Asia Science Letter

Information Bulletin of the Asian Office of Aerospace Research and Development Tokyo, Japan

ASL Volume 26 **Jul-Aug 00**

The Asia Science Letter is a bi-monthly publication of the Asian Office of Aerospace Research and Development (AOARD), Detachment 2 of the US Air Force Office of Scientific Research (AFOSR), the basic research manager of the Air Force Research Laboratory (AFRL). Its purpose is to inform the Air Force S&T community on the research and development activities in Asia and Pacific Rim countries including India and Australia. The assessments in this periodical are solely those of the authors and do not necessarily reflect official US Government, US Air Force, or AFOSR positions.

Highlights

The annual "Tri-Service Reception" was a great success attracting twice as many people as the previous years. 250 colleagues from Japanese government, industry, and academia, as well as our US Government associates located in Japan attended the function. This important annual event for AOARD, ARO-Far East, and ONR International Office Asia, strengthens our working relationships with the Japanese S&T community. Col. Reznick, AFOSR Commander, represented Headquarters and then, accompanied by Koto White, visited the Institute of Materials Research and Engineering, Nanyang Technical University, and the US Embassy in Singapore to promote AFOSR programs and partnership opportunities. He also visited Universiti Kebangsaan Malaysia to meet with the scientists developing Malaysia's first micro-satellite (article on page 8).

Congratulations to SSgt Mike Adams for being selected for a promotion. He was also the recipient of the "AFOSR NCO of the quarter" award for Jan-Mar 00. Dr. Jacque Hawkins was awarded "AFOSR Administrative Person of the Quarter" for the same period.

We are soliciting inputs for the Asian Initiative from AFRL Directorates. We still have some FY 00 funds remaining for a few small R&D contracts, and FY 01 initiative is in formulation. Please let us know if you have a cutting-edge Asian Researcher (and a US University researcher) that you want to team up in your research area.

Koto White
Director

TABLE OF CONTENTS

Features

Asian Electronics Manufacturing China & Hong Kong

Varied economic and political factors are driving the explosive growth in China's electronics industry, which until now has lagged the world. Now, as China opens to international commerce, things are happening rapidly in its major manufacturing centers -- Shanghai, Shenzhen (just north of Hong Kong), and Beijing -- as they compete to be "the place to be in China." In April, sponsored by the U.S. Department of Commerce, an International Technology Research Institute (ITRI) study was undertaken to survey electronics manufacturing in China and Hong Kong. An update to one conducted in '97, the study took a panel of U.S. experts to Hong Kong and China, to visit sites that spanned industrial, academic, and government centers. The panel reported their results to sponsors in May. The next event is an ITRI-coordinated international conference July 6-7 in Arlington, VA. (For info, email ttec@qwestisp.net.)

Any update on Asia is going to have a focus on Shanghai. Dramatic day-by-day changes there shock even those who frequent it for business. Long acknowledged as the business center of China, Shanghai is first remarkable for the massive construction of modern, well-equipped buildings that is still growing. Shanghai and Hong Kong, both being ports, have been open to foreigners and business; Beijing, on the other hand, is known for its bureaucrats. Hong Kong, characterized by highly international financial and commercial systems, has a very visible high-tech push. It's trying to strengthen its S&T infrastructure by promoting venture capitalists, etc., like Singapore, however, has fallen behind in manufacturing technology. Instead, it has moved into information technology, with high-tech investments in knowledge markets. Meanwhile, Hong Kong money and monies of foreign investors have poured into Shenzhen and Guangzhou, large mainland Chinese cities to the north along the Pearl River Delta in neighboring Guangdong Province. This is where traditional manufacturers have moved -- where land and labor costs are considerably lower than Hong Kong. The Guangdong Province now hosts the manufacturing centers for operations headquartered in business-friendly Hong Kong. These include, e.g., Legend QDI (PC motherboards), VTEC Ltd. (PCs, toys, and telecom products), strong in the Asia-Pacific region market share. To manufacture electronic products for export, Hong Kong performs the "front-end design" and transfers the "back-end" to China. Hong Kong also no longer hosts the best engineers and competes with Shanghai for the best students. In Shanghai, the best of both come from Fudan and Jiao Tung Universities. Effective national recruitment practices identify the best and the brightest, and Shanghai attracts them. Shanghai is the center for microelectronic and telecommunications equipment, self-sustaining targets of government investment. Many Shanghai companies are independently designing and researching integrated circuit (IC) products. Throughout Hong Kong and China, indications are that the primary research role of university and government labs is to provide services to industry customers. Universities devoted to electronics are Fudan & Jiao Tung (in Shanghai), and Tsing Hua & Beijing (in Beijing).

China's electronics and IC markets are growing and all capabilities rising rapidly. China is very market and export driven. Right now, the policies of different provinces are not consistent, with rules and procedures often not published (to change under WTO). But the overall policy of the central government, whose initial involvement in the electronics industry was in order to reduce dependence on imports and boost production capacity, is an open door. China has a national commitment to develop advanced technologies and to encourage and create linkages between technology and the economy. But because the Chinese are poor in marketing and managing, they look to ventures with foreign subsidiaries, wholly-owned foreign enterprises, and joint ventures with foreign firms like Motorola, Philips, AT&T, NEC, Mitsubishi, and Mitsui. In China, Taiwan, with vast outsourcing by its semiconductor giants and common culture, has been most successful. Meanwhile, China's State-Owned Enterprises (SOEs) are in need of reform, with most electronics SOEs operating in the red. In short, with its enormous domestic market and virtually unlimited human resources, China is the Asian trade force to be reckoned with. It's a lot of people. (Maurice)

Non-Ionizing Radiation Effects on Human Dr. Murphy (AFRL/HEDR) Visits Japan

Dr. Murphy of AFRL/HEDR recently visited Japan to attend a World Health Organization (WHO) conference and visit Japanese research laboratories. This visit reaffirms and expands AFRL/HEDR's already extensive contacts with Japanese researchers. Dr. Murphy also met with Korean researchers and discussed future plans to visit Korean laboratories. In addition Dr. Murphy met with Dr. Repacholi of the WHO and with Dr. Lyons from AOARD to plan a Pacific Rim Conference for 2001.

The **4th International Non-Ionizing Radiation Workshop,** Kyoto, Japan, 22-25 May 2000, was jointly organized by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and WHO and was attended by 180 scientists from 22 countries. Scientific sessions covered the areas of dosimetry, biological effects, health risks, and standards. Dr. Masao Taki is the Japanese member of ICNIRP and the only Asian member of this commission. ICNIRP provides guidance and recommendations on protection from Non-Ionizing Radiation. Along with the IEEE, ICNIRP influences the standards set by individual national authorities. AFRL/HEDR scientists are very active in the IEEE and have been influential in increasing communication between the IEEE and ICNIRP.

Interesting Japanese presentations included "Static and ELF Fields" by Professor Ueno from Tokyo University and "Genetic Effects of ELF Fields" by Professor Miyakoshi from Kyoto University. It was clear that non-ionizing EMF research is continuing to shift away from the lower frequencies (e.g., 50 and 60 Hz) to the higher frequencies, namely the radio frequency range used in mobile communications and radar. There was also some interesting discussion of the extremely conservative recommendations of ICNIRP on the limitation of human exposure to pulsed fields (the type employed in most radar and anti-electronic weapons) – standards based on preventing the microwave hearing effect.

