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## Highlights

AOARD is happy to have the opportunity to meet with visiting Air Force scientists who are invariably impressed with the quality of the R&D in the Asia Pacific region. We had the opportunity to host several AFMC visitors during September and October.

General Lester Lyles, AFMC Commander, visited AOARD on 10 September and was briefed by AOARD scientists and other members of the Tri-Service Team. AOARD and the other Tri-Service Directors also briefed Brigadier General Kennon, PACOM J4, during his visit to Japan on 10-11 September.

General Lester Lyles, AFMC Commander, visits AOARD

Dr. Lyle Schwartz, Air Force Office of Scientific Research (AFOSR) Director, and Dr. Barbara Wilson, Chief Technologist of AFRL, accompanied Dr. Jack Agee and his team of scientists visiting sites in Taiwan in support of Dr. Agee's Taiwan Nanoscience Initiative. Dr. Carroll, who accompanied the Taiwan group, then visited the Spring 8 cyclotron in Hyogo, Japan. Following the Taiwan visit,

Dr. Schwartz and Colonel Don Erbschloe visited AOARD September and presented award for The Civilian Administrative Person of the Quarter for January-March 2002 to Mr. Yoshi Erikawa.

Dr. Robert Sierakowski, the Chief Scientist of AFRL/MN, led a team of scientists including Mr. Kenneth Edwards (Director, Revolutionary Technology), Ms. Carrie Fowler (Director, Micro Platform Development), Mr. James Fillerup (AFOSR International Office), and Dr. Ted Sumrall (AOARD Consultant) on a visit to Japan and Korea, 15-26 September. The team visited several sites in Japan including the Japan Air Self Defense Force's Gifu Test Center, Mitsubishi Heavy Industries (Komaki, Japan) [con't. on next page]

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Tohoku University – Esashi Laboratory, University of Tokyo Department of Physics, (Professor Ryugo Hayano), Electro-Communications University – Aoyama Laboratory. Dr. Sierakowski also visited the U.S. Embassy and gave a briefing to the Japan Association of Defense Industries.

Dr. Jim Grote, from AFRL Materials Directorate, and Professor Paras Prasad (University of Buffalo) also visited Japan to attend the AOARD sponsored 3rd Chitose International Forum on Photonics Science & Technology in Chitose, Japan. Finally, Dr. Wes Hoffman from Propulsion Directorate-West visited sites in Japan accompanied by AOARD Program Manager Dr. Tae-Woo Park (see articles under Material Science).

In this issue's lead articles read about the Japanese Smart Materials Research Center, the new magnetically levitated train (MAGLEV) capable of speeds over 500 km/h, and positron research in Japan.

Terence J. Lyons, M.D., M.P.H.
Director

# Features

## R&D of Organic Electroluminescent Displays in Asia

The worldwide display market is forecast to become a $100 billion per year by 2010. Flat panel displays will make up more than 80% of the market, and large-area flat panel display sales will increase to $11 billion per year. Among the four methods for producing large-area flat panel displays, organic electroluminescence displays (OELD), also known as organic light-emitting diodes (OLED) are considered the most promising approach.

Prominent features of OELD are high luminance, superior image quality, no need for vacuum packing, a low-profile, thin and light structure, fast response speed (less than a microsecond), and low power consumption (less than LCD). The development of EL materials with such superior luminous efficiency leads to the realization of further lower power consumption and longer operation life. Government R&D projects in organic device technology have been inaugurated by New Energy and Industrial Technology Development Organization (NEDO) in 2002, in order to promote the small, personal information terminals. The project includes the METI program, relevant to the Advanced Social Foundation for Information and Communication Technology. Total budget of $50 million over 5 years, and Prof. Kido of Yamagata University has been assigned to a project leader. The project is focussed on the following goals:

?? Thin and light large-area displays of up to 60 inch size, with an energy efficiency superior to that of a fluorescent light bulb
?? Paper-like and soft sheet displays useful for input/output terminals of mobile equipment with a thickness of 0.2 mm and capable of displaying video
?? Development of low cost and high productivity roll – to – roll printing methods and applications to organic information tag.

Organic EL materials are comprised of small molecules, such as pentacene, or polymers of plastic-like materials. Small molecules must be evaporated onto a substrate using a vacuum process. Currently, Kodak, Idemitsu Oil and several other firms are providing small displays. Polymers are the most promising materials for large-area displays, and many manufacturing companies such as Cambridge Display Technologies (CDT), Du Pont, Dow Chemicals, and Sumitomo Chemicals are focusing on developing a new production method similar to ink jet printing. These companies are aiming at specifications for high efficiency of 50 lm/W, durability of > 100,000 hours, large scale production process, and low-cost technology that could be achieved by using plastic "sheets" of such polymers.

Some recent accomplishments have been announced by leading Asian companies. Fuji Electric Co (Japan) has recently developed a multilayer structure which integrated a blue emitting layer, a color conversion layer and a color purity improvement layer. At Nikkei Sangyo in August 2002, they reported an improvement of more than 30% in contrast ratio, four time the conventional operational life, and a 30% decrease in production cost were achieved. Samsung SDI (Korea) has created novel electrophosphorescent polymers that exhibit drastic improvement of four times in emission efficiency, 52% reduction in power consumption and more than 10,000 hours of operational life. They have also developed a novel production method of Light Induced Thermal Imaging (LITI) suitable for large area color EL panel, as reported at Nikkei Microdevices in September 2002. And at CEATEC Japan 2002, TDK (Japan) described an organic EL display that was developed through collaboration with ifire Technology (Canada), that consist of integrated color filters and white EL stacking layers.

Quite possibly, the next generation of LCD technology will be affected by these promising OELD developments, and competition will be spawned between LCD and OLED technology in the commercial market. (Miyazaki)

# Yamanashi Maglev Test Line

Japan's 18.4-km-long test track for superconducting magnetically levitated (maglev) trains lies in the heart of Yamanashi Prefecture, west of Tokyo. It spans variable terrain, with the majority of its length within tunnels. The Yamanashi Line opened in 1996, with the hope that it would one day become an integral part of service between Tokyo and Japan's second largest city, Osaka. It was preceded by Japan's first test line for superconducting maglev trains in Miyazaki. However, a second line was needed to study new designs and components, determine a range of dynamic effects, and gather data on performance and reliability.

On 31 July 2002, Prof. Kozo Osamura of Kyoto University, Dr. Nan Chen of the Asian Technology Information Program, and Dr. Ken Goretta of AOARD were hosted at Yamanashi by Dr. Hiroshi Nakashima of the Central Japan Railway Company. The visit included a presentation on the facilities and its accomplishments, tours of the line's control room and adjacent public museum, and a ride on a three-car maglev train. The maximum speed reached was 450 km/h. A train configured with five cars established at Yamanashi in 1999 a world-record train speed of 552 km/h.

The line has a maximum grade is 4% and its minimum radius of curvature is 8 km. Tests along the priority section have included efficacies of control algorithms (the trains are run remotely), effects of high-speed entrance into tunnels, stabilities of trains passing at relative speeds to 1003 km/h, and a wide variety of studies of components and systems. These tests have led to many significant improvements. Aerodynamic drag has been reduced to 55% of the best value attained at Miyazaki. Through use of aluminum alloys and composites, car weight has been reduced to half that of currently running Series 300 Shinkansen cars. Magnetic fields within cars have been reduced to <10 gauss through development of improved shielding. Tunnel entrances have been redesigned to greatly reduce in-ground vibrations generated by train entry. Vibrations within the train have been also been greatly reduced.

As the trains are now configured, they run on rubber wheels until speeds exceed approximately 150 km/h, at which point the wheels are retracted and the train is suspended by magnetic forces. The suspension scheme is based on superconducting magnets operating within all cars of the train. The magnets are fabricated from a NbTi alloy and are operated at liquid-He temperature. Their maximum magnetic field is 4.5 T, with the field at the ground coils being approximately 1 T. The He cryogen is circulated in a closed system, with gaseous He being refrigerated and condensed. Refrigeration and other power requirements are now met by on-board gas turbines; other means to produce the required electricity are being studied.

Linear electric motors on the sides of the track provide propulsion and inductive ground magnets along the sides of the track provide levitation. This design is different from the maglev railways in Germany, which feature magnets on the horizontal surface below the train. The German design induces a separation between train and track of approximately 1 cm. That distance was deemed too small for Japan, where earthquakes are a common occurrence. The Yamanashi configuration produces 10 cm of levitation from the ground at operating speeds and 8 cm of separation from the side walls.

Testing has progressed well beyond proof of concept. The maglev trains have accumulated more than 232,000 km of operation, carrying more than 35,500 passengers. The line's safety record is perfect. Dr. Nakashima believes that the technology now in place is capable of fulfilling the basic mission of project: travel between Tokyo and Osaka at approximately 500 km/h. In 2000, Japan's Ministry of Transport Maglev Technical Evaluation Committee concluded that superconducting maglev trains constitute a practical alternative for ultra-high-speed transportation.

The maglev line is projected to follow an inland route, in contrast to the coastal route of current high-speed Shinkansen trains. It would provide an alternative to the Shinkansens and, like them, constitute an ecologically friendly form of mass transportation. Technologies to support an operating train line, including, for example, large-capacity current inverters, suitable control equipment, and a convenient expansion system to facilitate boarding of the trains, have been implemented.

Superconducting maglev technology faces two significant challenges in Japan. First, the trains must guarantee reliable, long-term performance. Stresses and vibrations within the trains are significant and, despite the admirable record to date, long-term reliability cannot at present be assured. The Yamanashi Line is slated to operate through 2004, and thus substantially more data on performance will be generated. Second, the overall economics of maglev operation cannot be accurately assessed. The least-well-known aspect of the total economics is maintenance. Current high-speed trains in Japan, which run on tracks, require continuous maintenance of those tracks. Maglev trains should nearly obviate track maintenance. This savings must, however, be sufficient to balance construction costs, relatively high energy usage, and whatever maintenance will be required for the trains themselves. Prevailing concerns over reliability and economics, coupled with possible availability of new technologies based on high-temperature superconductors, have militated against near-term construction of a Tokyo-Osaka maglev line. Much will be learned over the next year and a half, when the future of maglev train technology in Japan will be decided. (Goretta)

# Positron Energy Storage

**Large Electron Positron Collider at CERN**

Professor Ryugo Hayano (University of Tokyo Department of Physics), also a collaborative researcher at CERN (European Organization for Nuclear Research), the world's largest particle physics centre, is a renowned researcher in the field of positrons and anti-matter. Dr. Hayano has been working in the area of anti-hydrogen for 10 years. He has also produced and investigated anti-protonic helium which "lives" longer than anti-hydrogen. The University of Tokyo financed the construction of a Decelerating Radio Frequency Quadrupole (RFQD) at CERN, the purpose of which is to slow down antiprotons to about 50 keV in energy, or about 1 % of the speed of light.

