by-one process of verifying suspected planets.

This latest announcement, however, is based on a statistical analysis method that can be applied to many planet candidates simultaneously. Timothy Morton, associate research scholar at Princeton University in New Jersey and lead author of the scientific paper published in *The Astrophysical*

## NASA's Kepler Mission Announces Largest Collection of Planets Ever

Journal, employed a technique to assign each Kepler candidate a planet-hood probability percentage – the first such automated computation on this scale, as previous statistical techniques focused only on sub-groups within the greater list of planet candidates identified by Kepler.

"Planet candidates can be thought of like bread crumbs," said Morton. "If you drop a few large crumbs on the floor, you can pick them up one by one. But, if you spill a whole bag of tiny crumbs, you're going to need a broom. This statistical analysis is our broom."

In the newly-validated batch of planets, nearly 550 could be rocky planets like Earth, based on their size. Nine of these orbit in their sun's habitable zone, which is the distance from a star where orbiting planets can have surface temperatures that allow liquid water to pool. With the addition of these nine, 21 exoplanets now are known to be members of this exclusive group.

"They say not to count our chickens before they're hatched, but that's exactly what these results allow us to do based on probabilities that each egg (candidate) will hatch into a chick (bona fide planet)," said Natalie Batalha, co-author of the paper and the Kepler mission scientist at NASA's Ames Research Center in Moffett Field, California. "This work will help Kepler reach its full potential by yielding a deeper understanding of the number of stars that harbor potentially habitable, Earth-size planets -- a number that's needed to design

future missions to search for habitable environments and living worlds."

Of the nearly 5,000 total planet candidates found to date, more than 3,200 now have been verified, and 2,325 of these were discovered by Kepler. Launched in March 2009, Kepler is the first NASA mission to find potentially habitable Earth-size planets. For four years, Kepler monitored 150,000 stars in a single patch of sky, measuring the tiny, telltale dip in the brightness of a star that can be produced by a transiting planet. In 2018, NASA's Transiting Exoplanet Survey Satellite will use the same method to monitor 200,000 bright nearby stars and search for planets, focusing on Earth and Super-Earth-sized.

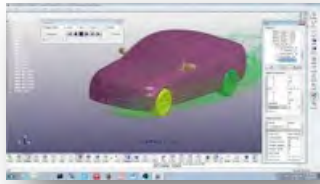
Ames manages the Kepler missions for NASA's Science Mission Directorate in Washington. The agency's Jet Propulsion Laboratory in Pasadena, California, managed Kepler mission development. Ball Aerospace & Technologies Corporation operates the flight system, with support from the Laboratory for Atmospheric and Space Physics at the University of Colorado in Boulder.

For more information about the Kepler mission, visit: <http://www.nasa.gov/kepler>

Felicia Chou - Headquarters, Washington  
[felicia.chou@nasa.gov](mailto:felicia.chou@nasa.gov)

Michele Johnson - Ames Research Center,  
Moffett Field, Calif.  
[michele.johnson@nasa.gov](mailto:michele.johnson@nasa.gov)

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



### ICFD Post treatment with LSPP4.3

#### Electromagnetism (EM) Playlist:

- Sheet Forming on conical die
- LS-DYNA CFD & EM thermal coupling
- Resistive heating problem
- 15 videos are available

#### Tutorial video Available for viewing

ICFD Post treatment with LSPP4.3 - Duration: 21 minutes. •216 views  
•1 month ago

ICFD and DEM coupling - Duration: 8 seconds. •351 views  
•4 months ago

ICFD coupled with DEM (LS-DYNA) - Duration: 40 seconds. •431 views  
•6 months ago

Electric Kettle simulation using Ls-Dyna - Duration: 42 seconds. •609 views  
•8 months ago



## FAQs

LSTC provide a huge number of FAQs at the ftp site [ftp.lstc.com/outgoing/support/FAQ](ftp://ftp.lstc.com/outgoing/support/FAQ). Many thanks to Jim Day of LSTC for making this information available.

**Some specific popular FAQs include:**

consistent units

[ftp://ftp.lstc.com/outgoing/support/FAQ/consistent\\_units](ftp://ftp.lstc.com/outgoing/support/FAQ/consistent_units)

An overview of Contact

<ftp://ftp.lstc.com/outgoing/support/FAQ/contact.overview>

Soft Contact

<ftp://ftp.lstc.com/outgoing/support/FAQ/contact.soft1>

General guidelines for Crash Analysis

<ftp://ftp.lstc.com/outgoing/support/FAQ/guidelines.pdf>

Hourglass Control

[ftp://ftp.lstc.com/outgoing/support/FAQ/hourglass\\_condensed](ftp://ftp.lstc.com/outgoing/support/FAQ/hourglass_condensed)

Dealing with Instabilities

<ftp://ftp.lstc.com/outgoing/support/FAQ/instability.tips>

Dealing with long run times

[ftp://ftp.lstc.com/outgoing/support/FAQ/long\\_run\\_times](ftp://ftp.lstc.com/outgoing/support/FAQ/long_run_times)

Mass Scaling

[ftp://ftp.lstc.com/outgoing/support/FAQ/mass\\_scaling](ftp://ftp.lstc.com/outgoing/support/FAQ/mass_scaling)

Negative Volume in Brick Elements

[ftp://ftp.lstc.com/outgoing/support/FAQ/negative\\_volume\\_in\\_brick\\_element.tips](ftp://ftp.lstc.com/outgoing/support/FAQ/negative_volume_in_brick_element.tips)

