EuSEC

European Systems Engineering Conference 2006
18-20 September 2006
Edinburgh, Scotland (UK)

INCOSE
International Council on Systems Engineering

Adding value in inter-disciplinary and multi-cultural environments

AFIS (France)
FINSE (Finland)
GfSE (Germany)
INCOSE NL (Netherlands)
INCOSE UK (United Kingdom)
Israel Chapter
NORSEC (Norway)
South African chapter
Swedish chapter
Turkish chapter

Welcome,

On behalf of the UK Chapter of INCOSE, and of the Planning Committee of the European Systems Engineering Conference (EuSEC) for 2006, I welcome you to Europe's premier Systems Engineering Event in Edinburgh. This year's theme, "Adding value in inter-disciplinary and multi-cultural environments", was selected to emphasize that modern Systems Engineering is not restricted to single-enterprise, single-nation projects. In keeping with the Conference Theme, the Planning Committee, composed of representatives from all around Europe, plus Israel and South Africa, have collaborated to bring you a truly multinational Technical Programme. This year the Conference is being held in Edinburgh, the hub of Scotland's thriving high technology industry as well as a home to major Universities, and a tourist destination known for its internationally-renowned architectural heritage and culture. We invite you to come together to enjoy the technical programme, to relax and to spend time talking to one another; taking advantage of the opportunity to learn from seasoned practitioners, tell your stories, exchange ideas, hold lively discussions, and, best of all, get to know your international engineering colleagues and make them your friends.

Through our offering of 9 Keynote and Invited Speakers, 24 Technical Papers, 7 Tutorials, 2 thought-provoking Panels, a Toolvendor Challenge, and exhibitors from the academic, industrial, consulting services and vendor communities, an enormous array of systems engineering information awaits you. Evening receptions and the symposium banquet with speakers and entertainment round out the menu of activities. We hope you find the Conference interesting, challenging and enjoyable.

Paul Davies, General Chair

Conference Programme

Host Committee

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INCOSE

The International Council on Systems Engineering (INCOSE) is an international professional society for systems engineers with the mission to promote the definition, understanding, and practice of world-class systems engineering in industry, academia, and government. INCOSE was formed in 1990 to develop the interdisciplinary approach as a means to design and develop successful systems. The first symposium was held in 1991. Since then, INCOSE has grown dramatically. Over 6,000 members, 50 chartered chapters worldwide, and more than 50 Corporate Advisory Board members now contribute to INCOSE. Today INCOSE members represent over 30 countries. And, with newly forming chapters the number continues to grow.

Region 3 of INCOSE, comprising Europe, Israel and South Africa, comprises about 25% of the total membership, and hosts this Conference.

Invited Speakers

Systems Engineering and Social Engineering for Network-Enabled Capability

Hillary Sillitto

Much has been written and done in recent years concerning the technical aspects of Network Centric Operations, referred to in the UK as "Network Enabled Capability" (NEC) or more recently, "Capability Enabled by Networks". It is becoming increasingly clear that effective capability depends as much on social as technical factors, in both development and operation: "the ultimate purpose of NEC is not to share data through technical networks but to share understanding through social ones." Further, it is clear that the benefits of NEC are a result of the emergent properties of a complex, dynamic and non-deterministic socio-technical system. What does this mean for procurers, developers and operators?

The presentation is in four parts. The first part will outline the "SPIT" (Social, process, information, technology) layered model, and use it to illustrate the "wicked problem" we are trying to deal with and show how critical system of systems issues can be mapped and understood with reference to these layers. Then we demonstrate how Architecture Frameworks allow us to analyse the problem in more detail while maintaining coherence and managing key technical and operational drivers across these layers. Some limitations and caveats on the use of Architectural Frameworks will be discussed. Then we will summarise the social and cultural issues that challenge the designers and architects of networked systems of systems; and show how these are mirrored in the Operational environment in terms of aligning training, doctrine, culture and user expectations of the technology. There will be a discussion of appropriate metrics and of some notable differences in national approaches to the human and command issues. The fourth part of the presentation provides an update on the approach being used to upgrade the MOD's Systems Engineering skills and improve the effectiveness of its interactions with industry. This approach is aligned with the Defence Industrial Strategy, benefits from recent INCOSE developments, and is increasingly focusing on "Systems thinking" and system value, to equip our people in Government and Industry to work together to deal with the complex challenges outlined in the earlier part of the presentation.

The speaker will conclude with a personal perspective on how some of the themes in the conference support his arguments.

The effective working of multicultural teams is of increasing relevance to the systems engineering environment.

Simon Harris

More international working presents the challenges of multinational teams, and diversity of background has been shown, despite considerable problems and risks that can lead to complete failure, often to produce the highest team performance. This paper examines some of the actual differences that impact on projects with people of different national and institutional cultures. It does this with the help of latest management research on the topic and with a study of engineers from six different national cultures and from two very different institutional cultures. This is brought together with conclusions that present recommendations from recent research concerning how to learn to adapt and thrive in multicultural project environments.