A radio frequency (RF)-based electrostatic trap, called a Paul Trap, is similar a Penning trap, which traps charged particles (ions) that can then be stored with a superposition of a magnetic field and a static electric field. The Paul Trap, however, uses variable electric fields and is capable of trapping both positive and negative particles at the same time. A shallow electrostatic potential well is formed for both the anti-protons (negatively charged) and the positrons (positively charged). A 50 megahertz (MHZ) variable electric field is used to confine the anti-positrons and a 1 gigahertz (GHZ) variable electric field is used to confine the positrons. The simultaneous trapping of anti-hydrogen and positrons in the same vicinity allows the two particles to be attracted towards each other, resulting in the formation of anti-hydrogen. The anti-hydrogen then annihilates on normal matter, producing gamma rays which are detected to prove the existence of anti-hydrogen.

In the future, the Hayano Laboratory will use neutral atom traps to suspend anti-hydrogen for further research and testing. The Hayano Laboratory is pursuing the generation of anti-hydrogen to prove that anti-hydrogen is exactly a mirror image of the hydrogen having same mass and electric structure but differing only in the signs of the charge. This will substantiate the Standard Model of particles and anti-particles. The anti-hydrogen trapping will utilize a variable magnetic gradient to trap anti-hydrogen by using its magnetic dipole. (Sumrall/Edwards)

# General News

**Site Visits: Dr. Robert Sierakowski, Chief Scientist of AFRL/MN, visits Japan and Korea.** Dr. Robert Sierakowski (Chief Scientist, AFRL/MN) accompanied by Mr. Kenneth Edwards (Director, Revolutionary Technology, AFRL/MNAV), Ms. Carrie Fowler (Director, Micro Platform Development, AFRL/MNAV), Mr. James Fillerup (AFOSR/IN), and Dr. Ted Sumrall (Liaison Scientist AOARD) visited government, industry, and university research sites in Japan and Korea, 15-26 September 2002.

?? JASDF Air Base, Gifu, Japan; 20 September 2002. Dr. Sierakowski visited the JASDF's - Gifu Air Base outside Nagoya at the invitation of Major General Fujio Hayashi. MG. The primary mission at Gifu is flight testing. An overview brief of the base was given and a tour of the base was provided, specifically to view the Japanese developed F2 fighter.

?? Mitsubishi Heavy Industries, Komaki, Japan; 20 September. The team discussed engine development.

?? Tohoku University –Esashi Laboratory, Sendai - Japan; 19 September 2002. Associate Professor Shuji Tanaka hosted the visit. The research at Esashi Laboratory is described in more detail in a separate article also in this issue if the ASL.

?? Electro-Communications University – Aoyama Laboratory, Chofu-Japan; 18 September 2002. Dr. Aoyama is engaged in world-class research on micro-robotics. The team was shown a demo of small robots (approximately 0.5 in.2) demonstrating rolling mobility and micro-hammer movement. In this demonstration, the robot is fitted with a micro-hammer and then programmed to hit a surface (in this case metal) with the hammer causing divots in the surface. Then a drop of liquid can be precisely placed in the divot.

?? University of Tokyo Department of Physics (Professor Ryugo Hayano) is conducting research on positron energy storage. This research is described in more detail in a separate article also in this issue if the ASL.

?? Briefing to Japan Association of Defense Industries: MDAO, US Embassy, Tokyo, Japan; 18 September 2002. Dr. Robert Sierakowski visited the Mutual Defense Assistance Office at the US Embassy in Tokyo and provided a briefing to the Japan Association of Defense Industries on activities at AFRL/MN. (Sumrall/Fowler)

**Site Visit: New Industry Hatchery Center and Esashi Laboratory Tohoku University, Sendai, Japan; 18 Sep 2002**. Dr. Sierakowski visited the Department of Mechatronics and Precision Engineering laboratories at Tohoku University. The network of MEMs associated labs, houses a large variety of lithographic, deposition, etching, micro-milling, and general precision engineering equipment. There are three clean rooms, at least two at Class 1000. The laboratory is open to international researchers, most from Asia and usually about 10 each year from industry. Industry participants work at basic research levels and rotate back into their companies later for product development. Annually, $30M is paid for by industry partners. Additional funds are

provided from the Japanese government (MEXT and METI), and from corporate sponsors, the most prominent being Nikon. Samsung as sole foreign corporate participant is listed as a donor.

Facility space is made available for free; research itself is paid for by the student; and all agree to share findings and publish in the open literature. No proprietary projects are pursued at the labs. The staff has 60 members. Areas of focus include applications in medicine, micro-accelerometers/gyros, micro-optical switches/rf filters/other IT devices, micro-power sources, and MEMs based nano-technology (e.g. ultra-high density storage devices). Specific products presented in detail by host Dr Shuji Tanaka included micro-catheters, micro-high sensitivity sensors (for weighing carbon nanotube H2 absorption, for example), micro-rocket engines, SiC ceramic micro-machining, micro-gyros, and micro-turbines.

The micro-turbine work now being done with IHI industries holds promise for a palm-sized electric generator. Efficiency is expected to be 2-3 times greater at 5-10 times less weight for the power generated compared to a conventional Li battery, with much more power—100-200 Watts. The micro-turbine can be a substitute for batteries in high power applications, such as with wheelchairs and robots. The engine uses propane. (Kaneshiro)

**Conference: U.S.-Korea Conference on Science, Technology, and Entrepreneurship (UKC), 8-13 July 2002, Seoul, Korea.** The Korean-American Scientists and Engineers Association (KSEA) was established 30 years ago. It is open to all U.S. scientists and engineers, including Korean-Americans in the U.S. who are engaged in technical disciplines. The annual conference of the KSEA, the U.S.-Korea Conference on Science, Technology, and Entrepreneurship (UKC) alternates between U.S. and Korean sites. Attendance averages nearly 500. This year's conference was co-organized by the KSEA and the Korean Federation of Science and Technology Societies (KOFST). It was held in conjunction with the KOFST-organized 2002 World Congress of (Ethnic) Korean Scientists and Engineers, which is held once every three years. Ethnic Koreans and many others from nearly 20 countries attended. Session topics for the conferences included Biotechnology, Information Technology, Nanotechnology, Electronic Materials, Optical and Optoelectronic Technology, Machinery and Manufacturing Technology, Polymer Science and Technology, Basic Science and Engineering, Space Science and Technology, Construction Technology, and Environmental, Energy, and Ecological Technology. The conference website is http://www.rpi.edu/~moonc/ukc/main.htm. (Park, Goretta)

**ESEP Assignment Completion, Larry Lewis (Australia 2000-2002)** My assignment here has embraced a number of activities, but primary among these are three areas. First is the work I've completed in re-designing the public release VisSim-based MSTARS modeling environment that I developed in the US to run under MATLAB/ Simulink and implementing that design. This has had enormous positive consequences here, including the selection of MSTARS as the official WSD 6-DOF modeling system, the selection of MSTARS as the weapon modeling environment for the Defence Intelligence Organization (DIO), and MSTARS selection as the test bed for the international MIST (Munitions Model Interface Specification for TTCP) project under TTCP KTA 7-11. Subsequent to its development here, MSTARS has already been used by DSTO/WSD in an important 6-week study to support the Australian proposal for the Low Cost Guided Infrared Rocket (LOGIR), a joint project with the US Navy. Largely as a result of MSTARS simulation demonstrations, the WSD LOGIR proposal was accepted by the government in Canberra. MSTARS development efforts are now ongoing in DSTO/WSD to develop ASRAAM, AMRAAM, and ESSM simulations, among others. As a wrap-up to the MSTARS work, I've taught several MSTARS courses here to over 40 people in various groups. The second area I was responsible for was to lead the initial brainstorming and development of a special simulation facility here that is now called the "Centre for Evaluation, Simulation and Analysis of Weapons" (CESAW). The CESAW facility was recently approved and funded. It will house MSTARS and other critical WSD software tools, as well as provide an environment for integrated weapon system simulation and analysis. The third area is my support of the international TTCP effort KTA 7-11, a follow-on effort to KTA 7-6 which I chaired and which was recently nominated for the TTCP Achievement Award. For KTA 7-11, in support of the Australian effort, I've developed specification guidelines and sample MIST interface implementations in MSTARS. A number of WSD simulation tools have been distributed to the US, UK, and Canada as part of the MIST project, including MSTARS.

Reflecting on my ESEP assignment to Australia as I prepare to return to the US, I can truly say that it has been the peak experience of my entire career. ESEP is a unique opportunity to make a meaningful technical contribution to a foreign defense establishment while learning about and experiencing another culture firsthand. One of the first things that occurs to ESEP engineers and scientists after our assignment begins is the realization that we are ambassadors of our own country in a foreign land. This realization brings a burden of responsibility for us to live up to the highest standards of character and competence. We are the window through which our hosts view America so we must always keep that in mind. But this responsibility also brings a great deal of pride because we know that we have an opportunity to make an impact that will leave our hosts with the highest impression of our country and our people.

As with most ESEP assignees, I was treated with tremendous respect and appreciation by my hosts. The work was challenging, interesting, and worthwhile. Perhaps even more than most ESEP assignees, I found myself in an unusually gifted organization - a group of exceptionally talented, friendly, team-oriented people who were highly motivated and highly focused on technical achievement while having lots of fun in the process. In a positively charged environment such

as this, every day brings new adventures and new challenges, and there are never-ending opportunities to contribute and to learn. But in spite of this once-in-a-lifetime exciting and rewarding work experience, what my wife and I will miss most are the numerous people who touched our lives - the friendships and the unique memories of life in a foreign land. This cultural experience even more that the technical experience represents the true value and meaning of the ESEP program. I will always remember and cherish my 2 years in this program, and I don't hesitate to recommend it to anyone who has the opportunity to participate.

