Asia Science Letter

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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

I would like to introduce LtC John Brewer, the newest member of the AOARD team. He is working part-time as our Singapore representative and is located in the Office of Defense Cooperation, US Embassy in Singapore. He is a bioenvironmental engineer in the US Air Force Reserves, and has a BS and MS in electrical engineering with specialty in antenna design. Dr. Brett Pokines returned to Rochester Institute of Technology at the end of August after spending a year at AOARD. He will return to AOARD next March. He was extremely busy till the day of his departure, hosting seven AFRL researchers for the MEMS study tour he had organized. Prof. Edward Feigenbaum spent the month of September at AOARD helping us assess computer software development in Asia.

Also in this reporting period, Dr. Thomas Kim received a Ph.D from Nihon University -- one of the largest and best universities in Japan. His dissertation topic was "Compressive Buckling Behavior of Thin Composite Isogrid Stiffened Structure."

Senior managers from AFOSR visited Japan, Korea, and Singapore to meet with officials in government, industry and academia to explore and assess the potential partnership opportunities in Asia. Col. Reznick (Acting Director, Commander) led the delegation for the Japan/Korea leg. Dr. Haddad (Director, Chemistry and Life Sciences), Dr. Rhoades (Director, Mathematics and Space Sciences), and Dr. Schwartz (Director, Aerospace and Materials Sciences) joined the Japan portion. Dr. Carlson (Chief Scientist) joined the Korea/Singapore leg. Dr. King (Director, AFRL International Office) and AOARD personnel participated in all three legs.

During FY 2000, the number of AOARD, AFOSR, and AFRL activities in Asia was the highest ever. A record number of Window-on-Science visits (69), conference support (30), and R&D Contracts (13) occurred and AOARD provided travel assistance for 23 Air Force researchers. With increased openness to international partnerships (especially in Japan) and a general increase in scientific activities in Asia, the time is ripe for AF researchers to visit Asia and explore partnership opportunities. Please let us know how we can help.

Koto White, Director

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Features

Commander Briefs AFOSR Programs and "Dual-Use" Technology

Under the joint auspices of the Nagoya American Center and the Aichi Prefecture Science and Technology Foundation, Colonel Steven G. Reznick presented a special lecture in Nagoya at the Aichi Prefecture Trade Institute last month. Forty focal points from the Japanese research community, including industry, government, and academia, and members of Japan's Research Exchange Club were in attendance. The Commander's lecture, "Collaborative Research Overview and Opportunities," focused on AFOSR programs and research opportunities. He described how AFOSR collaborative research, particularly in high-technologies like electronics and telecommunications, provides technology not only for military purposes but also for the civilian sector. The term military-civilian dual-use is relatively unused in Japan. Since the terms military and non-military technology are used to distinguish purely military applications from technology with commercial applications. He later entertained a variety of questions regarding our AFOSR and AOARD programs, policies, and procedures, and his USAF experience.

The event was co-sponsored by the Aichi Prefecture Science and Technology Foundation, headed by former Toyota Motor Corporation Chairman, Dr. Eiji Toyoda. Mr. Naruse, Managing Director, provided opening remarks. Accompanying the Commander were Ms. JoAnne Livingston, Director of the Nagoya American Center in Japan, LtC Edward Berghorn, Acting Director of the Defense Technology Office at the American Embassy in Tokyo, and Ms. Joanne Maurice of AOARD. (Maurice)

MEMS Visit to Japan

Researchers representing seven Air Force Research Laboratory (AFRL) Directorates visited Japan between the 16th and 26th of August. The Asian Office of Aerospace Research and Development (AOARD) sponsored the researchers. The goal of the visit was to assist Air Force microsystem and nanosystem research and development. Researchers from the Office of Scientific Research, Air Vehicles, Human Effectiveness, Information, Propulsion, Sensors, and Space Vehicles Directorates attended a workshop on Power Microelectromechanical Systems (PowerMEMS) held at Tohoku University as part of the International Symposium on Research and Education in the 21st Century. The workshop featured presentations from Japanese industries and universities developing micro-power systems as well as a briefing on microsystem research in Korea. During the workshop the Ministry of Industrial Trade and Industry (MITI) announced it would sponsor a feasibility study to develop a long-term multi-million-dollar PowerMEMS program in Japan.

In addition to the conference, the visitors conducted research site visits to the Denso Research Laboratory, the Japan Defense Agency, Mitsubishi Electric Corporation, Nippon Electric Company, Ritsumeikan University, and the University of Tokyo.

- Denso is developing scaled micro-robotic systems. A micromachine 9 mm in diameter by 50 mm long with integrated video, power management, locomotion, and communication elements was viewed by the AFRL scientists.
- The Japan Defense Agency's (JDA) Technical Research and Development Institute (TRDI) presented an overview of current research programs during the AFRL visit. It appears that the JDA is in the preliminary stages of developing a strategy for the use and implementation of micro-technology. Examples of microsystem technology appear to be integrated into current projects such as the conformal antenna.
- Mitsubishi Electric Corporation Research and Development Laboratories briefed the AFRL visitors on a wide range of micro-devices including inertial sensors, optical switches, and distributed micromachine systems.
- Nippon Electric Company presented a comprehensive program of research in biological & nano-technology and RF-MEMS during the AFRL visit.
- Ritsumeikan University is a world-leader in the area of high-aspect–ratio micro-structure fabrication. AFRL researchers toured the on-campus synchrotron radiation source that is the foundation of the university's microsystem program.
- University of Tokyo's Institute of Industrial Science houses a unique microsystems effort in Japan-collaboration between French and Japanese scientists in the Center for International Research on MicroMechatronics. Both governments provide support for this international effort. The activities at the Institute include development of nano-scale sensor systems, electro-static actuators, DNA chips, and optical switching systems.
- The University of Tokyo Mechanical Engineering (ME) Department projects focus on the development of micro-technology to enhance turbine performance.

