

## **Changing technologies** [OPPORTUNITIES IN SYSTEMS ENGINEERING](#)

*Systems engineering grows along with technology*

*The discipline is essential to managing huge, complex projects, many related to national defense and/or aerospace*

*The goal is essentially that of most engineering processes: a quality product (in this case a large product) that meets the user's needs*

*By Jon Boroshok  
Contributing Editor*

Rapid-fire technology changes help business become more and more globally competitive. They also boost the demand for systems engineers.

Systems engineering is an interdisciplinary approach to achieving successful systems, says the International Council on Systems Engineering (INCOSE, [www.incose.org](http://www.incose.org), Seattle, WA).

The society for systems engineers aims to promote world-class systems engineering in industry, the government and schools.

The approach isn't easy to explain. It has to do with defining customer needs and required functionality early in the cycle, then integrating ops, cost, schedule and more into a structured development from concept to production to operation.

### **Going farther**

**Cecilia Haskins**, INCOSE information director, declares that "Systems engineering is the best way to turn complexity from a liability to a competitive advantage." She notes that at last year's annual symposium ([www.incose.org/symp2005](http://www.incose.org/symp2005)), all the keynote speakers described their firms' projects in terms of increased distances: going farther into space or farther from the beach or deeper under the surface of the ocean.

Looking at the growing complexity in both technology and organization, **Haskins** sees a rising demand for systems engineers. This, she foresees, will include increased opportunities for diverse candidates. "Our membership right now is about 20 percent women and minorities," she says. "We feel that this must expand to meet the needs of the future."

### **Raytheon's Dr Ellen Ferraro integrates and tests systems**

In Andover, MA, Dr Ellen Ferraro is deputy director of the system validation, test and analysis directorate for Raytheon Integrated Defense Systems (IDS). She's second in command of more than 1,000 people and all aspects of system integration and test, including test facilities, test

equipment development and test engineering.

Ferraro has been with the company for twelve years, working on systems that protect U.S. armed forces and the country's borders. She's been involved in such varied projects as microwave scattering and propagation over the ocean, spread-clutter mitigation techniques for enhanced small-target detection, and the use of expert system technology in counter-drug enforcement.

She has presented more than a dozen technical papers at IEEE meetings and other conferences. "Technology is moving faster and faster. The changes are amazing over the last decade," says Ferraro.

She received her BSEE in 1989 from the University of Massachusetts-Amherst. Her 1994 PhD in electrical and computer engineering is also from U Mass, under a NASA grad student research fellowship. Her PhD research included developing an airborne radar altimeter to investigate surface and volume microwave scattering from the Greenland ice sheet.

Ferraro is a member of IEEE's 2007 radar conference committee. She's an active member of the Boston section of SWE, and received a SWE "distinguished new engineer" award in 1999. She was recently named a "woman to watch in 2006" by Mass High Tech magazine.

"Be willing to do as many different things as possible," is her advice to engineers. "Step out of your comfort zone."

### **Dwight Forbes works on HP's federal government team**

Dwight Forbes is a systems engineer providing pre-sales support for the Hewlett-Packard Co (HP) in Greenbelt, MD. He works on HP's federal government team, which is responsible for civilian agencies in the government. That means any government entity not involved in defense or intelligence, including NASA and even VA hospitals.

Forbes is responsible for technical support initiatives of HP's \$600 million civilian account business. He supports the sales team, helping it find IT solutions, and also represents the company at trade shows.

As manager of the HP center for public sector IT thought leadership, Forbes demonstrates solutions to an audience of senior government officials from the U.S. and abroad. The center is a particular point of pride for him, since he was responsible for pushing to get it designed and built. Now it's a showcase for the company.

Heavy responsibilities, but Forbes is well prepared with extensive program management experience and technical expertise in e-business and wireless solutions. At one point he was a consultant to the White House, helping set up an early e-mail system.

He started down the path to HP in 1980 when he went to work for Digital Equipment Corp (DEC). In 1998 DEC was sold to Compaq Computer Corp, which became part of HP in 2002.

Today Forbes and his team work constantly to meet the demands of customers, and serve as their trusted advisors. The technology is adaptable and flexible, changing with the customer, and the rate of change is speeding up too, he believes.

In 1972 Forbes received an AS in engineering from Bronx Community College of the City University of New York (CUNY). He went on to a BA in communications with a minor in CS from CUNY's City College, and completed the coursework for an MBA in quantitative methods from Fordham University's graduate school of business (New York, NY). He's a graduate of UCLA's African American leadership institute and has trained further in management and structured design and analysis.