**Site Visit; Tokyo University of Agriculture and Technology (Dr. Seizo Miyata, President)** Research areas at this National University, with a faculty of 452 and over 1,600 graduate students, include biotechnology, semiconductor nanotechnology, fiber engineering, and non-equilibrium process engineering. Professor Miyata's areas of research include opto-electronics including plastic thin films (nano scale – 10-15 nm). (Lyons)

# Aerospace and Mechanical

**Contract awarded: A Biomimetic Algorithm For Flight Stabilization In Airborne Vehicles, Based On Dragonfly Ocellar Vision, Dr. Gert Stange, Australia National University (1).** Jointly funded by AFRL/MN and AOARD, this contract is part of a larger AFRL/MN effort to tap the secrets of insects for guidance navigation and control. Insects, the ultimate in miniature autonomous flying vehicles, operate with unique vision processing capabilities and limited computational capacity. Dr. Stange and his colleagues plan to identify the spatiotemporal transfer characteristics of the dragonfly ocelli, using refined measurements of the ocellar lens optics, as well as electrophysiological and behavioral methods. Based on these results, they will be developing concepts for attitude control algorithms. (Nowack)

1. http://cvs.anu.edu.au/

**Conference: Japan Society of Aeronautical and Space Sciences Aircraft Symposium (1), 9-11 October 2002, Yokohama Japan.** This October saw the 40th Aircraft Symposium and the 16th associated International Sessions held in pleasant Yokohama. With support from AOARD, the international sessions provide a unique opportunity for English speakers to learn about projects in Japan and neighboring countries. This year, the 2002 Japan-Korean Joint Symposium was part of the International Sessions which meant that parallel tracks were required to accommodate the international papers. Korea's aerospace infrastructure is growing rapidly, so the 2003 Japan-Korea Joint Symposium in Korea should be well worth attending. The Congress of the International Council of the Aeronautical Sciences will be returning to the Pacific region in September 2004 when JSASS will host it in Yokohama (2). (Nowack)

1. http://yal.asl.seg.ynu.ac.jp/jsass/
2. http://www.jsass.or.jp/icas

**Conference: International Conference on Structural Integrity and Fracture, SIF 2002 (1), 25-27 September 2002, Perth Australia**. The shores of the Indian Ocean was the venue for the annual meeting of the Australian Fracture Group. This AOARD-supported conference represented a major effort by the group to make their conference international and they succeeded with papers from 6 continents. USAF has long been interested in Australian aircraft fatigue and fracture efforts, this conference brought together many disciplines interested in fracture. Look out for a similar conference in Sendai, Japan next year. (Nowack)

1. http://sif2002.civil.uwa.edu.au/Intro.html

**Symposium: Aerospace Numerical Simulation Symposium 2002; National Aerospace Laboratory, Tokyo; 3-5 July 2002.** The annual CFD symposium was held for advanced CFD analysis and new computing system. AOARD partially funded invited guest speakers from the US. Highlights included the following presentations:

- ?? Numerical Space Engine at Kakuda Space Propulsion Laboratory (Dr. Kimura, NAL). Main server consists of NEC SX-6 (vector parallel computer). A novel Web Supercomputing Environment (WSCE) has been adopted and GUI environment similar to Windows systems has been implemented for various super computers and peripheral equipment.
- ?? Future goals of ITBL (Dr. Fukude, JAERI) The IT-based Laboratory (ITBL) comprises a virtual laboratory that corresponds to the Science Grid of the DOE in the US. It is made up of nine government institutes and universities, and accomplished with four layer grid technology.
- ?? Computational and physical aspects of vortical flows on delta wings (Dr. Visbal, AFRL). Various aspects of vortical flows pertinent to modern aircraft were presented. Computer animations of highly unsteady flow fields were also shown.
- ?? CDF analysis of laser ramjet vehicles (Prof. Katsuyama, Tokyo University). Pulse laser ramjet has been noted as a low cost propulsion system. Using pressurized energy source, blast wave was induced and momentum coupling factor was evaluated under conditions of quiescent atmosphere and Mach 5 flow.

For more information on CFD activities in Japan, contact Dr. M. Yoshida of NAL (e-mail: yoshida@nal.go.jp) (Miyazaki)

# Computation and Communication

**Contract awarded: "Improvement of Apriori-based Graph Mining (AGM) Method," Prof. Hiroshi Motoda, Osaka University, Osaka, Japan, August 2002.** Prof. Motoda and his colleague Prof. Takashi Washio are world-class researchers in artificial intelligence, and in particular, in the fields of machine learning and knowledge discovery. The objective of the proposed research is to develop computationally highly efficient data mining techniques that

require a complete search for all frequent subgraph patterns in a graph-structured database.

Briefly, the "Basket Analysis," a standard method for data mining, derives frequent item-sets from a database. However, its mining ability is limited to transaction data consisting of items. In reality, there are many applications in which data are described in a more structural way, e.g., chemical compounds and Web browsing history. There are a few approaches that can discover characteristic patterns from graph-structured data in the field of machine learning. However, almost all of them are not suitable for such applications that require a complete search for all frequent subgraph patterns in the data. The PIs will first revisit a novel principle and its algorithm that derives the characteristic patterns that frequently appear in graph-structured data. This algorithm can derive all frequency induced subgraphs from both directed and undirected graph structured data having loops (including self-loops) with labeled or unlabeled nodes and links. It can then develop improvements in search efficiency by introducing efficient pruning techniques, and limiting the type of the graph to mine to connected subgraphs by introducing additional search constraints based on the graph connectivity.

With these improvements it is expected that the new algorithm can run by a several orders of magnitude faster than the original algorithm. POC: Dr. Robert Herklotz (AFOSR/NM), Dr. Tae-Woo Park (AOARD). (Park)

**Conference: Defence Applications of Signal Processing-2001 (DASP01) (1), 23-27 June 2002, Barossa Valley Resort, Australia:** The DASP01 is the 4th biennial workshop between the U.S. and Australia. It was originally scheduled during 16-21 September 2001, but was rescheduled to be in 2002 because of the "September 11" event. The workshop was sponsored, in part, by AFRL, AFOSR, and AOARD. It was attended by 76 invitees from academic and defense organizations in the U.S. and Australia. AFRL showed a strong presence with 10 researchers from SN, IF, and MN. The workshop consisted of four plenary presentations, 12 lecture sessions, and 39 poster presentations. One of the highlights of the workshop was a plenary presentation by Prof. Brian Anderson of the Australian National University, on the "Solved and Unsolved Problems in Adaptive Blind Equalization." The next workshop, to be held in 2004, will be hosted by the U.S. (Park)

1. http://www.dasp2001.org/

**Window-on-Science Visit: Dr. Jim Schroeder, Australian Cooperative Research Center for Sensor Signal & Information Processing (CSSIP), University of South Australia, Mawson Lakes, South Australia, 6-8 June 2002.** Dr. Schroeder was invited to the AFOSR Signals Communications Program Review Workshop organized by Dr. Jon Sjogren of AFOSR/NM. He presented a summary of their research in multiple-input-multiple-output (MIMO) diversity communications systems for a potential collaboration with AFRL. Dr. Bruce Suter of AFRL/IFGC, who attended the workshop, has expressed an interest in the MIMO research by a group of researchers from CSSIP and the University of Adelaide. (Park)

# Electronics and Physics

**Contract awarded: "Femtosecond laser microfabrication of three-dimensional microstructures in glass-like materials for bio-oriented applications," Professor Saulius Juodkazis, The University of Tokushima, Japan, October 2002:** Intense ultrashort light pulses that propagate in a dielectric can substantially modify its optical and mechanical properties. Often the optical nonlinearities are short-lived, disappearing soon after the exciting pulses pass. At higher light power densities, the transient nonlinearities are accompanied by destructive permanent modification of material's mechanical, optical, and chemical properties. The changes, known as optical damage, occur at power densities exceeding a certain critical value called the light-induced damage threshold (LIDT). The subject of laser-material interaction – especially with glass – has been the subject of intense study by many groups including CREOL in the US (Orlando, FL). However, measuring the usual laser induced damage threshold (LIDT) values, which defines dielectric breakdown of material, is different than finding the LIDT values relevant to laser material processing. In the latter, one must be aware of the type of "damage" (mass density change, color center formation, crystallinity change, etc.) and find "schemes" to controllably generate it. Though it is possible to make tiny holes in glass with any high-power femtosecond (fs) laser, it is far more difficult to insure that all holes be of the same dimension in a robust process at MHz laser repetition rates, where each hole has seen thousands of shots of varying intensity – that is, to find conditions and engineer materials for reproducible processing.

The Juodkazis team at Tokushima Univ. was the first to show that fs-laser irradiation can process glass controllably in 3D by tightly focused laser pulses, effectively starting the fs-laser fabrication craze now about 4 years old. They were also the first to demonstrate true 3D fabrication in polymer-glasses. On the new project, Prof. Juodkazis will develop laser microfabrication techniques for 1) 3D microstructuring of silica- and polymer-based glasses by using "unconventional" tightly-focused fs-laser irradiation coupled with wet chemical etching and 2) implementation of holographic recording using a fs-laser multi-beam interference technique. As no masks are necessary in either fabrication technique, they may be considered as methods of direct laser writing. In the project, fundamental characteristics of the optical/dielectric breakdown will be investigated by various spectroscopic techniques, the ablation rates measured at different fabrication conditions and interfaces, and light sensitive dopants (e.g., dyes) applied with the sole purpose of manipulating the LIDT value to make damage control more manageable. This approach is considered a key element in future materials development efforts for laser material processing.

The SVBL laser laboratories are among the best-outfitted in Japan with regards to laser microfabrication. In the US, other universities and national labs (e.g., Harvard and LLNL) are exploring the use of fs lasers for microfabrication but only with the traditional single beam direct-write processing approach. The Juodkazis approach is to use non-coplanar beams to generate a volume intensity pattern which is "matched" to the material damage threshold -- a level of sophistication not being pursued elsewhere. Prof. Juodkazis is one of the few out-of-country born staff offered a permanent position at a Japanese University. He recently spent a sabbatical at CREOL.

Expected applications of this research include laser-fabricated 3D microstructures within glass-like materials for bio-microfluidics, photonic crystals, and micro-total analysis systems (µ-TAS). Complex 3D microfluidic structures within glass would then be anodically attached to a Si-substrate, where the remaining structures (sensors, channels, controls) are formed by well-matured Si-technology. Such a µ-TAS arrangement is promising for minituarization of bio-chips. POCs for this work are Drs. Howard Schlossberg (AFOSR/NE) and Henry Helvajian (The Aerospace Corporation, LAAFB, CA). (Helvajian and Maurice)

**Contract awarded: "Synthesis of Two-Photon Absorbing Materials for Optical Limiting Applications," Prof. Kwang-Sup Lee, Hannam University, Taejon, Korea, September 2002.** As part of the 2002 International Research Initiative, Prof. Lee and Dr. Paul Fleitz (AFRL/MLPJ) will investigate nonlinear photon absorption in new polymer systems. Prof. Lee will focus initially on synthesis of one-dimensional systems with various combinations of donors and acceptors. The project will then be expanded to synthesis of structurally similar molecules with three-dimensional architectures. Characterization studies will be conducted at both Hannam University and WPAFB. (Goretta)

**Contract awarded: "Study of Cryogenic Plasma by a Pulsed Discharge in Super-fluid Liquid Helium," Professors Osamu Ishihara and Kazuo Minami, Yokohama and Niigata National Universities, Japan, September 2002:** This new project -- involving the creation and evolution of plasmas under the influence of strong electromagnetic fields -- could potentially open a completely new and exciting area in plasma research. In this field, it is known that ion super-fluidity in liquid helium and super conductivity in various materials are phenomena caused by the same physical existence/entity -- namely, Bose-Einstein condensate. Although thousands of researchers worldwide have been focusing their efforts on superconductivity, however, to present few researchers have pursued ion super-fluidity, due mainly to a lack of identifiable applications.

