Hazards forum

The Hazards Forum Newsletter

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Hazards Forum Newsletter

Issue No. 74 - Spring 2012

Contents

Edited by James Kearns

Views expressed are those of the authors, not necessarily of the Hazards Forum

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March 2012

Professor Ernest Shannon

In the last issue of the Newsletter we reported, with sadness, on the death of Professor Ernest Shannon CBE FREng. He was 73 and a native of Belfast. A former President of the Institution of Gas Engineers (1994) and the Institution of Mechanical Engineers (1996), he was elected to the Fellowship of Engineering (now RAEng) in 1987 and represented it on the Hazards Forum Executive from 2000.

Like many of his generation Ernest Shannon was educated at the local College of Technology and undertook an industrial apprenticeship (with Short Brothers) which provided the opportunity to work for a degree. He graduated from Queens University in aeronautical engineering and subsequently joined the staff of the University. It was at Queens University that Ernest Shannon met Professor Bernard Crossland, who figured so largely in the early life of the Hazards Forum. It was Bernard Crossland who persuaded Ernest Shannon to become a research fellow studying the fracture of ultra high pressure vessels, work for which he received a PHD. It was this work which lead to him joining British Gas in 1970. Shortly after his arrival Sir Denis Rooke, the distinguished engineer and manager, became Chairman of British Gas and continued in the role until shortly before Ernest Shannon's retirement.

His work at British Gas included the development of the "intelligent pig" for the internal inspection of operational pipelines and he and his team gained the 1989 MacRobert Award for engineering excellence for this work as well as Queens Awards for technology and exports. He subsequently became Director of Engineering Research and finally Group Director of Development. He retired from the company in 1995. Professor Shannon was an excellent member of the Hazards Forum Executive who made a strong contribution to its work. He was a warm and friendly man whose many engineering and business contacts and wide experience and understanding of risk issues were invaluable to the working of the Forum. Alongside his work for the Forum he was also a member of the HSE Investigation Board into the Hatfield Rail Disaster. He was appointed CBE in 2001 for services to economic development.

Dr Stuart Mustow, Past Chair and Distinguished Member

Engineering a Low Carbon Future – Risks and Rewards

James Kearns

On **Tuesday 29th November 2011** the Hazards Forum hosted an **evening event.** The event was co-sponsored by the Institution of Engineering and Technology and BP Alternative Energy and was held at the former's premises in Savoy Place, London.

This event was concerned with the unique challenges faced as the UK seeks to adapt to a changing energy mix. The lower carbon energy profile required to adapt to climate change is set to considerably alter the hazards faced by both industry and the public. This event provided a forum for these issues to be heard and discussed from a commercial and regulatory perspective, to consider the potential contribution of nanotechnology to lower carbon objectives and to examine its associated and wider ethical concerns. This event was also timely as it coincided with the Institution of Civil Engineers' (ICE) report on a low carbon infrastructure route map to 2050, which had been published[1] recently.

The event began with a few brief words from **Hazards Forum Chairman** Rear Admiral (retd) **Paul Thomas CB**, who welcomed the audience and thanked the Institution of Engineering and Technology and BP Alternative Energy for sponsoring the event. He then introduced the **chair for the evening Eddie Morland, Chief Executive** of the **Health and Safety Laboratory.** Mr. Morland thanked the Hazards Forum for holding this event and explained to the audience more about the previously mentioned ICE low carbon report. He then introduced each of the evening's speakers.

The event's first speaker was **John Armstrong, Head of Engineering Governance and Process Safety** at **E.ON UK.** His talk, which was titled *"Generation is Just Power Stations Isn't It?*" described the changing nature of the hazards to be managed in a major integrated power and gas company as it adapts to a lower carbon future. He also discussed the issues raised as generation installations change in complexity, with larger installations becoming more like process plants and smaller distributed sites moving generation closer to the end user.

The second speaker was **Peter Baker**, **Deputy Director** and **Head of Chemical Industries Division** at the **Health and Safety Executive (HSE)**, who gave a talk titled *"Low Carbon Future – A Regulator's Perspective"*. In this talk, Mr. Baker gave an overview of the outcomes of the HSE's Emerging Energy Technology programme, in which hazards from new lower carbon technologies are assessed. He provided a regulator's perspective of the emerging challenges for worker and public safety with the evolving energy mix, giving particular focus to issues associated with Carbon Capture and Storage (CCS).

The final talk of the evening was given by **Professor Geoff Hunt, Director** of the **Centre for Bioethics & Emerging Technologies** at **St Mary's University College, London**. In his talk, which was titled "*Contribution of Nanotechnology – Benefits and Risks*", Prof. Hunt provided an overview of potential applications of nanotechnology in the use and storage of energy, driving higher efficiencies and supporting low carbon goals. He also discussed some of the key ethical and

regulatory issues raised including life cycle and toxicity concerns.