(Pokines)

Aerospace

Research Contract: "Hyshot Flight Program" Prof Allan Paull, University of Queensland, Australia. The University of Queensland is home of the T-4 Shock Tunnel, the third largest in the world. As a result they have developed considerable expertise in high-speed flow phenomona including scramjets. Hyshot is a flight test program to fly a pair of supersonic combustors on a rocket launched out of Woomera, Australia in early 2001. One of the combustors will be fueled with gaseous hydrogen and the other left unfueled for reference. The primary objective is to correlate shock-tunnel data to actual flight data, in particular the behavior of the boundary layer in the combustor. USAF participation in Hyshot is funded by AOARD. (Nowack)

Site Visit: National Aerospace Laboratory, Kakuda Research Center, Kakuda Japan, 13 Oct 2000. Following the JSASS conference, Ed Pendleton (AFRL/VASD) and Mark Nowack (AOARD) visited the National Aerospace Laboratory (NAL) facilities at Kakuda. This facility focuses on space related problems and has high-altitude rocket and ramjet test cells. Of special interest was the High Enthalpy Shock Tunnel. This facility is the largest free-piston shock tunnel in the world, boasting a 17m shock tube and a maximum enthalpy of 25MJ/kg, and a maximum stagnation temperature of 10500 K. It was originally conceived to test the HOPE-X space craft and scramjet operation. Another interesting facility is a small start-up lab dedicated to laser induced ignition. The target application is spacecraft engines. (Nowack)

Conference: 1st S-RAMP Conference, Sapporo Japan, 2-6 Oct 2000. S-RAMP (STEP-Results, Applications and Modeling Phase) was organized by the Scientific Committee on Solar-Terrestrial Physics to provide a forum for scientists to present work relating to data collected on the sun-earth system during 1989-1997. AOARD supported this conference which saw AFRL participation as session organizers and presenters. (Nowack)

Conference: JSASS 14th International Sessions in 38th Aircraft Symposium, Sendai, Japan, 11-13 Oct 2000. The Japan Society for Aeronautical and Space Sciences annual conference brings together academia and industry from all over Japan. The International Sessions provide a forum for English language papers. AOARD once again provided support. Ed Pendleton (AFRL/VASD) gave one of two special lectures attended by the entire JSASS conference. His talk on aero-elastic wings was well received and highlighted a number of other papers dealing with aero-elastic phenomena. (Nowack)

Workshop: Next Generation Supersonic Transport Technology, National Aerospace Laboratory, Tokyo, 8 Sep 2000. An R&D program for the next generation supersonic transport (SST) was initiated at the National Aerospace Laboratory (NAL) of Japan in 1997. The program involves the development and flight tests of two types of unmanned experimental airplanes one non-powered and one twinjet structure. The non-powered airplane design was completed in 1999 and manufacturing and assembly are underway. For the jet, CFD design optimization was completed for the components, i.e. variable intake and composite main wing. Preliminary design of the entire airplane will be initiated within six months. This computerized design system development has been carried out in collaboration with industry and universities. Component research has also been conducted on subjects not directly related to the experimental airplanes; for example, low NOx combustor, low noise exhaust nozzle, internal CFD and boundary layer transition. Flight tests will be conducted from 2002 to 2005 in Australia.

At this workshop, project progress was reviewed and several developmental technology topics were summarized. The main session contents were:

- "Current Status of the Supersonic Research Program of NAL (NEXT) Project" (Dr. Sakata),
- "System Design & Manufacturing of Non-powered Experimental Airplanes" (including 10 lectures),
- "Research on SST and Supersonic Business Jet (SSBJ) in Boeing" (key note lecture by Dr. Radloff of The Boeing Company), and
- "Computational Design of the Jet-powered Experimental Airplane" (including 6 lectures).

Photo 1. Structure assembly of the first

non-powered airplane

Photo 1 shows the structure assembly of the first non-powered experimental airplane completed in Utsunomiya Factory, Fuji Heavy Industry Ltd. on 29 June 2000. Measurement units and sensors were also set up in Gifu Factory, Kawasaki Heavy Industry Ltd. at the end of September. (Miyazaki)

Conference: International Symposium on Computational Fluid Science, Institute of Fluid Science, Tohoku University Japan, 23 Aug 2000. This conference was part of the International Symposium on Research and Education 2000, a two-week long series of symposia to usher in the millennium. Although this was the fourth fluid science symposium, it was the first time the international symposium was held in English. This provided a unique opportunity for outsiders to see some of the foremost Computational Fluid Science (CFD) work in Japan. There were a number of papers presented on work tied into the Institute, specifically relating to the supercomputing center dedicated to fluid problems. Topics included micro flows, modeling dynamic problems, underwater shock wave propagation, and magnetic fields. A special presentation on the Whole-Earth Simulator project, an ongoing Japanese effort to build a 640 processor, 40 TFLOPS super computer to model whole-earth climate was well received. Most participants remained a second day to attend the Annual Forum on Research Activities at the Institute of Fluid Science, which like the symposium, was presented in English for the first time. Every research division in the Institute gave a summary of current research. (Nowack)

Electronics and Physics

Research Contract: Development of Asteroid Astrometry in Mongolia. This contract provides funds to assist with the development of asteroid astronomy capability at the Astronomical and Geophysical Research Institute's Khurel-Togoot Observatory near Ulaan-Baatar, Mongolia. The Spacewatch project at the University of Arizona provides information about comets and asteroids with scientific interest and which may pose a hazard to Earth. Adding observational capability to Khurel-Togoot would provide around-the-clock monitoring capability to the Spacewatch project. The University of Arizona is providing technical and material support for the project with AFOSR providing funding to support salaries and construction during the start-up phase. (Nowack)

Workshop: The symposium on Future Electron Devices 2000; Keidanren Kaikan, Tokyo, Japan, 4-5 October 2000. The Research and Development Association for Future Electron Devices (FED) was established in 1981 under the auspices of the Ministry of International Trade and Industry (MITI). The purpose of FED is to promote basic technologies for future electronics industries through the research and development of electron devices. This is part of the themes of the Industrial Science and Technology Frontier Program and New Sunshine Program sponsored by MITI. FED completed several projects:

(1) Superlattice Devices Project (1981-1990),
(2) Three-Dimensional Integrated Circuits Project (1981-1990),
(3) Fortified ICs for Extreme Condition Project (1981-1985),
(4) Bioelectronic Devices Project (1986-1995), and
(5) Superconducting Electron Devices Project (1988-1997).

Presently FED is conducting three R&D projects; Quantum Functional Devices, Ultra Low Loss Power Device Technology, and New-Generation Ferro-electric Memory. FED organizes "The Symposium on Future Electron Devices" annually focusing on the latest results of these projects. In addition, a special session entitled "Spintronics Devices" was held in conjunction with the Leading Research activity.

Two plenary talks were provided:

- "The guide of R&D of the future semiconductor device technologies" (Prof. Hirose of Hiroshima University), and
- "The latest topics of wearable information network technologies" (Prof. Itao of Tokyo University).

A special panel discussion "The role of universities and national research institutes for fundamental R&D in the coming age of Information Technology" stated that Japan's universities and national research institutes are not in a strong position for fundamental R&D areas in comparison with the US. Japan's anomalous status was analyzed and solutions were proposed in several presentations.

Four technical sessions were held:

- "Quantum Functional Devices" included 12 papers (3 invited). Ultra small silicon devices, silicon nanowire devices, polariton quantum wave devices, and novel multiple-valued logic systems were proposed and exemplified.
- "Ultra Low Loss Power Devices Technology" included 15 papers (4 invited). Various SiC devices were highlighted. Maximum operation temperature of above 400◦ C and high electrical power conversion

efficiency of more than 90% were demanded as the basic specifications.

