

Office of Naval Research International Field Office

Trip Report: Industry Tour of South Korean Industries

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These reports summarize global activities of S&T Associate Directors of the Office of Naval Research International Field Offices (ONRIFO). The complete listing of newsletters and reports are available on the ONRIFO homepage:

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1. Summary

During 5 – 9 November 2001, a visit was made to various South Korean industries and governmental organizations. We were accompanied on the trip by JUSMAG-K personnel (who acted as hosts and scheduled all visits)

as well as US Embassy, Seoul, Asian Office of Aerospace R&D (AOARD), and Air Force Research Laboratory (AFRL) personnel. The primary goal of the visit was to assess the opportunity of funding cooperative research and development with these various industries and organizations.

The sites selected for this year's industry tour included commercial, government, and university research labs. Areas that may be of particular interest to ONR and ONRIFO include reduction of cell phone radiation levels (Radio Research Lab); ceramic materials research (KIST); virtual reality rendering of the human body (EWU); high altitude airships (KARI); artificial intelligence, robotics, and wearable displays (KAIST); biometric recognition systems and speech recognition/automatic translation technologies (ETRI); and drag reduction and high speed hull forms (SAMSUNG).

2. Background

Once each year, Joint US Military Affairs Group – Korea (JUSMAG-K) hosts an industry tour designed to introduce international S&T funding agencies to industries, government agencies, and university research laboratories. Sites chosen to visit are based on individual funding agency input, as well as JUSMAG-K direction/guidance.

3. Highlights of discussions concerning areas of potential collaboration.

The site visits are as presented below, in chronological order.

Radio Research Lab: The RRL, a government research lab, performs research in the following areas:

- Radio spectrum resources
- Satellite utilization
- Broadcast technology
- Antenna technology
- I&C technical standards
- Radio environment site surveys
- Electromagnetic compatibility standards
- Radio utilization safety standards

During our visit, we received a brief on current research in the area of cell phone radiation patterns using 3-D CAD files and Arrayed Helical Antennae. Through their research they've been able to reduce SAR "significantly". They are currently seeking partners for research in this area.

Korean Institute for Defense Analysis, Center for Weapons System Studies: This government organization provides oversight of their entire weapons procurement process, including modeling and simulation of weapons programs capabilities. No significant opportunity for basic R&D cooperation exists.

Ministry of Science and Technology: Oversees national S&T policy, administers S&T affairs, and coordinates national R&D programs. Main functions include:

- Establishing policies for S&T development and conducting technology forecasting,
- Developing core technology, future-oriented technology and large-scale technology,
- Pursuing technological self-reliance in the safe use of nuclear technology,
- Formulating policies for R&D investment, human resources development, S&T information, and S&T cooperation,
- Supporting basic and applied research by government supported research institutes (GRI's), universities, and private institutes,
- Promoting public awareness.

They briefed that current expenditure in R&D is \$12.5B, divided between government (25%) and private institutions (75%). 11% goes toward industrial research, 13% for applied research, and 64% developmental. 20% of MOST's money went to areas where commercial companies face difficulty or high risk.

The organization identified seven areas for investment – as listed below; the first three are the top priority:

- Bio-technology: main focus (among others, such as preparing for bioterrorism) is brain technology, concentrating on difficult brain diseases common to Koreans. Their budget is expected to double in the next few years. The Air Force is very interested in the brain research.
- Nano-technology: Focus: Devices, materials, and processing. This area was started only a few months ago; their budget is expected to triple in the next few years.
- Space Technology: Goal is to have a space center operational by 2005 and 20 satellites in orbit by 2015
- Other areas are: IT, Environmental Technology, Cultural Technology, and Electronic Technology.

The organization consists of 2 “offices” (Science and Technology Policy; and Planning and Management) and 4 “bureaus” (Research and Development; Nuclear Energy; Basic Science and Manpower; and Science and Technology Cooperation.

Unfortunately, due to arriving late to this meeting because of horrendous traffic, this meeting was cut short. Another meeting in December of this year (during the ADD Dual Use Conference) is being planned with their International Cooperation Office. They seemed very agreeable to cooperate and desire further discussions with us.

