December 2002

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Editor **Trent Eggleston**
Editor Technical Content **Arthur B. Shapiro**
Technical Writer **David Benson**
Technical Writer **Uli Franz**
Graphic Designer **Wayne Mindle**
Feature Director **Marsha Victory**

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2nd Announcement and Call for Papers

4th European LS-DYNA Conference

22nd – 23rd May 2003, Ulm, Germany

For Complete Information Visit the Conference Website
http://www.ls-dynaconferences.de

The 4th European LS-DYNA Users' Conference will be held in Germany in May 2003. This conference will provide an ideal forum for LS-DYNA users from all over the world to share and discuss their experiences, to obtain information on up-coming features of LS-DYNA and to learn more about new fields of applications. The conference will be accompanied by an exhibition featuring the latest software and hardware developments related to LS-DYNA. We expect attendees and presenters from all over the world highlighting the numerous different application areas of LS-DYNA. In addition, you will also have the chance to follow lectures from developers from LSTC on the newest features of LS-DYNA. Dr. John Hallquist and speakers from DaimlerChrsysler, Saab, and Jaguar already confirmed their contribution as keynote speakers.

We strongly encourage you to participate in the conference either as speaker presenting a paper, as attendee, exhibitor or sponsor.

Call for Papers: We would be very pleased to receive contributions from the following fields of applications of LS-DYNA:

- Aerospace Applications
- Automotive Crashworthiness
- Ballistics and Penetration
- Biomechanics
- Civil Engineering
- Impact and Drop Testing
- Manufacturing Processes
- Modelling Techniques
- Metal Forming
- Nuclear Applications
- Occupant Safety
- Offshore Applications
- Optimization
- Pedestrian Safety
- Seismic Engineering
- Ship Building
- Transportation Applications
- Virtual Proving Ground

CONFERENCE PAPER SUBMISSION

Abstract deadline	Jan. 13, 2003
Notification of acceptance	Jan. 31, 2003
Final paper deadline	April 4, 2003
Paper length	10 pages
Presentation length	20 min.

CONTACT ADDRESS

DYNA*more* GmbH, Mrs. Kathleen Ryssel
Industriestr. 2 • D-70565 Stuttgart • Germany
Phone: +49 (0) 7 11 - 45 96 00 – 0
Fax: +49 (0) 7 11 - 45 96 00 – 29
E-mail: info@dynamore.de
http://www.dynamore.de

Many new capabilities were added during 2001-2002 to create version 970 of LS-DYNA. Some of the new features, which are also listed below, were also added to later releases of version 960. Most new explicit capabilities work for both the MPP and SMP versions; however, the implicit capabilities for MPP require the development of a scalable eigenvalue solver and a parallel implementation of the constraint equations into the global matrices. This work is underway. A later release of version 970 is planned in 2003 that will be scalable for implicit solutions.

Below is a list of new capabilities and features:

- MPP decomposition can be controlled using *CONTROL_MPP_ DECOMPOSITION commands in the input deck.
- The MPP arbitrary Lagrangian-Eulerian fluid capability now works for airbag deployment in both SMP and MPP calculations.
- Euler-to-Euler coupling is now available through the keyword *CONSTRAINED_EULER_ TO_EULER.
- Up to ten ALE multi-material groups may now be defined. The previous limit was three groups.
- Volume fractions can be automatically assigned during initialization of multi-material cells. See the GEOMETRY option of *INITIAL_VOLUME_ FRACTION.
- A new ALE smoothing option is available to accurately predict shock fronts.
- DATABASE_FSI activates output of fluid-structure interaction data to ASCII file DBFSI.
- Point sources for airbag inflators are available. The origin and mass flow vector of these inflators are permitted to vary with time.
- A majority of the material models for solid materials are available for calculations using the SPH (Smooth Particle Hydrodynamics) option.
- The Element Free Galerkin method (EFG or meshfree) is available for two-dimensional and three-dimensional solids. This new capability is not yet implemented for MPP applications.
- A binary option for the ASCII files is now available. This option applies to all ASCII files and results in one binary file that contains all the information normally spread between a large number of separate ASCII files.
- Material models can now be defined by numbers rather than long names in the keyword input. For example the keyword *MAT_PIECEWISE_LINEAR_ PLASTICITY can be replaced by the keyword: *MAT_024.
- An embedded NASTRAN reader for direct reading of NASTRAN input files is available. This option allows a typical input file for NASTRAN to be read directly and used without additional input. See the *INCLUDE_NASTRAN keyword.
- Names in the keyword input can represent numbers if the *PARAMETER option is used to relate the names and the corresponding numbers.
- Model documentation for the major ASCII output files is now optional. This option allows descriptors to be included within the ASCII files that document the contents of the file.

