TECHNOLOGY

From our reporter at the symposium of the Society of Photo-Optical Instrumentation Engineers and the Society of Photographic Scientists and Engineers at Reston, Va.

State of a burgeoning art

Time was when some physics teachers steered their students away from optics "because nothing ever happens" in that venerable field. The coming of the laser began to change all that. Now there is hardly any field in which new discoveries follow each other more quickly or more swiftly move from the laboratory to the commercial production line. And among many new subspecialties, none, perhaps, is changing faster than the field of fiber and integrated optics, which promises to revolutionize communications (SN: 7/19/75, p. 44 and 7/26/75, p. 60).

All the specific elements for integrated optical circuits have now apparently been demonstrated individually. What remains is the difficult task of developing new techniques for growing the complex "chips" to combine them all, and of finding reliable ways of connecting them to fibers. Specifically, a thin-film laser has apparently been developed to the point that it is expected to be commercially available soon from a Japanese firm. What will be perhaps the first demonstration of a complete optical circuit in the United States is expected in 1978-79, when the Navy finishes a billion-bit-per-second data network at its Electronics Laboratory Center.

Simpler applications of existing optical communications systems are rapidly gaining acceptance. In Japan, a power company has reportedly installed two separate optical networks, with fibers that can be strung near high-voltage electrical lines without suffering interference. This July the U.S. Navy is scheduled to demonstrate an aircraft in which 1,890 feet of wire has been replaced by 224 feet of optical fibers—weighing only one-fourteenth as much, at a system cost of $60,000 less. An experimental optical telephone system is operating in Atlanta. In Dorset, England, a police station has been outfitted with an optical communications system.

In interviews with SCIENCE NEWS several scientists expressed concern over a growing lag in American industry application of this new technology, which essentially originated in the United States. As one put it: "Japan is pulling ahead of us in optical devices the same way they did in transistors."

Fighting fire with FLIR

Two major obstacles to more effectively fighting wildfires have been how to find "hot spots" where no flame is showing and how to use aircraft at night, when calmer wind, lower temperature and higher humidity make the going much easier. Herbert J. Shields of the U.S. Forest Service's Equipment Development Center reported on a successful two-year experiment aimed at adapting sophisticated military avionics equipment to solve the problem.

First came the recently declassified night vision goggle (NVG), weighing less than two pounds and worn continuously by a helicopter pilot to see well enough to fly with only partial moonlight. The first successful demonstration of night fire suppression using the NVG occurred on August 28-29, 1974, in San Bernardino National Forest. The project became fully operational in Southern California in 1975. Several successful search and rescue operations at night were also made possible by the goggles.

Late last year, an infrared detector was added, whose output was displayed on a television screen inside the cockpit and recorded for later reference. Called FLIR—forward looking infrared—the device was developed for seeking out an enemy at night and got its name because it was designed for installation in the nose of a plane. Initial trials demonstrated its importance dramatically: A week after major fires in the Angeles National Forest, last November, a FLIR-equipped helicopter discovered several areas of glowing material that had crossed control lines, ready to kindle a new conflagration.

Shields says the use of NVG and FLIR in land management is just beginning. Research into the habits of nocturnal animals is likely to be an early additional application. Already NVG's have been used to catch people using the cover of darkness to poach trees for Christmas.

Help for night blindness

At a price of over $10,000, night vision goggles are still too expensive to help the estimated 100,000 to 200,000 people in the United States that suffer from retinitis pigmentosa—an inherited disease whose first symptom is night blindness. A number of companies have tried to produce cheaper versions; the latest is a device announced at the Reston meeting by ITT Electro Optical Products Division. The so-called Night Vision Aid was developed by James H. Burbo of ITT in conjunction with the National Retinitis Pigmentosa Foundation. It sells for around $3,500.

Light amplification did not need to be as great as that required in the military prototype. Thus the final product is extremely light weight, has a rechargeable battery, fits in the palm of the hand and has the light gain set at the factory according to the doctor's prescription. A small light-emitting diode is attached to allow a patient to search for keys, and so forth, in total darkness.

Because of the relatively low price, other users are expected to quickly enter the market. The Forest Service and some security companies have already begun to show interest. Burbo told SCIENCE NEWS he hopes the price can come down another factor of two as production picks up.

Finding fish by the glow

One of the most unusual applications of image intensification devices was described by William Dyer of Baird-Atomic, Inc. His company was asked by commercial fishermen to develop an instrument that could spot schools of fish at night, from an airplane, by detecting the faint glow of bioluminescent organisms excited by the passage of the fish.

The problem turned out to be not so much one of sensing the faint glow as discriminating it from extraneous sources—lights on boats, reflections on the water, and so forth. Eventually the problems were solved and the unique instrument was apparently functioning quite well—until a pilot exhausted from hours of flying around looking for glows destroyed the device's housing by landing his plane without remembering to lower the wheels.

Next, the mini-laser

Solid-state lasers have, until now, presented engineers with a peculiar dilemma—the "doped" kind have to be relatively large, to dissipate heat; the semiconductor kind can only be very tiny. What has been missing is a powerful inexpensive, "mini" sized laser. Talk around the conference centered on a new breed—the rare earth-pentaphosphate laser—as a likely candidate.

In so-called "glass" lasers, a tiny amount of optically active dopant, usually neodymium, is widely dispersed through a glass matrix, limiting the power density. If more than a few percent of neodymium is added, the glass breaks from thermal stress. But in the new pentaphosphate medium up to 50 percent of neodymium can apparently be used, so that for a given power level, the size is greatly reduced. So far the new lasers are relatively hard to fabricate, but one scientist speculated that they may one day become cheap, "nearly throwaway" devices.

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