US Army Corps of Engineers ®

U.S. Army Engineering and Support Center, Huntsville

Electronic Technology Systems Center

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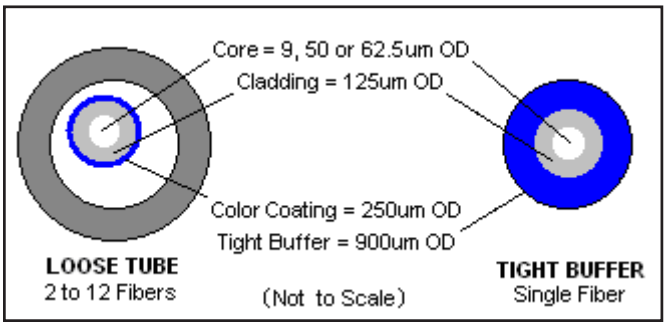
Fiber optic basics: what it takes

By Michael Lewis

Fiber optics is a widely used medium for communications including Electronic Security Systems (ESS), Utility Monitoring and Control Systems (UMCS) and Supervisory Control and Data Acquisition (SCADA) applications.

A basic Fiber Optic System (FOS) consists of a transmitter (Tx), which converts an electrical signal to pulses of light; Fiber Optic Cable (FOC), which carries the light; and a receiver (Rx), which changes the light pulses back to an electrical signal. The Tx and Rx functions may be packaged in the same device called a transceiver. This process can be applied to any protocol or signal format. FOC is preferred because it provides many advantages over wireless and copper mediums. Benefits include long distance transmission, high signal isolation, immunity to lightning, electromagnetic (EMI) and radio frequency interference (RFI) and high bandwidth capability. Because of the higher cost, the FOS becomes cost effective for larger campus environments where copper has distance limitations and for exterior environments, where line transients are a concern and the FOS is more secure and reliable than

See *Fiber optics* on page 3



The color of money: which should be used for system installation?

By Leigh Young

Funding for ESS and UMCS projects can be tricky. Between MILCON, OPA, OMA, BRAC, and all of the other appropriations, it can be difficult to remember what they are and the details for their use. First, let's start with a little general information.

MILCON is the acronym for a Military Construction appropriation. MILCON funds are used on a construction project that exceeds

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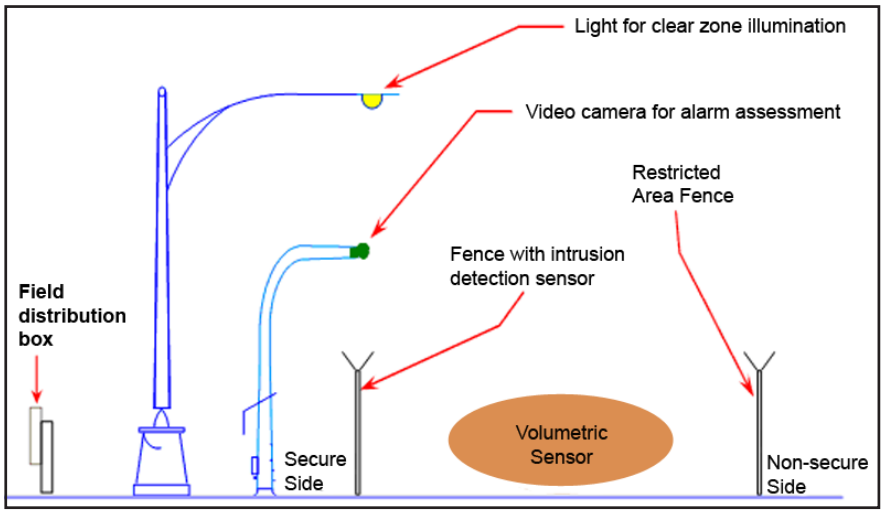
Protecting ballistic missile defense facilities — high priority

By Charles R. Malone

Protecting Ballistic Missile Defense (BMD) assets and facilities is a high priority in the Army physical security community. However, official Army policy for securing BMD facilities is lagging behind ongoing design and construction projects. In August 2008, a draft Army Regulation prescribing physical security policy for safeguarding BMD assets was released for review and comment, but this document has not yet been published. In the absence of official BMD security policy, the Army is currently recommending that AR 190-59, Chemical Agent Security Program, be used as the basis for designing electronic security systems to protect BMD facilities. This approach capitalizes on the extensive knowledge and experience gained through decades of safeguarding chemical agent storage and demilitarization facilities, particularly with respect to perimeter security. Applying "Level A" electronic security measures to BMD facilities provides the earliest possible detection and assessment of intrusion attempts at the site perimeter, thus facilitating a rapid response by security forces before mission-critical assets are compromised. An example "Level A" perimeter configuration is illustrated above.