Mr. John Armstrong began by explaining that E.ON's historical experience in the UK with electricity generation was of operating large coal and gas power stations, but that this was changing to other types of generation such as biomass, offshore wind and solar power.

Using the DECC energy pathways Mr Armstrong highlighted that one of the key requirements for the transition towards a low carbon economy may be the electrification of transport, which will involve the need to move much more electricity through a more expansive grid. Other components of a low carbon economy may be increased offshore wind with some of the DECC pathways requiring 10,000 offshore wind turbines along with carbon capture and storage and an additional 13GW of nuclear plants.

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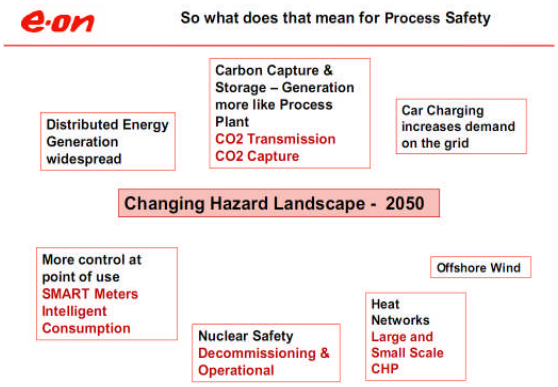
Mr. Armstrong then went on to explain the consequences of these requirements for process safety. The introduction of CCS will create new challenges as conventional power stations will be required to take into account processes that are not dissimilar to a chemical plant in some regards. CCS also involves transmission of carbon dioxide and its subsequent sequestration. Each of these will present novel hazards which will require careful management. The construction and operation of offshore wind turbines also poses difficult potential risks, such as from malfunctioning components, collapsing cranes used in construction, and ship collisions. The expansion of electric cars will place increasing demand on the electricity grid, which will need to be managed by encouraging intelligent consumption of electricity through smart metering. New nuclear power plants will require risk management through the construction, operation and decommissioning stages of each new plant.

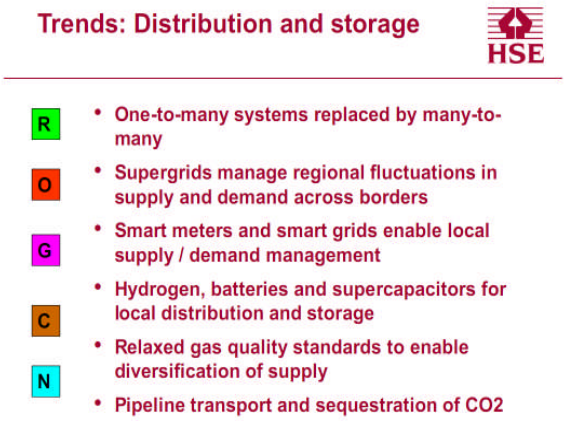


E.On are preparing for the management of these new hazards by investigating how the associated adverse events can be detected and prevented, as well as how the consequences can be controlled and mitigated should such an event occur.

The next talk was then given by **Mr. Peter Baker**, who presented the issues surrounding the drive for a low carbon future from both a regulator and an engineer's perspective. The Health and Safety Executive (HSE) are approaching the prospect of a low carbon future by pursuing certain strategic themes, such as the efficient use of energy, an increased diversity in energy sources and an

uncertainty in the technology to be used in the future.

The HSE has also indentified some key trends which are leading the drive to a low carbon future. The trends in power generation include not only expansion of renewables, but also an uptake of next generation biofuels, synfuels, landfill gas, CCS, coal gasification and new safer and more efficient nuclear plants. There are also trends in the distribution and storage of electricity in which one-to-many systems are replaced by many-to-many systems, whilst supergrids and smart meters will be developed to manage local supply and demand issues.



These trends present many challenges across the emerging energy sector. Engineers face large uncertainties and unknowns, especially as not all of the emerging technologies currently have appropriate standards or guidance. This lack of standards creates a potential for inconsistencies across the energy sector, which should be avoided. There are also questions over whether the future workforce (in both industry and regulation) will have the required competency and skills. On a local level, there will also be challenges with the public acceptance of certain technologies and planning issues.

Mr. Baker then discussed some projects which are currently been investigated. These include:

- CCS demonstration and deployment
- Wind farm life cycle hazards
- Major energy from waste installations.

CCS is an unproven technology that will require new pipeline structures and a massive scale-up of existing technologies. There are major accident hazards which are not currently well understood and possible regulatory gaps in the associated regulations. The hazards posed by wind farms are also uncertain. The North Sea wind arrays are amongst the world's largest construction projects and will require some major infrastructure such as sub-sea cables and substations. Energy from waste is an experimental technology used by inexperienced operators. There is a variable feedstock quality which leads to an uncertain performance. There are also issues about plants being sited close to residential areas.