- ID's have been added to the following keywords:
  *BOUNDARY_PRESCRIBED_MOTION
  *BOUNDARY_PRESCRIBED_SPC
  *CONSTRAINED_GENERALIZED_WELD
  *CONSTRAINED_JOINT
  *CONSTRAINED_NODE_SET
  *CONSTRAINED_RIVET
  *CONSTRAINED_SPOTWELD
  *DATABASE_CROSS_SECTION
  *ELEMENT_MASS
- The *DATABASE_ADAMS keyword is available to output a modal neutral file d3mnf. This is available upon customer request since it requires linking to an ADAMS library file.
- Penetration warnings for the contact option, "ignore initial penetration," are added as an option. Previously, no penetration warnings were written when this contact option was activated.
- Penetration warnings for nodes in-plane with shell mid-surface are printed for the AUTOMATIC contact options. Previously, these nodes were ignored since it was assumed that they belonged to a tied interface where an offset was not used; consequently, they should not be treated in contact.
- For the arbitrary spot weld option, the spot welded nodes and their contact segments are optionally written into the D3HSP file. See *CONTROL_ CONTACT.
- For the arbitrary spot weld option, if a segment cannot be found for the spot welded node, an option now exists to error terminate. See *CONTROL_ CONTACT.
- Spot weld resultant forces are written into the SWFORC file for solid elements used as spot welds.
- Solid materials have now been added to the failed element report and additional information is written for the "node is deleted" messages.
- A new option for terminating a calculation is available, *TERMINATION_ CURVE.
- A 10-noded tetrahedron solid element is available with either a 4 or 5 point integration rule. This element can also be used for implicit solutions.
- A new 4 node linear shell element is available that is based on Wilson's plate element combined with a Pian-Sumihara membrane element. This is shell type 21.
- A shear panel element has been added for linear applications. This is shell type 22. This element can also be used for implicit solutions.
- A null beam element for visualization is available. The keyword to define this null beam is *ELEMENT_PLOTEL. This element is necessary for compatibility with NASTRAN.
- A scalar node can be defined for spring-mass systems. The keyword to define this node is *NODE_SCALAR. This node can have from 1 to 6 scalar degrees-of-freedom.
- A thermal shell has been added for through-thickness heat conduction. Internally, 8 additional nodes are created, four above and four below the mid-surface of the shell element. A quadratic temperature field is modeled through the shell thickness. Internally, the thermal shell is a 12 node solid element.
- A beam OFFSET option is available for the *ELEMENT_BEAM definition to permit the beam to be offset from its defining nodal points. This has the advantage that all beam formulations can now be used as shell stiffeners.
- A beam ORIENTATION option for orienting the beams by a vector instead of the third node is available in the *ELEMENT_BEAM definition for NASTRAN compatibility.
- Non-structural mass has been added to beam elements for modeling trim mass and for NASTRAN compatibility.

