

To have and have not ... a pilot, that is.

UAVs and Deconfliction

An autonomous vehicle has goals and sub-goals and it develops a plan to achieve those goals within certain constraints.

Question: If you have ten autonomous vehicles all pursuing independent goals how do you make sure the plans each one develops do not conflict? And conflict can be not only physical – bumping into each other – but also temporal, strategic or tactical.

Answer: You need a UAV-VTD/SE!

The SEIC is leading a collaborative project with Dassault Aviation, MBDA and Kongsberg Defence and Aerospace to undertake a feasibility study on the implementation of a Virtual Technology Demonstrator/Synthetic Environment (VTD/SE) for international collaborative studies of autonomy, concepts of operations and/or deconfliction of Unmanned Aerial Vehicles (UAVs). The study sets out to establish the requirements for such a tool: its top-level functionality and its conceptual design.

Progress is governed by a systems engineering methodology known as SEDEP: the Synthetic Environment Development and Execution Process. SEDEP was developed under the auspices of a European Collaborative project, EUCLID (European Cooperation for the Long Term in Defence) entitled 'Realising the potential of a networked simulation in Europe'.

An ad hoc planning group was set up comprising both government and industrial representatives with expertise in UAVs. The group will oversee the implementation of SEDEP during the definition stages and through to conceptual design. In essence, this corresponds to the first four steps



of SEDEP's 7 process steps:

SEDEP Step 0: Definition of topic to be studied and user need analyses.

SEDEP Step 1: Definition of the VTD/SE functionality

SEDEP Step 2: Definition of the VTD/SE System Requirements

SEDEP Step 3: Conceptual design of the VTD/SE

To date, the project has delivered reports on the user and systems perspectives requirements as well as discussion documents on the levels of conflict relating to various degrees of autonomy. It will conclude later this year with a conceptual design for a demonstrator which should form the basis of a follow-on prototyping and assessment programme of development.

The project is supported by the Western European Armaments Group (WEAG) – which has recently been assimilated into the newly formed European Defence Agency (EDA).

For further information please contact Ayman El-Fatraty, (a.el-fatraty@lboro.ac.uk)

In the meantime...

... this year's Advanced Systems Engineering MSc course students have been busy investigating the environment for military pilot training in 2015 and deriving the requirements for a pilot training system for the Hawk Project at BAE Systems, Brough. ▶▶▶

Made to measure

introducing CEMMNT - the Centre of Excellence in Metrology for Micro and Nano Technologies



**A 5-year multi-million pound initiative
championed by the DTI's MNT**

Two aspects characterise Microsystems: firstly the multi-disciplinary nature of the underlying technologies and secondly the level of integration required to develop multi-functional devices. Both these characteristics place microsystems in a unique position from the perspective of an overall systems design and its evolution as well as the intended application.

Microsystems, although on a different scale to most conventional systems, have of late demonstrated a tendency towards increasing complexity on a par with larger platforms and systems. In this context, microsystems technology is advancing towards the realisation of multi-functional, intelligent devices such as the lab-on-a-chip for diagnostics or miniaturised inertial measurement units for aerospace and automotive applications. These sub-systems will

in future become integrated within larger systems to form part of an intelligent, ambient environment populated with sensors, actuators and wireless transceivers. Within these sophisticated environments, intelligence will be distributed and shared via ad-hoc, wireless networks and data/knowledge will be processed in real-time. Systems engineering, as a discipline, addresses all aspects which provide a framework for the integration of people, processes, tools and technologies in order to enable the development of complex and evolving systems. This capability is, therefore, equally applicable to the design and commercialisation of microsystems-based components and is only just being directed towards this field.

**to support the
entire spectrum
of the micro and
nano technology
chain**

The new year of 2006 sees the creation of a new Centre of Excellence in the UK, based at the SEIC, focused on metrology and characterisation of micro and nano technology based materials, products and systems. CEMMNT, is a 5-year multi-million pound initiative championed by the DTI's MNT programme and set up to help accelerate the integration of micro and nano technologies into products and processes within the UK industry. This will be achieved by strategically enhancing the UK measurement and characterisation supply chain to fill capability gaps, improve technology and increase access to existing capabilities. The goal is to support the entire spectrum of the micro and nano technology value chain.

The CEMMNT solution will be focussed on the needs of the customer. CEMMNT's technical service offering will consist of both existing and additional measurement equipment as well as expertise. This equipment has been carefully selected by the partners, in consultation with the DTI, to satisfy the anticipated needs of the UK in this field and can be characterised into two generic categories:

- Measurement and characterisation
- Research and development

Measurement and characterisation services will normally require off-the-shelf solutions that will be typically defined by the customer. In addition, CEMMNT will offer a range of complementary activities as part of an enhanced portfolio of services. Through this collaboration, CEMMNT will be able to provide high quality responsive services at competitive commercial rates using calibrated and traceable equipment.