Discussions were also held between AOARD (Dr Lyons), WHO (Dr Repacholi), and HEDR (Dr Murphy) regarding possible locations for a future Pacific Rim Conference on RFR bio-effects, dosimetry, and standards. AFRL (designated as a WHO Collaborating Center) is working with WHO to facilitate the international harmonization of a scientifically based RFR standard. Dr Murphy was also invited to speak at a Bio-electromagnetics meeting in Korea in October. Site visit reports are found in the Human System Section of this ASL. (Lyons)

Japan Looking to Double Foreign Students by 2010

The Japan Times lead article on Thursday, May 25, 2000, highlighted a proposal that Japan is considering to help increase the number of foreign students in Japan. The proposal would create a multibillion-yen fund using low-interest loans to provide financial aid to foreign students. The fund would primarily benefit students from developing countries in Asia. Students eligible for the loans could use them for travel and living costs as well as tuition. Increasing the number of foreign students in Japan is intended to help Japan's universities become more competitive in the international arena and provide indirect aid to developing countries. Increasing the number of foreign students may also help alleviate the competition for students among Japanese universities and colleges, which has been growing intense due to the declining birth rate. In the 1980's, Japan's government set a goal of 100,000 foreign students by the year 2000, but the last academic year saw only 55,700 foreigners studying in Japan. (Gaudreault)

Optical Inter-Satellite Link Technology in Japan

Free-space laser communications are expected to provide the capability for high bit-rate - up to a few Gbps. The Japanese government has made a major commitment in the development of inter-satellite link technology. Technological efforts are focused on optical inter-satellite links and for establishing a strong network between satellites in geosynchronous orbit and their respective ground stations. In response to requests from USAF scientists and engineers, a liaison report abstract that overviews research activity in Japan on this technology has been prepared and is located on the AOARD web site. For more detailed information, contact AOARD. (Miyazaki)

Aerospace

Research Contract: "Damage Tolerance and Assessment of Composite Structures Under Biaxial Prestress," Prof. Ian Marshall, Monash University, Australia. Prof. Marshall's research aims to provide previously unavailable assessment and design tools that take into account the real stress conditions present in composite structures subjected to accidental low velocity impact damage (LVID). This research has direct applications to Air Force R&D involvement in the area of damage tolerance of composite structures subjected to LVID.

The majority of previous work in this area has considered unstressed coupons of particular composite laminates subjected to a range of impact energies. A small number of previous studies have considered the effects of uniaxial pre-stress on the damage tolerance of composite structures without accurately correlating the various findings except in a very general way. Assessing impact damaged composite structures, or incorporating appropriate allowable damage at the design stage, is difficult since the results of tests carried out on stress-free coupons must be translated to real composite structures under some form of

applied stress. With few exceptions, the initial stress state of the impacted structure drastically changes the magnitude and form of resulting damage, thereby rendering evidence from stress free coupon testing misleading at best. Such difficulties have, over the years, led to a degree of pragmatism when assessing the damage tolerance of composite structures e.g. application of the inspection rule that "only visible indentations of greater than one tenth of an inch in composite airframes shall be worthy of detailed non destructive testing." Therefore, an understanding of the effect of prestress on damage tolerance is needed. This research will analyze the effect of bi-axial prestress on the damage resistance and tolerance of composite laminates. The objectives of this research are to

(1) generate damage tolerance data for composite laminates subjected to bi-axial prestress,
(2) develop a monitoring system for detecting and quantifying the extent of induced damage, and
(3) develop a methodology for mapping the load paths in the vicinity of damage.

Developing appropriate tools for predicting and simulating failure behavior is essential for designing reliable lightweight composite structures. The research will also provide tools for modeling and predicting this behavior. It will greatly decrease the risk associated with the use of damage tolerant designs for primary load carrying composite structures resulting in cost and weight savings and greater reliability for aircraft and spacecraft. (Kim)

Site visit: Institute of Industrial Science Open House, Tokyo University, Tokyo, 1-2 June 00: Tokyo University's Institute of Industrial Science (IIS) held its annual open house on 1-2 Jun 00. Exhibits were on display at both the Komaba and Roppongi campuses.

- Prof. Kobayashi and Prof. Taniguchi are working on multi-dimensional visual sensing. They are using stereoscopic methods to measure vorticity and velocity in three dimensions. (Website: http://icebeer.iis.u-tokyo.ac.jp/index.html)
- Prof. Toi's work on adaptive techniques for the finite element collapse analysis of framed structures was also displayed. This analysis is being developed and applied to static as well as dynamic collapse problems of steel frames. They have been able to experimentally validate their crush analysis. (Website: http://duke.iis.u-tokyo.ac.jp/~root/)

The website for IIS is http://www.iis.utokyo.ac.jp/english/. (Gaudreault)

Site Visit: Department of Mechanical Engineering, Hanyang University, Ansan, Korea, 23 May 00. Prof. Sung Kyu Ha has designed and fabricated a lightweight composite rotor for a flywheel energy storage (FES) system that can be integrated into spacecraft power systems. Instead of chemical batteries, the flywheel is an attractive means of achieving high-energy density and could even be used as momentum wheels (attitude control) to orient the spacecraft. The flywheels may also be safe, reliable, and non-polluting replacement for batteries in other industries that require energy such as automotive and power plants. It is likely that the International Space Station will replace the 5-year service life nickel-hydrogen batteries with flywheels. In all instances, cost, weight, and packaging volume reductions can be realized while increasing the designed life and flexibility of the energy storage system.

The composite flywheels are capable of storing or providing more than five times more power per kilogram than conventional chemical batteries. The energy density of chemical batteries is about 40 watt-hours per kilogram. The typical flywheel system is composed of five components: the rotor, the magnetic bearing, the motor/generator, the touchdown surface, and the housing. The motor/generator can enable the flywheel rotor to spin greater than 60,000 RPM. It functions by converting the electrical energy into kinetic energy increasing the rotor speed (like a motor) and then converts kinetic energy back into electrical energy causing the rotor to slow down (like a generator). Although flywheel technology has been demonstrated in the past, recent advances in composite materials and superconducting bearing technologies have improved its performances. Prof. Ha will be visiting the Space Vehicles Directorate on a Window-on-Science program to present a seminar on the development of flywheel composite rotor. (Kim)

Conference: Optical Frequency Standard for Information Communication (2000 CRL Symposium); Tokyo International Forum, Tokyo, Japan, 16 March 2000. Communication Research Laboratory (CRL) is one of the national center of excellence research institutes and holds its conference annually. Optical communications technology moves toward higher density systems, and the maintenance of optical frequency standards is becoming more and more important. The system has to be organized as soon as possible, where absolute standardization of optical frequency (optical wavelength) can be supplied. Several key technologies addressing those issues were explained including ultra- stable laser, precision spectroscopy, ultra-wide band optical comb generation and tera-hertz frequency generation combined with optical wave and millimeter wave. Problems, objectives and

methods for frequency standardization were addressed from different viewpoints including:

- Progress of optical frequency research, K. Shimoda (Tokyo Univ. and RIKEN)
- Next generation optical communication and optical frequency, K. Kikuchi (Tokyo Univ.)
- Exclusively stabilized light source, K. Ueda (Electro-communication Univ.)
- Precise spectroscopic method, S. Urabe (Osaka Univ.)
- Ultra wide band optical frequency comb technology, G. Ohtsu (Tokyo Institute of Technology).

Another 6 lectures on practical research activities were provided by NTT, CRL and other research institutes.