- An optional checking of shell elements to avoid abnormal terminations is available. See *CONTROL_SHELL. If this option is active, every shell is checked each time step to see if the distortion is so large that the element will invert, which will result in an abnormal termination. If a bad shell is detected, either the shell will be deleted or the calculation will terminate. The latter is controlled by the input.
- An offset option is added to the inertia definition. See *ELEMENT_ INERTIA_OFFSET keyword. This allows the inertia tensor to be offset from the nodal point.
- Plastic strain and thickness initialization is added to the draw bead contact option. See *CONTACT_DRAWBEAD_INITIALIZE.
- Tied contact with offsets based on both constraint equations and beam elements for solid elements and shell elements that have 3 and 6 degrees-of-freedom per node, respectively. See BEAM_OFFSET and CONSTRAINED_ OFFSET contact options. These options will not cause problems for rigid body motions.
- The segment-based (SOFT=2) contact is implemented for MPP calculations. This enables airbags to be easily deployed on the MPP version.
- Improvements are made to segment-based contact for edge-to-edge and sliding conditions, and for contact conditions involving warped segments.
- An improved interior contact has been implemented to handle large shear deformations in the solid elements. A special interior contact algorithm is available for tetrahedron elements.
- Coupling with MADYMO 6.0 uses an extended coupling that allows users to link most MADYMO geometric entities with LS-DYNA FEM simulations. In this coupling MADYMO contact algorithms are used to calculate interface forces between the two models.
- Release flags for degrees-of-freedom for nodal points within nodal rigid bodies are available. This makes the nodal rigid body option nearly compatible with the RBE2 option in NASTRAN.
- Fast updates of rigid bodies for metalforming applications can now be accomplished by ignoring the rotational degrees-of-freedom in the rigid bodies that are typically inactive during sheet metal stamping simulations. See the keyword: *CONTROL_RIGID.
- Center of mass constraints can be imposed on nodal rigid bodies with the SPC option in either a local or a global coordinate system.
- Joint failure based on resultant forces and moments can now be used to simulate the failure of joints.
- CONSTRAINED_JOINT_STIFFNESS now has a TRANSLATIONAL option for the translational and cylindrical joints.
- Joint friction has been added using table look-up so that the frictional moment can now be a function of the resultant translational force.
- The nodal constraint options *CONSTRAINED_INTERPOLATION and *CONSTRAINED_LINEAR now have a local option to allow these constraints to be applied in a local coordinate system.
- Mesh coarsening can now be applied to automotive crash models at the beginning of an analysis to reduce computation times. See the new keyword: *CONTROL_COARSEN.
- Force versus time seatbelt pretensioner option has been added.
- Both static and dynamic coefficients of friction are available for seat belt slip rings. Previously, only one friction constant could be defined.
- *MAT_SPOTWELD now includes a new failure model with rate effects as well as additional failure options.
- Constitutive models added for the discrete beam elements:
  *MAT_1DOF_GENERALIZED_SPRING

*MAT_GENERAL_NONLINEAR_6DOF_DISCRETE_BEAM
*MAT_GENERAL_NONLINEAR_1DOF_DISCRETE_BEAM
*MAT_GENERAL_SPRING_DISCRETE_BEAM
*MAT_GENERAL_JOINT_DISCRETE_BEAM
*MAT_SEISMIC_ISOLATOR

for shell and solid elements:

*MAT_PLASTICITY_WITH_DAMAGE_ORTHO
*MAT_SIMPLIFIED_JOHNSON_COOK_ORTHOTROPIC_DAMAGE
*MAT_HILL_3R
*MAT_GURSON_RCDC

for the solid elements:

*MAT_SPOTWELD
*MAT_HILL_FOAM
*MAT_WOOD
*MAT_VISCOELASTIC_HILL_FOAM
*MAT_LOW_DENSITY_SYNTHETIC_FOAM
*MAT_RATE_SENSITIVE_POLYMER
*MAT_QUASILINEAR VISCOELASTIC
*MAT_TRANSVERSELY_ANISOTROPIC_CRUSHABLE_FOAM
*MAT_VACUUM
*MAT_MODIFIED_CRUSHABLE_FOAM
*MAT_PITZER_CRUSHABLE FOAM
*MAT_JOINTED_ROCK
*MAT_SIMPLIFIED_RUBBER
*MAT_FHWA_SOIL
*MAT_SCHWER_MURRAY_CAP_MODEL

- Failure time added to MAT_EROSION for solid elements.
- Damping in the material models *MAT_LOW_DENSITY_FOAM and *MAT_LOW_DENSITY_VISCOUS_FOAM can now be a tabulated function of the smallest stretch ratio.
- The material model *MAT_PLASTICITY_WITH_DAMAGE allows the table definitions for strain rate.
- Improvements in the option *INCLUDE_STAMPED_PART now allow all history data to be mapped to the crash part from the stamped part. Also, symmetry planes can be used to allow the use of a single stamping to initialize symmetric parts.
- Extensive improvements in trimming result in much better elements after the trimming is completed. Also, trimming can be defined in either a local or global coordinate system. This is a new option in *DEFINE_CURVE_TRIM.
- An option to move parts close before solving the contact problem is available, see *CONTACT_AUTO_MOVE.
- An option to add or remove discrete beams during a calculation is available with the new keyword: *PART_SENSOR.
- Multiple jetting is now available for the Hybrid and Chemkin airbag inflator models.
- Nearly all constraint types are now handled for implicit solutions.
- Calculation of constraint and attachment modes can be easily done by using the option: *CONTROL_IMPLICIT_MODES.
- Penalty option, see *CONTROL_CONTACT, now applies to all *RIGIDWALL options and is always used when solving implicit problems.
- Solid elements types 3 and 4, the 4 and 8 node elements with 6 degrees-of-freedom per node, are available for implicit solutions.

- The warping stiffness option for the Belytschko-Tsay shell is implemented for implicit solutions. The Belytschko-Wong-Chang shell element is now available for implicit applications. The full projection method is implemented due to it accuracy over the drill projection.
- Rigid to deformable switching is implemented for implicit solutions.
- Automatic switching can be used to switch between implicit and explicit calculations. See the keyword: *CONTROL_IMPLICIT_GENERAL.
- Implicit dynamics rigid bodies are now implemented. See the keyword *CONTROL_IMPLICIT_DYNAMIC.
- Eigenvalue solutions can be intermittently calculated during a transient analysis.
- A linear buckling option is implemented. See the new control input: *CONTROL_ IMPLICIT_BUCKLE
- Implicit initialization can be used instead of dynamic relaxation. See the keyword *CONTROL_DYNAMIC_RELAXATION where the parameter, IDFLG, is set to 5.
- Superelements, i.e., *ELEMENT_DIRECT_MATRIX_INPUT, are now available for implicit applications.
- There is an extension of the option, *BOUNDARY_CYCLIC, to symmetry planes in the global Cartesian system. Also, automatic sorting of nodes on symmetry planes is now done by LS-DYNA.
- Modeling of wheel-rail contact for railway applications is now available, see *RAIL_TRACK and *RAIL_TRAIN.
- A new, reduced CPU, element formulation is available for vibration studies when elements are aligned with the global coordinate system. See *SECTION_SOLID and *SECTION_SHELL formulation 98.
- An option to provide approximately constant damping over a range of frequencies is implemented, see *DAMPING_FREQUENCY_RANGE.

