

NAWCAD SCMS and the U. S. Air Force 480 ISRW (Beale Air Force Base)



About the NAWCAD SCMS and the Air Force 480 ISRW

Naval Air Warfare Center Aircraft Division (NAWCAD) Special Communications Mission Solutions (SCMS) develops and delivers C4ISR* solutions for the warfighter for Joint Intelligence Systems, Crisis Response & Interoperable Communications, Mobile/Deployable C4 Integration, Network Engineering & Operation Centers, and Special Operations Forces Direct C4*. SCMS has specialized in C4ISR system design, development, and sustainment for over 30 years. It is a Department of Defense Working Capital Funded (DWCF) government organization whose mission is to provide the warfighter with best value solutions to meet real world mission requirements. SCMS is a rapid capability engineering and integration service provider that is often tasked with QRC* development including prototyping and testing of Top Secret/Sensitive Compartmented Information (TS/SCI) communications packages. As a government service organization, SCMS understands Federal, Department of Defense, and Intelligence Community constraints, and collaborates routinely with the 480 ISRW* and its global stakeholder groups and squadrons and was uniquely positioned to assemble the specialized team for this project. SCMS was tasked with engineering C4ISR solutions for next generation facilities at Beale Air Force Base.

A division of the United States Air Force, the 480 ISRW is a regionally and globally networked enterprise with cyber and information warfare responsibilities.

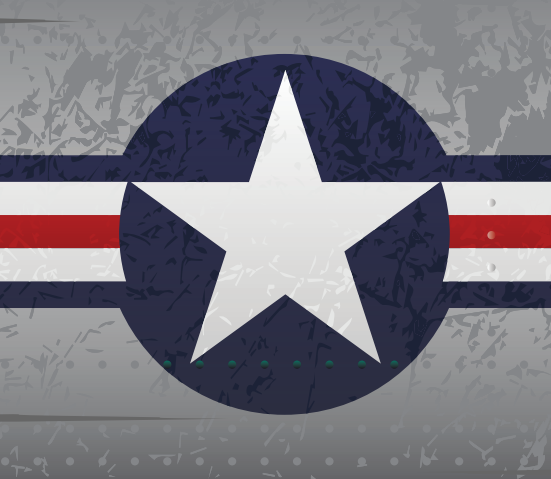
* 480 ISRW: 480 Intelligence, Surveillance and Reconnaissance Wing

* C4ISR: Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance.

* C4: Command, Control, Communication, and Computers

* QRC: Quick Reaction Capability

PANDUIT®

**Company**

Air Force ISR Wing

Country

United States

Industry

Government/Military/Intelligence
Community

Business Challenges

Create fixed infrastructure with bandwidth scalability sufficient to support increasing bandwidth to the desktop and increasing number of desktops with lengths up to 165m.

Panduit Solution

OM4+ Signature Core™ Fiber Optic
Cabling Systems

Business Benefits

Fixed network infrastructure that supports bandwidth requirements that are increasing by orders of magnitude over the foreseeable future. By avoiding the replacement of fixed infrastructure, the Wing is better positioned to field new capabilities at the speed of operational relevance.

Delivering the Ultimate in Reach and Performance

Panduit expertise enables 400G performance, supporting the ability to field capabilities at the speed of operational relevance

Business Challenges

Historically, the military environment has fielded systems one at a time with each system bringing its own network infrastructure and cabling. This resulted in a network fixed infrastructure that was not capable of scaling up to meet the requirements of the new systems being planned and incapable of supporting the known enterprise data and cloud services data transport capacity challenges.

As the 480 ISRW began planning a new infrastructure to support increasing bandwidth needs at Beale Air Force Base, they turned to the Special Communications Mission Solutions (SCMS) to engineer C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance) solutions for next generation facilities.

Future proofing the network infrastructure was a critical component of minimizing planning and execution delays in fielding new system capabilities. The evolution of network, server, and desktop virtualization technologies indicated that the Wing would need bandwidth to the desktop that supported levels at 100x their current activities. SCMS asked Panduit to partner in developing and implementing a communication solution capable of state-of-the-art data transport scalability to meet 480 ISRW needs for the next 15 years.

Several key functions drove the bandwidth need for the 480 ISRW:

- Deliver 4K real-time full motion video to the desktop
- Host enterprise data and cloud services
- Provide analysts access to externally hosted enterprise data and cloud services
- Support an increasing number of desktop devices with increasing bandwidth
- Support for Multi Domain and Joint All Domain Operations Command and Control
- Support reliable and assured communications to provide vital real-time battle space awareness and other intelligence and surveillance

These rigorous demands included establishing the architectural foundation for tackling bandwidth scalability challenges. The network fixed infrastructure could provide a cost-effective and reduced risk migration path while reliably handling high data rates inside the data center, to the local desktop, and also providing access to enterprise data and cloud services even at peak workload.