A new national project **"Research and Development for Standard Frequency of Optical Information Communication"** will be initiated in 2000 and continue through 2005. The main objectives of the initiative are to achieve high accuracy absolute optical frequency by controlling quantum state and to develop portable optical frequency standardization technologies. The final goal is to achieve 3.2 Tbps at 1500 km. This corresponds to 20 Gbps (with 50 GHz bandwidth), using 160 wavelengths. For further information, contact Dr. Izutsu (e-mail: mizutsu@crl.go.jp). (Miyazaki)

Electronics and Physics

Conference: The Annual Report Meeting 2000 of Semiconductor Research Work: Association of Super-Advanced Electronics Technologies (ASET), Tokyo, Japan, 23 May 2000. ASET consists of three committees; Semiconductor Technologies Research Committee, Magnetic Storage Technology Research Committee and Electro-Optic Display Technology Research Committee. Semiconductor R&D activities from 1996 to 2000 were reviewed:

- 193 nm ArF laser lithography . Total budget; 1996 - 1998, $17 M. The developed technologies are not well utilized yet.
- R&D for high throughput rate Electron Beam Lithography (EBL). Four member- companies. Total budget; phase 1 (1996-1998), $29 M and phase 2 (1999 -), more than $10 M. In phase 2, two approaches are being undertaken. Goal of Toshiba group is to commercialize a high throughput rate machine based on mask scanning method. Hitachi is developing direct beam writing method (DBW) using a matrix electron beam source.
- Proximity X-ray Lithography (PXL). PXL Research Lab. Total budget; 1996 - 2000, $62 M. A 70 - 100 nm half pitch technology will be developed for manufacturing equipment and test device of ULSI.
- Extremely Ultra Violet Lithography (EUVL) R&D. Total budget; 1998 - 2001, $105 M. EUVL technologies are now under development by 13 member companies including INTEL. The final goal is 70 nm nano-fabrication.
- Dry Etching Technology. Plasma Technology Lab. Total budget; 1996 - 2000, $34 M. Mechanism study of SiO2 etching in fluorocarbon plasma.
- Energy Saving & Highly efficient etch (ES&H) Technology for Dry Etching . Total budget; 1999 - 2003, $31 M. Environmentally benign Etch Technology Lab. (EEL) consolidates 14 member companies. Main objectives are reduction of etch gas usage, alternative gas technology, highly efficient etch technology and Per Fluoro Compounds (PFC) reaction control in exhaust line.

Dr. Ishitani (Research Director of ASET) summarized the future issues as a) Global collaboration for 70 nm technology ($2.6 B budget proposed by US), b) Focusing on high-precision mask making technology, c) Build-up of IP design technology. For more information, contact Dr. A. Ishitani (e-mail: ishitani@aset.tokyoinfo.or.jp). (Miyazaki)

Workshop: Wide bandgap semiconductor devices (Toward robust devices in 21st century), Gakushuin University, Tokyo, 27 April 2000. The government project on hard electronics "R&D of Ultra-Low-Loss Power Electronic Device Technology" started in 1998, supported by the Ministry of International Trade and Industry (MITI). The project will continue through 2003. This workshop was held to review the research results from the past 2 years and clarify critical issues in materials, processing, devices and systems of robust semiconductors. Topics included:

- Progress of hard electronics in Japan. K. Arai (ETL) introduced the activities of ETL's "Research Center of Power Electronics". Supported by MITI and collaborating with 10 private companies, the center was organized to develop low loss SiC power devices. The Kansai Electric Power Co., Inc. announced the recent commercialization of an SiC electrical power conversion diode with high efficiency.
- Characteristics of micro-wave AlGaN/GaN Hetero-Junction Field Effect Transistor (HJFET). Y. Ohno (NEC) presented characteristics of novel HJFET. The 0.25 micro-meter gate length device exhibited maximum current oscillation frequency (f_T) of 50 GHz

and maximum cutoff frequency (f_{max}) of 100 GHz. Normal device operation was observed even at 400 degree C.

- AlGaN/GaN Hetero-structure Field Effect Transistor (HFET) and its device physics. N. Maeda (NTT) discussed device simulation for AlGaN/GaN single HFET. The simulation revealed a high density 2-dimensional electron density for a non-lattice-matched gate structure. AlGaN/GaN/AlGaN double HFET showed improvement of 2D electron mobility (above 9000 cm2/Vs).
- SiC electronic devices. H. Matsunami (Kyoto Univ.) discussed a step controlled epitaxitial method developed for epitaxial growth of high quality SiC film. Technological issues were summarized for realization of a high performance SiC Metal-Oxide-Metal Field Effect Transistor (MOSFET).
- Information on ZnO invisible FET, M. Kawasaki (TIT) and Diamond Surface Acoustic Wave (SAW) filter, S. Shibata (Sumitomo Electric Inc.) were also presented.

SiC and diamond have been considered to be very promising semiconductor materials for novel functional devices. This is the first time that the results are presented to show clearly the superior characteristics of these materials as compared to other conventional semiconductor materials. The objective of the "Hard Electronics" project is to accelerate systematic research progress of SiC device. GaN material already exhibited the possibility of micro-wave FET and optical detectors following the success in commercialization of blue LED and LD. In the future, SiC and III-V nitrides will become the core materials in hard electronics. For further information, contact Dr. K. Arai (e-mail: karai@etl.go.jp). (Miyazaki).

Window On Science: Drs. K. Sugioka, T. Akane, K. Obata (RIKEN Institute of Physical & Chemical Research, Japan), T. Hamada (Hitachi Advanced Research Laboratory, Tokyo, T. Yoshida (Matsushita Research Institute, Tokyo) Y.F. Lu (National University of Singapore, NUS) WOS Visits, 22-30 January 2000. With its application to materials processing, the laser as a tool in industry is permitting the development of new materials and technologies that can benefit the aerospace industry. Towards this, 6 researchers (5 Japanese and 1 Singaporean) with considerable expertise were sponsored under the WOS program to present their research at the Aerospace Corporation (El Segundo, CA) and the recent LASE 2000 and LAMON-V Photonics West Conference (SPIE event, San Jose).

The Japanese researchers are participants in the national MITI-sponsored project, "Advanced Photon Processing and Measurement Technology," which is aimed at the generation and use of high-quality photon beams. Drs. Sugioka and Akane's expertise is in micro-machining of hard materials by hybrid ablation with applications to MEMS devices and laser-induced ohmic metallization. They reported their work on ZnO, a promising wide-bandgap semiconductor that as a sought-after substrate for nitride-based devices, best lattice-matches to GaN. They use a KrF excimer laser to irradiate the ZnO substrate as an effective pre-treatment to fabrication of n-type contacts. Dr. Obata's field is new-function films grown by pulsed-laser deposition techniques; Dr. Hamada's works with new nonlinear optical materials, such as photonic crystals, which can provide lasing. Dr.Yoshida's works with pulsed laser processing (ablation) for semiconductor microlaser nanostructures. Lastly, Dr. Lu, an expert in the plasma dynamics of laser ablation, leads large groups of research at NUS, where laser ablation is used to improve the quality of thin films. For example, they convert phenylcarbyne polymer to a thin film with diamond-like structure and hardness. Ablation together with an ion beam is a technique used on AlN deposited thin films. Dr. Lu's groups also use the laser to induce chromism in WO_3 thin films, a promising technique for optical recording, and also have developed breakthrough self-cleansing techniques. (POC: Dr. Henry Helvajian, Aerospace Corporation) (Maurice)

Site Visit: Denso Corporation, Nagoya, Japan, 18 January 2000. In Japan as in the U.S., there is a push towards vehicle safety. In Japan this direction has taken the form of making cars more intelligent in terms of performance. New programs in Intelligent Transport Systems (ITS) include GPS, rear-view vision & sensing, and collision avoidance systems. Denso Corporation, a key manufacturer of state-of-the- art electronic components for the high-end auto industry with a reputation of highly reliable products, performs its own R&D, assembly, and custom development of integrated circuits (ICs) for diversified needs. Like Toyota, of which it was till recently a member company, it applies a "just-in-time" manufacturing concept and intelligent automation. Its plants are located throughout the world. The 68-acre plant near Nagoya, Japan, employs over 4,000 people, has 5,000 machines, and has 15 billion Yen/month in sales. Products includes pressure sensors (1 million/month), piezoresistive accelerometers (500,000/month), alternators with IC regulators (800,000 units/month produced by 2 shifts on 3 high-speed transfer lines, 3.6 seconds to make each). IC components are assembled into electronic control units (ECUs) and application-specific-integrated-circuit (ASIC)-function at

the plant. ECUs include those for ABS, air bag, cruise, wiper, steering, suspension, engine control, thermal management systems, and sophisticated navigational controls. Denso is also developing communication systems, display technologies, and micromachining.

