SESSION I: Pop-Up Talks

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2) **Chris Hankin**, Imperial College London
3) **Anna Railton**, Smith Institute
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Imperial Workshop:

Representing risk and uncertainty in electricity security of supply assessments

Harvey Beck and Kristian Marr

February 2016

Background to Electricity Security of Supply Report

- **Weather, Plant Closures, Plant outages, Demand changes, Interconnector flows**
- **Model:** Dent (Durham University) for National Grid
  - Whole season adequacy
  - Probability theory of additional generation (equivalent firm)
  - Bootstrap uncertainty analysis
  - Winter severity analysis
- **Outlook period**: Our assessment is based on National Grid's Future Energy Scenarios over the next three winters (2015/16 to 2017/18).
- **FES Scenarios (discrete)**: No Progression, Slow Progression, Consumer Power, Gone Green
- **Our Sensitivities**: The scenarios don't capture all of the uncertainty in the outlook. So we produced 11 sensitivities around these.

The issues communicating the results

- We then need a clear and simple of communicating this to a range of stakeholders (industry, government, press & media, consumers etc.)

The problem

- The full results from the model can be too much information:
  - 4 scenarios
  - 11 sensitivities
  - Pre- and post-SBR/DSBR for 2015/16
  - Over three years

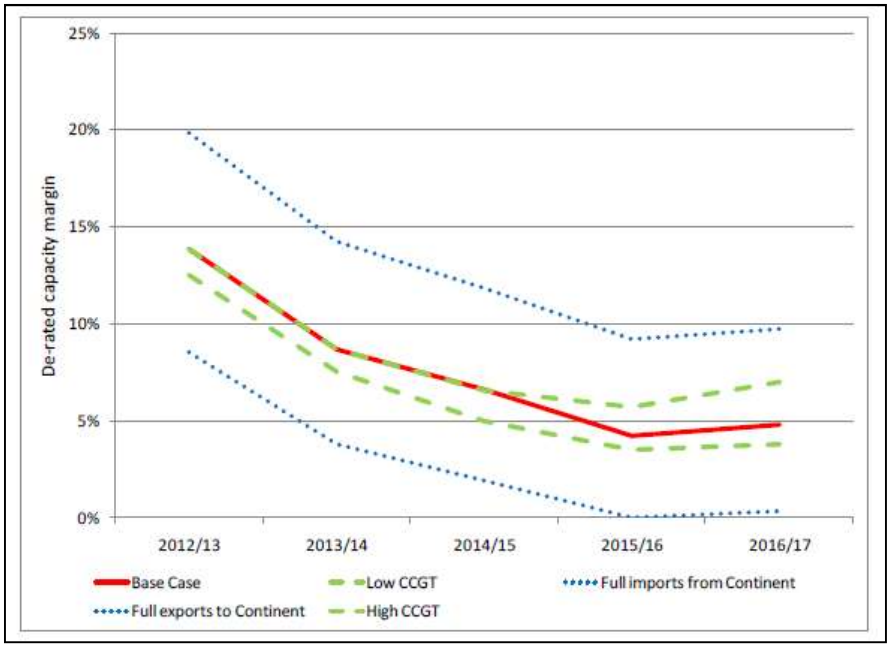
- Tables aren't clear enough for non-experts

- Generally, there are no statistical assessments of probability assigned to the scenarios or sensitivities.

