Presentation to BCS IRSG *Search Technology* 2012

Technology Landscaping in Dstl

Horizon Scanning Team

Information Management Department

28/11/2012

Work described is performed within Dstl Futures and Innovation Domain

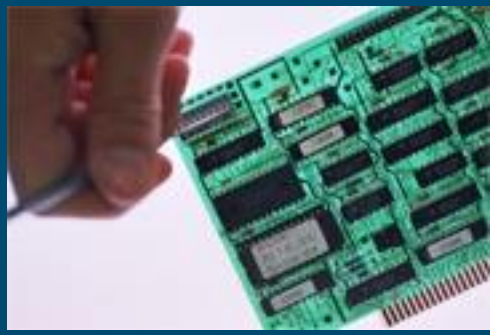
Presentation outline

- Dstl
- The technology landscaping challenge
- Information access
- ‘S&T horizon scanning’ in the MOD
- *‘A’* future of search…
- …and some thoughts on technology prediction

Who we are

Defence Science and Technology Laboratory (Dstl)

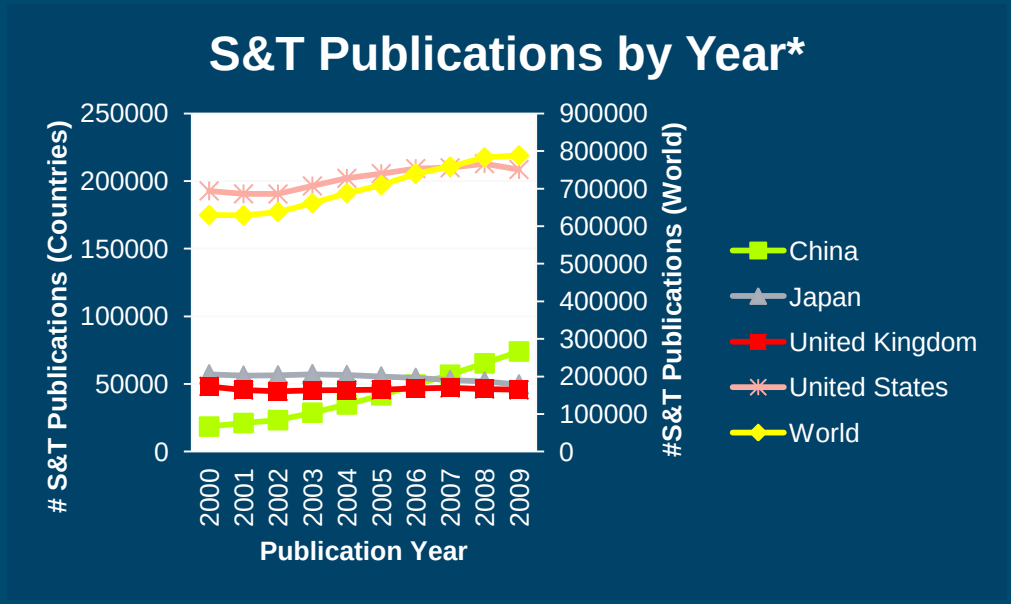
- MOD's science and technology experts.
- Provide independent, impartial S&T advice to MOD and UK government.
- Not just home based. Scientists deployed to support operations.
- Work with very small companies to world-class universities, huge defence companies, government departments … even other nations.
- Deep and widespread research for immediate and future requirements.
- Trading fund – run on commercial lines.



Dstl's Purpose

- To maximise the impact of science and technology for defence and security of the UK.

