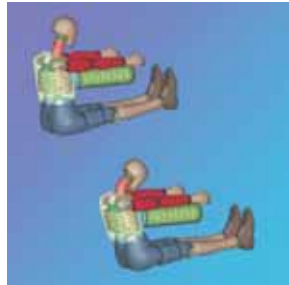


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COVER STORY

NATIONAL GEOGRAPHIC AND IBM
LAUNCH LANDMARK PROJECT TO MAP
HOW HUMANKIND POPULATED PLANET



AUTOMOTIVE INDUSTRY

FORD CROWN VICTORIA
CRASH SIMULATION



ANALYSIS SPOTLIGHT

SGI TECHNOLOGY POWERS
NASA MICHoud PREPARATIONS
FOR SHUTTLE RETURN TO
FLIGHT



FEA Information Worldwide Participant's



Contents

02	FEA Information Inc. Announcements		
03	IBM: National Geographic and IBM launch landmark project to map how humankind populated planet		
08	SGI: SGI Technology Powers NASA Michoud Preparations for Shuttle Return to Flight		
12	Abstract – Publication on the internet A Study on Yielding Function of Aluminum Honeycomb		
13	INTEL: Intel® Multi-Core Processors		
16	Conference Review		
18	ARA: FORD CROWN VICTORIA CRASH SIMULATION		
22	June Distributor LS-DYNA Sales		
23	EVENTS		
24	LS-DYNA Resource Page		
28	Hardware & Computing and Communication Products		
29	Software Distributors		
31	Consulting and Engineering Services		
32	Educational & Contributing Participants		
33	Informational Websites		
34	Archived News Pages		
35	Top Crunch News		
37	BIORID-II Dummy Model for LS-DYNA		
<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> Editor: Trent Eggleston Managing Editor: Marsha Victory Technical Editor: Art Shapiro Graphic Designer: Wayne L. Mindle </td> <td style="width: 50%; vertical-align: top;"> Technical Writers: Dr. David Benson Uli Franz Dr. Ala Tabiei Technical Consultants: Steve Pilz Reza Sadeghi </td> </tr> </table>		Editor: Trent Eggleston Managing Editor: Marsha Victory Technical Editor: Art Shapiro Graphic Designer: Wayne L. Mindle	Technical Writers: Dr. David Benson Uli Franz Dr. Ala Tabiei Technical Consultants: Steve Pilz Reza Sadeghi
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FEA Information Announcements

Conference CD: You can sign up now for the 5th European LS-DYNA Conference CD. There is no fee and shipping is free. Mailing is anticipated shipping the third week of July.

www.ls-dynaconferences.com

The link for the sign up form is on the side menu

Information for the 2006 Conference will be posted in August

The 5th European LS-DYNA User's Conference was a great success – We hope you can share in the 2006 conference held in the US.

**Sincerely,
*Trent Eggleston & Marsha Victory***

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National Geographic and IBM launch landmark project to map how humankind populated planet

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Five-Year Genographic Project Allows Individuals to Trace Own Migratory History

The National Geographic Society and IBM today launched a groundbreaking research initiative that will trace the migratory history of the human species.

The Genographic Project, a five-year research partnership, will use sophisticated laboratory and computer analysis of DNA contributed by hundreds of thousands of people, including indigenous peoples and members of the general public, to map how the Earth was populated. Led by National Geographic Explorer-in-Residence Spencer Wells, Ph.D., a team of international scientists and IBM researchers will collect genetic samples, analyze results and report on the genetic roots of modern humans.

With funding from the Waitt Family Foundation, the scientists will establish 10 centers around the world and will study more than 100,000 DNA samples from indigenous populations. The project is expected to reveal rich details about global human migratory history and to drive new understanding about the connections and differences that make up the human species.

"We see this as the 'moon shot' of anthropology, using genetics to fill in the gaps in our knowledge of human history," said project leader Spencer Wells. "Our DNA carries a story that is shared by everyone. Over the next five years we'll be deciphering that story, which is now in danger of being lost as people migrate and mix to a much greater extent than they have in the past."

The resulting public database will house one of the largest collections of human population genetic information ever assembled and will serve as an unprecedented resource for geneticists, historians and anthropologists.

Members of the general public are able to participate in the Genographic Project by purchasing a kit and allowing their own results to be included in the database. Individuals will be able to follow the progress of their own migratory history as well as the global research by logging on to nationalgeographic.com.

"National Geographic has been exploring and mapping the world for 117 years," said John Fahey, President and CEO of the National Geographic Soci-

ety. "Now, as a result of our remarkable partnership with IBM and Spencer Wells, we are deploying state-of-the-art science and technology to map our journey across the planet. We hope this ambitious and important project will increase our understanding and appreciation of our shared history. The field science work, so generously supported by the Waitt Family Foundation, will go into a virtual museum of human history." "IBM and National Geographic are embarking on a historic expedition into our collective past," said Samuel J. Palmisano, chairman and CEO of IBM. "Our two organizations have long contributed to scientific exploration and achievement, extending in different ways the boundaries of human knowledge and understanding. We continue this tradition of innovation that matters for the world and welcome the participation of the hundreds of thousands of people who will join in this amazing journey.

Scientists from IBM's Computational Biology Center, one of the world's foremost life sciences research facilities, will use advanced analytical technologies and data sorting techniques to interpret the samples and to discover new patterns and connections within the data they contain. IBM is also providing the core computational knowledge and infrastructure that will manage the hundreds of thousands of genotype codes being analyzed by the Genographic Project.

"The more we can improve our understanding of the common origin and journey of humankind, the greater the possibility for all of us to see each other as members of the same family," said Ted Waitt, founder of the Waitt Family Foundation. "And with that awareness,

we can find ways to live and work together on a global basis."

The Genographic Project has three core components:

- **Field Research** - Collecting DNA samples and field research with indigenous populations are central to the project. Blood samples from indigenous populations, whose DNA contains key genetic markers that have remained relatively unaltered over hundreds of generations, are reliable indicators of ancient migratory patterns. Wells and a consortium of scientists from prominent international institutions will conduct the field and laboratory research. An international advisory board will oversee the selection of indigenous populations for testing as well as adhering to strict sampling and research protocols.

Public Participation and Awareness Campaign - The public can take part by purchasing a Participation Kit, (U.S. \$99.95 plus shipping and handling), and submitting their own cheek swab samples, allowing them to track the overall progress of the project as well as learn their own migratory history. These personal results will be stored securely and anonymously to ensure the privacy of participants. National Geographic and IBM will regularly update the public and the scientific community on project findings, by such means as the Web site www.nationalgeographic.com/genographic and National Geographic's many other media platforms worldwide. A television program, "The Search for Adam," will air in the U.S. on the National Geographic

- Channel Explorer series and around the world on the National Geographic Channel. Public participation may be restricted in some countries, such as China and India, where the export of genetic materials requires government approval. The Genographic Project will work with relevant authorities to achieve the broadest level of public participation possible.
- Genographic Legacy Project - Proceeds from the sale of the Genographic Participation Kits will help fund future field research and a legacy project, which will build on National Geographic's focus on world cultures. The legacy project will support education and cultural preservation projects among participating indigenous groups.

Help unravel the mystery of our species' journey

Humans are found everywhere on Earth. Yet how did we get here? Where did we come from? And why do we all look so different? IBM and National Geographic are mounting the Genographic Project, an ambitious attempt

Leadership. Innovation. Technology. If IBM can power a project of this magnitude, imagine what it could do for your organization.

To learn more about the Genographic Project and to purchase a kit, <https://www5.nationalgeographic.com/genographic/>

to help answer these fundamental questions. The five-year study will use one of the largest collections of DNA samples ever assembled to map how the Earth was populated.