No Cure No Pay

Tom Gilb

50% of all software projects are total failures and another 40% are partial failures according to widely quoted surveys in UK, USA and Norway. Large government projects in all 3 countries have been reported with spectacular failure and expense to taxpayers (Royal Academy of Engineering and British Computer Society 2004). What is the problem? Most discussions have centered on improving the software engineering process itself: better estimation, better requirements, better reuse and better testing. No doubt all those can be improved. However, I suggest the motivation to improve them needs to be put in place first. Think about it. Most of these failures have been fully paid for! We not only pay well for failure, but the bigger the failure, the more people get paid! My suggestion is simple. Pay only when defined results are provably delivered. This requires several things:

- Contracts that release payment only for meaningful results;
- The ability to define those results, particularly qualitative ones, and particularly the organizational ones;
- The ability to deliver those results incrementally, thus proving capability at early stages and continuously.

Note: This paper specifically addresses the software problem, but I am sure that the ideas here apply to the wider systems engineering problem to some interesting degree as well.

Considering Organisations and Enterprises as Systems

Alain Faisandier

This discussion deals only with systems created and used by human beings and which can be in the domain of technology, strategy or organisations. Studies and experiments done by the community of systems engineers, aims to define a new discipline which is very useful for any industrial and organisational domains. A brief introduction shows the links between the general theory of systems and the notion of Systems Engineering as seen today. Then, the discussion figures out the necessity of a minimum of rationality when creating this kind of systems, explaining some fundamentals, principles or concepts. As an example, the methodological thought leads to understand that daily humans do not need "products" but they need "services".

The speaker provides a more precise, and rational definition than those existing in today standards, that allow to perform a genuine engineering method applicable to any kind of concerned systems. This definition ensure the cultural continuity from the Greeks till now and compatible with technological and organisational advances. As examples this definition is applied to an organisation as NATO and more briefly to industrial enterprises. Whether the idea of engineering organisations and enterprises as systems is attractive to engineers, raises questions of feasibility and relevance. Organisations and

enterprises are composed of human beings, hence, defined as "Human Systems"; so the discussion ends with some words about human factors that could help or hinder the adoption of these useful rational ideas.

The Meaning and Value of Systems Engineering: A Life-cycle Appreciation

Philip M'Pherson

There is something strange about Systems Engineering (SE). Definitions have been appearing and reappearing throughout SE's life ever since it began to emerge as a topic that some organisations, engineers and academics talked and wrote about during the 1950s. And the arguments continue. If the value of anything is to be appreciated, a good understanding is first required of what the thing is, and how it contributes to the values of the various stakeholders. Accordingly the emergence of the 'thing' called Systems Engineering will be clarified during its first life-cycle from 1950 to 2000 – which also spans the author's experience of SE first as a hard-hat practitioner, then as an academic. The values contributed to SE's stakeholders, and the costs, are examined with respect to the individual systems engineer, the corporate provider, the human operators and supporters who have to live and work inside systems, and on to the end-users who enjoy/suffer the onslaught of systems. Without doubt SE has the potential to contribute considerable positive intangible value, as well as reducing costs. But that value will not be fully realised until society can come to terms with 21st century complexity and appreciate the endeavours of the systems engineer of the future as the Master of Complexity.

Complex Systems Science and its Effects on Systems Engineering

Sarah Sheard

Many systems engineers have heard terms similar to "chaos," "fractal," and "butterfly effect," but most are not aware that these concepts have the potential to improve significantly how we engineer systems. Chaos science and its descendants, including topics such as nonlinear behavior, network dynamics, multi-agent systems, and evolutionary computation, are coming to dominate the research agenda in sciences related to systems engineering. To date, these sciences have informed true advances in other engineering fields such as electrical engineering, but have yet to make much of an impression on systems engineers. This talk answers the following questions:

- What is complex systems science?
- Why should it have an effect on systems engineering?
- What is the state of systems engineering today, and why will an understanding complex systems help?
- What effects is it having now?
- What effects do we want it to have? What effects do we want it not to have?
- How can we make it have the effects we want?

Many engineers fear that this new set of sciences in too complicated and too divorced from what they do on a day to day basis. INCOSE Fellow Sarah Sheard is convinced this is not the case, and has put together this talk (as well as other products) specifically to help inform practicing systems engineers of some useful areas to pursue.

Removing the barriers for Design for Production; how to make it happen!

Jan Verbeek

Concurrent engineering and design for manufacturing and assembly (DFMA) concepts and methods all seem so logical so how can it be that companies still face so many problems in trying to implement them? What is blocking them, what issues are in the way of the long-awaited results given the market pressure on product innovations, lead times and cost? Is it the thinking? Is it the doing? Experience with big aerospace and defence companies as well as with more down to earth SME's taught me that there are a few cultural and some more practical barriers in organisations. These barriers disturb a full and smooth implementation of Design for Production. Using a pragmatic approach of Systems Engineering, thereby integrating all the lean, six sigma and other more monolithic process improvement methods might do the job however.

"Knowledge, abilities, cognitive characteristics and behavioral competences of engineers with high capacity for engineering systems thinking (CEST)"

Moti Frank

A major high-order thinking skill that enables engineers to successfully perform systems engineering tasks is Engineering Systems Thinking. To successfully perform their tasks, systems engineers need a systems view or, in other words, a high capacity for engineering systems thinking (CEST). This paper summarizes the findings of three studies aimed at identifying the knowledge, abilities, cognitive characteristics (thinking skills) and personal traits (behavioral competences) of systems engineers with high capacity for engineering systems thinking (or, in other words, successful systems engineers). The findings suggest that successful systems engineers possess interdisciplinary knowledge. They are expert in at least one main field but have general knowledge in additional fields and disciplines. They become familiar with the jargon and professional language of the other disciplines and are able to communicate with people or experts from different fields and disciplines. Overall, 10 cognitive characteristics, 11 abilities, and 10 behavioral competences were identified. In addition, nine additional roles of systems engineering were identified.