Highlights of News Pages Posted on FEA Information in November
Archived on the News Page

Nov. 4th	The servers in the **SGI**® Origin® family
	ETA - Virtual Proving Ground is a revolutionary new systems analysis software package.
	STRELLA - LSTC's direct distributor in Russia for LS-DYNA and related suite of products.
Nov 11th	**Oasys** markets its own peripheral software, oasys PRIMER, D3PLOT and T/HIS that is fully compatible with LS-DYNA
	HP offers the industry's broadest range of servers based on the Itanium processor family (IPF) architecture
	KOSTECH - Korean Simulation Technologies - Korea
Nov 18th	**Intel**® server and workstation components let your system achieve new levels of computing performance.
	CEI's new software product for mesh generation, Harpoon, is now available
	CAD-FEM GmbH - Germany
Nov 25	Train AVI - **Courtesy of Xiangdong Xue**, Advanced Railway Research Centre University of Sheffield The Innovation Centre
	Fujitsu's 50-inch Plasmavision SlimScreen® monitor, the new high-definition P50XHA10 that includes a host of new features.
	Get exceptional performance on everything from data-intensive design applications to real-time financial analysis with the **AMD Athlon**™ MP processor for workstations.
	LEAP - **Leading Engineering Analysis Providers** - Australia

Netherlands-Based Firm Depends Upon Nonlinear Capabilities to Ensure Ride Safety – reprinted from ANSYS Inc. www.ansys.com

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Introduction:

Ride safety is a constant concern for amusement park owners and visitors. With more than 309 million thrill-seekers passing through park gates annually, the slightest mechanical error can be disastrous. Fortunately, many ride developers do their part to avoid such situations by employing skilled engineers to design and analyze each part prior to construction.

One example of rigorous engineering is the British Airways London Eye. Standing at more than 135 m and 120-ft taller than Big Ben, the London Eye is the world's largest observation wheel - a far cry from the original 250-ft. Ferris wheel invented by George Ferris Jr.

Iv-Infra depended upon ANSYS' nonlinear capabilities to analyze gap and spring models.

Challenge:

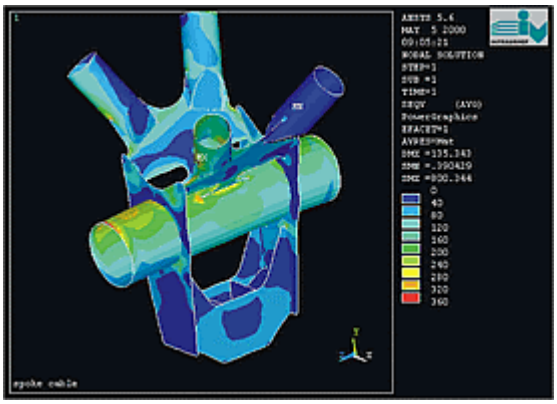
The much-publicized 1,800-ton structure now stands proud on the River Thames, just opposite the Houses of Parliament. The wheel is capable of carrying up to 4,500 riders a day, enabling them to see up to 25 miles across the city. But perhaps the most remarkable of all the statistics is that the main contractor had just 16 months to complete the project from start to finish.

Designed and developed by Marks Barfield Architects, the future of the wheel lay in the hands of the Dutch steel fabrication and construction company Hollandia b.v. In order to complete the project on

time, Hollandia employed the services of Iv-Infra (Papendrecht, The Netherlands) as a subcontractor for the design calculations and verifications of the steel structure.

The first step: a feasibility study and preliminary calculations so that the factory could begin constructing parts for the assembly of the landmark structure. The two-month feasibility study investigated five main issues that would determine how the final structure would be designed:

- Overall stability
- Fatigue loading
- How the components would stand up to different types of loads
- Dynamic behavior due to wind conditions
- Static strength of the steel



Detail of spoke cable connector
click here for larger image

Solution:

Due to time restrictions, many calculations were worked out up-front for the feasibility test, and then later ratified using finite element analysis (FEA) techniques to ensure accuracy. Once the feasibility study determined that the project could be completed successfully, the team began building a complete model of the structure in ANSYS Multiphysics, distributed by ANSYS Inc. (Canonsburg, Pa., U.S.A.). The model was complicated because it was made from many different elements and designed to be in constant motion.

