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**Articles**

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**March Updated Conference News  
By LSTC and ETA  
LS-DYNA Conference May 2-4 2004**

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**BAE SYSTEMS Designs Mount for Ministry of Defence,  
Uses ANSYS to Drastically Reduce Number of Prototypes and Tests  
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## **EXECUTIVE SUMMARY**

### **Challenge:**

To develop a composite shock and anti-vibration mount for the British Ministry of Defence for use within the Royal Navy, with a damping mechanism that was inexpensive and easy to manufacture, while having negligible effect on the static/quasi-static characteristics of the composite mount

### **Solution:**

Use ANSYS simulation software to design the mount to withstand a wide range of static and dynamic loading conditions

### **Benefits:**

- Ability to meet shorter timescales and to remain commercially competitive
- Ability to modify designs quickly and easily, with few prototypes
- Ability to duplicate harsh under water explosive conditions necessary for accurate simulation of the mount stress state and equipment response
- Ability to analyze the properties of the composite materials

### **Introduction:**

BAE SYSTEMS' Engineering Dynamics team has more than 50 years of experience in structural design and simulation. Its team of mechanical engineers has used finite element analysis (FEA) extensively, to assess the effects of non-contact underwater explosions on ships and submarines, designed using composite materials, structural optimization, and dynamic simulation. The team uses ANSYS®, composite design software, and in-house codes to simulate static, dynamic, and non-contact shock loading.

Naval ships and submarines are exposed to many types of shocks, whether at war, or during peacetime. Non-contact underwater shocks, from mines or other sources, can cause severe damage to these vessels and their equipment. In many cases, however, precautions taken during the design stages can minimize the damage. This is where shock simulation is paramount.

For the past two years, Scott Lafferty, a Consultant Engineer for BAE SYSTEMS, has been working to develop a 'Composite Shock and Anti-Vibration Mount' for the Naval Fleet of the British Ministry of Defence. This mount will significantly reduce acceleration levels and transmitted vibrations to the machinery it supports during severe non-contact underwater explosions and normal operation.



Non-contact underwater shocks, from mines or other sources, can cause severe damage to these vessels and their equipment.

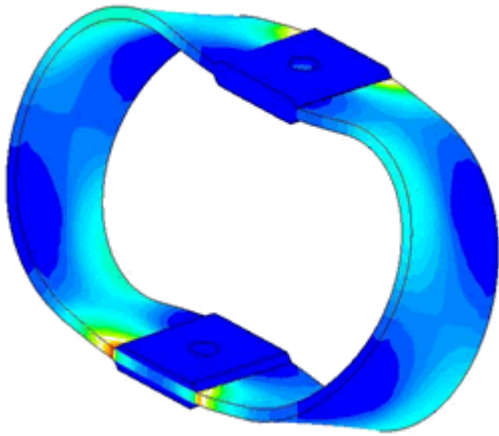
### **Challenge:**

During combat, in order for weapons and other vital shipboard equipment to remain functional, they must be able to withstand severe shocks. Unfortunately, designing such shock-resistant equipment is costly and difficult, especially because of space and weight constraints.

The best way to protect the equipment is to affix it to shock mounts, which will lessen the force of the shock, by transferring it to the equipment gradually, making it more of a quasi-static event than a dynamic one. During a shock event, significant deflections occur, so the mount must be able to deflect freely throughout the shock motion. Otherwise, the acceleration levels may be greater than the initial shock, which can damage the equipment.

The ship or submarine may also have noise requirements for quiet running, which make it necessary for some equipment to be flexibly mounted. Although there are many anti-vibration mounts on the market, few meet the deflection capability requirements of a shock mount. Shock mounts have occasionally been used in tandem with anti-vibration mounts, but those systems are expensive to design, purchase and fit.

The Ministry of Defence Sea Technology Group commissioned BAE SYSTEMS' Engineering Dynamics Team to design a cost-effective shock and anti-vibration mount. Among the extensive list of specifications and requirements, was the stipulation that it had to be capable of being retrofitted to replace existing shock mounts. This immediately restricted the possibilities in design, because it meant that most of the dimensions were already fixed.



The Ministry of Defence Sea Technology Group commissioned BAE SYSTEMS' Engineering Dynamics Team to design a cost-effective shock and anti-vibration mount. Among the extensive list of specifications and requirements, was the stipulation that it had to be capable of being retrofitted to replace existing shock mounts. This immediately restricted the possibilities in design, because it meant that most of the dimensions were already fixed.

Another challenge was that the mount had to possess specific vertical and horizontal stiffness that would be high enough to safely support equipment and low enough to isolate vibrations, while having the proper damping characteristics to absorb shock and vibration.