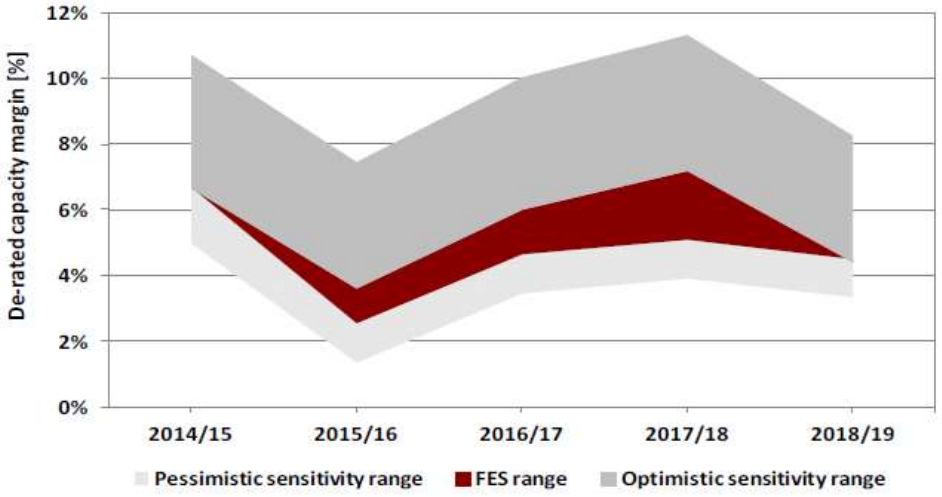
Evolution of approach

- **Presenting ranges**: We moved from presenting individual scenarios and sensitivities, to presenting ranges broader ranges. Try to reduce the focus on the 'middle' scenario or sensitivity.
- **Broader representation of sensitivities:** These are no longer named, rather grouped into pessimistic/optimistic.
- **Representing specific years**: Showing the impact of specific tools on the outlook.