- "Next-Generation Ferro-electric Memories" included 7 papers (3 invited). The objective of the project is to develop an improved ferro-electric non-volatile memory in which the stored data are not destroyed during the readout operation. Preparation and characterization of different ferro-electric gates were compared.
- "Spintronics Devices" included 4 invited papers. Spintronics devices are the new functional devices, which utilize the degree of freedom of electrons as carriers and spins. Non-volatile magnetic memory (MRAM), spin transistors and spin coherent devices, and hybrid functional devices of magnetic materials and semiconductors were explained.

The quantum functional devices project will be completed next March and consolidated into another new project. More detailed information can be obtained from "FED Journal", an English language periodical published by the R&D Association. (http:/www.fed.or.jp) (Miyazaki)

Conference: The 2nd Asia-Pacific Symposium on Multi-dimensional Microscopy and Related Technologies (APS Confocal Microscopy 2000), National Sun Yat-Sen University (NSYSU), Kaohsiung, Taiwan, 30 July - 3 August 2000. APS Confocal Microscopy 2000 was arranged to directly follow the Photonics Taiwan 2000 Symposium. It was joined by many participants of the Optical Sensing, Imaging, and Manipulation for Biological and Biomedical Applications Conference of the Taipei Symposium. The scientific program included topics on near IR to UV imaging, time-resolved imaging, novel light sources for microscopy, digital signal processing/analysis and contrast mechanisms, laser trapping, X-ray microscopy, interferometry and phase imaging, near-field scanning microscopy, live cell microscopy, green fluorescent protein, and Ca-ion imaging. About 125 researchers participated.

Highlights:

- Dr. Chien Chou of the Peitou Medical Radiation Laboratory near Taipei uses Zeeman laser scanning in a heterodyning technique to distinguish "snake photons" in turbid scattering media (such as tissue) from diffusive ones. These are photons that are neither ballistic (go straight through) nor diffusive; they retain a forward direction (are near axis) as well as partial temporal coherence and polarization. The retained info is used in this confocal imaging technique.
- Prof. Min Gu of Swinburne U. of Technology in Australia uses fluorescence resonance energy transfer (FRET) for microscopy in cell biology. The approach varies from conventional ones by being 2-photon excitation based and uses an IR pulsed laser rather than the typical damaging UV source.
- Dr. Peter So of MIT uses a tagged protein (the enzyme exonuclease) as an automatically-linking nanomachine. By applying a magnetic or electric field, the stress and strain distribution in a cellular system can be mapped, 3D viewing of moving cellular complexes is possible, and provides a means to study gene activation. Actually manipulating single DNA molecules becomes real.
- The application of various adaptive optic techniques such as wavefront sensing and control for 2D microscopy. (Maurice)

Conference: Photonics Taiwan 2000, Taipei, Taiwan, 26-28 July 2000. Over 400 researchers participated in the summer's giant International Optoelectronics Symposium in Taipei, Photonics Taiwan 2000. The AOARD-supported event was co-located with two related international expositions, OPTO Taiwan 2000 and Display Taiwan 2000. Sponsored by SPIE, Taiwan's National Science Council, and the Photonics Industry Development Association (PIDA), these events drew 1000's of industry members from Japan and South-East Asia, especially the local Hsinchu community.

The Symposium consisted of 5 parallel conferences and a workshop. The Conferences were 1) Optoelectronic Materials and Devices, 2) Display Technologies, 3) Input/Output Imaging Technologies, 4) Optical Storage and Optical Information Processing, and 5) Optical Sensing, Imaging, and Manipulation for Biological and Biomedical Applications. The Workshop entitled "Lasers and Optoelectronics in Environmental Monitoring and Ecological Protection Applications" included remote sensing with a focus on quasi-phase-matched lightsources (QPL) and periodically-poled lithium niobate (PPLN) laser sensing.

Dr. Teruo Hiruma, president and CEO of Hamamatsu Photonics in Japan, and Dr. Yung S. Liu, Director of the Opto-Electronics and Systems Labs (OES) of the Industrial Technology Research Institute (ITRI) in Taiwan presented opening plenaries.

Topics within the Optoelectronic Materials and Devices Conference were GaN LED and materials, quantum dots, quantum-well intermixing and lasers, semiconductor LEDs and lasers, epitaxial growth, integrated optical

components and devices, organic light-emitting devices, and advanced light-emitting devices. Prof. Y. Arakawa (U. of Tokyo), in an invited paper, provided a review and synopsis of the progress in GaN LED materials and GaN-based quantum dot lasers for infrared to blue-violet ranges. Highlights included:

- "Radiative recombination mechanism in GaN-based LEDs". Mr. H. Kudo of Yamaguchi U., Japan, presented an interesting paper on the excitonic optical properties of $In_xGa_{1-x}N$ ternary alloys. Clearly observing 2 emission components in these alloys (InGaN/AlGaN single-quantum well LEDs), Mr. Kudo and colleagues deduced an intrinsic property a free-carrier recombination process based on strong electron-phonon interactions. His paper won the Best Student Paper Award at the Symposium. Mr. Kudo's samples were provided by Dr. Shuji Nakamura while at Nichia.
- "High-quality GaN and 3C-SiC epitaxial layers". Work led by Dr. Z.C. Feng of the Institute of Materials Research and Engineering (IMRE) in Singapore was presented on the structural and optical properties (IR reflectance analysis) of epitaxially-grown GaN on Si and sapphire (grown by metal organic chemical vapor deposition, MOCVD) and 3C-SiC on Si (grown by low pressure chemical vapor deposition, LPCVD). IMRE's specially grown GaN films are doped and undoped on silicon (Si) and/or sapphire substrates. On Si, a composite intermediate buffer layer consisting of amorphous Si and GaN/AlGaN is successful. Though polycrystalline in nature, grains within the films show perfect single-crystal wurtzite structure and exhibit strong photoluminescence. Further, the preparation method is low-cost and has potential for integration.
- "Magnetostatic microwave device". Dr. C.S. Tsai, Director of the Institute for Applied Science and Engineering Research (CASER) at Academia Sinica in Taiwan (also Professor at the University of CA, Irvine) presented a novel device – a "spin wave" created modulator. A "spin wave" is a magneto-static wave. The device is basically a micro-stripline magneto-optic Bragg-cell modulator. The propagating wave's dispersion and velocity are not constant, and by changing the applied magnetic field, the carrier frequency can be tuned. The device has applications as an electronically-tunable notch filter (with a tunable range as large as 10 to 33 GHz) and as an ultra-wideband RF frequency-hopping device. Unlike acoustooptic Bragg modulators, the spin wave switching speed can be in the ns range, making optical space switching another application. The device is based on hybrid materials (YIG/GGG films) that can be combined for miniaturization with established GaAs integrated circuitry. (Maurice)

Conference: 13th International Conference on High-Power Particle Beams (BEAMS 2000), Nagaoka, Niigata, Japan, 25-30 June 2000. BEAMS 2000 convened in the northwestern city of Nagaoka, Japan, covering current topics in high-power beams. Over 250 researchers from 20 countries participated, among them the world's best plasma physicists from Japan, Europe (especially close-by Russia), and the US. Professor Kiyoshi Yatsui of the Dept. of Electrical Engineering at Nagaoka University of Technology, and Director of the Extreme Energy-Density Research Institute (EDI) at the University, chaired the AOARD-supported BEAMS and led a tour through the Institute's facilities. Several major Japanese nuclear power plants are located in the Nagaoka vicinity, and BEAMS concluded with a tour to one of the world's largest.

