# CABLELAB'S SCIENCE AND TECHNOLOGY FOR THE CATV INDUSTRY

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Today, more than ever before, the key determinant of the strength of any industry's economy is the efficiency of that industry's technology. The difference between success and failure in our marketplace today often comes down to who has the better technology. For the CATV industry to remain economically sound, we must achieve and maintain a leadership position in technology. In those areas where our activities have not historically defined the frontiers of technology, it is essential that we be close enough to those frontiers so that we are able to exploit new discoveries whenever and wherever they are made.

I maintain that the CATV industry, including cable TV systems operators, equipment manufacturers, and programmers, has and continues to build one of the strongest science and technology enterprises that the telecommunications industry has ever seen. CableLabs was established, in part, to give our business leaders a preview of technological change. To accomplish this, a technology time line had to be established, starting with technology assessment, moving promising technology to projects, and then weeding out the failures and turning the successes over to operations.

It is important to recognize that we live in an age characterized by change. The CATV industry has been aware for some time that a strategic technology entity, such as CableLabs, was needed to help manage the rapid pace of technological change. Even the best of leaders with the brightest strategic mind is reduced to dealing purely with tactics if a grenade is tossed in his or her lap with the pin pulled. Also, it became clear, that no single MSO or system operator could hope to gain a sufficient amount of the benefit from a basic R&D or engineering program to justify the investment on its own.

CableLabs has a major role to play in working with the CATV industry to take basic discoveries and move them through the pre-competitive development phase for a whole array of relevant technologies. By sharing the risks, we can speed up the process and enable our industry to compete on a more level playing field with the alternative entrants and competitors.

Of course, when the doors of CableLabs were initially opened, there was no time line. First executive staff had to be hired, space leased, and the hundred and one other details handled that are involved in starting a company from scratch. A board of directors and the executive board committee were elected. The technical advisory committee and the technical advisory steering committee were appointed. Liaison with existing technical groups and the manufacturers was established. Staff was hired and work began on timely projects that demanded immediate attention, primarily advanced television and consumer electronics issues. An extensive survey of the industry's technical leaders gave the Labs valuable insight into areas that required priority attention.

CableLabs started a technical newsletter (*SPECS Technology*) along with a clearinghouse that functions both as our eyes to the world and the world's eyes to us. Several projects were initiated, including building a developmental headend, scientific research on F-fitting failures, battery life testing, and NTSC subjective testing. An optimized systems operations (OSO) study is also underway.

An important activity which was assigned to the CableLabs' Office of Science and Technology was to define a list of critical technologies, to specify where we are with respect to business opportunities or possible threats in each of those

technologies, and then to make a series of recommendations. Those include recommending action that should be taken to improve the cable industry's relative stance, to improve our utilization of these technologies, and to take more effective advantage of areas where we have a leading position.

As a result, a search for a top flight physicist with business training was undertaken. We looked for an individual who is able to understand business strategy and to communicate with the CEOs; who is able to understand the relationships between technology and business opportunities; and who is capable of developing a technology strategy responsive to the industry's business strategy. Now that this position has been filled, technology assessment is truly underway. Already, this effort is beginning to yield information that helps place important current and emerging technologies on the technology "S" curve. An "S" curve is a way of graphically displaying a technology's initiation, expansion and maturity.

For instance, we learned the following: that our existing silicon-based hybrid amplifier technology still has a significant amount of headroom both in performance and bandwidth. Large screen displays with very good resolution, brightness, and at reasonable prices are beginning to appear on the horizon. Fiber optic devices and even the glass (and other mediums) are developing much faster than originally anticipated. Fiber optic amplifiers are a reality now and will be a factor in the CATV business shortly. Coherent modulation schemes are much further along and are expected to be available for experiments within two to three years.

For CableLabs and the cable TV industry, fiber optics is a technology, not a business. However, the evolution toward fiber-rich network architectures, including the last frontier – fiber to the home – is a major driving force for the extension of broadband capabilities and fulfillment of the consumer's appetite for entertainment, a powerful marketplace incentive. Future improvements in lightwave capability may come from using coherent technology and optical amplifiers. Coherent systems will offer the advantages of greater receiver sensitivity and longer fiber reach, as well as greater receiver selectivity and ease of adding or dropping channels – in much the same way as FM radio stations are tuned-in, the ultimate optical radio.

Future progress in fiber optics depends heavily on photonics, or technology for making optoelectronics devices. Two key technological developments are making tomorrow's devices possible. One is quantum-engineered materials, which do not exist in nature and are tailor-made to have certain desirable optical or electrical properties. The other is the integration of a large number of individual optical and electronic components on the same chip. We are watching technological advances closely and are working with R&D facilities as well as manufacturers of components and equipment to assure development of devices and systems dedicated to cable-specific requirements.