Quasi-static simulations

<ftp://ftp.lstc.com/outgoing/support/FAQ/quasistatic>

Restarting Analyses

<ftp://ftp.lstc.com/outgoing/support/FAQ/restart>

Modeling spinning bodies

<ftp://ftp.lstc.com/outgoing/support/FAQ/spin>

Spring Back

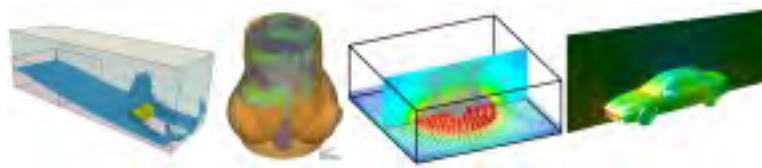
<ftp://ftp.lstc.com/outgoing/support/FAQ/springback>

Stress vs Strain for plasticity models

[ftp://ftp.lstc.com/outgoing/support/FAQ/stress\\_vs\\_strain\\_for\\_plasticity\\_models](ftp://ftp.lstc.com/outgoing/support/FAQ/stress_vs_strain_for_plasticity_models)

User-defined materials

[ftp://ftp.lstc.com/outgoing/support/FAQ/user\\_defined\\_materials.faqFAQs](ftp://ftp.lstc.com/outgoing/support/FAQ/user_defined_materials.faqFAQs)



## **LS-DYNA Support**

At this site you will find answers to basic and advanced questions that might occur while using LS-DYNA, information about new releases and ongoing developments.

**March 03, 2016 LS-DYNA R8.1.0 (R8.105896) released**

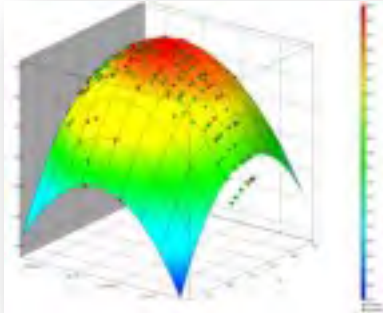
**Feb 22, 2016 Recent Changes History Variables for Certain Material Models**

**Jan 22, 2016 - Rich document History Variables for Certain Material Models**

**TUTORIALS - <http://www.dynasupport.com/tutorial>**

### **Getting started with LS-DYNA**

LS-DYNA is used to solve multi-physics problems including solid mechanics, heat transfer, and fluid dynamics either as separate phenomena or as coupled physics, e.g., thermal stress or fluid structure interaction. This manual presents very simple examples to be used as templates (or recipes). This manual should be used side-by-side with the LS-DYNA Keyword User s Manual . The keyword input provides a flexible and logically organized database. Similar functions are grouped together under the same keyword. For example, under the keyword, \*ELEMENT, are included solid, beam, and shell elements. The keywords can be entered in an arbitrary order in the input file. However, for clarity in this manual, we will conform to the following general block structure and enter the appropriate keywords in each block. 1. define solution control and output parameters 2. define model geometry and material parameters 3. define boundary conditions



**LS-OPT**

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LS-OPT, the graphical optimization tool that interfaces perfectly with LS-DYNA,

Allows the user to structure the design process, explore the design space and compute optimal designs according to specified constraints and objectives. The program is also highly suited to the solution of system identification problems and stochastic analysis.

The graphical tool LS-OPTui interfaces with LS-DYNA and provides an environment to specify optimization input, monitor and control parallel simulations and post-process

optimization data, as well as viewing multiple designs using LS-PREPOST.

**Optimization**

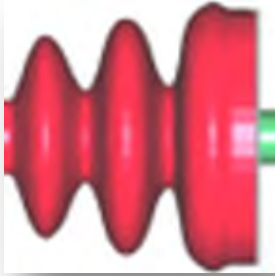
- Size-/Shape optimization
- Constraints, mixed continuous/discrete variables, multiple load cases, etc.
- Multi-Objective optimization (Pareto Frontier)
- Reliability based design optimization

**LS-TaSC - LS-TaSC 3.1 released**

**Topology Optimization**

A tool for the topology optimization of non-linear problems involving dynamic loads and contact conditions. It can be used to find a

concept design for most structures analyzed using LS-DYNA.



### LS-DYNA Examples

The site presents approximately 200 LS-DYNA examples from various training classes. The input files and several class notes are available for download.

The download is free of charge, a login is not required. The majority of content has been contributed by LSTC/DYNAmore. The content is prepared for educational purposes. Hence, material properties and other parameters might be non-physic for simplification.

#### Among the files and Sections:

**LS-DYNA Keyword Search** If you are looking for an example containing some specific LS-DYNA keyword you may use the site search in the header section of this page.

**Show Cases** This folder contains several LS-DYNA examples focusing on specific load cases or keywords.

**Metal Forming** The examples in this section are from the introductory class on metal forming from LSTC. You may access the examples separately by the menu on the left. The examples are prepared for LS-DYNA 970 and upwards.

**ALE** The examples in this section are from the ALE (Arbitrary Lagrangian Eulerian Method) class of M'hamed Souli. M'hamed Souli is

Professor at the University in Lille France. Both authors are key developers for the powerful capabilities of the Eulerian Methods in LS-DYNA. You may access the examples separately by using the menu on the left. The examples run with LS-DYNA 970 and upwards.

**Thermal** The examples in this section present examples about the thermal capabilities of LS-DYNA. The examples are provided by Dr. Art Shapiro. Art is working since decades on topics related to DYNA3D, LS-DYNA and TOPAZ. He is the key developer for the thermal capabilities of LS-DYNA. Art is one of the co-founders of LSTC. You may access the examples separately by using the menu on the left.