Finally, Mr. Baker discussed some infrastructure challenges which will be faced by the emerging energy technology industries in the future. There is currently a fragmented, ageing EU energy infrastructure which will need updating and integrating. Smart grids and meters are needed to support distributed generation and system balancing. “Green jobs” may be concentrated in sectors with poor occupational health and safety performance, and there is projected to be major skills shortages across all sectors. For further reading, Mr. Baker cited a document titled “Health and Safety in the New Energy Economy”, which was published in December 2010[2].

The final talk of the evening was then given by **Professor Geoff Hunt**, who explained how nanotechnology could contribute to a low carbon economy. The talk began with an overview of what nanotechnology was and some of its applications. Nanotechnology is the manipulation of matter on the scale of one billionth of a metre. This scale is comparable to the diameter of a DNA helix and large viruses. Substances can change properties dramatically at the nano-scale level. These novel properties provide potential new benefits and hazards.

Nanotechnology has applications in many industries such as agriculture, medicine, housing, food, electronics and energy. It is an enabling technology with significant potential for a low carbon economy. Nanotechnology can help to improve sustainability through areas such as:

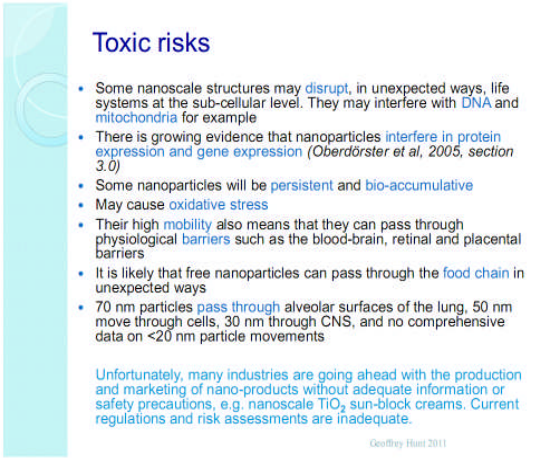
- Pollution prevention
- Recycling and remediation
- Insulation
- Alternative energy production

Pollution prevention can be achieved through molecular sensing of pollutants, acidity and chemical agents. Nanotechnology may also be used to purify water without the use of chlorine. A nanoporous ceramic has also been invented to absorb waste mercury more efficiently as well as possibly lead and radionuclides.

Nanotechnology is helping with recycling and remediation issues through the development of nanostructures for filtration, catalysis, separation and absorbents. Nanomaterials are being developed that would render harmless a range of toxic substances. Superparamagnetic nanoparticles have also been designed that would bind to any molecular target and could then be magnetised to remove them from the medium.

Much improved insulation of buildings can be achieved with nano and other advanced technologies that can enable a variety of new applications such as solar, wind and kinetic energy harvesting and self cleaning glass, as well as enabling energy storage and conservation. Sensor technologies can also allow buildings to respond to the environment.

Nanotechnology can also enable energy production from alternative sources. These include innovations in wind energy, hydropower, geothermal, bio-mass, solar and tidal energy generators. It is estimated that a reduction of electricity consumption of 75% in homes and industry could be achieved.



Prof. Hunt then discussed some of the risks of nanotechnology. The main risk arises from the potential toxicity of nanoparticles. The reactivity of a particle increases quickly as its size decreases. Some nanoscale structures may disrupt life systems at the sub-cellular level in unexpected ways. Nanoparticles have high mobility meaning that they can pass through physiological barriers such as the blood-brain, retinal and placental barriers. It is also likely that nanoparticles can pass through the food chain in unexpected ways. These and other risks mean that, although nanotechnology can offer vast benefits, much caution must be exercised, at least until the risks are better understood[3].

Eddie Morland then thanked the speakers for their presentations and opened the floor for comment and questions.

The discussion period included questions about wind intermittency and nuclear decommissioning, and whether the associated hazards had been considered. There were also remarks about problems with the cost effectiveness of CCS. There was also a brief discussion about nanotechnology regulations and how nanotechnology could be used to improve the efficiency and safety of nuclear power plants. Another question was whether the growth in low carbon energy technologies will be undermined by lack of investment.

The discussion period was closed with brief concluding comments from **Mike Chrimes, Director** of **Engineering Policy & Innovation**, at the **Institution of Civil Engineers (ICE)**. Mr. Chrimes discussed that there are enormous challenges faced in the transition to a low carbon economy, not least in the scale of some of the construction projects. For example, some projects will involve 300km of wave devices and 10,000 new wind turbines. There is a lot of risk involved in the low carbon economy, but perhaps the main cause for concern comes from the shortage of skills and knowledge that the industry is facing. He then referred the audience back to the ICE low carbon infrastructure route map to 2050 report mentioned earlier[1].