### **Solution:**

To meet the timeframe, budget, and specifications of the Ministry of Defence, the Engineering Dynamics Team immediately turned to ANSYS simulation software. At the outset, a series of simplified design iterations showed that it would be best to design the mount using composite materials modeled in ANSYS. The team has used this procedure many times; for static, dynamic, and shock analyses of substantial composite structures, including mine hunter machinery rafts, support brackets, pipe, and pipe joints.

The team first chose a material, Epoxy/E-glass, based on cost, mechanical properties, chemical and environmental resistance, temperature stability, and the fire-retardant properties of its resin. The material's manufacturer conducted initial tests to identify the properties of a single layer of the material, which were used within ANSYS to represent the lamina layer properties.

“Over the period when the manufacturer was performing the lamina tests, a mount was modeled in ANSYS, with the existing mount dimensions, using isotropic material properties,” explains Lafferty. “We then set up ANSYS to automatically perform design optimization on several of the minor dimensions. The objective function was set as the stress level at a defined location, the state variables were set as the required stiffness, and the design variables were set as the minor dimensions. From this assessment, the trends in mount stiffness, stress, and geometry were developed from which the optimum mount shape was identified.” He adds that, “As in most design cases, what we call the optimum configuration is purely a compromise, and represents the best combination of factors, such as stress, stiffness, weight, and cost.”

Next, a finite element (FE) model was developed, using the elements with the lamina properties specified by the manufacturer. A starting lay-up was identified, then modeled in ANSYS, with its sequences and fiber orientations set to vary automatically, using the design optimization algorithms in ANSYS. Design trend graphs were then developed, showing the variations in mount stiffness and stress that would be caused by modifying the parameters, and identifying a lay-up that would give the proper vertical and horizontal stiffness, while it minimized the stress state within the mount.



In addition, a series of 3-D sub-models was developed to find a range of possible configurations, fastening methods, and materials for the mount fixings, which are crucial to the design because of their effects on stress and stiffness. The results led the team to a design that would minimize these effects, and which could be manufactured consistently and economically.

A detailed 3-D FE model was then developed with the optimized shape, lay-up, and fixing design. Analysis showed that it would meet all of the specifications and safety factors required by the Ministry of Defence.

For the non-contact shock loading simulation, the team modeled equipment supported on the composite mount, and applied a shock load to the base of the mount. The equipment response results showed that, because of the low damping ability of the composite material, the shock could have damaged the equipment, and, perhaps, injured personnel.

The next step was to perform a series of tests to ascertain an acceptable level of damping. The team still had to come up with a damping mechanism that would be inexpensive and easy to manufacture, without affecting the static/quasi-static characteristics of the composite mount. After investigating many options, they selected a material that is normally used to reduce structural resonance and impact-induced noise on large flat panels.

A 3-D harmonic model of the composite mount, damping material, and equipment was developed in ANSYS to determine the mount's damping characteristics. Analysis established the optimum quantity of the damping material and its positioning on the mount, to achieve the best damping characteristics. The results indicated that this design would increase the damping by 200%.

Using the design details established from the ANSYS analyses, a batch of prototype mounts was manufactured. Results of quasi-static and dynamic tests on these prototypes, in comparison with the original design specifications and the FE models, showed that the stiffness of the mount in the vertical direction was within 2% of the result calculated in ANSYS. The horizontal stiffness was within 5%, an error that was slightly higher because of the complexity of the horizontal loading conditions. No audible or visible matrix/fiber failure was found in any of the tests. The dynamic tests indicated that the introduction of the damping material had, in fact, increased the mount's damping by 202%, which was impressively close to the 200% that was predicted.

### **Benefits:**

Throughout the project, the use of ANSYS in design has drastically reduced the number of prototypes and tests needed on the mount. ANSYS made it possible for the team to simulate complex explosive conditions that could not have been duplicated in a laboratory. It also allowed the engineers to modify designs quickly and easily, and perform numerous design iterations, which would have been very expensive to test on prototypes.

As Lafferty notes, "The Engineering Dynamics team uses this method of design by analysis extensively, mainly to meet shorter timescales and to remain commercially competitive."

The final, and defining, shock test of the mount is scheduled for mid-July. All of the simulations indicate that it will be successful, and that the acceleration of the mounted equipment will be significantly less than the shock input, meeting all of the requirements stipulated by the Ministry of Defence.



This mount was designed to support a specific mass range. During the next phase of the project, it is expected that the design will be extended to support an increased range of equipment masses. At the same time, a set of composite mounts will be fitted to a Navy vessel for onboard trials.

Lafferty says, “The composite shock and anti-vibration mount has been designed and developed using primarily ANSYS software. Extensive analyses have been performed using the static, nonlinear static, harmonic, nonlinear transient dynamic, and optimization algorithms. The use of design simulation using ANSYS has allowed us to reduce timescales and supply prototype mounts at minimum cost. The resultant mount performs as ANSYS predicted, and we will, therefore, use ANSYS extensively for the next phase of the project.”