The Pebble Bed Modular Reactor and the usage of Systems Engineering to Establish New Standards for the Nuclear Revival

Willie Theron

sponsored by UGS

The realisation that nuclear power will become an essential and leading contributor for future power generation is slowly dawning on the world. But the pressure to ensure nuclear safety will stay with the design teams. The next generation nuclear power plants will have to comply to new rules, not based on the existing water cooled reactor technology, and known as Generation IV reactors. The world leader in the development of such a Generation IV nuclear power plant is PBMR (Pty) Ltd in South Africa. Becoming the leader in the field of HTGRs (High Temperature Gas-cooled Reactors), did not happen overnight. A set of unique circumstances in South Africa and technical developments in Germany during the 60's and 70's have provided a once in a life time opportunity to a team of engineers and scientists to create a new nuclear power plant. The early adoption of systems engineering practices by the development team has undoubtedly created new momentum into a technical domain dominated by water cooled reactors. The current nuclear power industry is straddled by regulations, legal requirements and rules based design, which all contribute to complex designs, high capital and operational cost, all to ensure safety to the public. The fresh approach taken by PBMR in the design process of this new nuclear plant was not always appreciated by other stakeholders in the nuclear industry. The intention of the speaker is to provide a brief overview of the PBMR technology, its engineered passive safety features, matching the nuclear body of knowledge with the systems engineering body of knowledge, some new approaches to existing methodologies to ensure optimal interaction, the unique challenges faced by the team, and the systems engineering opportunities now emerging in the new nuclear world.

Track 1
(Main Auditorium, JW centre I)

Monday 18th September

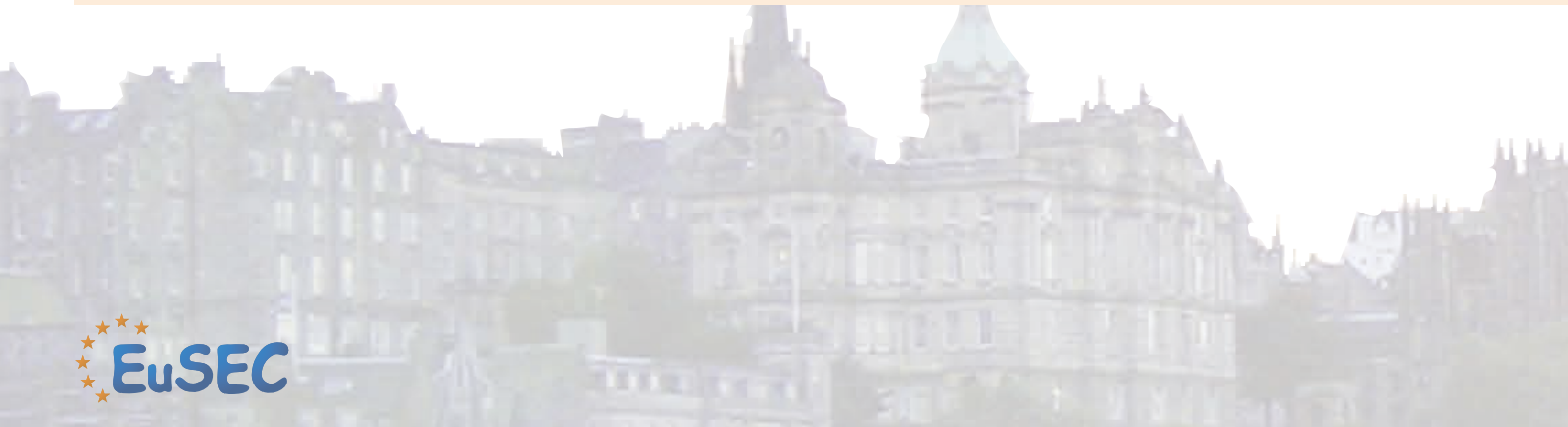
9.00	-	9.30	**Opening session and President's Address** - *Paul Robitaille (President INCOSE)*
9.30	-	9.45	**Introduction to Toolvendor Challenge**
9.45	-	10.30	**Systems Engineering and Social Engineering for Network-Enabled Capability** – *Hillary Sillitto (Head of UK Ministry of Defence Integration Authority)*
10.30	-	11.00	**Coffee Break** in Exhibits Hall
11.00	-	11.45	**A Systems Engineering Environment for Integrated Building Design** - *Azzedine Yahiaoui (Eindhoven University of Technology)*
11.45	-	12.30	**Systems Engineering for Adding Value in the Built Environment** - *Hennes de Ridder, Ruben Vrijhof (Delft University of Technology)*
12.30	-	14.00	**Buffet Lunch** in Exhibits Hall *During lunchtime: INCOSE Technical Board Open House in Bruce Room*
14.00	-	14.45	**Systems Engineering, Increasing the Efficiency of Research Infrastructure Projects** - *Wolfgang Ansorge (RAMS-Con Management Consultants)*
14.45	-	15.30	**Systems Engineering within the Formula Student Project at Delft University of Technology** - *Miki Hegedus, Robbert J. Hamann (Delft University of Technology)*
15.30	-	16.00	**Coffee Break** in Exhibits Hall
16.00	-	17.30	Education Controversy Panel Debate – **Can Systems Engineering be taught effectively at Undergraduate Level?** Chair: *Sue Goodlass (BAE Systems)*
17.30	-	19.00	**Icebreaker Reception** in Exhibits Hall
19.00	-	on	**Conference Banquet** in Main Dining Room