The Genographic Project is the brainchild of Dr. Spencer Wells, a pioneer in using DNA samples to map human migratory patterns. Working with Dr. Wells will be researchers from IBM's Computational Biology Center—one of the world's foremost life sciences research facilities—and a global team of prominent research scientists from 10 research centers around the world. Together, they will seek answers to long-standing questions regarding man's epic migration patterns.

You can contribute your DNA anonymously to the study by purchasing a public participation kit*. By participating in the project, you will learn interesting information about your family's deep ancestry over the ages.

The Genographic Project Web site will be regularly updated with personalized migratory maps so that each personal history can become more vivid and detailed over the length of the project.



Dr. Ajay Royyuru, IBM Research's lead scientist for the Genographic Project, recently shared his thoughts about IBM Research's role in this exciting and innovative initiative.

From determining where an individual's ancestors can first be found to mapping migration patterns of humankind, IBM and the National Geographic Society expect that there will be many discoveries (both big and small) that will take

place during their five-year research partnership known as the Genographic Project.

This is the most ambitious genetic anthropology research initiative in history, with plans to gather one of the largest collections of DNA samples to map how humankind populated the planet. IBM's role in the partnership will be to handle all aspects of storage and analysis of this complex data.

What is IBM Research's role in this project?

Dr. Royyuru: The objective is to understand human migration, the journeys our ancestors traveled over the last 50 thousand years. The only way to get to an answer to a question like that is by digging deep. We have to gather large quantities of genetic data that describes our deep ancestral history; geographic, anthropological and cultural data that describes the diverse tapestry of peoples around the world, and find the correlations between these to draw conclusions on the migratory history of humankind. Our research team will be working closely with National Geographic and scientists worldwide to analyze the data and draw those conclusions.

How did IBM Research get involved?

Dr. Royyuru: The National Geographic Society approached IBM with the idea for this project on the recommendation of Dr. Spencer Wells, a geneticist and anthropologist, who said that he needed the company's expertise. After meeting with IBM Research, Wells was convinced that he had found the perfect partner for this enormous undertaking.

It's certainly not every day that a scien-

tist in a corporate research institution is asked to participate in a project that seeks to trace the migration patterns of humankind, going back tens of thousands of years. Fortunately, the company doesn't shy away from big challenges, so we were able to pursue this remarkable opportunity.

Have you always thought of mapping the migratory history of humankind as a big challenge that you would like to attempt?

Dr. Royyuru: Trying to find these patterns of humankind has always been an attractive goal to those who do genetics. This holds true for me too, of course, as a researcher in computational biology. Finding the answers has been possible all along, but not practical because of the number of people you'd have to have to draw meaningful conclusions.

But this project goes far beyond what's been done before. It asks the questions that literally every person on the planet wonders at one time or another: Who am I? Where am I from? I can go back six generations myself. But what is that? Two hundred years? And it's all geographically in one place, too. But beyond that, there's no information. We know the human species originated in Africa and spread from there sometime in the last 100,000 years or less. Who were my ancestors and how did they get to be in that part of the world?

Which aspects of this study do you consider most remarkable?

Dr. Royyuru: I must confess I'd take part in the project solely for the opportunity to understand human diversity. But I also feel that the scale and scope of it will allow researchers to learn things that we don't already know in an

area that we are eager to study – information-based medicine.

The understanding of how medicine relates to a population, why one solution works for some people and not for others, how to minimize side effects and maximize benefits, these are all very important for the future of healthcare. And to reach this understanding, you have to get to the root of what population diversity means. The data from the Genographic Project, while not having any medical content, will far exceed anything we could ever get in a medical study.

The potential benefits of a study such as this are clear. Are there any potential controversies that might arise?

Dr. Royyuru: Yes, the fact is that we are asking people to volunteer something that is very personal, sequencing regions of their genomes – this is what defines them, what's unique to them. There is an enormous amount of sensitivity to such data, which we fully respect. Confidentiality and privacy cannot be compromised. (See sidebar for more information on the security and privacy systems that are in place.)

There also might be some controversy from those who challenge the theory of evolution itself. But I'm a scientist, I believe in what the data tell me and I go with that. I'm not here to question someone else's beliefs. Our team is looking solely at what the scientific facts tell us.

About National Geographic Founded in 1888, National Geographic is one of

the world's largest nonprofit scientific and educational organizations. Its mission is to increase and diffuse geographic knowledge while promoting the conservation of the world's cultural, historical and natural resources. National Geographic reflects the world through its five magazines, cable television channels and programs, films, radio, books, videos, maps, interactive media and merchandise, reaching as many as 300 million people each month.

About IBM IBM is the world's largest information technology company, with more than 80 years of leadership in helping businesses innovate. In recent years IBM has launched a series of major research initiatives designed to overcome many of the remaining "grand challenges" of science, including the Deep Blue chess-playing computer and unraveling the mysteries of protein folding with BlueGene, the world's fastest supercomputer. For more information about IBM, visit www.ibm.com.

About the Waitt Family Foundation Established in 1993 by Gateway Computer founder and now Chairman Ted Waitt and his wife, Joan, the Waitt Family Foundation focuses on humankind's past, present and future. Specifically, the foundation funds projects aimed at making discoveries about our past that will help inform the way we are today and reveal untapped possibilities for the future. For more information about the Waitt Family Foundation, visit www.waittfoundation.org

SGI Technology Powers NASA Michoud Preparations for Shuttle Return to Flight (MOUNTAIN VIEW, Calif. (June 20, 2005)

Lockheed Martin Runs Debris Impact Analysis and Design/Modeling Analyses of External Fuel Tank on SGI Systems

“Based on the criteria set by the NASA agency-wide team, SGI and LS-DYNA® software (a general-purpose transient dynamic finite element program) from Livermore Software Technology Corp., became the obvious choice”, as Jimmy Blevins, structural dynamics engineer, Lockheed Martin Space Systems-Michoud explained.



NASA Michoud

SGI® Altix® high-performance computing systems are helping to ensure the safety of space flight by enabling NASA Michoud engineers to successfully run impact analysis simulations of foam, ice, and other debris and to model/analyze the design of the Shuttle's external fuel tank. Here the ET-120 (External Tank-120) is shown leaving the manufacturing facility at sunrise on New Years Eve on its way to Kennedy Space Center. Image Courtesy Lockheed Martin Spaces Systems-Michoud.

With NASA now projecting a mid-July Space Shuttle return to flight, Lockheed Martin Space Systems-Michoud Operations continues their impact analysis of the external fuel tank using the SGI® Altix® computing system and SGI® InfiniteStorage purchased from Silicon Graphics (NYSE: SGI) in June 2004. Michoud, which designs and assembles the Space Shuttle external fuel tank for NASA, made the purchase to complete impact analysis simulations of foam, ice, and other debris and to model/analyze the design of the Shuttle's external tank. Michoud chose

SGI® high-performance compute technology because SGI benchmark tests demonstrated to Michoud engineers that they could run the three-million-plus calculations required in time to deliver their findings by NASA deadlines.

Shuttle return-to-flight preparations are occurring throughout NASA facilities and space centers. Michoud, in New Orleans, is a government-owned, contractor-operated component of the NASA Marshall Space Flight Center in Huntsville, Ala. Engineers at Lockheed Martin-operated Michoud facility are work-

ing closely with the Ice Formation Team at NASA Kennedy Space Center as well as Glenn Research Center, which delivers the computational fluid dynamic (CFD) models Michoud uses for impact analysis.

As part of the effort to ensure the safest possible return to flight, the structural dynamics group at Michoud was charged with debris impact analysis on the Shuttle's external fuel tank. Potential debris elements include foam and ice and the analysis is location-specific, such as foam off the inner tank flange or foam off the forward ogive (pronounced oh-jive)—which is the aerodynamically-shaped forward end of the tank. Other elements include solid rocket booster (SRB) exhaust products, SRB ablator (material used to transfer heat away from high heat-erosion areas) and even butcher paper, which is put up around the motors to keep out moisture. The elements range in size from small masses of .0001 pounds all the way up to some ice particles as large as .09 pounds. Possible trajectories of each one of these pieces of debris—where they could go and where they could hit—result in millions of combinations.

