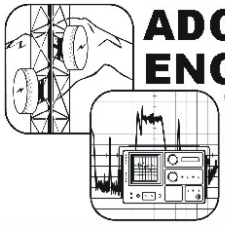
Managing a Systems Integration Project

Management Briefing Number 7

ONE OF A SERIES OF NOTES ON TECHNOLOGY FROM ADCOMM



ADCOMM ENGINEERING COMPANY

Specialists in Public Safety Communications

3929 184th Place SE
Bothell, WA 98012-8827
Voice: 425-821-8827 Fax: 425-488-3952
Web Site: www.adcommeng.com

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MANAGING A SYSTEMS INTEGRATION PROJECT

Managing a Systems Integration Project

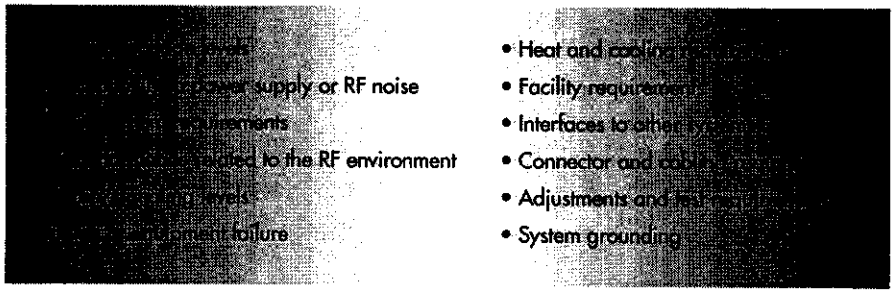
By Joe Blaschka Jr.

When I first started my two-way radio career, things were simple. Most radio systems consisted of a few base stations or maybe a repeater. Many mobile radios were single channel, or at most, four channels. There were a few complex systems in large cities and at some utilities, but even those systems were relatively simple compared to current technology.

In the early 1970s, a considerable amount of federal grant money was allocated for improving public-safety communications. Some big players got into the communications systems business, including Boeing, TRW and Aerospace Corp., along with more traditional two-way radio companies like Motorola, GE and RCA. The aerospace companies had systems engineering experience, but unfortunately didn't understand the two-way radio communications business, so they

An antenna mounting structure was integrated into this historic building built in the 1930s (left). A large microwave system is staged at Harris Farinon (right).

Figure 1: Technical Items to Consider During Systems Integration



didn't remain in this market long. Motorola, GE and a few other companies stuck around, also providing systems integration. In those days, radio manufacturers also supplied most of the equipment needed for a major system, including microwave equipment and site construction.

Over the years, systems integration has changed. As manufacturers narrowed product and business focuses, they had to rely on outside suppliers to provide many of the components required for a complex system. As radio technology evolved, they integrated microwave, multiple sites, computer controllers, data communications and additional sites for increased coverage needs and higher frequency band requirements. And systems are continually becoming more complex.

Buying a large system is often expensive. Someone must design the system, select subsystems and engineer interfaces, handle land-use and zoning issues, monitor installation, assist with system optimization and provide acceptance testing support. These tasks can be done by one of four entities: a major equipment supplier, system owner, third-party integrator or third-party project manager along with the owner. An integrator must have expertise in many areas to ensure a successful outcome.

Understand the Customer

The biggest problem with designing a land mobile radio system is to ensure it satisfies a client's communications requirements. A system can function perfectly, but if it doesn't meet a customer's needs, it won't be successful. An integrator must fully examine a client's requirements for coverage, budget, functionality, capacity, ongoing costs, and operational and maintenance complexity.

Missing the boat on any one of these features can cause a system to fail. Technical personnel often have problems relating to a customer's operational needs, resulting in miscommunications between the two groups. Someone has to interpret operational language into technical language and vice versa.

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Technical Expertise

Anyone attempting to provide systems integration must have the technical expertise to understand the systems being integrated, the interactions and the interfaces. This issue has tripped up many systems integrators. Sometimes a radio system manufacturer's employees who perform systems integration don't understand all the systems and interfaces. A project manager needs to bring equipment suppliers into the process early and have them provide detailed interface information and share what the owner wants to accomplish with suppliers. If possible, obtain all suppliers' "buy-offs" in writing on the contract, which helps spread the risk and eases technical burdens.

Sometimes seemingly simple systems, like power supplies, cause the most trouble. Take nothing for granted. "Poverai no doverai" (trust but verify) should be the systems integration motto. To that end, a project manager should ensure enough time is available for engineering and analysis during the system design phase, so equipment will work together when implemented. The more preliminary work performed, the lower the risk when implementation begins (Figure 1).

Management Issues

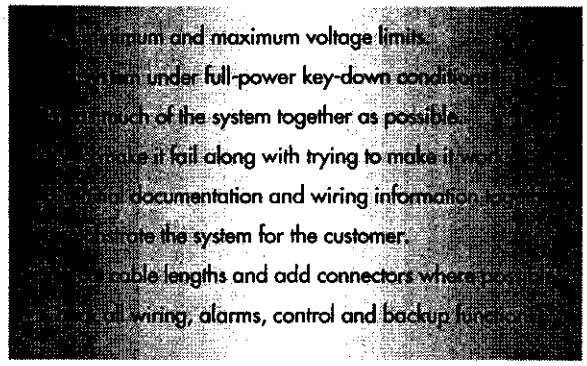
Various issues that need supervision surround a system's design and implementation. A large project requires a considerable time investment. A systems integrator must oversee not only technology issues, but also personnel and budget concerns. Also during the process, the client needs direction.