Tuesday 19th September

9.00	-	9.45	Invited Speaker: **Mixing Cultures in Systems Engineering Projects: Challenges and Opportunities** - *Simon Harris*
9.45	-	10.30	Invited Speaker: **Considering Organisations and Enterprises as Systems** - *Alain Faisandier*
10.30	-	11.00	**Coffee Break** in Exhibits Hall
11.00	-	11.45	**Systems Engineering and Related Disciplines** - *Siebert Benade (University of Pretoria)*
11.45	-	12.30	**Strategic Multi-Stakeholder Trade Studies** - *Michael Emes (University College London)*
12.30	-	14.00	**Buffet Lunch** in Exhibits Hall
14.00	-	14.45	**Systems Architecture: A View Based on Multiple Impacts** - *Tom Gilb*
14:45	-	15.30	**Survey of the Use of Systems Architecting in the Development of Complex Technical Systems - Exemplified by the Autonomous Underwater Vehicle Hugin** -
15.30	-	16.00	**Coffee Break** in Exhibits Hall
16.00	-	17.30	**Toolvendor Challenge** Contestants Moderated Presentations and Debate
17.30	-	19.00	**Reception** for invited guests only
19.00	-	on	**Special Event with Dinner**

Wednesday 20th September

9.00	-	9.45	Invited Speaker: **Complex Systems Science and its Effects on Systems Engineering** - *Sarah Sheard*
9.45	-	10.30	Invited Speaker: **Knowledge, abilities, cognitive characteristics and behavioral competences of engineers with high capacity for engineering systems thinking (CEST)** - *Moti Frank*
10.30	-	11.00	**Coffee Break**
11.00	-	11.45	**The Wrong Kind of System Engineering** - *Colin Brain*
11.45	-	12:30	**Managing Technical Uncertainty** - *Robert Dale (MBDA)*
12.30	-	14.00	**Buffet Lunch** in Exhibits Hall
14.00	-	14.45	**Implementing Systems Engineering - A Step-By-Step Guide** - *Bram de Landtsheer et al. (INCOSE Netherlands)*
14.45	-	15.30	**A Strategy for the Implementation of ISO 9001 and ISO 14001 Utilizing ISO/IEC 15288** - *Harold W. Lawson (Lawson Konsult AB)*
15.30	-	16.00	**Coffee Break** in Exhibits Hall
16.00	-	17.00	**Closing Plenary** Vision 2020, the Globalisation of Systems Engineering - *Ralf Hartmann (EADS)* Systems Engineering Handbook v3 - *Terje Fossnes* Best Paper Awards - *Terje Fossnes*



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Track 2 (Lecture Theatre IV)	Tutorial a (Carnegie Room)	Tutorial b (Wardlaw Room)
Integrating System Views Emerging from Different (Engineering) Cultures - *Andreas Peukert, Ulrich Walter (Technische Universität München)*	**T1** **UML and SysML for Systems Engineers** *Matt Hause and Francis Thom (Artisan Software)*	**T2** **Dealing with Uncertainty in Systems Engineering** *Mark Powell (SAIC / Stevens Institute)*
Marketing + Sales + Systems Engineering = Business Development? - *George Wallace*		
The role of systems engineering in global standardisation - *John Holt (Brass Bullet), Dr Paul McNeillis (BSI)*		
Meeting the Challenge of Knowledge Creating Systems - *James Martin (The Aerospace Corporation)*		
"Fireside Chat" Panel Debate: **How to prepare papers for acceptance at INCOSE International Symposium** - Chair: *Duncan Kemp (UK MoD)*		
Invited Speaker: **How to Procure Services on a 'No Cure, No Pay' Basis** - *Tom Gilb*		
Invited Speaker: **The Meaning and Value of Systems Engineering: A Life-cycle Appreciation** - *Philip M'Pherson*		
Systems are Imaginary - Systems are Not Real: Some Thoughts on the Nature of Systems Thinking - *James Martin (The Aerospace Corporation)*	**T3** **What You Need to Know About Chaos, Complexity, and Complex Adaptive Systems to Do Systems Engineering Well in the 21st Century** *Sarah Sheard (Third Millenium Systems)*	**T4** **Systems Engineering, Increasing the Efficiency of Research Infrastructure Projects** *W.R. Ansorge (RAMS-CON Management Consultants)*
Who is Afraid of Reviews? - *Avigdor Zonnenshain, Sharon Shoshany Tavory (RAFAEL)*		
Network-Centricity in Software Product Development - *Oleksiy Mazhelis, Mirja Pulkkinen (University of Jyväskylä), Osmo Vikman (Nokia Group)*		
A Generic Requirements Management and Engineering Software Selection Process - *Markus Hoppe (HOOD Group)*		
Toolvendor Challenge Contestants Moderated Presentations and Debate		
UK Chapter AGM (*INCOSE UK Chapter Members only*)		
Invited Speaker: **Removing the barriers for Design for Production; how to make it happen!** - *Jan Verbeek*	**T5** **Architecture Frameworks & Modelling** *James Martin (The Aerospace Corporation)*	**T6** **Project Success is not really difficult** *Delivering the best possible project results in the shortest possible time* *Niels Malotaux (N R Malotaux - Consultancy)*
Invited Speaker: **The Pebble Bed Modular Reactor and the usage of Systems Engineering to Establish New Standards for the Nuclear Revival (sponsored by UGS)** - *Willie Theron*		
The Systems Modelling Language - *Matthew Hause, Alan Moore (ARTiSAN Software Tools)*		
System Safety Analysis: SysML and UML in the Automotive Context - *Ireri Ibarra Alvarado, Richard K. Stobart, Rudi Lutz (University of Sussex)*		
12 Ways to Use a Functional Model - *Andreas Vollerthun, Marcelo de la Cruz (3D Systems Engineering GmbH), Roberto Borsari (Tetra Pak Carton Ambient S.p.A.)*		
Model-Based Support for Integration and Testing of an Industrial System - *Niels Braspenning, J.M. van de Mortel-Fronczak, J.E. Rooda (Eindhoven University of Technology), D. Kostic (Embedded Systems Institute)*		

