Update

Newsletter for ISA Certified Control Systems Technicians® (CCST®)

August 2006

In this issue:

CCST of the Month:

Peter Elliot, CE, CCST

Peter Elliott is a licensed marine engineer with a long list of credentials. In 2004, he added ISA's Certified Control System Technician® (CCST®) to the list after learning about the program in an automation control systems training course.

"ISA mirrors many of the international and government standards that marine engineers must meet in order to perform our jobs," said Elliott. "The ISA certification was a natural extension of my continuing education and training."

A 30-year career veteran, Elliott is currently working for Matson Navigation Company's government services division as chief engineer on a U.S. Department of Defense ship stationed in the western Pacific. He is responsible for managing all facets of mechanical operation, propulsion systems and maintenance for the 45-year old steam-propelled vessel. He supervises a 15-person crew including six engineers, one electrician and one communications officer, and, in conjunction with shore-based engineers, he administers a $3 million-$5 million annual budget.

"We are basically a floating power plant with a 19,000-horsepower steam propulsion system and all the associated support auxiliaries," he said.

Elliott's credentials include an active secret security clearance. The exact location, cargo, and mission of his ship at any given time are classified information.

Matson Navigation Company is the principal carrier of containerized freight and automobiles between the West Coast and Hawaii, Guam, and Mid-Pacific. Founded in 1882 and incorporated in 1901, it is the largest subsidiary of Honolulu-based Alexander & Baldwin, Inc.

Elliott works on a 120-day on/off rotation for the Oakland, Calif.-based company. When not aboard ship, he resides in Carrabassett Valley, Maine.

Prior to joining Matson one year ago, Elliott worked three years for APL/Patriot Government Services. In this position, he supported the U.S. military operations in Iraq, working aboard a class of ships known as LMSRs (large, medium-speed, roll-on/roll-off ships) which transport heavy brigade equipment and combat support.

Elliott is a member of the Marine Engineers Beneficial Association (MEBA), a maritime union established in 1875 and the primary source of marine engineering officers for companies such as Matson.

A course instructor at MEBA's training facility, the Calhoon School in St. Michaels, Md., encouraged Elliott to pursue the ISA CCST® certification.

"The ISA certification was a natural extension of my continuing education and training."

ISA established the CCST® program in 1995 to recognize and document technicians' knowledge, education, and experience in instrumentation, measurement and control. The program was developed in conjunction with the Instrument Technicians Labor-Management Cooperation Fund, the Instrument Contracting and Engineering Association (ICEA), the International Brotherhood of Electrical Workers (IBEW), and the United Association of Plumbers and Pipe Fitters (UA).

The CCST® program offers three levels of certification with varying education and experience requirements. Level I requires a minimum of five years of education, training and/or work experience. Level II requires seven years of education, training and/or work experience with at least two years in instrumentation/measurement and control. Level III requires 13 years education, training and/or work experience with at least five years in instrumentation/measurement and control. CCSTs must renew their certification every three years. This is accomplished by earning Professional Development Points (PDPs) by working, training, and continually gaining knowledge in the field.

The CCST® program covers seven performance areas or domains: Calibration, Loop Checking, Troubleshooting, Start-up, Maintenance/Repair, Project Organization and Administration.

Continued on page 2.

Hazardous Gas Detection for Homeland Security

By Tadeusz M. Drzewiecki, Joseph M. Iseman, and Nagaraja Yaddanapudi

Simultaneous, continuous, real time, measurement, monitoring, and control of gas mixtures are ubiquitous requirements in science and engineering and more recently in safety and homeland security applications. Property-based gas analysis for ternary gas mixtures (gases in groups of three) first saw applications in the 1990s. Since then, numerous applications (mainly in the medical field for measuring respiratory gases) are ternary, such as oxygen (O2), nitrogen (N2), and carbon dioxide (CO2).

Scientists handled the presence of water vapor, a fourth gas, as a known concentration constituent in a saturated state because we measure the temperature as part of the gas analysis scheme. However, we quickly realized a system that could assay four gases would have much broader applicability. We could thus monitor anesthetic agents, such as halogenated hydrocarbons in combination with nitrous oxide.