For several years now Prof. Minami of the Niigata side of this collaboration has been successfully producing plasma states in a cryogenic environment by applying a pulsed discharge in both dense gas and super-fluid helium. In so doing, they have evidenced – clearly and by naked-eye observation – a unique afterglow florescence. The phenomenon is associated with the transient cryogenic plasma and is not mentioned in conventional texts or literature on the subject of pulsed discharge. Both Profs. Ishihara and Minami suspect the observed florescence phenomenon may involve quantum hydrodynamics -- that the phenomenon is experimental evidence of a quantum hydrodynamic phenomenon that until now, has only been postulated.

The cryogenic plasma of this work involves various unknown phenomena such as cluster and electronic bubble formations, ion-superfluidity, and the creation of a new type of strongly-coupled plasma. Though only recently awarded, the Minami team is actively producing and measuring basic physical parameters of the transient ultracold plasma, while the Ishihara side is at work in identifying any new physics from a theoretical approach. AFOSR has previously funded portions of Prof. Ishihara's work on turbulence theory in plasmas while he was on the faculty of Texas Tech University. POC for this work is Dr. Robert Barker, AFOSR/NE. (Maurice)

**WOS Visits: Japan-US Symposium on Pulsed Power and Plasma Applications HI, 4-8 August 2002:** With Window-on-Science sponsorship, Drs. Makoto Katsurai (University of Tokyo), Kazuhiko Horioka (Tokyo Institute of Technology), Ken Yukimura (Doshisha University), and Drs. Kiyoshi Yatsui, Weihua Jiang, and Nobuhiro Harada (Nagaoka University of Technology), traveled to Hawaii to participate in the Japan-US Symposium on Pulsed Power and Plasma Applications. Prof. Jiang chaired the meeting that convened in Kailua-Kona, 4-8 Aug 02, and covered the most up-to-date applications of pulsed power and plasma technology -- a science of simultaneously achieving and managing large amounts of energy in short times, and involves high energy densities, high pressures, and intense magnetic fields. The main focus of the seminar was on applications of plasma and charged particle beams based on pulsed power technologies. Topics included pulsed power generation, plasma applications, high-power radiation sources, discharge plasmas, and magnetic confinement of plasmas. Topics from the WOS participants included:

?? A new type of merged compact toroids as an efficient internal pulse power heating method for plasma fusion researchers.

?? "Ion beam evaporation" (IBE) -- the generation of ablation plasmas from various target materials for thin-film deposition and synthesis of nano-size powders and fullerenes.

?? Pulsed power technology applied to removal/treatment of the species (NOX and SOX) that cause acid rain.

?? Development and testing of new types of compact repetitive pulsed power generators.

?? A stacked MOS-FET switch wherein each unit is triggered by an optically coupled signal such that all units are controlled simultaneously by a common trigger circuit. The switch's on-off risetime operation is 30 ns at a repetition rate of 2 MHz.

The meeting of experts confirmed that the application of pulse-power and plasma technology holds much potential, with novel applications existing in nuclear energy, materials science and processing, and especially in the environmental, physical, chemical, and medical sciences. Recent development of compact pulsed power sources has shown significant progress applicable to both commercial application, and thrusts within AFRL's Directed Energy and Propulsion Directorates and NRL. Representation was 27 from Japan, 14 from the US, and 1 from Germany. For additional information, contact Ed Schamiloglu at the U of NM. (Maurice)

**Workshop: The Advanced Photon Processing and Measurement Technology Project (1), ANA Hotel, Tokyo; 23 July 2002.** The "Advanced Photon Processing and Measurement Technology" project has been running for five years (1997-2002) with support from the Ministry of Economy, Trade and Industry (METI). Total budget has exceeded $60 million and with members from 13 private firms, one university and a government institute (AIST). The workshop summed up overall R&D results of the project. Included highlights were as follows;

?? High-power all-solid-state laser technology: Slab-type or rod-type diode-pumped solid state lasers achieved an average power of 12 KW, an electrical-optical efficiency of 23 % and a laser head volume of 0.045 $m^3$.

?? Tightly-focusing all-solid-state laser technology: Innovative structure-type fiber laser was composed of laser fibers with rectangular cross sections and pumping LD module, and attained an optical power of 1 KW and an efficiency of 17 %. By the harmonic generation with CLBO crystal, high power green beams of 217 W and high power UV beams of 42 W were obtained with the diode pumped laser of peak power of 10 KW at the electrical-optical efficiency of 23 % and the focused beam diameter of 40 micron meter.

?? Macroscopic processing technology: Hybrid combination of iodine laser and YAG laser generated 23 KW output power at 1 micron meter wavelength. The present method was applied to high quality laser welding of 30 mm thick steel plates and 20 mm thick aluminum alloy plates. High welding speed of 1.0 m/min and high aspect ratio were obtained.

?? Microscopic processing technology: Well-classified ultra-fine particles of refractory metals and Si were obtained in the diameter range of 20 to 50 nm.

?? Two other topics of Non-destructive measurement technology and In-situ measurement technology were also summarized.

For next three years, starting in 2003, a new government project of high-efficiency laser machining technology has been proposed with total budget of $30 million. (Miyazaki)

1. http://www.ripe.mstc.or.jp

**Workshop: The 9th International Workshop on Femtosecond Technology (FST2002); AIST Tsukuba, Japan; 27-28 June 2002.** The Ministry of Economy, Trade and Industry (METI) initiated a 10-year project of femtosecond technology in 1995 under the Industrial Science and Technology Frontier Program. In order to execute femtosecond technology project, the Femtosecond Technology Research Association (FESTA) was established in collaboration with the National Institute of Advanced Industrial Science and Technology (AIST), universities and ten private firms. The target of FESTA lies in ultra-fast opto-electronic device technology for developing Tb/s communication systems, and ultra-fast high-brightness X-ray pulse generation and metrological technology.

The total attendees of the present conference were about 300. As shown in two plenary talks, main topics were focused on advanced device technologies and transmission technologies for ultra-fast network system: Ultra-fast OTDM Transmission Technology with Advanced Optical Devices (Dr. Weber, Heinrich-Hertz-Institute), and Revolutions in Ultra-fast Pulse Technology 1960 – 2001 and Future Prospects (Dr. Taylor, Imperial College, London).

Two invited talks were presented from the perspective of scientific application of femtosecond laser pulse: Femtosecond Laser Nanofabrication (Prof. Kawata, Osaka University), and Single Optical Mode - Spontaneous Emission Coupling of a Quantum Dot in a Three Dimensional Microcavity (Dr. Solomon, Stanford University).

Regular 32 presentations were divided to 4 sessions, and 99 poster presentations were displayed. Highlights included:

?? Dynamics of Molecules and Clusters in Ultra-short Intense Laser Fields (Prof. Yamanouchi, Tokyo University) A new method called Mass-Resolved Momentum Imaging (MRMI) has been proposed as a method to evaluate quantitatively the extent of the anisotropy of the fragment ejection. The investigation of mixed states of molecules and light fields is proved to be a first step for the realization of control of molecular dynamics in intense laser fields.

?? Picosecond Time Resolved X-ray Diffraction by Using Laser-Driven Hard X-ray Pulses (Prof. Nakamura, Tokyo Institute of Technology) Similar topics were presented for a series of picosecond time – resolved X-ray diffraction experiment.

In 2003, two related international conferences will be convened: (1) Eu-US-Japan Symposium on Ultraspeed Photonic Conference in Chiba, Japan on 15 July 2003, and (2) Femtosecond Technology (FST) 2003, also in Chiba, Japan on 16 – 17 July 2003. For further information, contact FESTA (http://www.festa.or.jp). (Miyazaki)

# Human Systems

**Conference: The 10th International Conference on Environmental Ergonomics (ICEE 2002), Fukuoka, Japan; 23-27 September 2002.** This 10th Meeting is the first time that this Conference was held at an Asian venue. Academia,

government laboratories, and industry were all well represented in the 296 attendees from 24 different countries; 207 papers were presented. The conference was co-sponsored with ONR. Dr. Hodgdon of the Naval Health Research Center, was a member of the Organizing Committee and several presentations were given by scientists from USARIEM. Other military organizations represented included DCIEM (Canada), DMRI (Singapore), Israeli Defence Force Institute of Military Physiology, the JASDF Aeromedical Institute (Japan), and the Institute of Naval Medicine (U.K.). Topics include cold and heat stress, thermal comfort, survival in adverse environment, clothing, protective equipment, illumination, noise, performance under environmental stress, hypo- and hyperbaric environment, modeling and manikins, standards, and related topics. (Lyons)

**Contract awarded: "The Development of Guidelines for Assessing the Safety Impact of Metallic Implants in Personnel Exposed to Radiofrequency Fields," Dr. Vitas Anderson, EME Australia Pty Ltd., Melbourne, Australia August 2002.** The objective of the proposed research is to develop guidelines for assessing the safety impact of metallic implants inside personnel exposed to electromagnetic fields. This proposal, which is the first of two-phase research plan, addresses an important U.S. function in determining the amount of energy absorbed near a metal object within the human body during exposure to an electromagnetic field. This is an important area of research that directly supports the DoD mission. Electromagnetic fields are emitted by ground- and space-based directed energy systems that are crucial for DoD capabilities, including communication and air traffic control. Understanding the biological impact of the electromagnetics energy absorbed by the human body is essential for personnel to do their jobs without health hazards in the directed energy environments mandated by Air Force global operations. POC: Dr. Patrick A. Mason (AFRL/HEDR), Dr. Terence Lyons (AFOSR/AOARD). (Lyons, Park)

**Window-on-Science Visit: Professor Hideki Kawahara, Department of Design Information Sciences, Faculty of Systems Engineering, Wakayama University; 7-10 August 2002.** Professor Kawahara, expert on auditory signal processing and speech information processing, visited AFRL/HE at Wright Patterson Air Force Base on 7-8 August 2002 and participated in the AFOSR Workshop on Computational Audition at Ohio State University on 9-10 August 2002. He introduced his STRAIGHT 2 system which is speech analysis, modification and synthesis program designed to enable versatile manipulations of speech while maintaining high-quality reproduction of manipulated speech. Developed with support from the Advanced Telecommunications Research Laboratory and the CREST Program of JST, it provides virtually perfect decomposition of speech signals into spectral information and periodicity information. Such de-convolution is accomplished by a sophisticated adaptive window design and a spline based smoothing algorithm. This decomposition enables independent control of each parameter on nonlinear time-frequency warping. (Lyons)