Korean Institute of Science and Technology: As the rest of the official party went to Kyung Hee University to discuss acupuncture research, I went alone to KIST to discuss ceramic materials research. While very vague and short on specifics, Dr Gueung-Ho Kim was very receptive to cooperating w/ONR in future research and utilizing the VSP/CSP programs to enhance collaborations. I left with Dr Kim's promise to provide copies of his abstracts, as well as a proposal for joint basic research program. Dr Kameda will visit to evaluate the proposal when received.

Seoul National University: A planned visit to SNU's acoustics lab was instead a visit to Dr Shin's modeling lab, where he discussed his work (CASPER – Computer Aided Ship Production Engineering Research) being funded in part by the ONRIFO NICOP program (other partners include Dassault and IBM). Discussion was very interesting and Dr Shin has made significant progress in the modeling of shipyard processes. Future visits to SNU will be to visit Prof Na in the Acoustics Lab.

Ehwa Woman's University: We were provided a brief on current research into virtual reality rendering of the human body and internal organs and the development of the "virtual patient". Dr Kim, head of the Center for Computer Graphics and Virtual Reality, has developed a system whereby inputs from X-rays, MRIs, CAT-Scans and other non-invasive diagnostic tools are used to generate a virtual patient, where different surgical techniques can be tried and evaluated. This has strong application for training and remote medical treatments. They are very open to selling the current product as well as collaborating on future research (a CAVE system is being planned for next year). Dr Kim has promised to provide informational material electronically, and I plan to see if there is a direct application to current Navy needs. LCDR Caron Shake, the new BUMED representative in Singapore, may also be interested in this capability.

Republic of Korea Medical Command: This visit was planned based on Air Force interest in the use of acupuncture for emergency medical treatment. After receiving a general command overview brief, we discussed the ROK Armed Forces' use of acupuncture. The ROK Army currently uses acupuncture in the field for trauma and acute pain, and in the hospital for stroke, facial paralysis, pain, common cold, and indigestion treatments. There is one acupuncture doctor (a six year training curriculum) per army division. There is no desire to cooperate in research, but they are willing to allow US to investigate and train.

Korea Telcom: Here, we received an overview brief of the company and a fairly detailed brief of their new satellite (KOREASAT 5). Korea Telcom has the following key business areas: conventional telephone service, wireless/satellite services, internet services, data services, and intelligent network services. Profit last year was ~ US\$900 Million on ~ US\$9 Billion in revenues. There are currently three satellites in geosynchronous orbit, with KOREASAT 5 planned in Sept 2005 (no information provided on KOREASAT 4, if indeed one existed). KOREASAT 5 is a dual use (civilian and military (military payload: EHF, X-band)) satellite, operated by KOREASAT in peacetime and the military in wartime. This company does very little basic research (nearly all of their research is done by ADD) and I saw no significant partnering opportunities for ONRIFO.

Hanwha: This private company makes commercial explosives and ammunition. They do almost no basic research but have an \$800K per year "proof of concept" budget (again, basic research is conducted at ADD and then passed to companies who conduct the follow-on development). Very little opportunity for cooperative R&D.

Korea Aerospace Research Institute: This government research institute satisfies demands for national aerospace technologies and performs R&D on aerospace technologies and national projects. Specific R&D areas include the core technologies for aircraft, satellites, scientific sounding rockets and related systems (aerodynamics & performance, structures and materials, flight dynamics and control), as well as the development, integration, and application of advanced technologies. Current projects include satellite, regional transport plane, and UAVs (mainly for highway and pipeline security).

They briefed three main projects: Commercializing their 8-seater composite aircraft (no research on the effects of aging on composite material characteristics), satellite research, and their research on high altitude vehicles (untethered, >20KM). High altitude vehicles have found renewed interest as large area surveillance platforms, and KARI seems to be ahead of the research here. They are looking to build these airships as communication stations and their plan has two stages: stage one is 3hrs on station at 3km altitude (2003); stage two is a 200m balloon on station at 20 km altitude indefinitely (2007). The plan is to utilize an electric motor for station keeping, using sunlight during the day to both run the motor and charge batteries. At night, the stored energy will be used to power an H₂/O₂ fuel cell. This seems to be of particular interest, and Dr Phil Koenig (who has been researching these airships) will visit soon. They are very interested in cooperative development of this technology.