Denso applies laser technology in several products, including 1) laser-radar cruise control, 2) DVD navigation, and 3) sensing and measurement instrumentation (for gas flow, viscosity, particle-size, and vibration). Their unique laser scattering gas-flow visualization tool won a national prize in Japan.

Denso is currently attracting attention for its laser-radar cruise control. High-speed time measurement technology was developed into the world's first practical adaptive cruise control (ACC) system. The ACC system is based on 2-dimensional (up & down) scanning pulsed laser radar sensor technology for distance measuring of moving vehicles ahead. (In customary methods, beams shot left & right by shifting angles suffered false detection and lost sight of vehicles ahead.) Denso's GaAs-based (850 nm, IR) multiple-quantum-well laser has 15W output power, with no changes over 10,000-hr pulsed operation at 90◦C, despite being mounted beneath the bumper. A bonded Au-Sn-Ni solder layer sustains the high vibration and thermal shock, extending life and reliability. Denso's 2D scanner uses a hexagonal mirror to rapidly rotate precise beams and enables accurate measuring of 100-meter-forward distances. They use pattern-recognition algorithms to distinguish moving and non-moving objects. Their compact 1.1 mm^2 (Complimentary-Metal-Oxide-Semiconductor logic) ASIC chip converts very short time periods to numeric values, processing signals digitally with high (0.5 ns) resolution. (Conventional digital circuits are used mainly to process digital data, and when used for time measurement, the clock period is used -- here, the laser pulse timing.) Further compactness and performance enhancements are expected as they incorporate high-speed techniques such as silicon-on-insulator (SOI) thin-films in their CMOS circuit processing. Their electronics are all GaAs and Si-based, with no wide-bandgap semiconductor work planned. In manufacturing, YAG lasers (replacements for CO_2) are being used for cutting and scribing, drilling, trimming, soldering and welding. Laser welding is used to seal components, e.g., the outside rings of actuator (plug) units. Laser trimming of IC chips (e.g., regulators, controllers, sensors) is by robots via YAG. (Maurice)

Conference: International Symposium on Photonics and Applications (ISPA'99), Singapore; 29 Nov - 3 Dec 99. 250 researchers participated in the recent ISPA in Singapore. Coverage of the latest developments in photonic technologies was showcased in over 350 papers and posters representing almost 1000 researchers. The Symposium consisted of four parallel conferences: 1) design, fabrication, and characterization of photonic devices, 2) advanced photonic sensors and applications, 3) photonic systems and applications in defense and manufacturing, 4) photonics technology into the 21st century: semiconductors, microstructures, and nanostructures. It was sponsored by Singapore's Nanyang Technological University and SPIE (the International Society for Optical Engineering).

U.S. government research was strongly represented with notable talks by Dr. Gordon Day of the National Institute of Standards and Technology (NIST), AFRL/SNDP's Drs. Mike Hayduk and Serey Thai (fiber lasers), and several AFRL contractors. Photonics is a technology integrator and enabler, ideally bridging electronics, signal processing, optics, and micro-mechanics. For these reasons, important developments in photonics have force-multiplying effects on the performance and enhancement of military systems. Photonics are thus key for military scenarios of the future. Topics that drew discussion at ISPA'99 include:

- In a plenary by Dr. A. Sivathanu Pillai, Chief Controller of R&D in India, phontonics as key technology was outlined with respect to missile warfare where India claims to be 2nd in the world. They claim software is its core technology.
- New optoelectronic integrated circuit (OEIC) technologies based on hybrid approaches that incorporate diverse materials were reported in several sessions. Commercially targeted for optical data buses, point-to-point links, interconnects, sensors, and imaging, OEICs have these applications and more in military systems, especially with respect to radar, advanced imaging, and ultimately precision guidance. Weight and power savings make OEICs attractive for space-based platforms.
- Groups led by Drs. Y.F. Lu and Z.C. Feng of the National University of Singapore (NUS) reported their use of lasers in micromachining and materials processing and wide-bandgap semiconductors, respectively. In a special session on Nitrides, Feng's groups reported success with MOCVD-growth of GaN thin films. In addition, they reported on prospects for SiC, for which material quality (the high density of micro-pipes) is still a problem. NUS's GaN thin films are doped, undoped and specially-grown on silicon (Si) and/or sapphire substrates. On Si, composite intermediate buffer layers consisting of amorphous Si and GaN/AlGaN are successful. Though polycrystalline in nature, grains within the films show perfect single-crystal wurtzite structure

and exhibit strong photoluminescence. NUS's preparation is low-cost and has potential for integration.

- National Chiao Tung University (NCTU), Taiwan reported on yellow emissions, common deep-level n & p-type doping in GaN. Their yellow emissions, like those of researchers elsewhere, are not well understood.
- A novel pyroelectric ($PbTiO_3$) thin-film IR sensor based on micro-opto-electronic-mechanical (MOEMs) technology was reported (Taiwan). The device's greatly-reduced sensing/cantilever area (reduced by a factor of 150 over other devices) attaches directly to a silicon substrate. A simple finish of black paint provides ample absorption. (Maurice)

Micro Systems

Site Visit: The National University of Singapore, Department of Physics, Singapore, 7 June 00. The delivery of a new HVE Dynamitron 3.5 MV nuclear accelerator combined with a high excitation focusing quadrupole triplet (OM2000) to Dr. Frank Watt's laboratory in the Research Centre for Nuclear Microscopy will enable further advancement in material testing and micro-fabrication methods. In addition to a diverse range of material testing research to support pollution control and bio-medical applications Dr. Watt's group has developed a new three-dimensional maskless micro-fabrication method. Dr. Jeroen van Kan and Dr. Andrew Bettiol are developing this unique method of forming high-aspect-ratio three-dimensional structures. Protons are used to precisely expose polymethylmethacrylate (PMMA) or SU-8 resist.

Three-dimensional structures are achieved by altering the dosage of protons between .5 and 3 MeV so that structural heights between 5 to 150 μm can be achieved. A change in the proton energy changes the depth of resist exposure. The reorientation of the resist/substrate system in the exposure chamber allows additional structural shapes. Figure 2 details a double layered grid produced in one single layer of 20 μm Su-8 using two exposures at proton energies of 0.6 and 2.0 MeV. Currently structures with sub-micron feature sizes can be produced, eg 150 nm walls have been produced in 1 μm thick PMMA.