The main topic of BEAMS 2000 was the production of intense pulsed particle beams and associated applications. Plasma and pulsed-power research involves storing (inductive and capacitive), shaping, transmitting, and measuring high-voltage, high-current, high-energy plasmas and pulses. This is required for applications such as nuclear fusion, high-power microwave generation, particle accelerators, space propulsion, and even laser drivers. Energies, voltages, and currents involved can be in the MW/MV/MA/sub-ns regime, calling for challenging materials and techniques. As in previous BEAMS, this one covered the generation and propagation of intense pulsed charged particle beams, pulsed power technology, particle beam interaction with targets, plasma, diagnostics, high-power RF radiation and X-ray sources, z-pinch technology, and various applications. However, high-power particle beams, in addition to being an energy driver for inertial confinement in nuclear fusion, have gained significant interest from the industrial community, with novel applications in materials science and processing, environmental, physical, chemical, and medical sciences.

Highlights include:

- Research led by Profs. H. Akiyama and S. Katsuki of Kumamoto U., Japan, who have considerable expertise in plasma instability, included: 1) behavior studies of exploding wire arrays (used for imploding-liner producing z-pinch to achieve, e.g., nuclear fusion), 2) optical observation of shockwave-produced instability in gas-puff z-pinch plasma, and 3) resistance characteristics of high-current pulsed arc discharges at 0.1-0.6 μs after sparkover. This

expertise is useful as "opening switches" – i.e., fuses. Kumamoto U. also has expertise in integrating flux compression generators. Using a new Japanese material for their transformers, they get 10 kV out for every 1 kV in.

- Researchers led by hosts Drs. Yatsui and Jiang of the EDI, with over 20 contributions, were most prolific. Of particular interest is EDI's newly constructed machine, the "ETIGO-IV," a repetitive pulsed-power generator capable of storing 1.35 kJ and delivering an output pulse of 400 kV, 13 kA, in 200 ns pulse lengths at a repetition rate of 1 Hz. This is useful for high-power microwave generation. They also presented many topics in materials processing via laser ablation and pulsed ion-beam evaporation (ablation plasma) and also first-time experimental observation of the evaporation front in sublimation of a solid (graphite).
- Drs. M. Kristiansen and J. Dickens of the Pulsed-Power Research Lab at Texas Tech reported on MURI-program/DDR&E-sponsored AFOSR research, including ultra high-power microwave generation by a coaxial-type virtual cathode oscillator (vircator). Dr. Jiang (EDI), while a visiting scientist at Texas Tech, contributed by performing vircator modeling and simulation.

An AOARD-sponsored R&D project is underway towards further enhancements. (Maurice)

Human Systems

News: CELLULAR TELEPHONE USE IN ASIA

China now has surpassed Japan in the total number of cellular telephone users. Of the more than 170 million cellular phone users in Asia 51.7 million are in China, 51.1 million in Japan, and 9 million in Australia (The Bulletin, 2 August 2000, p-79).

Site Visits: Display Manufacturers, Korea, 1-11 September 2000. AFRL/HECV Scientist, Dr. Hopper, traveled to Korea under funding from the AFRL Asian Office of Aerospace Research and Development (AOARD) to initiate R&D projects to underpin the imminent dependence of cockpit display production programs on Asian manufacturers. Key DoD aircraft programs including F-22A, F-16C/D, C-130J, AH-64D, F/A-18E/F will depend on production at LG-Philips LCD in Kumi, Korea for their cockpit displays beginning in FY01. After attending the International Display Conference in Seoul, 5-7 September, Dr. Darrel Hopper visited LG Phillips LCD production facilities in Kumi. Dr. Hopper also visited Hyundai Electronics LCD in Ichon. Hyundai is researching new design techniques for active matrix liquid crystal displays (AMLCDs) including a novel design technique that improves AMLCD switching speed and cell capacity. The Hyundai/Dankook concept, when explored, may improve future AMLCDs consumer products to the point that they meet cockpit performance specifications. Currently, all civilian and military cockpit displays, including those manufactured by LG in Kumi, require custom designs and separate, low volume production runs to achieve performance specifications. AMLCD is presently the preferred electronic display technology for all aircraft cockpits (F-22, F-16 MEDS, V-22, B-7x7, etc.) as well as for notebook computers, cars navigation systems, and, soon, flat panel monitors. (Lyons)

Conference: Symposium on CF3I, Newcastle, New South Wales, Australia; 4-6 September 2000. This AOARD sponsored Conference was attended by representatives from the U.S. Environmental Protection Agency (EPA), the OSD, the F-16 System Program Office (SPO), and the Air Force Research Laboratory. Topics addressed included fire suppression and inerting properties of CF3I, fundamental diagnostics and kinetics of CF3I in combustion, material properties and fuel compatibility assessment of CF3I, toxicology of CF3I, and processes for manufacturing CF3I. Military applications of CF3I including its use as a fuel tank inertant were presented. (Lyons)

Site Visit: Tokyo Institute of Psychiatry, Tokyo, Japan; 24 August 2000. Dr. Brian Tsou from AFRL/HECI visited the Tokyo Institute of Psychiatry to discuss brain imaging research using Infrared Spectroscopy/infrared CT (IR CT). Dr. Hoshi is studying the utility of IR CT for brain imaging. She is attempting to combine the best aspects of both time-resolved spectroscopy and continuous wave spectroscopy applied to studying activated brain areas and task performance. IR CT is a non-invasive and continuous brain imaging technique. Thus, it is ideal for correlating human performance and neuronal activation in healthy human volunteers. (Lyons)

