OUR DEBUT ISSUE!
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Product Report: Underground Cable Locators

Connection

How Jones Communications Crossed the Potomac River—from Below

By Tom Gorman

In 1995, Jones Communications began the process of rebuilding i Alexandria, VA cable system. The system would be the most advance cable system in the nation. Together with rebuilding the system to a 75 MHz passive optical HFC network, Jones installed a Nortel DMS-50 phone switch and ventured into the phone business.

Simultaneously, Jones was in the process of acquiring neighboring systems i Virginia and Maryland. The company was intent on becoming the dominan multi-communications provider in the Washington, DC region. The strategy t accomplish this was by connecting the systems in the two states.

With more than 425,000 customers in the region, engineers started plan ning, and the corporation approved the interconnect construction plan Approximately 300 route miles in length, the network would be the launchin pad for numerous services to all customers in the region. Presentations to Jone executives pointed out the need for an interconnect to compete in th Washington DC marketplace. Enough fiber is being installed to allow the insta lation of an OC-12 synchronous optical network (SONET), internal LAN/WA applications, and the carriage of numerous video applications as two supe headends are created.

There was only small problem in the way of constructing this network: Th Potomac River.

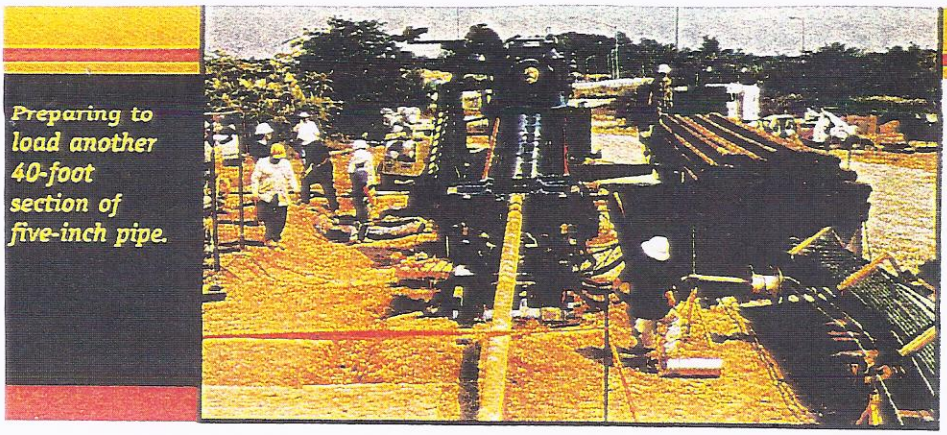
The Potomac is the dividing line between Maryland and Virginia Alexandria is on the south side of the river, while Prince George's County, M hugs the shore on the north side.

Where do you start?

Network engineers started with the determination of fiber counts, not on for the crossing, but the interconnect in total.

In making such calculations, it's important to note that you're not on determining fiber allocation to the backbone interconnect, but the additiona fiber required to serve the needs of each portion of cable system it goe through. In Prince George's County, for example, Jones operates a dual cabl plant. Additional incremental fiber was allocated to migrate the system to HF architecture, times two!

Workers prepare to join a section of 10-inch sleeve. The sleeve fits over the five-inch pipe that carries the innerduct.



Preparing to load another 40-foot section of five-inch pipe.

Once fiber counts and routes were determined, the next step was gaining access to the river. On the Maryland side of the river, access would come by placing fiber along the Capital Beltway, into an area near an exit ramp to the beltway and from there into the river. In Alexandria, the best location to approach the river happened to be in the middle of the historic Olde Towne district, and through a city-owned park.

The City of Alexandria was not keen on the idea of having its park ruined by boring machinery, not to mention the 24-hour-a-day operation. While the pre-engineering indicated that a bore had a higher probability of success if attempted from the Virginia side of the river, the city balked at approving the permits. We then decided to start from the Maryland side of the river.

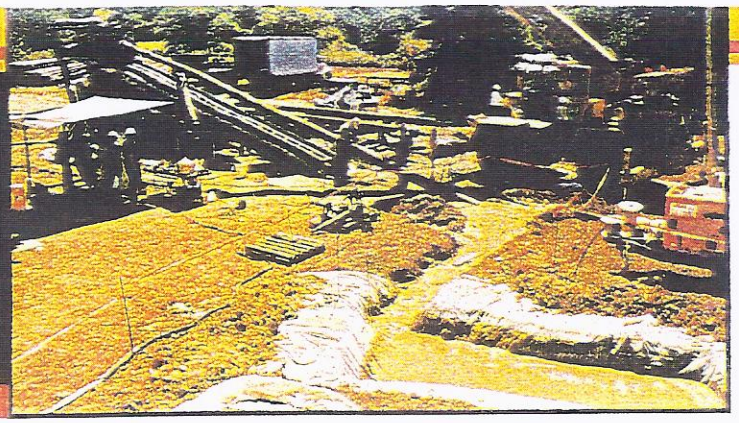
Initial conversations on what it would take to get across the river started with the Army Corps of Engineers. The Corps of Engineers is the keeper of river engineering. They map out and keep detail of riverbeds for just such purposes.

