More heroes of optical communications

If light is the wave of the future in communications, the fiber-optics technology that exploits it has to overcome a number of practical hurdles. Therefore "hero experiments" (so called because they keep breaking records) are testing not only the ultimate physical properties of the fibers and light sources but also various practical combinations of factors (SN: 2/23/85, p. 119). Several such achievements were reported at the recent meeting in San Diego of the Conference on Optical Fiber Communication '85.

Two related experiments at AT&T Bell Labs set new records for the speed at which the light signal can be modulated. Up to now the maximum rate of modulation had been 2 billion bits per second (2 gigabits per second), that is, 2 billion light pulses a second. Both these experiments raised that to 4 gigabits per second, one using internal, the other external, means of modulation. Four gigabits per second equals 62,500 two-way voice conversations or 44 television channels.

Internal modulation means switching the light source on and off 4 billion times a second. In the past this had been difficult to do while still maintaining spectral control of the signal, that is, the precision of its wavelength. In long-distance transmission, dispersion of the signal as it passes through the fiber also hurts, causing loss of definition in the pulses. In the direct modulation experiment Alan Gnauck of AT&T Bell Labs in Holmdel, N.J., and coworkers used a specially designed distributed-feedback laser and showed that they could turn it on and off 4 billion times a second to produce pulses with extremely stable wavelength. They transmitted these signals over 103 kilometers of fiber without needing a repeater to boost the power and restore the signal.

In the external modulation experiment Steven K. Korotky of Holmdel and coworkers used an optical switch made of a lithium-titanium niobate waveguide element that shifted the light signal in and out of the fiber in response to an electrical signal pulsed 4 billion times a second. With the external modulation these experimenters could use a somewhat higher-powered laser, and were able to send the signal without repeaters over 117 km of fiber. People in the field often multiply the bandwidth (maximum modulation rate) times distance to get a figure by which to compare experiments. This one, Korotky says, establishes a record for a single fiber channel of 0.47 trillion bit-kilometers per second. It is also the first time, he says, that an optical switch has been used as an external modulator. The system would be economically competitive, he says, with a cost of about $300 for modulation.

The other possible light sources for optical signals are light-emitting diodes (LEDs). As Paul W. Shumate Jr. of Bell Communications Research, Inc., in Murray Hill, N.J., told the meeting, using LEDs would be desirable, particularly in local loop applications (connections to subscribers' premises), because of their low cost and high reliability compared with lasers. However, potential users have feared that LEDs put too little power into the fiber.

Shumate and J.L. Gimlett, M. Stern, M.B. Romeiser and N.K. Cheung of Bellcom's Holmdel facility have shown that LEDs of both the surface-emitting and edge-emitting variety can produce enough power to send a signal of 140 million bits per second (a technologically reasonable rate) over several kilometers of fiber. This, they say, is sufficient for use in local subscriber loops.

The lasers used in most of these hero experiments are single-longitudinal mode-emitters — that is, they emit one very precise wavelength. Such lasers are expensive and difficult to make. More practical for long-haul transmissions would be a more garden-variety laser that emits a short range of wavelengths. R. Goodfellow of Plessey Research (Caswell) Ltd. in Caswell, England, and co-workers used a buried heterostructure laser emitting at 1.556 micrometers to send 1.300 gigabits per second over 103 km of fiber engineered by Corning Glass Works of Corning, N.Y., to have minimum signal dispersion for the laser's wavelength. This, they say, represents the highest value yet recorded of the bit-rate-times-distance figure, 139 gigabit-kilometers per second, for a multilongitudinal mode (imprecise wavelength) laser. They see it as a practical route to long-haul, high-speed systems in the short term. —*D. E. Thomsen*

Making babies bigger before birth

Infants weighing as little as 1½ pounds at birth can survive with the aid of costly, highly technical care — incubators, respirators, pulse and breathing rate monitors and tube feedings. But U.S. medical resources are being strained by the ever-increasing need for this expensive treatment. Moreover, many infants born too small do not survive, even with high-tech care: A newborn weighing less than 5½ pounds is 40 times more likely to die during the first month than is a heavier baby. Now the Institute of Medicine (IOM) of the National Academy of Sciences argues that it is time to turn to preventive approaches. It reports that much of the loss of newborns and much of the need for high-cost neonatal treatment could be prevented by increasing women's access to good-quality prenatal care.

The urgency of this argument is underscored by reports this week that the rate of decline in the U.S. rate has slowed. According to data of the Public Health Service, the infant mortality rate, which had dropped steadily from 24.7 per 1,000 live births in 1965, appears to be plateauing at about 11 deaths for each 1,000 births. Japan and several countries in northern Europe have rates below 9 per 1,000.

Birthweight is considered to be a major determining factor in infant survival. In addition, low-birthweight infants have an increased risk of such handicaps as cerebral palsy and mental retardation. "What's needed is a shift in emphasis from treating the effects of low birthweight to treating the causes," says Richard E. Behrman, chairman of the IOM committee and dean of the School of Medicine at Case Western Reserve University in Cleveland.

About a quarter of a million U.S. infants are born each year weighing less than 5½ pounds — the definition physicians use for a low-birthweight infant, a classification that includes both premature babies and those with intrauterine growth retardation (SN: 10/15/83, p. 250; 10/22/83, p. 266). The Public Health Service reports that the incidence of low birthweight stopped dropping in 1980. The proportion of U.S. babies that are of low birthweight—6.8 percent of live births — is higher than the rate in at least 12 other developed countries.

"The overwhelming weight of the evidence indicates that prenatal care reduces the risk of low birthweight," says the IOM committee. But, Behrman says, there is evidence "that long progress in enrolling greater numbers of women in prenatal care early in pregnancy has halted and may even be deteriorating." The committee calculates that early and regular prenatal care for all women could reduce the annual incidence of low birthweight by 35,000 or more.

The groups at highest risk for having low-birthweight babies are also those least likely to receive adequate prenatal care. "Teenagers, unmarried women, the poor, black women and those with less than a high school education are much more likely than other women to have a low-birthweight baby," says Behrman. The committee calculates that for a target population of 1.4 million high-risk women, each dollar spent on prenatal care could save as much as $3.38 on specialized hospital care for low-birthweight infants. At a congressional hearing members of the committee stated that the entire cost of prenatal care for a woman, on the average $500 to $800, is less than that of a single day of hospitalization in the intensive care nursery for a low-birthweight infant. The committee cites current financial restraints, including Medicaid restrictions on the number of allowable prenatal visits, as a major barrier to adequate prenatal care. —*J.A. Miller*