

TECHNOLOGY@ATC

James Baker - seeing an increase in partnerships
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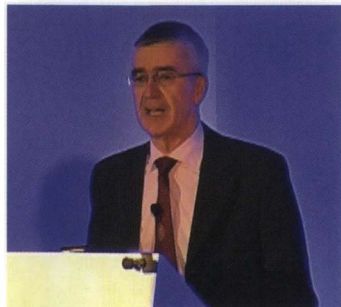
A conference of innovation and collaboration
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Partnering for capability – sharing the vision for defence

The ability of our armed forces to protect citizens at home and abroad depends on an ever expanding pool of creativity and innovation. As our adversaries get smarter, the demand for new technologies, new ways of thinking and new ways of doing things has never been greater.

Vital elements in this transformation of defence capability are partnerships between MoD, industry and academia that ensure that the very best solutions can be delivered in the shortest timescales.

BAE Systems is at the vanguard of this transformation and during November at the Strategic Capabilities Solutions / Advanced



Professor Philip Sutton speaks at the conference

Technology Centre 'Partnering for Capability' conference the company showcased how partnerships involving brilliant minds in high achieving teams are building success for our defence needs.

350 delegates drawn from BAE Systems, MoD, partners from industry and universities attended the conference held this year in the striking surroundings of the Newbury Racecourse Main Grandstand.

Guest speaker, Professor Philip Sutton, the MoD's Director General R&T Strategy, set the scene for the day by highlighting the need for industry and the MoD to become more closely aligned in their thinking and to concentrate on delivering vital equipment to the front line. "We are dealing with increasingly ingenious adversaries and it's absolutely critical that



Conference key messages:

- **BAE Systems is committed to delivering the highest levels of innovation to its customers and across the Company through partnering across the defence industry.**
- **Breadth of partnership is critical to continual and effective innovation – partnering with the MOD/ Government, partnering with the Supply Chain/ Academia, partnering within the Company helps BAE Systems deliver to its customers.**
- **BAE Systems is an active partner with other organisations, as well as offering partnership across the UK defence sector. We engage in and facilitate partnering to support the highest levels of innovation.**

the research and development community works together to ensure we stay one step ahead of them. R&D is not solely about the creation of new technology, it's about buying more time for our servicemen and women and doing our utmost to protect them." he said. His message to industry was summarised as: 'Help define

solutions to defence research goal challenges; work with the MoD to identify 'win-win' approaches and be a determined provider of R&D solutions'

Together with Strategic Capability Solutions, the ATC is at the heart of these endeavours; playing a full role in delivering
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A Conference of collaboration...

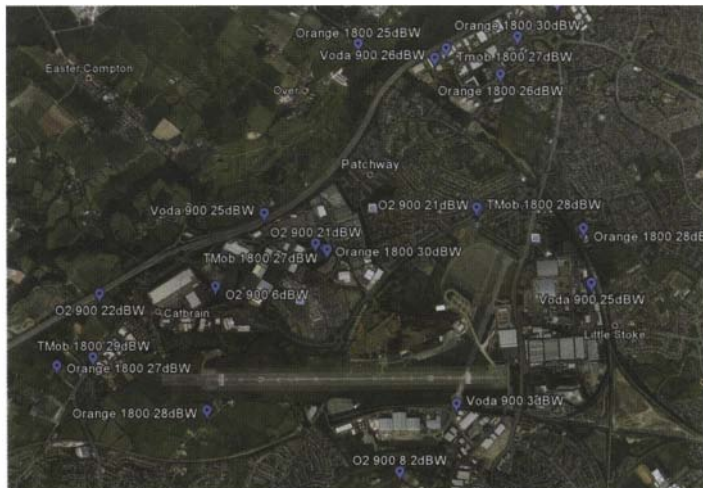
The 'Partnering for Capability' conference at Newbury demonstrated how innovation is delivered through partnership for BAE Systems. Here are some key technologies showcased at the conference that highlight this approach.

Performance...