“Because of the complexity of the model we were dealing with,” said Iv-Infra’s Arie Lanser, “we decided to use ANSYS, which made the creation of the model relatively easy, but also allowed us to verify the individual parts. The majority of the model is nonlinear, and ANSYS is recognized for its strengths in this area.”

Once the model was built, parameters were added to determine the fatigue life of the structure. The movement of the rim made this very difficult, and imperfections had to be built into every position of the wheel. To work out the fatigue, consultants plotted the stress against the number of cycles. Given that the wheel turns two times an hour, that's a massive 438,000 cycles in the planned 50-year time scale.

Another major factor in the analysis of the London Eye was the dynamic behavior of the structure due to wind loading. Hollandia also wanted to ensure the ride was as comfortable as possible for the visitors, with motion sickness being a real concern. The company decided to use tuned mass dampers in the rim near each capsule.

“Using the ANSYS Multiphysics, we performed dynamic wind analyses on every one of the 32 capsules, according to the advice of the TNO-Bouw research institute in Holland,” said Lanser. “The calculation was enormous because the load on each capsule is different during the course of the cycle, so we had to investigate 6,400 loadings on each one over a period of 320 seconds. But that provided us with the data required to determine the size and placement of the dampers and the behavior of the structure.

Benefits:

“As well as being suitable for constructing a model of the entire structure, ANSYS also made verifying the local parts easier and offers strong contact solvers for the gap and spring models,” Lanser continued. “Our choice of this analysis tool was also guided by the fact that all analyses were nonlinear and that the English verification body that was approving our calculation were ANSYS users.

“All participants are delighted that the London Eye is fully operational. The London Eye is already being hailed as a monument for future generations - not bad considering the deadline the whole team had to meet.”

FEA Information Participants

Headquarters	Company	
Australia	Leading Engineering Analysis Providers	www.leapaust.com.au
Canada	Metal Forming Analysis Corp.	www.mfac.com
France	Dynalis – Cril Technology Simulation	www.criltechnology.com
Germany	DYNAmore	www.dynamore.de
Germany	CAD-FEM	www.cadfem.de
India	GissEta	www.gisseta.com
Italy	Altair Engineering srl	www.altairtorino.it
Japan	The Japan Research Institute, Ltd	www.jri.co.jp
Japan	Fujitsu Ltd.	www.fujitsu.com
Korea	THEME Engineering	www.lsdyna.co.kr
Korea	Korean Simulation Technologies	www.kostech.co.kr
Russia	State Unitary Enterprise - STRELA	www.ls-dynarussia.com
Sweden	Engineering Research AB	www.erab.se
Taiwan	Flotrend Corporation	www.flotrend.com
UK	OASYS, Ltd	www.arup.com/dyna
USA	Livermore Software Technology	www.lstc.com
USA	Engineering Technology Associates	www.eta.com
USA	ANSYS, Inc	www.ansys.com
USA	Hewlett Packard	www.hp.com
USA	SGI	www.sgi.com
USA	MSC.Software	www.mscsoftware.com
USA	DYNAMAX	www.dynamax-inc.com
USA	CEI	www.ceintl.com
USA	AMD	www.amd.com
USA	Dr. T. Belytschko	Northwestern University
USA	Dr. D. Benson	Univ. California – San Diego
USA	Dr. Bhavin V. Mehta	Ohio University
USA	Dr. Taylan Altan	The Ohio State U – ERC/NSM
USA	Prof. Ala Tabiei	University of Cincinnati
Russia	Dr. Alexey I. Borovkov	St. Petersburg State Tech. University
Italy	Prof. Gennaro Monacelli	Prode – Elasis & Univ. of Napoli, Federico II

tele atlas success story –
Compaq and tele atlas (India) produce digitized maps

Reprinted from www.hp.com

Tele Atlas (India) produces very comprehensive and up-to-date digitized maps for export from India to their parent company in Belgium. Regarded as the number one reference brand in digital mapping, Tele Atlas takes great pride in offering one of the most advanced and talented international teams in creating geometrical maps of Europe on Compaq workstations. Based in Noida in the heart of Uttar Pradesh with a team of 256 staff, Tele Atlas has 335 Compaq workstations and 6 ProLiant servers processing millions of acres of land for an exceptionally wide range of applications including in-car navigation and Geographical Information Systems products.