2012



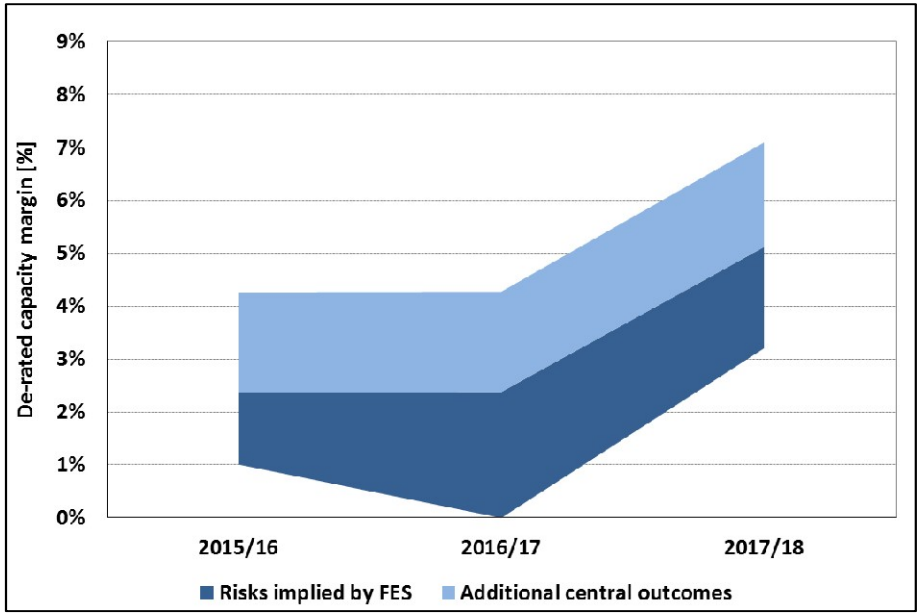
2014



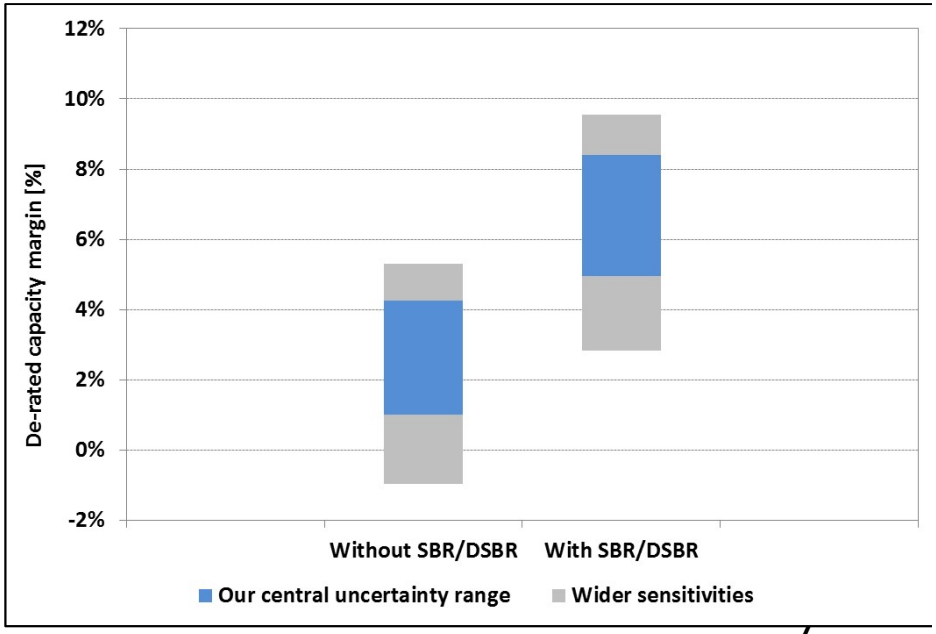
2015 approach

- The 2015 approach remained broadly in line with 2014, but with some alterations.
  - The specific sensitivities in the central view changed.
  - It was our view that the FES scenarios (risks implied by FES) adequately covered the downsides. So our central view sensitivities only covered the upsides (additional central outcomes).
- We produced a wider range of downside sensitivities. But they weren't in the central view or these graphs.

De-rated margins (%)



Impact of new tools 15/16 (%)



*Lower demand, plant returning to the market, increased plant availability and full interconnector imports from Continental Europe.

What we've kept and continued challenges

What we've kept

- **Ranges**: Representing the risk as a range is helpful. Helps prevent against a focus on the middle scenario and moves attention to the uncertainty in the outlook.
- **Upside/downside sensitivity**: As we're discussing ranges, easier to focus on the broader upside/downside sensitivities rather than plotting individual sensitivities.

Continued challenges

- **Technical**: It remains a technical subject which can be challenging for non-experts. So there are inherent challenges when communicating the results.
- **Wide range of assessments**: We assess a wide range of outcomes, which can lead to information overload.
- **Probabilities**: Generally, there are no statistical assessments of probability assigned to the scenarios or sensitivities.
- **Consistency**: Can be a challenge as what we to show and highlight can change year-on-year.

How the research community can help support improvements

Engagement with scenario building process – NG FES consultation. Analysis of Technological uncertainties.

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Ofgem is the Office of Gas and Electricity Markets.

Our priority is to protect and to make a positive difference for all energy consumers. We work to promote value for money, security of supply and sustainability for present and future generations. We do this through the supervision and development of markets, regulation and the delivery of government schemes.

We work effectively with, but independently of, government, the energy industry and other stakeholders. We do so within a legal framework determined by the UK government and the European Union.

www.ofgem.gov.uk

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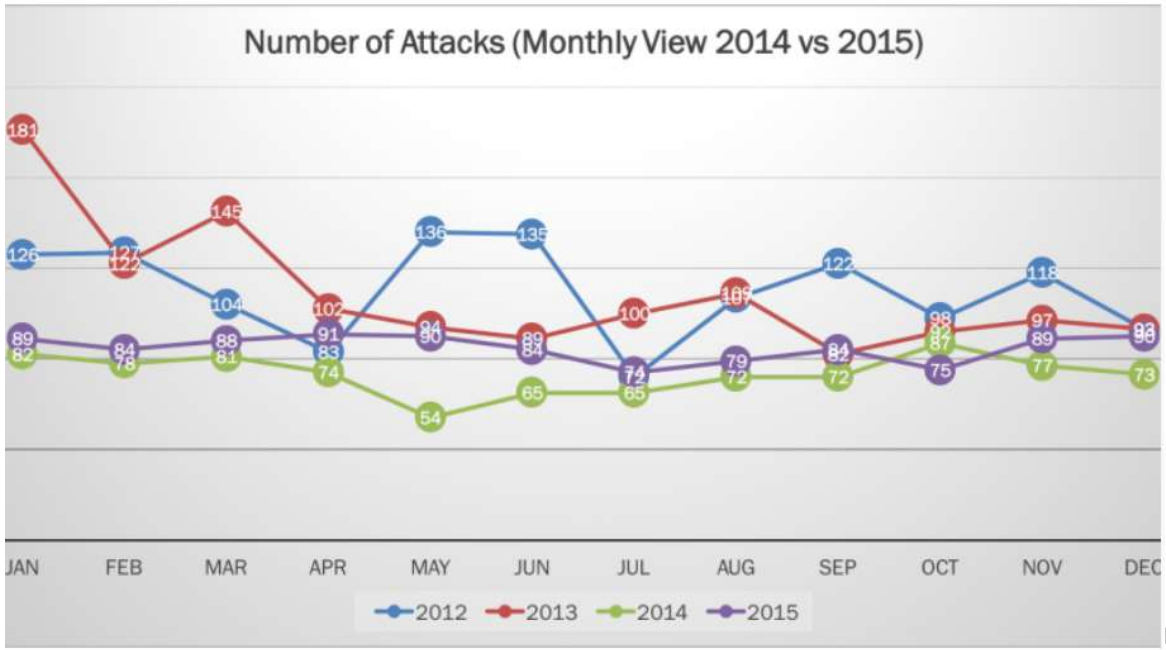
Problem Statement



How do I decide how much to invest in cyber security?