**2004 International ANSYS Conference  
The Hilton Pittsburgh & Towers  
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[http://www.ansys.com/conf\\_2004/index.htm](http://www.ansys.com/conf_2004/index.htm)

**CONFERENCE OVERVIEW**

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## **"Accurate & Affordable Personal Identification"**

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This white paper provides an overview of a new, cost effective and contemporary solution to meet the current personal identification requirements emerging today in social service environments, and correctional markets, as well as retail, financial, and access applications.

### **1. INTRODUCTION**

**Positive IDentification - PID, developed by NEC Solutions, Inc. is a one or two finger capture, store, search, and match system that provides positive identification verification of individuals.**

Biometrics are mathematical representations of physical characteristics or traits. Finger image identification systems have become the dominant form of biometric identification today and are 99.9 percent accurate. These systems are also considered to be the easiest to operate. And finger imaging is the only proven technology that can not only verify a person, but also identify a person from a large database in excess of one million individuals.

NEC's PID finger imaging system includes hardware and software necessary to provide positive identification and verification. The PID system is based on NEC's proven Automated Fingerprint Identification System (AFIS) technology. This technology employs the most advanced pattern identification and fingerprint matching methods available today. Combined with the latest in hardware technology, PID is a cost effective fingerprint identification system.



PID is built upon open system principles emphasizing scaleable architectures and standard hardware and software application. PID workstation are based on office-standard, Windows® platforms. Servers are housed upon scaleable Microsoft Windows-NT™ and UNIX™ configurations for database repository storage and fingerprint matching

PID can be implemented as a functionally independent application, or seamlessly integrated into new or existing vertical market solutions. PID can offer Value Added Resellers (VARs) and System Integrators (SIs) identification capabilities to be incorporated into existing product lines. PID will also work with an installed system vendor if a customer deems its application useful

#### **1.1 Background**

For more than two decades, NEC pioneered the implementation of AFIS systems in the law enforcement community. Nearly half of the states with AFISs are utilizing an NEC AFIS. NEC is recognized as the

industry leader in AFISs, latent identifications, and large (greater than 1 Million records), networked AFISs.

As personal identification becomes more a matter of societal well-being and public safety, NEC has successfully transitioned its proven finger imaging technology for enforcement applications with the PID line of products. This technology in these applications not only maintains the consistent accuracy as in its traditional application, but it also maintains its advantages over other biometric implementations. For example, finger image capture by live scan is far less intrusive to the subject than methods used to capture retinal images.

New technology and its application to AFIS have resulted in a "downsizing of AFIS". This downsizing results in lower operational costs and, includes:

- Smaller processing footprints
- More powerful computing platforms
- Scalable architectures

All technical fingerprinting functions have been automated, therefore formal fingerprint training is not needed to operate the PID system. PID was developed to allow minimally-trained users to utilize PID's intuitive graphical user interface(GUI).

It is this same system, ported to windows-standard workstations and user friendly GUIs, which allows PID to provide the most accurate and easy to use method of identification and verification available today

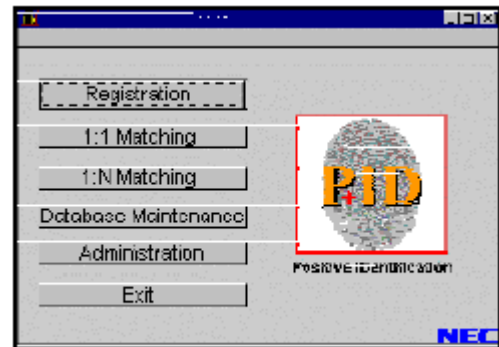


Figure 1 – PID Main Menu

PID system functions are accessed through the PID main menu as illustrated in the PID Main Menu. These main menu options include:

- Registration
- 1:1 Match
- 1:N Search/Match
- Database Maintenance
- Administration

This screen represents a PID only solution, as opposed to an integrated-PID solution. An integrated-PID solution would incorporate PID functions (i.e. fingerprint storage, search/match, etc.) into a vertical market application, such as corrections or health care. These integrated applications would be customized to react to appropriate fingerprint search/match results, such as releasing a prisoner upon a "hit", denying an enrollment upon a "hit", etc. An integrated-PID solution is achieved by application developers and system integrators through the use of a PID developers kit.

## 2.1 Input Processing

NEC Solutions offers Pentium®-based workstations running Windows 95 or NT as input platforms. This workstation and the finger image capture software are used to input data to PID. This data contains at a minimum, a fingerprint minutia file to either register or search with, and optionally a file key (identification number), fingerprint image, demographics, and/or a photo image. Fingerprints are input to PID through a single-finger, live-scan device, a standard component of the PID workstation. PID supports

all standard and commercially available live-scan devices, such as those offered by Identicator and Identix.



