

Solving network concerns yesterday, today and tomorrow: Air-blown fiber

Some say the technology's time has come; some others say it has always been.

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In the article titled "A comparison of conventional fiber and blown cable," published in *Cabling Installation & Maintenance* in August 2014, authors Paulson and Klingensmith cite that the term "air-blown fiber" is a registered trademark of Sumitomo Electric. The trademark and technology, most analysts would agree, were ahead of the times when this blown fiber system was first introduced to North America in 1991—during a time when OM1 62.5-micron multimode optical fiber was king and enterprise network upgrades occurred every six years or so.

Today, as bandwidth increases from 10 Gbits/sec to 40 and 100 Gbits/sec and beyond to keep pace with the huge and ever-growing big data demands driven by cloud

computing, video transport, mobile communications and the ongoing flux of emerging technologies, network needs have certainly caught up with blown fiber technology.

A survey conducted by the Telecommunications Industry Association's (TIA) Fiber Optics Technology Consortium (FOTC) during a pre-conference seminar at the 2014 BICSI Fall Conference, identified the top five network concerns and priorities of network designers, contractors, installers, end users, and consultants. Additional data can be found at www.tiafotc.org. According to that survey's results, the top five concerns and priorities are:

1. Low maintenance/minimize downtime
2. Futureproof network
3. Scalability
4. Support high-bandwidth applications
5. Security

Blown fiber technology aligns with these needs and offers solutions. Its benefits that are crucial to today's high-density, high-speed, and continuously changing networks extend beyond the top five priorities and are also addressed for a comprehensive understanding of air-blown fiber technology.

Blown fiber technology defined

Essentially there are three methods of installing optical fiber: 1) Conventional cabling through which optical fiber cable is pulled by large work crews into innerduct or mesh ducts, and into conduit; 2) Blown cable systems that use a blowing technique to install similarly constructed optical cables as conventional cabling, but at a reduced outside diameter (OD); and 3) Blown fiber systems through which optical fiber bundles rather than cables are blown into empty tube cables that make up the fiber pathway infrastructure. Because industry often refers to blown cable and blown fiber systems synonymously, it is important to note that they are distinctly different fiber-installation methods. Air-Blown Fiber or ABF is used when referring specifically to Sumitomo Electric Lightwave's blown fiber solution.

The next several paragraphs will detail how blown fiber addresses the



Air-Blown Fiber non-PVC tube cable can be direct buried in the outside plant, replacing the need for both innerduct and conduit. It is flexible enough to be placed in an existing conduit pathway.

previously referenced five network concerns and priorities.

Low maintenance/Minimize downtime—The blown fiber system provides a point-to-point (PTP) continuous splice-free optical fiber run, eliminating potential points of network failure. This splice-free capability is a major differentiating factor between blown fiber and blown cable systems, which like conventional cabling requires much splicing (potential points of failure). Based on the inherent design of the blown fiber system and its use of continuous end-to-end optical fiber runs and clearly defined pathways, it takes significantly less time to troubleshoot a network problem. The real-time scalability attributes of the system also speed up network restorations, resulting in the elimination or significant reduction of network downtime.

in real-time high-bandwidth optical fiber installations and upgrades. Therefore, these three network design priorities are discussed in concert. Whether for an integrated network backbone or physically separated network, such as a distributed antenna system (DAS), security system, or building automation system, blown fiber technology allows any optical fiber type and count to be blown in and out of the network at speeds of up to 150 feet per minute. The blown fiber infrastructure prepares the network to immediately exchange one optical fiber type for another, accommodating virtually unlimited pathway, fiber and bandwidth capacity.