This is an example of a Level A perimeter configuration.

Applicable ESS and UMCS United Facility Criteria documents

Designers who develop designs for electronic security systems (ESS) and utility monitoring and control systems (UMCS) have to adhere to many design requirements such as the Unified Facility Criteria (UFC) documents. UFCs provide planning, design and construction criteria that are essential in designing a compliant ESS and UMCS. All ESS and UMCS projects will adhere to the following UFCs:

- UFC 3-401-01FA, Utility Monitoring and Control Systems
- UFC 3-410-02A, Heating, Ventilating and Air Conditioning (HVAC) Control Systems
- UFC 3-520-01, Interior Electrical Systems
- UFC 3-580-01, Telecommunications Building Cabling Systems Planning and Design
- UFC 4-020-01, DoD Security Engineering Facilities Planning Manual
- UFC 4-020-02FA, Security Engineering: Concept Design
- UFC 4-020-03FA, Security Engineering: Final Design
- UFC 4-020-04FA, Security Engineering: Electronic Security Systems
- UFC 4-021-02NF, Security Engineering: Electronic Security Systems, with Change 1
- UFC 4-022-01, Security Engineering: Entry Control Facilities/Access Control Points

These documents specify minimum requirements. Therefore, designers should be aware of site specific and local command requirements due to the possibility of more stringent measures that will need to be taken into consideration.

Fiber optics

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wireless systems.

Optical fiber comes mainly in three sizes; Single Mode (SM) with a 9 micrometer (μm) core is used for long range applications, while Multi Mode (MM) with a 50μm or 62.5μm core is used for shorter distances. The core is made of nearly pure glass and coated with an opaque cladding which makes the bare fiber 125μm in diameter and acts like a mirror to reflect the light within the fibers' core. The bare optical fiber is then packaged as loose tube or tight buffered. Loose tubes can contain 2 to 12 color-coded fibers packaged into cables. Options for packaging will be influenced by the environment where the fiber will be installed. Water blocking tape or gel are standard protective features in addition to dielectric members and yarn to provide tensile strength. Metal armor is advised where rodents or other hazards may penetrate the outer jacket. Interior and exterior ratings differ for outer jackets and cables can be ordered with a built-in messenger wire for aerial applications.

Manufacturers classify cables for specific applications such as for plenum ceilings, riser (vertical or non-plenum) installations and exterior Outside Plant (OSP). Restrictions for these classifications are found in the National Electrical Code (NEC). The type will be marked as follows: OFC for conductive (conductors or components inside the cable), OFN for non-conductive and additional markers such as OFCG for general purpose, OFNR for riser and OFCP for plenum. The plenum jacket is flame retardant and required in areas where they are directly exposed to building air circulation pathways. Riser cables are specially constructed so the fibers inside the cable can withstand being hung vertically, but they cannot be used in plenum areas. OSP is more rugged, but cannot continue for more than 50 feet inside a building before being terminated unless it is also rated as riser or plenum.

For MM cable, 50μm fiber has become more desirable in recent years due to greater bandwidth and lower loss per kilometer compared to 62.5μm. Both MM types can carry data up to roughly eight miles powered by a light emitting diode (LED) in the 850 and 1330 nanometer (nm) wavelengths. Connectors and transmission equipment for MM is less expensive and should be used unless the system will be part of a larger SM system.

The upper bandwidth limit for SM fiber cable has not been reached with current technology and can travel unrepeated for over 50 miles. Data transmission equipment for FOC continues to evolve and increase the utilization and capacity of individual strands of fiber. SM transmitters are powered by a laser diode in the 1330 and 1500nm wavelengths. The laser diode is faster, more precise and has a higher output which contributes to the longer range and higher cost for SM equipment.

The total distance capability of either system (MM or SM) is subject to a number of factors. Inherent losses in the FOC, splices, connectors and couplings effectively reduce the amount of light launched into the fiber as it is transmitted from end to end. These variables make up an optical power budget, which is calculated during design to ensure an operational tolerance exists for potential drift and aging of system components. The operational power budget for any Tx or Rx will be listed in its specifications.