**Conference: 2nd Asian Conference on Vision, Gyeongju, Korea; 22-24 July 2002.** This Bi-National forum, attended by 200 participants and 116 papers from 7 nations, reflects increasing capability in Asia in vision and other sensory systems research. Topics include visual psychophysics, color vision, visual optics, visual perception and cognition, eye movement, motion, depth perception, space perception, attention, clinical vision, computational vision, visual physiology, vision and other sensory modality, colorimetry, applied vision. The conference was attended by Dr. Brian Tsou from AFRL Human Effectiveness Directorate. The 3rd ACV is planned for Chongqing, China in Nov 2003. (Lyons)

**Window-on-Science Visit: Prof. Kwangyun Wohn, Virtual Reality (VR) Research Center, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea, 24 April 24 2002:** Prof. Wohn, Director of VR Research Center at KAIST, was hosted at the AFFRL/HEC, Wright-Patterson AFB (WAFB), by Dr. Darrell Hopper. Prof. Wohn presented a seminar entitled "Experiential Computing," which stresses the change of computing trends toward experiential aspects, i.e., providing not only visual and audio, but also haptic and immersive experience. During post-seminar discussions, he found many research areas of common interests, such as: 3-D audio rendering and sound generation, multi-modal interaction, high-resolution display technology and its applications, and usability studies of wearable computing devices. Prof. Wohn and Dr. Hopper also discussed various possibilities for future research collaborations, and identified a research project entitled "Reality Office." The essence of this research is "perceptualization" of remote situations within a confined area. (Park)

# Material Science

**Contract awarded: "Super widegap nitride semiconductors for UV lasers," Professors Hiroshi Amano and Isamu Akasaki, Meijo University, Japan, October 2002:** A new GaN project will combine the expertise of two world-leading laboratories – Meijo University (Amano and Akasaki) and Arizona State University (Ponce) -- to establish a basic scientific framework that correlates the microstructure, electron band structure (and thus the optical and electrical properties), and mechanical properties in ternary, quaternary and superlattice AlGaInN systems. The knowledge will be utilized to fabricate heterostructure lasers that function reliably at UV and even vacuum UV regions, as encountered in space-based applications.

Study of AlGaN & AlGaInN alloys is important because many researchers believe that, eventually, owing to its higher stability and alloy miscibility over wider ranges of composition than its InGaN ternary alloy counterpart, AlGaInN will replace InGaN QW superlattices in certain LEDs by choice. The wider bandgap AlGaN/GaN alloy heterostructures and their radiative recombination (emission)

in the near-to-deep UV spectral regions will eventually replace InGaN/GaN-based blue LEDs and diode lasers altogether, simply because the UV LEDs will be more efficient pumps of white light phosphors for solid state lighting. A source of material problems facing GaN researchers lies in the microstructure of micro-layers of AlGaN epitaxial films. At the atomic scale, it is observed that the density of defects increases rapidly with AlN molar fraction. These defects (threading dislocations and point defects) are not well understood and obstruct efforts to reduce undesirable deep level emissions, and thus increase the UV light emission efficiency. The requirement of high quality, crack-free, high AlN mole fraction AlGaN is difficult to achieve and why UV devices have not been developed.

In this project, the Meijo team will use a special growth technique developed and refined there called "hetero-epitaxial lateral overgrowth technique" – a special combination of low-temperature (LT) interlayers and mass transport epitaxy – to overcome the problem. Since 1986, the numerous technological advances of Professors Akasaki and Amano have shaped the field and become standard practice. These innovations include the use of LT buffer layers, which relieves tensile stress due to lattice mismatch during growth, subsequently enabling the growth of high-quality GaN epilayers with good reproducibility. The LT interlayer approach alone solves the fracture problem and, at the same time, reduces the dark-current of the UV detectors. Used alone, however, certain other (edge) dislocations still exist, which degrade the performance of UV emitters. The combination of AlN LT interlayers and the use of the grid-patterned "substrate" is found to solve the problem. The team will use an interlayer pattern consisting of trenches and plateaus to thereafter select and seed growth areas. The films produced, when thick enough, form an effective "substrate." As a brand new substrate idea, the Meijo growth technique is a promising candidate for nitride epitaxial growth.

Commercial interest in Japan resides in current industrial applications and future development of the optoelectronic industry. The short wave UV laser emitters will provide much higher optical memory density recording in DVD applications, etc. POC: Cole Litton (AFRL/MLPS). (Maurice)

**Conference: Materials and Processing 2002, 15-18 October 2002, Waikiki HI:** As part of the anniversary of the Japan Society for Mechanical Engineers' formation of the Materials and Processing group, their annual conference was made into an international affair and held jointly with ASME. The conference covered materials topics such as new material characterization and mechanical response as well as fabrication. It also covered smart materials and nano-structured materials. (Nowack)

**Conference: 10th Japan-U.S. Conference on Composite Materials (ACCM-3) (1), 15-18 September 2002, Stanford, CA.** This conference series seeks to assess state-of-the-art technologies, identify and discuss key emerging issues in composites technology, and promote exchange and cross-fertilization of ideas. The recent conference, which was co-organized by Prof. Fu-Kuo Chang of Stanford University and AIST of Tsukuba, Japan, and Dr. Takashi Ishikawa of the National Aerospace Laboratory, in Tokyo, covered many aspects of composites technology. Topics included sandwich, smart, civil, and composite structures; automotive applications; manufacturing; modeling and numerical analyses; nondestructive examination and health monitoring; ceramic and metallic composites; textile composites; fatigue, fracture, and failure; and property characterization. Eight plenary lectures were presented. (Goretta)
1. http://structure.stanford.edu/conference/

**Conference: Eighth International Conference on Quasicrystals (ICQ8) (1), 8-13 September 2002, Bangalore, India.** ICQ8, the eighth conference in this series, was organized by faculty of the Indian Institute of Science. Attendance was approximately 200. Topics covered in this multidisciplinary conference included the physics and metallurgy of quasicrystalline solids, metallic glasses, and nanostructured metals. Quasicrystals display unique mechanical and chemical properties and unusual structural and physical properties. Study of them is a significant part of modern metallurgy. Metallic glasses and nanophase alloys also exhibit unique properties and are now being fabricated by several techniques and are being developed for a wide range of applications. (Goretta)
1.http://metalrg.iisc.ernet.in/

**Contract awarded: "Numerical investigations on the failure mechanisms of particulate composite materials under various loading conditions," Prof. Hiroshi Okada, Kagoshima University, Kagoshima, Japan, August 2002.** Prof. Okada has developed novel numerical techniques based boundary-element methods and s-type finite-element analyses to simulate a variety of materials responses. Working with Dr. C.-T. Liu of AFRL/PR at Edwards Air Force Base, he will investigate fracture of solid rocket propellants. Efforts will focus on effects of multi-axial loading on stress distributions among the filler particles. Effects of particle volume fraction, particle size and distribution, and loading conditions will be examined. (Goretta)

**Contract awarded: "Residual-stress analysis of contact-damaged zone using nanoindentation technique," Prof. Dongil Kwon, Seoul National University, Seoul, South Korea, August 2002.** Prof. Kwon has developed a unique nanoindentation system which he is now marketing commercially. He and his group make extensive use of it in their academic research. In this project, they will investigate residual stresses and remnant damage induced by impact. Controlled static indentations will be made in several materials, including steel, titanium, and glass. The residual-stress induced by the damage will be quantified spatially by use of nanoindentation techniques. The relations between the stress state and damage on ultimate failure will be studied. (Goretta)

**Window-on-Science Visits: Drs. Yoshikazu Matsumura and Akihiko Otsuka, Japan Ultra-high Temperature Materials Research Institute, Ube, Japan, 3-10 August 2002.** Drs. Matsumura and Otsuka attended the Third International Workshop on Ultrahigh Temperature Polymer Derived Ceramics in Boulder, Colorado. Three presentations were made: "Long-term oxidation of polymer-derived SiC composite at 1500°C;" "Development of a collaborative proposal on polymer-derived ceramics/MEMS between Japan, Italy, and the U.S.", and "A joint proposal on polymer-derived structural ceramics." In addition, they discussed their Laboratory's unique capabilities in fabrication and study of ultrahigh-temperature materials, including various apparatus for fabrication and film deposition, in-situ X-ray diffraction at temperatures to 2000°C, and thermal-property measurement to 2000°C. (Goretta)

**Site Visit: National Aerospace Laboratory, Chofu Airfield Branch, Tokyo, Japan; 2 August 2002.** The National Aerospace Laboratory's programs at Chofu include work under Dr. Takashi Ishikawa on polymer- and ceramic-matrix composites. Although some fabrication research is conducted, the majority of the efforts at NAL are focused on test and evaluation. Unique experiments include very-long-term effects of environmental exposure on the properties of polymer-based composites and elegant high-temperature testing of ceramics-based composites. Small specimens and large-scale structures are tested. (Goretta)

**Contract awarded: "Fracture and toughening of composites of polymers and nanoscale inorganic and organic fillers," Dr. Albert F. Yee, Institute of Materials Research and Engineering, Singapore, July 2002.** Several years ago, researchers at Toyota Motor Company discovered that addition of a few percent of exfoliated nanoscale clay particles to polymers could impart remarkable increases in strength and stiffness. Efforts over the ensuing years have focused on optimizing the effect and improving fracture toughness, which can decrease in concert with increases in strength. The work in this project will center on addition of nanoscale species in addition to clay to enhance simultaneously strength, stiffness, and toughness. Various matrices will be examined. The experimental program will consist of fabrication, characterization of mechanical properties, microstructural studies, and analysis of processing-structure-property relations. AFRL POC: Charles Lee (AFOSR/NL). (Goretta)

**Contract awarded: "Production systems for iridovirus-based photonic crystals," Prof. Vernon K. Ward, University of Otago, Otago, New Zealand, July 2002.** Substantial current effort focuses on self-assembly of crystals for photonic devices such as sensors or lasers. Tailoring optical gaps enables localization of optical energy and subsequent access to many nonlinear responses. Current assembly and fabrication approaches are, however, limited and not able to access the most-promising space groups. A potential alternative is to use non-spherical building blocks, such as viruses. This effort, in collaboration with WPAFB and the Massachusetts Institute of Technology, centers on the production of photonic crystals from invertebrate iridescent viruses. The major common feature of all iridescent viruses is the iridescent or opalescent blue-green coloration of heavily infected larvae or purified pellets of virus. This coloration is caused by Bragg refractions that are induced by closely packed paracrystalline arrays of virus particles. The work at the University of Otago will consist of producing useful quantities of three viral species, developing and applying new purification routes, exploring viral surface chemistries, and providing means for modification and mediation of viral-viral interactions. AFRL POC: Richard Vaia (AFRL/MLBP). (Goretta)