The four gases are oxygen, carbon dioxide, and the simultaneous two agents. Four-gas mixtures, as it turns out, also cover the great majority of cases industrial applications encounter. Typically, a hazardous gas will appear in the air with some water vapor content. In general, we can treat air as a single gas. Thus we can analyze air, water vapor (humidity), and the two other gases. We must treat air, however, as a three-gas mixture of oxygen, nitrogen, and carbon dioxide when analyzing gases in the presence of combustion or other reactive processes that can cause the oxygen and carbon dioxide levels to vary.

The continuing concern over expedient use of readily available chemicals in terrorist scenarios has raised the issue of hazardous gases monitoring to far greater levels of importance than just its economic and technical aspects. The main problem for conventional specific gas monitors, however, is knowing what sensors to implement for which hazardous gases. Most commercial-off-the-shelf (COTS) monitors may handle as many as six gas species, often with some overlap, but when the number of possibilities is in the hundreds, acquisition costs become prohibitive, either from the standpoint of the number of sensors used or the expense of total assaying devices, such as gas chromatographs.

Such a system—that could rapidly, accurately, and with appropriate sensitivity respond, detect, and warn of an occurrence of a chemical incident within enclosed spaces, such as buildings and transportation facilities—would be a valuable tool. Chemical threats in lower concentrations, such as those posed by chemical warfare agents that include blood, vesicant, nerve, choking, and blister agents, pose a resolution problem that the property-based approach is not geared for at the levels in which they may appear in the atmosphere. However, these gases may be concentrated by as much as a factor of 100, merely by removing oxygen and nitrogen from the sample, so now we can examine the 1ppm at concentration levels of 100 ppm.

A low-cost, property-based, universal gas sensor-analyzer system can be the basis for a threat detection and identification system that could meet government and industrial goals of both low-cost acquisition and operation and high performance by responding to concentration levels of gas species designated to present hazardous toxic doses to human potential that cause acute immediate danger to life and health and exceed permissible exposure limits.

About the Authors

Tadeusz M. Drzewiecki, Dr. Eng., is president and chief executive of Defense Research Technologies, Inc., a developer of fluidic sensors and control systems under government grants and contracts from the Department of Defense, National Institutes of Health, and Department of Energy, in Rockville, Md. **Joseph M. Iseman, Ph.D.,** is senior scientist, and **Nagaraja Yaddanapudi** is senior mechanical engineer.

Ultrasonic Gas Measurement

The use of ultrasonic technology in gas measurement poses some challenges. Dampening of acoustic sound waves in gases is considerably higher as compared to liquids. High frequency sound waves are quickly absorbed by the medium. This issue is addressed with low frequency transducers, which operate at a frequency of 500 kHz. An additional difficulty lies in actually getting the sound waves from one transducer to the other and back again—the waves have to penetrate the pipe wall, enter the gas, and leave it again through the pipe wall. Because of the very different densities and sound velocities of metallic pipe walls and gaseous medium, a large portion of the sound wave is reflected at the transition surface between pipe wall and gas. Only a small portion is transmitted into the gas. The reflected part of the wave remains inside the pipe wall and propagates to the receiver as noise.

For correct flow measurement, only the sound wave propagating through the gas is relevant. Higher operating pressures reduce the difference in densities and thus also the reflected noise signals. In order to maximize the signal to noise ratio, a special multi-pulse signal transmission method was developed. Modern digital signal processing capabilities achieve this separation of noise from signal with high precision. The key lies in sensor specific filters and narrow band amplifiers. Even small signals of a few micro-volts are recognized and evaluated.

Clamp on ultrasonic measurement typically takes place on gas injection or natural gas operating systems in the oil and gas industry or on high-pressure gases in the production of synthetics (PP, PE) or the food industry (extraction, freeze drying) and also on low-pressure gases inside plastic pipelines.

SOURCE: John O'Brien of Flexim in New York (JOBrien@flexim.com)

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Continued from page 1.

Elliot received Level I certification in March 2002 and plans to renew it again in 2008. Because the certification quantifies and certifies his skills against a known standard, he believes it benefits his career although it is not required in his current position.

He encourages those who are considering the certification to accept the challenge. "Although the goal is the destination," he said, "we learn and grow from the efforts of the journey."