In preparation to run the estimated three-million-plus variations of possible debris impact analysis, Michoud's Information Technology Systems (ITS) department considered a number of hardware and software vendors to meet the staggering computational demands. Based on the criteria set by the NASA agency-wide team, SGI and LS-DYNA® software (a general-purpose transient dynamic finite element program) from

Livermore Software Technology Corp., became the obvious choice, as Jimmy Blevins, structural dynamics engineer, Lockheed Martin Space Systems-Michoud explained.

"Right now, we can't simulate real world behavior of an external tank in something like a wind tunnel test," said Blevins. "It's absolutely impossible to do, and there is no way they were going to let me shoot at a real tank filled with liquid propellant. We had to rely upon high-performance computers to run simulation code that gives us the behavior of how a piece of foam would come off a tank. We had to come up with an analytical method to correlate that testing effort with what would actually happen to the tank in flight. And the only way to get there was with LS-DYNA, and the only way to deal with LS-DYNA on the scale that we required was to go with the SGI system."

Blevins, who almost single-handedly runs the impact analysis on the SGI Altix system, added, "SGI ran some benchmarks for us with LS-DYNA. The results were compelling. A job that would have taken eight days to run on our current system took a little over four hours to run on the Altix server. The model sizes we're running now are much bigger than the benchmark tests. I'm running jobs that are about 30 hours each, which would have taken months, if they had even been possible to run at all. I don't believe these LS-DYNA calculations, at the detail level we need, would ever have run on another machine. With the SGI Altix system, we basically compressed two years worth of work into about three months."

Lockheed Martin Spaces Systems-Michoud, a long-time SGI customer, completed installation of a SGI® Altix® 3000 server with 64GB RAM with the Linux operating environment running on 32 Intel® Itanium® 2 processors, as well as a 4TB SGI® InfiniteStorage TP9100 solution, last July. ITS systems administrators Leslie Jennings and Bob Meibaum were originally charged with defining the user requirements and selecting the appropriate hardware.

"What the SGI Altix server offered was shared memory as opposed to a cluster of PCs," said Meibaum. "In a cluster, each PC has a certain amount of memory on it and then you have to communicate between the PCs, but you can't see the memory: you're communicating between the processors on the PCs. With the Altix system, the memory is accessible by any of the processors. Any of the 32 processors on this Altix system can access any of the 64 gigabytes of memory. Shared memory makes for a much more flexible and faster machine."

"We reviewed benchmarks and talked to software vendors and they said that the SGI Altix server ran various applications really well, and LS-DYNA ran very, very well on Altix system," said Jennings. "Another reason we selected Altix server is that I really like the idea of having one company behind the hardware and the Linux software. A lot of times when you buy a Linux box, you have your hardware from here and your software from there and then system support is hard to get. But I know I can always count on support from SGI, and that meant a lot to me as a system

administrator. Now that we see the power of the Altix system in our impact analysis, we are considering the purchase of a similarly configured Altix system for future work at Michoud."

SGI Helps Improve External Tank Design Capabilities

At the same time as the SGI Altix system acquisition, Michoud, for a separate external tank re-design effort, purchased 11 Silicon Graphics® visual workstations each with 1GB RAM. The workstations are being used to remodel portions of the original external tank design database, which was limited to only wireframe design capabilities, into the CATIA® CAD-CAM application from Dassault Systemes. CATIA enables Michoud engineers to make a solid from the wireframe model, shade it, and do impact and volume analysis. In a sense, CATIA, powered by SGI visualization workstations, is used to draw a complex "skin" around the wireframe models, which was used to re-draw the outside mold line for the external tank, which in turn is used to make CFD models.

"Throughout the years, SGI technology has empowered NASA in many aspects of space flight and we are humbled by the future scientific possibilities," said Anthony Robbins, president of SGI Federal. "SGI technology is helping to ensure the safety of space flight, and we look forward to our continued contributions throughout the 21st century."



Image Courtesy Lockheed Martin Spaces Systems-Michoud.

NASA Michoud

NASA Michoud engineers used a SGI® Altix® system to complete impact analysis simulations of foam, ice, and other debris and to model/analyze the design of the Shuttle's external fuel tank. The external tank is seen here in production.

About Lockheed Martin: Lockheed Martin Space Systems - Michoud Operations designs and assembles large aluminum and composite structures such as the Space Shuttle External Tank for aerospace and other applications at the NASA Michoud Assembly Facility in New Orleans. Further information can be found on the Web: www.lockheedmartin.com/michoud/ or

<http://www.globalsecurity.org/space/facility/michoud.htm>. Headquartered in Bethesda, Md., Lockheed Martin employs about 130,000 people worldwide and is principally engaged in the research, design, development, manufacture and integration of advanced technology systems, products and services. The corporation reported 2004 sales of \$35.5 billion.

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A Study on Yielding Function of Aluminum Honeycomb

Abstract & Introduction

**THE PAPER (1.99MB) IS ON LINE:
www.feapublications.com - side link: Featured**

Authors:

Shigeki Kojima
Toyota Communication Systems Co., LTD., Japan

Tsuyoshi Yasuki, Satoshi Mikutsu
Toyota Motor Corporation, Japan

Toshikazu Takatsudo
The YOKOHAMA RUBBER CO., LTD. Japan

Keywords: Automotive Crashworthiness, Offset Deformable Barrier (ODB), Aluminum Honeycomb, and Material-126

Abstract

This paper describes newly developed yielding function of aluminum honeycomb. Physical compression tests of aluminum honeycomb were performed and it was found that yielding stress of aluminum honeycomb highly depended up on direction of compression. Using these test data, a yielding function was newly derived as a function of volumetric change and angle of compression.

The yielding function was introduced to MAT126 as an option. ODB frontal collision analysis result with the yielding function showed much better correlation with test results than with MAT126 without the option.

1. Introduction

In using offset frontal collision analysis to predict the amount of vehicle deformation, it is essential for the ODB model (Offset Deformable Barrier model) to replicate the compression

property of aluminum honeycomb accurately. Numerous studies have been published of the compression property of aluminum honeycomb along a single axis, but in an offset frontal collision, the aluminum honeycomb is compressed not just along one axis, but also in the oblique direction.

This paper focuses on the compression property of aluminum honeycomb in the oblique direction. Independently conducted tests of aluminum honeycomb compression indicated that the yielding function of aluminum honeycomb is dependent on the direction of compression. The yielding function that was derived was incorporated into the material model for LS-DYNA in an attempt to improvement accuracy of vehicle deformation prediction, and an offset frontal collision analysis was carried out.

Intel® Multi-Core Processors

With more than 15 multi-core processor designs underway, Intel is on a fast-track to deliver multi-core processors in high volume across all its platform families, including client, server and communications systems. A multi-core processor includes two or more complete execution cores per physical processor, enabling server platforms to handle more tasks, software threads or applications simultaneously. These capabilities can be expected to drive a remarkable new era of server performance and flexibility, providing business with platforms that can better handle escalating workloads and rapidly evolving usage models.

Intel dual-core processors are just the first step in this transition. The first Intel dual-core processor was launched for desktops in April 2005, and Intel is already working on a multi-core architecture that could eventually feature dozens or even hundreds of processor cores on a single die. Plans are also underway to develop specialized, configurable cores that will deliver optimized performance for some of tomorrow's most critical tasks, such as data mining and advanced image and speech processing.