Hackmageddon.com

This week Lincolnshire County Council reported it had been infected with ransomware and received a demand for £347 ($500) in bitcoins. Ransomware is a form of malware that restricts access to a victim's computer in some way, usually by encrypting files. Some of the most successful and well known ransomware include CryptoLocker, Alpha Crypt and Teslacrypt. Teslacyrypt v3 has been recently discussed as it was highlighted by a number of security reports at the end of 2015 when its developers significantly upgraded its encryption scheme1. Since then researchers have seen a spike in the number of incidents of Teslacrypt with more than 70,000 in the space of seven days2.

CERT UK Advisory 04.02.2016

Approach

- **Target**
  - *Vulnerability*: The particular attack method
  - *Depth*: The network location of the data assets

- **Control**
  - *Level*: The Degree to which a control is implemented
  - *Mitigation*: The amount of damage that is expected to be stopped by implementing this control
  - *Direct Cost*: The cost to implement and maintain a control
  - *Indirect Cost*: Costs related to the implementation of a control not seen as direct costs

- **Organisational Profile**: Characteristics unique to the Company or organisation

Case Study

27 Controls

Control	Number
Security Software	4
Network Security Tools	7
System Configuration	8
Administration Tools	2
Policy Development	4
Education and Training	2

37 attacks

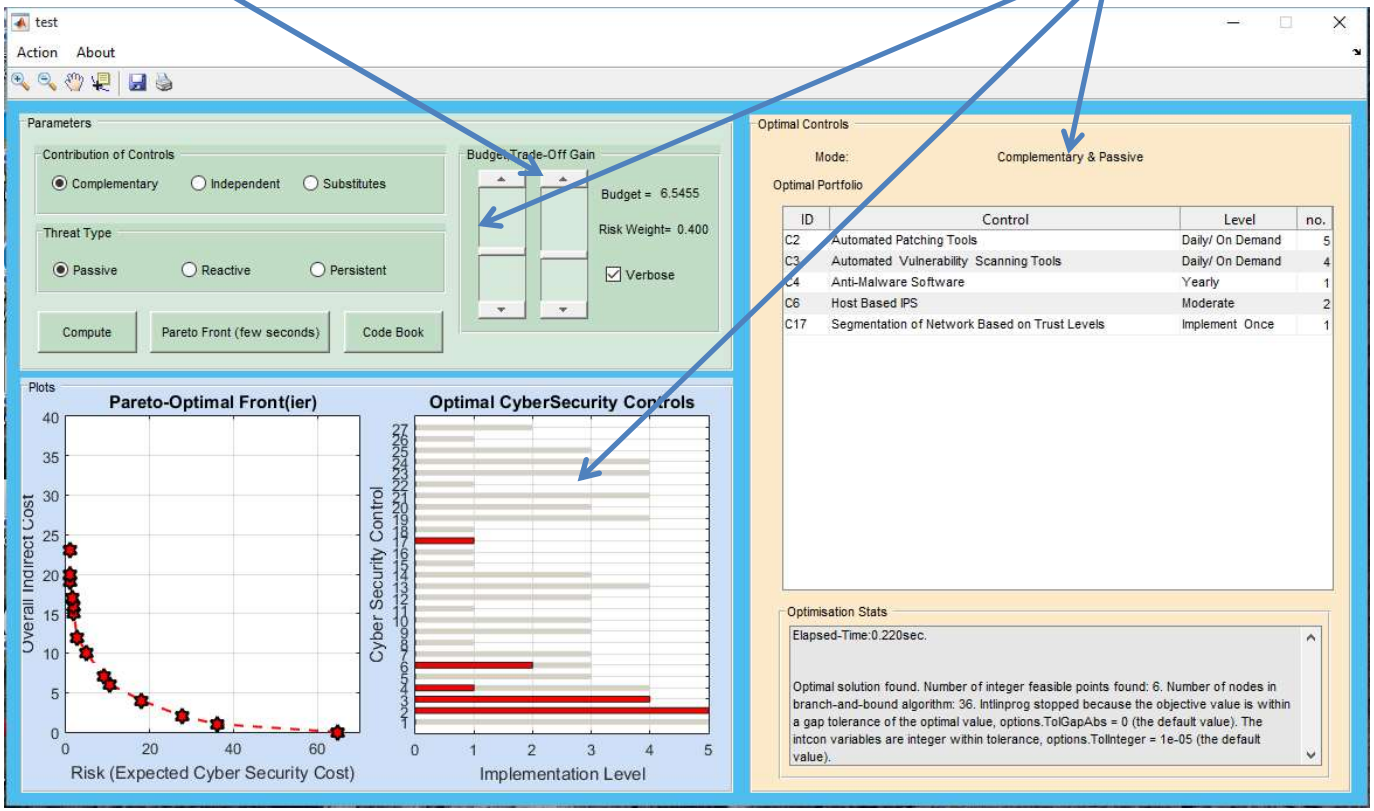
Vulnerability	Number
Software Errors: Data Interaction	8
Software Errors: Resource Management	8
Software Errors: Defence Flaws	6
Social Engineering: Targeted	3
Social Engineering: Untargeted	4
Network Vulnerabilities: Direct	4
Network Vulnerabilities: Indirect	4