**DYNAlook**

**DYNAlook**

The site presents papers from European and International LS-DYNA User Conferences and papers provided by other users. 1604 papers are available.

The papers are from LS-DYNA Conferences and are accessible via the search functionality.

<b>13th International LS-DYNA Conference</b> Detroit, 2014	<b>12th International LS-DYNA Conference</b> Detroit, 2012	<b>11th International LS-DYNA Conference</b> Detroit, 2010
<b>10<sup>th</sup> European LS-DYNA Conference</b> <b>Wurzburg 2015</b>	<b>9th European LS-DYNA Conference</b> Manchester, 2013	<b>8th European LS-DYNA Conference</b> Straßburg, 2011 ...

**DUMMY Model Support** - Currently, the manuals of models developed by DYNAmore are available.

This site provides detailed information on dummy models for LS-DYNA. In the near future the models developed by LSTC will be added. The LSTC dummy and barrier are models are no fee and included with the LS-DYNA license.

To license the models we kindly ask to contact your local LS-DYNA distributor. Any kind of proposal or enhancements for the models and this site is very welcome.

**Among the Dummy Models on this site you can find:**

**Side Impact Dummies**

**ES2/ES2re -**  
DYNAmore

**World SID 50%**  
DYNAmore

**US-SID**  
DYNAmore

**Rear Impact Dummies**

**BioRID-II V3.**  
DYNAmore

**Child Dummies**

**P-1.5**  
DYNAmore  
**P-3.0**  
DYNAmore

### LSTC Models Overview

Free or low cost FE models are important to LS-DYNA users in various fields. Therefore, LSTC is developing models with the help and support of our customers. Some of the models are joint developments with our partners.

LSTC's Models are available at no cost to licensees of LS-DYNA who are current with their annual license fees (Annual License) or maintenance fees (Paid-up License). Models are fully unencrypted and accessible. LSTC endeavors to make the models as complete, accurate, reliable, and easy to use as possible.

This section of our site was created to keep users informed about our models. It will be

### Barrier Models

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

updated periodically to reflect changes to existing models and announce newly released models.

Feedback about the models is welcome and will be used to improve future releases. To submit questions, suggestions, or feedback about LSTC's models, please send an e-mail to: [atds@lstc.com](mailto:atds@lstc.com).

For news and updates about our dummy models, please join our models news mailing list.

[www.lstc.com/products/models/maillinglist](http://www.lstc.com/products/models/maillinglist)

## AEROSPACE WORKING GROUP

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

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®.

The actions of the AWG serve to support the use, development, and reliability of LS-DYNA® for aerospace numerical analyses.

Some participants are partially or fully funded by the Federal Aviation Administration (FAA) in the National Aviation Research Plan 'Aircraft Catastrophic Failure Prevention Research' program, or by the National Aeronautics and Space Administration (NASA), or associated with the participants as LS-DYNA® users.

### **Engine Related Impact Failure (ERIF) - Arizona State University (ASU)**

- Boeing
- Central Connecticut State University (CCSU)
- Federal Aviation Administration (FAA)
- General Electric Aviation
- George Mason University (GMU)
- Honda Aircraft Engine
- Honeywell
- Livermore Software Technology Corporation (LSTC)
- National Aeronautics and Space Administration (NASA)

- Ohio State University (OSU)
- Pratt & Whitney
- Pratt & Whitney Canada
- Rolls-Royce
- University of Akron
- Williams International

### **Cabin Interior (CI)**

- B/E Aerospace
- Boeing
- Bombardier
- Central Connecticut State University
- Cessna
- Federal Aviation Administration (FAA)
- Humanetics
- National Aeronautics and Space Administration (NASA)
- Wichita State University
- Zodiac Aerospace





**Participant’s Training Classes**

**Webinars**

**Info Days**

**Class Directory**

**Participant Class Directory**

<p><b>Arup</b> (corporate)</p>	<p><a href="http://www.oasys-software.com/dyna/en/training">www.oasys-software.com/dyna/en/training</a></p>
<p><b>BETA CAE Systems S.A.</b> (corporate)</p>	<p><a href="http://www.beta-cae.com/training.htm">www.beta-cae.com/training.htm</a></p>
<p><b>DYNAmore</b> (corporate)</p>	<p><a href="http://www.dynamore.de/en/training/seminars">www.dynamore.de/en/training/seminars</a></p>
<p><b>ESI-Group</b> (corporate)</p>	<p><a href="https://myesi.esi-group.com/trainings/schedules">https://myesi.esi-group.com/trainings/schedules</a></p>
<p><b>ETA</b> (corporate)</p>	<p><a href="http://www.eta.com/support2/training-calendar">www.eta.com/support2/training-calendar</a></p>
<p><b>LSTC</b> (corporate)</p>	<p><a href="http://www.lstc.com/training">www.lstc.com/training</a></p>
<p><b>LS-DYNA OnLine</b> (Al Tabiei)</p>	<p><a href="http://www.LSDYNA-ONLINE.COM">www.LSDYNA-ONLINE.COM</a></p>

**ARUP** Visit the website for complete listings/changes/locations

[www.oasys-software.com/dyna/en/training](http://www.oasys-software.com/dyna/en/training)

To enrol on any of these courses please email Dyna Support at [dyna.support@arup.com](mailto:dyna.support@arup.com).