Empowering the Software Industry

Multi-core processors are an example of parallelism, which Intel has been driving forward for more than a decade: first with multi-processor platforms and then with Hyper-Threading Technology (HT). Throughout that time, Intel has been working with leading software vendors to deliver multi-threaded code that can take full advantage of these capabilities. As a result, Intel has es-

tablished extensive tools, resources, expertise and relationships that have helped drive thread-optimization across a wide range of business applications.

Now Intel is accelerating these efforts, working with leading developers and academia to deliver increasingly advanced tools, adaptive libraries and other infrastructure that will help the industry take full advantage of evolving platform capabilities. These resources will help software developer's transition from dozens of threads in some of today's leading operating systems and applications, to hundreds or even thousand of threads in future solutions.

In tandem with these efforts, Intel is working with key vendors to fuel the ongoing development of virtualization, consolidation, grid and utility computing solutions. These technologies are already helping IT organizations utilize Intel processor-based platforms more effectively, and will be increasingly important to take advantage of next-generation systems based on multi-core processors.

Delivering Cross-Platform Value

Powerful, balanced platforms are as important as software in translating multi-core processing into meaningful business value, and Intel is focused on delivering innovative new capabilities across all its platform families. Today, that means delivering the latest memory (DDR2) and I/O (PCI Express*) technologies, along with extended bus architectures that can keep pace with increasing processor performance. It also means integrating innovative new platform technologies, such as Intel®

Virtualization Technology, Intel® I/O Acceleration Technology (Intel® I/OAT), Intel® Active Management Technology, and Intel Power Tools.

In conjunction with Hyper-Threading Technology, these new capabilities will be instrumental in helping businesses grow, optimize value, reduce costs and mitigate risk as they transition to multi-core processor-based platforms. They will also help them establish a flexible, standards-based foundation for ongoing platform, IT and business innovation.

Helping Businesses Transition:

Multi-core processors represent a critical industry inflection point. Intel envisions delivering a 10X performance gain over the next four years (compared to a 3X improvement in the last four years). To help businesses make the most of this transition, Intel is increasing its enabling efforts, providing additional information, tools and resources that can help you plan and implement a successful migration.

Seed Platforms—to help enable mainstream adoption, Intel plans to offer early and broad access to multi-core processor-based platforms for development, testing and validation—beginning with dual-core processor-based platforms in mid-2005.

Software Optimization for Multi-Core Processors—Intel provides independent software vendors (ISVs) and corporate developers with cutting edge tools for threaded software development and optimization; as well as information, training and professional support. Intel® Software Network (Intel® SN) will make these resources more accessible and valuable than ever before.

Transition Guidance for Multi-Core Processors—Intel® Solution Services

provides expert guidance that can help you get the most from multi-core processors and other new platform capabilities, within the context of your unique business and IT environment.

The Impact of Multi-Core Processors on Your Business and IT Strategy:

The flexibility, reliability and manageability of Intel® processor-based platforms—along with the performance advantages of multi-core processors—will help fuel transformative new business and IT usage models, both now and in the future. The following may be helpful as you plan for change.

Explore Transformative Business Solutions—From real-time business interactions to automated asset tracking, the ability of technology to transform business is increasing. Many of these solutions will demand fast throughput for multiple, simultaneous transactions—a perfect fit for Intel multi-core processor-based platforms.

Take Advantage of Increasingly Flexible CPU Resources—In tandem with new virtualization solutions, Intel multi-core processors will enable increasingly granular allocation of processing power. Plan on using these capabilities to tailor and enhance service levels for multiple applications and complex workloads.

Work to Optimize Datacenter Efficiency—Server virtualization and consolidation, grid computing, and embedded IT capabilities are helping companies simplify their datacenters, improve utilization, and reduce total costs. Multi-core Intel processors will give IT more granular control to support these and other critical advances.

More Information:

Get detailed background information about Intel multi-core processor architecture.

- Read the Intel press release on next-generation Intel multi-core processors.
- Access the Intel® Software Network for tools, information and support that can help you optimize your transition to multi-core processor based platforms.
- Read about emerging usage models, and how they are likely

to impact the next decade of business and IT innovation. [PDF 70KB]

Innovative Intel Platform Technologies:

- Intel® Active Management Technology
- Hyper-Threading Technology
- Intel® Virtualization Technology
- Intel® I/O Acceleration Technology (Intel® I/OAT)
- 64-bit Computing
- Intel Power Tools and Thermals

REVIEW: 5th European LS-DYNA Users' Conference 25th – 26th May 2005, The ICC, Birmingham UK



Arup were pleased to have the opportunity to host the 5th European LS-DYNA Users Conference at The ICC in Birmingham, UK on 25th and 26th May 2005.

More than 70 people attended a social event on Tuesday 24th May which gave the opportunity to meet and talk before the first day of the conference opened on Wednesday.

The conference opened with presentations from three of our keynote speakers; Neil Hannemann, Executive Director of Engineering at McLaren Cars, Professor John Middleton, Head of Biomechanics Research Unit at Cardiff University and Dr Stefan Glaser, Manager at BASF AG.

The event also brought together over 80 speakers from companies and universities all over the world to present papers on applications ranging from shaken babies to advanced thermoplastic composites, and 16 exhibitors presented their products and services related to LS-DYNA in an accompanying exhibition.

Along with the presentations through the day, the Conference Dinner was brought to a close with a presentation from the dinner sponsors; IBM and OCF and after-dinner entertainment in the form of Perry McCarthy - one of Britain's top racing drivers and part of motor racing folklore!

John Hallquist wrapped up the last session of the day talking about new features in the upcoming release of LS-DYNA which will include scalable parallel implicit capabilities using MPI.

The conference provided an ideal forum for LS-DYNA users from all over the world to share and discuss their experiences, to obtain information on upcoming features of LS-DYNA, and to learn more about new application areas.

ARUP would like to specifically thank the following:

Organisers:

- CAD-FEM GmbH
- CRIL Technology
- DYNAmore GmbH
- Engineering Research AB,
- LSTC
- Strela

Keynote Speakers:

- Neil Hannemann
- Professor Middleton
- Dr. Stefan Glaser

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Additionally, thanks to all of you that attended and making the conference such a successful event.

ARUP

FORD CROWN VICTORIA CRASH SIMULATION

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Complete Graphics and Movies with full article on:

http://www.arasvo.com/crown_victoria/crown_vic.htm

The NCAP frontal impact test was simulated with the full vehicle model using the LS-DYNA finite element code

The Silicon Valley Office of ARA has developed a high fidelity model of a Ford Crown Victoria for performing crashworthiness simulations. This study was part of an overall program sponsored by National Highway Traffic Safety Administration (NHTSA) to develop a set of crash models for various vehicles that represent the full range of vehicle types currently on the road. This set of vehicle models can be used to establish the crash safety of future light-weight vehicles developed under the Partnership for a New Generation of Vehicles (PNGV) program.

The overall program to develop and validate a high-fidelity crash simulation model for the Ford Crown Victoria was a combined experimental and modeling effort under the management of the Volpe National Transportation Systems Center (VNTSC). MGA Research Corporation performed component validation tests on the Crown Victoria and had previously performed vehicle frontal and side impact tests. Results of the vehicle tests are shown on the Crown Victoria Crash Test Video page [1]. Component tests for this program included the front bumper rigid pole impact test [2], the front door rigid pole impact test [3], and the vehicle frame rigid wall impact test [4].

The preliminary phase in the development of a crash simulation model was the vehicle tear-down and measurement of the structural geometries. An illustration of the Crown Victoria in this tear-down process is shown in Figure 1. Once the nonstructural components were removed from the vehicle, tape was applied to the components to discretize the structure prior to measurement. An illustration of the Crown Victoria with the exterior surfaces discretized is shown in Figure 2.



