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US ARMY CORPS of ENGINEERS

ELECTRONIC TECHNOLOGY SYSTEMS CENTER

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Volume 2, Issue 3

SYSTEM DESIGN: A FINE ART

Many of our clients are responding to the events of September 11, 2001, with a comprehensive review of their security programs. The first step is the site survey. The key to a security site survey is to document existing conditions, identify security-related deficiencies and develop associated upgrade recommendations. These recommendations are normally accompanied by budgetary cost estimates, a crucial piece of information in the planning process.

The survey identifies what needs to be done; a design effort determines how it will be done.

Fundamentally, the design documents take your survey findings, which include identified deficiencies and subsequently developed functional requirements, and translate them into language that is universally accepted by the construction/installation industry. A design package usually consists of three items:

Plans: Design drawings are a pictorial representation of the finished system. Very simply, they locate components within the facility, define connectivity of the system components and establish the manner in which the components will be installed. Figure 1 shows a typical design detail from an exterior intrusion detection system design package.

Specifications: Specifications define textually various requirements of the project that are not necessarily spatially dependent and therefore not easily represented on a drawing. Specifications will address such items as warranties, software functionality, testing procedures, material requirements and security component characteristics.

Cost Estimate: It always comes down to cost. Therefore, it is always necessary to develop a cost estimate for the project. Once the design drawings and specifications are finished, it is simple to create a bill of materials, assign material and labor costs and produce an estimate of the total project cost. This material is essential to determine the appropriateness of an integrator's bid for a project and to gauge the adequacy of available funds.

In some circumstances, other items are included such as an operational concept that discusses operational issues such as staffing, maintenance and response. A design analysis is also sometimes included in cases where a significant calculational effort is required during the course of the design. This might be the case when building response to a blast or the transient flow of airborne contaminants is of concern.

There are at least two primary reasons for a design package:

1. **Biddability:** If the project is to be competed between two or more companies, basic and consistent project information will need to be provided to the bidders in order to receive directly comparable bids. Without this, you have little hope of being able to easily compare the various bids with exceptions, alternatives and substitutions.

2. **System Performance:** Without at least basic design information, there is no assurance that the resulting system will meet your functional requirements, i.e. do the job you need it to do. The system needs to meet your needs, not the integrator's assessment of your needs.

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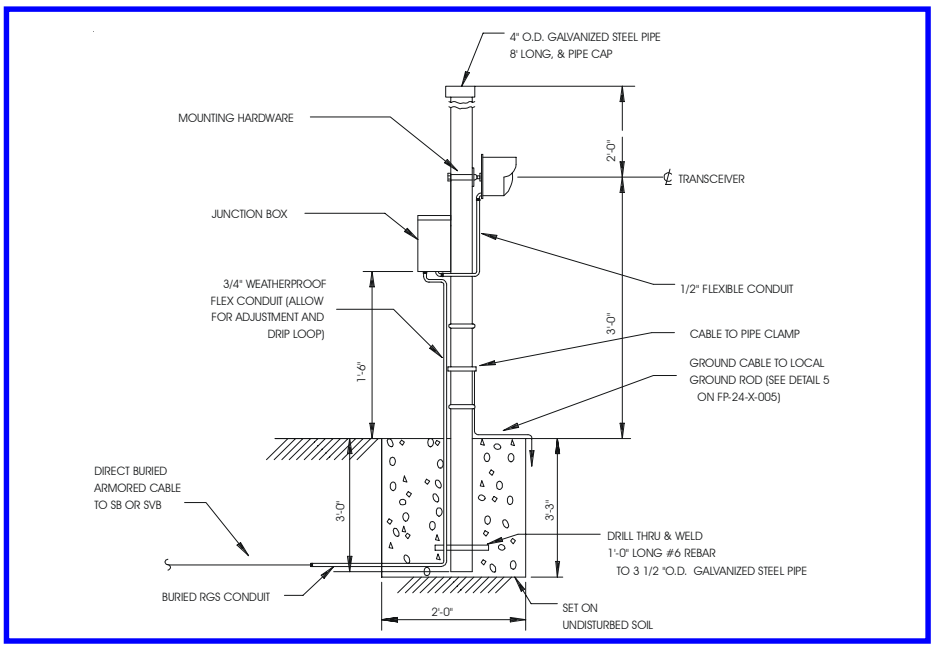

Figure 1. Mounting an exterior sensor on a stable platform requires consideration of numerous items, some recommended by the manufacturer, others based on sound engineering principles. This detail illustrates the amount of information required to do it right.