<b>Date</b>	<b>Training Class</b>
Scheduled on request	Oasys PRIMER - An Introduction
Scheduled on request	Oasys PRIMER - Automatic Assembly of Multiple Crash Cases
Scheduled on request	Oasys PRIMER - Spotwelds and Connections
Scheduled on request	Oasys PRIMER - Seat and Dummy Positioning
Scheduled on request	Oasys PRIMER & D3PLOT - An Introduction to JavaScripting

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

[www.beta-cae.com/training.htm](http://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.gr](mailto:ansa@beta-cae.gr) for further details.

Recommended Training Courses (Complete information on website)

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

Submitted: Albert Oswald

**DYNAmore** Visit the website for complete listings / changes / locations

[www.dynamore.de/seminars](http://www.dynamore.de/seminars)

**Seminars, information & support days in April - May**

Download full seminar brochure (pdf): [www.dynamore.de/seminars-2016](http://www.dynamore.de/seminars-2016)



**We are pleased to offer you a selection of seminars and free-of-charge information & support days in April - May 2016.**

**Trainings**

Contact Definitions in LS-DYNA	5 April (L) / 15 April
PRIMER as Preprocessor for LS-DYNA	14 April
Introduction to LS-DYNA	19-21 April / 10-11 May (T)
User Materials in LS-DYNA	22 April
LS-OPT – Optimization and Robustness	26-28 April / 2-4 May (L)
Modeling Metallic Materials	10-11 May
Introduction to Nonlinear Implicit Analysis	12 May (T)
Damage and Failure Modeling	12-13 May
Smoothed Particle Hydrodynamics (SPH)	23-24 (V)
Metal Forming with LS-DYNA	30-31 May

**Information days (free of charge)**

Webinar: New Multiphysics Features in LS-DYNA	4 April
Webinar: LS-OPT: Optimization/DOE/Robustness	11 April
Webinar: New Features in LS-DYNA R8.1	13 April
Information day: Welding and Heat Treatment	14 April (Z)

**Support days (free of charge)**

· LS-DYNA	15 April / 20 May
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If not otherwise stated, the event location is Stuttgart (S), Germany. Other event locations are:  
 L = Linköping, Sweden; V = Versailles, France; Z = Zurich, Switzerland; T = Turin, Italy

Overview and registration: [www.dynamore.de/seminars](http://www.dynamore.de/seminars)

If the offered seminars do not fully suit your needs, we are pleased to meet your individual requirements by arranging tailored on-site training courses on your company premises.

DYNAmore hopes that our offer will meet your needs and would be very pleased to welcome you at one of the events.

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

**Basic OpenFOAM training for  
application engineers**

2 Mar 2016 to 3 Mar 2016  
CFD & Multiphysics  
Pune, India

**VA One: Coupled FEA/SEA Training**

3 Mar 2016 to 4 Mar 2016  
Vibro-Acoustics  
Farmington Hills, Detroit, MI

**VPS - Getting started with  
CRASH simulation**

7 Mar 2016  
Crash, Impact & Safety  
Seoul, Korea

**LSTC** Visit the website for complete listings/changes/locations

[www.lstc.com/training](http://www.lstc.com/training)

### **March**

- **MI Intro LS-PrePost**
- **MI Intro LS-DYNA**

### **May**

- **CA Intro LS-PrePost**
- **CA Intro LS-DYNA**
- **MI Contact**
- **MI Composite**

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

**On Line** [www.LSDYNA-ONLINE.COM](http://www.LSDYNA-ONLINE.COM)

For Information contact: [courses@lsdyna-online.com](mailto:courses@lsdyna-online.com) or 513-3319139

### **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 Viscoplastic 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.



**BETA CAE Systems S.A.**

**[www.beta-cae.gr](http://www.beta-cae.gr)**

**BETA CAE Systems S.A.– 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 or LSTC to provide an integrated solution in the field of optimization.

**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

**BETA CAE Systems S.A.– 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





**CRAY**

**[www.cray.com](http://www.cray.com)**

## **THE CRAY® XC™ SERIES: ADAPTIVE SUPERCOMPUTING ARCHITECTURE**

The Cray® XC™ series delivers on Cray's commitment to an adaptive supercomputing architecture that provides both extreme scalability and sustained performance. The flexibility of the Cray XC platform ensures that users can precisely configure the machines that will meet their specific requirements today, and remain confident they can upgrade and enhance their systems to address the demands of the future.

Cray® XC40™ and XC40-AC™ supercomputers are enabled by a robust Intel® Xeon® processor road map, Aries high performance interconnect and flexible Dragonfly network topology, providing low latency and scalable global bandwidth to satisfy the most challenging multi-petaflops applications.

While the extreme-scaling Cray XC40 supercomputer is a transverse air-flow liquid-cooled architecture, the Cray XC40-AC air-cooled model provides slightly smaller and less dense supercomputing cabinets with no requirement for liquid coolants or extra blower cabinets. A reduced network topology lowers costs, and the system is compatible with the compute technology, OS, ISV and software stack support of high-end XC40 systems.

## **MAXIMIZE PRODUCTIVITY WITH CRAY CS SERIES SUPERCOMPUTERS**

Understanding the need for nimble, reliable and cost-effective high performance computing (HPC), we developed the Cray® CS™ cluster supercomputer series. These systems are industry-standards-based, highly customizable, and expressly designed to handle the broadest range of medium- to large-scale simulation and data analytics workloads.

All CS components have been carefully selected, optimized and integrated to create a powerful HPC environment. Flexible node configurations featuring the latest processor and interconnect technologies mean you can tailor a system to your specific need — from an all-purpose cluster to one suited for shared memory, large memory or accelerator-based tasks.