Army engineers informed us that, in this application, directional boring is the preferred method. For environmental reasons, underwater installations are "strongly encouraged" to use boring as the primary method for installation; boring doesn't disturb the riverbed. In fact, a permit for any kind of installation other than boring typically is not given unless absolutely necessary.

The stretch of river the installation would cross includes a large channel, which also serves as an anchorage for boats. It is a highly trafficked area, and by boring we mitigated concern over damage to the installation. Permits also had to be obtained from a number of entities representing the federal government and the governments of Virginia, Maryland, and Washington, DC. This was the longest process of all.

Jones contracted with CommLink Constructors, of Concord, NC as the general contractor for the project. Dynamic Cable Construction, of Ben Wheeler, TX, performed the actual boring. Dynamic specializes in this type of work (there are only three or four in the nation who would even bid on it!)

After six months of delay, (due to more permitting issues) the Potomac River crossing finally got underway on August 25, 1997. The initial estimates were that the project would be completed in two weeks, with the construc-



Bentonite mud, collected in a holding pit, provides cutting force for the boring head.

a mud tunnel for the pipe to travel through. Once the boring head is 35 feet into the ground, the machine stops. A second 40-foot long piece of pipe with an outside diameter of five inches (called a drill stem) is attached to the bore head, and the process begins again. Every 35 feet of progress requires that a new piece of pipe be attached. The process is repeated until the bore is done.

tion crews working 24 hours a day. The nation's largest track-mounted directional boring rig was brought to the Maryland shore of the Potomac, and the drilling began. This boring machine delivered 436,000 pounds of push-pull force, and 57,000 pounds of rotational torque! The setup for the machine took nearly two weeks alone. A small city was created next to the river, with approximately 20 people working around the clock.

How does it work?

Attached to the boring machine is a device called the boring head, which can steer left or right, up or down. The head is some 40 feet long and filled with electronics that can send information back to the operator during boring. Two wires are placed across the river along the path that the bore is intended to go. These wires, placed approximately 20 feet apart from each other, lay on the river bed for the whole length of the bore shot, exiting on the other side of the river.

When current is passed through the wires, the electronics in the boring head can measure the generated electro-magnetic field; the bore operator receives information on elevation and azimuth based on those readings. The operator then can plot the location of the boring head throughout the process and can steer it to maintain the intended course.

A second machine, called a mud machine, mixes a combination of fresh water and a clay substance called bentonite into a mud compound that is injected into the center of the boring head. The mud is forced out through the front of the boring head with such high force, that it is actually what does the cutting.

As the bentonite is shot forward, the machine pushes the boring head into the dirt, and the boring begins. The bentonite flushes the cuttings out of the bore hole and creates a "wall cake,"

THE BOTTOM LINE

Permits, Permits, Permits!

As in any project, careful planning is the key to success. In the case of the Potomac River crossing, the permitting process was the most time-consuming and exasperating process. Anyone planning a crossing such as this should allocate close to one full year for the permitting process. At bare minimum, add six months to the timeframe given by any permit granting authority to obtain a permit.

Because of the location of the crossing, permits were required from:

- Maryland State Highway Administration. (In return for permits to build in Maryland right-of-way, Jones provided one 12-count fiber to the state for installation on traffic control cameras along the Capital Beltway. This process for resource sharing took nearly eight months. The permit needed to be signed by the Governor of Maryland!)
- Army Corps of Engineers
- U.S. Coast Guard
- Department of Corrections (Yes, someone intended to build a prison once upon a time in the middle of the river.)
- Maryland Board of Public Works
- Maryland Wetlands Department
- Maryland Department of Natural Resources
- Washington, DC
- Virginia Park Authority (which owns the dirt under the river)
- US Park Authority (which owns the water in the river)
- City of Alexandria

When planning a project like this, remember that using the right companies makes a tremendous difference. Jones didn't feel compelled to cut costs and do it themselves. Letting the experts do what they do best is the right thing to do. While we were concerned over the process of "tripping out," the contractors from CommLink and Dynamic didn't bat an eye. This is a part of the process. In addition, using the best duct and cable placing equipment ensured success.

Throughout the process, the mud mixture returns out of the bore hole and is collected in a pit. There is a large pump in the pit that collects the mud returns and recycles it through the mud machine. Soil and mud engineers (yes, there are mud engineers in the world) sample the returns to determine the mud mixture throughout the process. If the soil has a high concentration of clay, the mixture is pretty lean, if there are a lot of rocks, the mixture becomes very thick, in order to maintain the wall cake.

