August 24, 2001

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An Online Newsletter of Discovery Institute

Fiber-Optic Fables: Rewriting Telecom History

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Polls Would Indicate Germans Bombed Pearl Harbor?

We live in an age of famously embarrassing historical ignorance. Judging by responses given by "Pearl Harbor" moviegoers to knowledge poll queries, quite a few viewers would accept the late John Belushi's "Animal House" claim that the Germans bombed Pearl Harbor. One of the grand fictions of telecom history is that the established carriers left fiber innovation to others. One version, given currency by, among others, former Justice Department antitrust chief Anne Bingaman, is that but for federal pro-competition policy by the FCC and AT&T divestiture Judge Harold Greene the fiber-optic revolution would have been delayed. A second version, promoted recently by the American enterprise Institute's James Glassman, has MCI and Sprint as the pioneers, with MCI led by corporate visionary William McGowan into the fiber future.

As history goes, these tales are not much better than Bluto Blutarsky's rendition of how America got into World War II. The true story of how fiber became the dominant technology for long distance transmission is instructive, and shows that regulators not only did not help ignite the fiber boom, but likely retarded it.

While optical transmission actually was first achieved by Alexander Graham Bell's Photophone in 1880[1], practical applications for glass fibers were stymied by technical hurdles for another 80 years. The first commercial application to succeed was in 1960, when the flexible gastroscope was introduced. But even then the inability to manufacture glass of sufficient purity convinced most telecom professionals that fiber would never be practical for communications.

Four years later, in 1970, Corning Glass Works successfully sent signals through 1,320 feet of glass, a distance equivalent to less than one-fifth the 8,000-foot average length of Bell company "last mile" plant.[2] But material dispersion in the glass, which scatters and absorbs light, still presented formidable obstacles to practical use of fiber for telephony.

GTE Gets Lit

It took nearly seven years after Corning's initial lab success for fiber to make its marketplace debut. In 1977 GTE turned up ("lit") fiber between two central offices in suburban Los Angeles, days ahead of AT&T's suburban Chicago fiber lighting. The fiber used then was suitable, however, solely for relatively short-range inter-office links, and not long distance transmission.

This early fiber was so-called multi-mode fiber, in which the solid glass core is wide enough so that light propagates in several modes, at different angles; each mode arrives at the end point at a different time, thus degrading the signal. It was thus necessary to space repeater stations closely to enable transmission.

It took deployment (first in England, in 1983) of "single-mode" fiber, whose core is so narrow as to permit only one mode of light to pass, to make long distance transmission economical. Because the light travels in only one mode, repeater stations can be spaced more than 50 miles apart. The economics of long distance fiber thus for the first time surpassed the economics of terrestrial and satellite microwave.[3]

This key technology advance did indeed happen around the time AT&T was sundered, but was entirely unrelated to that event. As for Judge Greene, he had no more to do with fiber development than he did with Neil Armstrong's

walking on the moon.

MCI and Sprint were then able to roll out their networks. AT&T, hampered by stretched out depreciation schedules (it finally wrote off $6 billion of plant in 1988), was understandably slower to deploy. This was not foot-dragging on AT&T's part, but rather a rational response to multi-decade plant depreciation schedules predicated upon equipment usability, not economic life.

Petabit Connection for America, a Cable Modem in Every Home

The 1990s have seen several tremendous strides in fiber technology. Collectively, such improvements create fibers today that can carry terabits (trillions of bits) of information, compared to megabits (millions) in the 1980s and gigabits (billions) in the 1990s.[4] Bundle hundreds of multi-terabit fibers into a single cable and petabits (quadrillion) can be carried. The capacity of a single petabit cable could provide every one of America's 105 million homes roughly 10 megabits per second—equivalent to today's top cable modem speeds.

If 10 megabits per second per home sounds fanciful, the Consumer Electronics Association has just released a paper stating that cable providers will ultimately upgrade their networks to provide each home with 100 megabit-per-second access.[5] John Sie, Chairman. CEO of Starz Encore Group, a major distributor of cable content, predicted at Progress and Freedom Foundation's recent Aspen Summit that the subscription video-on-demand (SVOD) business model will soon spur broadband demand for entertainment video.[6] At the same venue Discovery Senior Fellow George Gilder stated that advances in dense wavelength division multiplexing (see footnote 4) will enable carriers to combine as many as 1,000 wavelength colors per fiber in an 864-fiber cable, with each color wavelength capable of carrying 10 terabits per second.[7] With 8.64 petabit capacity, such a cable could give each home over 82 megabits per second. (This assumes, of course, that local broadband access vastly expands, a topic for a future edition of Bandwidth.)

Sopwith Camel No More...

Thus today's fiber—developed entirely independently of such firms as MCI and Sprint—no more resembles what was in Corning's lab in 1970 than does today's F-22 supersonic stealth-technology fighter aircraft resemble a World War I Sopwith Camel biplane. As for the regulators, the Bell System break-up was predicated on the presumed superiority of microwave radio over coaxial cable and copper; fiber was not a factor.

Let's be clear: NONE of the new entrants into telephony—CLEC, cable, long distance upstarts—led the fiber parade. They simply took advantage of favorable regulatory rules. MCI Chairman William McGowan, hailed as a great technology visionary, was in fact long wedded to satellite as the future of long distance; in 1983 MCI announced the largest ever purchase of satellite transponder capacity. And MCI joined the soon-to-be-defunct Satellite Business Systems venture.[8]

Meanwhile, established carriers were hamstrung by regulators, denied adequate depreciation, forced to socialize their new services or offer them under regulatory handicap, and held to common carrier regulatory bargains entered into long ago in a monopoly regulatory environment.

Thus does "fiber fiction" make for entertaining summer beachfront reading, but bad history. The country has enough of the latter without adding to the total.

[1] Bells' device carried sound waves on sunlight reflected off a mirror onto a telephone receiver with a selenium cell. Sound waves emitted by the speaker caused the mirror to vibrate, and the reflected light carried the vibrations to the receiver. Transmission was open air, and ultimately reached 700 feet.

[2] Corning's project was prompted by a 1966 paper by Dr. Charles Kao, of IT&T's Standard Telecommunication Laboratories in England, recounting experiments with pure glass that raised for the first time the plausible prospect of fabricating ultra-pure, and hence low-loss, glass fibers suitable for communications.

[3] Satellite transmission cost is the same anywhere within its "footprint"—its coverage area. This gave satellite an edge over terrestrial systems for long distance networking until single-mode fiber arrived.

[4] The deployment of rare-earth erbium-doped optical amplifiers enabled end-to-end optical transmission, further reducing power and repeater requirements. Advances in dense wavelength division (frequency) multiplexing enabled hundreds of optical wavelengths (each a channel) to be combined on a single fiber. A new frequency window for transmission was opened by Lucent in 1999, enabling yet more channels.

[5] 100 Mbps and Beyond: Bringing Consumers High-Speed Access, CE Frontiers (Consumer Electronics Assn., August 2001).

[6] Panel Discussion at PFF Aspen Summit 2001, August 21, 2001.

[7] Plenary Address: Why Broadband is Not Yet Free, PFF Aspen Summit 2001, Aug. 21, 2001.

[8] The tale is told in MCI's own corporate history. Cantelon, Philip J., The History of MCI: the Early Years , pp. 337-343 (Heritage Press 1993).vv

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Is published by Discovery Institute

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