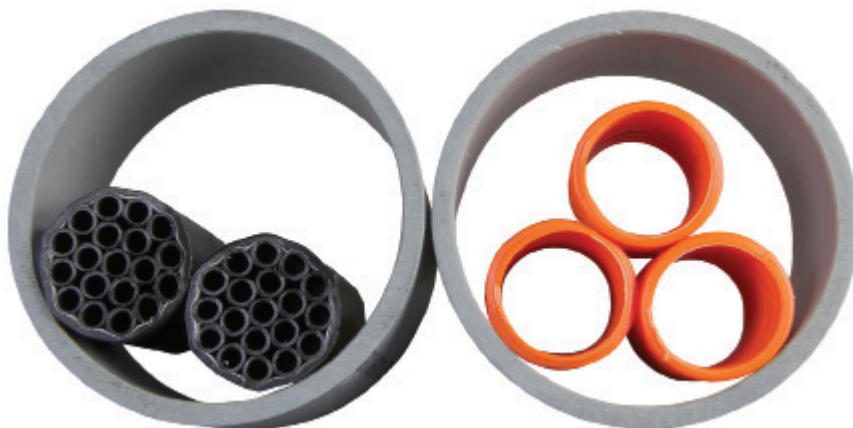
For quick and easy optical fiber installations, high-bandwidth upgrades, and any moves, adds and changes (MACs), this process can be completed when and where it is

solve the debate about what type of optical fiber to install today—OM3 multimode optical fiber, OM4 multimode optical fiber, or singlemode optical fiber.

Because optical fiber can be blown in and out of the network continuously, and the undamaged blown-out optical fiber can be reused, there is no end to the fiber and bandwidth life cycle. Neither conventional nor blown cable systems can make this claim. Thus, an ABF system provides network managers with the freedom to scale and control exact bandwidth requirements at any time in an already-futureproof-ready network.

Security—For physical security, the scalability feature of blown fiber allows the latest high-bandwidth security solutions to be installed at a moment's notice. For example, with a blown fiber system in place, Las Vegas's McCarran International Airport was able to respond quickly to emergency mandates from the Transportation Security Administration for heightened security following the attacks of September 11, 2001. Gerard Hughes, McCarran's senior network analyst, estimated that the work would have taken approximately 12 weeks to complete with at least double the number of installers at a project cost ranging between \$150,000 and \$200,000 had a traditional fiber-optic cabling infrastructure system been in place. With air-blown fiber, the project took 7 days with two installers and cost \$13,000.

For information technology (IT) security and the protection of data, blown fiber provides the physical



In the same standard 4-inch conduit, two 19-tube cables yield 38 optical fiber pathways, versus the three pathways established using 1.25-inch innerduct.

Futureproofing, Scalability, High-bandwidth support—The primary feature of a blown fiber network is the capability for immediate scalability, laying the groundwork for an already futureproofed network that facilitates

needed in minutes or hours versus the days, weeks or months associated with conventional cabling. Because a quick and fast-blowing installation of any optical fiber type can be achieved, the use of blown fiber helps



Tube distribution units—TDUs—are generally located in telecom rooms and are used at tube cable pathway branching locations. Maintenance, rerouting and MACs of the optical fiber pathway are accomplished at the TDUs.

segregation of classified data required for multiple levels of security through the use of individual tube pathways. These segregated data classifications can be easily and quickly changed and reallocated, while protecting against one classification mixing with another and eliminating points of vulnerability whereby the network signal can be disrupted or intercepted. With blown fiber deployments, restricted or secure areas do not need to be physically accessed, eliminating intrusion, tampering, and potential optical fiber damage.

Benefits beyond the top 5

Air-Blown Fiber (ABF) technology has solved other important network issues, which may explain its consistent growth since the early 1990s and its more-recent accelerated trend of adoption among government/military and high-profile, commercially familiar networks spanning virtually all major vertical industries. It is important to note that all blown fiber systems are not created equal, and vary in design, speed and functionality. Key benefits

to consider when selecting blown fiber include the following.