The 480 ISRW was especially concerned with stress on the physical layer of its existing network infrastructure. It needed the flexibility to expand and change layout options to accommodate the high-speed data requirements of its customers from several different arms of the military and intelligence community. It also included complex channels with a high number of interconnect points that pushed the limits on length.

Along with the pressure to lower capital and operating costs, the 480 ISRW required that its infrastructure investments would last longer than previous generations. This new network infrastructure had to meet current high-performance and reliability requirements as well as be able to scale to handle future data rates and capacity demands for at least 15 years.

In addition, the data center network infrastructure had to meet a variety of Federal, DoD, ODNI, and Air Force requirements for critical fixed infrastructure, including 10 U.S. Code § 2926 Operational Energy Strategy and related US Code Requirements; Federal Critical Infrastructure Requirements; ODNI Data Center Requirements; Intelligence Community Information Enterprise Requirements (IC IE); Air Force Mission Critical Facilities Engineering Standard (AF MCFES), which requires ANSI TIA 942A, Tier 3 Design Standards for this particular infrastructure; and ISR mission system performance and availability requirements.

The solution required the selected infrastructure supplier to participate in onsite testing after the install to verify the stated performance.

The objective was to develop an advanced next-generation data center architecture with a higher number of connectors in the channel to simplify moves, adds, and changes by increasing the design options for technology growth in existing and new installations.

Early in the design phase, the solution development team that included Air Force and SCMS civilians visited Panduit to receive an overview of Panduit's OM4+ Signature Core™ Fiber Optic Cabling which was designed to increase channel length at high data rates. The solution design team followed up with Panduit after the meeting with an opportunity to visit one of their primary communications hubs at Langley, Virginia to demonstrate the capabilities of the OM4+ Signature Core™ Fiber Optic Cabling.

Test Phase at Langley

Panduit was asked to demonstrate that it could consistently pass 100G traffic on lengths up to 125m at the Langley facility. Since the 480 ISRW was concerned about channel reliability of mission-critical systems, the goal was to test randomly chosen long links and verify error-free data communications. Centered around OM4+ Signature Core™ Fiber Optic Cabling, Panduit also used readily available components:

- HD Flex™ High Density Fiber Enclosures
- HD Flex™ OM4+ Cassettes
- Multiple colored OM4+ fiber trunks to identify different networks
- PanMPO™ Fiber Connectors which allow quick polarity and gender changes
- Colored keyed LC patch cords to inhibit connecting to the wrong network

The testing was done with state-of-the-art lab equipment provided by Panduit that could measure the Bit Error Rate (BER) in addition to insertion loss (IL) to fully ensure the data packets were successfully being passed over a significant time period. The testing certified error free transmission of 100G over four parallel fiber lanes for distances up to 246m. Based on the success at Langley, Panduit was selected to participate in the solution development team for the Next Generation Hub facility at Beale Air Force Base.





Innovative Custom Products at Beale AFB

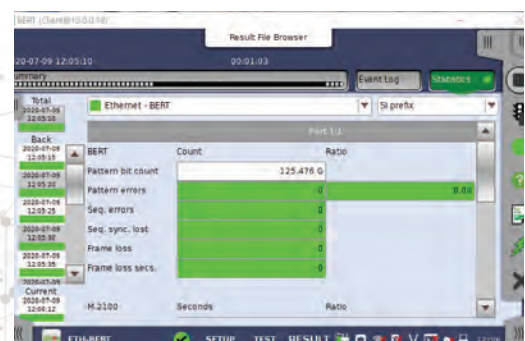


During the design of the NextGen Hub, the Wing made it known that the location of the workspaces in the command center would be reconfigured often, in support of rapidly developing mission requirements and evolving ISR tradecraft. After visiting the facility and collaborative consultation with other solution development team members from SCMS and UT Services, Panduit engineers developed several custom products to meet the specific needs of this NextGen communications Hub. These included a multi-user telecommunications outlet (MUTOA) solution with cassettes and a payout reel to allow agile user workstation movement. Panduit also provided a system that allows the in-floor-zone-box patch panel to tilt, giving better access to the panels and providing easier trunk installations/changes of multicolored keyed trunks. As a result, the communications Hub had maximum flexibility in its layout along with the highest performance speed and data integrity.