Conference: Aviation Medical Society of Australia and New Zealand Annual Scientific Meeting, Broome, Australia; 16-19 August 2000. Scientific papers of interest included pilot selection, sleep & fatigue, cardiovascular adaptation to +Gz, decompression sickness, heat stress, cold water immersion, and cabin fumes. Dr. David Salisbury, the Commander of Canada's Defense and Civil Institute of Environmental Medicine (DCIEM) presented a review of his organization's research programs. Dr. David Newman's presentation, on cardiovascular adaptation to high +Gz was particularly

interesting. This May, Dr. Newman, from the Royal Melbourne Institute of Technology (RMIT), received the Arnold D. Tuttle Award from the Aerospace Medical Association for his article, "Analysis of the Gz Environment During Air Combat Maneuvering in the F/A-18 Fighter Aircraft" (Aviat Space Environ Med 1999; 71: 310-5). Another interesting presentation was on sleep apnea by Dr. Ron Grunstein of the University of Sydney. Dr. Grunstein's research emphasized results of sleep disturbance on daytime performance. He has been funded by the NSW Roads and Traffic Authority to study the effect of traffic noise on sleep and daytime performance. (Lyons)

Site Visit: University of Newcastle, Newcastle Australia, 14 and 15 August 2000. The University of Newcastle has over 19,000 students in eleven different faculties. Dr. Lyons gave a talk on 15 August on AOARD Programs organized by the Research Branch and attended by representatives from the Faculties of Engineering and Science and Mathematics. Of note:

- Department of Chemical Engineering is the major node for both the Special Research Center for Multi-phase Processes and for the Cooperative Research Center for Black Coal Utilization. The CRC for Multi-phase Processes is focused on 1) agitation and mixing, 2) hydrodynamics of multiphase systems, 3) flocculation, and 4) agglomeration & granulation.

- The Industrial Safety and Environmental Protection Group (Dr. Bogdan Dlugogorski, Dr. Eric Kennedy, and Dr. Behdad Moghtaderi) are active in studying halon chemistry, including the development of methods for conversion technologies for CF2ClBr and CF3Br to useful chemicals including CF3I. Environmental research includes biomass combustion and detection of toxic by-products including PAHs, PCBs and dioxin. Research is also conducted on new fire suppressants, utilizing countercurrent flame apparatus and a narrow channel test chamber to study flame spread under simulated zero G conditions.

- The Department of Physics is active in researching surface science and its applications to materials. Dr. Paul Dastour is studying surface coatings for aerospace applications, polymer surfaces and polymer photovoltaic surfaces. Dr. Franks is studying gelforming ceramics. The Plasma physics Group is studying space magnetometry and the ionoshere. It is also a core partner in the Cooperative Research Center for Satellite Systems which is building the Australian Satellite FedSat1.

- The Department of Aviation and Technology (Dr. Peter Pfister) includes research in decision making and executive function. The Department is an Australian Research Council Key Center for Human Factors and Applied Cognitive Psychology and a member of the Cooperative Research Center for Aviation medicine.

Conference: The XIII Congress of the International Society of Electrophysiology and Kinesiology, Hokkaido University, Sapporo, Japan; 25-28 June 2000. Among the many areas covered by this International Conference were recent developments in bio-magnetics and trans-cranial magnetic stimulation. Dr. Shoogo Ueno, from the University of Tokyo, delivered an Invited Seminar on "Recent Advances in Bio-magnetics" covering the effects of intense static magnetic fields on biological systems and materials, magneto-encephalography, Electrical MRI, and trans-cranial magnetic stimulation. Subsequent speakers presented several applications of trans-cranial magnetic stimulation including research applications (sensori-motor cortical interactions and a study of handedness vs. hemisphere dominance) and treatment of medical conditions (Parkinsonism and Spinocerebellar Degeneration). (Lyons)

Site Visit: The Laboratory of Supramolecular Biophysics, Research Institute for Electronic Science, Hokkaido University, Sapporo, Japan; 25-28 June 2000. Research Institute for Electronic Science with a staff of 76 (44 researchers) is dedicated to the study of electronic materials, intelligent materials and devices, scientific instrumentation & control, and informatics & processing. The Laboratory of Supra-molecular Biophysics uses a near infrared imaging technique to study higher brain function. Professor Tamura led the joint NEDO-MITI project that, with Hamamatsu Photonics and Shimadzu, developed the 64-channel Infrared Spectroscopy/infrared CT (IR CT). (Lyons)

Material Science

Research Contract: "Fracture and Toughening of Composites of Polymers and Nanoscale Inorganic and Organic Fillers," Prof. Albert F. Yee and Prof. Neal TS Chung, Institute of Materials Research and Engineering (IMRE), Singapore. Nanocomposite materials have attracted great interest in transportation, construction, and space industries since they exhibit novel physical properties. Nanocomposite is defined as particle

size of the dispersed phase is less than 10 nm. Nanocomposites possess unique properties typically not shared by their more conventional micro-composite counterparts and therefore offer new technology. Significant property improvements, such as in modulus, barrier property, and flammability, can be obtained with relatively small volume fractions of inorganic nano-clay materials. Understanding the mechanism of intercalation of polymer chains in layered nano-clay structures is critical in preparation of good nanocomposites.

Prof. Yee and Chung will investigate fracture and toughening of composites of polymers and nanoscale inorganic and organic fillers. The objective of the research is to investigate the mechanical properties, and particularly the fracture mechanisms of a number of nanocomposites, and to discover possible approaches to their toughening. This research will provide much needed insights on the design of high temperature thermosets and polymer composites with enhanced toughness without compromising processability, chemical and heat resistance and other important mechanical properties.

The proposed work plan will encompass the following:

- To prepare and baseline mechanical properties of several nanocomposites of polymers and nanoscale fillers. The matrix materials include thermoplastics (e.g. nylon-6) and thermosets (epoxies and BMI, thermally and E-beam-cured), nanoparticles (fillers and tougheners) exfoliated, functionalized clay, functionalized hyperbranched polymers and functionalized silsesquioxane (POSS) with organic tethers. Emphasis will be on the microstructural basis for the brittleness of these nanocomposites.
- To modify the surface chemistry of the appropriate nanofillers to improve their ability to function as fillers.
- To modify the processing conditions used to obtain the nanocomposites to obtain different and desirable microstructures.
- To determine the relationship between processing, microstructure, and mechanical performance of these nanocomposites, especially toughness.
- To attempt the toughening of some of these nanocomposites
- To investigate the fracture and toughening mechanisms of the modified nanocomposites.
- To formulate a rational procedure for toughening nanocomposites in general.

This proposal has direct applications to Air Force R&D in the area of lightweight structural materials. This research will provide an increased understanding of the interplay between the microstructures and the fracture toughness of polymeric and composite materials. It will also provide a revolutionary way (on nanoscale level) of improving the toughness of polymeric and composite materials. If successful, this will provide a foundation for the technology to develop critical resins and composites for non-autoclave fabrication of large aircraft and spacecraft components.