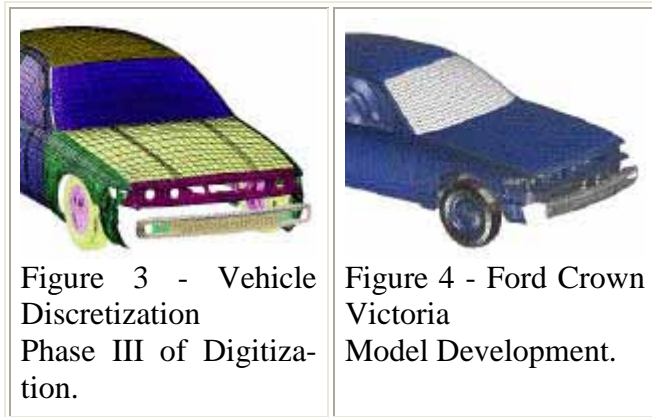
Figure 1 - Vehicle Tear-Down Process Initial Phase of Digitization.



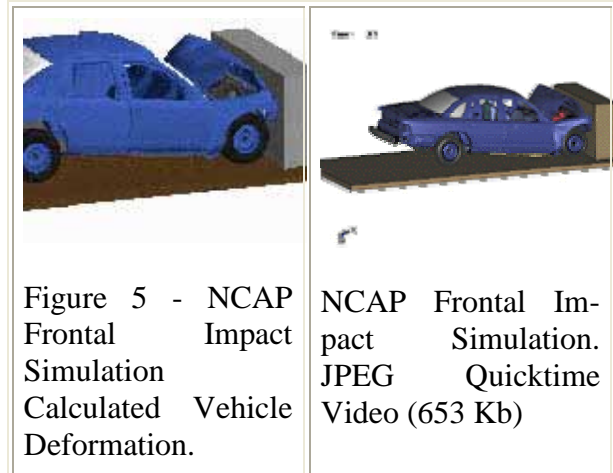
Figure 2 - Vehicle Discretization Phase II of Digitization.

The resulting measured surfaces were then modified to an appropriate format for use in the vehicle model mesh generation program TrueGrid. External surfaces as seen in TrueGrid are shown in Figure 3. These digitized surfaces were then used to generate the vehicle com-

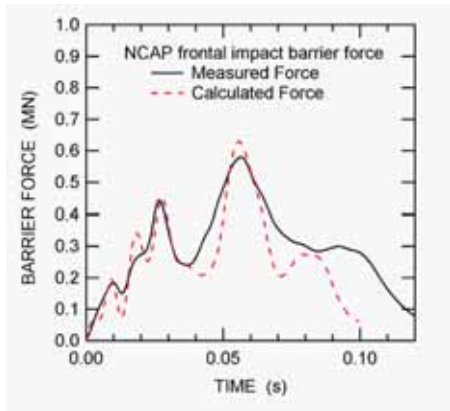
ponents in the finite element model. The corresponding FE model is shown in Figure 4.



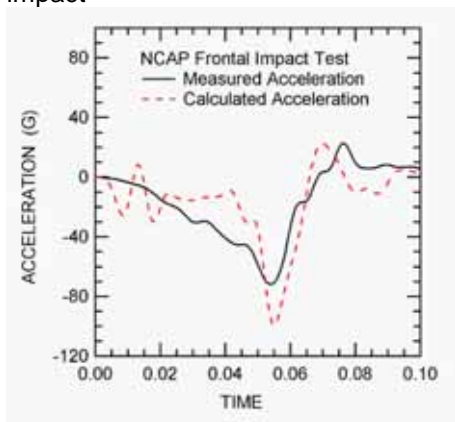
Full vehicle crash test data was available for the Ford Crown Victoria from testing performed under the New Car Assessment Program (NCAP). This testing included both frontal barrier and side impact testing. The NCAP frontal impact test was simulated with the full vehicle model using the LS-DYNA finite element code. This frontal impact condition was a 15.6 m/s (35 mph) impact of the vehicle into a rigid wall. The calculated vehicle response in the frontal impact simulation is shown in Figure 5. Many of the characteristics observed in the tests were reproduced in the simulation. The overall collision response produces a forward pitching motion of the vehicle with a noticeable downward motion forward of the passenger compartment and a lifting of the rear of the vehicle. The hood was folded upward in the middle and the deformations were limited in the vehicle behind the firewall. This vehicle frontal crash behavior can be seen clearly in Movie 1 [5].



The calculated and measured wall impact force histories, for the NCAP frontal impact test, are compared in Figure 6(a). The magnitude and time of the peak forces agree quite well. The maximum impact force occurs at a time of approximately 55 ms and corresponds to the time the engine is directly loaded through the crushed forward vehicle components against the wall. The late time impact force history drops off more rapidly in the simulation than in the experiment. This discrepancy may result from additional mass in the test such as crash dummies and instrumentation that were not included in the current simulation. The calculated and measured engine longitudinal accelerations are compared in Figure 6(b). The magnitude of the calculated peak acceleration is approximately 30% higher than that in the test with a shorter pulse width. Additional analysis is required to determine the source of these discrepancies. The calculated response also has a larger magnitude cyclic response during the first 20 ms, which could be an artifact of the engine mount modeling.



(a) Comparison of measured and calculated wall impact force.

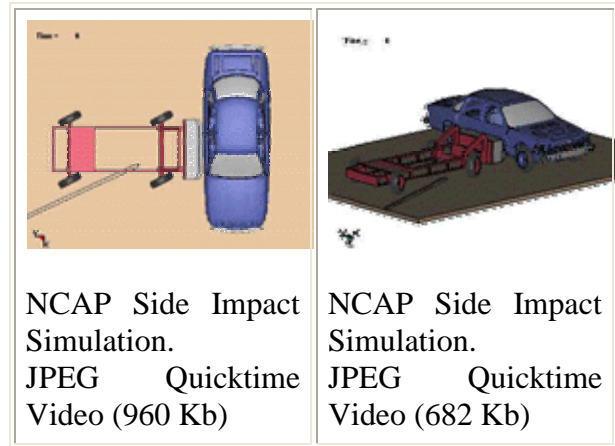


(b) Comparison of measured and calculated engine acceleration.

Figure 6 – NCAP Frontal Impact Simulation Vehicle Collision Measures

The NCAP side impact test was simulated with the full vehicle model and a model created for the Movable Deformable Barrier (MDB). Note: this model of the MDB was not independently validated. The side impact test was a 14.9 m/s (33.25 mph) impact of the MDB into the stationary vehicle side. The wheels of the MDB were angled at 27 degrees relative to it's axis to represent the relative motion of the two vehicles. The calculated vehicle response in the side impact simulation is shown in Movie 2 [6]

and Movie 3 [7]. Many of the characteristics observed in the tests were reproduced in the simulation. The overall crush of both the MDB front and the vehicle side compare reasonably well with the test. The gross motions of both the MDB and struck vehicle were also reasonably well calculated.



Comparisons of the calculated and measured MDB accelerations are shown in Figure 7. The magnitude of the longitudinal acceleration is slightly over predicted in the simulation. This may be a result of either the car or the crushable MDB models being slightly too stiff.

