Syllabus: SYST 659 001 Topics in Systems Engineering

Course Overview:

- The key objective of this course is to broaden the student's understanding and appreciation of the range of factors that are relevant to the engineering, development and acquisition of large-scale "mega-systems"
    - Different circumstances warrant different systems engineering and project management approaches – not a "one size fits all"
- At the conclusion of the course, students should be able to identify circumstances that warrant different approaches, be able to recognize which processes warrant tailoring, and be able to discuss how to do so.
- This course is requires a basic understanding of current best practices in the disciplines of project/program management, systems engineering, and business.
- The course will encourage systems thinking and will help the students to continue to build critical thinking skills
- First half of the semester will cover factors that determine the context for systems that we engineer and acquire. It will conclude with a project where the student will "profile" a project of his/her own choosing. This will be documented in a short classroom presentation and an accompanying report (annotated briefing).
- The second half of the course will focus on different approaches that may be appropriate for different circumstances. These approaches will address requirements development, risk management, design patterns and tenets, stakeholder relations, and discovery engineering. This will conclude in a group presentation and an accompanying group paper on a assigned topic.
- A key aspect of this course is teamwork. It is the norm not only within a project team but between the team and its external stakeholders. The students should view this as an additional opportunity to build teamwork skills.
- Students will be expected to complete the assigned readings prior to the class so that they are better positioned to participate in classroom discussion. Students will be expected to maintain a weekly journal in which they will provide their commentary on the readings.
- This course is expected to be very interactive and student participation is not only encouraged, but expected. Students should be prepared to provide relevant comments, drawing on the readings, their personal knowledge, as well as their class research.

Grading allocation:

- 40% group project
    - 35% my assessment of the overall content and presentation (everyone in the team gets the same grade)

    - 5% your team's assessment of your contribution/involvement
- 30% individual project
- 20% journal
- 10% classroom participation

Reading Material:

- Stevens, R. *Systems Engineering in the Twenty-First Century: The Opportunity and Challenge of Mega-systems*. Manuscript.
- Loch, C, A. DeMeyer, M. Pich, *Managing the Unknown: A New Approach to Managing High Uncertainty and Risk in Projects***.**
- Selected papers available on-line (see syllabus for initial list of papers; others may be added as appropriate)

Class Date	**Class Objectives**	**Reading Material**

Class 1:	Describe course objectives, organization and approach
	Describe class projects and expectations
	Introductions
	Discussion: Setting the context -- trends for information systems
	• Socio-technical systems (not just technology)
	• Imperatives to share information (defense, homeland security, supply chain…)
	  o Enabling conditions (technology…)
	  o Policy
	• Imperatives for agile and rapid response (defense, commercial)
	  o Enabling technologies (SOA…)
	  o Policy
		• Megasystems: Chapter 2

Class 2	Mega-system concepts • Systems • System of Systems • Mega-systems • Mega-systems framework	• Megasystems: Chapter 3 and 4

	• Tame vs wicked problems Class exercise on tame vs wicked problems Organize into teams for first class project	
Class 3	Mega-system concepts (cont'd) • Mega-systems framework • Tame vs Wicked Problems • Profiler Discussion of mid-semester presentation	• Rittel, Horst and Melvin Webber, "Dilemmas in a General Theory of Planning", pp 155-169. Policy Sciences, Vol 4., Elsevier Scientific Publishing Co, Amsterdam, 1973. • Richardson, Adam. Wicked Problems: Today's Business Problems can be Impossible to Define, Let Alone Solve. http://designmind.frogdesign.com/articles/fall/wicked-problems.html Megasystems: Chapter 5
Class 4	An example of emergent behavior Systems Engineering Recap • Systems engineering • Software engineering • System of systems engineering • Engineering challenges of mega-systems	Megasystems: Chapter 5
Class 5	Enterprise Systems Engineering Profiler • Describe profiler • Implications for SE and PMs o Political, organizational, cultural, economic, policy,	Megasystems: Chapter 5.5 Loch. DeMeyer, Pich, Managing the Unknown, Chapters 1, 3
Class 6	Mega-systems case study: Developing the Electronic Product Code Network	Megasystems: Chapter 8
Class 7 and 8	Mid semester presentations (15 mins) • Present and explain rationale for profiles for your selected cases	Students provide briefing slides with annotations per directions
Class 9	Feedback from mid-semester presentations Classroom exercise: Discuss similarities and differences	Megasystems: Chapter 9

	between profiles Observations from case studies	
Class 10	Implications for SE Practice • Changing requirements • Cross-project/cross-system interoperability and integration • Managing diverse stakeholders • Discovery engineering	Megasystems: Chapter 10
Class 11	Diagnosing complexity and uncertainty Acquisition under uncertainty • Types and sources of uncertainty • Mapping development and acquisition strategies to types of uncertainty • Building in options • Impact of organizational culture and individual leader perspectives	Loch, DeMeyer and Pich, Chapter 4
Class 12	Learning and selectionism in projects	Loch, DeMeyer and Pich, Chapters 5,6,7
Class 13	Establishing the project mind-set: systems thinking Putting the infrastructure in place: how to manage different types of systems	Loch, DeMeyer and Pich, Chapters 8, 9
Class 14	Dry run for final class project reports out (30 min	Deliver briefing slides with annotations
Class 15	Final Report out for final class project (30 min each)	Deliver briefing slides with annotations