

Air blown fiber offers installation advantages in many applications.

Installation Options: Air Blown Fiber

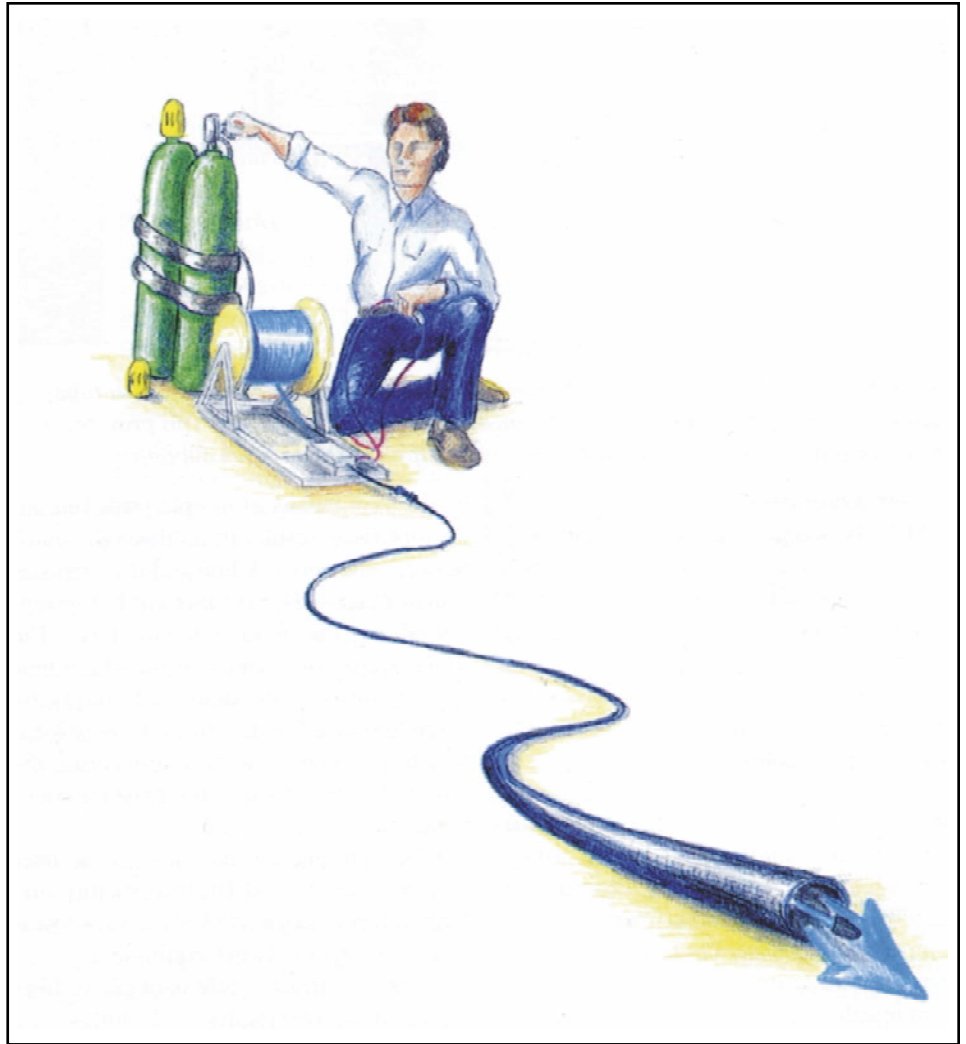
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Conventional methodology used in designing and building optical fiber LAN infrastructures is ill-equipped to deliver the flexibility to accommodate ongoing adds, moves, and changes caused by advances in information technology and evolution within the organization. The more dynamic the organization, the more the organization must spend to keep its LAN capabilities current with user demands.

The bulk of these costs are associated with labor-intensive pulling and splicing of new cable to handle, for example, multimedia, to change the location of a network hub, or to relocate a department within the organization. Additional costs can be traced to downtime or disruptions in the workplace during cable-pulling operations.

LAN managers have attempted to reduce future costs by installing more fiber than required at the outset, thereby hoping to capitalize on a "one-time" installation procedure. They do this by crystal-balling future needs, hoping their guesswork proves correct.