**Contract awarded: "Design and synthesis of functionalized fullerenes as two-photon absorptive materials," Prof. Long Y. Chiang, National Taiwan University, Taipei, Taiwan, Republic of China, July 2002.** This research will provide increased understanding of the interplay between molecular architecture and nonlinear optical response of organic materials. It will also provide a potentially revolutionary method to improve two-photon cross sections and broadband characteristics. The project will consist of design and synthesis of fullerene (C60)-based conjugated starburst compounds and dendritic macromolecules with enhanced two-photon absorptivity and broadband responses. It will provide insights into design of highly active, two-photon-absorbing chromophores, combining AFX synthesis and photochemistry developed at AFRL/MLBP and Prof. Chiang's expertise in C60 chemistry and materials. Prof. Prasad of SUNY-Buffalo will collaborate on characterization of optical properties. AFRL POC: Loon-Seng Tan (AFRL/MLBP). (Goretta)

**Conference: Third Asian-Australian Conference on Composite Materials (ACCM-3) (1), 15-17 July 2002, Auckland, New Zealand.** The ACCM series is sponsored by the Asian-Australasian Association for Composite Materials. The University of Auckland served as the host organization for ACCM-3. The ACCM series is now firmly established in Asia-Oceania as the equivalent of the International Conference on Composite Materials series. The first two ACCMs were held in Osaka, Japan, in 1998, and Kyongju, Korea, in 2000. ACCM-3 was held in conjunction with the Sixth International Conference on Flow Processes in Composite Materials (FPCM-6). The conference featured a large technical program focused on polymer, metal, and ceramic composite materials and structures. Topics that were covered included materials development, modeling, processing, mechanical properties, health monitoring, joining, design, applications, new materials systems, and eco-friendly manufacture. (Goretta)

1. http://www.cce.auckland.ac.nz/accm/

**Conference: Mechanics and Materials in Design, The Fourth International Conference (1), Nagoya, Japan, 5-8 June 2002.** This conference traces its roots to Mechanics in Design, a conference organized by Prof. S. A. Meguid of the University of Toronto and held in Toronto in 1996. A second conference was held in Nottingham in 1998. The scope of the

series was then expanded to include additional attention to materials issues and, in 2000, Mechanics and Materials in Design was held in Orlando. Materials research was added because it was thought that rapid and significant advances in new materials offer more promise for structural improvements than do optimized mechanics-based designs. The recent conference in Nagoya included nearly 100 attendees and 110 presentations.

Plenary lectures were presented by Prof. Meguid on the role of computational mechanics in engineering and bioengineering and Prof. S. Kitipornchai on nonlinear numerical modeling of transmission towers. Talks and posters focused on materials and processing (six sessions), computational mechanics (four sessions), computational techniques (one session), intelligent manufacturing (four sessions), intelligent design (two sessions), and advanced mechanical testing (one session). Among the many exciting developments were improved modeling of vibrations in structures, analysis of the properties of shape-memory polyurethane foams, manufacture of polymer concrete bodies that exhibit excellent properties for machine-tool applications, manufacture of polymers with significantly improved damping properties, and improved understanding and properties of polymer-clay nanocomposites Conference papers will be published in selected journals. (Goretta)

1. http://133.66.140.25/m2d/

# Micro & Nano Systems

**Symposia on Nanotechnology in Japan:** Two symposia on Japanese governmental projects of nanotechnology were held in succession, one was sponsored by METI (Keizaisangyousho), and the other by MEXT (Monbukagakusho).

**Symposium: NEDO Forum 2002 (1), Prince Hotel, Tokyo, Japan; 19 September 2002.** NEDO indicates New Energy and Industrial Technology Development Organization, and engages in national projects funded by METI. The forum had 19 sessions in parallel, including nanotechnology, biotechnology, information technology, fuel cell and other topical technologies.

The nanotechnology program included 9 projects. They are nanocarbon technology, nanoglass technology, nanocoating technology and so on. Total budget in 2002 is estimated about $50 million. The nanoprocessing and measurement program included 4 projects. Total budget is $7 million.

The revolutionary material industry creation program included 3 projects whose budget is $15 million. The organization of the total program consists of Institute of Advanced Industry, Science and Technology (AIST), 69 universities and 79 private sectors. Active research members number 522 from these sites. Highlights included:

?? Frontier Carbon Technology (Prof. Yoshikawa, Institute of Technologies) Carbon nanotubes and diamond wafers were picked up and their applications to electronic devices were envisioned intensively.

?? Nanometrology Project (Dr. Tanaka, AIST) New standard materials for nanometrology were proposed and prepared. Positron annihilation spectroscopy was applied for calibration.

?? Business-related Nanotechnology (panel discussion) Zyvex Inc. (US) was picked up and analyzed as a most advisable example.

In Feb 2003, international conference of nanotechnology "Nanotech 2003 + Future" will be held in Tokyo under sponsorship of NEDO, JETRO and AIST.

1. http://www.nedo.go.jp

**Symposium: Open Forum of Nanotechnology Researchers Network Center of Japan; Tokyo; 24 September 2002.** A new organization was established in July 2002 to manage the Nanotechnology Support Project by the Ministry of Education, Culture, Sports, Science and Technology (METI). The center supports and promotes (1) Information from Researchers' Work, and (2) Facilities for Researchers. The following are the selected research facilities;

?? Ultra High-voltage Transmission Electron Microscope Supporting Group,

?? Nano Foundries Supporting Group,

?? Synchrotron Radiation Supporting Group,

?? Molecule Synthesis and Analysis Supporting Group.

A topical panel discussion was held at the symposium. Human body building by nanotechnology was stressed by Prof. Kawai of Osaka University. One of conclusions was that the disadvantages of Japanese national projects have been due to a lack of visionary project leaders. For more information, contact Nanonet (http://www.nanonet.go.jp). (Miyazaki)

**Site Visit: Tohoku University, Sendai, Japan, 12-13 September 2002:** Drs. Wesley Hoffman of AFRL/PRSM, Takao Miyazaki, and Tae-Woo Park of AOARD visited several research centers at the Tohoku University located about 300 km from Tokyo. The first visit was to the Esashi Laboratory (1) at the New Industry Creation Hatchery Center, where Dr. Hoffman gave a seminar on his microtube work "The Far-Reaching Nature of Microtube Technology." The seminar was well attended by 30-plus faculty members and graduate students, and it was followed by a lively discussions and questions. After the seminar, we toured the lab facilities, and were briefed on their current research activities in MEMS and nanotechnology. Dr. Hoffman was very much impressed with not only their creativity, but also their capability to design and fabricate any MEMS device.

The second visit was the Kawazoe Lab (2) in the Institute of Materials Research where the research staffs conduct modeling and simulation of new materials using their own tera-flop level super computer system. Dr. Park is hosting three researchers at the lab under the Window-on-Science program as invited speakers to the AFRL and AOARD sponsored workshop "ab initio molecular dynamics" in December this year.

The third visit was to the Tomita Laboratory (3) of the Institute of Multidisciplinary Research for Advanced Materials. We were briefed on their current research in the development of novel inorganic materials including carbon materials by controlling the reaction fields of preparation processes at nanometer level. Overall, Dr. Hoffman stated that the centers' research activities in MEMS and nanomaterials are world class, and his visit was extremely valuable for him as a bench-level scientist. (Park)

1. http://mems.mech.tohoku.ac.jp/esashilab/top_e.html
2. http://www-lab.imr.tohoku.ac.jp/~wkawazoe/index.html
3. http://www.icrs.tohoku.ac.jp/labo/Tom/main-e.html

**Conference: 2nd International Workshop on Quantum Nonplanar Nanostructures & Nanoelectronics 2002 (QNN'02) (1), AIST Tsukuba Research Center, Tsukuba, Japan, 9-11 September 2002:** The highly interdisciplinary QNN'02 brought together over 200 international participants from the fields of materials science, engineering, and fabrication of nanostructures that involve novel materials, physics, and chemistry. The scope of the Workshop included 1) nanostructure electronic devices, 2) electrical and optical properties of low-dimensional quantum structures, 3) growth of quantum structures on patterned substrates, cleaved facets, and high-index substrates, and 4) technology for atomic-scale characterization and fabrication. Towards true molecular and nano-electronics and optoelectronics, a special focus was the electrical and optical properties of nanostructures. Topics included semiconducting carbon nanotubes and other low-dimensional systems for potential use in optoelectronic and quantum computing applications, and also quantum transport, diluted magnetic semiconductor nanostructures, superlattices, magneto-optics, and spin-coupled systems.

Two years ago, AIST commenced the 2nd-stage of a 10-yr project aimed at the development of novel quantum effect devices using nanostructures. The Workshop in part reported on various projects promoted by the Advanced Technology Institute (ATI) and CREST JST (Japan Science and Technology Corporation). It was organized by several affiliated Japanese research institutes and co-sponsored by ATI and CREST JST (Japan Science and Technology Corporation). (Maurice)

1. http://unit.aist.go.jp/photonics/q-nano/qnn2.htm

**Workshop: US-Korea Workshop on Nanostructured Materials and Nanomanufacturing, 11 July 2002, Seoul, Korea.** AFOSR supported the US-Korea Workshop on "Nanostructured Materials and Nanomanufacturing," which was held on 11 July 2002 in Seoul, Korea. Two open-panel sessions were co-organized by Dr. Byung-Lip Lee of AFOSR/NA, Dr. Tae-Woo Park of AOARD, and Prof. Sung-Goon Kang of Hanyang University. A total of 16 expert panelists representing various areas of nanotechnology participated, including Dr. Brett Pokines of AOARD. The panelists were from the following institutions: UCLA, Skyworks, Inc., Harvard University, University of Massachusetts, Seoul National University, LG Corporate Institute of Technology, Hanyang University, Korea Institute of Science and Technology, National Program for Tera-Level Nanodevices in Korea, University of Cincinnati, AOARD, Korea Institute for Advanced Study, Electronics and Telecommunications Research Institute of Korea, Samsung Advanced Institute of Technology, and Yonsei University. A videotaped Workshop Proceedings is available. This Workshop was held immediately following the two-day Nanotechnology Symposium in Seoul, arranged by the Korean-American Scientists and Engineers Association and co-chaired by Dr. Byung-Lip Lee and Prof. Sung-Goon Kang. As a result of these successful events, it is planned to hold US-Korea Nanotechnology Symposia as annual events, held alternately in the two countries. (Pokines, Park)