Navigation using opportunistic radio sources

A radio positioning system has been developed that uses signals from transmitters such as cellular, television and public broadcast radio to rival GPS and other satellite-based positioning systems. The low signal strength of GPS leaves it highly susceptible to jamming and can result in intermittent or denied service indoors and in canyons. The higher powers of terrestrial signals allow radio positioning in challenging GPS-denied environments and when combined with the covert nature of using opportunistic signals, also reduces the likelihood of jamming.

The accuracy of a radio positioning system is dependant on the signal bandwidth. Analogue TV, digital TV, digital radio, 3G cellular, HI-FI, Wi-MAX and the future 4G wireless protocols are all higher bandwidth than GPS and other satellite systems such as GLONASS and Galileo. This means that 'opportunistic transmitters' could provide greater positional accuracy as well as much higher signal strength and availability compared with typical GPS. The system can also be adapted to work in reverse as a means of tracking the movement of friendly and hostile forces based on their transmitter characteristics.



Map showing the many public-domain transmitters that can be used for GPS-denied navigation.

Awareness...

Fusion of information for future land reconnaissance



The main objective of a military reconnaissance mission is to gain 'situational awareness' to allow battlefield commanders to decide on courses of action. In achieving this, land operations in increasingly 'asymmetric' situations such as insurgency and terrorism have many complexities over symmetric reconnaissance including limited lines of sight, unlimited hiding places and the presence of non-combatants. This work supports the Strategic Capability Solutions CAP D200 project for future reconnaissance concepts in which novel means of intelligence gathering and data sources are being investigated.

The mix and multitude of data sources and means of acquiring information in future missions provides an opportunity to develop new ways of combining or fusing



information, thereby giving a more complete picture to our forces. In addition, the opportunity exists to reconfigure or adapt those sources to optimise the information for differing scenarios. This project has drawn on previous work and relevant university partnership projects including ALADDIN, ARGUS-DARPA and OASIS to improve the ability to track multiple, diverse objects through a number of non-overlapping fields of view from camera positions. The effectiveness of these approaches has been measured by its impact on the situational awareness picture.

Real time terrain sensing

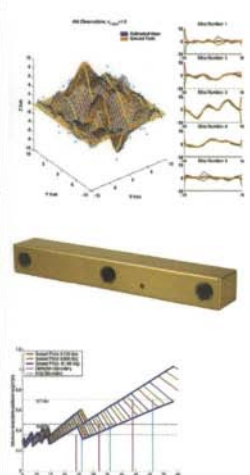
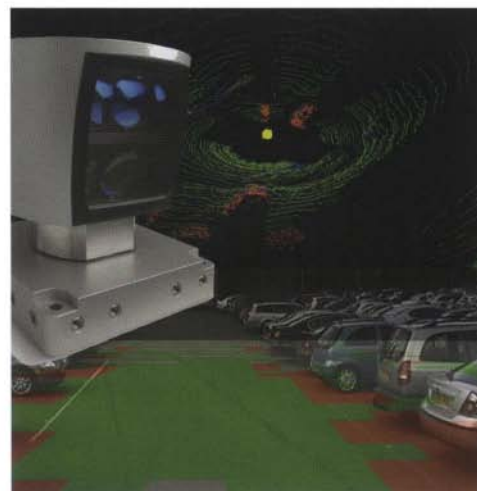
On-board sensors allow vehicles to detect obstacles and estimate terrain surface geometry.

Knowledge of the local terrain surrounding a vehicle is essential for the autonomous control of a platform to plan and traverse safe paths or warn drivers of upcoming hazards. This project has demonstrated real time detection of obstacles and estimation of terrain surface geometry on board a full scale vehicle in urban environments at normal driving speeds. The work is based on range imaging

devices such as laser based LIDAR, stereo cameras and motion analysis. Results can help raise the level of autonomy of today's robotic platforms and provide safer operation for manned vehicles.

The works has featured:

- Real time detection of obstacles and terrain surface geometry from on-board range imaging sensors
- Application to autonomous, tele-operated (remote controlled) and manned vehicles
- Potential for additional exploitation into sea and air domains.