Tutorial c
(Bruce Room) **Wednesday 9.00 - 15.30**

T7
Competitive Systems Engineering: how to do systems engineering in hot competition. Detailed pragmatic and unconventional techniques.
Tom Gilb (Result Planning Ltd)

Toolvendor Challenge

A challenge has been issued to the exhibiting tool vendors. The challenge describes a 'high level' system being developed by a fictional company. The system is one to which all the conference attendees should relate. The registration package contains a description of the problem with a checklist to help compare the tools. During the Opening Plenary session, the details of the challenge will be presented, and, on Tuesday afternoon two parallel sessions are scheduled to allow presentations from the vendors, plus questions and answers on the techniques and tools.

Each vendor is expected to use SE techniques and their own tool to work out a solution to the problem. During the Toovendor Challenge Presentation, no explicit marketing information may be presented. Each vendor will present their solution in more detail at their booth in the Exhibits Hall.
For a first, limited functionality, version of the system, participants have been asked to:

1. Compose the system specification
2. Demonstrate requirements handling
3. Define the system in its environment
4. Define logical sub-systems, flows from sub-systems to the environment and flows between sub-systems
5. Define sub-system activities
6. Describe the functional modes of the system and transfers between them
7. Identify the main dynamic procedures in the different functional modes, and describe the control of two of the identified procedures

Academic Forum

A leading role for Academia in Systems Engineering Research and Education

An Academic Forum will be held on Thursday 21st September. The forum is free and available to all conference delegates. Participation from industry representatives is welcome and encouraged. A flyer specifying location and programme for the day is in the registration materials.

Systems Engineering is developing rapidly, with many activities and formal publications that demonstrate that it is maturing as a discipline. For example:

- The International Standard on Systems Engineering (ISO 15288)
- Systems Engineering (the peer-reviewed Journal of the INCOSE)
- INCOSE's Professional Certification Program (CSEP)

However, Academia's contribution to developing the Systems Engineering discipline and to aiding its understanding and application is fragmented and inconsistent and varies significantly across institutions. Within Academia there are very different fundamental views on the discipline, with the risk that its role is potentially confusing and damaging to the development and application of the discipline. Further, many of the developments in Systems Engineering are being led by government and industry organisations, with Academia, at best, trying to keep up with the latest work or, at worst, delivering products that are not up to date.
In this Academic Forum, the role of Academia in developing and defining modern Systems Engineering (the Research focus) and in facilitating its understanding and adoption (the Education focus) will be discussed. The aim is to stimulate a debate on the involvement of Academia in the forefront of Systems Engineering, with questions such as these:

- What are the leading developments in Systems Engineering and who is driving them?
- What does the Systems Engineering community and its beneficiaries need from Academic Research and Education?
- Does Academia currently have the capabilities and experience in Systems Engineering to play a leading role?
- What leading role should Academia take? Is it already doing so? Should something extra, or different, be done?
- How should we develop our Research and Education within and across institutions to be able to deliver a valuable leading role for Academia?

Venue: Rooms 1.82 and 1.83 in the Earl Mountbatten Building (Electrical, Electronic and Computer Engineering), Heriot-Watt University, Edinburgh

Panel Debates

Two panel debates are included in the programme; both have multicultural themes. One will look at different approaches to University teaching of SE; the other will look at ways of getting your (non-US) papers published at the INCOSE International Symposium.

Papers Panel

How to prepare papers for acceptance at INCOSE International Symposium

Chair

Duncan Kemp (UK MoD)

Purpose of panel

To increase European participation in international symposia, by

- Improving the quality of European papers
- Increasing the likelihood of getting papers accepted

Panel Abstract

The panel will explore the benefits of and approaches to getting a paper accepted. The panel will give an overview of the benefits of presenting at the INCOSE international symposium, as well as the panellists top tips for getting a paper accepted.
The panel will open with a presentation from Duncan Kemp, outlining his perception of the benefits of presenting at symposia to:

- The individual
- Their employer (whether they are public sector, industry or academia)
- The SE profession

Duncan and the rest of the panellists will then present their personal views on why they have been successful at publishing papers at international symposia.

