CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: 15th Annual International Symposium of the International Council on Systems Engineering (INCOSE)
Project No. 20.06002.01.011

DATE/PLACE: July 10–14, 2005, Rochester, New York

AUTHOR: Olufemi Osidele

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PERSONS PRESENT:

Over 900 attendees from 23 countries

BACKGROUND AND PURPOSE OF TRIP:

The International Symposium is an annual event of the International Council on Systems Engineering (INCOSE). The theme for this year was: Bridging Industry, Government, and Academia. The Symposium reached beyond INCOSE's strong heritage of government programs in the defense and aerospace industries to include the commercial sector and expand interaction with systems engineering education and research programs in universities and colleges. The author is a member of INCOSE, and attended this Symposium under the professional development program of the Center for Nuclear Waste Regulatory Analyses (CNWRA).

SUMMARY OF PERTINENT ACTIVITIES:

Five plenary speeches unanimously identified new challenges for systems engineering in the industrial, commercial, and academic sectors. These challenges stem from the complexity of products and services now demanded by customers and clients all over the world. Such complex requirements call for distributed, highly interactive systems that must operate reliably in new and often untested environments. Consequently, more sophisticated analytical methods and tools, and more rigorous verification and validation procedures are required to support development of products and services. Ultimately, this presents tougher challenges for reliability assessment and risk management. The keynote speakers illustrated these new challenges with real examples of NASA's space missions, subsea oil and gas production, business development and economic growth, advanced color imaging, and software development for space missions.

Over 140 technical papers were presented covering topics in modeling, process improvement, reliability, risk management, system integration, performance measurement and analysis, education and research. Most papers described systems engineering applications in the industrial and commercial sectors, including anti-terrorism, environmental protection, public health, transportation, aerospace, consumer goods, and various emerging technologies.

Modeling was portrayed as a key aspect of the future direction of systems engineering. In particular, advances have been made in the use of database systems and unique system definition language to manage multiple interfaces in complex systems, and to support and ensure effective traceability through the entire product life cycle. Another key topic discussed was system reliability. Several

presentations identified that the focus is rapidly shifting from component reliability to interface reliability, which underscores the need for traceability in the development and evaluation of complex systems.

Several exhibits showcased the latest tools, products, and services of several well known industrial and commercial enterprises, including Boeing, Eastman Kodak, General Dynamics, NASA's Jet Propulsion Laboratory, Lockheed Martin, and Xerox. Universities and colleges, such as California Institute of Technology, Johns Hopkins University, Massachusetts Institute of Technology and University of Southern California, displayed and discussed their respective teaching and research programs in systems engineering. Software vendors I-Logix, Vitech, and Telelogic marketed a wide variety of products based on systems engineering principles. The author had a chance to learn about Vitech's flagship CORE® Product Suite. This product suite claims to offer an integrated and flexible approach to collaborative product development and management. Using a central database management system as a repository for project information and documentation, the product suite is able to seamlessly integrate an entire product development life cycle, provide complete traceability, and perform discrete event simulation using built-in or external programming tools.

The author participated in two tutorials. The first was an introduction to model-based systems engineering. This tutorial provided insights into requirements and functional analyses, system design, verification and validation, risk identification, and decision analysis. Executable models were presented for automating and coordinating all stages of the project life cycle, as well as a "natural language" approach to design traceability analysis. The second tutorial dealt with unified life cycle modeling. This tutorial introduced life cycle modeling as a formal approach to structuring and documenting the order of activities. The objective of the "unification" was to provide a consistent and universal system development methodology for life cycle modeling. Four basic life cycle modeling patterns were presented—sequential, incremental, evolutionary, and iterative. These patterns form the basis for unified life cycle modeling. Also, a risk-based approach for life cycle modeling pattern selection was discussed. Finally, the unified life cycle modeling concept was illustrated with two case studies—a hypothetical satellite system comprising space and ground subsystems, and a platform-based laser printer product line development system.

CONCLUSIONS:

This symposium offered a unique opportunity to learn about recent developments in systems methodology and application of systems principles to the evaluation and solution of complex science and engineering problems. It also provided a forum to interact and share experiences with professionals of diverse and seemingly unrelated backgrounds. Such cross-disciplinary knowledge acquisition is potentially transferable to support current and future CNWRA research and consulting endeavors.

PROBLEMS ENCOUNTERED:

None.

PENDING ACTIONS:

None.

RECOMMENDATIONS:

The INCOSE International Symposium typically attracts attendees from multiple disciplines and nationalities. This provides opportunities to interact with a broad spectrum of industry professionals, acquire new knowledge and skills, and obtain a global perspective on various technical issues. Because NRC projects often demand multi-disciplinary integration, the knowledge acquired from such diverse sources would enhance CNWRA capabilities for providing technical assistance to NRC. Annual participation is recommended.

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