Paul Thomas then thanked the sponsors for the event, the speakers for their talks, those who had contributed to the discussion and Eddie Morland for chairing the event. He then invited all attendees to network and continue their discussions over the light refreshments which followed.

Further Contact Details Provided by Contributors:

- Geoff Hunt's website is: http://www.nanohelp.info/

[**Ed. note:** [1.] The Institution of Civil Engineers' low carbon report can be found on their website at: http://www.ice.org.uk/lowcarbonreport

[2.] "Health and Safety in the New Energy Economy" is available at: http://www.hse.gov.uk/eet/new-energy-economy.pdf

[3.] Prof Hunts full presentation is available at: http://www.nanohelp.info/images/00-Hunt-Hazards_Forum_29-11-11.pdf

For more information please also see: Hunt, G & Mehta, M (eds), "Nanotechnology: Risk, Ethics & Law", Earthscan, London, 2006.

An Introduction to BCS, the Chartered Institute for IT

- the leading body for IT professionals-

Prof. M. J. Norton D.Eng
BCS President 2011-12

The last year has been one of change for many organisations where cost saving has been to the fore, notably in the public sector where the public sector spending review has had enormous impact.

Many businesses and organisations have turned to IT to help develop solutions to these challenges. Equally, the government laid out its vision of a recovery in the UK based on innovation and entrepreneurship, yet another area where IT will inevitably play a central role as it has in the past – the UK has a tremendous history of delivering some of the most pioneering innovations in technology.

As a result, the IT profession is one of the fastest growing disciplines in the UK. IT touches more areas of business than almost any other and many organisations want to recruit well-rounded staff that have business focused skills and can demonstrate an understanding of how IT can benefit the business as a whole. Many people who work in this profession opt to belong to BCS, The Chartered Institute for IT.

The role of IT professionals is multifaceted; there are those who advance the knowledge and understanding of computer science, others who apply IT to the solution of engineering problems and an increasing number who exploit the technology to deliver business or service advantage.

However, the speed at which the IT industry has developed, altering the way we all live and work, has not been matched by a similar level of acceptance for the individuals who research, develop and deploy the technology as professionals.

BCS, The Chartered Institute for IT, is committed to changing this state of affairs and making IT *the* leading profession of the 21st Century. The aim is to ensure IT is viewed on a par with established professions such as engineering, accounting and the law, giving IT professionals the standing they deserve.

With a world-wide membership exceeding 70,000, the Institute champions the global IT profession and the interests of individuals engaged in that profession for the benefit of all.

The metamorphosis of IT to the status of a profession can be exemplified by the

changing role of chief information officer (CIO). There have been debates in the past about whether organisations even needed a CIO, but reliance on technology is embedding the CIO role ever more strategically at the heart of business.

As more chief executive officers (CEOs) are now looking to IT to enable their business to grow, make savings, be smarter and drive change, the Institute believes it's time for CIOs to take their deserved seat in Boardrooms around the world.

Progress is being made and CIOs are now increasingly recognised as the people who are catalysts for reform within organisations and across industries. There is a welcome emphasis now on the direct alignment of IT with business goals and growing recognition for the professionals who are engaged in these processes.
And it is here that the Institute is able to help its membership. BCS remains relevant to and supportive of the priorities, needs and aspirations of its individual members at every stage of their career from student through to the boardroom. The Institute offers members a range of grades from associate through to chartered (CITP) status. Members can also benefit from practical support and information services. The Institute also offers continuing professional development and a series of respected professional certifications, helping to promote professional practice tuned to the demands of business.

The Institute has over UK 40 branches, 16 international sections, plus 50 specialist groups, all of which provide both members and the public with an unrivalled opportunity to keep abreast of current developments in numerous areas of interest in the IT arena.

Branch and specialists group events and activities are coordinated by the respective group's volunteer committee. Members of BCS can affiliate themselves with up to three branches or sections, and once affiliated can choose to simply enjoy the personal and career development opportunities on offer in the area, or to volunteer for committee posts to influence at a higher level.

The Institute offers a range of consultancy services to employers to help them adopt best practice. It also collaborates with government, industry and relevant bodies to establish good working practices, codes of conduct, skills frameworks and common standards.

A recent example of this is the newly launched BCS CESG Certified Professional scheme for information assurance (IA) specialists working for or with government and the wider public sector. The scheme supports a key objective of the Government's UK Cyber Security Strategy – improving levels of professionalism in IA across the public and private sector.

The full scheme focuses on developing and delivering an IA Specialist Certification Scheme for anyone working in government, the wider public sector or those working on government and public sector contracts. It will certify IA specialists against specific IA roles and skills aligned to the competency framework Skills for the Information Age (SFIA) and BCS' SFIA*plus*.