As fingerprints are scanned, PID's Fingerprint Image Capture software performs a quality check on the fingerprint. This provides an immediate quality assessment of the fingerprint image, automates input quality control, and ensures administrators that proper input procedures are being enacted.

PID then performs automatic minutiae/relation extraction, or Feature Extraction, on the image to extract the characteristics of the fingerprint.

A fingerprint minutiae is a fingerprint ridge ending, or a ridge bifurcation (where the ridge separates into two ridges). NEC AFIS systems are the most accurate systems due to their feature extraction techniques.

These input procedures are either done in conjunction with a registration, or upon execution of a 1:1 Match, or a 1:N Search/Match. A registration would input all fingerprint related data, demographics, and other optional record elements, such as a photo image and PID card (see Section 4.1.1.2, PID - Card), etc

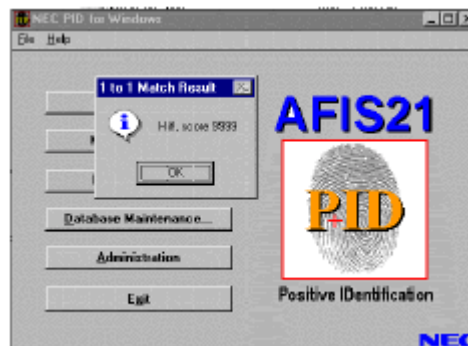
## 2.2 Fingerprint Matching

PID's fingerprint matching algorithms are based on the same minutiae-based algorithms implemented in NEC's AFIS products.

PID's fingerprint matching algorithms are based on the same minutiae-based algorithms implemented in NEC's AFIS products.

PID provides two types of fingerprint matching:

- 1:1 Match
- 1:N (1:Many) Search/Match



### 2.2.1 1:1 Match

A 1:1 match compares a minutia file extracted from a fingerprint image captured by a live-scan device against a fingerprint minutia file in the PID database. An ID number of the stored fingerprint minutia file in the PID database is input to locate and retrieve the record. PID will return a hit or miss result based upon the score of the match and the 1:1 the stored fingerprint minutia file in the PID database is input to locate and retrieve the record. PID will return a hit or miss result based upon the score of the match and the 1:1

The 1:1 match results are then presented with a quantitative score. This screen illustrates a nonintegrated PID application in which the user would take an action based upon the "Hit" result. In an integrated PID

implementation, the native application (e.g. jail management system) would automatically trigger an action based upon the result, such as a door opening, allowing access to records, etc.



### 2.2.2 1:N Search/Match

The 1:N search/match is initiated in the same manner as in the 1:1 match, except that the identification number is not given and the entire PID database is searched to identify the person. The file keys of all PID records whose match returns a score higher than the 1:N Search/Match threshold set by the PID administrator are returned.

Another PID feature applicable to identification searches (1:N) is pre-filtering. This is implemented to reduce response times and thus hardware and configuration complexities (i.e., system costs). Pre-filtering will delimit a search by searching only the portion of the database which has the highest probability of producing a match. For example, if a male subject is being registered, then only the male portion of the database is searched. Depending upon the sex distribution of the PID database, this filter could significantly reduce match response time. Other standard delimiters include finger number, age and race. NEC Solutions also offers optional Pattern Classification software which allows the fingerprint classification type (e.g. whorl) to be used as a filtering criteria.

## 2.3 Administration & Storage

PID system administration is minimal. Once configured, the only periodic maintenance is system backup. The PID administration function allows PID system settings, such as matching and image quality thresholds, to be defined. PID utilities allow for the printing and management of reports, audit trails, etc.

PID stores demographic, image, and system data on magnetic media and optionally, rewritable CD-ROM. Typically, less than 1K bytes of storage is required for a single finger minutiae record and less than 25K bytes are required each for a single fingerprint image, and subject photo.

## 3. Applications

PID is designed for use in environments where positive identification needs to be established quickly and reliably. Examples of these environments include:

- Social Service Programs
- Jail/Prison Environments
- National Identification

as well as a host of other applications:

- Illegal Immigration Control
- Health Care
- Driver's License

- Debit/Credit Cards, and other Positive Card Holder Verification Applications
- ADP Security
- Secure Installation/Access Control Applications
- Gun Registration

These will be integrated-PID applications in that PID will provide the identification element for these applications by integrating with the respective, native application software which resides within each application area. PID server hardware components will simply attach to the existing applications' LAN. PID establishes and builds upon its own self contained database which uses standard communication protocols to perform PID operations.