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At its most basic level, a design package is a floor plan showing the location of key components; at the most advanced, a design package will provide detailed information on how components are actually interconnected including wire size, routing and in some cases color. The design package also tells the integrator what products to use from start to finish. For example, if you have an existing system, there is a real maintenance advantage to consistently using the same type of electric strikes (or door contacts, or request to exit motion sensors, or card readers, etc) throughout the system. The design package is the only tool an end-user has to precisely define what is desired in the final system. Broad descriptions and a reliance on the ability and experience of the integrator will end in disappointment. Finally, a good set of design drawings is of great assistance to the system integrator in the contractually required production of as-built drawings. These as-built drawings, in turn, will be of great assistance to you in future system maintenance, repair and expansion activities. The design effort does add some time, and therefore money, to the project. However, experience has shown that this effort is an excellent investment in terms of the long-term performance of the resulting system.

The system specifications are especially important when it comes to system performance. The specifications should require some sort of final system test before acceptance by the owner. These specifications should include or refer to a set of written test procedures outlining in some detail how each portion of the system will be tested to ensure complete, end-to-end, system functionality. This not only assures the owner of a properly functioning system, it also provides a benchmark against which the owner can compare future system test results. (These test procedures can also be used for periodic functional tests and to test individual portions of the system after any type of maintenance or repair work.)

The specifications are also where the requirements for system operational training are required. A survey was recent conducted among three access control industry leaders about the training that is provided to end users at the completion of an installation. The answer: it depends on the integrator. In other words, if it is not in the contract (i.e., the specifications) it may not happen. In these days where security system management almost requires a database administration background, focused training is essential to long term, efficient system operation.

Let's face it, a security system is like any other building system investment: it takes effort to properly plan and implement. There has been a lot of effort in the last two to three years to shortcut this process in order to get systems installed fast and cost effectively. There has also been a lot of effort in the last year or so to remove these sytems and replace them in a more systematic and methodical process. If you want the system to work well, there is no substitute for a design package.

WHAT'S THIS THING, LONWORKS?

LonWorks is an overall platform of network technologies for use in control applications. Created by the Echelon Corporation, the technology is a widely used standard for interconnecting all types of building automation devices such as thermostats, air conditioning and heating units, electric meters and lighting systems to each other and to the Internet for control and monitoring applications.

The underlying data protocol is LonTalk. The data network processing is done via the Neuron chip, also developed by Echelon. The Neuron chip is used by many product manufacturers as a communication controller; others use it as an application processor. The protocol underlying LonWorks networks and the signaling used by Echelon's power line and free topology transceivers have both been adopted as standards by the American National Standards Institute (ANSI).

More and more companies, including major building automation system manufacturers have incorporated the LonWorks technologies into their hardware and software products. Because the LonWorks technology is an open-protocol (i.e. available to all interested parties), control and monitoring devices from multiple manufacturers can be connected together on the same media for an interoperable system. The technology is being embedded in all types of control applications technologies, all they way down to smart devices, such as lighting ballasts and damper actuators. Also, HVAC systems are now delivered with LonWorks controls factory installed.

Echelon claims there are more than 18 million LonWorks devices built into buildings, homes, factories, trains and other systems worldwide and there have been a number of major LonWorks building automation systems installed in the U.S. at Federal facilities. The flexibility of LonWorks technology and the ability to pass data easily between manufacturers' systems will lead to more multi-vendor projects on sites with multiple buildings or multi-phased projects.

Echelon is a founding member of the LonMark® Interoperability Association, an open industry forum of hundreds of leading manufacturers, integrators and users dedicated to promoting the use of interoperable LonWorks devices. More information is available at www.LonMark.org. Further information regarding Echelon can be found at www.echelon.com.