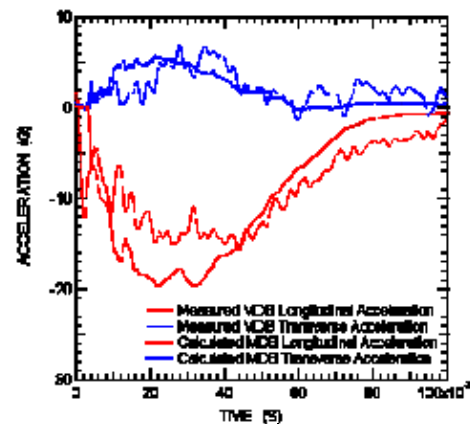


Figure 7 – NCAP Side Impact Simulation MDB Accelerations

References:

- 1) http://www.arasvo.com/crown_victoria/cv_movies.htm
- 2) http://www.arasvo.com/crown_victoria/bumper.htm
- 3) http://www.arasvo.com/crown_victoria/door.htm
- 4) http://www.arasvo.com/crown_victoria/frame.htm
- 5) http://www.arasvo.com/crown_victoria/crvic_movies/movie_f2a.MOV
- 6) http://www.arasvo.com/crown_victoria/crvic_movies/movie_s2a.MOV
- 7) http://www.arasvo.com/crown_victoria/crvic_movies/movie_s2b.MOV

LSTC Distribution Channel

June Highlighted FEA Participants for LS-DYNA Sales – Support – Training – Benchmark

Australia – LEAP www.leapaust.com.au/

LEAP stands for Leading Engineering Application Providers. Our area of expertise is the application of technology to enable efficient product development, manufacturing, and management of the whole process throughout the entire lifecycle.

India – Altair India www.altair-india.com/

Altair Engineering India. Based in Bangalore. Altair Engineering India markets and supports an advanced suite of CAE Products in the Indian sub-continent

Hosting the 3rd South Asia LS-DYNA User Conference 2005 to be held in Bangalore on August 12, 2005.

KOREA - THEME

Theme Engineering has its main office located in Seoul, Korea. Full sales, training and support throughout Korea.

Hosting the Korean Users conference on LS-DYNA, November 25, 2005

Sweden ERAB www.erab.se/

Engineering Research AB is a centre of excellence in the field of Computational Structural and Solid Mechanics, CSM, and Simulation Based Design. Our competence is based on both advanced academic research and development and on a long term industrial experience.

TAIWAN – FLOTREND

Flotrend is LSTC's distributor in Taiwan for sales, training and support throughout Taiwan for LS-DYNA, LS-PrePost and LS-OPT.

US – DYNAMAX www.dynamax-inc.com/

Dynamax, Inc has always kept updated in its engineering expertise and understood customer's expectations. With more than ten years professional experience in using the LS-DYNA software to solve customer's problems especially in the automobile industries.

EVENTS

- June 25-27, 2005
8th U.S. National Congress on
Computational Mechanics, Austin,
TX
- October 05-08, 2005
TCN CAE 2005 International Con-
ference on CAE and Computational
Technologies for Industry
Italy – (Numerica)
- August 12, 2005
Altair India – 3rd South Asia LS-
DYNA User Conference, Bangalore,
India
- October 20-21, 2005
German-LS-DYNA Forum
(DYNAmore)
Bamberg, Germany
- November 09-11, 2005
23rd CADFEM Users' Meeting – Int'l
Congress on FEM Tech. W/ANSYS
CFX & ICEM CFD Conference,
Bonn, Germany
- November 25, 2005
Korean Users Conference –
LS-DYNA (THEME)
- November 29-30, 2005
Japanese Users Conference
(Nagoya) LS-DYNA (JRI)
- June 2006
LS-DYNA
9th International LS-DYNA Users
Conference – Deerborn, MI
(LSTC)

LS-DYNA Resource Page

Interface - Hardware - OS And General Information

**LS-DYNA General Information- www.lstc.com sales@lstc.com
Now available – Training at LSTC Michigan Office**

Version: 970	Classes: www.lstc.com classes	30-day demonstration licenses available – no fee
		Sales sales@lstc.com

Participant Hardware and OS that run LS-DYNA (alpha order)

All Hardware and OS listed have been fully QA'd by Livermore Software Technology Corporation

AMD Opteron Linux	HP PA8000 HPUX	INTEL IA32 Linux, Windows	SGI Mips IRIX6.5
CRAY XD1 Linux	HPIA64 HPUX or Linux	INTEL IA64 Linux	SGI IA64/Linux Altix/Prism
FUJITSU Prime Power SUN OS 5.8	HP Alpha True 64	INTEL Xeon EMT64 Linux	
FUJITSU VPP Unix System V	IBM Power 4/5 AIX 5.1	NEC SX6 Super-UX	

LS-DYNA Resource Page

Participant Software Interfacing or embedding LS-DYNA

Each software program can interface to all, or a very specific and limited segment of the other software program. The following list are software programs interfacing to or having the LS-DYNA solver embedded within their product. For complete information on the software products visit the corporate website.

ANSYS - ANSYS/LS-DYNA

www.ansys.com/products/environment.asp

ANSYS/LS-DYNA - Built upon the successful ANSYS interface, ANSYS/LS-DYNA is an integrated pre and postprocessor for the worlds most respected explicit dynamics solver, LS-DYNA. The combination makes it possible to solve combined explicit/implicit simulations in a very efficient manner, as well as perform extensive coupled simulations in Robust Design by using mature structural, thermal, electromagnetic and CFD technologies.

AI*Environment: A high end pre and post processor for LS-DYNA, AI*Environment is a powerful tool for advanced modeling of complex structures found in automotive, aerospace, electronic and medical fields. Solid, Shell, Beam, Fluid and Electromagnetic meshing and mesh editing tools are included under a single interface, making AI*Environment highly capable, yet easy to use for advanced modeling needs.

ETA – DYNAFORM

www.eta.com

Includes a complete CAD interface capable of importing, modeling and analyzing, any die design. Available for PC, LINUX and UNIX, DYNAFORM couples af-

fordable software with today's high-end, low-cost hardware for a complete and affordable metal forming solution.

ETA – VPG

www.eta.com

Streamlined CAE software package provides an event-based simulation solution of nonlinear, dynamic problems. eta/VPG's single software package overcomes the limitations of existing CAE analysis methods. It is designed to analyze the behavior of mechanical and structural systems as simple as linkages, and as complex as full vehicles

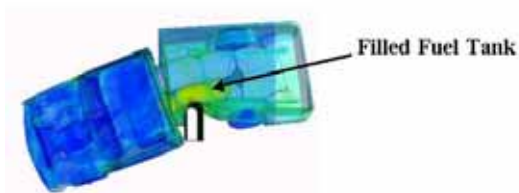
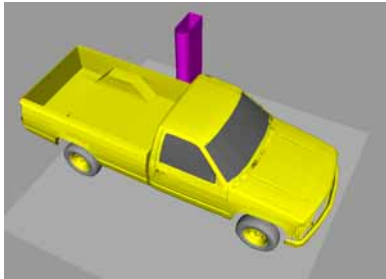
MSC.Software

“MSC.Dytran LS-DYNA”

www.msc.software.com

Tightly-integrated solution that combines MSC.Dytran's advanced fluid-structure interaction capabilities with LS-DYNA's high-performance structural DMP within a common simulation environment. Innovative explicit nonlinear technology enables extreme, short-duration dynamic events to be simulated for a variety of industrial and commercial applications on UNIX, Linux, and Windows platforms. Joint solution can also be used in conjunction with a full suite of Virtual Product Development tools via a flexible,

cost-effective MSC.MasterKey License System.



Side Impact With Fuel Oil Inside

MSC.Software - MSC.Nastran/SOL 700

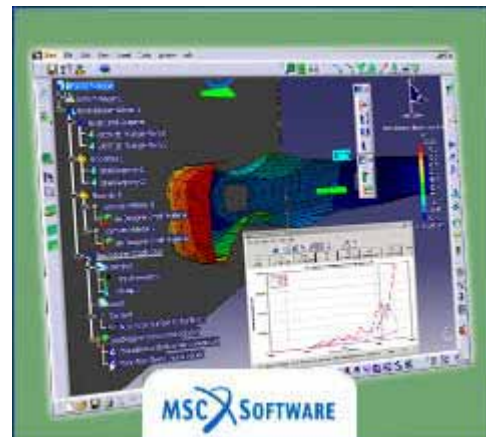
The MSC.Nastran™ Explicit Nonlinear product module (SOL 700) provides MSC.Nastran users the ability access the explicit nonlinear structural simulation capabilities of the MSC.Dytran LS-DYNA solver using the MSC.Nastran Bulk Data input format. This product module offers unprecedented capabilities to analyze a variety of problems involving short duration, highly dynamic events with severe geometric and material nonlinearities.

cMSC.Nastran Explicit Nonlinear will allow users to work within one common modeling environment using the same Bulk Data interface. NVH, linear, and nonlinear models can be used for explicit applications such as crash, crush, and drop test simulations. This reduces the time required to build additional models for another analysis programs, lowers risk due to information transfer or trans-

lation issues, and eliminates the need for additional software training. The MSC.Nastran Sol 700 will be released in November 2005. Beta release is available now !

