The economy, reliability and small size of the new solid state devices—and their fast operating times when used in switching applications—have made possible the changes we see around us, from small transistor radios, computers and satellite communications to the less obvious changes in the telecommunications network. Electronic switching systems have now been developed that will eventually supersede Crossbar systems. This new equipment uses the common control technique that was pioneered with Crossbar but the electronic control circuitry is many times faster than the relay type circuits currently in use. Somewhat paradoxically, the increased speed of electronic switching will not directly reduce the time a subscriber needs to reach the party with whom he wishes to talk because, already, calls are connected almost as soon as the originator has finished dialing. But the faster electronic equipment can refer to more information when setting up a call and the memory circuits that store this information will use programmed logic which is easier to change than the wired logic of existing common control systems. It is anticipated that this combination of speed and of a larger, more flexible memory will result in a more personalized form of telephone service. For example, subscribers may be able to reach people they call frequently by dialing only two or three digits instead of seven, or they may be able to arrange for incoming calls to be routed temporarily to another location. These and many more services can be provided in this new age but it is not certain what form these services will take, because no one knows which of the services telephone users will want and be prepared to pay for.

Another benefit to be derived from the increased intelligence of electronic systems and the greater reliability of its solid state components will be an increased ability to take care of its own operation. Already, common control switching systems can isolate and report defective units. A limited amount of extra equipment is supplied so that Crossbar systems can continue to operate unattended for months between visits by a maintenance crew. This trend will be carried further and electronic switching offices will be self-checking and self-repairing to a degree that leads switching engineers to talk of an "immortal machine"

Recent developments in the field of transmission have been equally significant and exciting. Some, such as over-the-horizon radio and satellite communication, have caught the imagination of people everywhere. But they have also shown that radio waves are becoming very congested and that the conservation and efficient use of the available frequency spectrum is a matter demanding international regulation of the highest order. Because of the tremendous demands for frequency bandwidths resulting from the "communications explosion", two recent innovations may prove to be crucial to the development of telecommunications over the remainder of this century. The first is the reversion to cable. Recent research has lead to the evolution of high capacity, high quality, long-haul transmission over co-axial cable that is economical and fully competitive with microwave equipment. The second is more properly an invention—the discovery of the "Laser" This makes available tremendous bandwidths at the lower end of the light spectrum, i.e., at frequencies far above those used for telecommunications today. In so far as bandwidth is the natural resource used for telecommunication transmission, the invention of the Laser has been compared in significance with the addition of nuclear power to the world's available sources of prime power.

Mention should also be made of a new transmission multiplexing technique, Pulse Code Modulation (PCM), by which a voice circuit is sampled at regular and frequent intervals. Each sample of the signal is then coded in a digital manner similar to a telegraph signal. The coded samples from many voice circuits are then interleaved and transmitted over a single pair of conductors to a distant point, where they are sorted, decoded and the original signals reconstituted. PCM is interesting for many reasons. First, the principles were discovered and disclosed 30 years ago but the practical application was dependent on the developments of solid state devices over the past ten years. Second, it is the first time that digital or telegraphic rather than analog techniques have been used for the transmission of speech. This has the advantage that on long circuits, amplifiers can be used which differentiate between the desired signal and undesired noise and which