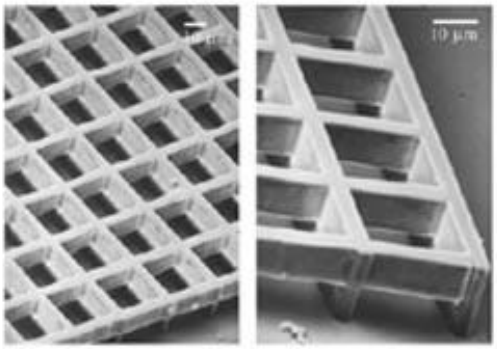

Figure 2. Su-8 structure fabricated with proton-beam micro machining.

The researchers at the National University are currently developing a process to use the SU-8 negative photoresist exposed with protons as a mold to electroplate Ni. Current experiments have shown that post-bake and curing steps are not required in this SU-8 process mitigating cracking and internal stress in the resist. The Su-8 mold can be removed with a commercial chemical stripper. The use of the nuclear microscope produces precise high-aspect-ratio-structures at a lower total cost than other fabrication methods that require a synchrotron radiation source and mask. (Pokines)

Site Visit: Universiti Kebangsaan Malaysia (UKM), Malaysia, 27 May 00. Malaysia is planning to launch its first micro-satellite, TiungSat-1, into low earth orbit from Kazakhstan on 25 August 2000 ISC Kosmotras. Prime Minister Mahathir Mohamad started the project in 1995 to educate and train Malaysian engineers to develop indigenous space systems in near future and to conduct scientific experiment in space. By October 1997, the satellite was built and the ground station was completed. The launch was delayed until a launch vehicle became available.

Colonel Reznick, AFOSR Commander, and Dr. White, AOARD Director, visited UKM where the ground control station is located. We met with Dr. Ahmad Sabirin Arshad, Managing Director of Astronautic Technology Sdn Bhd (ATSB); Dr. Zainol Abidin Abdul Rashid, Associate Professor at UKM and two engineers responsible for the ground station. Major Tim Lawrence (EOARD) who attended the University of Surrey with Dr. Rashid arranged this visit.

The satellite was built by engineers at ATSB using the technology developed by Surrey Satellite Technology Ltd. based in University of Surrey, United Kingdom. ATSB has been set up to implement the program, and it is a company wholly funded by the Malaysian Government. The satellite is three-axis stabilized, weighs 50 Kg, and is

powered by Gallium Arsenide solar cells and Nickel Cadmium batteries. Mission payload includes multi-spectral earth imaging CCD cameras, store and forward digital communication system, a Cosmic Ray Energy Deposition Experiment and autonomous GPS orbital positioning demonstration. (White)

Site Visit: Ritsumeikan University, Kusatsu, Japan, 25 May 00. One of the top private Universities in Japan, Ritsumeikan University consists of four campuses. Dr. Susumu Sugiyama leads the effort in the Faculty of Science and Engineering located on the Biwako-Kasatsu campus to develop micro- & nanosystems. Along with local industry, Ritsumeikan University (RU) invested in the construction of a synchrotron radiation (SR) source in 1995. A total of 16 beamlines with operating electron energy of 575MeV exist at the facility with four beamlines reserved for micromachining. The SR source is the foundation for a multi-user-high-aspect ratio structure foundry service supporting industrial, government and academic micromachine research in Japan.

Dr. Susumu Sugiyama joined RU from the Toyota Central Research & Development Laboratory in 1994. He specialized in micromachines for harsh environments such as automobile engine pressure sensors. His current focus is on developing high-aspect-ratio-structures. Dr. Sugiyama's research team at RU produces the thinnest & tall structures in the world. Polymethylmethacrylate (PMMA) and nickel structures .2 μm thick and 17 μm tall are produced using the SR source at RU, see Figure 1. The enabling mechanisms to form these thin & tall structures is reduced distance between the mask and the resist and improved understanding of Fresnel diffraction and substrate effects.

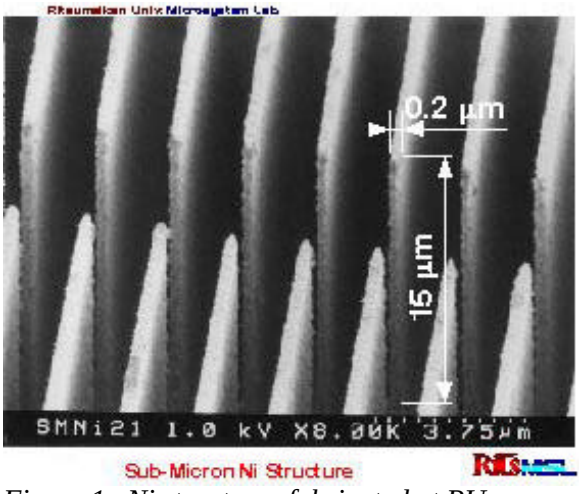

Figure 1. Ni structures fabricated at RU.

A wide range of activities in micro- & nanosystems is underway at RU including work on micro-total analysis systems (μ-TAS), optical system development, and the construction of polysilicon nanowires 0.1 - 0.5 μm in diameter. Work by Dr. Osamu Tabata includes the development of a unique three-dimensional SR micromachining technique. Dr. Satoshi Konishi is developing piezoelectric micro-actuators and pneumatic silicon wafer conveyance systems. (Pokines)

Human Systems

Site Visit: Institute of industrial Science (IIS), University of Tokyo, Roppongi, Tokyo, Japan; 1-2 June 2000. The annual open house of the IIS (a research establishment of the University of Tokyo) included exhibits on material science, information technology, micro-mechatronics, multi-media communication, and underwater technology. In the process of relocating to the new campus at Komaba (just outside Tokyo), some of the laboratories held their exhibits in Komaba instead of at the old Roppongi Campus. As in previous years a considerable amount of man-machine-interface research was embedded in this engineering research.

In the Department of Environmental and Ocean Engineering (Professor Ura) there was a demonstration of their new underwater robot ("Tridog") which uses a vision based guidance system. Also demonstrated was multi-underwater-vehicle simulation using a shared, distributed virtual merged world on a wide Area Network for controlling underwater vehicles.

In the Computer Vision Laboratory (Professor Ikeuchi) research included study of the merits and problems with digitization (for example digitization of cultural heritage) and the study of geometry, photometry, and illumination in mixed and virtual reality. Demonstrations included the recognition and classification of vehicles.

Professor Sato's Laboratory research on mixed reality included "the Enhanced Desk" (a pan tilt camera and IR camera was used to track the operators hands performing both pointing and manipulation tasks) and the perceptual glove (3D tracking of human hand movement using optical cameras). Demonstrations included an interactive book. The operator pointed to icons in the book that would call up relevant information to be projected on the desk, and which could in-turn be manipulated interactively in real time. (Lyons)

Site Visit: Nagoya Institute of Technology, Nagoya, Japan, 25 May 2000. Dr Murphy (AFRL/HEDR) visited the laboratories of Drs. Osamu Fujiwara and Jianqing Wang at the Nagoya Institute of Technology. Research at these laboratories include: (1) Various metals are used to either shield or absorb RFR radiation in order to reduce both electromagnetic interference and exposure to the human body during use of electronic devices, such as cellular phones. (2) the FDTD method is being used to model RFR absorption in the human head. Of considerable interest to AFRL/HEDR, which is engaged in projects on similar topics, is the modelling of RFR absorption. The researchers in Nagoya were familiar with the work of HEDR, having acquired our human and rat RFR dosimetry models from the Internet. There is obvious potential for collaboration with this laboratory and the principal scientists will be invited to visit AFRL/HEDR on the WOS Program. (Lyons)