Hybrid Solution

- **Control Games –** All sub-games of a single control identifying the best strategy for each possible level.
- **Control Sub-Game –** The analysis of each possible combination of levels of a single control up to the maximum level denoted by the sub-game.
- **Knapsack of Control Sub-Games**
- More efficient solution than Full Game solution and better handling of Indirect Costs than Pure Knapsack

Tools

- We have built tools that allow users to specify parameters such as budget and risk appetite and compute optimal investment portfolios.



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Sequential decision-making under uncertainty

Dr Anna Railton, Smith Institute

- Mathematical Consultancy based in Oxford/Harwell of c. 20 people.
- Provide companies with independent advice and technical services based on the application of mathematics, statistics, modelling and algorithms.
- Have technical expertise in system design, assessment and analysis, model building and implementation and data analysis.

Smith institute
for industrial mathematics and system engineering

- DfT grant: “Optimal Decisions for Large-Scale Transport Systems”
- Outcome: developed mathematical framework for optimal decision making
- Can be used on problems that have these five components:
  - States
  - Decisions
  - New information (i.e. source of uncertainty)
  - Means of updating the state variable
  - Means of quantifying the cost/contribution as system evolves.
- Example: shortest time routing

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- Adapting a rail schedule to uncertain delays
- Spatial inventory problems
- Mothballing decisions
- Impact of change on a network