Innovations in packaging, power, cooling and density translate to superior energy efficiency and compelling price/performance. Expertly engineered system management software instantly boosts your productivity by simplifying system administration and maintenance.

Maximize your productivity with flexible, high-performing Cray CS series cluster supercomputers.

CRAY

[www.cray.com](http://www.cray.com)**CRAY® SONEXION® SCALE-OUT LUSTRE® STORAGE SYSTEM**

Brought to you by Cray, the world's leading experts in parallel storage solutions for HPC and technical enterprise, the Cray® Sonexion® 2000 system provides a Lustre®-ready solution for popular x86 Linux® clusters and supercomputers through Cray Cluster Connect™. As a leader in open systems and parallel file systems, Cray builds on open source Lustre to unlock any industry-standard x86 Linux compute cluster using InfiniBand™ or 10/40 GbE utilizing proven Cray storage architectures.

The Cray Sonexion 2000 system provides 50 percent more performance and capacity than the Sonexion 1600 system in the same footprint.

**Simplify**

- Through its fully-integrated and pre-configured design, Cray Sonexion storage gets customers deployed faster and reduces the total number of components to manage.
- The Sonexion system's compact design reduces the total hardware footprint of petascale systems by 50 percent over component-based solutions.

**Scale**

- Performance scales from 7.5 GB/s to 1.7 TB/s in a single file system.
- Capacity scales in modular increments; the Sonexion 2000 system stores over two usable petabytes in a single rack. Fewer drives and components reduce capital costs as capacity grows.

**Protect**

- New software-based GridRAID offers higher levels of data protection and up to 3.5 times faster rebuild times than traditional RAID6 and MD-RAID storage.
- Cray ensures quality, reliability and stability at scale through exhaustive thermal and real-world stress testing, system hardening and availability, and tight hardware and software integration.

**OPEN ARCHIVE AND TIERED STORAGE SYSTEM FOR BIG DATA AND SUPERCOMPUTING**

Cray Tiered Adaptive Storage (TAS), powered by Varsity, is designed to meet the expansive data preservation and access needs driven by big data, where data needs to migrate fluidly from high performance storage to deep tape archives, while always being accessible to users.

CRAY

[www.cray.com](http://www.cray.com)**With Cray TAS you can:**

- Deploy tiered storage and archives faster
- Feel confident preserving and protecting data into the future, using Linux®
- Simplify managing data using familiar tools for years to come

**CRAY® URIKA-XA™ EXTREME ANALYTICS PLATFORM**

Pre-integrated, open platform for high performance analytics delivers valuable business insights now and into the future

The flexible, multi-use Cray® Urika-XA™ extreme analytics platform addresses perhaps the most critical obstacle in data analytics today — limitation. Analytics problems are getting more varied and complex but the available solution technologies have significant constraints. Traditional analytics appliances lock you into a single approach and building a custom solution in-house is so difficult and time consuming that the business value derived from analytics fails to materialize.

In contrast, the Urika-XA platform is open, high performing and cost effective, serving a

wide range of analytics tools with varying computing demands in a single environment. Pre-integrated with the Apache Hadoop® and Apache Spark™ frameworks, the Urika-XA system combines the benefits of a turnkey analytics appliance with a flexible, open platform that you can modify for future analytics workloads. This single-platform consolidation of workloads reduces your analytics footprint and total cost of ownership.

Based on pioneering work combining high-performance analytics and supercomputing technologies, the Urika-XA platform features next-generation capabilities. Optimized for compute-heavy, memory-centric analytics, it incorporates innovative use of memory-storage hierarchies and fast interconnects, which translates to excellent performance at scale on current as well as emerging analytics applications.

Additionally, the enterprise-ready Urika-XA platform eases the system management burden with a single point of support, standards-based software stack and compliance with enterprise standards so you can focus on extracting valuable business insights, not on managing your environment.

CRAY

[www.cray.com](http://www.cray.com)

**THE URIKA-GD™ GRAPH DISCOVERY APPLIANCE IS A PURPOSE-BUILT SOLUTION FOR BIG DATA RELATIONSHIP ANALYTICS.**

The Urika-GD™ appliance enables enterprises to:

- Discover unknown and hidden relationships and patterns in big data
- Build a relationship warehouse, supporting inferencing/deduction, pattern-based queries and intuitive visualization
- Perform real-time analytics on the largest and most complex graph problems

The Urika-GD system is a high performance graph appliance with a large shared memory and massively multithreaded custom processor designed for graph processing and scalable I/O.

With its industry-standard, open-source software stack enabling reuse of existing skill sets and no lock in, the Urika-GD appliance is easy to adopt.

The Urika-GD appliance complements an existing data warehouse or Hadoop® cluster by offloading graph workloads and interoperating within the existing enterprise analytics workflow.

Realize rapid time to powerful new insights.



## DatapointLabs

[www.datapointlabs.com](http://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 company 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**

[etainfo@eta.com](mailto:etainfo@eta.com)

[www.eta.com](http://www.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



## ESI Group

[www.esi-group.com](http://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.



## ESI Group

[www.esi-group.com](http://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.

**VisualDSS** 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. *VisualDSS* 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.

**Latest Release is Visual-Environment v11.0**



**JSOL Corporation**

[www.jsol.co.jp/english/cae/](http://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](http://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.