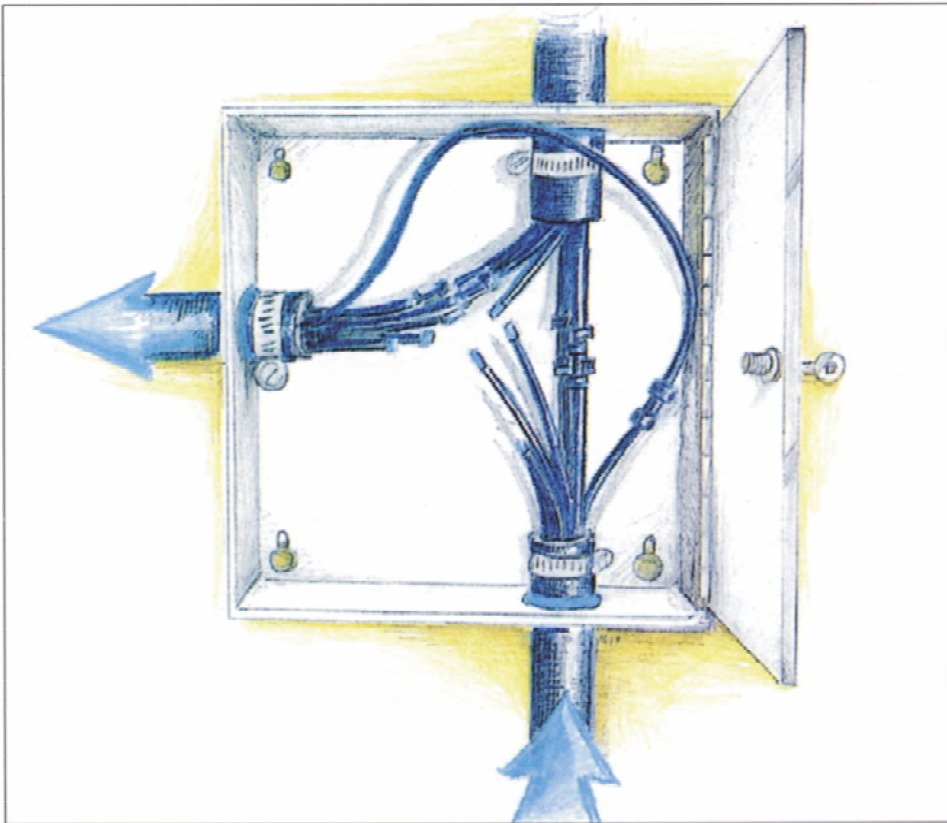
More often than not, it proves wrong, and the anticipated savings do not materialize.



ABF blowing equipment consists of bottles of air or dry nitrogen fed through tubing into the air blowing system. An air-driven motor in the blowing head controls the speed at which fiber travels into the tube cells

A relatively new LAN infrastructure technology called air blown fiber (ABF) can solve this problem. One of the first applications in the United States was at the University of Utah. Since then, the technology has proven

itself, and is being adopted by a wide range of businesses and institutions (see Applications) to "future proof" their networks. In addition to handling voice, data, and video LAN traffic, ABF is also employed for HVAC and security systems.



ABF tube cables, containing up to 19 individual tube cells, are interconnected in tube distribution units or "junction boxes" by means of push-fit connectors. This provides a splice-free path between the network hub and equipment the network supports.

System Overview

ABF is manufactured by Sumitomo Electric Lightwave Corp., Research Triangle Park, N.C. Called the FutureFlex4 Air Blown Fiber System, it uses either compressed air or dry nitrogen to blow small, lightweight, multi-fiber cables called fiber bundles into previously installed tube cables.

Fiber bundles contain from 2 to 18 strands of singlemode 50/125 gm or 62.5/125 .1m multimode optical fiber. These bundles are typically one-fortieth the size of conventional fiber cable of comparable capacity, because no strength members are required to protect the fiber from tensile stress during installation.

Tube cable replaces conduit and innerduct used in conventional systems. Flexible and rugged, it contains from 2 to 19 individually marked tube cells, and meets industry specifications for indoor and outdoor applications.

Typically, an ABF backbone is constructed with tube cables containing more cells than required at the outset. This provides an in-place right-of-way for growth or changes. Tube cable cells are joined in tube distribution units (TDUs or "junction

boxes") by means of simple push-fit connectors. This results in a "through route" between the network hub and the workstation or other sites and functions being supported by the fiber infrastructure. The TDU is also the location from which new applications can be supported simply by extending tube bundles from the new location to the TDU and then connecting the required tube cells into the existing backbone.

Fiber termination units provide a juncture between the ABF infrastructure and fiber jumpers connected to servers, computers, or other network equipment. Once the infrastructure is in place, fiber installation commences. Bundles are blown into any route of coupled, empty tube cells at rates up to 150 feet per minute, achieving splice-free runs to 6,000 feet, depending on network configuration. Conversely, should requirements change, fiber can be blown out of a tube cell and new fiber blown in. The removed fiber can be used elsewhere since no damaging stresses are imposed on it during either installation or removal. In most circumstances, only two installers are needed to put an ABF system in place.

