

Space Project Management and Systems Engineering

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Project Management Training

- Large and complex projects (in all sectors) face difficulties delivering the required technology performance within their budget and schedule constraints.
- Director General of ESA was encouraged in 2008 by Council at Ministerial level to “put in place methods, processes and tools, to reinforce the Agency’s capabilities to control the cost and planning of ESA projects”.
- One of the recommendations of the Edwards report (2010), was therefore that ESA should develop a Project Manager Training Programme for major space projects
- UCL-MSSL was successful in winning a contract to deliver this training based on a series of lectures and realistic ‘simulations’
- Professors Alan Smith and Michael Emes have now successfully completed 4 cohorts of the 14 day programme. The fifth cohort is currently underway and ESA have extended the contract for a further 5 cohorts

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Systems Engineering Training

- The next stage in the Agencies move to reinforce the skills it needed was to focus on Space Systems Engineering. The desire was to move away from a sub-system focus towards an end-to-end view
- UCL-MSSL secured the contract for this training in 2015, again based on a training model combining taught sessions and realistic 'simulations'.
- The training is split over two weeks with the first being dubbed the Definition Module and the second the Implementation Module. Through these the full mission lifecycle is explored. Simulations include scenarios such as creating the MRD, doing a design trade-off and planning verification.
- We have now completed 4 cohorts, with the 5th completing in December. The Agency is also interested to extend this training.
- As part of the programme we also cover a one-day focussed module where we have covered Systems of Systems / Architecture Frameworks and the Systems Engineering Planning

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Research

- Through the engagement with ESA the centre is developing areas of research that can benefit both parties
- On our MSc programmes each year we typically have several students interested to undertake their project with a space sector focus. Recent examples of final projects include:
 - What are the success factors in the development of new and immature technologies in the space sector?
 - Blockchain-driven business transformation in the space industry
 - Exploring the paradigm of risk for CubeSats in Deep Space
- One of our PhD students (Juan Carlos Guerrero) is currently modelling the cost and schedule performance of projects, with a particular focus on the challenges of managing projects delivering scientific instrumentation for spacecraft. Part of this research has involved input from ESA project managers

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Research - MBSE

- **Study:** Explore the use and evolution of Model Based Systems Engineering (MBSE) models through the project lifecycle
- **Study lead:** Benoît Pigneur – Lecturer, Department of Space and Climate Physics, UCL
- **Background:** This research initiative is partially funded by ESA and it was developed in response to a call for research projects in MBSE under ESA's Open Space Innovation Platform.
- **Key outcome:** Contribution to the digitalization of space projects through enhancement of system engineering practice.
- **Some key activities:**
 - Better understand the need for MBSE in space projects with respect to systems attributes, characteristics and maturity required at each phase of the project lifecycle.
 - Map the digital tools to different types of projects across the lifecycle to ensure digital continuity. Identify gaps.
 - Create guidelines for establishing a digital model philosophy.

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Research - Future

- More broadly, Dr Chekfoung Tan has recently started developing ideas to conduct information systems (IS) research in the space sector.
- IS research has been widely conducted and applied in various sectors such as healthcare, construction, retail, education, marketing and government sectors. However, limited research has been done on the role of information systems in the space sector.
- We are also interested in a range of research areas including
 - Risk and reliability modelling;
 - Requirements management;
 - Technology selection and decision making;
 - Working in technology development in international teams;
 - Monitoring progress in complex projects