## Oasys Ltd. LS-DYNA Environment

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 de-penetrate impactors at multiple locations and produce many input decks

[www.oasys-software.com/dyna](http://www.oasys-software.com/dyna)

- 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](http://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

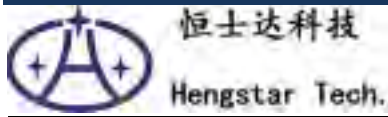
Key benefits:

- 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



## Shanghai Hengstar

**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..

[www.hengstar.com](http://www.hengstar.com)

**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 focus 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](http://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.



[www.penguincomputing.com](http://www.penguincomputing.com)

Penguin Computing provides customized build-to-order server solutions for enterprises and institutions with special hardware requirements. We complement our hardware and software solutions with Penguin Computing on Demand (POD)—a public HPC cloud that provides supercomputing capabilities on-demand on a pay-as-you-go basis.

Penguin is a one-stop shop for HPC and enterprise customers, providing solutions for a wide array of computing needs and user profiles:

- HPC and cloud solutions optimized for industry-specific uses

- High-powered workstations for individual power users

- Highly power-efficient server platforms for enterprise computing

- Private and public cloud solutions, including hybrid options.

Focus

Penguin Computing is strictly focused on delivering Linux-optimized enterprise solutions. We use a thorough, proven hardware qualification and testing process to ensure that our solutions deliver optimal performance and robustness.

Penguin's in-house development team is dedicated to providing a complete highly interoperable software stack that is tuned for Penguin hardware. As a result our solutions are easy-to-use and "just work." Our integrated approach even extends to our hybrid compute solutions, which combine local and cloud computing resources, taking ease-of-use and cost-effectiveness to the next level. Penguin customers can reduce capital expenditures by right-sizing clusters for average resource utilization and easily and quickly offload excess workload into the cloud.

Penguin also offers a full range of services and support that is backed by a seasoned team of Linux, HPC and application experts.

Canada

**Metal Forming Analysis Corp MFAC**[galb@mfac.com](mailto:galb@mfac.com)[www.mfac.com](http://www.mfac.com)

LS-DYNA

LS-OPT

LS-PrePost

LS-TaSC

LSTC Dummy Models

LSTC Barrier Models

eta/VPG

eta/DYNAFORM

INVENTIUM/PreSys

**United  
States****CAE Associates Inc.**[info@caeai.com](mailto:info@caeai.com)[www.caeai.com](http://www.caeai.com)

ANSYS Products

CivilFem

Consulting ANSYS

Consulting LS-DYNA

**United  
States****DYNAMAX**[sales@dynamax-inc.com](mailto:sales@dynamax-inc.com)[www.dynamax-inc.com](http://www.dynamax-inc.com)

LS-DYNA

LS-OPT

LS-PrePost

LS-TaSC

LSTC Dummy Models

LSTC Barrier Models



United  
States

**ESI-Group N.A**

[www.esi-group.com](http://www.esi-group.com)

QuikCAST	SYSWELD	PAM-RTM	PAM-CEM
VA One	CFD-ACE+	ProCAST Process	Visual-
VisualDSS	Weld Planner	Visual-Environment	IC.IDO

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United  
States

**Engineering Technology Associates – ETA** [etainfo@eta.com](mailto:etainfo@eta.com)

[www.eta.com](http://www.eta.com)

INVENTIUM/PreSy	NISA	VPG	LS-DYNA
LS-OPT	DYNAform		

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United  
States

**Livermore Software Technology Corp**

[sales@lstc.com](mailto:sales@lstc.com)

**LSTC** [www.lstc.com](http://www.lstc.com)

LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
LSTC Dummy Models	LSTC Barrier Models	TOYOTA THUMS	

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United  
States

**Predictive Engineering**

[george.laird@predictiveengineering.com](mailto:george.laird@predictiveengineering.com)

[www.predictiveengineering.com](http://www.predictiveengineering.com)

FEMAP	NX Nastran	LS-DYNA	LS-OPT
LS-PrePost	LS-TaSC	LSTC Dummy Models	
		LSTC Barrier Models	

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**France****DynaS+**[v.lapoujade@dynasplus.com](mailto:v.lapoujade@dynasplus.com)[www.dynasplus.com](http://www.dynasplus.com)

Oasys Suite

LS-DYNA

LS-OPT

LS-PrePost

LS-TaSC

DYNAFORM

VPG

MEDINA

LSTC Dummy Models

LSTC Barrier Models

**Germany****CADFEM GmbH**[lsdyna@cadfem.de](mailto:lsdyna@cadfem.de)[www.cadfem.de](http://www.cadfem.de)

ANSYS

LS-DYNA

optiSLang

ESAComp

AnyBody

ANSYS/LS-DYNA

**Germany****DYNAmore GmbH**[uli.franz@dynamore.de](mailto:uli.franz@dynamore.de)[www.dynamore.de](http://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](mailto:j.mathijssen@infinite.nl)[www.infinite.nl](http://www.infinite.nl)

ANSYS Products	CivilFem	CFX	Fluent
LS-DYNA	LS-PrePost	LS-OPT	LS-TaSC

**Italy****EnginSoft SpA**[info@enginsoft.it](mailto:info@enginsoft.it)[www.enginsoft.it](http://www.enginsoft.it)

ANSYS	MAGMA	Flowmaster	FORGE
CADfix	LS-DYNA	Dynaform	Sculptor
ESAComp	AnyBody	FTI Software	
AdvantEdge	Straus7	LMS Virtual.Lab	ModeFRONTIER

<b>Russia</b>	<b>STRELA</b>		<a href="mailto:info@dynamore.com">info@dynamore.com</a>	
	LS-DYNA	LS-TaSC	LS-OPT	LS-PrePost
	LSTC Dummy Models		LSTC Barrier Models	