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A TRUE OLYMPIC TEAM

You are tasked with designing and coordinating the perimeter security for one of the world's largest and most prestigious sporting events. The event entails 2,399 athletes representing 77 nations competing in 78 events.

The project includes securing the perimeter of approximately 102 acres of diverse grounds and will require 19,361 linear feet of chain link fencing of various heights, the installation of 61 separate gates with openings ranging in size from 6 - 24 feet, and the placement of 12,260 feet of concrete Jersey barriers.

The electronic security that will be required to monitor the perimeter includes 75 pan-tilt-zoom dome cameras, 91 light poles, 22,500 feet of strain-sensitive cable sensor, and 49,500 feet of differential capacitance sensor wire.

You only have 90 days to coordinate and finalize the installation of all required equipment and the installation must be completed during the middle of winter.

By the way, 45 days after the completion of the event you must remove all of the fencing and equipment that was installed and restore the grounds so that there is no trace of all of your effort and work.

Sounds like an impossible task, doesn't it? Well the Corps of Engineers secured the Olympic Village for the 2002 Winter Games on time as a result of good planning, sound project management and reliable contract partners. Consequently, the athletes at the 2002 Olympic Games in Salt Lake City were able to focus on the competition, knowing that their safekeeping had been the object of thousands of manhours of prior and ongoing effort.

The Olympic Village for the 2002 Winter Games was located on the University of Utah campus and shared jurisdictional boundaries and buildings with the Fort Douglas U.S. Army Reserve base. The intent of the village was to provide the necessary amenities to Olympic athletes and officials from the moment of their arrival to the conclusion of the Winter Games, all within one secure perimeter. The village area consisted of approximately 275 buildings and checkpoint locations and provided living quarters and

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Figure 1. A portion of the sensored perimeter bordered a busy street. Vehicle penetration resistance was accomplished by mounting the fence on Jersey barriers using specially fabricated brackets.

Figure 2. The snow and need to accommodate specific site features presented challenges not normally encountered in perimeter intrusion detection system design. The sharp angle in the fence shown here was to avoid a horticultural specimen under study by the University of Utah.

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dining halls as well as comfort and convenience areas such as a hair salon, fitness center, and spa area for the Games' participants. The design and installation of the Athletic Village perimeter was led by the Electronic Security Center with support from the Protective Design Center and coordination with numerous agencies including the Secret Service, FBI, DoD, Utah Olympic Public Safety Command (UOPSC), Salt Lake Organizing Committee (SLOC), Fort Douglas U.S. Army Reserve, University of Utah, a multitude of equipment vendors and Olympic sponsors.

The perimeter security aspects of this project were challenging. Not only was the perimeter fence to serve as a delineation between the secure and non-secure areas, it also needed to provide a significant resistance to vehicle penetration. Therefore, as shown in Figure 1, the majority of the sensored fence was mounted on top of Jersey barriers via specially fabricated mounting brackets. The actual configuration of the fence had to be coordinated with a number of parties, especially the University of Utah. The perimeter of the Olympic Village impinged on several University arboretum areas which contained several species of plants under intense research scrutiny. All work in these areas had to be conducted with great caution and University oversight. As shown in Figure 2, this resulted in a non-typical perimeter fence configuration. The terrain of the Olympic Village also created some challenges with regard to CCTV assessment. Unitized pan, tilt, zoom (PTZ) domes, located to accommodate specific fields of view, provided a highly reliable and flexible platform from which to meet the surveillance requirements under these challenging conditions. Finally, a new temporary electrical distribution system was installed to support the new area lighting system required for acceptable video surveillance during nighttime conditions.

Security surrounding the Winter Olympics was particularly focused due to the high profile nature of the Games and evaluated terrorist threat. However, from the time the Corps of Engineers completed final system testing of the installation and commissioned the area to the conclusion of the Olympic (and Paralympic) Games, there was not a single report of a major security breach for the area. This high-profile project was successfully completed as required and on time.