Site Visit: Kyoto University, Department of Experimental Radiology, Faculty of Medicine, 24 May 2000. Following the ICNIRP Conference Dr Murphy from AFRL/HEDR and I visited the laboratories of Professor Junji Mikakoshi at Kyoto University. Dr Mikakoshi has done considerable research on the effects of low frequency EMF and static magnetic fields on mutation induction and gene expression, which might relate to carcinogenicity. He is now turning his attention to the potential carcinogenic effects of RFR. Dr Taki (a WOS visitor to AFRL/HEDR in 1999) is assisting him with exposure devices and dosimetry. Because of mutual interest in the technical issues relating to RFR experimental exposures, Dr Mikakoshi was invited to Brooks AFB as a WOS visitor. (Lyons)

Conference: The 10th Asia Pacific Military Medical Conference (APMMC), Singapore, 7-12 May 2000. The 10th meeting of the APMMC was attended by over 400 delegates from 28 nations in the Asia Pacific Region. Many nations were represented by general officers. Opening Remarks were made by Deputy Prime Minister Dr. Tony Tan of Singapore and closing remarks were made by Lieutenant General Smith, Commanding General, U.S. Army Pacific. The meeting was jointly hosted by the USARPAC Surgeon (MG Adams) and the Chief of Singapore Medical Corps (BG Lee). Also attending were the Commanders of the following research organizations: U.S. Army Research Institute of Environmental Medicine (USARIEM), U.S. Army Aeromedical Research Laboratory, Naval Medical Research Center, Naval Medical Research Unit #2 (Jakarta), and the Naval Health Research Center, as well as representatives from the Uniformed Services University of Health Sciences. Of the over 280 papers and posters, many addressed military medicine issues including infectious disease. Other research topics of interest included anthropometry, heat stress, fear of flying, war-fighter physiologic status monitoring, and acceleration. The 11th Asia-Pacific Military Medicine Conference will be held in Auckland, New Zealand. (Lyons)

Site Visit: Singpaore Air Force Aeromedical Center, Singapore, 10 May 2000. The Singapore Air Force Aeromedical Center, opened in 1982, uses a human centrifuge (Environmental Tectonics Corporation's G-FET) to provide 3 days of acceleration familiarization training for its pilots. The G-FET is capable of G onset rates of 8 G/sec to 15 G. and is equipped with a dual gimbaled gondola. The Center is implementing commercialization of its initial and periodic examinations and specialty consultations for aviation vocations and these services are now provided in-house by Singapore Technologies Medical Services Pte. Ltd. Discussed were possible research projects using Singapore's state-of-the-art human centrifuge and possibilities for collaboration with AFRL/HESA. (Lyons)

Window on Science: Dr. Eric Kennedy and Dr. Bogdan Dlugogorski of The University of Newcastle Department of Chemical Engineering, and Mr. Noritaka Nagasaki of F-Tech Inc. attended the Halon Options Working Conference (HOTWC 2000), Albuquerque, New Mexico; 2-4 May 2000. This annual international conference provides a unique forum for technical papers and poster presentations covering halon options in fire suppression, explosion suppression, the inertion of flammable environments, and the protection of assets. The phase-out of halon production under the Montreal Protocol on Substances that Deplete the Ozone Layer and anticipated regulatory actions from the Kyoto Conference on Climate Change make continued research and development of halon options vital to the protection of people, property, and the environment. At the request of Dr. Juan Vitali of the AFRL/MLQ Fire Research Group, AOARD sponsored two of the key speakers from Australia to attend this conference:

(1) Dr. Dlugogorski gave a presentation on the flammability properties of mixtures of hydrocarbon blends with CF3I and C3HF7 which covered the flammability envelopes of two hydrocarbon blends, and

(2) Dr. Kennedy presented a process for conversion of halon 1211 (CBrCIF2) which discussed the results of an ongoing study aimed at converting halons into products of economic value.

Mr. Nagasaki of F-Tech Corporation, the world's largest manufacturer of Tri-fluoroethanol, also attended HOTWC 2000 and afterwards was invited to visit AFRL/MLQ.

Discussions were held on potential routes of synthesis and on the potential for recycling existing stocks of Halon 1301 into non-ozone-depleting and usable CF3I. (Lyons)

Workshop: An Introduction to Using Anthropometry for Effective Solutions, Universiti Malaysia Sarawak, Sarawak, Malaysia, 13-17 March 2000. This workshop introduced by the Vice Chancellor of Universiti Malaysia Sarawak (UNIMAS), was attended by over 30 attendees from 8 different nations. The primary presenters included Kathleen Robinette from the Human Effectiveness Directorate of AFRL, Professor Martin Helander from Nanyang Technological University, Mr. Marc Rioux from the National Research Council of Canada, and Associate Professor Ravindra Goonetilleke from the Hong Kong University of S&T. Government, academia, and industry were well represented. The workshop covered a range of topics including applied anthropometry, 3D surface anthropometry, measurement and data collection methods, statistical analysis, and 3D modeling techniques. There were interesting discussions concerning

- The development of anthropometric databases, including issues such as the need for regional databases (namely ASEAN) besides world databases,
- Identifying industrial partners,
- Anthropmetry applications from medical, military, apparel to automotive design, and

Implementation of measurement methods that are cultural-sensitive given the diversity and complexity of population demographics in the Asian region. (Lyons)

Site Visit: Daicell Chemical Industries, LTD., Harima Plant, Escape System Engineering Group Hyogo Pref., Japan, 8 March 2000. Daicel Chemical Industries is a leading developer and manufacturer of specialty chemicals such as cellulose derivatives, organic chemicals, plastics, and films. Products also include inflators for automobile air bags. Research activity is being conducted in high performance materials and environment, including biodegradable plastics and waste plastic gasification. Total sales in 1999 were about 164 billion yen.

Daicel is the only domestic ejection seat manufacturer in Japan. Daicel Chemical Industries has 30 years of experience in manufacturing ejection seats for the Japanese Air Self Defense Force including seats for the T-2/F-1, the F-15J/DJ, T-4, and F-2. In addition they have also manufactured seats for Japan Ground Defense Force helicopters including the AH-1s and the OH-1. Unique development facilities include the Harima Wind Blast test facility, with 600 knot capability. Daicel's Harima plant also develops and manufactures gun propellants, rocket motors for missiles, life support equipment and pyrotechnic devices such as initiators, actuators, and UWARS. The total sales of the Aerospace & Defense System Product Group was over 8 billion yen in 1999. (Lyons)

Upcoming Conferences In Asia

These upcoming conferences may be of interest to you. Contact us for more details or check our homepage at http://www.nmjc.org/aoard/ Conferences in **BoldFace** are AFOSR/AOARD Sponsored.

