



## International Council on Systems Engineering

### Delaware Valley Chapter Meeting

(Non-members welcome to attend)

#### **Social Systems Modeling for Systems Engineers**

**Speaker:** Gnana K. Bharathy, PhD, PMP, Ackoff Collaboratory for Advancement of the Systems Approach [ACASA], University of Pennsylvania (<http://www.seas.upenn.edu/~bharathy/>)

*For abstract and speaker's biographical summary, see next pages.*

#### **Science Enablers for Systems Engineering SIG**

**SIG Info:** Paul S. Giovanni, Senior Member Engineering Staff, Requirements Engineering, Enterprise Architecture, Lockheed Martin Corporation, Moorestown, NJ

**Date:** Tuesday, April 15, 2008

**Time:** 5:30 p.m.  
\$10 for the buffet meal (students \$5)

**Place:** Boeing, Integrated Defense Systems, Rotorcraft Division (Ridley Park, PA) Building 3-04  
*(Visitors will be greeted at the Security Guard House, along Route 291 and will be escorted into Bldg. 3-04. See directions on next page.)*

**Agenda:**

- 5:30 to 6:00 Arrival and Introductions
- 6:00 to 6:30: Buffet Meal
- 6:30 to 6:45: Chapter Business and SIG announcement
- 6:45 to 7:30: Part 1
- 7:30 to 7:40: Break
- 7:40 to 8:25: Part 2
- 8:25 to 8:30: Wrap Up

#### **RSVP**

By Monday, April 14th, 2007, you must contact Terry R. Kling [terry.r.kling@boeing.com](mailto:terry.r.kling@boeing.com) (phone 610-591-1831) and give your name, country of origin and contact information. For U.S. citizens, photo identification in the form of a valid driver's license must be presented to the Boeing Security Guard upon entering the Boeing facility. Foreign nationals must have a valid passport for display at time of visit. Green card holders must have their green card with them for admittance. All non-U.S. citizens are required to provide the following information to Terry R. Kling; full name, date of birth, place of birth, passport and/or visa #, country of citizenship, dual citizenship country (if applicable), company of affiliation within the Delaware Valley region and/or within the U.S., member of INCOSE (yes/no), email address and phone contact information.

## Directions to Boeing, Ridley Park, PA

Boeing may be accessed from I-95. From I-95S, exit at Ridley Park (Exit 8) and make a left onto Stewart Ave. From I-95N exit at Ridley Park (Exit 8) and make a right onto Stewart Ave. Take Stewart Ave. to Route 291. Make a right on to Route 291. At the next traffic light, make a right into the facility. Parking is located on your left (Lot 6), prior to the guard house (adjacent Building 3-28). Each attendee will be provided with a badge at the guard house and will be escorted into Building 3-04. An escort will meet you at the security guard house after you check in with the guard.

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For further information about the International Council on Systems Engineering, please see:

- The INCOSE website at <http://www.incose.org/> and
  - The Delaware Valley Chapter web site at <http://www.incose.org/delvalley/>
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## Speaker Biography

Gnana Bharathy is a Project Manger at Ackoff Collaboratory for Advancement of the Systems Approach [ACASA], University of Pennsylvania (<http://www.seas.upenn.edu/~bharathy/>), where he is leading a team in modeling and simulating social systems. Particularly, the recent project involves modeling social, economic, institutional and political stability.

Gnana has a bachelor's degree in technology/ engineering (National Inst. Technology, India), a master's degree in process and risk (Univ. of Canterbury, NZ) and masters and PhD degrees (Univ. of Pennsylvania) in systems engineering with award winning dissertations. His doctoral work pertains to modeling and simulation of social systems.

Before and after his doctorate, Gnana has also worked in consulting industry for a total of over seven years, particularly in risk analysis in various areas of operational and project risks, including in such areas as technology projects, energy, environmental, safety and business continuity. He has also worked in developing and applying models, analytical tools and techniques in the decision sciences and strategic management areas including strategic risk management and scenario planning.

Gnana has authored (or co-authored) over fifty technical reports and over twenty papers relating to such topics as modeling and simulation of human behavior in social systems, risk analysis and risk management, organizational transformation, decision-making, as well as process and environmental issues.

Gnana is a member of the International Council on Systems Engineering (INCOSE), and is also a beneficiary of awards from INCOSE (Steven's Doctoral Student Award in 2005) and Wharton Decision Process Center. He is also a Project Management Institute certified Project Management Professional, and has membership in the Institution of Professional Engineers New Zealand (GIPENZ), and the Society for Risk Analysis. He is also working towards his CSEP certification. Gnana has lived in several countries, spanning three continents.

## **Abstract: Social Systems Modeling for Systems Engineers**

It is not an overstatement to declare that systems thinking and understanding human behavior are crucial, if not decisive, factors in the success of any endeavor, process, or system. Modeling the behavior of human agents and socio-cultural groups is a newly evolving practice, motivated by the need to better understand how dangerous ideas spread, how leaders and followers behave, what motivates them, and how they might be influenced to cooperate, mitigate conflicts, and benefit the overall good.

Although all the nuances and complexities of human behavior and the complex interactions within social systems cannot be adequately captured to make point predictions, the virtual worlds constructed out of realistic human behavior models can assist in exploring the space of possibilities and provide analytical assistance and immersive training to decision makers.

In this talk, we will explore through selected case studies what social system modeling is, how one could incorporate human behavior into our models, and finally implications of this evolving practice to systems engineering as well as other related disciplines.

Yet, until recently, there have been limited tools and virtually no systematic process found in the literature or in practice for constructing, validating and refining models of human behavior, and hence, modeling social systems in a defensible manner. Over the last several years, the researchers at the Ackoff Collaboratory for Advancement of the Systems Approach (ACASA) of the University of Pennsylvania were able to make significant progress in developing social system modeling tools as well as an integrative modeling process. Subsequently, we applied the same process to create several models of social systems, including real and archetypical actors such as leaders, followers, populations, crowd members, rebels, and agitators in conflict situations. We have also been able to validate the integrative and modeling process against real world datasets (i.e., under naturalistic conditions) by testing, verifying and validating these models against real world datasets. During the course of the studies, we have also integrated existing, but fragmented, frameworks in social science to model individual human and social system behavior.

The Ackoff Collaboratory for Advancement of the Systems Approach (ACASA), named for Dr. Russell Ackoff, Emeritus Anheuser-Busch Professor of the Wharton School, operates as a think tank in the vanguard of systems approaches, and is also a major center behind systems engineering programs at the University of Pennsylvania. ACASA is a lab without walls aimed at facilitating trans-disciplinary interactions amongst colleagues across scientific fields. We are particularly interested in how social systems theories can inform computational tools and simulators and, conversely, how computational integrations help to identify gaps in science and stimulate new research needs (<http://www.acasa.upenn.edu>). ACASA is headed by Professor Barry Silverman, who is professor of systems engineering with secondary appointments in computer science, medicine and business. <http://www.acasa.upenn.edu/barryg.htm> He is serving the current semester on sabbatical in Australasia.

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