Typically, within each of these applications, a single record for each applicant is desired. Therefore, to eliminate duplicate enrollments, a 1:N Search/Match is first performed to establish non-enrollment. A "Hit", indicates a previous enrollment, and may be an attempt to re-enroll. Upon a "No-Hit", on the 1:N Search/Match, the applicant is typically registered.

The 1:1 Match is usually performed after the initial 1:N Search/Match and registration process for verification of identity services.



### 3.1 PID For Social Services

Social service clients will use PID for program enrollment, eligibility determination, and recertification. Prior to application, a 1:N Search/Match is performed to verify that the applicant is not already registered. If the person is already enrolled, the applicant is identified. In this manner, fingerprints can be used to reduce fraudulent welfare benefit claims that cost taxpayers millions of dollars each year.

Most recertification procedures mandate an appearance and case update as a standard procedure. A 1:1 Match is performed as a recertification procedure to verify the individual's identity.

The functionality offered with the PID-Card option (See Section 4.1.1.2, PID - Card) is applicable to social service applications where benefit issuance is increasingly being implemented with Electronic Benefit Transfer (EBT) cards. The advantage of PID-Card is the immediate and authorized verification of the card holder.

### 3.2 PID For Jails/Prisons

PID for jail and prison environments can identify recidivists upon facility entry, verify inmate identification prior to release, and control prisoner movement within the justice system.

PID can also support a range of secondary correctional functions, such as visitor control, drug dispensation, debit/credit account applications, and work release, among others.



### **3.3 PID For Illegal Immigration Control**

PID can serve a host of roles in controlling illegal immigration. Verification procedures for legal passage complement the traditional procedures of repeat offender identification to local and regional authorities.

### **3.4 PID For National Identification**

PID can serve international markets as well in applying fingerprint technology for national identification. Foreign countries are open to the consolidation of criminal databases with social programs and fingerprints can serve as the “key” between the two repositories.

### **3.5 PID for Computer System Access Control**

PID can provide an effective means to secure access to sensitive information stored on computer systems. Upon system log-on, a user’s finger image can be scanned to identify the person and determine his/her eligibility to systems files and functions. This application is more secure and easier to use than passwords.

An enterprise-wide installation of this application will:

- Provide robust network security
- Eliminate costly and time-consuming password management
- Create a unique cross-application identifier to replace multiple passwords

## **4. PID Product Configurations**

PID server configurations are primarily determined by the response time requirements of the 1:N Search/Match. The number of records a potential system may aggregate to does not define a configuration. Verification applications can be housed on significantly smaller system configurations than Identification applications. With 1:1 matches taking less than one second for a response, this becomes an insignificant measure of system configuration.

In small system configurations, fingerprint matching is implemented in software. Fingerprint matching in larger systems is implemented with hardware matching.

### **4.1 PID Workstations**

PID workstations are available as either a stand-alone workstation, or as a client to a PID server. The stand-alone workstation provides a fingerprint capture, storage, and matching capability within one workstation. This workstation includes a live-scan device, PID Base software, and software modules for Finger Image Capture, Quality Check, Feature Extraction, 1:1 Matching, and optionally, 1:N Search/Match software.



The PID Client workstation includes the same software and hardware as the standalone, except the matching software is now performed at the PID server. This client/server configuration realizes a centralized database repository and faster matching speeds. All networking and communication software is included. Essentially, all workstation hardware and software is inclusive to providing a complete identification system.



### 4.1.1 PID Workstation Options

PID workstations can also be configured with optional photo and card capabilities.



#### 4.1.1.1 PID - Photo

The PID-Photo option adds photo imaging to standard PID. The photo adds an additional identification element in creating a complete identification solution. A typical implementation would be in the verification process. Upon a "Hit", the verified subject's record would be displayed with demographics, photo, etc. This not only indicates a "Hit", but also provides a visual reassurance of identification in comparing the record's photo to the subject whose fingerprint was verified.

#### 4.1.1.2 PID - Card

PID - Card allows typical card applications to verify authorized card holders by storing fingerprint minutia data on the card. Only the authorized card holders fingerprint will match this fingerprint minutia data. Card registration entails performing a 1:N search to verify the registrant is not already enrolled in the program, and thus does not already possess a card, and writing the fingerprint minutia data to the card. Other optional data, such as a photo, and/or demographics is also written. PID implements the latest in card encoding technologies.