Date	Name	Place
Jul 9-13, 00	2000 International Symposium on Environmental Biotechnology	Kyoto, Japan
Jul 9-14, 00	**22nd International Symposium on Rarefied Gas Dynamics (RGD22)**	**Sydney, Australia**
Jul 11-13, 00	2000 International Microprocesses & Nanotechnology Conference	Tokyo, Japan
Jul 11-14, 00	Fifth Optoelectronics and Communications Conference	Chiba, Japan
Jul 12-14, 00	The International Workshop on Activematrix Liquid-Crystal Displays-TFT Technologies & Related Materials	Tokyo, Japan
Jul 24-26, 00	6th Int'l Conference in Asia on Materials Science and Technology	Hong Kong, China
Jul 24-28, 00	International Liquid Crystal Conference (ILCC 2000)	Sendai, Japan
Jul 26-28, 00	**Photonic Taiwan 2000**	**Taipei, Taiwan**
Jul 31 – Aug 2, 00	The 2nd Asia-Pacific Symposium on Confocal Microscopy and Related Techno	Kaoshuing, Taiwan
Aug 6-11, 00	**7th International Symposium on Polymer Electrolytes (ISPE7)**	**Queensland, Australia**
Aug 9-14, 00	Int'l Symposium on Safety Science and Technology	Beijing, China
Aug 14-18, 00	International Symposium on Applied Mathematics	Dalian, China
Aug 15-17, 00	Int'l Conference on Advances in Strategic Technologies 2000 - ICAST 2000 -	Putra Jaya, Malaysia

Aug 15-18, 00	Int'l Symposium on Antennas Propagation and Electromagnetic Theory	Beijing, China
Aug 16-18, 00	**4th International Conference on Fracture and Strength of Solids**	**Pohang, Korea**
Aug 16-19, 00	Aviation Medical Society of Australia and New Zealand	Broome, Australia
Aug 18, 00	**International Symposium on Research and Education in the 21st Century, PowerMEMS**	**Sendai, Japan**
Aug 18-20, 00	**2nd Asian-Australasian Conference on Composite Materials (ACCM-2000)**	**Kyongju, Korea**
Aug 20-23, 00	**Topical Workshop in Heterostructure Materials (TWHM'00)**	**Japan**
Aug 21-25, 00	World Computer Congress 2000, Information Processing Beyond Year 2000	Beijing, China
Aug 22-24, 00	**3rd Composite Durability Workshop (CDW 2000)**	**Kanazawa, Japan**
Aug 22-25, 00	Int'l Conference on Antennas and Propagation	Fukuoka, Japan
Aug 27-Sep 1, 00	26th International Congress on Occupational Health	Singapore
Aug 28-31, 00	2000 International Conference on Solid State Devices and Materials (SSDM 2000)	Sendai, Japan
Aug 29-Sep 1, 00	The 1st Asian Conference on Crystal Growth and Crystal Technology	Sendai, Japan
Sep 4-6, 00	**CF3I Seminar**	**Newcastle, Australia**
Sep 5-7, 00	The 1st international Display Manufacturing Conference & Exhibition	Seoul, Korea
Sep 5-8, 00	International Symposium on Optical Memory 2000 (ISOM 2000)	Hokkaido, Japan
Sep 10-14, 00	16th Int'l Workshop on Rare-Earth Magnets and Their Applications 11th Int'l Symposium on Magnetic Anisotropy and Coercivity in Rare-Earth Transition Metal Alloys	Sendai, Japan
Sep 10-14, 00	2000 International Symposium on Formation, Physics, and Device Application of Quantum Dot Structures (QDS2000)	Hokkaido, Japan
Sep 10-15, 00	The 11th International Conference on Molecular Beam Epitaxy	Beijing, China
Sep 11-13, 00	MINPREX 2000 Int'l Congress on Mineral Processing and Extractive Metallurgy	Melbourne, Australia
Sep 11-14, 00	The 15th International Acoustic Emission Symposium 2000	Tokyo, Japan
Sep 12-15, 00	Int'l Laser and Opto-Electronic Products Exhibition	Beijing, China
Sep 13-15, 00	The International Conference on the Physics and Application of Spin-Related Phenomena in Semiconductors	Sendai, Japan
Sep 13-17, 00	Int'l Conference on Microwave & Millimeter-Wave Technology	Beijing, China
Sep 17-22, 00	25th International Conference on the Physics of Semiconductors (ICPS25)	Osaka, Japan
Sep 18-20, 00	The 6th Asian Symposium on Information Displays and Exhibition	Xi'an, China
Sep 18-21, 00	8th International Conference on Ferrite's (ICF8)	Kyoto, Japan
Sep 21-22, 00	10th Fracture Mechanics Seminar	Kyoto, Japan
Sep 24-27, 00	The 9th International Conference on Shallow-Level Centers in Semiconductors	Hyogo, Japan
Sep 24-27, 00	**International Workshop on Nitride Semiconductors**	**Nagoya, Japan**
Sep 24-28, 00	The 9th International Conference on High Pressure Semiconductor Physics	Hokkaido, Japan
Sep 24-28, 00	**Bulk Metallic Glasses Conference**	**Singapore**
Sep 25-29, 00	The 14th Int'l Conference on High Magnetic Fields in Semiconductor Physics	Shimane, Japan
Sep 25-29, 00	24th International Congress on High Speed Photography and Photonics	Sendai, Japan
Sep 27-29, 00	9th International Symposium on Semiconductor Manufacturing (ISSM2000)	Tokyo, Japan
Sep 27-29, 00	IEEE International Workshop on Robot and Human Interaction (ROMAN2000)	Osaka, Japan
Oct 1-4, 00	6th International Conference on Soft Computing (IIZUKA 2000)	Fukuoka, Japan
Oct 2-6, 00	**Solar-Terrestrial Energy Program-Results, Applications and Modeling Phase**	**Sappro, Japan**
Oct 9-12, 00	SPIE 2nd Int'l Asia-Pacific Symposium on Remote Sensing of the Atmosphere, Environment, and Space	Sendai, Japan
Oct 11-14, 00	2000 International Forum on Biochip Technologies	Beijing, China
Oct 14-16, 00	International Symposium on Superconductivity 2000 (ISS 2000)	Tokyo, Japan
Oct 18-20, 00	The 6th Asian Symposium on Information Displays & Exhibition	Xian, China
Oct 18-20, 00	Advanced Metallization Conference 2000: Asian Session (ADMETA 2000)	Tokyo, Japan
Oct 19-21, 00	International Symposium on Smart Structures and Microsystems 2000	Hong Kong, China
Oct 22-25, 00	International Symposium on Micromechatronics and Human Science	Nagoya, Japan
Oct 22-28, 00	IEEE International Conference on Industrial Electronics, Control and Instrumentation (IECON-2000)	Nagoya, Japan
Oct 23-26, 2000	**International Conference on Adaptive Structures & Technologies (ICAST)**	**Nagoya, Japan**
Oct 25-27, 00	The Third Asia-Pacific Conference on Simulated Evolution and Learning (SEAL2000)	Nagoya, Japan
Oct 25-27, 00	**10th International Conference on Artificial Reality and Tele-Existence**	**Taipei, Taiwan**