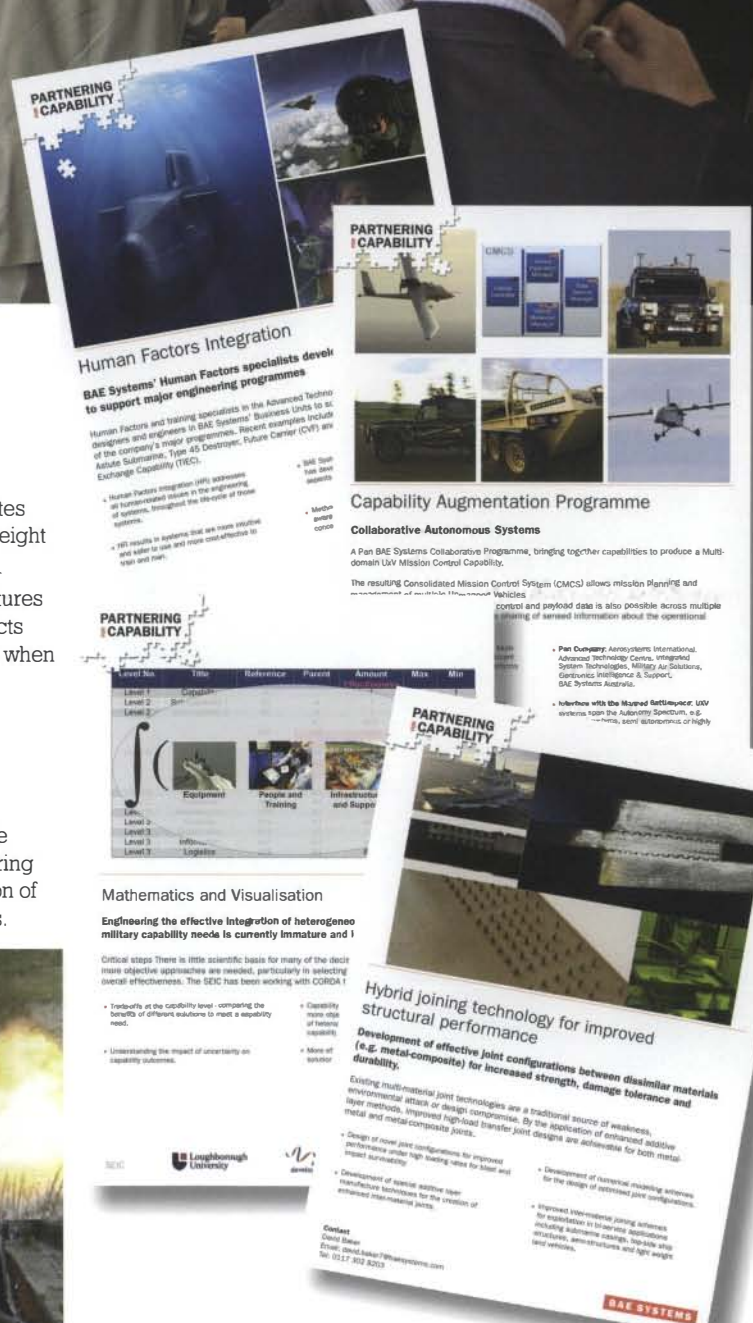
Survival...

Multilayer structures for surviving blast and ballistic threats

There are pressing needs to reduce the weight of military vehicles while providing increased crew protection. Fibre composites are the lightweight structural materials of choice but their performance when subject to blast from explosions and ballistic threats such as shells falls short of demand. Recent developments have hinted that combinations of materials rather than the conventional monolithic approach to structure fabrication can yield benefits of better resilience to blast while maintaining low weight.

This work has used these developments to explore:

- Augmentation of blast / ballistic resistance of structural fibre composites while maintaining low weight
- Tuned, multilayer, multi-material (MLMM) structures that minimise lethal effects behind the armour even when the armour yields
- Dedicated design tools to predict and optimise protective behaviour of MLMM systems
- Development of scalable and low cost manufacturing techniques for integration of multi-material structures.



Posters and exhibition stands showing the many technologies and innovations were displayed and demonstrated.