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<b>Sweden</b>	<b>DYNAmore Nordic</b>		<a href="mailto:marcus.redhe@dynamore.se">marcus.redhe@dynamore.se</a>	
	<a href="http://www.dynamore.se">www.dynamore.se</a>		Oasys Suite	
	ANSA	μETA	LS-DYNA	LS-OPT
	LS-PrePost	LS-TaSC	FastFORM	DYNAform
	FormingSuite		LSTC Dummy Models	
			LSTC Barrier Models	

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<b>Switzerland</b>	<b>DYNAmoreSwiss GmbH</b>		<a href="mailto:info@dynamore.ch">info@dynamore.ch</a>	
	<a href="http://www.dynamore.ch">www.dynamore.ch</a>			
	LS-DYNA		LS-OPT	LS-PrePost
	LS-TaSC		LSTC Dummy Models	
			LSTC Barrier Models	

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<b>UK</b>	<b>Ove Arup &amp; Partners</b>		<a href="mailto:dyna.sales@arup.com">dyna.sales@arup.com</a>	
	<a href="http://www.oasys-software.com/dyna">www.oasys-software.com/dyna</a>		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	

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<b>China</b>	<b>ETA – China</b>		<a href="mailto:lma@eta.com.cn">lma@eta.com.cn</a>		
	<a href="http://www.eta.com/cn">www.eta.com/cn</a>				
	Inventium	VPG	DYNAFORM	NISA	
	LS-DYNA	LS-OPT	LSTC Dummy Models	LS-PrePost	
			LSTC Barrier Models	LS-TaSC	
<b>China</b>	<b>Oasys Ltd. China</b>		<a href="mailto:Stephen.zhao@arup.com">Stephen.zhao@arup.com</a>		
	<a href="http://www.oasys-software.com/dyna">www.oasys-software.com/dyna</a>				
	PRIMER	D3PLOT	HYCRASH	T/HIS REPORTER	SHELL
	LS-DYNA		LS-OPT	LSTC Dummy Models	LS-PrePost
	DIGIMAT	FEMZIP	LSTC Barrier Models	LS-TaSC	
<b>China</b>	<b>Shanghai Hengstar Technology</b>		<a href="mailto:info@hengstar.com">info@hengstar.com</a>		
	<a href="http://www.hengstar.com">www.hengstar.com</a>				
	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				

<b>India</b>	<b>Oasys Ltd. India</b>	<a href="mailto:lavendra.singh@arup.com">lavendra.singh@arup.com</a>		
	<a href="http://www.oasys-software.com/dyna">www.oasys-software.com/dyna</a>			
	PRIMER	D3PLOT	T/HIS	
			LS-OPT	LSTC Dummy Models
				LS-PrePost
			LS-DYNA	LSTC Barrier Models
				LS-TaSC

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<b>India</b>	<b>CADFEM Eng. Svce</b>	<a href="mailto:info@cadfem.in">info@cadfem.in</a>		
	<a href="http://www.cadfem.in">www.cadfem.in</a>			
	ANSYS	VPS	ESAComp	optiSLang
	LS-DYNA	LS-OPT	LS-PrePost	

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<b>India</b>	<b>Kaizenat Technologies Pvt. Ltd</b>	<a href="mailto:support@kaizenat.com">support@kaizenat.com</a>		
	<a href="http://kaizenat.com/">http://kaizenat.com/</a>			
	LS-DYNA	LS-OPT	LSTC Dummy Models	LS-PrePost
	Complete LS-DYNA suite of products		LSTC Barrier Models	LS-TaSC

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Distribution/Consulting	Asia Pacific	Distribution/Consulting
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<b>Japan</b>	<b>CTC</b>	LS-dyna@ctc-g.co.jp		
	<a href="http://www.engineering-eye.com">www.engineering-eye.com</a>			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	CmWAVE	

<b>Japan</b>	<b>JSOL</b>		Oasys Suite	
	<a href="http://www.jsol.co.jp/english/cae">www.jsol.co.jp/english/cae</a>		JMAG	
	JSTAMP	HYCRASH	LS-PrePost	LS-TaSC
	LS-DYNA	LS-OPT		
	LSTC Dummy Models	LSTC Barrier Models	TOYOTA THUMS	

<b>Japan</b>	<b>FUJITSU</b>	<a href="http://jp.fujitsu.com/solutions/hpc/app/lsdyna">http://jp.fujitsu.com/solutions/hpc/app/lsdyna</a>		
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	CLOUD Services	

<b>Japan</b>	<b>LANCEMORE</b>	<a href="mailto:info@lancemore.jp">info@lancemore.jp</a>		
	<a href="http://www.lancemore.jp/index_en.html">www.lancemore.jp/index_en.html</a>			
	<b>Consulting</b>			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models		

<b>Japan</b>	<b>Terrabyte</b>	<b>English:</b>		
	<a href="http://www.terrabyte.co.jp">www.terrabyte.co.jp</a>	<a href="http://www.terrabyte.co.jp/english/index.htm">www.terrabyte.co.jp/english/index.htm</a>		
	<b>Consulting</b>			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	AnyBody	

<b>Korea</b>	<b>THEME</b>	<a href="mailto:wschung@kornet.com">wschung@kornet.com</a>		
	<a href="http://www.lsdyna.co.kr">www.lsdyna.co.kr</a>			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			

