Göteborg September 12, 2005

Course Program
PV12 - **SYSTEMS ENGINEERING**

The last fifteen years have seen an increasing competitive pressure on organisations – some of the factors driving this are increased product complexity, increased globalisation, the introduction of software, and the transition to electronically managed information. Systems Engineering (SE) is a key technology/approach to manage this complexity.

SE as a knowledge field is an interdisciplinary approach and means to enable the realisation of successful systems or systems of systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with system design and validation while considering the complete problem. Thus SE integrates different disciplines and specialty groups into a team effort forming a structured development process that proceeds from concept to production to operation.

The aims of the Ph.D. course on Systems Engineering are to make participants learn and adopt SE principles, tools, and techniques, by (*i*) making them aware of the field of Systems Engineering, and (*ii*) apply the knowledge in exercises and their individual research project. The objectives are to provide participants with:

- An overview of Systems Engineering research and practices
- Insights into critical areas of SE

Course Leader
Assistant Professor Fredrik Berglund
Product and Production Development
Chalmers University of Technology

Invited Lecturer
Professor Dr.-Ing. Eduard Igenbergs
Institute of Astronautics
Technische Universitaet Muenchen

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Prerequisites
The course will be given in English. Participants have to attend on all parts of the course.

Course Fee
The course is free of charge for Pro-Viking Ph.D. students. For external Ph.D. students (non Pro-Viking members) the course fee is 400 Euro. The fee for participants from industry will be 800 Euro. This includes lunch and refreshments during the breaks, and hand-outs, but excludes the costs of traveling and hotel.

Hotel
Rooms have been reserved for participants at Hotel Lorensberg (http://www.hotel-lorensberg.se). Participants make their own reservations using booking number: GB891.

Hotel Lorensberg	Tel: 031 - 81 06 00
Berzeliigatan 15	Fax: 031- 20 50 73
412 53 GÖTEBORG	info@hotel-lorensberg.se

Please note that the reservation must be made before September 16.

Certificate
All participants will be registered at Chalmers University of Technology, from which they receive a formal certificate. The course leads to 7,5 ECTS points (5 högskolepoäng). Whether or not these points are recognised depends on the participants own university.

Application
Send an e-mail to Fredrik Berglund. The maximum number of participants is 25. Applicants from Pro-Viking members (universities and industry) will be prioritised.

For further information, please contact:

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Program

The Systems Engineering course will run at three occasions.

Preparation for Part 1:

Participants will need to read and reflect upon one of the recommended literature:

- Introduction to Systems Engineering (2000). Andrew P. Sage.
- Systems Engineering: Coping with Complexity (1998). Stuart Arnold, et al.
- Systems Engineering and Analysis (1998). Benjamin S. Blanchard, Wolter J. Fabrycky.
- Systems Engineering Principles and Practice (2002). Alexander Kossiakoff, William N. Sweet.

A short report (max. 2 pages) and presentation (appr. 3 slides/5-10 min) should be prepared summarising the participant's own research project and how you think Systems Engineering could provide insights on perceived problems in your research. Based on the SE literature, some research questions related to your own research project should be outlined covering areas where you think SE could be a possible approach. One of these questions will be chosen for the student assignment.

Part 1 (3-6 October):

Day 1:

9.30-10.00	*Registration and coffee*	
10.00-10.30	Course Introduction	Fredrik Berglund
10.30-12.00	Participants' presentations	
12.00-13.00	*Lunch*	
13.00-13.30	SE Introduction	Fredrik Berglund
13.30-14.45	Definitions I: The model based communication and the generic engineering process Definitions II: The System definitions Definitions III: Patterns, Structures, Architectures and Processes	Prof. Igenbergs
14.45-15.00	*Coffee*	
15.00-17.00	Systems Engineering and Operations Research	Prof. Igenbergs
19.00-	Social event - Dinner	

Day 2:

10.00-12.00	The System Engineering Process I: The industrial modeling of requirements	Professor Igenbergs
12.00-13.00	*Lunch*	
13.00-14.45	The Systems Engineering Process II: The industrial modeling of the development process	Professor Igenbergs
14.45-15.00	*Coffee*	
15.00-16.00	Course Assignment	Fredrik Berglund
16.00-17.00	The Systems Engineering Process III: Application	Professor Igenbergs
17.00-18.00	Systems Engineering in practice	Einar Dragstedt
18.00-	Social event	

[16.00-18.00 INCOSE seminar with invited members from industry]

Day 3:

9.00-12.00	The Systems Engineering Process IV: Systems Engineering and Marketing	Professor Igenbergs
12.00-13.00	*Lunch*	
13.00-14.45	Evaluation I: Risk, Cost and Quality	Professor Igenbergs
14.45-15.00	*Coffee*	
15.00-17.00	Assignment preparation†	Berglund/Igenbergs

Day 4:

9.00-12.00	Evaluation II: Utility Theory and Application	Professor Igenbergs
12.00-13.00	*Lunch*	
13.00-14.45	The role of decisions	Professor Igenbergs
14.45-15.00	*Coffee*	
15.00-16.00	Assignment preparation†	Berglund/Igenbergs

† *Individual discussions on chosen topics for the course assignment*

Part 2 (21-23 November):

Day 1:

10.00-12.00	The requirements management process	Fredrik Berglund
12.00-13.00	*Lunch*	
13.00-14.45	Where do requirements come from?	MariAnne Karlsson
14.45-15.00	*Coffee*	
15.00-16.00	Where do requirements come from?	- -
16.00-17.00	From user requirements to technical requirements	Fredrik Berglund

Day 2:

09.00-11.00	Requirements management tools and techniques	Fredrik Berglund
11.00-12.00	Support for RM and Conceptual Design	Johan Malmqvist
12.00-13.00	*Lunch*	
13.00-14.45	Experiences of RM in automotive/naval industry	Fredrik Berglund Johan Malmqvist
14.45-15.00	*Coffee*	
15.00-16.00	Requirements Management in practice	tbd
16.00-17.00	Assignment preparation†	Fredrik Berglund

Day 3:

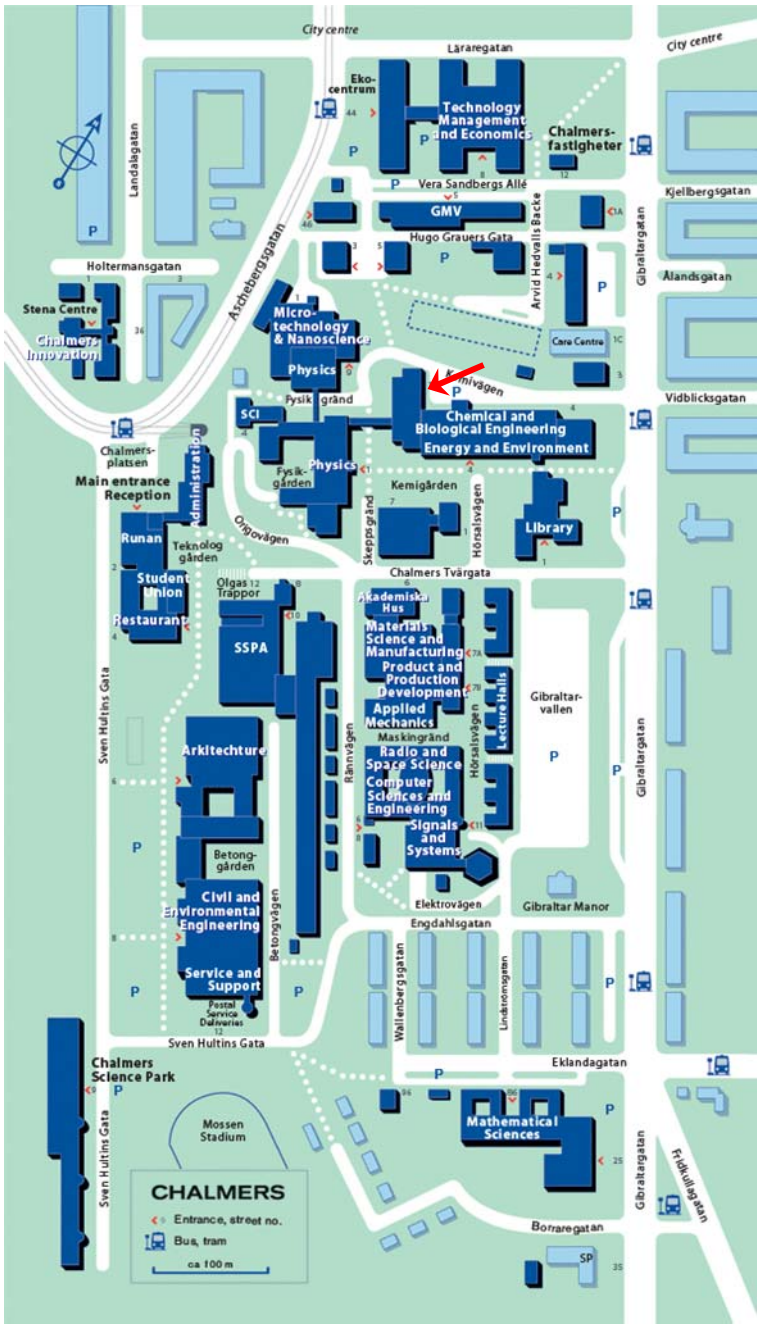
9.00-12.00	Aspects of SE Information Management Introduction and background, the systems engineering process from an information management perspective, process, methods, tools & data exchange, data exchange frameworks, information modeling for method definition and data exchange, overview of state of the art, research ideas related to information modeling.	Dr. Erik Herzog Syntell
12.00-13.00	*Lunch*	
13.00-14.45	Verification and Validation	Tom Strandberg, Syntell
14.45-15.00	*Coffee*	
15.00-16.00	Verification and Validation	- -
15.00-17.00	Assignment preparation†	Fredrik Berglund

† *Individual discussions on chosen topics for the course assignment*

Presentation of course assignment

The course assignment will be submitted electronically to Fredrik Berglund. Each assignment will be reviewed by the course leaders and three other course participants (i.e. each student must review three student assignments). Date for the submission of the course assignment and the review process will be decided during the first part of the course.

Location



The course will be held at "*10:an*" on the tenth floor at the school of Chemical and Biological Engineering at Campus Johanneberg, – Chalmers University of Technology. Entrance at Kemivägen 10 through the goods terminal (gods-mottagning) – take the elevator up to the 10th floor.