Fiber Optic connections are made in several ways. Splices are meant to be long term and may be fusion or mechanical. Fusion uses an electrical arch to precisely melt bare fiber ends together. The mechanical splice uses a friction locking device to hold the two ends together and employs an index matching gel to ensure coupling of the light from one end to the other. FOC may be terminated with connectors by fusion or mechanical splice of a pigtail with a factory finished connector, or by gluing bare fiber inside a connector prior to cleaving and polishing. Factory finished ends can be installed quicker using a mechanical splice built inside the connector. All methods require specialized tools and have drawbacks. Fusion machines are expensive, glued connectors are labor intensive and mechanical splices may not be as reliable in extreme environments.

Connectors provide fiber optic junctions that can be disconnected and reconnected as necessary and come in a variety of types, including FC, LC, SC and ST. While most connectors have been developed and are best suited for certain applications, it is important to match the same type connector for all couplings, interconnect panels and transmission equipment in a system. Any connector type may have options for a polycarbonate, metal or ceramic ferrule. The ceramic and metal ferrules are durable, but more expensive and should be used where connectors are likely to be moved around often.

Color of money

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$750,000. MILCON funds cover all work and materials required to produce a complete and usable facility or a complete and usable improvement to an existing facility. These funds are not to be confused with renovation funds, which can be used for a project that does not add to the area or footprint of the facility or provide for a new feature or system. MILCON projects are extremely sensitive because they are defined by public law and approved by Congress, and they have legislated milestones that must be met. These funds are programmed from a DD Form 1391 and the scope of the project cannot increase beyond the description of the DD Form 1391. MILCON funds are available for obligation for five years.

OPA (or OPN, PMC, OPAF) is the acronym for an Other Procurement (OP), Army appropriation. These funds are appropriated to procure equipment that is not otherwise appropriated for - communications and electronics systems typically fall under this category. These are sometimes referred to as a "tail" when coupled with the DD Form 1391. The description for these funds has to be included or these funds do not get appropriated. OP funds are available for obligation for three years.

OMA (or O&M, OMNG, OMAR, OMN, OMAF, OMMC, etc.) is the acronym for an Operations and Maintenance (O&M), Army appropriation. This appropriation is a yearly fund for the services. These funds may be used for unspecified minor construction with a limit of $750,000. O&M funds are available for obligation for one year.

BRAC is the acronym for a Base Realignment and Closure appropriation. These funds will act like MILCON with most of the same rules and regulations. The exception is usually the period of time the funds are available for obligation.

For the Army, Army Regulation 415-15, Army Military Construction and Nonappropriated-Funded Construction Program Development and Execution, 12 June 2006, is the first place to check for how we can specifically spend our dollars. UMCS equipment is classified as "Installed Building Equipment" and is paid for with MILCON funds. However, from the definition in paragraph 6-2, ESS is classified as "Personal Property (Fixed)". This simply means that electronic security equipment is fixed in place to the real property (facility) but could be removed "without destroying the usefulness of the facilities". Personal property cannot be purchased with MILCON funds. Paragraph 6-12 deals with ESS specifically and refers us to Chapter 7.

Table 7-1, Funding of Information Systems Support Components shows what appropriations can be used to fund ESS components. MILCON can be used to procure and install cables and cable paths. It can also be used to install cameras, monitors, sensors, just about everything. However, end devices must be procured with procurement dollars.

O&M funds are the most commonly used funds to add, update, and of course, maintain ESS projects. Use of these funds for unspecified minor construction is governed by Title 10 of the U.S. Code Section 2805, Paragraph (c). The amount may be up to $1.5 million if the project is "intended solely to correct a deficiency that is life-threatening, health-threatening or safety-threatening" (10 USC 2805(c)(1)(A)).

What if your DD Form 1391 left out all the ESS information? Can you add funds from your yearly O&M allotment? That answer is a resounding, "NO!" Appropriations Law requires that you cannot add to a MILCON facility with O&M funds for two years after completion of the construction. Additional MILCON funds may be available within your command or from your service proponent, and in very rare cases, you can petition Congress for more money. The safest bet is to make sure the MILCON project includes your security requirements.

With all the dollar limitations, you may be wondering how you can get a project estimate when you don't know exactly what you need. Fortunately, there are two Tri-Service tools that are Microsoft Excel spreadsheet-based available for your use and can be obtained from the ESS MCX. The ESS Budget Estimator is a fantastic tool that will give you a workable budget when only the basic data is known. It will split out separately the MILCON and OPA costs for the project and is a great tool for DD Form 1391 preparation. If you need a more detailed cost estimate, the ESS Cost Estimator will let you specify details — sensor numbers and types, camera numbers and types, etc. This tool comes in very handy during the end-of-year crunch when defining projects for expiring dollars.