### 4.2 PID Servers

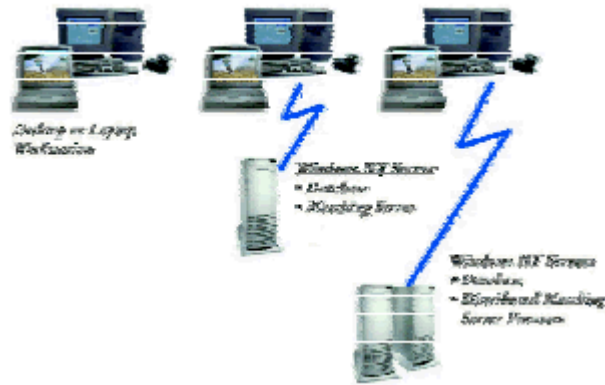
>PID servers perform all centralized storage, backup, and matching functions for PID applications. NEC offers as server options:

- Intel (NT)-based ProServa servers for software matching solutions
- RISC (UNIX)-based servers for hardware matching solutions

#### 4.2.1 Software Matching

The ProServa SH is a quad-processor capable, high performance Pentium Pro processor (200MHz) server designed specifically to meet the demands of midrange business critical applications. The ProServa main memory can be expanded to 1GB for large search/match applications and 11 Drive Bays are available for the RAID-capable server. This server line will match at speeds in the hundreds of fingerprints/second range.





### 4.2.2 Hardware Matching

PID implemented with RISC (UNIX)-based servers are designed for very large application environments. Matching is performed in a separate hardware device known as a Fingerprint Matching Processor (FMP). The FMP is a specialized processor designed exclusively to perform extremely high fingerprint matching rates in the thousands of fingers/second range.



### 4.3 PID Scalability

This completely scalable client/server implementation of the PID technology makes use of NEC's UP4800 UNIX-based server and can be configured to meet any application requirements. An increasing number of FMPs can be implemented by adding additional UP4800 matching servers.

PID's client/server architecture and completely scalable configurations, combined with the latest in NEC's workstation solutions, make PID a price competitive solution for your identification application.

<http://www.sw.nec.co.jp/hpc/sx-e/sx6/index.html>



**The SX-6 Series, with the entire vector processor implemented on a single chip. Its amazingly compact body allows the SX-6 series to achieve a new level of price performance.**

## Penguins Can Fly

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When the Altix 3000 series was introduced in January 2003 it took the open standards community by storm, quickly garnering widespread attention and an unprecedented number of industry awards. Now—with the introduction of Altix 350—SGI makes the advanced architecture and capabilities of Altix available to a whole new set of users with a platform that delivers best-in-class price, best-in-class performance, based on open standards.

Scaling from one to sixteen 64-bit Intel® Itanium® 2 processors and up to 192GB of global shared memory in a single system, Altix 350 fills the gap between commodity Linux servers and the high performance computing capabilities of the Altix 3000, making it an ideal choice for workgroup/departmental, technical database, or throughput cluster applications. The Altix 350 system scales beyond the 2-4 processors typically supported by other Linux offerings to handle a wider range of computing problems, while, in cluster configurations, it is the perfect platform to accommodate throughput workflows.

Customers worldwide have already begun to appreciate the unique benefits of Altix 350. "To process 3D image sequences of the cardiovascular system in a distributed and parallel environment, we needed a mid-range computing server capable of providing a large amount of shared memory and multi-processor computing with greater price/performance than was previously available," said Alejandro Frangi, Ramón y Cajal Research Fellow and co-director of the Computer Vision Group within the Aragon Institute of Engineering Research and the Department Electronic Engineering and Communications, both at the University of Zaragoza, Spain. The Altix 350 system is part of a more general grid computing test bed facility recently built with support from the Spanish Ministry of Science & Technology and the University of Zaragoza. "The SGI Altix 350 easily meets those requirements, while incorporating industry-standard components like 64-bit Intel Itanium 2 processors and compilers, along with Linux and Open Source software, that are increasingly crucial to maintaining portability within our multi-platform environment."

#### Open Systems Pricing for the Midrange

By combining the core architectural features of Altix with an innovative packaging system, SGI has created a highly economical new platform. Starting at just \$12,199 USLP, with an average configuration USLP of \$5400 per processor, Altix 350 offers the demonstrated scalability and reliability of Altix at a very competitive price.



Commodity Linux servers lack the proven performance of Altix, while midrange proprietary UNIX® solutions can cost up to three times more. Altix 350 is the only open standards-based solution available to meet demanding midrange computing needs with full scalability



NASA has computational modeling requirements suitable for a spectrum of machines. NASA's 512-processor Altix system is an example of the high end, and we operate several commodity PC clusters within the Agency," said Bob Ciotti, Tera-Scale Applications Lead at NASA Ames Research Center. "There is clearly a need for systems in the middle range with better scaling characteristics than PC clusters yet costing much less per processor than supercomputing systems. With the right price/performance combination, a system of that character would help us make more efficient use of all our computing resources."

Designed to expand on demand through the independent scaling of processors, memory, or I/O capacity, Altix 350 allows users to optimize the system configuration to get the most from each dollar invested while flexibly adapting to changing requirements. You never have to buy more processors when what you really need is more memory or more I/O, allowing you to perfectly right-size a system for reduced total cost of ownership.

