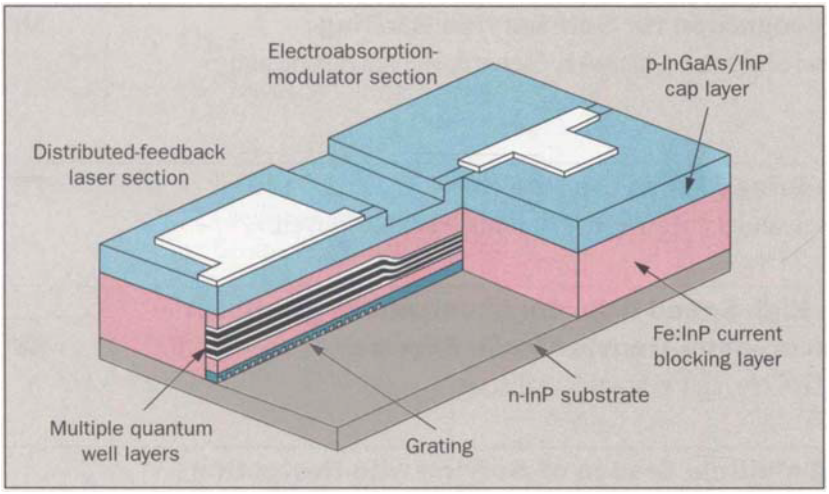
# AT&T INNOVATION BRIEFS

*The briefs in this section are summaries of recent discoveries and developments within AT&T Bell Laboratories. AT&T readers who would like to contribute future items, and readers who would like further information as well, are encouraged to contact the* AT&T Technical Journal *editor.*

### Electroabsorption-Modulated Lasers Improve Data Transmission




**Schematic diagram showing the cross-sectional layer structure of an integrated electroabsorption-modulated DFB laser.**

Researchers at AT&T Bell Laboratories recently developed a new monolithic photonic integrated circuit that is capable of transmitting data error-free at 2.5 Gb/s over 500 km of standard optical fiber—nearly ten times the distance possible with the directly modulated lasers in use today. The electroabsorption-modulated laser (EML) consists of a 1.55 μm multiple quantum well distributed-feedback (DFB) laser integrated on a single chip (500 μm x 750 μm in size) of indium phosphide with an electroabsorption modulator, using a technique known as selective-area metalorganic vapor phase epitaxy. Rather than coding information on pulses of light by turning the laser *on* and *off*, which results in large excursions, or chirp, of the lasing wavelength, the DFB laser in EML is used as a continuously *on* source of pure, single-wavelength light, and the modulator is used to absorb or transmit the light in response to an applied voltage. The low chirp of the EML allows it to transmit data over long distances without errors. In addition, the monolithic integration of laser and modulator results in lower component cost and a more compact size relative to discrete devices. By using EMLs emitting at different wavelengths, signals are wavelength-division-multiplexed together and transmitted through a single fiber using optical amplifiers to achieve long transmission spans without the need for signal regeneration. This approach is used in AT&T Global Public Network's Next Generation Lightwave Network, which uses EMLs to transmit eight channels each at 2.5 Gb/s over 360 km, for a total capacity of 20 Gb/s per fiber. The first service application in AT&T's network is planned for late 1995. AT&T Microelectronics' Optoelectronics Strategic Business Unit will manufacture EMLs for application in a variety of high-performance lightwave systems.

**Building Impact-Tolerant Portable Electronic Products**

AT&T's traditional desktop telephones with their physical ruggedness have been the standard for the world. Achieving such ruggedness in AT&T's new generation of "mobility enhancing electronic devices"—such as notebook computers and cellular and cordless telephones—would add considerable value and market differentiation. In making these devices rugged, however, product designers face formidable challenges. They must determine how to estimate impact forces accurately and also how to cushion densely packed, fragile components such as LCD displays and disk drives against the impact forces without compromising the stringent size, weight, and cost constraints associated with portable products. Bell Laboratories researchers have developed a proprietary computer simulation program that predicts that the use of viscoelastic polymer materials (elastomers) in portable products is an efficient means of protecting them during a collision. In combination with experimental tests and theoretical materials science, these simulations have also provided means to accurately predict the detailed impact response of such rubbery materials even under deformations approaching 50 percent when the area of contact is known. It is now possible to choose an "appropriate cushioning rubber" from a vast database of materials and also to "engineer" (design at the molecular level) the right material. Research is continuing to generalize the approach to impacts involving corners and foamed materials. Coupled with the program's ability to model impacts involving full three-dimensional objects, this advance will minimize the iterative cycle of physical prototyping and testing in designing sleek, attractive, mobile electronic products with optimum shock protection.