# Upcoming Conferences In Asia

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| DATE | CONFERENCE | PLACE |
|---|---|---|
| **Nov 18-22, 02** | **9th International Conference on Neural Information Processing (ICONIP02)** | **Singapore** |
| **Nov 18-22, 02** | **4th Asia-Pacific Conference on Simulated Evolution and Learning** | **Singapore** |
| **Nov 18-22, 02** | **International Conference on Fuzzy Systems and Knowledge Discovery** | **Singapore** |
| Nov 19-22, 02 | 2002 Asia-Pacific Microwave Conference (APMC 2002) | Kyoto, Japan |
| Nov 19-23, 02 | 2nd International Symposium on Advanced Ceramics | Shanghai, China |
| Nov 24-28, 02 | First International Conference on Information Technology Applications (ICITA 2002) | Bathurst, Australia |
| **Nov 25-26, 02** | **Australasian Workshop on Structural Health Monitoring** | **Clayton, Australia** |

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| Nov 25-29, 02 | 2nd International Workshop on Nano-scale Spectroscopy and Nanotechnology | Tokyo, Japan |
| Nov 26-28, 02 | 2002 Interim International Symposium on Antennas and Propagation (ISAP I-02) | Yokosuka, Japan |
| Nov 27-29, 02 | Seventh International Conference on Manufacturing | Bangkok, Thailand |
| Nov 27-29, 02 | International Symposium on Innovative Materials Processing by Controlling Chemical Reaction Field (IMP2002) | Miyagi, Japan |
| **Dec 2-3, 02** | **Third Australian Conference on Laser Diagnostics in Fluid Mechanics and Combustion** | **Brisbane, Australia** |
| Dec 2-3, 02 | 3rd International Workshop on Junction Technology 2002 | Tokyo, Japan |
| Dec 2-5, 02 | IUPAC Polymer Conference on the Mission and Challenges of Polymer Science and Technology (IUPAC-PC2002) | Kyoto, Japan |
| Dec 2-6, 02 | The Sixth Asia-Pacific Symposium on Engineering Plasticity and its Applications | Sydney, Australia |
| Dec 2-6, 02 | The 15th Australian Joint Conference on Artificial Intelligence (AI'02) | Canberra, Australia |
| Dec 4-6, 02 | The Ninth International Display Workshops (IWD'02) | Hiroshima, Japan |
| **Dec 4-7, 02** | **International Congress on Biological and Medical Engineering** | **Singapore** |
| **Dec 9-11, 02** | **APAM 2002 International Conference on International Collaboration and Networking: Creating a Global Nanotechnology Network** | **Hsin-chu, Taiwan** |
| **Dec 9-12, 02** | **IEEE International Conference on Data Mining (IEEE ICDM-2002)** | **Maebashi, Japan** |
| Dec 10-12, 02 | The 5th International Conference on Nano-Molecular Electronics (ICNME2002) | Kobe, Japan |
| Dec 11-13, 02 | IAPR Workshop on Machine Vision Applications (MVA2002) | Nara, Japan |
| **Dec 14-15, 02** | **The Future of Artificial Intelligence Workshop** | **Ito, Japan** |
| Dec 14-17, 02 | 3rd International Workshop on Junction Technology 2002 | Tokyo, Japan |
| Dec 15-18, 02 | 8th Asian Conference on Solid State Ionics | Langkawi, Malaysia |
| Dec 15-18, 02 | Intelligent Systems and Applications ISA 2002 | Shanghai, China |
| **Dec 16-18, 02** | **The 2nd International Conference on Structural Stability Dynamics (ICSSD 02)** | **Singapore** |
| Dec 16-19, 02 | 6th International Conference/Exhibition on High Performance Computing (HPC-Asia 2002) | Bangalore, India |
| **Dec 18-20, 02** | **Ab Initio Direct Synamics Workshop** | **Maui, Hawaii** |
| Dec 28-30, 02 | International Symposium on Experimental Mechanics | Taipei, Taiwan |
| **Jan 6-8, 03** | **Workshop on Selective, Patterned and Self-assembled Growth of Nanostructures** | **Hong Kong, China** |
| Jan 6-10, 03 | 10th International Symposium on Deep Seismic Profiling of Continents and their Margins (IASPEI) (SEISMIX 2003) | Taupo, New Zealand |
| Jan 13-14, 03 | International IEEE Conference on the Business of Electronic Product Reliability and Liability | Hong Kong, China |
| Jan 15-17, 03 | International IEEE Conference on the Business of Electronic Product Reliability and Liability | Shenzhen, China |
| Jan 13-15, 03 | 1st International Symposium on Information Technology in Engineering | Sydney, Australia |
| Jan 14-17, 03 | The 8th International Symposium on Advanced Physical Fields (APF8): Advanced Materials for Quantum Computing | Tsukuba, Japan |
| Jan 15-17, 03 | 6th International Topical Workshop on Contemporary Photonic Technologies (CPT 2003) | Tokyo, Japan |
| Jan 19-23, 03 | 16th IEEE International Micro Electro Mechanical Systems Conference (MEMS 2003) | Kyoto, Japan |
| Jan 19-24, 03 | 20th International Conference on Atomic Collisions In Solids (ICACS 20) | Puri (Orissa), India |
| **Jan 21-23, 03** | **US-Korea Workshop on Metallic Structural Materials** | **Maui, Hawaii** |
| **Jan 21-24, 03** | **Topical Workshop in Heterostructure Materials (TWHM'03)** | **Okinawa, Japan** |
| Jan 22-30, 03 | 2nd International Conference on "Platform Science and Technology for Advanced Magnesium Alloys" | Osaka, Japan |
| Jan 23-24, 03 | The 4th Korea-Japan Joint Workshop on Microwave & Millimeter-wave Photonics | Daejon, Korea |

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| Jan 24-26, 03 | The 8th International Symposium on Artificial Life and Robotics (AROB) | Oita, Japan |
| **Jan 26-30, 03** | **2nd International Conference on "Platform Science and Technology for Advanced Magnesium Alloys" (PSTAM 2003)** | **Osaka, Japan** |
| Jan 27-31, 03 | The Third International Workshop on Oxide Surfaces (IWOX3) | Hokkaido, Japan |
| Jan 28-31, 03 | MAP India 2003 - India's Largest Conference and Exhibition on GIS, GPS and Remote Sensing | New Delhi, India |
| Feb 2-8, 03 | International Society for Plant Pathology (ICPP 2003) | Christchurch, New Zealand |
| Feb 3-7, 03 | 3rd World Congress on Medicinal and Aromatic Plants (WOCMAP III) | Chiang Mai, Thailand |
| **Feb 4-7, 03** | **Australian Computer Science Week 2003 (ACSW 2003)** | **Adelaide, Australia** |
| Feb 4-7, 03 | Fourth Australasian User Interface Conference (AUIC2003) | Adelaide, Australia |
| Feb 6-7, 03 | 9th Symposium on Microjoining and Assembly Technology in Electronics (Mate 2003) | Yokohama, Japan |
| Feb 10-14, 03 | Conference on Permutation Patterns | Dunedin, New Zealand |
| Feb 11-14, 03 | International Conference on Computer Graphics and Interactive Techniques in Australia and South East Asia | Melbourne, Australia |
| Feb 17-18, 03 | HUMS2003 - DSTO International Conference on Health and Usage Monitoring | Melbourne, Australia |
| Feb 18-21, 03 | The 3rd International Display Manufacturing Conference & Exhibition | Taipei, Taiwan |
| **Feb 19-22, 03** | **International Display Manufacturing Conference (IDMC 2003)** | **Taipei, Taiwan** |
| Feb 2003 | 12th Australian Electrichemistry Conference (12AEC) | Hobart, Australia |
| Mar 1-4, 03 | International Conference on Fuzzy Information Processing: Theories and Applications | Beijing, China |
| Mar 2-7, 03 | Fifth International Workshop on Nonlinear Waves and Chaos in Space Plasmas. Indian Institute of Geomagnetism. | Maharashtra, India |
| **Mar 3-5, 03** | **2nd Workshop on Mechano-Electromagnetic Property of Composite Superconductors** | **Kyoto, Japan** |
| **Mar 3-7, 03** | **International Conference on Low Energy Antiproton Physics (LEAP '03)** | **Yokohama, Japan** |
| Mar 5-8, 03 | 19th International Conference on Data Engineering | Bangalore, India |
| Mar 10-11, 03 | Multi-lingual Information Management (RIDE-MLIM'2003) | Hyderabad, India |
| Mar 11-13, 03 | 8th Atmospheric Sciences and Application to Air Quality (ASAAQ 2003) | Tsukuba, Japan |
| Mar 13-15, 03 | The 3rd International Conference on Numerical Analysis in Engineering (NAE2003) | Batam Island, Indonesia |
| Mar 16-19, 03 | 8th International Symposium on Plasticity and Impact Mechanics | New Delhi, India |
| Mar 19-22, 03 | The 1st International Symposium on Point Defect and Nonstoichiometry in Semiconductors (ISPN2003) | Sendai, Japan |
| Mar 20-22, 03 | 1st International Symposium on Point Defect and Nonstoichiometry | Sendai, Japan |
| Mar 21-23, 03 | IEEE 2003 International Conference on Computational Intelligence for Financial Engineering (CIFEr2003) | Hong Kong, China |
| Mar 26-28, 03 | 8th International Conference on Database Systems for Advanced Applications | Kyoto, Japan |
| Mar 26-28, 03 | 7th International Symposium on Power-Line Communications and Its Applications (ISPLC2003) | Kyoto, Japan |
| Apr 2-4, 03 | FEF-03 Finite Elements on Flow Problems | Nagoya, Japan |
| Apr 6-10, 03 | IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP'2003) | Hong Kong, China |
| Apr 6-10, 03 | International Conference on Acoustics, Speech and Signal Processing (ICASSP) | Hong Kong, China |
| Apr 9-11, 03 | International Ceramic Exhibition 2003, Concurrent Conference: 2nd Fulrath Memorial Symposium on Advanced Ceramics | Tokyo, Japan |
| Apr 14-16, 03 | ISCA Workshop on Spontaneous Speech Processing and Recognition. | Tokyo, Japan |

