International News

Japan

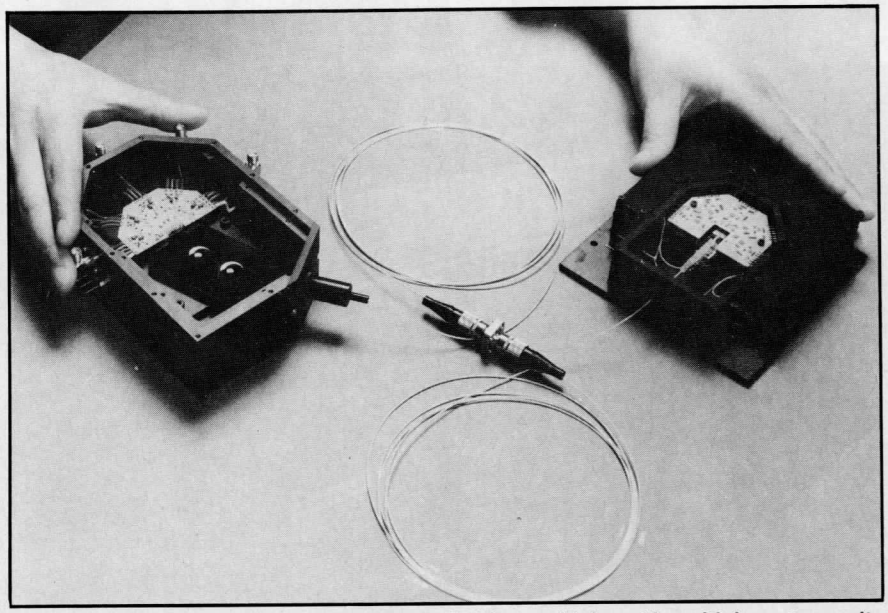
Toshiba, NEC Prototype Optoelectronic ICs

While a variety of discrete semiconductor optical devices and their associated electronic circuits are being used in optical communications and other optical systems, researchers are looking for ways to integrate entire optical "circuits" on a single chip. Although the concept of integrated optics has been around since the 1960s and the first complete device was demonstrated around 1976-77, no commercial products have as yet been introduced.

Stewart Personick of Bell Communications Research, Inc., Red Bank NJ, presented a paper at OFC/IGWO '86 on potential telecommunications applications of integrated optics and integrated optoelectronics. He reported that these devices will bring two major benefits: speed, and lower cost due to monolithic integration of functions. In particular, broadband distribution and other communication networks of the future will rely on these devices' almost infinite information-carrying capacity and large potential for cost savings.

Two breakthroughs from Japan serve to demonstrate a trend towards more integration on chips. Toshiba Corp. in Tokyo has developed a prototype integrated demultiplexer which can separate as many as five multiplexed optical signals from an optical fiber cable. The device integrates onto a single crystal silicon substrate most key components, including waveguides, a photodiode array, and a refractive grating. Toshiba makes the gratings' minute rectangular grooves (0.7 micrometer wide and 0.3 μm deep) using the company's advanced VLSI microlithography, including the ion beam etching method.

The device has the advantage of being able to separate wavelengths as close as 5 nanometers, a factor of 20 better than the previous limitation, making it possible to cram more signals within the low loss, wideband wavelength region of the fiberoptic cable. Toshiba has also developed an integrated-type transmitter including a DFB laser diode array, and a titanium indiffered waveguide on a lithium niobate substrate. The company did the research for this transmitter/receiver system as part of the large-scale "Optical Measurement and Control System" project conducted under a program set up by Japan's Agency of Industrial Science and Technology, Ministry of International Trade and Industry.



Toshiba's prototype integrated wavelength division multiplexer/demultiplexer transmits up to five signals only 5 nanometers apart.

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Meanwhile, NEC Corp., while participating in the MITI project in some areas, pursued its own research on optoelectronic integrated circuits. *Electronics* magazine recently reported the company's development of 1.3-μm, 1.2-gigabit per second optoelectronic ICs for short communication links. The Tokyo-based company selected an indium phosphate substrate, necessary for the long wavelengths, and integrated a double-channel planar buried heterostructure laser with three heterojunction bipolar drive transistors. The receiver chip incorporates a p-i-n diode and three InGaAsP FETs, and has a sensitivity of -14 dBm at 1.2 Gbit/s for an error rate of 10^{-9}.

Fujio Saito, general manager of NEC's Opto-Electronics Research Laboratories in Kawasaki, was reported as saying NEC will be able to produce the devices in volume within three years. Israel Ury, president of Ortel Corp., Alhambra CA, also sees the first integrated optics and optoelectronics products being introduced from Japan in the next three years. "The advantages are significant, although I don't know of anyone in the U.S. that's working on these devices at 1300 nanometers." Ortel has demonstrated optoelectronic ICs at 840 nm in the past, and is currently researching optoelectronic computer interconnections, though Ury has no predictions about when such products will be out.

Last fall, Crystal Technology Inc., Palo Alto CA, introduced the first U.S. commercial optical guided wave device, a beam intensity modulator designed for use in hybrid integrated optics and optoelectronics devices. According to Richard Becker, Crystal's manager of integrated optics, hybrid devices are not only a step towards monolithic integration, but a valid market in their own right, since "hybrid devices allow you to optimize the individual components."

He reported that the company is using the modulator as a market probe to see what researchers are really interested in. They have developed a line of generic devices for high speed intensity and phase modulation, as well as optical switching.