This proposal was considered under the Asian Initiatives for basic research on determining the micromechanisms of fracture and their relationships to the microstructure and processing with the overall goal to devise and test strategies for toughening nanocomposites without compromising their desirable properties and processability. This task may require at least 3 years of intensive work. If successful, support of the follow-on task may be available from AFRL/ML (CTA 1-Polymer Technology; CTA 3-Composites and Sustainment IAA). (Kim & Tan)

Conference: The 3rd Composite Durability Workshop (CDW), Tokyo, Japan, 23 August 2000. Advanced composite materials and structures have served many industries for more than 25 years. The cost of fibers and manufacturing processes have declined as composite usage has increased. Today, composites are omnipresent in aerospace, civil, and sporting applications. Composites are also widely used for renovations and repair of aging structures. In all these tasks, reliability and durability of composites has become an essential concern. Durability analysis is defined as the prediction of the structural integrity of a composite system after a complex mechanical loading history in interaction with environmental variations for an imposed lifetime. This workshop brought people representing academia, industry, and government to present their views and recommendations. Prof. Yasushi Miyano organized this year's workshop. Next year's CDW will be held in Albuquerque, NM. (Kim)

Conference: The 2nd Asian-Australasian Conference on Composite Materials (ACCM-2000), Kyongju, Korea; 18-20 August 2000. Two years ago the first conference was held in Osaka, Japan to promote and report on the latest progress in composite technologies. This year's conference attendees totaled about 250 from 15 countries and over 200 technical papers were presented. The ACCM-2000 focus was on the manufacturing applications of composite materials

(metallic, polymer, ceramic) and structures. The plenary sessions were:

(a) "Information Technology and Composites" by Prof. Thomas Hahn (AFOSR/UCLA)
(b) "Design and Manufacture of Composite Grids." By Prof. Steven Tsai (Stanford Univ.)
(c) "National Science & Technology Policy in Korea" by Dr. E.J. Jun (Ministry of S&T, Korea)
(d) "Recycling of Polymer Materials for Automobile" by Dr. N. Sato (Toyota Inc.)

Prof. Chang Sun Hong (Korea Advanced Institute of S&T) organized this year's conference. Prof. Hong is also leading research into improvement techniques for strain monitoring of composite structures using fiber Bragg grating (FBG) sensors. The FBG sensor utilizes a wavelength-swept fiber laser to monitor strain levels. The extrinsic Fabry-Perot (EFPI) sensor system processes signals by using wavelets for damage detection of composite structures. This real time monitoring of quasi-static and dynamic strains of multi-points were successful. He has also investigated damage detection of composite materials using EFPI sensors. The EFPI fiber sensor was used successfully to monitor the occurrence of buckling and delamination growth of composite panel. Optical fiber sensors have shown a potential to evaluate real time health monitoring of metallic and non-metallic structures.

Dr. Jin Yang and his colleagues at the Ssangyong Research Center presented a novel paper, "Ultra-fine cement matrix of the continuous fiber reinforced composite." Fiber reinforced cement composites are characterized by high tensile strength and toughness that can be an attractive material for structural applications such as bunker hardening, column support, marine structure, and even turbine blades used in high temperature ranges. Along with graphite fiber, cement paste was used as a matrix instead of polymer matrix. It was determined that ultra-fine cement particles above 13,000 cm^2/g were required to increase density and penetrate into the space between continuous fibers. Initial test revealed that the maximum flexural strength was increased 15 times when compared to polymer matrix composites. However, the cement matrix is lightweight and durable. It offers low-cost water curing manufacturing (non-autoclave), non-electromagnetic, fire and UV radiation resistance. One potential problem is the fiber corrosion and degradation by $Ca(OH)_2$ in the cement matrix. Additional mechanical evaluations and fabrication of specimens using finer cement particles are planned. (Kim)

Micro Systems

Conference: The First International Symposium on Laser Precision Microfabrication (LPM 2000), Omiya, Saitama, Japan, 14-16 June 2000. Recent advances in laser technologies have enabled rapid growth in the laser-based processing of materials and micromachining. Tools have been developed that allow complex precision micromachining incorporating step-and-repeat functions and delivering multiplexed beams with multi-stage processing. Deep UV mask imaging has been made possible. High-speed/high-volume precision trepanning and percussion drilling have made possible microfabrication of tapered nozzles, such as those required for ink-jet printers, micro-propulsion systems, and focal-spot scribing (i.e., within a material). With efficient frequency conversion, compact diode-pumped solid state (DPSS) lasers have also emerged as viable sources of precision microfabrication. The laser has become the tool of choice for processing incompatible materials such as glass and semiconductors.

Towards facilitating these recent innovations, the first LPM was organized and convened near Tokyo with about 200 researchers representing 16 countries. Chaired by Professor I. Miyamoto of Osaka University, the AOARD-sponsored LPM covered both research and industry applications in microoptics, microelectronics, and micromechanics. Topics included: ablation dynamics, surface and bulk structuring such as "nano-bumps" and other novel laser-textured surfaces, high-speed precision patterning, ultra-fast pulse processing, debris-free processing, and the processing of polymer, metal, ceramic, and semiconductor thin films. In general, metals (including steel and copper) are processed at wavelengths from near-IR to visible, while ceramics, glasses, and polymers are processed with UV or ultrashort-pulse radiation. In glass processing, an important topic was the microfabrication of photonic components (the printing and trimming of gratings, lenses, relief holograms, and waveguide and circuit structures). The short absorption length in most ceramics and the high energy density on the sample result in ablation with little heat transfer into the piece and thus reduce thermal-induced cracking, a problem in the machining of brittle materials.

Highlights:

- Researchers under Dr. A. Yabe at the National Institute of Materials and Chemical Research in Japan achieve high-quality etching (micromachining) of transparent materials such as glass, quartz, and polymers by laser ablation of an organic solution. A solution of acetone containing pyrene is used. The

pyrene absorbs the UV radiation, acting as a molecular heater. Multiphotonic absorption at the interface between the solution and the transparent material leads to the formation of a super-heated solution and a high-temperature/high-pressure vapor attacking process. Dr. Yabe's group also reported on crystallization mechanisms in terms of photochemical reaction and photothermal reaction. In a 2-step irradiation method, they obtain crystallized complex oxide thin films.

- Dr. K. Sugioka of the RIKEN Institute of Physical and Chemical Research in Japan presented novel hybrid laser technology for the precision microfabrication of hard materials such as the wide bandgap semiconductors (diamond, GaN, and SiC). In a multiwave excitation process, his group accurately ablates the hard materials by irradiating them with two lasers (UV and vacuum UV) of small fluence. Dr. Y.F. Lu of National University of Singapore reported on a laser "steam cleaning" debris-removal method based on explosive boiling. The method is useful on delicately-structured surfaces requiring non-contact.
- Researchers from the Osaka National Research Institute, Osaka U., and Tokushima U. were active and presented work including: 1) the formation of photonic crystals in resins by a 2-photon-absorption/photo-polymerization process, 2) optical radiation pressure force micromachining – a "laser trapping" technology, 3) transient light-induced refractive index changes by laser microfabrication in polymer films, and 4) laser microexplosion fabrication by ultrashort pulses.
- Taiwanese researchers at Chung-Cheng Institute of Technology in collaboration with the Academia Sinica reported on mechanisms of laser-induced transformation of carbon fullerenes and nanotubes (which, with high pressure, can be transformed into forms of diamond).
- Dr. Henry Helvajian of the Aerospace Corporation in El Segundo, CA, presented an invited paper on nanosatellites and the MEMS fabrication of unique glass-ceramic microthrusters by laser microprocessing.