Continued on next page

Remember that proper planning leads to a well executed project so get involved as soon as possible. Find a point of contact with your local Directorate of Public Works or Corps of Engineers Resident Office and see what projects are in the planning phase. Make sure your local Provost Marshall is involved in all facility planning, and volunteer to review designs and planning documents.

For more information, please contact your local budget office, Office of Counsel or the ESS MCX.

1.Component	Military Construction Program			2. Date
Army	Physical Security Equipment Budget Estimator Tool			1/16/2009
3. Installation and Location/UIC			4. Project Title	
FT Ready for Duty, USA			ESS Project	
5. Category Code	6. Project Number	7. User Defined	8. User Defined	9. Project Cost
XXXX	123456	N/Aq	N/A	414,932

COST ESTIMATE

System	Supporting Infrastructure	PSE Equipment	Total
Controlled Access Areas	8,689	29,684	38,374
Sensitive Compartmented Information Facilities	75,421	120,001	195,423
Interior Intrusion Detection Zones	0	0	0
Interior Closed Circuit Television Zones	4,345	16,121	20,466
Exterior (Bldg Façade) Access Control Zones	4,212	9,627	13,840
Exterior (Bldg Façade) Intrusion Detection Zones	0	0	0
Exterior (Bldg Façade) CCTV Zones	2,852	3,842	6,694
Perimeter Access Control Zones	0	0	0
Perimeter Intrustion Detection Zones	0	0	0
Perimeter Closed Circuit Television Zones	0	0	0
Biometric Access Control Zones	0	0	0
Thermal Imaging Zones	0	0	0
Video Analytic Zones	0	0	0
Exterior (Bldg Façade) Monitored Door Zones	0	0	0
ACS Local Monitoring Zones	1,492	7,964	9,456
CCTV Local Monitoring Zones	2,985	19,617	22,602
ACS Remote Monitoring Zones	2,985	14,843	17,828
CCTV Remote Monitoring Zones	5,970	48,124	54,093
SUBTOTAL	**108,952**	**269,824**	**378,775**
User Input (only applied to PSE Equipment)			
1. ACF	1	0	
2. Contingency	5 %	13,491	
3. SIOH	8 %	22,665	
4. Escalation	1	0	
User Input (for OCONUS Mobilization/Per Diem)			
5. OCONUS	$ -	0	
TOTAL	**108,952**	**305,980**	**414,932**

Total OP Request	**$**	**305,980.08**
Total MILCON Request	**$**	**108,951.61**

Summary of an estimate created with the ESS Budget Estimator.

Mark Your Calendar

Training opportunities available

ICIDS III System Administrator course in July

The first OPMG sponsored Integrated Commercial Intrusion Detection System (ICIDS) III System Administrator Course was held April 6-10. The second System Administrator Training Course will be held July 20-24. The ICIDS III System Administrator Training Course is designed to provide students with the skills required to successfully operate and manage a functional ICIDS III system. Through lectures, case studies, practical exercises and related hands-on experiences, students acquire the skills necessary for proper operation and management of the ICIDS III, including how to configure and modify their system into a functional state that complies with installation needs. Students will be exposed to and learn to operate the ICIDS III, including a variety of intrusion detection sensors, entry control equipment and CCTV cameras. Recipients successfully completing this training will receive an official certificate of completion. For more information, please contact the course manager at 256-895-1879 or by e-mail at ContactESC@usace.army.mil.

Force protection equipment demonstration in May

The U.S. Army Product Manager, Force Protection Systems (PM-FPS), will conduct Force Protection Equipment Demonstration VII (FPED VII) from May 19-21, at the Stafford County Regional Airport, Stafford, Va.

The event's purpose is to identify and demonstrate material solutions to force protection challenges. Attendees will have the opportunity to observe and talk to vendors of commercial-off-the-shelf force protection equipment. The FPED requires vendors to demonstrate rather than merely display their equipment. Visit the FPED VII Web site at www.fped7.org/ for more information including registration instructions.

While at FPED, please visit our booth and meet the ESC Team. We will be highlighting our ESS engineering and installation capabilities, and we welcome the opportunity to discuss how we can help you meet the security objectives for your facilities.

2009 Training Courses

Electronic Security Systems (ESS) Design Course

April 20 – 24	Huntsville, Ala.
April 27 – May 1	MacDill AFB, Fla.
June 22 – 26	Huntsville, Ala.
July 20 – 24	Bernkastel-Kues, Germany
Aug. 17 – 21	Destin, Fla.

For more information, please call 256-895-1740.