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JESIP

JOINT EMERGENCY SERVICES INTEROPERABILITY PRINCIPLES

Working Together – Saving Lives

JESIP

Joint
Emergency
Services
Interoperability
Principles

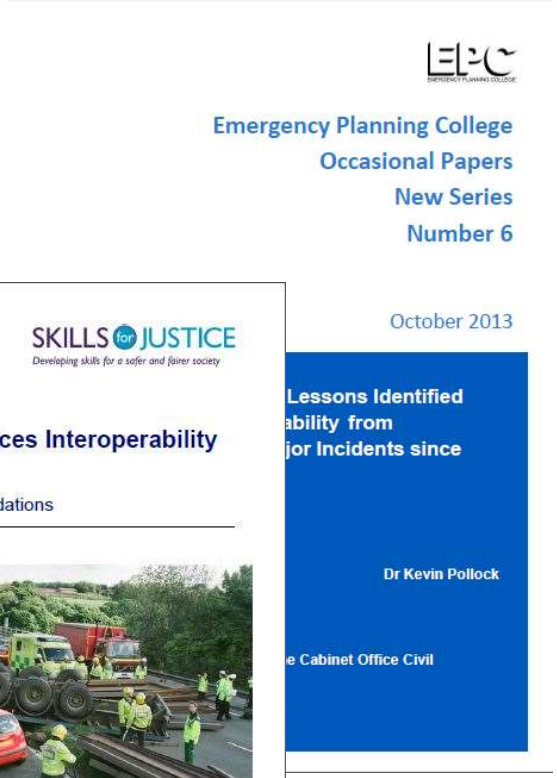
Julian Frost

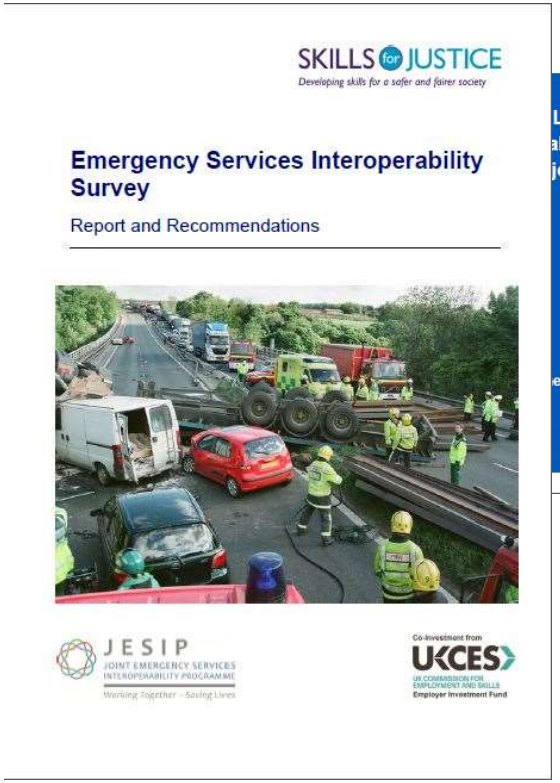
HMIC Led Review 2015

- The formation of joint doctrine has provided the three services with an agreed structure and framework within which to work
- Strategic Level support for Principles is good
- Local alignment of policies and procedures in progress
- The tri-service approach in delivering the training is considered hugely beneficial and facilitated a change in culture

Programme Drivers

- Common themes where improvement needed
- Pollock Report
  - Review of 32 major incidents
  - Improve how ES learn from past events
- Workforce survey on interoperability
  - Lack of joint training
  - Lack of joint testing & exercising