MSC.Software – Gateway for LS-DYNA

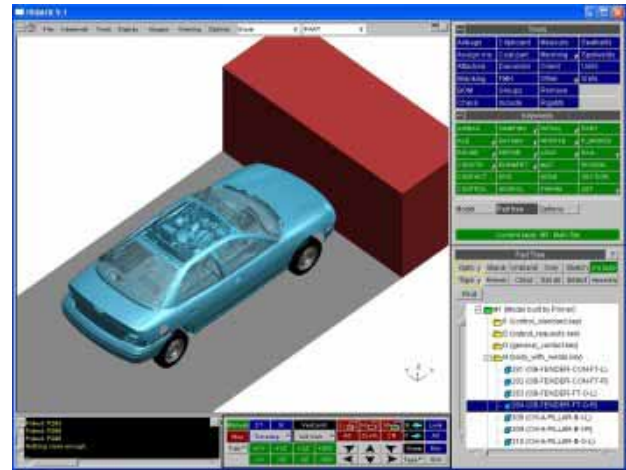
Gateway for LS-DYNA provides you with the ability to access basic LS-DYNA simulation capabilities in a fully integrated and generative way. Accessed via a specific Crash workbench on the GPS workspace, the application enhances CATIA V5 to allow finite element analysis models to be output to LS-DYNA and then results to be displayed back in CATIA. Gateway for LS-DYNA supports explicit nonlinear analysis such as crash, drop test, and rigid wall analysis.



Gateway products provide CATIA V5 users with the ability to directly interface with their existing corporate simulation resources, and exchange and archive associated simulation data.

Oasys software for LS-DYNA
www.arup.com/dyna

Oasys software is custom-written for 100% compatibility with LS-DYNA. Oasys PRIMER offers model creation, editing and error removal, together with many specialist functions for rapid generation of error-free models. Oasys also offer post-processing software for in-depth analysis of results and automatic report generation.



 LS-DYNA Events
INDIA 08/12 (Altair India) 3rd South Asia LS-DYNA User Conference,
Italy 10/05-10/06 (Numerica) (Numerica) TCN CAE 2005 International Conference on CAE and Computational Technologies for Industry - workshops focusing on LS-DYNA
Germany - 10/20-10/21 (DYNAmore) German LS-DYNA Forum
Germany - 11/09-11/11 (CADFEM) Int'l Congress on FEM Tech.. workshops focusing on LS-DYNA
Korea 11/25/05 (THEME) Korean LS-DYNA Users Conference
Japan 11/29-30/05 (JRI) Japanese LS-DYNA Users Conference (Nagoya)
US 06/06 (LSTC) 9th International LS-DYNA Users Conference

Hardware & Computing and Communication Products



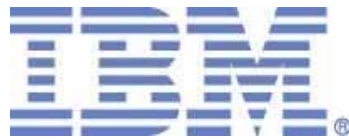
www.amd.com



www.fujitsu.com



www.hp.com



www-1.ibm.com/servers/deepcomputing



www.intel.com



www.nec.com



www.sgi.com



www.cray.com

Software Distributors

Alphabetical order by Country

Australia	Leading Engineering Analysis Providers www.leapaust.com.au
Canada	Metal Forming Analysis Corporation www.mfac.com
China	ANSYS China www.ansys.cn
China	MSC. Software – China www.mscsoftware.com.cn
Germany	CAD-FEM www.cadfem.de
Germany	DynaMore www.dynamore.de
India	GissETA www.gisseta.com
India	Altair Engineering India www.altair-india.com
Italy	Altair Engineering Italy www.altairtorino.it
Italy	Numerica SRL www.numerica-srl.it
Japan	Fujitsu Limited www.fujitsu.com
Japan	The Japan Research Institute www.jri.co.jp
Japan	CRC Solutions Corp. www.engineering-eye.com
Korea	Korean Simulation Technologies www.kostech.co.kr
Korea	Theme Engineering www.lsdyna.co.kr

Software Distributors (cont.)

Alphabetical order by Country

Netherlands	Infinite Simulation Systems B.V www.infinite.nl
Russia	Strela, LLC www.ls-dynarussia.com
Sweden	Engineering Research AB www.erab.se
Taiwan	Flotrend www.flotrend.com.tw
Turkey	FIGES www.figes.com.tr
USA	Altair Western Region www.altair.com
USA	Engineering Technology Associates www.eta.com
USA	Dynamax www.dynamax-inc.com
USA	Livermore Software Technology Corp. www.lstc.com
USA	ANSYS Inc. www.ansys.com
UK	Oasys, LTD www.arup.com/dyna/

Consulting and Engineering Services

Alphabetical Order By Country

<p>Australia Manly, NSW www.leapaust.com.au</p>	<p>Leading Engineering Analysis Providers Greg Horner info@leapaust.com.au 02 8966 7888</p>
<p>Canada Kingston, Ontario www.mfac.com</p>	<p>Metal Forming Analysis Corporation Chris Galbraith galb@mfac.com (613) 547-5395</p>
<p>India Bangalore www.altair-india.com</p>	<p>Altair Engineering India Nelson Dias info-in@altair.com 91 (0)80 2658-8540</p>
<p>Italy Torino www.altairtorino.it</p>	<p>Altair Engineering Italy sales@altairtorino.it</p>
<p>Italy Firenze www.numerica-srl.it</p>	<p>Numerica SRL info@numerica-srl.it 39 055 432010</p>
<p>UK Solihull, West Midlands www.arup.com</p>	<p>ARUP Brian Walker brian.walker@arup.com 44 (0) 121 213 3317</p>
<p>USA Irvine, CA www.altair.com</p>	<p>Altair Engineering Inc. Western Region Harold Thomas info-ca@altair.com</p>
<p>USA Windsor, CA www.schwer.net/SECS</p>	<p>SE&CS Len Schwer len@schwer.net (707) 837-0559</p>

Educational & Contributing Participants

Alphabetical Order By Country

China	Dr. Quing Zhou	Tsinghua University
India	Dr. Anindya Deb	Indian Institute of Science
Italy	Professor Gennaro Monacelli	Prode – Elasis & Univ. of Napoli, Federico II
Russia	Dr. Alexey I. Borovkov	St. Petersburg State Tech. University
USA	Dr. Ted Belytschko	Northwestern University
USA	Dr. David Benson	University of California – San Diego
USA	Dr. Bhavin V. Mehta	Ohio University
USA	Dr. Taylan Altan	The Ohio State U – ERC/NSM
USA	Dr. Ala Tabiei	University of Cincinnati
USA	Tony Taylor	Irvin Aerospace Inc.

Informational Websites

The LSTC LS-DYNA Support site
www.dynasupport.com

FEA Informationwebsites	www.feainformation.com
TopCrunch – Benchmarks	www.topcrunch.org
LS-DYNA Examples (more than 100 Examples)	www.dynaexamples.com
LS-DYNA Conference Site	www.ls-dynaconferences.com
LS-DYNA Publications to Download On Line	www.dynalook.com
LS-DYNA Publications	www.feapublications.com
LS-DYNA CADFEM Portal	www.lsdyna-portal.com .