Although Forbes travels a lot in connection with his work, he telecommutes from home three days out of ten. This lets him enjoy his new status as a grandfather. He used to think of doing missionary work after retirement, but with the arrival of the grandbaby his plans have changed. "I'm not going anywhere, thanks to my new grandchild," he says.

### **Phillip Hohn is a Six Sigma black belt at ITT Electronic Systems**

Phillip Hohn works for ITT Electronic Systems (Clifton, NJ) as a value-based Six Sigma black belt/lean engineer. ITT Electronics makes systems for airborne electronic warfare and rotary and fixed-wing aircraft.

Lean manufacturing, Hohn explains, is a central component of ITT's value-based Six Sigma effort. His job is to optimize the engineering processes that ensure dependable products for ITT customers. In fact, he wears lots of hats on the job. They help him improve the organization's systems engineering processes to meet Capability Maturity Model Integration (CMMI) requirements.

Hohn is the first INCOSE-certified systems engineer on the ITT team. His job is to "lean out" systems engineering processes to align with Six Sigma philosophy, while ensuring that requirements are managed properly.

He has launched several black belt projects, saving an estimated \$300,000 a year for his company. He's also generated black belt project definition files, mentored new green belt candidates through to certification, and developed value-stream maps for key processes to ensure on-time completion.

A native of Jamaica, Hohn earned his 1989 BSEE at the New Jersey Institute of Technology and a 1991 MSEE at Syracuse University (Syracuse, NY). He has been with ITT for four years, and at Allied Signal for five years before that.

At Allied Signal he worked on a reusable launch vehicle for NASA, and got to visit Cape Canaveral and see the shuttle ops and control room. "It was an awesome experience from an engineering standpoint," he says.

He notes that while ITT is very flexible, work/life balance is still a challenge for him. His

after-hours activities include home improvement and quality time with his five-year-old daughter.

In the future, Hohn would like to become a director of systems engineering. "Since the CMMI requires systems and software to be integrated, people are taking systems engineering very seriously, much more than in the past," he says.

### **Delilah Smith is a senior engineer at Miltec**

At Miltec (Huntsville, AL), Delilah Smith is working on two programs related to national defense: an Air Force missile defense for a high-speed weapons system, and a low-cost Army cruise weapons system.

Smith is a senior engineer. She performs pre- and post-flight test analysis, implements and evaluates guidance algorithms, develops degree-of-freedom (DOF) models, analyzes system performance and supports real-time flight software development.

She likes the challenges of her job. Working in defense, she says, she's constantly exposed to new technology that she might never see on the commercial side.

Smith has been with Miltec for five years. Before that she was at Nichols Research Corp (Huntsville, AL) as a staff directorate manager, working with several missile systems. She scheduled tasks and budgeted hours and dollars, and also did simulations, mechanization, implementation and evaluation of guidance loops, plus hardware-in-the-loop testing and pre- and post-flight analysis.

She earned her 1982 BSEE at the University of Alabama and a masters in math at Alabama A&M University. Her original plan was to teach math, but after graduation she went into defense engineering instead. She felt that as one of few women in the industry, she would have more opportunities. She's found that to be the case, although "There's still a lot to be desired in this industry from a female and minority perspective."

Smith is a member of Women in Defense (WID, [wid.ndia.org/horizon/](http://wid.ndia.org/horizon/)), an affiliate of the National Defense Industrial Association. She also mentors for NBSE. She enjoys traveling and exploring new cultures and backgrounds, for work and on her own.

### **Irma Contreras engineers aircraft products at Woodward**

Irma Contreras is a product development engineer for Woodward (Rockford, IL). Woodward designs, manufactures and services energy control systems and components for aircraft and industrial engines and turbines. Contreras works on the General Electric aircraft account, guiding specialty valves and other components of aircraft engines from design through certification.

"As a kid I watched my father do mechanical and electrical work around the house, and I wanted to do it, too," she says. While working for her 1998 BSME at Northern Illinois

University, she did co-ops involving machine and IE time studies.

She met a Woodward recruiter at an on-campus career fair, and has been with the company since graduation. She's moved from staff engineer to product engineer with the GE team. "Starting out as a staff engineer you get familiar with everyone in the group," she says, and their cooperation made the transition easy.