As a registered charity incorporated by Royal Charter in 1984, BCS also has obligations to wider society—namely, to promote the study and practice of computing and to advance knowledge of and education in IT for the benefit of the public.

One of the ways it does this is by leading the debate on the increasingly important role IT plays in our every day lives, from initiating and informing discussion of IT strategic issues with government, industry, and academia by means of the media, high-profile thought leadership events, and the annual BCS and Computing UK IT Industry Awards. BCS also advises government and its agencies on proposed IT-related legislation.

An example of this comes from the recent success of a campaign by the Institute's Academy of Computing to re-instate computer science on the school curriculum. Following various meetings and input into reports and consultations, BCS, together with its partner group, Computing at Schools (CAS), have produced a potential computer science curriculum which was referred to by the Rt. Hon. Michael Gove, the Secretary of State for Education when he recently endorsed the importance of computer science on the school curriculum.

The BCS Academy of Computing is also responsible for the administration and assignment of a number of prestigious professional and academic awards including the Lovelace Medal, Roger Needham Award and Distinguished Dissertations.

The essential requirement for professional competence coupled with appropriate professional standards lies at the heart of all the Institute's activity and services. BCS sets and maintains the highest professional standards for IT professionals through the BCS Code of Conduct.

This also means representing the IT profession on current issues and liaising with other professional bodies, including engineering institutions and overseas societies. To this end, BCS has a number of joint membership agreements with other professional bodies and BCS is licensed by the Engineering Council to award Chartered Engineer status (CEng) and Incorporated Engineer status (IEng); and more recently by the Science Council to award Chartered Scientist status (CSci).

The Institute has many responsibilities under its Royal Charter including that of developing and maintaining standards in educational qualifications so they provide an appropriate foundation for those who wish to follow a career in computing or information systems. BCS has a programme of visits to Universities and other Higher Education Institutions to review and accredit computing courses.
At the very highest level, a group of elected Trustees is responsible for the Institute's direction and strategy.

BCS is governed by its Trustee Board, which is in turn elected by the BCS Council, a representative body of our membership. The Trustee Board and Council are responsible for a number of member bodies, including strategic boards, each of which is headed by an elected Vice-President. The day-to-day management and administration of BCS as a whole is carried out by employees based in offices in Swindon and London.
Further information, including membership grades, professional certifications and professional development advice can be found at: www.bcs.org

Further Contact Details:

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BCS President 2011-12
Chartered Director, Chartered IT Professional & Chartered Engineer
FREng, FBCS, FIOD, FIET.

Safety of Software Intensive Systems

John McDermid
BCS Engineering and Science Board

To a significant degree modern society depends on software, whether for on-line banking, communication with friends and family, or travelling to work. This dependency is growing and, increasingly, software is also responsible for the safety of the complex systems and products on which we rely – be they aircraft, cars, lifts, washing machines, or power stations.

For some time, software has been critical to the control and operation of aircraft. Now, the same is true with more everyday systems. For example, few modern cars will have less than 40 processors, and some "high end" vehicles have perhaps 100 processors and 100 million lines of software, with about 85% of functions software enabled (as on modern aircraft). Not of all of this software has a safety role, but many functions do – brake by wire, automated stability control, and adaptive cruise control, to name but three.

Perhaps less obviously, we are now developing and deploying so-called "systems of systems" (SoS) where independently defined systems interact to provide some services, and their interactions, whether anticipated or not, can have a bearing on safety. Here software is a critical medium – in individual system functionality, to support communication in the SoS, and to support interaction with the user. An obvious example is air traffic control, but such SoS are also found on our roads. For example, the "automated highway" section of the M42 has displays on the gantries guiding traffic (e.g. informing drivers when the hard shoulder is open); the interactions and interdependencies with the independently designed and operated road vehicles (more strictly with the drivers) make this an SoS [1].

In complex systems it is difficult, and inappropriate, to identify single causes of accidents or incidents – but it is instructive to identify cases where software was a causal factor. Historically there are remarkably few of these, but there have been some fatalities, e.g. from the Therac 25 radiation therapy machine (several patients received overdoses) [2]. There are many more incidents, and it is hard to say how prevalent these are as they are often compensated for by human operators, and may go unreported. However, the sudden, massive departure from the commanded trajectory of a Boeing 777 flying out of Perth, Australia [3], is a good example of an incident where software was a causal factor (it used data from a failed sensor). In some cases the accidents or incidents stem from genuine software problems – implementation errors which were not detected – but it is perhaps more common that the problems arise from incompletely understood requirements. In other words the software does what it was specified to do – but that is inappropriate and unsafe in some situations.