The research and development capability will be underpinned by the measurement and characterisation equipment and expertise held within the partner organisations. CEMMNT will engage with its customers to provide bespoke

CEMMNT brings together five globally-recognised market-leading organisations that are ideally positioned to supply micro and nanometrology and characterisation services to UK industry: The National Physical Laboratories, QinetiQ, Taylor Hobson, Coventor and BAE Systems' Systems Engineering Innovation Centre (SEIC).

Together these organisations represent some of the finest resources in the UK and Europe and have collectively agreed on the following key strategic objectives:

- **Create** a centre of excellence through collaboration, developing new instrumentation and tooling techniques, novel metrology solutions and a coherent measurement system
- **Produce** fast and effective measurement and characterisation processes that reduce technical barriers for the commercialisation of micro and nanotechnology based systems

- **Provide** tailored access to new and existing facilities that meet the needs of customers
- **Establish** systems-centric approaches to micro and nanometrology to enhance the process of commercialisation
- **Promote** the potential success and best practice application of micro and nanometrology throughout the MNT supply chain to reduce the gap between method and application
- **Develop** the capability to advance the frontiers of micro and nanometrology and ensure this is linked into the supply chain
- **Establish** a framework for training, workshops, education and dissemination on aspects relating to micro and nanometrology
- **Engage** all stakeholders across the entire supply chain with equal emphasis on large industries, application sectors and SMEs

The Centre's hub will be based at the SEIC in Loughborough.

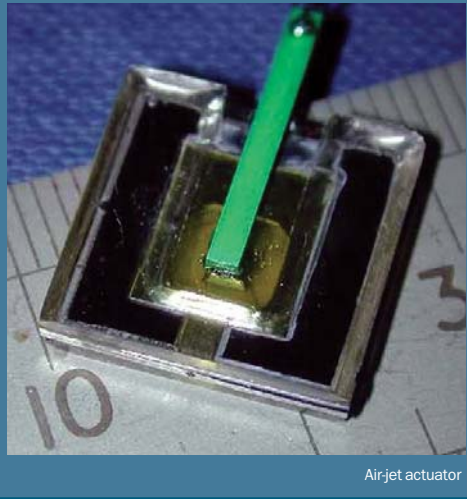
THE IMPORTANCE OF MICRO-AND NANOTECHNOLOGY TO BAE SYSTEMS

Microtechnology

- is the 'electronics second wave' providing miniaturised sensors and actuators to compliment electronics systems.
- is leading to smaller lighter cheaper devices making product systems more capable.
- If BAES has an access advantage, it gains commercial advantage and added value.
- creates new markets.

Nanotechnology

- has the potential for major product disruption
- could create totally new markets
- will enable multi-functionality



Airjet actuator

research and development solutions to help solve more challenging technical problems in micro and nanotechnology. Through CEMMNT, there will be access to a network of expert resources that:

- Support product prototyping and development
- Introduce a systems-centric approach to product development through systems engineering, modelling and simulation; and
- Enable technology transfer of research techniques and equipment to facilitate new instrumentation development

This unique initiative will, it is believed, enhance the success of the UK's programme of MNT commercialisation helping sustain the lead the UK enjoys in this field as well as create new and timely opportunities for businesses across a wide range of applications. The formal launch date is planned for the second quarter of 2006.

For further information please contact Ayman El-Fatraty, Interim CEO of CEMMNT (a.el-fatraty@lboro.ac.uk) or see the website at www.cemmnt.co.uk



▶▶▶ The team of ten employees created an online shared data environment to help manage data and communication within a geographically distributed workforce.

In order to understand how a pilot training system functions, the team applied newly learned systems engineering methods. This allowed them to consider all aspects of pilot training, to iterate the functional model as system understanding increased and ensure that the model was both complete and correct. Once the functional model of the system had been defined, further systems engineering tools were used to assess the robustness and consistency of the system.

Focused research identified the key issues affecting the training requirements of a Military Pilot in the 2015 environment:

- 4th generation aircraft will require more information management skills and less airmanship
- Multi-Role aircraft will be expected to undertake a wider range of operations
- The NEC battlespace will require aircrew to fulfil a greater tactical role
- Pressurised defence budgets will demand even more cost-effective training
- Military operations will be predominantly conducted by international coalitions
- Emerging nations will shift the global political balance as well as create new markets
- Conflicts will increasingly be smaller scale, of shorter duration and against flexible threats

Using the model, the team examined the current UK pilot training system and made recommendations for improvement, including:

Increase realism - make use of higher fidelity networked training assets to prepare the trainee in a more realistic manner. This would allow the reduction of expensive flying hours by acquainting the trainee with the new platform through better simulators. Networking will enhance the overall training package.

Reduce costs of Operational Conversion Unit (OCU) – bring the training requirements associated with the traditional OCU units into the scope of a centralised training system. This would allow a structured, common and controlled training programme to be established that is targeted to achieving the end goal of an Operational Pilot capable of contributing to their operational squadron without any extended conversion training.