It is important that standardized work procedures avoid the problem of technicians installing or adjusting in different ways. This can potentially be a major problem when technical people work independently on small systems or individual pieces of equipment. The people involved in implementing a system must function together as a team, or problems will occur down the line. Small operations that use a shoestring management approach often incur problems because the one-person-does-it-all approach doesn't work well for managing large systems.

Staging

Staging is one of the best ways to reduce risk during final installation and is a great tool for demonstrating the system to a client. As much as possible, a system should be assembled at a shop location so it can be connected and tested before it is spread out over multiple sites. Many people mistakenly think that staging is too expensive and blindly hope every-

Figure 2: Items to Consider During Staging



thing works in the field. It is much easier and less expensive to operate a command at one location and determine if the proper action occurs at another location when the equipment is 10 feet apart instead of 10 miles.

If the whole system can't be staged, it should be broken into major subsystems and staged. For example, a large radio system interconnected with microwave could be connected in the shop without the microwave. The microwave instead could be staged at the vendor's location and tested there as a system.

Many wiring errors in the vendor equipment are found during staging. During one project, a power-supply system vendor wired low-voltage disconnect relays so they weren't connected. When the batteries ran down, the disconnect didn't work. Because of the wiring bundle, it wasn't obvious that the disconnect relays weren't connected. This might have gone undetected until some time later when the batteries failed during a power outage. These problems could have been fixed in the field, but would have been expensive and time consuming.

In addition, it always looks better to a client if the system bolts in and works. This may be optimistic, but staging always helps reduce the number of basic problems that need to be fixed in the field (Figure 2).

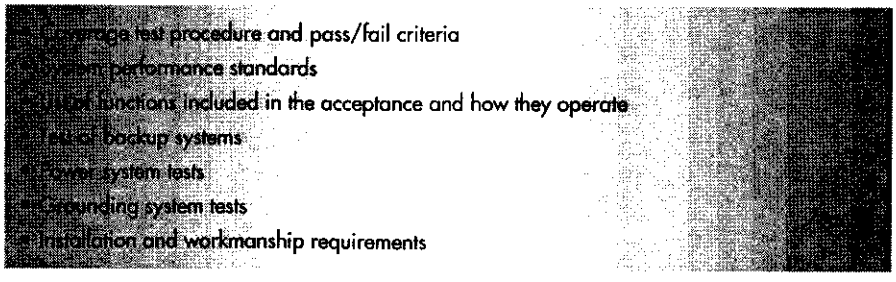
Scope of Work and Acceptance Criteria

One of the biggest problems with most projects is miscommunication between the owner and system supplier on the statement of work, what constitutes a complete system and what constitutes acceptance. If there isn't a clearly written and complete statement of work, you can almost guarantee there will be problems when the system is nearly complete. Problems begin when an owner says, "I thought this or that was supposed to be included," and the systems integrator says, "Don't you remember the conversation we had when we decided this was to be left out because of cost?"

Don't leave anything to memory. Get everything in writing, being as specific as possible. If the scope changes, get a change order. You need a defined set of acceptance criteria for determining when the system is done, on which both system integrator and owner are in agreement. An acceptance test procedure should define the criteria for system acceptance (Figure 3). This should be part of the statement of work and defined early. Failure to do this can result in long delays while the owner and systems integrator argue about if and when the system is finished. The statement of work should also clearly define when installation stops and maintenance or warranty starts, in addition to addressing the following issues:

- Who decides on coverage?
- Who is responsible for permits, land-use applications and fees?
- What happens if a land-use decision changes the design?
- Who should provide power and telecommunications to the sites?
- Who is responsible for warehousing the equipment?
- Who constructs and maintains road and site access?
- Who pays for training costs for the owner's technicians and managers?
- Who is responsible for risks taken?
- Who is responsible for user and field units?
- Who coordinates user equipment installs and training?
- Who decides on required system functions?

Figure 3: Acceptance Test Procedure Criteria



It is important to detail how acceptance tests will be run. For example, how do you test for 95 percent coverage? There are several different methods that can have different results. How will the functions operate? It is best to resolve those issues before testing begins. Systems have gone unaccepted for more than a year because of disagreements between an integrator and owner on some of these issues. In the meantime, the owner holds the final payment, and the systems integrator is out the money. Some owners use this to extract additional work from an integrator.

If you think you can handle the previously mentioned items, then you can probably try your hand at systems integration, which can be fun and technically challenging. Owners often save money if they work with an independent engineering company or small systems integrator and are willing to accept some risk or budget contingency money. Conducting your own systems integration is not for everyone, but the results can be rewarding if done correctly. ***PSR***

Joe Blaschka Jr., P.E., is the principal at Adcomm Engineering Co., a professional communications consulting engineering firm, where he has worked on more than 300 communications system projects. Blaschka has more than 25 years of experience working with communications systems ranging from early IMTS systems to modern wide-area public-safety trunked radio systems. Blaschka is a registered professional in four states and is active in APCO, NENA and IEEE. He can be contacted at (425) 821-8827 or by fax at (425) 488-3952. His e-mail address is j.blaschka@adcomm911.com

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