What is the video outlook for America? This question is being asked often. Americans and the world have a love affair with multi-channel television. As the public demand and appetite for television increases, we must be able to deliver more and more programming. The way that we can do this is through video compression and digital modulation. It is not easy, it is not here yet, and it presents tremendous technical challenges in compression ratios and motion compensation.

However, the rapidly falling costs and increased processing speeds of semiconductor devices (microprocessors and memories) have already resulted in a heightened interest in accomplishing an advanced TV transmission standard using digital techniques. Without compression, it would take 50 or more cable channels to transmit a digital HDTV signal and about eight cable channels to send a normal, digitized TV channel. But new digital compression techniques have

emerged to drastically reduce the digital television transmission bandwidth. Some concepts are well known. Other new approaches, like compression by fractals, are being developed. Which techniques are the best choice for cable applications remains an open issue.

As an example of some recent concepts, which have received attention in the trade press, consider a system utilizing data compression that transmits programming over cable systems or other distribution channels in short bursts to receivers that store information in memory, and then play it back in real time. A two-hour program may be viewed in real time, but can be sent in a short time (e.g., 15 seconds), allowing transmission lines to be freed for other uses. However, to accomplish this, even with significant compression ratios, it is necessary to have transmitters and receivers with several Gbits of RAM/video memory (based on standard memory chips) or other high storage capacity and very fast access devices. Also, this "video file" transfer will require high data stream rates (e.g., 2 Gbits/second). It is a very interesting concept, but the requirements and today's technology currently make any reasonable application cost prohibitive.

We need new approaches to video storage – reusable optical disks, organic molecule-based memory, or memory chip-by-inch. New HDTV sets will need video frame memories as well as digital signal processing. At CableLabs, we are particularly interested in the expected timing of device developments for the next generation of several integrated circuits (ICs). Memory chips (DRAM) are and will remain the worldwide "technology driver" in the future, and at the same time progress in their development is a benchmark for other families of devices such as microprocessors (CPU), digital signal processors (DSP), etc. All those ICs, by their manufacturing complexity and capabilities, are equal to or are some number of generations behind DRAMs. Today, a DRAM chip can store 4 Mbits of information, and the newest 16 Mbits chips are going through customer qualification. However, 1 Gbits chips are not expected to be qualified before 1998, and their availability is assumed for year 2004.

The new display technologies are focusing on reproducing the versatility of the CRT in larger viewing area-to-volumeratio and lower power devices. Flat screen technologies may give us a television set that can be hung on the wall like a picture. Both plasma and liquid crystal display technologies hold promise for the video flat panel of the future, but for now they are restricted to non-TV applications. One thing is for sure, the display of the future will convey information faster, with more resolution and color than ever before. The big question is what signal requirements and image quality perception will result from different distortion forms as compared to today's NTSC process. In other words, the question "what's good enough" is a moving target.

Technology advances and their implementation in cable systems' advanced network architectures are a very attractive arrangement, both from the perspective of quality/reliability and minimizing operating costs. And hopefully, the depressed economy and the need to tighten capital and operating expenditures won't jeopardize CableLabs' efforts and place the industry in an unprepared state to deliver advanced television signals as well as alternative services to cable customers when the time is right.

In the future, the technology "spoils" are going to go to the quick, the smart, the tenacious. What we need is greater flexibility and greater ability to match technology to changing customer demands. In the cable TV industry, long-range technological and engineering strategic thinking is not as well-developed as it should be. We are prepared at CableLabs to help, and we look on technological competitiveness as one of the most pressing of the CATV industry's problems. But, we deeply believe that we, as a technology-based consortium, are not nearly as well qualified to make the strategic business decisions for the industry as are

each of system operators themselves. Nor do we believe that technological transfusions in the absence of such strategic plans are any solution at all.

In conclusion, let me say that the CableLabs' Office of Science and Technology plans to continue its diligent exploration of new technologies for our industry. CableLabs also fully intends to rely upon its highly effective Technical Advisory Committee, comprised of senior engineering and technical executives from our member companies. We intend to continue the work that has made the cable television industry the most successful communications industry in this country, bar none. The industry's multi-channel technology has long been admired by the international markets and to this day draws compliments from them.

CableLabs' Office of Science and Technology has rapidly come up to speed and is now positioned to help the CATV industry monitor the rapidly moving frontiers of technology. We clearly understand our role at CableLabs is to discover, capture, and mold promising technology to the benefit of the CATV business.

Thank you.