In support of LPM were several of Japan's laser-processing societies. Much of the presented work was sponsored under a national project entitled "Advanced Photon Processing and Measurement Technology." Japan is a world leader in laser microprocessing -- especially with respect to lithography, drilling, trimming, and micro-soldering systems for the manufacture of electronic devices. (Maurice)

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
Nov 12-15, 00	The IEEE International Conference on Management of Innovation and Technology 2000 (ICMIT 2000)	Singapore
Nov 13-14, 00	XEL 2000	Yokohama, Japan
Nov 13-17, 00	8th Conference on Frontiers of Electron Microscopy in Materials Science	Matsue, Japan
Nov 14-16, 00	1st International Conference on Systems Biology (ICSB2000)	Tokyo, Japan
Nov 14-17, 00	1st International Conference on Cat-CVD (Hot-Wire CVD) Process	Kanazawa, 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 15-17, 00	4th International Symposium on Quantum Functional Devices (QFD 2000)	Kanazawa, Japan
Nov 20-23, 00	3rd International Hydrology and Water Resources Symposium (Hydro2000)	Perth, Australia
Nov 20-24, 00	**The 7th Singapore International Conference on Communication Systems (ICCS'00)**	**Singapore**
Nov 21, 00	7th International Symposium on Quantum Effect Electronics	Tokyo, Japan
Nov 26-28, 00	The Third International Conference on Computer Aided Industrial Design and Computer Aided Conceptual Design	Hong Kong, China
Nov 27-Dec 1, 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 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, China
Dec 3-6, 00	2000 Asia-Pacific Microwave Conference	Sydney, Australia
Dec 4-7, 00	The 10th International Workshop on Inorganic and Organic Electroluminescence (EL '00)	Hamamatsu, Japan
Dec 4-8, 00	**Contaminated Site Remediation Conference 2000**	**Melbourne, Australia**
Dec 4-8, 00	**The 21st Asia Conference on Remote Sensing**	**Taipei, Taiwan**
Dec 4-8, 00	25th Australasian Combinatorial Mathematics and Combinatorial Computing Conference	Christchurch, New Zealand
Dec 5-7, 00	The 4th International Conference on Nano-Molecular Electronics (ICNME2000)	Kobe, Japan
Dec 5-7, 00	2nd Singapore International Symposium on Protection against Toxic Substances (SISPAT)	Singapore
Dec 5-8, 00	The Sixth International Conference on Control, Automation, Robotics and Vision	Singapore
Dec 6-9, 00	10th International Conference on Biomedical Engineering (10th ICBME)	Singapore
Dec 11-13, 00	2000 IEEE Workshop on Neural Networks for Signal Processing (NNSP 2000)	Sydney, Australia
Dec 11-15, 00	Australian Optical Society Conference Australian Institute of Physics Symposium	Adelaide, Australia
Dec 12-14, 00	E-Business for Aerospace and Airlines, Asia-Pacific 2000	Singapore
Dec 13-15, 00	SPIE Smart Electronics and MEMS	Melbourne, Australia
Jan 15-17, 01	6th International Symposium on Artificial Life and Robotics (AROB)	Tokyo, Japan
Jan 15-17, 01	Fourth International Topical Workshop on Contemporary Photonic Technologies (CPT2001)	Tokyo, Japan
Jan 15-18, 01	International Symposium on Nano-network Materials: Fullerenes, Nanotubes, and Related Systems (ISNM2001)	Kanagawa, Japan
Jan 16-19, 01	International Conference on Experimental Implementation of Quantum Computing (IQC 01)	Sydney, Australia
Jan 31-Feb 2, 01	15th International Conference on Information Networking (ICOIN-15)	Oita, Japan
Feb 5-9, 01	**Advanced Research Workshop on Semiconductor Nanostructures**	**Queenstown, New Zealand**
Feb 7-9, 01	Energy & Environment Exhibition	Tokyo, Japan
Feb 21-23, 01	Internet Workshop 2001 (IWS2001)	Tokyo, Japan
Mar 5-6, 01	2001 Topical Symposium on Millimeter Waves	Yokosuka, Japan
Mar 5-7, 01	The First International Conference on Molecular Electronics and Bioelectronics (1st ICM&BE)	Hyogo, Japan
Mar 13-17, 01	IEEE Virtual Reality 2001 Conference	Yokohama, Japan
Mar 14-15, 01	The Second International Symposium on Mixed Reality (ISMR2001)	Yokohama, Japan
Mar 18, 01	Workshop on Autonomous Artificial Systems Exploring Hostile Environments	Dubai, U.A.E.
Apr 2-4, 01	International Symposium on Electromagnetics in Biology and Medicine	Tokyo, Japan
Apr 19-21, 01	32nd International Symposium on Robotics	Seoul, Korea
Apr 24-27, 01	10th International Space Planes and Hypersonic Systems and Technologies Conference	Kyoto, 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**
May 20-23, 01	IFAC Workshop on Mobile Robot Technology	Jejudo, Korea
May 20-24, 01	Sub Optic 2001	Kyoto, Japan
May 28-30, 01	4th International Symposium on Assembly and Task Planning (ISATP2001)	Fukuoka, Japan
Jun 6-8, 01	5th International Conference on Mechatronics Technology	Singapore
Jun 6-8, 01	4th Asian Conference on Robotics and its Applications	Singapore
Jun 6-8, 01	International Conference on Optical Engineering for Sensing and Nanotechnology (ICOSN2001)	Yokohama, Japan
Jun 12-16, 01	2001 IEEE International Symposium on Industrial Electronics	Pusan, Korea