Panelists

Duncan Kemp (UK), Terje Fossnes (Norway), Rudi Kaffenberger (Germany), Niels Malotaux (Netherlands)

Education Panel

How can Systems Engineering be taught at undergraduate level?

Chair

Sue Goodlass (BAe Systems)

Purpose of panel

Where do Systems Engineers come from? Is Systems Engineering a discipline which can be taught, or is it a skill which is gained through experience?
This panel will discuss the relevance of Systems Engineering in undergraduate courses; and inform delegates of current INCOSE activities in Systems Engineering education.

Panel Abstract

The panel will begin with an overview of the work done so far by the INCOSE Systems Engineering education working group, in particular the progress made towards a generic Systems Engineering curriculum for Systems Engineering.

The remaining panellists, who represent a broad range of educators current involved in Systems Engineering education and employer organisations, will each give their views for or against the propositions that:

- Systems Engineering can be taught effectively at undergraduate level.
- Systems Engineering should be an essential element of ALL undergraduate engineering and management degrees.
- Universities are turning out graduates with skill sets appropriate for working in today's industry.

The discussion will then be opened up to the floor to further discuss the above and any other aspects of Systems Engineering education.

Panelists

Michel Galinier (France), Cecilia Haskins (Norway), Philip M'Pherson (UK), Rashmi Jain (USA)

Tutorials

T1- SysML and UML for Systems Engineers

Matthew Hause and Francis Thom (UK)

This training course for Systems Engineers covers the Systems Modelling Language (SysML) and UML 2.0 modelling techniques and how they fit into the development process. Most UML courses are for the MIS sector or are targeted at programmers and do not address the very specific issues relating to Systems Engineers such as modelling requirements, physical and logical architectures, constraints, timing, parametric equations, continuous systems, concurrency and distribution. This course is specifically designed to present a pragmatic method, based on the de facto object-oriented modelling languages, UML 2.0 and the SysML, for the development of safety critical and technical systems. Examples, exercises and workshops are all based on real-time examples and the current SysML and UML 2.0 specifications.

T2 - Dealing with Uncertainty in Systems Engineering

Mark Powell (USA)

Uncertainty permeates every aspect of Systems Engineering, from the first concept exploration until retirement of the system. Without uncertainty, Systems Engineering becomes, well, just engineering. How a systems engineer deals with the uncertainties in a project plays a major part in its success or failure. This tutorial addresses the role that uncertainty plays throughout the entire project lifecycle, and how the systems engineer can more effectively deal with it to assure project success. It is based on a graduate course taught at Stevens Institute of Technology as part of the graduate systems engineering degree program. This tutorial addresses the probability theory, probability models, and statistics needed in the practice of Systems Engineering to more effectively deal with uncertainty. State of the art approaches will be discussed with real world examples. A CD will be provided to the student with extensive references, a probability and statistics programming language, worked out exercises of real world systems engineering problems, relevant papers, and a textbook on the statistics needed by systems engineers.

T3 - SE in a chaotic, complex environment

Sarah Sheard (USA)

This tutorial surveys the exciting new sciences of chaos and complexity theory, complex adaptive systems, networks, small world theory, and even advances in cognitive science, and shows how they relate to systems engineering. Exciting new discoveries are appearing in the news every day... just this week a research study was publicized that showed that during sleep the brain functions as smaller disconnected networks instead of one large coherent network. While quite mysterious according to traditional views of the brain, when looked at from these new views this becomes intuitively understandable and sensible, providing insight into the function of sleep that has puzzled doctors for ages.

Similarly, our approach to building, using, and maintaining ever more complex systems, particularly those systems that involve independently owned and operated, interconnected computers that continually adapt to the environment around them, can be viewed much more simply and intuitively if we understand how complex adaptive systems work together in networks similarly to networks of biological systems.

Building on the author's very successful 2005 paper presentation on Practical Applications of Complexity Theory for Systems Engineers, this tutorial goes into more detail on chaos and complexity theory, including exercises.

T4 - Systems Engineering, Increasing the Efficiency of Research Infrastructure Projects

W.R. Ansorge (Germany)

"The costs of research are rising, due in particular to the increased use of expensive instruments and infrastructures. Therefore, a higher level of support is necessary in order to achieve impacts of the same size as under previous framework programmes."

This statement is brought forward by the European Commission in its 2005 document "Building the ERA of knowledge for growth" as a major argument for doubling the R&D investment in the seventh framework programme (FP7). Pan-European and international research infrastructure facilities needed for front end scientific and technological and basic research projects have substantially increased in size and complexity. Inevitably, this seems to have lead to a cost explosion in the acquisition and operation of new research infrastructure projects. The aim of this tutorial is to demonstrate innovative techniques unknown or not fully exploited in current research infrastructure acquisition projects and the associated scientific community to avoid a dramatic increase of the required budget for realization and operation of research infrastructure instruments and facilities.

T5 - Architectural Frameworks and Modelling

James Martin (USA)

Architecture provides the unifying structure (or roadmap) for exploration of the problem space and for characterization of the solution space such that better decisions can be made. Architecture is an arrangement of feature and function that maximizes some objective. This tutorial will describe fundamental concepts used in architecture modeling that will assist you in developing and using your own architectures.