### **Record-breaking Performance**

The SGI Altix 3000 demonstrates record-breaking performance compared with competitive 64-bit systems on industry-standard application, processing, memory, and I/O benchmarks. Since Altix 350 uses the same NUMAflex™ architecture and optimized Linux operating environment, it delivers similar capabilities and performance as the Altix 3000 for configurations up to 16 processors.

SGI's patented NUMAflex architecture is key to the scalability and performance of Altix. With NUMAflex—the world's fastest, lowest-latency interconnect—processors have direct, high-speed access to all system memory and other processors, allowing Altix systems to scale efficiently where other systems bottleneck.



### **Open Standards Leadership**

The SGI Altix 350 is the first production-quality midrange Linux solution, and is 100% binary compatible with industry standard 64-bit Linux. Hundreds of applications have been ported and optimized for Altix, including over 80 key technical computing applications for industries such as energy, media, sciences, manufacturing and government. Working closely with software vendors, SGI continues to expand the number of optimized applications every week.

“ We needed a mid-range technical server capable of providing a large amount of shared memory and multi-processor computing with greater price/performance than was previously available...the SGI Altix 350 easily meets those requirements.”

– Dr. Alejandro Frangi, Aragon Institute of Engineering Research, University of Zaragoza, Spain

SGI has worked closely with the Linux community to improve the scalability and reliability of Linux for the most demanding applications. Even more importantly, SGI takes Linux to the next level of manageability and performance with a unique set of differentiated tools and libraries that have no equivalent on other Linux platforms. Until now, customers that needed these advanced capabilities were forced to purchase expensive proprietary UNIX platforms and software. Furthermore, SGI uniquely offers full support—front-line and back-line—for its Linux solutions. This means that customers go to a single source - SGI - to resolve technical issues for their hardware and systems software.

With open standards, unrivalled scalability and performance, comprehensive support, and a unique set of value added management tools, Altix is the first Linux solution that is truly ready for prime time.

### **Powering the Technical Database**

Technical database applications can leverage Altix 350 for unprecedented levels of performance. Up to 192GB of shared memory allows Altix to hold large data sets entirely in memory and share data across processors for maximum performance, while extremely high I/O bandwidth (up to 7GB/sec) ensures that I/O intensive database applications run unimpeded. The modular scalability of Altix 350 makes it easy to configure the optimum amount of CPU, memory and I/O for any database application.

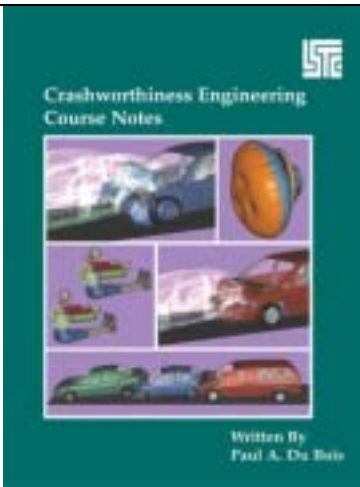
### **Altix 350 for Throughput Clusters**

Since a single Altix 350 can take the place of several less capable commodity Linux servers at comparable cost, standard clusters of Altix 350 systems are an ideal solution for throughput workflows consisting of diverse jobs and applications. The proven scalability of Altix reduces the number of systems needed in a cluster, simplifying management and reducing infrastructure cost while increasing real productivity. For instance, an Altix cluster node can accommodate multiple small jobs simultaneously, or handle larger jobs that would bottleneck on a commodity cluster node. For large capacity computing jobs, an Altix 3700 supercluster is the preferred solution, with global shared memory between cluster nodes to accommodate data sets that exceed the memory of a single cluster node.

### **Expanding Horizons**

While Altix 350 is an ideal platform for technical markets, its unique capabilities clearly make it suitable for a broad range of midrange applications that SGI hopes to serve through an expanding portfolio of resellers and other partners. With best-in-class pricing, unparalleled performance, and a robust set of tools that take Linux to a new level, Altix 350 is ready to tackle any job that comes its way.