- Eliminates physical disruption to the facility and re-entrance into conduit, ceilings, walls and manholes; addressing the safety issues, for example, of industrial/energy network environments and the infectious disease control and patient safety concerns of health-care networks
- Provides flexibility by either eliminating the need for both conduit and innerduct, or the significant reduction of both in pathway infrastructure design
- Offers a point-to-point continuous splice-free optical fiber run, eliminating potential points of network failure
- Supplies virtually unlimited pathway, fiber and bandwidth capacity, solving filled conduit and duct bank problems
- Drives fast and easy fiber installations, upgrades and MACs in secure, hazardous and hard-to-reach areas
- Delivers an environmentally friendly optical fiber installation system

that is reusable, renewable and sustainable

- Saves typically 70 to 90 percent of the time and costs associated with conventional cabling systems for optical fiber-related projects and generates continuous return on investment (ROI)

ABF infrastructure

At the heart of the blown fiber system is an infrastructure of tube cable, available in a wide variety of outdoor, indoor/outdoor, plenum and riser-rated and low-smoke/zero-halogen options. These tubes form the intrabuilding and interbuilding topology, ultimately providing virtually unlimited optical fiber, bandwidth and pathway capacity. The installation of the tube cable is the only occurrence of physical disruption to the building, campus and/or its grounds. The non-PVC tube cable contains up to 19 smaller empty tubes and can be direct buried in the outside plant (OSP), replacing the need for both innerduct and conduit while reducing labor-intensive work in manholes for upfront infrastructure cost savings. The tube cable also is flexible enough to be placed in an existing conduit pathway if required.

To convey the extent of capacity provided by the tube cable, consider that a total of only three, 1.25-inch innerducts through which conventional fiber optic cable is pulled, yield

only three pathways in a standard 4-inch conduit. In that same 4-inch conduit, two 19-tube cables yield 38 optical fiber pathways. This ultimately resolves congested conduit and increases the likelihood of never having to lay additional conduit.

Because of its virtually unlimited pathway space, the blown fiber tube cable infrastructure needs to be installed only once. The same tube cable pathway, through which any required optical fiber type and counts can be quickly blown in and out, can be reused time and time again, eliminating the need to re-enter the path-

(TDUs), or tube distribution enclosures (TDEs), using push-fit connectors to create reliable point-to-point network connectivity. TDUs, generally located in telecommunications rooms (TRs), are used at tube cable pathway branching locations. Easy maintenance, rerouting and MACs of the optical fiber pathway are accomplished at the TDUs. Demarcation of each tube within the tube cable makes network segregation fast and easy, including segregating for various security classifications of data.

Because the tube cables offer a modular solution, different path-

from HVAC and physical security to communications under one common backbone. The blown fiber modular infrastructure solution opens opportunities for new innovative pathway architectures and configurations for value-added engineering.

To further illustrate the versatility provided by the tube cable pathway and TDUs, consider the addition of a new building to the network. Instead of installing conduit and innerduct from the building back to wherever the central data center is housed and then pulling in the optical fiber, the tube cable needs to be extended only from the local or closest TDU to the new building. This allows optical fiber to be installed in minutes to the fiber termination unit in the TR or other termination point, thereby minimizing disruption and saving considerable labor and pathway infrastructure costs.

Non-disruptive fiber installation

Once the tube cable pathway is in place, the exact optical fiber types and counts required can be quickly and easily blown into the tubes using compressed air or nitrogen. Blown fiber bundles use the same type of optical fibers as conventional and blown cable and are terminated in fiber termination units using standard methods.

Because the fiber installation is completed behind the scenes generally in a TR by only two installers at each end of the continuous fiber run, there are no large work crews as with conventional and blown cable systems, and there are no disruptions to the buildings, grounds or the daily activities of the enterprise.



Blown fiber requires only two installers—one at each end of a splice-free continuous fiber run. This modest personnel requirement eliminates large work crews and disruption.

way or conduit system. A few spare tubes within the tube cable can be left empty for future expansion, providing immediate real-time future-proofing for the network and eliminating the need for an investment in dark fiber.