One of the unique challenges in this environment is the high number of different networks and data classifications. The Wing required 15 different color-coded cable jackets and extensive use of connector keying for easy identification of the various networks and classifications coupled with enhanced data security. Panduit specially manufactured unique colors to support these requirements. It is uncommon for companies to request 15 colors because they typically do not have this many networks and classifications. Panduit was able to quickly deliver the new colors per the request.

Side-by-Side Testing of OM4+ and OM5 at Beale AFB

Always on the lookout for the highest performance possible, SCMS and the Wing wanted to learn if newer OM5 multimode fiber optic cable would offer longer transmission lengths and better future proofing than OM4+ Signature Core™ Fiber Optic Cabling for the new Common Mission Control Center (CMCC) facility. Panduit proposed OM4+ Signature Core™ Cabling rather than its OM5 cabling because Signature Core™ Cabling offers a better price and the same reach length. In addition, OM5 is designed to be used with SWDM transceivers which are not ratified for multimode transmission by the IEEE. To determine which solution would best accommodate its needs, the Wing conducted a live head-to-head test between another company's OM5 fiber optic cabling and Panduit's OM4+ Signature Core™ Multimode Fiber Optic Cabling. The test channels for both products were installed by another solution team member, Walker Telecom, to make sure this was a fair comparison. The channels included duplex LC patch cords, MPO trunks, and patch panels. The results showed that when used with common single wavelength transceivers such as 100G-SR4, Panduit's OM4+ fiber optic cabling significantly outperformed the OM5 fiber optic cabling and achieved a maximum reach of 505m. Tests with the multiple wavelength SWDM transceivers showed little difference between the two cabling types. Based on this testing and the lower cost of OM4+, the USAF awarded Panduit with the CMCC data center, but also required BER testing to verify the performance once this site was finished.





SCMS concluded that

“at half the cost of a single mode fiber optic channel, Signature Core™ Multimode Fiber Optic Cabling has provided us the ability to implement state-of-the-art architectures and expand the layout options. We now have the reliability, flexibility, and future-proofing that we were previously missing.”

400G Testing Passes at 400m

To verify that all projects would meet the requirement for being future proofed for a minimum of 15 years, the Wing asked Panduit to conduct another round of onsite testing at their West Coast Communications Hub. However, this time it would be at lengths up to 165m and data rates up to 400G. Given that the design called for channels with up to six different connection points to allow for easy moves, adds, changes and that the IEEE specifies a maximum reach of 100m over OM4 for just a 2-connection point channel, this is one of the most difficult applications possible.

To test the installation, Panduit brought commercially available 100G-SR4, 100G-BiDi, and 400G-SR8 transceivers, Cisco 100G switches, and the recently released Viavi 400G tester. As with previous tests, Panduit used precision lab test equipment to measure BER and IL. After testing the channels at 100G and achieving passes up to 350m with the 100G-BiDi, that testing was stopped to start the more stringent 400G tests. Initial tests started with just a couple of connection points at 157m, but after successive passes a maximum reach of 400m with six connection points was attained. To make sure this performance was indicative of real usage, the test channels included runs from the server cabinet to the switch cabinet to the operations floor analyst desktops and back again. This was the first known test of 400G in a customer data center and validates that Panduit's Signature Core™ Fiber Optic Cabling gives the USAF an extended usable life by providing a cost-effective path to 100G and 400G Ethernet, 128G Fiber Channel and beyond.

"The Facilities Program Manager challenged my team to design a 30-year network infrastructure to match their 30-year facility plan. We decided to partner with Panduit to achieve this," said Edwin Tirona, president of UT-Services. "When the onsite testing revealed 400 GBs at 400 meters, I knew we had exceeded the goal using Panduit SignatureCore fiber. Simply put, no other multi-mode fiber available today can perform consistently at that level. We are now ready for whatever the Weapon and C4ISR Mission Systems folks can dream up."