GovEnergy workshop in August

GovEnergy is an energy training workshop and trade show that addresses the difficult challenges of federal energy management. It is supported by numerous equipment manufacturers. Participants will be able to receive professional development and learning through technical training in various tracks, visit equipment manufacturers' booths, discuss best practices with nationally recognized energy experts and earn education credits and training certificates. This event is open to federal agencies and will be held Aug. 9-12, at the Rhode Island Convention Center in Providence, R.I. Please visit our booth and meet the UMCS team.

For more information, visit www.govenergy.com.

ASK MCX!

Q: My district is in the process of building and renovating various buildings such as housing barracks and SCIFs. I just noticed that on our specs it calls for keyless access. After some research I found out that keyless access was mandated by ACSIM in 2004, but it appears no technical guidance has ever come out (UFGSs). Then I also heard that in 2007 it was mandated that this keyless access system needs to be able to use CAC cards.

Do all rooms have to have CAC card access or just the main entrances? We are playing with the idea of using keypad access for the individual rooms in some buildings and for others we plan to use a hotel style card system inside the buildings.

A: We cognitively separate "keyless entry" (as described in "The Army Standard for General Instruction Building [GIB] and Army Continuing Education System [ACES] facilities" and "The Army Standards for Electronic Key Card Access for all Facilities") from electronic entry control systems (EECS) designed to provide physical security features.

Keyless entry systems are synonymous with those "hotel-like" card access systems. Keyless entry systems are intended solely to be replacements for facility management applications. Instead of issuing brass keys to personnel, cards are issued instead. In practice, keyless entry systems do not provide the robust level of protection that a physical security EECS provides. For example, a keyless entry system does not provide "door forced" or "door held" alarms, both of which are required features of an EECS.

EECS are physical security systems designed to strictly control ingress (and egress) for protection level resources. EECS specifications can be found in UFGS 28 20 01.00 10, "Electronic Security Systems." This is applicable to SCIFs and any other areas where strict, physical security requirements govern.

There is no mandate to use CACs for keyless entry. Any provisions for CAC-based access control are strictly relevant to physical security applications. The confusion may be a result from the 2007 issuance of the DoD 5200.8-R that states, "The CAC shall be the principal identity credential for supporting interoperable access to installations, facilities, buildings and controlled spaces." On the surface, this is fairly benign; however, the reality is the document itself provides doctrine and policy for the application of physical security measures (protection of assets).

The CAC can be used as the coded credential in both types of systems (keyless entry and EECS).

ETSC Bulletin needs you for our new section

The ETSC Bulletin has a new section to promote more community-wide idea sharing. We're calling the new section the "View From The Field" and are soliciting ideas, abstracts, and even articles from our eyes-on-the-ground — YOU! If there are problems with the ESS or UMCS at your site or if you've found a neat solution to that frustrating issue, chances are there are others just like you who have the same issues. We want to help spread the word on current events happening from YOUR point of view. Please submit your ideas, abstracts and articles to us via e-mail at Contact-ESC@usace.army.mil. Do not send any site specific ESS "problems" that may be considered a vulnerability to this e-mail address. We look forward to hearing from you and thank you for your help!

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Check us out online:

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UMCS

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Useful Acronyms:

ACP: Access Control Point

ESC: Electronic Security Center

ESS: Electronic Security Systems

ETSC: Electronic Technology Systems Center

MCX: Mandatory Center of Expertise

UMCS: Utility Monitoring and Controls Systems

You can learn more about Huntsville Center and its many programs by accessing online fact sheets.

Find fact sheets on:

Access Control Points

Electronic Security Systems

Utility Monitoring and Control Systems

... and many more!

Check them out at www.hnd.usace.army.mil/pao/factshts.aspx

Who We Are

The Electronic Technology Systems Center (ETSC) is a team within the U.S. Army Corps of Engineers that provides unmatched experience and technical expertise in the specialized fields of Utility Monitoring and Control Systems and Electronic Security Systems.

Located in Huntsville, Ala., the ETSC supports the Corps of Engineers, the Army, other services and various defense and federal agencies. ETSC has hundreds of active projects around the world.

In its technical consulting role, the ETSC performs engineering surveys, develops criteria, reviews designs and conducts special studies and training for a wide variety of customers. For those customers needing "turn-key" project execution, the ETSC provides indefinite delivery, indefinite quantity (ID/IQ) contracts for system engineering, procurement and installation through a seamless, expedited task order process.

Each year the ETSC participates in numerous conferences, symposia, working groups and trade shows to build relationships and influence future development and application of UMCS and ESS technology.

Points of Contact

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