ABF tube cables are typically joined in tube distribution units

way configurations can be quickly devised. To reduce costs and improve efficiency, tube cable pathways can be reconfigured to support multiple topologies simultaneously, such as star, hierarchical star, centralized/home-run, passive optical LAN, or fiber-to-the-enclosure (FTTE), enabling the integration of everything

With a scalable, futureproof blown fiber system, installers can blow out undamaged 50-micron multimode optical fiber and blow in any other multimode or singlemode optical fiber type between buildings that are located 6,000 feet apart—all in about 1.5 hours without ever getting their hands dirty. The non-disruptive feature of blown fiber appeals to all end users, but has even greater importance for those with safety concerns—namely hazardous environments associated with industrial manufacturing and highly sanitized environments associated with healthcare.

Industrial facilities, such as refineries that contain, manufacture, use or produce potentially explosive gases, vapors and other hazardous materials, face a unique set of safety challenges for optical-fiber-related MACs. By installing a 1.7-inch 19-tube cable accommodating 456 optical fibers only once, blown fiber allows quick and easy MACs while improving safety. Only two installers are needed to safely blow the optical fiber into the tube cable without cable trays, lifts and poles, and without needing to access hazardous areas. Blown fiber fully complies with Section 500 of the *National Electrical Code (NEC)*, which specifies requirements for preventing dangerous gases from leaving classified areas by using caps and gas-blocking couplings, while allowing vacant and occupied tubes to be ready for quick and easy optical fiber installations, upgrades and expansions.

For healthcare applications, one of the most compelling values of blown fiber is that it eliminates disruptive

construction work, re-entrance into walls and ceilings, and any physical disruption to the hospital or healthcare campus that can compromise infection control and safety for patients, staff and visitors. Compliant with Infection Control Risk Assessment (ICRA) requirements of the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), blown fiber's clean and environmentally friendly installation eliminates the time-consuming and costly infection-control preparatory processes involved with entering conduit, walls and ceilings to accomplish installations, upgrades and MACs. Potentially toxic mold spores and airborne pathogens lie dormant above ceiling tiles or in walls until disturbed, posing direct threats to immune-deficient patients and to highly sanitized areas. Some cabling systems use high-efficiency particulate arresting (HEPA) filtration units and negative air pressure enclosures (NAPEs) to help reduce the chances of infection. However, infection control processes can cause other patient safety disruptions, such as moving patients, crowding hallways and interrupting the critical work of healthcare staff and providers.

In describing her experience with blown fiber, Sherry Mettley, director of IT infrastructure at Penn State Milton S. Hershey Medical Center, said, "We often need to respond quickly to new high-bandwidth technology and network changes by our departments, and with blown fiber we know we have the capacity to make MACs rapidly, efficiently and cost-effectively for emerging technology, growth and change. Blown

fiber proves how the physical layer can save budget dollars and improve infection control, while escalating the speed and delivery of new healthcare technologies and the critical needs of our patients, clinicians and the communities we serve."

Not only has blown fiber technology solved the top five FOTC survey concerns and priorities of network designers, contractors, installers, end users and consultants, but it also addresses, among other benefits, the immediacy of network change. While early adopters of blown fiber would contend that the technology's time has always been, blown fiber technology is now proving to many that its time has definitely come. As the only fiber solution to offer a point-to-point, splice-free, zero-points-of-network-connectivity-failure with no end to the fiber and bandwidth life cycle, network managers possess the power to make immediate changes and upgrades confidently, whether migrating from 10G to 40/100G and beyond, upgrading a DAS with the latest technology, staying ahead of the curve of big data, or redesigning an entire network—all in a matter of hours in real time and at a fraction of the cost of other options. For Air-Blown Fiber, futureproofing is an obsolete term, because the system is a technology of now. ❑

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