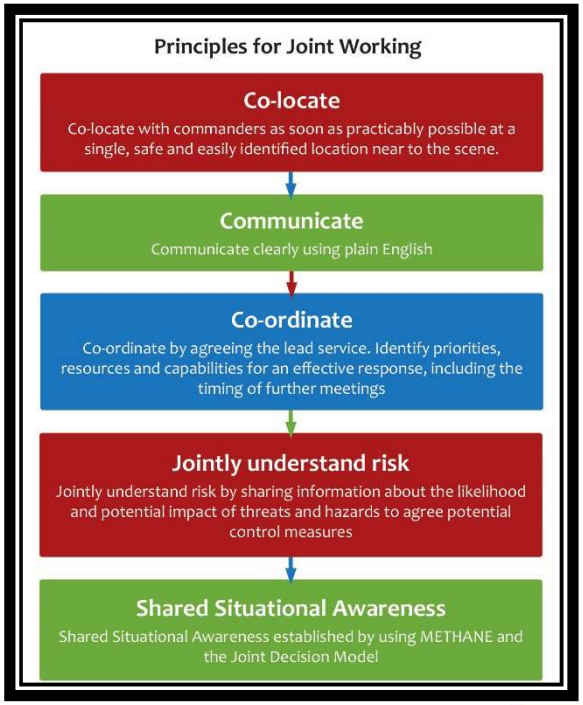


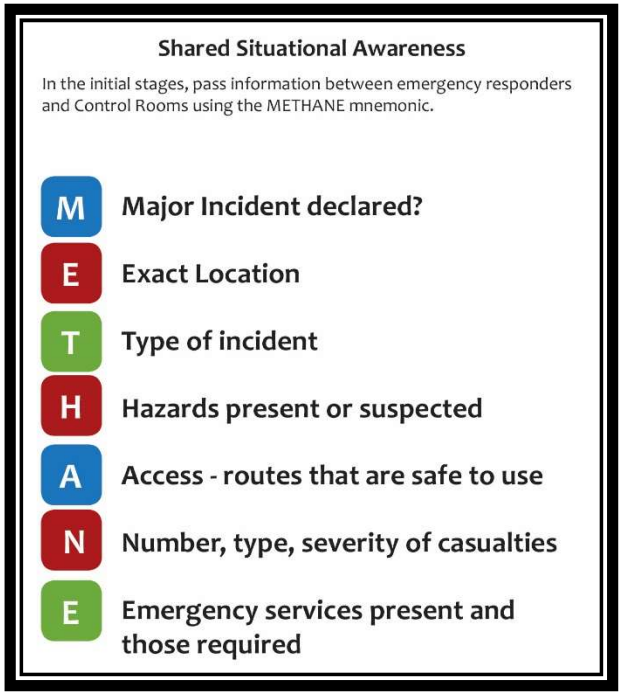


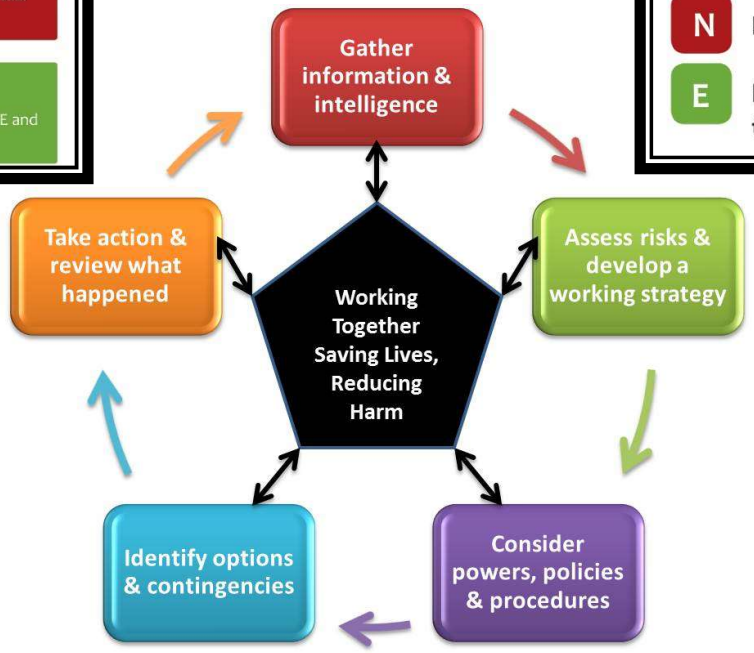
Why was JESIP needed?

- Local joint working - daily occurrence
- Larger and more complex incidents are the challenge
  - More organisations involved
  - All aspects amplified
  - Lack of major incident command training and experience
- Lack of national consistency

Joint Doctrine – the basics







Police Conflict Management Model

Police National Decision Model

Joint Decision Model

HMIC Led Review 2015

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Further Information

www.jesip.org.uk

Follow us on Twitter @jesip999

Email us on contact@jesip.org.uk

- Local ownership is key - talk to your local resilience partners about involvement in training, testing and exercising
- Use the website – Joint Doctrine, JESIP films, products and templates
- Access E-Learning packages & Wider Responder Awareness Package
- Follow us on Twitter

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Decision Making Under Risk & Uncertainty

Pop-Up Talk – Mike Colechin

Establishing a multi-£M portfolio of low carbon energy innovation

Risks and Uncertainties:

- Risk: technologies, markets and regulations are changing
- Uncertainty: how will the future energy system develop?

- What commercial solutions will be needed to achieve 2050 energy policy goals?
- How will the system transition from now to 2050?

- Measurable: rates of technology development, past economic growth trends etc
- Unmeasurable: policy decisions, future market structures, consumer responses

Significance: our consideration of these issues has shaped the ETI's portfolio of activity, determined priorities, and informed all specific funding decisions made by our Board

ETI's decision making process

- Gather evidence of current energy landscape and potential future system and technology scenarios
- Identify key stakeholders and understand their needs and capabilities
- Utilise evidence and internal capabilities to deliver whole system analysis and modelling of lowest cost futures
- Identify key solution options and associated improvements required to deliver these futures
- Propose projects and activity that supports and develops these 'options'
- Receive ETI Board approval to fund projects

ETI programme portfolio

- Challenges:
  - data/evidence/capability
  - timescales
  - changing economic climate
- Communicating decisions:
  - governance processes
  - Project Information Mgmt System
  - strong external communications
- Improvements:
  - streamlining processes
  - broader context than ‘least cost engineering solutions’
- Academic opportunities:
  - modelling
  - policy & regulation
  - end user behaviour
  - markets

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For more information about the ETI visit www.eti.co.uk

For the latest ETI news and announcements email info@eti.co.uk

The ETI can also be followed on Twitter @the_ETI

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