The most advanced of these, the 1 × 2 or 2 × 2 switch, should be available sometime this summer in versions that operate at all three communications wavelengths. "We're aiming for the R&D market, just to get these components into the research lab," said Becker. "But, we're building them with a mass-production mentality. Manufacturability is of utmost importance." Becker is not sure how U.S. products measure up to what the Japanese are doing. "Japan has been very quiet," he said.

—Holly Bigelow

Australia

Outlook Bright for Fiber Communications

A report recently released by the Australian government documents the importance of fiberoptics and optical communications in Australian industry. Produced by the Dept. of Industry, Technology, and Commerce, the report, "Optical Communications and Fiberoptics—Australian Capabilities and Opportunities," specifically examines the use of this technology in the telecommunications link between Melbourne and Sydney. The optical fiber cable for this link cost $11.52 million, U.S., and the recent contract with Queensland Rail for 535 kilometers of cable cost $1.44 million. A total Australian market of $43.2 million by 1990 and $216 million by 1995 has been predicted. The report says this market will probably continue to have a higher concentration of telecommunications applications compared to other countries. Telecom Australia will be making a concerted move into optical fiber, with an estimated demand of up to 50,000 fiber-km annually by 1987.

Within the local market, demand for optical fiber installations has been in the urban areas and intercapital links. By the year 2000 Telecom Australia expects all of its interstate trunk circuits to be digital and plans are underway to establish an Integrated Digital Network (IDN) on a national basis.

A Critical Report. Despite its dominant role in fiberoptics, Telecom Australia has its critics. A survey conducted of individuals and organizations involved in optical communications reveals a concern for Telecom's R&D policies. They suggest that Telecom's minimal investment in R&D (1%) does not fully utilize Telecom's capabilities, and is less than equivalent agencies in other countries spend. The respondents also agree that there is a lack of contact between industry and the government and academic research communities. What is missing, they say, is a strategic plan for the country's telecommunications research and development.

Respondents also believe that local manufacturers need more venture capital. They feel that Australian industry is unduly inhibited by its preoccupation with its own size, and that this in turn has led to an unjustified dependence on imported technology through local subsidiaries of multinationals which carry out their own research and development abroad. Many of those surveyed saw opportunities for Australian R&D in specific product and activity areas such as sensors, HCT semiconductors, and system design. Another major issue noted by the report is the need to establish a local component facility to provide measurement and calibration for the characterization of optical communications and systems.

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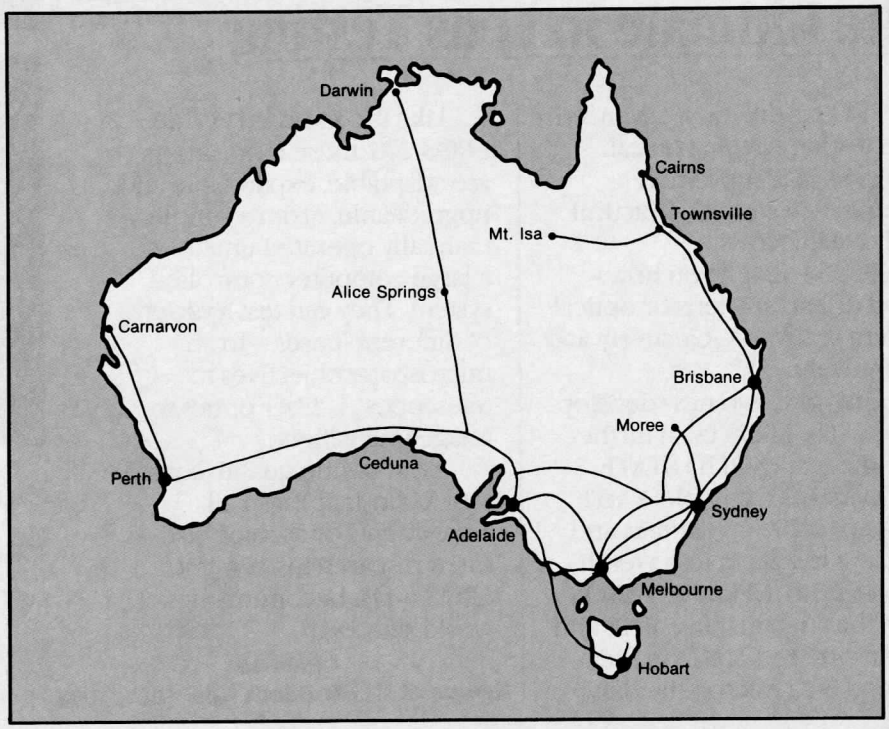
However, the report notes that Australia has a number of export opportunities: the U.S. for optical fiber cable, optical terminal and link equipment; New Zealand for optical fiber cable and complete systems (petrochemical plants); and South East Asia for optical fiber. The firms engaged in the export of these products are mostly small and their exports are limited in scale. To encourage exports the Australian government provides financial incentives in the form of taxable cash grants for expenses incurred in export promotion. But many subsidiaries of multinationals, such as NEC Australia Pty. Ltd., do not export from Australia because the parent companies can be more competitive by exporting from their home base. Little research is done by these companies in Australia.

The report says that most of the Australian R&D carried out in optical communications technology has some practical application. Work by Prof. Snyder and F. Ruhl of the Australian National University made



Australia's proposed optical fiber systems long-distance trunk network, mid-1990.