Jun 25-29, 01	13th International Conference on Composite Materials	Beijing, China
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
Jul 1-6, 01	**5th International Symposium on Advances in Polymers and Composites**	**Singapore**
Jul 1-6, 01	International Conference on Materials for Advanced Technologies (ICMAT)	Singapore
Jul 4-6, 01	International MEMS (Micro Systems) Workshop 2001	Singapore
Jul 9-13, 01	8th IFIP TC 13 Conference on Human-Computer Interaction (INTERACT 2001)	Tokyo, Japan
Jul 15-19, 01	The 4th Pacific Rim Conference on Lasers and Electro-Optics (CLEO/Pacific Rim 2001)	Chiba, Japan
Jul 15-19, 01	International Meeting of the Psychometric Society (IMPS-2001)	Osaka, Japan
Jul 16-18, 01	Fourth International Symposium on Impact Engineering (ISIE/4)	Kumamoto, Japan
Jul 17-22, 01	International Conference on Phenomena of Ionized Gases (XXV ICPIG)	Nagoya, Japan
Jul 24-27, 01	**2001 International Symposium on Signals, Systems, and Electronics**	**Tokyo, Japan**
Jul 25-27, 01	The 40th Society of Instrument and Control Engineers Annual Conference (SICE2001)	Nagoya, Japan
Jul 30-31, 01	**First Asian Conference on Vision**	**Kanagawa, Japan**
Jul 30-Aug 4, 01	The 13th International Conference on Crystal Growth (ICCG-13)	Kyoto, Japan
Sep 3-5, 01	9th International Symposium on Integrated Circuits, Devices Systems (ISIC 2001)	Singapore
Sep 10-12, 01	2001 International Symposium on Micromechatronics and Human Science	Nagoya, Japan
Sep 16-20, 01	Defense Applications of Signal Processing 2001	Adelaide, Australia
Sep 21-23, 01	The First International Symposium on Measurement, Analysis, and Modeling of Human Functions (ISHF2001)	Sapporo, Japan
Oct 2-6, 01	**The 6th International Conference on Laser Ablation (COLA '01)**	**Tsukuba, Japan**
Oct 4-5, 01	The 1st International Symposium on Advanced Fluid Information (AFI-2001)	Sendai, Japan
Oct 15-19, 01	6th International Conference on Mercury as a Global Pollutant	Minamata, Japan
Oct 16-19, 01	21st International Display Research Conference (Asia Display)	Nagoya, Japan
Oct 17-21, 01	2001 International Conference on Control, Automation and Systems (ICASE)	Cheju, Korea
Oct 21-26, 01	8th International Conference on Environmental Mutagens	Shizuoka, Japan
Oct 24-26, 01	**8th Microoptics Conference (MOC'01)**	**Osaka, Japan**
Oct 28–Nov 2, 01	**International Conference on Silicon Carbide and Related Materials 2001 (ICSCRM2001)**	**Tsukuba, Japan**
Oct 29-Nov 3, 01	IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2001)	Maui, Hawaii
Nov 6-9, 01	**5th International Conference on Durability Analysis of Composite Systems (DURACOSYS 2001)**	**Tokyo, Japan**
Nov 11-16, 01	9th International Conference on the Conservation and Management of Lakes	Shiga, Japan
Nov 13-16, 01	**7th Japan International SAMPE Symposium and Exhibition (JISSE-7)**	**Tokyo, Japan**
Dec 3-6, 01	**Asia Pacific Symposium on Multi-Dimensional Microscopy 2001**	**Melbourne, Australia**
Dec 4-7, 01	5th East Asian Conference on Chemical Sensors (EACCS 01)	Nagasaki, Japan
Jun 25-27, 02	International Symposium on Distributed Autonomous Robotic Systems	Fukuoka, Japan
Jul, 02	**Topical Workshop in Heterostructure Materials (TWHM'02)**	**Japan**
Jul 7-11, 03	5th International Congress on Industrial and Applied Mathematics	Sydney, Australia

Upcoming Window-on-Science Visitors

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Dates	Visitor Name	Affiliation and Country	Topic	Visit Location
11-13 Nov, 00	Dr. Yuichi Sasajima	Sumitomo Chemical Co., Ltd., Japan	Compound Semiconductor MOCVD Growth and Characterization	AFRL/MLPS
12-15 Nov, 00	Dr. Yiu-Wing Mai	University of Sydney, Australia	Damage and Durability of Composite Materials	USAF Academy

26 Nov-1 Dec, 00	Dr. Shigefusa Chichibu	University of Tsukuba, Japan	GaN Semiconductor Devices & Physics	WOS/Conference in Boston, MA
26 Nov, 00	Dr. Zhe Chuan Feng	Institute of Materials Research and Engineering, Singapore	Wood-Witt GaN Defects Reduction Program	AFRL/MLPS Conference in Boston, MA
27 Nov - 8 Dec, 00	Dr. Stanley Barnett	CSIRO, Australia	Biological Effects of Non-Ionizing Radiation	USAF Academy AFRL/HEDR HQ USAF/DFB
29 Nov - 5 Dec, 00	Dr. Masatomo Sumiya	Shizuoka University, Japan	Electronics, Lasers & Laser Diodes, Optoelectronic Materials	AFRL/MLPA AFOSR/NE
6 Dec, 00	Mr. Kazuoki Matsugatani	Denso Corporation, Japan	MEMS	AFRL/PRPG
6 Dec, 00	Dr. Nobuaki Kawahara	Denso Corporation, Japan	MEMS	AFRL/PRPG
6 Dec, 00	Dr. Kunihiko Hara	Denso Corporation, Japan	MEMS	AFRL/PRPG
14-21 Dec, 00	Prof. Gyusung Chung	Konyang University, South Korea	Theoretical Chemistry	Conference in Hawaii Visit MHPCC
19-21 Dec, 00	Prof. Yoon Sup Lee	KAIST, South Korea	Computational Materials Chemistry	WOS/Conference in Honolulu, HI
19-21 Dec, 00	Prof. Hosung Sun	Sungkyunkwan University, Korea	Computational Materials Chemistry	WOS/Conference in Maui, HI
19-21 Dec, 00	Prof. Yuriko Aoki	Hiroshima University, Japan	Computational Materials Chemistry	WOS/Conference in Maui, HI
19-21 Dec, 00	Prof. Takako Kudo	Gunma University, Japan	Computational Materials Chemistry	WOS/Conference in Maui, HI
19-21 Dec, 00	Dr. Kiyoyuki Terakura	National Institute for Advanced Interdisciplinary Studies, Japan	Computational Materials Chemistry	WOS/Conference in Maui, HI
21-24 Jan, 01	Dr. Kotaro Obata	RIKEN, Japan	Lasers & Laser Physics	The Center for Microtechnology
20-27 Jan, 01	Dr. Koji Sugioka	RIKEN, Japan	Lasers, Laser Physics & Laser Microprocessing	The Center for Microtechnology
20-27 Jan, 01	Dr. Toshimitsu Akane	RIKEN, Japan	Lasers, Laser Physics & Laser Microprocessing	The Center for Microtechnology
10-12 Apr, 01	Prof. Koichi Shimizu	Hokkaido University, Japan	Biological Effects of ELF Electrical Fields	AFRL/HEDR
16-24 Apr, 01	Dr. Zhe Chuan Feng	Institute of Materials Research and Engineering, Singapore	Wood-Witt GaN Defects Reduction Program	AFRL/MLPA AFOSR/NE

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