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Panduit Total Solution at CMCC

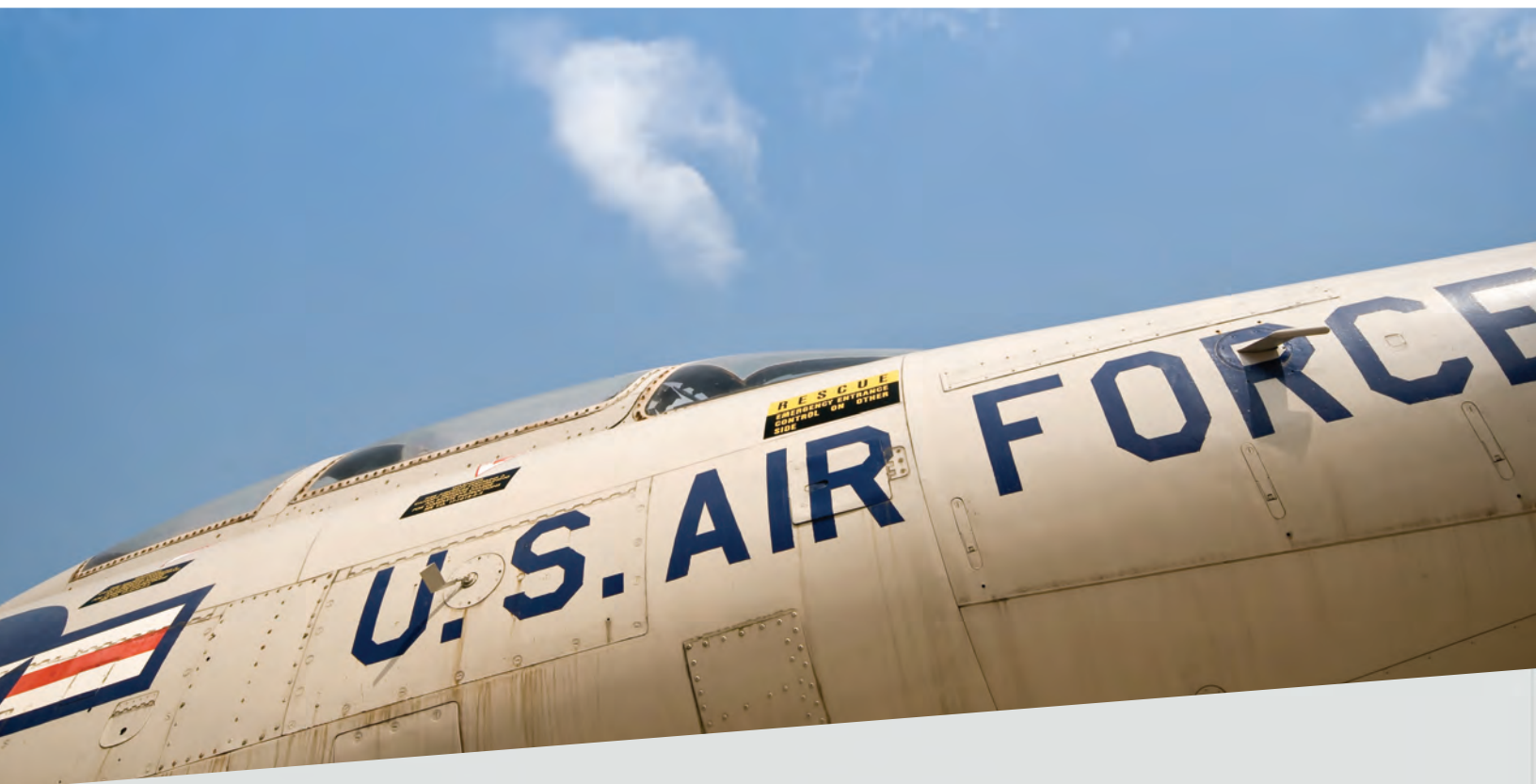
- HD Flex™ Enclosures and Cassettes
- Singlemode and multimode trunks, interconnect fiber cables, and patch cords
- PanZone® Raised Floor Enclosures
- J-Pro™ Cable Support System
- FiberRunner® Cable Routing System
- Self-laminating label cassettes

SCMS solution team, composed of members from Facina Global Services, CACI, BAE Systems, and UT Services, worked with Panduit to do the 100G and 400G testing of the installation to verify the 165m reach could be met.

Business Benefits

SCMS concluded that "at half the cost of a single mode fiber optic channel, Signature Core™ Multimode Fiber Optic Cabling has provided us the ability to implement state-of-the-art architectures and expand the layout options. We now have the reliability, flexibility, and future-proofing that we were previously missing."

Signature Core™ Fiber Optic Cabling seamlessly supports Wing legacy systems and also provides the required scalability for future Ethernet/Fibre Channel application needs. As a result, the Wing can scale up its network components to 400G without needing to rip and replace any of the fixed cabling infrastructure. This provides the Wing the most cost-effective and least risk approach for continually scaling up bandwidth to meet the requirements of the new systems, virtualization and related network changes, enterprise data and cloud services over the next 15 years.



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