editorial

Lightwaves—the new look in communication

I believe that fibers which guide lightwaves will be the most revolutionary advance in communication since the transistor and the ensuing solid-state revolution. This illustrates again that the power of science and technology lies in the particular rather than in the general.

Communication by means of light is no new thing. It goes back to signal fires and smoke signals. The semaphore telegraph was invented in 1791, and the heliograph in 1822. Each was successful; the semaphore over fixed routes for the transmission of brief but important government and commercial messages, and the heliograph in military operations in the sunny and clear American West. Because of particular advantages, electrical telegraphy replaced the semaphore and radio replaced the heliograph.

There was no lack of intent or effort to revive communication by light. In 1880, Bell talked over a distance of 1300 feet by means of his photophone. The practical impact was nil; electrical communication was more flexible and more economical. Studies on transmission through sequences of lenses were made at Philips in the Netherlands subsequent to World War II. In 1946–48 Warren Tyrrel did experimental work at Bell Laboratories on optical transmission through glass tubes as well as through a sequence of lenses, using a point-a-light source (a sort of fine arc) and a photomultiplier receiver.

These attempts at communication by means of light-wave failed in part through lack of a coherent source, and the laser was hailed as the harbinger of useful optical communication. Little that was useful happened. The atmosphere is not always transparent. Experimental underground lens guidance systems worked remarkably well but were costly and held promise for very high capacity systems only.

Low-loss fibers have changed everything. Marvelous in themselves, they are useful because they appeared in the right technological, economic and social context. The technological context is that of light-emitting diodes, semiconductor lasers and integrated circuits. These developments, together with the fibers, promise *cheap* and *simple* broadband communication over a variety of distances—internally in computers, switching systems, aircraft and spacecraft as well as between points many miles apart. The economic and social context is one of limited space in ducts under city streets, increasing cost of copper and other materials and the need for more circuits and more bandwidth.

Communication by means of lightwaves succeeded, failed and will finally succeed again not because it is inherently good or bad, but because particular implementations are better or worse than competing modes of communication. Particular implementations discussed by the authors of this month's special issue (page 23) are sure to be realized in commercial form. I believe that this will lead ultimately to digital circuits to and from telephones in homes and offices. These circuits will be less costly rather than more costly than the wires we now use. They will transmit pulses fast enough to accommodate not only voice and data, but video signals as well. This is the ultimate picture. Early applications will be less spectacular, and their benefits will be chiefly a saving in materials and space and more bits per dollar between telephone offices.

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