Key Components

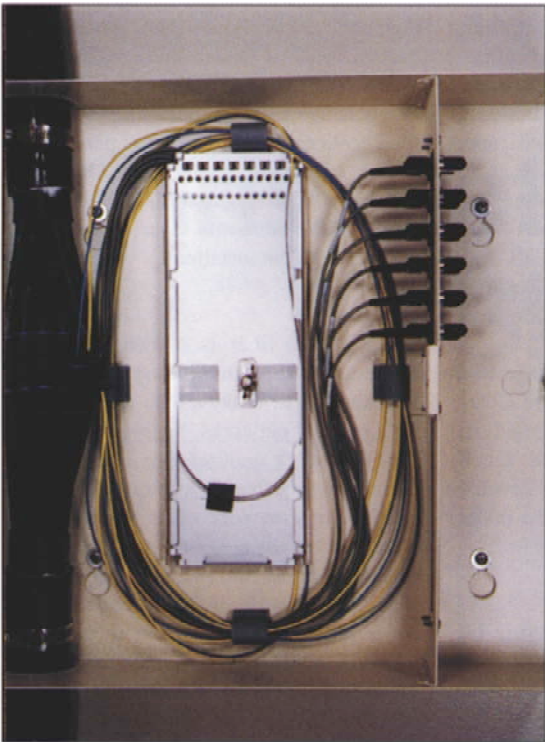
ABF blowing equipment is composed of several components. The pressure source is industrial grade dry nitrogen (or air), typically in a 3(X) cubic foot bottle, with its regulator allowing control from 0 to 200 psi. Through a system of tubing and fittings, pressurized nitrogen is delivered to the blowing system. This unit consists of a payoff stand on which reels of ABF bundles are placed, and a blowing head used to direct the fiber bundle and nitrogen into the tube. An air-driven motor located in the blowing head is used to control the speed at which fiber travels into the tube cells.

Tube cable is available in a number of configurations to cover virtually every application and installation environment. It is designed to meet all requirements for use in plenum, riser, general-purpose indoor, and outside plant applications. For outdoor applications, the outer jacket is designed to prohibit water intrusion and can be supplied with steel armor for direct burial. Individual tube cells have an outside diameter of 8 mm and an inside diameter of 6 mm. A typical outside-plant 19cell cable has an outer diameter of 43 mm and can contain as many as 342 fibers when fully loaded.

ABF fiber bundles are contained in a special low-density jacket material with a textured surface that improves the aerodynamic features of the fiber bundle. During installation, the bundles float through the tube cell with minimum contact to cell walls. A small plastic end cap is fitted to the end of the fiber bundle to facilitate movement of the bundle end through tube connectors. Bundles are provided in reels up to 4,000 meters in length, are color coded to identify fiber type, and are UL approved for use in plenum and riser tube cables. A 6-fiber ABF bundle has an outside diameter of 2 mm, and an 18-fiber bundle has an outside diameter of 3 mm.

Applications

ABF is being employed across a spectrum of applications from education to public works. If there is a single prerequisite, it is that the network undergoes ongoing modifications to accommodate ongoing moves, adds, and changes caused by advances in IT and evolution within the organization.



Education

In 1990, the University of Utah established a fiber master plan to bring order to a communications infrastructure in virtual chaos. In response to a request-for-proposal to 30 vendors, approximately 20 responded, and all but one proposed conventional systems. ABF was accepted by the university because it addressed three design aspects: long-term flexibility, long-term costs, and long-term expandability. The technique enabled the university to install less fiber than initially anticipated, in its efforts to accommodate future growth. It also reduced end-to-end attenuation due to the elimination of field splices, while its more direct fiber routing capability minimized design issues in several of the longer fiber spans.

While changes have been made to the university infrastructure, the entire initial project design utilized 190,000 feet of 6-cell tube cable and 330,000 feet of 6-fiber, 62.5 gm bundles. Since the installation began, ABF has proven itself a viable technology at the university by addressing expansions, changes and modifications to the network.

At the other end of the education spectrum is Hilliard Elementary School in Nassau County, Fla. The school specified fiberoptics to avoid electromagnetic

interference from frequent lightning 'Storms. ABF technology was 'elected for the 10-building campus because the school wanted to avoid installing more fiber than required at the outset to meet initial needs. Hilliard's network handles data, energy management, and the fire alarm system. The data system accesses each classroom wiring closet and is designed to provide fiber to individual desktops. According to the school's Administration, flexibility, long-term cost savings, ease of maintenance, and ease of troubleshooting have made the technique cost effective for the Nassau County School Board.

Public Works

The Metropolitan King County (Washington) West Point Wastewater Treatment Plant selected ABF as its network infrastructure when undertaking a modernization program.

The selection was based on ABF's ability to accommodate current requirements and provide the flexibility to add or modify the network in the future.

For the West Point plant, copper was ruled out based on previous lightning-related experiences. ABF won over conventional systems because sections of available conduit at the existing facility were undersized and unable to accommodate additional fiber.