Modern systems, even software-intensive ones, are remarkably safe. This is due, in no small part, to mature safety engineering methods and the application of disciplined processes to the development of software. However the current techniques are at or near their limit in addressing the complexity of modern systems. Whilst there are approaches for dealing with user interaction, they are perhaps not as widely used as they should be, and none of the techniques (for systems, software, or users) readily scale to address the problems of SoS.

In essence, in developing and deploying complex software-intensive systems, and

SoS, where safety is an issue we need to be able to do four things:

1. Determine safety requirements in the context of use of the system
2. Design and assess software of significant complexity, both in initial development, through evolution and in post-development deployment
3. Analyse (unplanned) configurations of systems, especially in SoS, and the interaction between the new configurations and the users
4. Demonstrate the safety of the resultant system and software

The community has recognised these issues for some time, and some possible approaches are emerging, for example:

1. Complex systems requirements – there are a number of approaches, e.g.
    - Leveson's STAMP which adopts a systems theoretic viewpoint, rather than espousing a "reliability" model [4]
    - Simulation-based approaches to SoS hazard analysis [5]
2. Improved techniques for, and understanding of, the assessment of complex systems, e.g.
    - Use of formal techniques [6]
    - Analytical approaches to fault propagation [7]
    - Recognition of the need for evidence-based approaches [8]
3. Analysis of configurations allowing for human understanding
    - Approaches employing principles from psychology [9]
4. Demonstration of safety
    - Approaches based on software safety cases, and the establishment of sufficiency of evidence [10]

Despite the growing recognition of the issues, and some emerging research results, there remain some significant challenges, including:

- Risk benefit trade-offs – software adds complexity and gives benefits; traditionally safety and risk assessment approaches work focus mainly on "risk avoidance"; this is no longer viable in modern complex systems and the community needs to be prepared, and to have methods, to justify one against the other, i.e. to make risk-benefit trade-offs explicitly.
- Standards and industrial practices – the standards and techniques which are applied to the current classes of systems are at or near their limit for the more complex applications and, arguably, are espousing approaches which are inappropriate for emerging classes of systems, e.g. focus on internal causes of failure, not interactions as causes of failure; the community needs to develop more appropriate standards and industrial methods, building on research results, where these are applicable;
- Increasing inter-dependency of safety and security – in many cases, especially in networked systems and SoS, there is a growing possibility that security issues (often called cyber threats) can lead to unsafe failures of systems; whilst work has been done in this area, much more is required to enable safety and security to be assessed in a unified way; also software development and assessment standards for safety and security are unhelpfully divergent, and effort is needed to reduce the divergence;
- Professionalism and ethics – society gains benefits from the growing sophistication and inter-connection of systems, but there are limits to what it is prudent to develop and deploy – this is an area where ethical judgments are required; engineers should always ask: Can it be built? Can it be built

safely? Can its safety be demonstrated (to a sufficient degree)? These questions need to be extended to SoS, including the configuration of some particular SoS from existing components. Where not all of the questions can be answered positively, ethical standards require that the system concept be reviewed, or challenged.

As indicated earlier, the safety record of current software-intensive systems is remarkably good, given their complexity. A reason for this, not mentioned above, is that much of the development has occurred in industries, e.g. aviation and railway signalling, where concern for safety is deeply embedded in the culture. These industries are facing the challenges of complexity and inter-connection discussed above, but are doing so from a good starting point, in terms of both experience and culture.

However the growing use of software and the inter-connection of otherwise independent systems means that safety critical and safety related software is being produced in industries with less of a track record in addressing safety issues, and less of a safety culture. In some cases, perhaps most obviously with communication systems, the increase in criticality is largely hidden from the system developers and operators. Thus there is a role for the Hazards Forum and the BCS to raise awareness in these sectors, and for the BCS to contribute to development of understanding and technical standards relevant across a wide range of industries. These are challenging but important objectives for all professionals concerned with system safety.

References

[1] A. J. Arlow, C. J. Duffy, J. A. McDermid, Safety Specification of the Active Traffic Management Control System for English Motorways, 1st IET International Conference on System Safety, London, IET, 2006.

[2] N.G Leveson, C. S. Turner, An Investigation of the Therac-25 Accidents, IEEE Computer, 26(7): 18-41, July 1993.

[3] In-flight upset event 240km North-West of Perth, WA Boeing Company 777-200, 9M-MRG, 1st August 2005.

[4] N. G. Leveson, A New Accident Model for Engineering Safer Systems, Safety Science, 42 (4): 237-270, April 2004.

[5] R. Alexander, Use of Simulation for Systems of Systems Hazard Analysis, PhD Thesis, Department of Computer Science, University of York, September 2007.

[6] J. C. P. W. Woodcock, P. G. Larsen, J. Bicarregui, J. S. Fitzgerald, Formal Methods: Practice and Experience, ACM Computing Surveys, 41 (4): 1-36, 2009.

