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Stay at ATR Optical and Radio
Communication Research Laboratories

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ATR光電波通信研究所

FINAL REPORT

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Dr. HIROYO OGAWA

on

STAY AT ATR OPTICAL AND RADIO COMMUNICATION
RESEARCH LABORATORIES

Prepared by

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This is a brief report on my stay at ATR Optical and Radio Communication Research Laboratories. My first contact with ATR was in 1988, when Dr. Iwasaki visited our laboratory in Philadelphia. This is the first time I heard about ATR. In subsequent years Dr. Hiroyo Ogawa, Mr. Kamiya and others visited our laboratory. I first visited ATR in September 1990. I was immediately impressed with facility, the quality of work and especially with the high technical caliber and friendliness of the researchers. During my visit I had a chance to discuss with President Yoji Furuhashi and Dr's Masami Akaike and Hiroyo Ogawa some form of cooperation between ATR and our Center for Microwave-Lightwave Engineering at Drexel University. Subsequently Mr. David Polifko, one of our students, joined ATR for a nearly two year stay.

I came to ATR on November 9 1992. The following day, Nov. 10 was the date for the annual open house at ATR. Guests came from all over Japan to see the activities of this fine institution. For me it was indeed a great pleasure to see what the other laboratories within ATR are doing. I was profoundly impressed with the wide variety of excellent research work pursued at ATR.

During my stay at ATR I delivered for technical lectures on the application of lightwave technology to microwave systems, circuits and devices. A copy of the slides shown at these lectures is attached to this report. A fifth lecture, on education and University Industry relation within our Center for Microwave-Lightwave Engineering, was also presented.

I also gave a talk at the meeting of the Tokyo chapter of the IEEE-MTT society, representing ATR. I have also visited NTT at Yokusuka and NEC at Miyazakidai and gave a talk at both places. Finally I had a chance to visit two Universities, Science University of Tokyo, where Dr. Akaike was my host and the University of Osaka, where I was the guest of Professors Sueta and Izutsu. I have also gave presentations at these places.

In our center during the past seven or eight years we concentrated on the interaction of microwaves and lightwaves. Our work covered both the systems and device aspects of this area. Our first thrust was the design, fabrication and testing of an optically fed and controlled phased array antenna, the subject of my first lecture at ATR. This project required the development of high speed fiberoptic links with small losses with good noise performance and large dynamic range. Our initial work with the optical microwave interface circuits, as well as the development of superior devices led to dramatic improvement of the performance of the fiberoptic

links. Now they are employed in all sorts of systems in communication, signal processing and parallel optical processing. This was the topic of my fourth talk.

Our initial work in the device area focused on the optical control of microwave devices. Here we considered the optical illumination as an additional terminal to the device. Our early work focused on the microwave PIN diode which we used for optically activated switching and oscillator tuning applications. More recently our efforts focused on the thorough understanding of the optical properties of active microwave components such as the MESFET, HEMT or HBT. We utilize these devices as input ports to MMICs for the optical control of oscillators, phase shifters, amplifiers and to mix modulated optical carriers with microwave signals. This was the topic of my second talk. My third talk at ATR focused on novel integrated optic devices, sensors, modulators and switches fabricated on III-V materials.

ATR, as I observed during my short visit, works on many of the same topics, and with the leadership provided by Drs. Furuhashi and Ogawa have moved to the forefront of this emerging technology.

The future developments in the field of microwave-optics will focus on the chip level integration of microwave and photonic devices and new applications in communications. In communication, the future will be dominated by optical and microwave (e.g. satellite) communications. The interface of these two technologies will become increasingly more important, particularly with the evolution of personal communication. To realize the great potential of this field, microwave-optics, we have to aggressively pursue the chip level integration of microwave and photonic devices. This will provide smaller, lower cost and more reliable devices, which in turn will lead to more sophisticated applications. My conversation with ATR indicates that they concur with this direction for future developments.

Finally, I would like to say that my stay at ATR has been interesting and provided stimulus for new research. I was most impressed with the quality of research, the high caliber of the staff, many of whom became friends. I would like to thank Dr. Habara, the chairman of ATR, Dr. Furuhashi, the President of the Optical and Radio Communication Research Laboratory, and last, but not the least, Dr. H. Ogawa, my host, for making my stay at ATR possible. I hope in the future we can work together on exciting new research topics.

Sincerely

Peter R Herczfeld