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innovation through partnerships both internal and external to the company. James Baker, Director and General Manager of the Advanced Technology Centre, reinforced the need for collaboration:

"We are seeing an increase in partnerships across the R&D sector. It's only through

collaboration that we can achieve the results our armed forces need in a timely and affordable way. This event reflects the importance of partnering and the presence of so many colleagues from across the defence sector gives us an opportunity to discuss and plan new ways of cooperating in the future." he said.

Examples of key developments involving ATC and partners that capture the theme of the conference included:

Collaborative Autonomous systems

This pan company effort formed part of the Strategic Capability Solutions' Capability Augmentation Programme or CAP and has brought together mission planning and management capability for unmanned vehicles. The approach is flexible and can be applied to unmanned vehicles in the air and land domains with varying levels of autonomy from driver aided through semi autonomous to highly autonomous. The system is capable of dealing with dynamic mission re-planning, mission handover and interfacing with legacy systems.

This highly collaborative effort included the ATC, Aerosystems International, Integrated Systems Technology, Military Air Solutions, Electronics & Integrated Solutions and BAE Systems Australia.

Human performance assessment system 'Gwylio'



The 'Gwylio' concept provides an integrated suite of human performance assessment tools and is a state of the art capability for conducting 'human in the loop' trials involving multiple facilities such as simulators, rigs and real systems.

The system provides a flexible framework for analysing human performance in any exercise involving multiple facilities.

Complex exercises can even be managed automatically and data (both objective and subjective) are analysed in real time, giving instant access to results.

Gwylio operates over a network, synchronises all data and can be controlled remotely making it ideal for network enabled assessments.

Partners in this work include the ATC, NLR, Deep Blue, Avionics, Noldus, RuG and Elbit.

BAE Systems University Partnership new technologies for Unmanned Air Vehicles – FLAVIIR.



This programme, jointly funded by BAE Systems and the Engineering and Physical Sciences Research Council is the response to a grand challenge set by the company to develop technologies for a maintenance free, low cost UAV without conventional control surfaces and yet fully capable of conventional aircraft performance.

FLAVIIR forms part of the BAE Systems strategy to concentrate funding on selected universities to facilitate a greater degree of cooperation between university partners and include system integration into the research agenda.

Future UAVs will be cheaper, more modular and rely on designs that consider many cross-discipline interactions and



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James Baker, Director & General Manager,
BAE Systems Technology & Engineering Services

trade-offs. The project ensures that BAE Systems understands the emerging technologies and how they fit together to deliver suitable systems for the future.

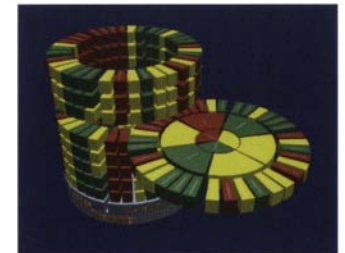
The university partners are: Cranfield, Imperial College, Leicester, Liverpool, Manchester, Nottingham, Southampton, Swansea, Warwick and York

Through Life Capability Management (TLCM)

The defence of the realm hinges on the many 'lines of development' that make up the capability of our current armed forces. It's not just about equipment and logistics; it's also about people, training, organisation, information, concepts and doctrine and infrastructure. All these aspects of a modern defence capability must be managed efficiently and harmoniously from cradle to grave hence the notion of Through life capability management.

As part of the company's activities on this topic, Strategic

Capability Solutions and the Systems Engineering Innovation Centre (SEIC) are addressing some of the systems engineering aspects. For example, there is little scientific basis for many of the decisions that must be made when addressing through life capability provision. More objective approaches are needed, particularly in selecting options and evaluating overall effectiveness. The SEIC has been working with CORDA to develop approaches to understand trade offs, the impact of uncertainty on capability outcomes and more effective presentation of options and solutions to decision makers.



The conference was not just about communicating success. The event was also a valuable opportunity for stakeholders in the future of defence to network and forge new links.

A delegate's view:

» The event was a unique opportunity to meet a number of areas within BAE Systems... I cannot think of another forum that would enable such a breadth of initial contacts in such a short space of time. One final observation as an "outsider" is that in BAE Systems you do appear to have a high level of communication between related groups. Achieving that in a very large company is no mean feat. »

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