[7] R. Niu. A Failure Propagation Model Based Framework for System Safety Analysis. PhD Thesis, Beijing Jiaotong University, 2010.

[8] D. Jackson, M. C. Thomas, L. I. Millett (Eds), Software for Dependable Systems: Sufficient Evidence?, National Academies Press, 2007.

[9] G. Montano, J. A. McDermid, Human Involvement in the Dynamic Reconfiguration of Integrated Modular Avionics, in Proceedings of the 27th IEEE/AIAA Digital Avionics Systems Conference (2008), Vol. 4.A, pp. 1-13, 2008.

[10] R. D. Hawkins, T. P. Kelly, Software Safety Assurance - What Is Sufficient?, In proceedings of the 4th IET International Conference of System Safety, London, 26-28 October 2009.

From the Secretary.....

We look forward to seeing as many members as possible at the **Annual General Meeting** on Tuesday 20th March 2012 at the Institution of Civil Engineers, One Great George Street, London, SW1P 3AA at 16.30 when changes to the Executive Committee will occur. An account of the meeting is planned for publication in the next Newsletter.

As a follow on from the Forum's events on infrastructure resilience last year, which included discussions on the **National Risk Register** published by the Cabinet Office, readers may be interested to see the Cabinet Office link to "the **January 2012 update** to this document; the National Risk Register of Civil Emergencies- January 2012 edition which has been published to update the public on the Government's current assessment of the likelihood and potential impact of a range of different civil emergency risks (including naturally and accidently occurring hazards and malicious threats) that may directly affect the UK. It also provides information on how the UK and emergency services prepare for these emergencies":

www.cabinetoffice.gov.uk/resource-library/**nation**al-**risk**-**register**

As a reminder to its background, "in 2008 Government published, for the first time, a National Risk Register, fulfilling a commitment made in the National Security Strategy. This was the first step in providing advice on how people and businesses can better prepare for civil emergencies."

The **Calendar of Events** on Page 16 shows many forthcoming events including the date of the first in an important series of Evening Events being planned by the Forum on **Risk Understanding and Communication.** The public perception aspects will be considered, in particular, including ways of improving this. The second in the series is being planned for 20th September. Please see the Hf website for updates as the planning of these develops.

Brian Neale

Parliamentary and Scientific Committee

The latest issues of "Science in Parliament", the journal of the Parliamentary and Scientific Committee of which the Hazards Forum is a member, has among its contents the following articles. Any member who would like any further information on any of the articles below should visit the PSC website www.ScienceInParliament.org.uk

UNDERSTANDING SOCIETY: A LIVING LABORATORY OF LIFE IN THE UK	Professor Patricia Broadfoot
BOOK REVIEW	Ian Taylor
WHAT IS THE PUBLIC UNDERSTANDING OF RISK?	Addresses to the P&SC by Dr Chris Elliott FREng, David Simmons and John Swanson
ARCTIC METHANE EMERGENCY	Dr Stephen Henley CEng FGS FIMMM
STAKEHOLDER PERSPECTIVES ON VALUE-BASED PRICING	Eric Low
STEM CELLS FOR SAFER MEDICINES: A PREDICTIVE TOXICOLOGY CONSORTIUM	Professor Frank Bonner
SIN OFFICERS IN SWITZERLAND: WORKING IN A SMALL RESEARCH PEARL	Gaby Bloem
ANNUAL LUNCHEON OF THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE	
STRATIFIED MEDICINES: THE FUTURE OF HEALTHCARE	Louise Leong
VALLEY OF DEATH	Glyn Edwards
ASTRAZENECA BRIXHAM	Paul Duckett
SOCIETY OF BIOLOGY DEGREE ACCREDITATION PROGRAMME	Dr Mark Downs FSB, FLS

PUTTING COPD ON THE MAP – COLLABORATING TO FIGHT DISEASE	Dr Paul Whittaker and Professor Chris Brightling
TRANSPARENCY IN CLINICAL RESEARCH	Andy Powrie-Smith
WHAT DO YOU NEED TO KNOW ABOUT ANIMAL RESEARCH TODAY	Barbara Davies
IMPLICATIONS OF THE NEW EU DIRECTIVE REGULATING ANIMAL EXPERIMENTS FOR THE UK	Dr Maggy Jennings OBE
WHAT IS MEDICAL INNOVATION?	Allison Jeynes-Ellis
IS SCIENTIFIC FREEDOM THE ELIXIR OF CIVILISATION?	Addresses to the P&SC by Professor Donald Braben, Professor James Ladyman, Professor Benjamin Davis and Professor David Delpy
WETTER, WARMER, WINDIER …WILL THE UK'S INFRASTRUCTURE COPE?	Addresses to the P&SC by Professor Jim Hall, Professor Will Stewart and Professor Brian Collins
STANDING UP FOR ORPHANS	John Irwin
'COST-PER-QALY IN THE US AND BRITAIN: DAMNED IF YOU DO AND DAMNED IF YOU DON'T'	Dr Adrian Towse
PUTTING DATA AT THE HEART OF OUR HEALTHCARE INDUSTRY	Samantha Marshall
UNLOCKING PATIENT DATA FOR BETTER CARE AND RESEARCH	Sir Mark Walport FRS
THE INNOVATION REVIEW AN INDUSTRY RESPONSE	Nick Burgin
INVESTING IN UK HEALTH AND LIFE SCIENCES	David Willetts MP