Archived News Page

May 2005

May 2nd

FUJITSU: PRIMEQUEST

AMD: x86 Dual-Core Processor

FIGES: Distributor – Turkey

Altair Italy: Distributor - Italy

May 23rd

MSC.Software: SlimDesigner

LSTC Conference Announcement
June 04-06 Dearborn, MI

THEME – Distributor – Korea

CRC – Distributor – Japan

May 9th

AMD: Benchmark Direct Link

NEC: SX-6

IBM: Clustering

Infinite: Distributor – Netherlands

CAD-FEM: Distributor – Germany

LEAP: Distributor - Australia

May 16th

CRAY: XD1 System Bundle w/LS-DYNA

ANSYS: Workbench

Dynamax: Distributor – US

MFAC: Distributor – Canada

ERAB: Distributor - Sweden

TOP CRUNCH News – Uploaded June

Dr. David Benson – www.topcrunch.org

1. **Computer System: Altix3700/BX2**
 - a. Vendor: SGI
 - b. CPU Interconnects: NUMALINK
 - c. MPI Library: SGI MPT 1.11
 - d. Processor: Intel/Itanium 2 1.6GHz
 - e. Number of nodes: 1
 - f. Processors/Nodes: 16**
 - g. #Nodes x #Processors per Node = 16 (*Total CPU*)
 - h. Operating System: Linux64/SGI ProPack3.3
2. Code Version: [LS-DYNA](#)
3. Code Version Number: [5434a](#)
4. Benchmark problem: [3 Vehicle Collision](#)
- 5. Wall clock time: 12388**
6. RAM per CPU: Information Not Provided
7. RAM Bus Speed: Information Not Provided
8. Benchmark Run in Single or Double Precision: Single
9. Benchmark Run SMP or MPP: MPP
10. System Dedicated/Shared: Dedicated
11. Location: Mountain View
12. Submitted by: Nick Meng
13. Submitter Organization: SGI

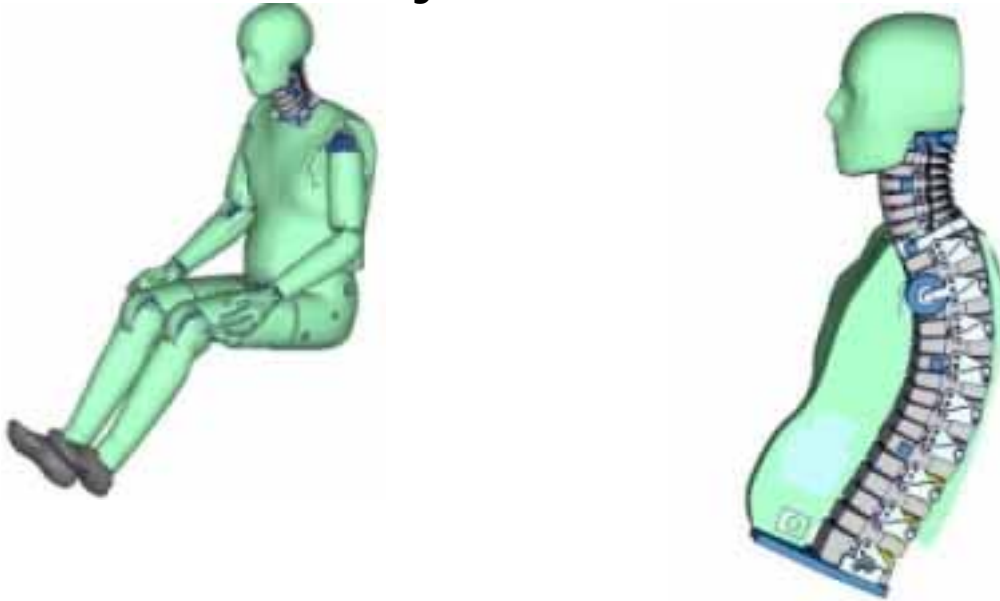
1. **Computer System: Altix3700/BX2**
 - a. Vendor: SGI
 - b. CPU Interconnects: NUMALINK
 - c. MPI Library: SGI MPT 1.11
 - d. Processor: Intel/Itanium 2 1.6 GHz
 - e. Number of nodes: 1
 - f. Processors/Nodes: 24**
 - g. #Nodes x #Processors per Node = 24 (*Total CPU*)
 - h. Operating System: Linux64/SGI ProPack3.3
2. Code Version: [LS-DYNA](#)
3. Code Version Number: [5434a](#)
4. Benchmark problem: [3 Vehicle Collision](#)
- 5. Wall clock time: 8864**
6. RAM per CPU: Information Not Provided
7. RAM Bus Speed: Information Not Provided
8. Benchmark Run in Single or Double Precision: Single
9. Benchmark Run SMP or MPP: MPP
10. System Dedicated/Shared: Dedicated
11. Location: Mountain View
12. Submitted by: Nick Meng
13. Submitter Organization: SGI

1. **Computer System: Altix3700/Bx2**
 - a. Vendor: SGI
 - b. CPU Inerconnects: NUMALINK
 - c. MPI Library: SGI MPT 1.11
 - d. Processor: Intel/Itanium 2 1.6 GHz
 - e. Number of nodes: 1
 - f. Processors/Nodes: 32**
 - g. #Nodes x #Processors per Node = 32 (*Total CPU*)
 - h. Operating System: Linux64/SGI ProPack 3.3
2. Code Version: [LS-DYNA](#)
3. Code Version Number: [5434a](#)
4. Benchmark problem: [3 Vehicle Collision](#)
- 5. Wall clock time: 6672**
6. RAM per CPU: Information Not Provided
7. RAM Bus Speed: Information Not Provided
8. Benchmark Run in Single or Double Precision: Single
9. Benchmark Run SMP or MPP: MPP
10. System Dedicated/Shared: Dedicated
11. Location: Mountain View
12. Submitted by: Nick Meng
13. Submitter Organization: SGI

On Top Crunch the input file along with the instructions on running it, are available on the download page of Top Crunch.

Visitors to the site can plot the performance of any of the machines that have been benchmarked on the site.

BIORID-II Dummy Model for LS-DYNA



The FAT (German Automotive Research Organization) has launched a project to develop models for the BioRID-II dummy. The BioRID-II dummy is designed to estimate injuries in rear crashes. Hence, it allows designing seats that provide a more safety against whiplash. Whiplash injuries may occur even if the impact speed is very low. A typical scenario might be the rear impact of a vehicle that is stopped at a red light. Usually, the damage to the vehicles is considerably small. But the insurance costs due to whiplash injuries are very high. In 2005 the insurers in the US paid 10 Billion USD (Aspen Insurance) due to whiplash.

The project for developing accurate finite element models is defined similarly to the development of USSID, Eurosid-1 and ES-2 dummy models. A steering committee defines targets and milestones for the software developers. In regular meetings the process is monitored and further experimental tests are defined. Experienced engineers from Audi, BMW, Hammerstein, Karmann, Kieper, Mercedes, Opel, Porsche, Johnson-Controls, and Volkswagen are involved in

the setup of the project. The project started in January 2005 and will last until end of 2006. DYNAMore, a distributor of LS-DYNA in Germany, will be responsible for the development of the LS-DYNA models. Because some OEMs are on a tight schedule one aim was to have a first release in the very soon to allow analysis on current seat designs. Hence, a first model based on CAD-Data, material test data, and the calibration test is already available. Further validation work will be performed in the next few months to correlate the dummy models with an extended set of experimental data generated during the project.

The models will be commercially available to non-FAT-Members. For further information on the LS-DYNA models contact:

Uli Franz - uli.franz@dynamore.de
Industriestr. 2 - 70565 Stuttgart
Germany
+49-(0)711-459600-0
www.dynamore.de