According to West Point authorities, installing conduit in the newly constructed facilities in a redundant configuration would have cost \$550,000, excluding the cost of installing loose tube fiber, innerduct, and repeater stations. Savings occasioned by using ABF in eliminating the conduit runs were enough to pay for the contract. Engineers also calculated that standard technology of a loose tube fiberoptic installation would add to the complexity of the network, increase its maintenance costs, and reduce its reliability.

A Florida electric utility solved the challenge of interconnecting its first-level data center and IS other locations dispersed over three levels by using air blown fiber.

The environment consisted of open cable trays and conduit in extremely difficult working conditions.

Under a conventional scenario, the project called for a crew of 8 to install 9000 feet of 24-strand multimode fiber by pulling it through conduit and innerduct, then performing splicing and testing. This represented four times the amount of fiber needed to meet requirements at the time, with the excess fiber proposed for future use.

The utility's selection of air blown fiber reduced the installation crew to three, the multimode strand requirements to six, and eliminated splicing. It allowed the utility to reduce its upgrade to consist of installing only 900 feet of 19-cell tube cable, 3600 feet of 7-cell tube cable, and eight tube distribution units. Six-strand multi-mode fiber bundles were blown through to destinations. Since the original implementation of the network, every location on the LAN has been served with additional fiber requirements.

Health Care

Like every other 1-IMO, Kaiser Permanente was overloaded with data

One of the first applications in the United States was at the University of Utah

in the early 1990s. Treatment technologies were advancing fast along with the availability and variety of new services. Several years ago, officials determined that the information infrastructure in Kaiser's Southern California region needed an overhaul to efficiently serve its 2-million-plus members. The results of a test run project using air blown fiber at one of Kaiser's campuses resulted in incorporating the technology at 15 major campuses in the Southern California region. By the end of 1995, more than 1.6 million feet of tube cable had been run with less than 10 percent of its total capacity in use.

Among the benefits Kaiser reaped through ABF technology is the fact that very few conduits or other cable routing infrastructures had to be accessed, which caused less disruptions than typically associated with conventional systems.

Minimal patching and splicing resulted in lower ongoing maintenance, upgrade, administration and patching costs. The cabling structure also improved signal quality and reduced the number of outages and network downtime.

Military Applications

The Naval Air Systems Command in Arlington, Virginia, selected air blown fiber to enable consolidation of 39 separate organizations using 19 different e-mail systems along with four network operating systems into a single, state-of-the-art pervasive and expandable network. These networks extended across 40 floors in 6 buildings in the Crystal City area. According to NASC officials, air blown fiber labor costs were between 60 and 70 percent lower than estimates for a conventional pulled fiber system. Moreover, while some 27,000 feet of optical fiber were blown,

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through 7,000 feet of tube cable, no breakage occurred during installation. The command's standard operating procedure of incorporating a 15% performance margin to accommodate fiber degradation from installation-caused damage proved unnecessary with air blown fiber.

Fort Gordon, Georgia, is the site of the

U.S. Army's telecommunications training facility. Estimates to install a conventional fiberoptic campus-wide LAN backbone serving 52 terminals in 11 of 24 buildings reached \$226,000, most of which represented labor costs. Technicians at Ft. Gordon were trained in ABF technology, resulting in accommodating all 24 buildings being "wired" at a cost of only \$60,000. A continuing benefit is that these technicians now handle on-going maintenance.

Similar ABF success stories have been recorded at the Naval Air Warfare Center in Patuxent River, Maryland, and the Naval Command, Control and Ocean Surveillance Center's research, development, test and evaluation division in San Diego, California.

Manufacturing

American Axle and Manufacturing a Detroit-based manufacturer of front, rear, and four-wheel-drive axles operating 10 major facilities at six locations. The company set a 1000-day deadline to migrate from a closed, mainframe-based system to an open, client/server networking environment with a completely new cable topology. ABF was selected as the backbone architecture because it can span more than 6000 feet without splicing. This is an important feature for the heart of the AAM system, which requires runs of about 1500 feet between buildings plus approximately 2000 feet of fiber for connections within each facility.

Slotted TDUs allow adding ABF distribution units anywhere along a cable run without cutting adjacent tube bundles

housing on-line fibers. This feature supports a modular design allowing crews to install ABF in phases that fit into production schedules in an industry where downtime costs can exceed \$20,000 per minute.

The combined features of ABF have yielded cost savings of 20% when compared to conventional fiber installations, according to the installer.

Conclusion

Air blown fiber is a technology that overcomes the uncertainty of change encountered in today's data and telecommunications networks. Guesswork about future network requirements is eliminated due to the fact that the fiber can be quickly added to a network when needed. A network can be changed in a matter of hours due to the speed and simplicity of blowing fiber units into the existing tube network. As a result, users have experienced the reduced costs, ease of installation, and total flexibility of managing a "future proof" network.

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