The use of an architecture framework leads to a more model-driven systems approach and allows you to "discover" the essential attributes of the problem space that must be addressed by the system solution. Architecture models are where these essential attributes are defined and evaluated. This approach to architecting will be described within the context of the DOD Architecture Framework (DODAF) and other frameworks like the Federal Enterprise Architecture Framework (FEAF) and the Zachman Framework.

There can be a hierarchy of architectures that helps focus the architecture team on the right level of abstraction. The architecture you develop will have impacts above and below you in the hierarchy. Several examples of architecture frameworks will be discussed along with application guidance for each: Zachman, Gartner Group, The Open Group, Reference Model of Open Distributed Processing, Federal Enterprise Architecture (US), and Department of Defense (US). The various modeling constructs within the DOD Architecture Framework will be described so that you can see how a framework can integrate the overall systems architecting and engineering activities.

T6 - Project Success is not really difficult...

Niels Malotaux (Netherlands)

In today's competitive environment, it's not enough to run a project until it is ready. We must accomplish ever more in less time. This calls for constantly optimizing the way we run projects. Not all theory works as expected in practice and our intuition from time to time does fail to make us doing the right things.

In this tutorial we will present a complete set of methods that have been proven in practice to make projects deliver more successfully in significantly shorter time, creating real business value. We will show methods you can start using immediately in your own environment, optimizing the short term planning, focusing on what is really necessary and optimizing the longer term planning.

An important basic element is the time-honored Plan-Do-Check-Act (PDCA- or Deming-) cycle, which helps us find, if applied properly (that's the catch!), the best ways to execute the project and how we can optimize our methods even further. By introducing "mutations" in the Act-phase of PDCA frequently, keeping what works better and shelving what works less, we force rapid evolution of our performance. Therefore we call these methods Evolutionary Project Management Methods or "Evo".

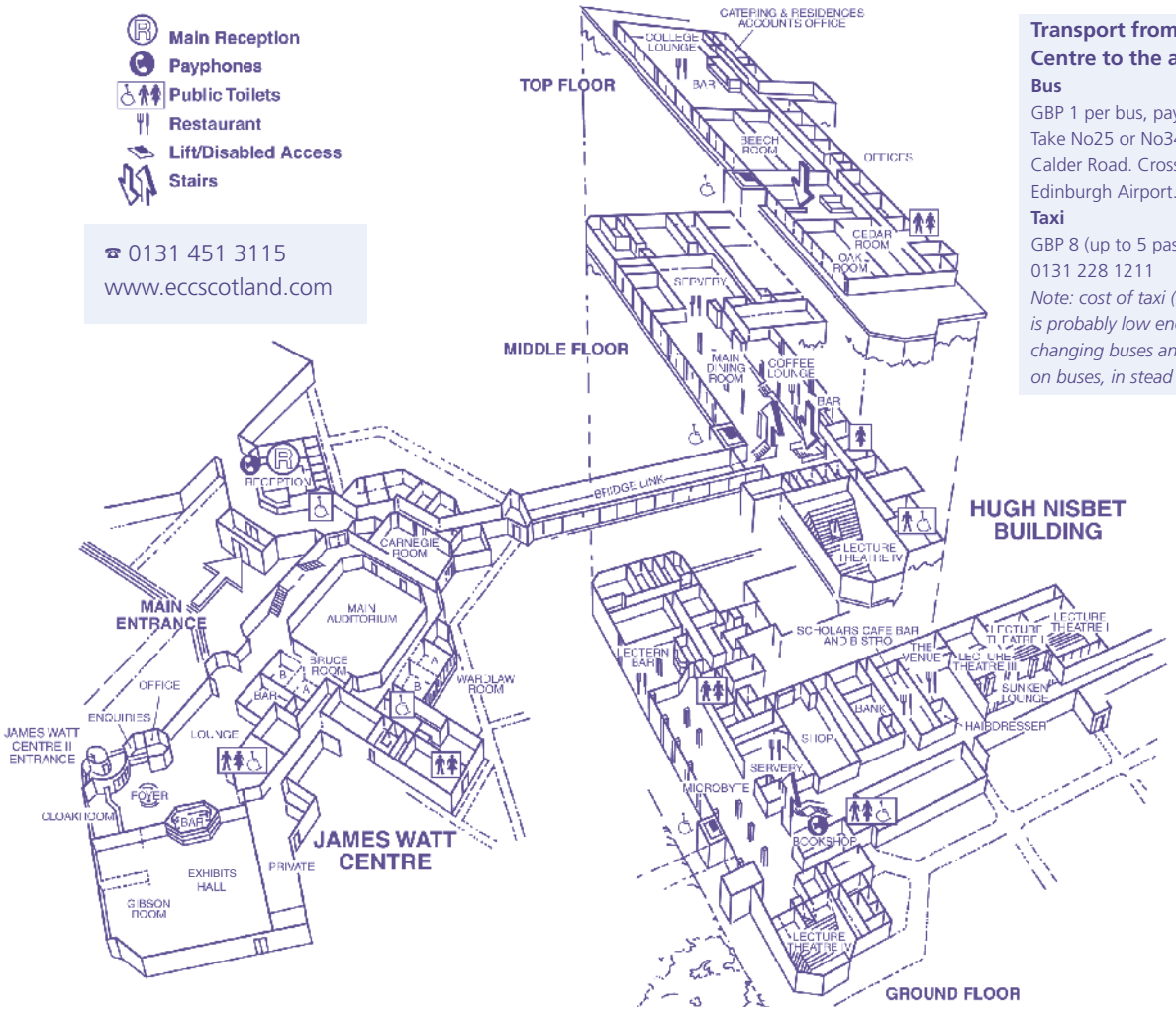
At the end of this tutorial I will ask you "Can you afford not to use Evo?". You will know the answer.