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| Apr 14-17, 03 | International Conference on Non Ionizing Radiation (ICNIR) | Kuala Lumpur, Malaysia |
| Apr 15-19, 03 | 21st AIAA International Communications Satellite Systems Conference & Exhibit (AIAA ICSSC-21) | Yokohama, Japan |
| Apr 16-18, 03 | Cool Chips VI-An International Symposium on Low-Power and High-Speed Chips | Yokohama, Japan |
| Apr 18-22, 03 | 3rd International EMF Seminar in China | Guilin, China |
| Apr 20-23, 03 | Eleventh International Conference on Nuclear Engineering (ICONE-11) | Tokyo, Japan |
| **Apr 30- 2 May 03** | **The Seventh Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD-03)** | **Seoul, Korea** |
| May 3-5, 03 | First International Conference on Smarandache Geometries (Mathematics) | Gold Coast, Australia |
| May 7-11, 03 | ICIAM 2003 The 5th International Congress on Industrial and Applied Mathematics (Mathematics) | Sydney, Australia |
| **May 11-15, 03** | **7th International Conference on Organic Nonlinear Optics (ICONO7) / International Conference on Organic Photonics and Electronics (ICOPE 2003)** | **Sorak National Park, Korea** |
| May 11-16, 03 | 3rd World Conference on Photovoltaic Energy Conversion | Osaka, Japan |
| May 12-15, 03 | IEEE International Symposium on Cluster Computing & the Grid (CCGrid 2003) | Tokyo, Japan |
| **May 12-16, 03** | **International Conference on Shape Modeling & Applications (SMI 2003)** | **Seoul, Korea** |
| May 12-17, 03 | IEEE International Conference on Robotics and Automation (ICRA 2003) | Taipei, Taiwan |
| May 16-19, 03 | 33rd International Symposium on Multiple-Valued Logic (ISMVL 2003) | Tokyo, Japan |
| **May 18-23, 03** | **The 4th International Conference on Intelligent Processing and Manufacturing of Materials (IPMM'03)** | **Sendai, Japan** |
| May 19-22, 03 | SAE "Spring" Fuels & Lubricants Meeting | Yokohama, Japan |
| **May 19-22, 03** | **7th Southeast Asian Ergonomics Society and 4th Malaysian Ergonomics Conference (SEAMEC 2003)** | **Kuching, Malaysia** |
| May 19-23, 03 | The 7th International Symposium on Artificial Intelligence, Robotics and Automation in Space (i-SAIRAS 2003) | Nara, Japan |
| **May 20-24, 03** | **The First International Congress on Bio-Nanointerface** | **Tokyo, Japan** |
| May 25-28, 03 | IEEE International Symposium on Circuits and Systems (ISCAS 2003) | Bangkok, Thailand |
| **May 25-30, 03** | **The 5th International Conference on Nitride Semiconductors (ICNS-5)** | **Nara, Japan** |
| May 26-30, 03 | The 7th Asian Symposium on Visualization (7ASV) | Singapore |
| May 26-28, 03 | 5th International Conference on Stochastic Structural Dynamics (SSD-03) | Hangzhou, China |
| May 28-30, 03 | Third International Conference on Fatigue of Composites (ICFC 3) | Kyoto, Japan |
| Jun 1-5, 03 | 7th International Conference on Properties and Applications of Dielectric Materials (ICPADM 2003) | Nagoya, Japan |
| Jun 2-4, 03 | The 3rd International Conference on Computational Science | Melbourne, Australia |
| Jun 3, 03 | The 9th International Conference on Radiation Curing (Red Tech Asia 2003) | Yokohama, Japan |
| **Jun 2-5, 03** | **30th IEEE International Conference on Plasma Science (ICOPS 2003)** | **Jeju, Korea** |
| Jun 15-18, 03 | JSME-IIP/ASME-ISPS Joint Conference on Micromechatronics for Information and Precision Equipment (IIP/ISPS Joint MIPE)-2003 | Yokohama, Japan |
| Jun 16-18, 03 | 2003 JSME-IIP/ASME-ISPS Joint Conference on Micromechatronics for Information and Precision Equipment | Yokohama, Japan |
| Jun 23-25, 03 | International Conference on Advances in Structural Engineering | Sydney, Australia |
| Jun 25-27, 03 | Third International Symposium on Turbulence and Shear Flow Phenomena | Sendai, Japan |
| Jun 25-27, 03 | Scientific Submarine Cable 2003 (SSC03) Workshop | Tokyo, Japan |
| Jun 27-Jul 02, 03 | IEEE International Symposium on Information Theory 2003 (TSFP-3) | Yokohama, Japan |
| Jun 30-Jul 11, 03 | XXIII General Assembly of the International Union of Geodesy and Geophysics (IUGG) | Sapporo, Japan |
| Jul 6-11, 03 | STRINGS 2003 (Mathematics) | Kyoto, Japan |
| Jul 6-11, 03 | XIX International Congress of Genetics | Melbourne, Australia |

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| Jul 7-11, 03 | 5th International Congress on Industrial and Applied Mathematics | Sydney, Australia |
| **Jul 8-11, 03** | **The sixth International Conference on Information Fusion (FUSION 2003)** | **Cairns, Australia** |
| Jul 9-11, 03 | Computer Graphics International Conference (CGI 2003) | Tokyo, Japan |
| Jul 13-26, 03 | XXVth IAU General Assembly. The International Astronomical Union. | Sydney, Australia |
| Jul 14-17, 03 | Modeling and Simulation Society of Australia and New Zealand, CSIRO Land and Water (MODSIM 2003) | Queensland, Australia |
| Jul 16-20, 03 | International Symposium on Computational Intelligence in Robotics and Automation (CIRA 2003). | Kobe, Japan |
| Jul 20-24, 03 | IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM2003) | Kobe, Japan |
| Jul 20-25, 03 | The 24th International Symposium on Shock Waves | Beijing, China |
| Jul 22-26, 03 | Conference on Lasers & Electro-Optics & The Pacific Rim Conference on Lasers and Electro-Optics (CLEO/PACIFIC RIM 2003) | Taipei, Taiwan, Republic of China |
| Jul 29- Aug 1, 03 | IEEE International Conference on Multisensor Fusion and Integration for Intelligent Systems (MFI 2003) | Tokyo, Japan |
| Aug 13-18, 03 | Thirteenth International Heat Transfer Conference | Sydney, Australia |
| Aug 17-21, 03 | 6th International Symposium on Antennas, Propagation & EM Theory (ISAPE-2003) | Beijing, China |
| Aug 19-22, 03 | International Symposium on Speed-up and Service Technology for Railway and MAGLEV Systems (STECH2003) | Tokyo, Japan |
| Aug 25-29, 03 | 18th IAVSD Symposium | Atsugi, Japan |
| Aug 24-29, 03 | World Congress on Medical Physics and Biomedical Engineering - WC2003. | Sydney, Australia |
| Aug 26-28, 03 | International Conference on Computational Mesomechanics (Mesomechanics 2003) | Tokyo, Japan |
| Sep 1-5, 03 | 18th International Radiocarbon Conference. Rafter Radiocarbon Laboratory of the Institute of Geological and Nuclear Sciences. | Wellington, New Zealand |
| **Sep 3-5, 03** | **Australian International Conference on Radar (RADAR 2003)** | **Adelaide, Australia** |
| Sep 3-5, 03 | IEEE 9th International Software Metrics Symposium (Metrics 2003). | Sydney, Australia |
| Sep 8-11, 03 | 2003 International Workshop on Acoustic Echo and Noise Control (IWAENC2003) | Kyoto, Japan |
| Sep 10-12, 03 | International Conference on Advanced Technology in Experimental Mechanics 2003 (ATEM '03) | Nagoya, Japan |
| Sep 16-25, 03 | The 12th Mathematical Society of Japan, International Research Institute (12th MSJ-IRI),"Singularity Theory and its Applications" | Sapporo, Japan |
| Sep 29-Oct 2, 03 | The 5th International Meeting of Pacific Rim Ceramic Societies (PacRim 5) | Nagoya, Japan |
| Oct 8-13, 03 | The 8th IUMRS International Conference on Advanced Materials | Yokohama, Japan |
| Oct 7-10, 03 | International Symposium on Mixed & Augmented Reality (ISMAR 2003) | Tokyo, Japan |
| Oct 12-15, 03 | IEEE Intelligent Transportation Systems Conference - (ITSC 2003) | Shanghai, China |
| Oct 13-17, 03 | International Conference on Intelligent Agent Technology. Web Intelligence Consortium (WIC) (IAT 2003) | Beijing, China |
| Oct 19-23, 03 | IEEE International Telecommunications Energy Conference (INTELEC 2003) | Yokohama, Japan |
| Oct 20-22, 03 | The 5th International Conference on Fracture & Strength of Solids | Sendai, Japan |
| Oct 22-26, 03 | International Symposium on New Perspectives in Shell and Spatial Structures | Taipei, Taiwan |
| Nov 2-7, 03 | International Gas Turbine Congress 2003 Tokyo | Tokyo, Japan |
| Nov 3-7, 03 | 11th Asia-Pacific Conference on Non-Destructive Testing | Seoul, Korea |
| Nov 3-8, 03 | 3rd International Symposium on Slow Dynamics in Complex Systems | Sendai, Japan |
| Nov 4-7, 03 | 3rd Asia-Pacific Conference on Environmental Electromagnetics (CEEM 2003) | Zhejiang, China |
| Nov 6-12, 03 | World Health Organization & US Air Force Asia Pacific EMF Conference | Bangkok, Thailand |
| Nov 9-13, 03 | International Conference on Power Engineering-03 (ICOPE-03) | Kobe, Japan |
| Nov 16-20, 03 | The 7th International Conference on Atomically Controlled Surfaces, Interfaces and Nanostructures | Nara, Japan |
| Nov 19-21, 03 | Japan International SAMPE Symposium and Exhibition | Tokyo, Japan |
| Dec 1-3, 03 | International Symposium on Micro-Mechanical Engineering -Heat Transfer, Fluid Dynamics, Reliability and Mechatronics-(ISMME 2003) | Tsukuba, Japan |

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| Dec 7-11, 03 | 4th International Conference on Fluid and Thermal Energy Conversion | Bali Island, Indonesia |
| Dec 8-12, 03 | Congress on Evolutionary Computation (CEC 2003) | Canberra, Australia |
| 2003 | Pacific Rim Radio Frequency Radiation Conference (Moved from Nov 4-7, 2002) | Bangkok, Thailand |
| Jan 5-7, 04 | 17th National and 6th ISHMT-ASME Heat and Mass Transfer Conference | Tamil Nadu, India |
| Apr 4-9, 04 | 18th International Congress of Acoustics (18th ICA) | Kyoto, Japan |
| May 16-21, 04 | 7th World Biomaterials Congress | Sydney, Australia |
| May 31- Jun 3, 04 | International Conference on Multiphase flow (ICMF-2004) | Yokohama, Japan |
| Jun 7-10, 04 | 24th CIMAC Congress 2004 in Kyoto (CIMAC KYOTO 2004) | Kyoto, Japan |
| Jul 25-28, 04 | 47th IEEE Midwest Symposium on Circuits and Systems (MWSCAS) | Hiroshima, Japan |
| Aug 29- Sep 3, 04 | 24th Congress of the International Council of the Aeronautical Sciences (ICAS 2004) | Yokohama, Japan |
| Dec 17-19, 04 | International Conference on Recent Advances in Composite Materials | Varanasi, India |

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*All the web sites listed in the ASL are hyperlinked.*

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