Korea Advanced Institute of Science and Technology: At this institute, which is both a research institute and undergraduate/graduate school, we were briefed on their recent research in the areas of Artificial Intelligence, Robotics, and “wearable displays” (the latter of which is drawing much interest from the AF). They are very proud of their work in the areas of Intelligent Agent (web-based personnel agent, information retrieval, and e-commerce systems), face and gesture recognition systems, virtual reality, and robotics. In fact, their robot, AMI, has won worldwide robotics competitions. Their future research areas include advanced sensor and intelligence for the robot, as well as upgrading to bipedal mobility. They are very open to cooperative programs.

Electronics and Telecommunications Research Institute: This is a government research institute that focuses in all areas of IT and computer networking (satellite and 3g cell phone technology, network technology, semiconductor technology, and computer/software technology), but also has some areas of specific interest to ONR – namely biometric recognition systems (security) and speech recognition, speech synthesis, and automatic translation technologies (capable manpower). Although a government organization, they are self sustaining – income from royalties (345 billion Won) covers expenses (321 billion Won). They are open to cooperative research with foreign partners and are certainly worth a visit by the CTTO folks.

Samsung Heavy Industries: At this private company, we received an overview of the facility, including a tour of their tow tank and cavitation channel. They reported that their recent research in the area of drag reduction and hull forms has achieved a 20% reduction in drag. Next year they plan to do further research in the area of drag reduction, using “bubbles”, as well as high speed hull forms. They were excited when I discussed recent (fairly) drag reduction work by ONR and told them how to access some of the reports via the web. They would like to work with us in a cooperative program, but would require management approval, which they were

unsure of. They have in the past cooperated with MIT, but never with a government organization. Since the Korean fiscal year is concurrent with the calendar year, they have already picked their research projects for next year, and secured funding. Still, I think this is an important place for Dr Phil Koenig to visit.

Agency for Defense Development: Unfortunately, instead of a general overview of their basic research across all spectrums and areas of potential cooperation (that will be the intent of the December ADD Dual Use Conference), this tour consisted of two parts: a tour of their materials show room and military hardware museum. While interesting, no areas of ONR IFO interest for collaboration were presented.

Korean Aerospace Industries: This company, which builds itself as “Korea’s aircraft builder”, provided a detailed overview of the UAV program. They reported that they do no basic research of their own (again, BR is conducted by ADD which then passes on to KAI for follow-on development). No areas of ONR IFO interest for collaboration were presented.

Samsung Techwin: This company is competing for US Government business overhauling/repairing the engines on all types of military aircraft and ships (in addition to some commercial) in the Asian theatre. No potential for ONRIFO collaboration.

Hyundai Heavy Industries Maritime Research Institute: Another ship design/hydrodynamic test facility where we were given an brief overview of the company and then toured their tow tank and circulating water tank. An impressive facility, although a little less forth coming on recent and planned research than Samsung. Unsure of potential cooperation with ONR IFO.

4. Assessment

I found this Korean industry tour to be of immense value and believe we’ve identified no less than eight locations or specific projects for further investigation. These items include: discussions at MOST (scheduled for December); ceramic research at KIST (to be evaluated by Dr Kameda); shipyard modeling work done at SNU (monitored by Dr Koenig under his NICOP); “virtual reality patient” at Ehwa Women’s University (I hope to have the information to pass to the CTTO folks and BUMED rep in Singapore); high altitude, untethered airships at KARI (to be investigated by Dr Koenig); wearable displays at KAIST (again, CTTO folks); biometric recognition systems and speech translation software at ETRI (CTTO); and drag reduction research at Samsung (Dr Koenig).

In short, we found items of interest to IFO, and the Koreans seemed to be more willing to at least discuss international cooperation with us. I hope to have the follow-up visits done within the next month or so.

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