**Fly, penguin, fly.**

	<p><b>Crashworthiness Engineering Course Notes</b></p> <p><b>Fax this order to LSTC, US - 925 961 0806</b></p> <p><b>Attn: Marsha Victory</b></p> <p><b>Book Order Includes Shipping:</b>  <b>Total - US/Canada \$75.00 Michigan 6% tax – CA tax according to County</b>  <b>Total International \$100.00</b></p>
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China	MSC.Software – China	<a href="http://www.mssoftware.com.cn">www.mssoftware.com.cn</a>
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USA	INTEL	<a href="http://www.intel.com">www.intel.com</a>
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USA	AMD	<a href="http://www.amd.com">www.amd.com</a>
USA	ALTAIR – Western Region	<a href="http://www.feainformation.com/alt_west/alt_west.shtml">www.feainformation.com/alt_west/alt_west.shtml</a>
USA	SE&CS	<a href="http://www.schwer.net/SECS">www.schwer.net/SECS</a>
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## Special Announcements and Highlights of News Pages

Posted on FEA Information and archived one month on the News Page

Feb. 02	AMD	AMD Athlon™ MP Processor: Now available in Model 2800+
	NEC	NEC launches the latest HPC server: SX-6i
	CAD-FEM	Distributor In Germany
Feb 09	IBM	Technology in clustering, chip technology, Linux
	ANSYS	ANSYS LS-DYNA 8.0 includes a New 10-Node Tetrahedron Element, SOLID168.
	LEAP	Distributor in Australia
Feb 16	LSTC	Conference Registration
	MSC.Software	MSC.Dytran 2004, featuring the first integrated release of MSC.Dytran and LS-DYNA
	MFAC	Distributor in Canada
Feb 23	SGI	Penquins Can Fly
	JRI	JRI's activities in "knowledge engineering"
	DYNAMAX	Distributor in US

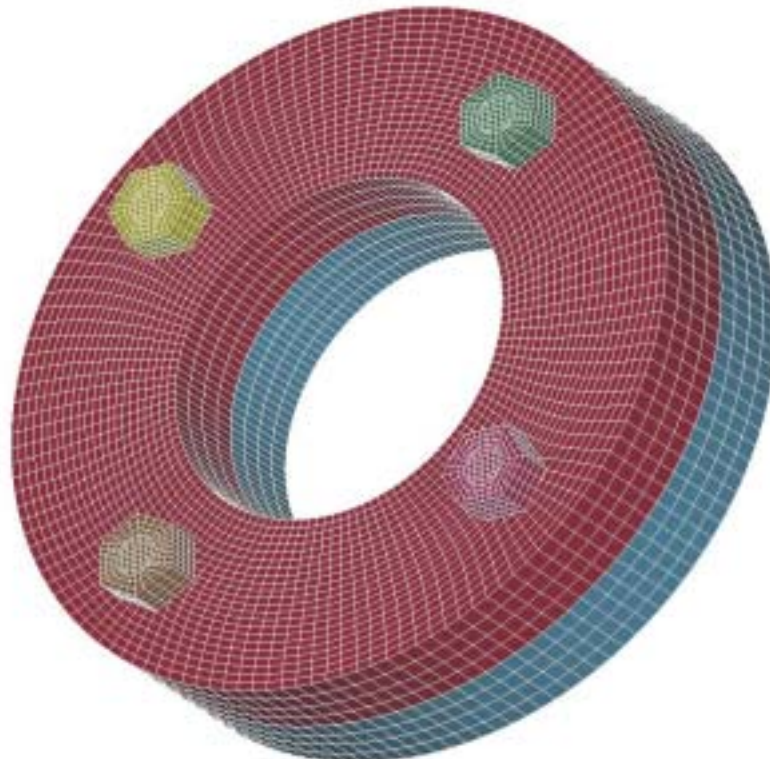
<b>2004</b>	
May 2-3	8th International LS-DYNA Users conference will again be held at the Hyatt Regency Dearborn, Fairlane Town Center, Dearborn, MI hosted by LSTC and ETA
May 10-12	OPTECH04, Optimization Technology Meeting 2004
May 24-26	2004 ANSYS Users Conference and Exhibition to be held in Pittsburgh, Pennsylvania, U.S.A.
Sept 21 & 22	Japan: JRI LSDYNA conference – Japan Research Institute
Sept 26 – 28	China: ANSYS 2004 Annual User Conference – ANSYS China
Date To be posted in April edition	Germany: 2004 CAD-FEM Users´ Meeting - Internationale FEM-Technologietage - CADFEM
Oct 14 & 15	Germany: 3rd local LS-DYNA Conference - DYNAmore

## Stress Initialization Extension

- Provides a simple procedure for stress initialization in fasteners such as bolts
- Uses existing capabilities in LS-DYNA with the addition of 1 new keyword
  - \*INITIAL\_STRESS\_SECTION
- Equilibrium is obtained by setting desired stress level during the dynamic relaxation phase.
- Works with a subset of materials including elastic and plastic models.
  - Does not apply to materials with equations of state or rubber like materials.
    - For rubber materials, the reference geometry is available.
- Works with all solid element formulations
- The option is implemented in the next update to version 970

In the example below the four bolts are initialized to 20000 psi stress

View - 8



Time = 8  
Contours of Z-stress (total stress)  
min=-9121.36, at element 18473  
max=29762.5, at element 20816