Trouble under the river

After progressing 1,000 feet, the electronics in the boring head had a problem. The only way to correct it was to bring the pipe back out of the hole, fix the problem, and start over again. While this is a difficult situation, it is also not unusual. As a matter of fact, the crews had to "trip out" of the hole on four different occasions due to various problems. But after 3,200 feet, they met their match.

While a five-inch outside diameter steel pipe is rigid, after placing approximately 2,000 feet in the river, it becomes very flexible. Think of pushing a rope: The shorter it is, the easier it is to push. As the rope lengthens, it bends, and can no longer be moved in the desired direction. To keep the pipe rigid, it became necessary to place another 10-inch diameter pipe over the original 5-inch pipe. This pipe was pushed approximately 1,000 feet into the river to act as a guide. By doing this, the boring process, in effect, can re-start 1,000 feet into the river, thereby improving the chance of keeping the bore in line.

Throughout the project, small pockets of gravel were encountered in the river. This caused the project to go more slowly than anticipated. After boring 3,200 feet, the boring rig encountered large gravel. When large gravel is encountered, it can bind up the boring machine. That can mean two things. First, the boring rig must once again trip out of the hole and all the work is lost. Second (and most worrisome), is that the boring head gets stuck and has to be abandoned. If this happens, not only is the entire pipe lost, but so is the boring head. At a cost of $200,000, there was little choice but to try to bring the pipe to the surface, and come in from the Virginia side of

the river. By the time the pipe was pushed to the riverbed, it was now 3,800 feet from the Maryland shore.

Back to Alexandria

After negotiating with the city of Alexandria, crews were able to set up and begin boring to meet in the middle. To alleviate the city's concern over noise, a 20- foot high wall was erected around the work site. Insulation was added to further reduce the noise level. The intent was to push pipe from the Virginia side of the river to the point where the bore had ended. After one week of pushing, both ends of the pipe had met. They were pulled up onto a barge in the middle of the river. Working with engineers from Arnco, who supplied the innerducts and installation equipment, the three conduit innerducts were placed in the pipe, and the pipe was welded together.

The innerduct installation had to be done on a barge in the middle of the river. Three reels of innerduct were loaded on the barge and filled the 3.75-inch inside diameter pipe in each direction, using three Arnco Max Trak duct pushers in tandem. To ensure a successful installation of the three one-inch ducts, Arnco created a specially formulated silicone lubricant. This reduced the duct's exposure to excessive stress that comes from such a tight installation. The remaining portion of the pipe was buried (after obtaining the proper permits) in the river using a technique called "jetting." Jetting consists of blowing the dirt and silt from the river bottom so that the pipe can sink deep into the muck.

Using an Arnco Products Air Trak, Jones placed 2-192 count fibers in the pipe. The Air Trak actually uses compressed air to blow the fiber through the innerduct, while simultaneously pushing it. This cable placing technology made for an easy ending to a difficult job. After six weeks of work, it only took 40 minutes to blow each fiber through the innerduct. Manholes were set on both sides of the river, and the fiber was pulled to telephone poles for splicing. Once the project was finished, Jones rebuilt and re-sodded the park, making it more attractive than it had been before work began.

With all that fiber, and the coverage area served by the network, Jones is now in the business of voice, video and data without dependency on other providers. In addition, more revenue opportunities exist for leasing bandwidth, dark fiber, and even conduit.

Tom Gorman is senior director of engineering for Jones Communications of Maryland.

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Blowing dirt and debris from the pipe.

JONES
COMMUNICATIONS

Mr. Mickey Redwine, President
Dynamic Cable Construction, Inc.
Rt. 3 Box 3253
Ben Wheeler, Texas 75754

December 18, 1998

Dear Mickey.

Jones Communications of Maryland has had an ambitious plan to construct a major fiber network in the Washington, DC metropolitan area. When we were faced with the task of connecting Alexandria, Virginia with Prince Georges County, Maryland, we had quite an obstacle in the way; the Potomac River. With the help of Dynamic Cable, our goal was realized.

I wanted to take the time to thank you for the tremendous effort put forth by you and your team. A 6800' directional bore is obviously no small undertaking. Frankly, I wasn't so sure we weren't biting off more than we could chew. When Dynamic arrived, it was obvious we were in good hands. The skill and professionalism displayed made me (and the company) confident that the job would get done. From setup to breakdown, your team truly made an almost impossible job seem easy. Even when the river bed wouldn't cooperate, there was never a doubt about attaining success.

More importantly, and not to be overlooked, was the personal attention (OK, hand holding) you gave me and my staff throughout the project. You and your team were available to meet and give updates at a moments notice throughout the project. You brought in the right team and the right equipment to get a difficult job done. I am forever grateful.

You can be certain that if ever I need to get a major directional boring job done, you'll be the first to get the call. If you ever need a reference, please feel free to use me.

Very Truly Yours,

Thomas J. Gorman
Senior Director of Engineering
Jones Communications