From the start, Tele Atlas understood that innovation stems from partnership. Forging long-term collaborations has been the key to their success, as well as to their own stability and consistent growth.

"Our commitment to quality is demonstrated by the resources we invest in the development of highquality products and services. This ensures that only leading edge technologies bear the name Tele Atlas," expounds Danny Grobben, IT Manager at Tele Atlas.

Tele Atlas was born in the 1980s from a vision that digitizing maps would create huge opportunities and demand in the new era of information technology. This has been the basis for their fast growth into a multinational company, with offices in Europe, Japan, USA and India. Some of their biggest customers are Blaupunkt of Bosch, Germany and VDO Dayton of Holland. Last year, Tele Atlas reported a total revenue of 40 million EUROS.

In-car navigation systems are rapidly becoming the standard equipment of every new vehicle in Europe and Japan. In response to this market opportunity, Tele Atlas has formed partnerships with Bosch to collaborate on specific navigation products such as navigation CD-ROMs, travel guides and special guides for golf courses.

"Our database is compiled from a number of reliable sources such as detailed road maps from national publishers," Danny explains. "These are combined with local authority information, aerial and satellite images. Furthermore, these are processed by leading experts, computer technicians, geographers and surveyors who continually conduct local field tests."

Before converting the maps to in-car navigation, Tele Atlas employs about 200 people driving around Western Europe, collecting data and verifying every road, lane, park and place of interest," Danny says. The result is a seamless high-quality map database with uniform specifications.

The digital maps of Tele Atlas are also at the heart of the new traffic telematics technology. This technology gives mobile telephone users dynamic traffic information, navigation and recommendations, emergency assistance and information services. Tele Atlas has provided the ideal

information infrastructure, enabling exciting in-car navigation services such as the planning of trips by tourists or business travellers, or search and mapping of services from directories and guidebooks.

"What we are doing now is ensuring the production of our digital maps are on time and of the highest quality possible. What used to take years to digitize, is now done in months with our production facility in India in combination with the fastest workstations from Compaq." Danny Grobben IT Manager, Tele Atlas (India)

the power to digitize

For technology, Tele Atlas chose Compaq Computer as its worldwide partner. "We have collaborated with Compaq to set up the most advanced digital mapping facility in India," remarks Danny, who relies on the dependable Compaq workstations and servers. Preliminary planning and maintenance of the world-class production facility are handled by experienced IT consultants from Compaq.

The geometric mapping of Belgium, for example, took Tele Atlas ten years to complete. Measuring 30,000 sq km, the basic lines were completed and were verified by field tests by 40 site inspectors who travelled on the actual routes themselves. This enabled digital mapping to be combined with the users' input to generate maps that are up-to- date before being offered for sale.

Head of IT at the Tele Atlas Plant in India, Danny Grobben, explains: "What we are doing now is ensuring the production of our digital maps are on time and of the highest quality possible. What used to take years to digitize, is now done in months with our production facility in India in combination with the fastest workstations from Compaq."

In the new millennium, the world is indeed getting smaller because of maps created by Tele Atlas which has done a great job in helping us find our way around easily.

Integral to this success has been the use of high-end Compaq Professional Workstations and ProLiant servers.

"Although speed is crucial when rendering and working with the large file sizes used in geographical information systems, reliability and stability are also vital. This is exactly what Compaq workstations have to offer."

At the very heart of Tele Atlas is the desire to explore and discover. So wherever you want to be in the world, if there's a way, they'll find it.