HSE eNews – Some Examples

++ **Health and Safety Newsletter – March 2011** ++

In this issue:

- Refocusing health and safety - find out more about the challenges for reform
- London 2012 - how the construction industry is being urged to build on lessons learned
- Challenging the regulators - what's it all about?
- How do you keep your finger on the health and safety pulse?
- plus lots more, including court stories, real-life case studies, and new guidance

http://www.hse.gov.uk/pubns/books/newsletter-march12.pdf

++ **RoSPA Occupational Health and Safety Awards 2012** ++

HSE is delighted to support RoSPA's annual Occupational Health and Safety Awards. We share RoSPA's view that competent health and safety advice, along with visible committed safety leadership enables organisations to reduce accidents and ill health in a cost effective way.

The RoSPA Safety Awards have been recognising health and safety success since 1956. This key fixture in the health and safety calendar offers organisations a prime opportunity to prove their ongoing commitment to raising health and safety standards.

Winners of a RoSPA Occupational Health and Safety Award will receive their awards at prestigious presentation ceremonies and gala dinners at the Hilton Metropole Birmingham May 15 - 17th 2012, alongside the Safety and Health Expo, or in the Glasgow Hilton September 20th 2012.
http://www.hse.gov.uk/events/rospaaward.htm

++ **Ports and Logistics sector data summary and analysis** ++

This report examines the accidents reported in the ports industry over a five-year period from 2006/07 to 2010/11 (provisional). The data represents accidents and dangerous occurrences reported to HSE under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 1995. A further section is included on enforcement activity carried out by HSE in the 3 years to 2010/11 (provisional).
http://www.hse.gov.uk/logistics/statistics.htm

Calendar of Events

Please check the Events section of the Hazards Forum website for more information at **www.hazardsforum.org.uk** and to see any updates in the calendar. These may include additional events or perhaps amendments to the Events shown below.
Please note that attendance is by invitation.

Date	Event	Venue	Contact/further information
MARCH			
20	>> Hazards Forum: Annual General Meeting for members as per Notice	Institution of Civil Engineers, One Great George Street, London, SW1P 3AA	Tim at admin@hazardsforum.org.uk
20	>> Hazards Forum Evening Event: A resilient transport infrastructure for a world event: From planning to implementation - the 2012 Games	Institution of Civil Engineers, One Great George Street, London, SW1P 3AA	Tim at admin@hazardsforum.org.uk
APRIL			
25	ICE Event: The Delivery of a Low Carbon Society – Beyond Rhetoric – Or Not?	Institution of Civil Engineers, One Great George Street, London, SW1P 3AA	events@ice.org.uk
MAY			
3	IMechE event, HF supported: Natural Hazards – a Proportionate Response	Institution of Mechanical Engineers, One Birdcage Walk, London	E_fox@imeche.org
29	IMechE event, HF supported: Software Reliability 2012	Institution of Mechanical Engineers, One Birdcage Walk, London, SW1H 9JJ	J_williams@imeche.org
JUNE			
12	>> Hazards Forum Evening Event: Risk Understanding and Communication (1 of 3)	Institution of Civil Engineers, One Great George Street, London, SW1P 3AA	Tim at admin@hazardsforum.org.uk
13	SaRS event: Paradigm Shifts: Cross-Industry Lessons Learned from Fukushima and other Major Incidents	SaRS Headquarters, One Central Park, Manchester, M40 5BP	info@sars.org.uk
JULY			
03	SaRS event, HF supported: What has Reliability Ever Done for Us?	SaRS Headquarters, One Central Park, Manchester, M40 5BP	info@sars.org.uk

The Hazards Forum's Mission is to contribute to government, industry, science, universities, NGOs and Individuals to find practical ways of approaching and resolving hazard and risk issues, in the interests of mutual understanding, public confidence and safety.

The forum was established in 1989 by four of the principal engineering institutions because of concern about the major disasters which had occurred about that time.

The Hazards Forum holds regular meetings on a wide range of subjects relating to hazards and safety, produces publications on such topics, and provides opportunities for interdisciplinary contacts and discussions.

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