---

<b>Korea</b>	<b>KOSTECH</b>	<a href="mailto:young@kostech.co.kr">young@kostech.co.kr</a>		
	<a href="http://www.kostech.co.kr">www.kostech.co.kr</a>			
	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	

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<b>Taiwan</b>	<b>APIC</b>	<a href="http://www.apic.com.tw">www.apic.com.tw</a>		
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	eta/VPG	FCM

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**POD (Penguin Computing on Demand) offers software including LSTC's LS-DYNA**

[www.penguincomputing.com/services/hpc-cloud](http://www.penguincomputing.com/services/hpc-cloud)

**Penguin HPC clusters are optimized for engineering workloads and offer:**

- Instant access to an HPC Cloud Cluster
- High performance InfiniBand bare-metal compute
- Free support from HPC experts
- No charges for network transfers
- Cost-effective, pay-per-use billing model
- Secure environment for private data
- Detailed billing reports for user groups and projects

**Self Registration Portal – featuring rich--documentation, wiki, FAQ, pricing and more.**

<https://pod.penguincomputing.com/>

**POD Software Applications and Libraries (visit site for complete listing)**

**FEA, CFD and FDTD Modeling**

- **LS-DYNA / LS-PrePost** LS-DYNA is an advanced general-purpose multiphysics simulation software package. Its core-competency lie in highly nonlinear transient dynamic finite element analysis (FEA) using explicit time integration. LS-PrePost is an advanced pre and post-processor that is delivered free with LS-DYNA.
- **OpenFoam:** OpenFOAM (Open source Field Operation And Manipulation) is a C++ toolbox for the development of customized numerical solvers, and pre-/post-processing utilities for the solution of continuum mechanics problems, including computational fluid dynamics (CFD).



- **ANSYS HFSS:** ANSYS HFSS software is the industry standard for simulating 3-D full-wave electromagnetic fields. Its gold-standard accuracy, advanced solver and compute technology have made it an essential tool for engineers designing high-frequency and high-speed electronic components.
- **ANSYS Fluent** ANSYS Fluent software contains the broad physical modeling capabilities needed to model flow, turbulence, heat transfer, and reactions for industrial applications.
- **Star-CD and Star-CCM+:** STAR-CCM+ is CD-adapco's newest CFD software product. It uses the well established CFD solver technologies available in STAR-CD, and it employs a new client-server architecture and object oriented user interface to provide a highly integrated and powerful CFD analysis environment to users.
- **Convergent:** CONVERGE is a Computational Fluid Dynamics (CFD) code that completely eliminates the user time needed to generate a mesh through an innovative run-time mesh generation technique.
- **Lumerical:** Simulation tools that implement FDTD algorithms.



**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 to the increase use of LS-DYNA more and more in recent years.

In calculations of optimization, robustness, statistical analysis, larger amount of LS-DYNA license in short term are required.

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

This service is offered to the customers by the additional price to existence on-premises license, which is relatively inexpensive than purchasing yearly license.

**The following services are available**

**Contact; JSOL Corporation Engineering Technology Division [cae-info@sci.jsol.co.jp](mailto:cae-info@sci.jsol.co.jp)**

**(only in Japanese).**

**HPC OnLine**

NEC Solution Innovators, Ltd.

[http://jpn.nec.com/manufacture/machinery/hpc\\_online/](http://jpn.nec.com/manufacture/machinery/hpc_online/)

**Focus**

Foundation for Computational Science

<http://www.j-focus.or.jp>

**Platform Computation Cloud**

CreDist.Inc.

<http://www.credist.co.jp/>

**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

#### 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.

## Rescale Cloud Simulation Platform

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/software-solutions/cloud-solutions/esi-cloud](http://www.esi-group.com/software-solutions/cloud-solutions/esi-cloud)



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/software-solutions/cloud-solutions/esi-cloud](http://www.esi-group.com/software-solutions/cloud-solutions/esi-cloud)

### 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

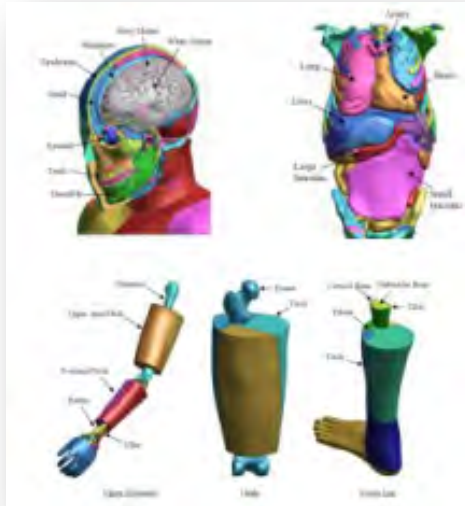
### Collaboration

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

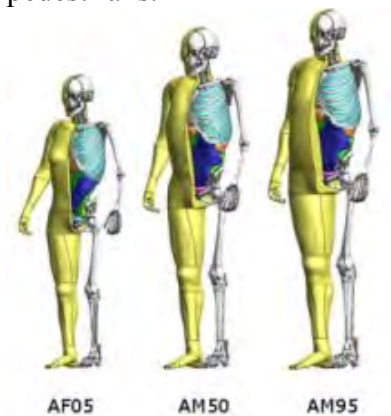


The Total Human Model for Safety, or THUMS®, is a joint development of Toyota Motor Corporation and Toyota Central R&D Labs. Unlike dummy models, which are simplified representation of humans, THUMS represents actual humans in detail, including the outer shape, but also bones, muscles, ligaments, tendons, 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](mailto: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](mailto: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](mailto:atds@lstc.com).



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