	(ICAT2000)	
Oct 30-Nov 2, 00	Magneto-Optical Recording International Symposium and Asia-Pacific Data Storage Conference 2000	Nagoya, Japan
Oct 3-Nov 5, 00	International Conference on Intelligent Robots and Systems (IROS2000)	Kagawa, Japan
Nov 1-4, 2000	International Topical Symposium on Advanced Optical Manufacturing and Testing Technology	Chengdu, China
Nov 8-10, 00	Optics and Optoelectronics China 2000	Beijing, China
Nov 9-11, 00	Techno Ocean 2000	Kobe, Japan
Nov 13-17, 00	8th Conference on Frontiers of Electron Microscopy in Materials Science	Matsue, Japan
Nov 14-18, 00	**7th Int'l Conference on Neural Information Processing (ICONIP 2000)**	**Taejon, Korea**
Nov 15-17, 00	2nd International Conference on Optical Design and Fabrication (ODF2000)	Tokyo, Japan
Nov 19-23, 00	**International Conference on Communication Systems (ICCS'00)**	**Singapore**
Nov 20-23, 00	3rd International Hydrology and Water Resources Symposium (Hydro2000)	Perth, Australia
Nov 26-28, 00	The Third International Conference on Computer Aided Industrial Design and Computer Aided Conceptual Design	Hong Kong
Nov 27-1 Dec, 00	**4th Asia Pacific Conference on Computer Human Interaction (APCHI)** **6th S.E. Asian Ergonomics Society Conference (ASEAN Ergonomics)**	**Singapore**
Nov 27-Dec 2, 00	International Symposium on Microelectronics and Assembly (ISMA2000)	Singapore
Nov 28-30, 00	IAPR Workshop on Machine Vision Applications (MVA2000)	Tokyo, Japan
Nov 29-Dec 1, 00	**2nd International Conference on Experimental Mechanics**	**Singapore**
Nov 29-Dec 1, 00	International Display Workshop	Kobe, Japan
Nov 29-Dec 3, 00	**2nd International Symposium on Microelectronics & Assembly (ISMA'00)**	**Singapore**
Nov 30-Dec 2, 00	International Symposium on GPS/GNSS	Seoul, Korea
Nov 30-Dec 2, 00	International Symposium on Electronic Materials and Packaging 2000 (EMAP2000)	Hong Kong, China
Dec 3-6, 00	Sustainable Energy and Environmental Technologies	Hong Kong
Dec 4-7, 00	The 10th International Workshop on Inorganic and Organic Electroluminescence (EL '00)	Hamamatsu, Japan
Dec 4-8, 00	2000 Contaminated Site Remediation Conference	Melbourne, Australia
Dec 4-8, 00	The 21st Asia Conference on Remote Sensing	Taipei, Taiwan
Dec 5-7, 00	The 4th International Conference on Nano-Molecular Electronics (ICNME2000)	Kobe, Japan
Dec 11-15, 00	Australian Optical Society Conference Australian Institute of Physics Symposium	Adelaide, Australia
Dec 13-15, 00	SPIE Smart Electronics and MEMS	Melbourne, Australia
Feb 5-9, 01	**Advanced Research Workshop on Semiconductor Nanostructures**	**Blenheim, New Zealand**
Apr 2-4, 01	International Symposium on Electromagnetics in Biology and Medicine	Tokyo, Japan
May 6-9, 01	**International Light Materials for Transportation System (LiMat 2001)**	**Pusan, Korea**
May 6-11, 01	11th Asia Pacific Military Medical Conference	Auckland, New Zealand
May 14-18, 01	**Indium Phosphide and Related Materials, 2001 (IPRM'01)**	**Nara, Japan**
Jul 1-5, 01	Integrated Optics & Optical Communications Conference (IOOC) Opto-Electronics Communications Conference (OECC) Australian Conference on Optical Fibre Technology (ACOFT)	Darling Harbour Convention Centre, Sydney, Australia
July 1-6, 01	**5th International Symposium on Advances in Polymers and Composites**	**Singapore**
July 1-6, 01	**International Conference on Materials for Advanced Technologies (ICMAT)**	**Singapore**
July 15-19, 01	The 4th Pacific Rim Conference on Lasers and Electro-Optics (CLEO/Pacific Rim 2001)	Chiba, Japan
July 15-19, 01	International Meeting of the Psychometric Society (IMPS-2001)	Osaka, Japan
Jul 24-27, 01	**2001 International Symposium on Signals, Systems, and Electronics**	**Tokyo, Japan**
Jul 29-Aug 3, 01	The 18th International Conference on Crystal Growth (ICCG-13)	Kyoto, Japan
Oct 2-6, 01	The 6th International Conference on Laser Ablation (COLA '01)	Tsukuba, Japan
Oct 15-19, 01	6th International Conference on Mercury as a Global Pollutant	Minamata, Japan
Oct 21-26, 01	8th International Conference on Environmental Mutagens	Shizuoka, Japan
Nov 11-16, 01	9th International Conference on the Conservation and Management of Lakes	Shiga, Japan
Jul 7-11, 03	5th International Congress on Industrial and Applied Mathematics	Sydney, Australia

Upcoming Window-on-Science Visitors

Contact us for more details if you are interested in the following WOS visitors.

Dates	Visitor Name	Affiliation and Country	Topic	Visit Location
1-31 Jul 00	Dr. Ikai Lo	National Sun Yat-sen University, Taiwan	GaN Crystal Growth Techniques	AFRL/MLPO
14-21 Jul 00	Dr. Naminosuke Kubota	Mitsubishi Electric Corporation	Ducted Rocket Engine Technology	AFRL/PRSC & MNGG AMSAM-RD-PS
18-20 Jul 00	Dr. Nigel Smith	Monash University	Liquid-Fuelled Combustor Flow & Reaction via Conditional Moment Closure Method	AFRL/PRSC
26 Jul-3 Aug 00	Prof. Masamitsu Tamura	University of Tokyo	Chemistry of Energetic Materials	AFRL/PRRM & MNME AMSAM-RD-PS
16-18 Aug 00	Prof. Wan Soo Huh	Soonsil University, Korea	Physical Properties of Polyolefin Blends	AFRL/MLBP
20-23 Aug 00	Prof. Greg Walker	Univ. of Tasmania, Australia	Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows	WOS/Conference at Minnowbrook, NY
25 Aug 00	Dr. Hiroyuki Ogawa	Institute of Space & Astronautical Science	Hypersonic Flow	SMC/TEL
25 Aug 00	Prof. Hirobumi Saito	Institute of Space & Astronautical Science	Satellite Engineering	SMC/TEL
28-30 Aug 00	Dr. Naoya Ogata	Chitose Institute of Science & Technology	Novel intelligent thin films derived from salmon & scallop DNA for optical applications	AFRL/MLP AFOSR/NL
7-12 Sep 00	Dr Paul Bates	Griffith University, Australia	Cooperative Research Center (CRC) and Human Factors Research	AFRL/HE
11-15 Sep 00	Dr. Jun-ichi Sakai	Toyama University	Solar Physics	AFRL/VSBS
14-16 Oct 00	Prof. Chung-wen Lan	National Taiwan University	Bulk Crystal Growth, Computational Fluid Dynamics	AFRL/SNHX
16-20 Oct 00	Dr. You-Seop Lee	Pohang University of Science & Engineering	Stability of buoyancy-driven convection in CZ-growth & effect of cusp magnetic field on traveling thermal wave in CZ crystal growth	AFRL/SNHX
21 Oct 00	Dr. Tom Barnes	University of Auckland	Atmospheric	AFRL/DEBS

Points of Contact at AOARD

Tel/Fax: +81-3-5410-4409/4407

Or

Unit 45002, APO AP 96337-5002
DSN: 315-229-3212
Fax: 315-229-3133

Dr. Koto White: *whiteko@aoard.af.mil*
Maj. Michele Gaudreault: *gaudream@aoard.af.mil*
Maj. Mark Nowack: *mark.nowack@aoard.af.mil*
Dr. Terence Lyons: *lyonst@aoard.af.mil*
Mr. Thomas Kim: kimt@aoard.af.mil
Ms. Joanne Maurice: mauricej@aoard.af.mil
Dr. Takao Miyazaki: miyazakit@aoard.af.mil
Dr. Jacquelinn Hawkins: hawkinsj@aoard.af.mil
Dr. Brett Pokines: pokinesb@aoard.af.mil
SSgt Michael Adams: adamsmi@aoard.af.mil

- *The ASL is also available at:* http://www.nmjc.org/aoard/Asia_Sci_Ltr_Dir.html. *All the web sites listed in the ASL are hyperlinked.*
- *Japanese to English translation is available to Air Force customers.*

Visit our Homepage
http://www.nmjc.org/aoard/