T7 - Competitive Systems Engineering: how to do systems engineering in hot competition. Detailed pragmatic and unconventional techniques.

Tom Gilb (Norway)

Some systems engineering is done in continuous international competition; for example, telecommunications products. The problem is to visibly beat the competition in quality and price while also beating them on time to market. There are specific engineering methods and processes that emphasize the ability to 'beat the enemy'. This tutorial will highlight the specific methods we can offer to aid the competitive engineering process. The methods are innovative and the key idea is the ability to quantify all critical qualitative aspects of a system, not just the conventional ones.

Edinburgh Conference Centre, Heriot Watt University - Edinburgh, Scotland (UK)



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Transport from the Conference Centre to the airport:

Bus

GBP 1 per bus, pay exact fare to the driver
Take No25 or No34 from the Campus till Calder Road. Cross the Road take No35 to Edinburgh Airport.

Taxi

GBP 8 (up to 5 passengers). Call CityCabs 0131 228 1211

Note: cost of taxi (may have to add GBP 1 tip) is probably low enough to avoid hassle of changing buses and spending about 40 min on buses, in stead of about 10 min in the taxi.

General Schedule

Every day

	8.00 - 18.00	Registration desk open	Foyer
	8.00 - 8.45	Speakers Breakfast	Main Dining Room
	8.00 - 18.00	Speaker Ready Room	Office
	10.30 - 11.00	Coffee break	Exhibits Hall
	12.30 - 14.00	Buffet Lunch	Exhibits Hall
	15.30 - 16.00	Coffee break	Exhibits Hall
	11.00 - 12.30	4 Paper presentations	Main Auditorium and Lecture Theatre IV
	14.00 - 15.30	4 Paper presentations	

Plenary sessions

Monday	9.00 - 10.30	Opening and keynote	Main Auditorium
Wednesday	16.00 - 17.00	Closing	Main Auditorium

Invited speakers

Tuesday	9.00 - 10.30	4 invited speakers	Main Auditorium and Lecture Theatre IV
Wednesday	9.00 - 10.30	4 invited speakers	

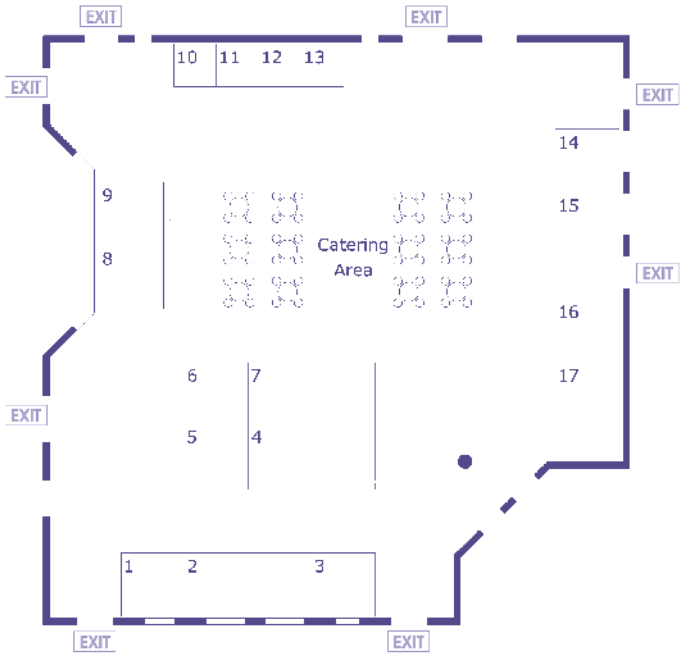
Panel Debates and Toolvendor Challenge

Monday	16.00 - 17.30	2 Panel debates	Main Auditorium and Lecture Theatre IV
Tuesday	16.00 - 17.30	2 Challenge tracks	

Tutorials

Monday	11.00 - 17.30	Tutorials T1 and T2	T1-3-5:	Carnegie Room
Tuesday	11.00 - 17.30	Tutorials T3 and T4	T2-4-6:	Wardlaw Room
Wednesday	9.00 - 15.30	Tutorials T5, T6 and T7	T7:	Bruce Room

Exhibitors



1 Vitech Corporation
2 IRqA
3 Galorath
4 Telelogic
5 Thales
6 SELEX Sensors and Airborne Systems
7 Systems Engineering Innovation Centre
8 Artisan Software
9 Project Performance International
10 INCOSE, UK Chapter of INCOSE
11
12
13 College of Defence Management and Technology, Centre for Systems Engineering
14 IBM Rational Software
15 Advantage Technical Consulting
16 UGS
17 MBDA Missle Systems