Her proudest achievement is her work/life balance, interfacing with her team on the job and her family at home, including a child of three and a baby.

### **Matthew Ittycheria manages STSS at General Dynamics C4**

Matthew Ittycheria is a manager of the integrated product team for space tracking and surveillance systems (STSS) at General Dynamics C4 Systems in Gilbert, AZ. He has thirty-six years of engineering experience, all but ten of them in spacecraft systems engineering for geostationary, medium and low-earth orbit (GEO, MEO and LEO) applications.

He started his present job in 1999 at Spectrum Astro, which was later acquired by General Dynamics.

General Dynamics C4 is involved in the STSS program for the U.S. Air Force as a subcontractor to Northrop Grumman. Ittycheria and his group analyze the design and building of spacecraft, and he expects his team of twenty-eight people to double when production starts next year.

Before joining Spectrum Astro he spent four years at Motorola in Chandler, AZ. He led the systems engineering team that procured spacecraft for the Teledesic program, a 126-satellite LEO constellation designed to provide broadband Internet access, and wrote the primary technical procurement document for the spacecraft. Unfortunately, the system never became operational.

Ittycheria earned his BSME at Madras University (Madras, India) in 1969, and completed an MSME at Cornell University (Ithaca, NY) in 1979. He started in the space business with RCA right after grad school.

He enjoys working in the industry. "Space is a challenge," says Ittycheria. "There's enough problem-solving and cutting-edge technology to keep any techie happy." Right now he's eager to see his current STSS project up in space, which should happen in the next five or six years.

Ittycheria doesn't expect any major changes in systems engineering for the space industry. After all, the industry is nearly fifty years old now. It's mature and well established, he says thoughtfully.

### **Tiffany Epps: Northrop Grumman geospatial analyst instructor**

Northrop Grumman's Tiffany Epps is a systems engineer. Her company contracts her out as a geospatial analyst instructor at the National Geospatial Intelligence Agency (Fort Belvoir, VA). She has more than eight years experience as a geospatial analyst, and has been teaching the subject for five years.

Her skills include project planning and management, implementation and production, and she's experienced with the remotely sensed imagery/geographic information system (RSI/GIS). She also has a high-level top-secret clearance and is a Department of Defense (DOD) certified instructor.

As a geospatial analyst instructor she trains DOD civilian and military students to create geospatial products using a variety of systems. She also trains newly integrated geospatial and imagery analysts in GIS, and recently served as a liaison between the Defense Geospatial Intelligence Agency and the Federal Emergency Management Agency (FEMA). Currently she's training analysts who will support military ops overseas.

It's interesting work for an instructor, as class participants range from absolute beginners to experts. Classes typically have twenty-five to thirty students and run from a week to four months.

Epps got her start fourteen years ago in the U.S. Army. Her military work put her on a career path in systems engineering, and she's currently completing a BA in business management at Strayer University (Woodbridge, VA).

She's also an instructor in the Army reserves, and a member of the Army Engineer Association.

### **Deanna Witzel does systems design at WorleyParsons**

Deanna Witzel has been a technical specialist/systems engineer at WorleyParsons (Reading, PA) for almost six years. The company provides professional services to the energy, resource and complex process industries.

Power is one of the industries that WorleyParsons serves. Witzel is in wastewater and cooling-water handling, developing engineering reqs and specs, creating piping and instrumentation diagrams, and calculating pump and pipeline sizing and pressure drops.

She's also responsible for reviewing vendor drawings of major plant equipment, including combustion turbines and heat-recovery steam generators. Her systems experience includes design calculations, equipment specification, materials selection and technical coordination with vendors.

Witzel received her BSME from the University of Michigan college of engineering in 1992. She started out in manufacturing, and had been an application engineer for eight years before

joining WorleyParsons.

"Up to then I really hadn't done anything I learned in my favorite classes at college," says Witzel. "Now I'm using everything I know and always learning something new." She also uses management and leadership skills honed in Air Force reserve officer training.

She likes interacting with various disciplines, clients and vendors, and being part of a team working toward a common goal. She definitely prefers solving problems through people rather than on a computer, she notes with a laugh.

"There are so many pieces of the puzzle," says Witzel. "It's hard to make everyone's agenda work and meet their needs." But she's succeeding very well, and her supervisors and local management have recognized her potential.

"There are only a few women in management in our Reading office, especially in technical areas," Witzel says. "I'd like to change that."

D/C

Jon Boroshok is a freelance writer in Groton, MA.