Improve trainee selection - introduce a sophisticated upfront assessment phase to determine the capability of the trainee. This will allow weak students to be rejected from the programme before significant spend has occurred.

The model together with a collection of software tools were provided to, and accepted by, the Hawk Customer at the project presentation.

For more information or for a copy of the slides please contact John Cleveley at the SEIC (j.cleveley@lboro.ac.uk.)

If you would like more information about the MSc Advanced Systems Engineering email to seic@lboro.ac.uk

In the news

The Chief Executive of the East Midlands Development Agency and senior SEIC managers hosted a visit by the Head of Operations for Airbus UK and presented the East Midlands as an opportune region for Airbus to establish a new Engineering Centre. The SEIC was shown as an exemplar of how government, industry and academia collaborate to maximise leverage and how the competencies of the SEIC, in terms of systems engineering, could be a key factor in addressing their requirements. Should Airbus decide to invest in this region, the East Midlands will be able to boast a considerable aerospace presence on a national basis.

The SEIC's plans to establish a national aerospace innovation network on systems engineering (AIN-SyE), were presented at the Engineering and Technology Board of the Society of British Aerospace Companies (SBAC). The SEIC's activities within this framework will help evolve the national research and development programmes in this field from a systems engineering perspective.

The SEIC hosted one of the satellite seminars for the MANUFUTURE 2005 conference held at Rolls Royce in Derby. The seminar focused on future

aerospace manufacturing techniques and attendees were introduced to relevant research on health monitoring using the SEIC fuel rig and shown the ConSERT robotic demonstrator system.

In January, the SEIC began talks with senior technical staff from CS&S/MASS to discuss opportunities for collaboration and named areas to be pursued with the aim of identifying a programme of research addressing the requirements of CS&S.

The SEIC is involved in a number of proposals to be submitted into the DTI's Technology Programme. Prime amongst these is an Aerospace Innovation and Growth Team proposal (AeIGT), headed by QinetiQ, to establish tools for identifying and embracing future disruptive technologies. Such a capability would enable the design of products with sufficient flexibility to enable the integration of novel technologies and thus mitigate against the risk of disruption.

BAE Systems and the SEIC played an important role at the recent INCOSE International Workshop. Through leading the Technical activities and the Corporate Advisory Board of INCOSE, the company continued to gain prominence in its support for systems engineering.

Drs Kirsty Brown (DSTL) and Peter Bolton (SEIC) attended the Annual Conference on SyE for Defence at the Defence Academy for the UK, Shrivenham. The conference enhanced the collaboration between DSTL and the SEIC on Capability Acquisition and Management.

Simon Howison, Group Engineering Director Air Systems and Chair of the UK Engineering Council, visited the SEIC for an update on Air Systems' directed research programmes and an overview of other current programmes and potential relevant prospects. LU and BAE Systems staff from SEIC took the opportunity to present their work and showcase the labs and facilities. Discussions on how to move from the formation stages of SEIC to a re-focused set of drivers and deliverables made a positive and valued contribution to the way ahead and to ensuring that BAE Systems' benefits increase in the future.

If you or your company are interested in getting involved or would like more information on any of these topics contact Ayman El-Fatraty, Customer Manager, (a.el-fatraty@lboro.ac.uk)

Farewell Peter, Welcome Annette

Back in October 2002 Peter Phillips set off to Loughborough University to turn a radical idea into a reality. The idea was to create a unique partnership between industry, academia and government for Systems Engineering and, as is the nature of things unique, there was no template to follow. Peter later said it was like being given a blank piece of paper.

Nearly three and a half years later, the SEIC has indeed become a reality, a hive of research and educational activity with a well established infrastructure ready to face the future with confidence. In truth, Peter's blank piece of paper was full of vision, challenges and hard work. Always at the interface between two cultures, he worked tirelessly alongside his university counterparts to deliver this vision and having seen the SEIC take shape and materialise, he has now



Peter Phillips (centre) and his wife Barbara enjoy Andrew Bradley's speech at Peter's retirement party. Inset: Annette Harrison

chosen a well-earned retirement in which he will pursue his passion for photography. His SEIC colleagues and all SEIC stakeholders extend their best wishes for Peter and his family and a BIG THANK YOU!

The SEIC will continue to remain in good hands with the appointment of Annette Harrison as the new Management Head. Annette's previous position in BAE Systems was as Head of

Commercial and Procurement for Tornado Capability, based at CS&S MASS in Warton. She brings considerable experience in developing partnerships and delivering customer service and will take the SEIC through to its next stage of development.

A warm welcome from all and here's to the SEIC's future.

FEEDBACK

Please email your feedback, news and views to seic@lboro.ac.uk. Edited by Ayman El-Fatraty and Amanda Pearce. Copyright SEIC*. All Rights reserved. Spring 2006

FUTURE ISSUES

- Architectures
- Integrated Wing Project