Technology landscaping challenge

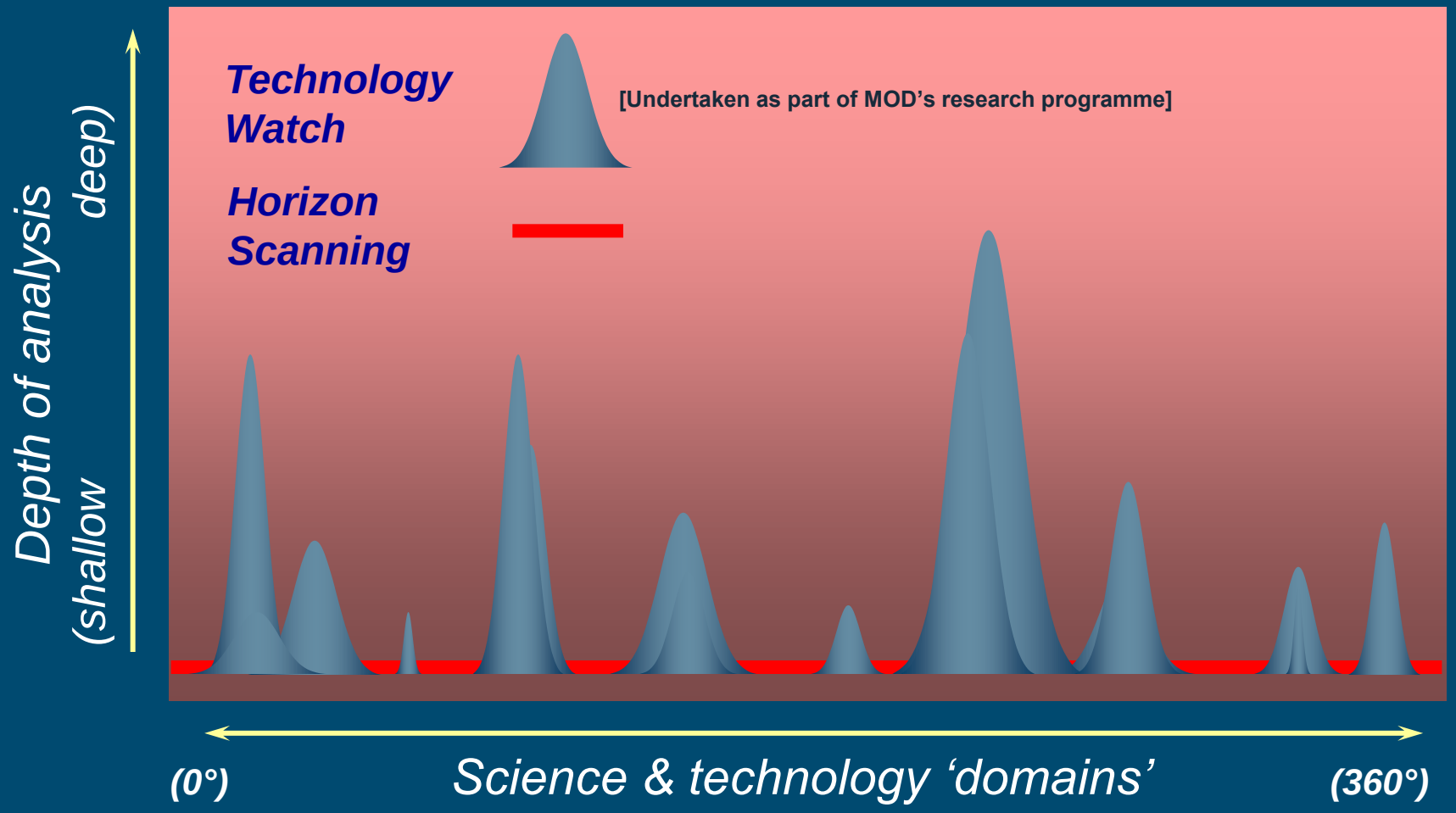


Country	Expenditures on R&D (billions of US$, PPP)**
United States	405.3
China	251.8
Japan	144.1
Germany	69.5
South Korea	44.8
France	42.2
United Kingdom	38.4
India	36.1
Canada	24.3
Russia	23.8
Brazil	19.4

- UK MOD non-nuclear research expenditure: £400M
- World R&D expenditure estimated at one trillion dollars in 2010***

- *National Science Foundation, Science and Engineering Indicators.
- ** Battelle R&D Funding forecast 2012
- *** http://royalsociety.org/uploadedFiles/Royal_Society_Content/Influencing_Policy/Reports/2011-03-28-Knowledge-networks-nations.pdf

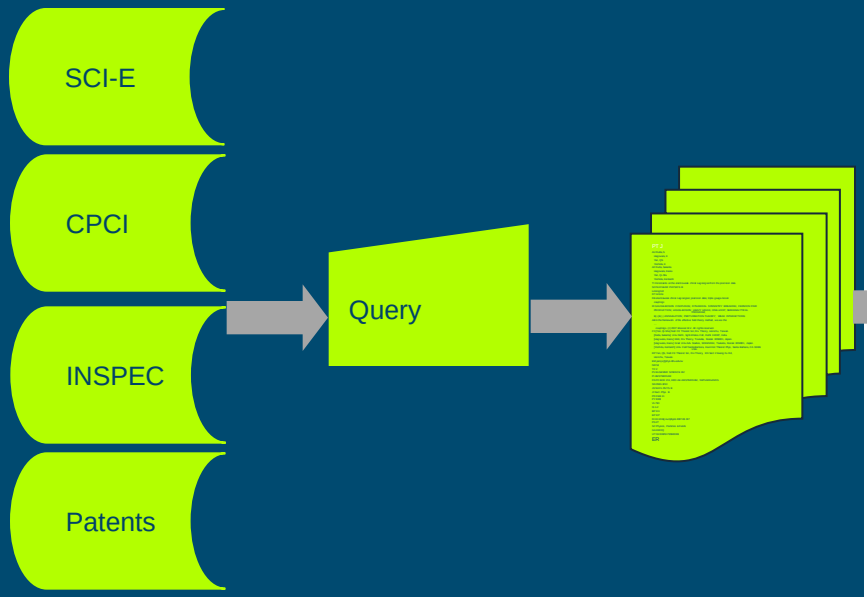
S&T landscape in an MOD context…



Techniques for information access

- In **searching**, we *describe* what is (likely to be) interesting *before* we retrieve it.
- In **scanning**, we *realise* what's interesting *after* we've retrieved it.

Scientometrics: landscaping through search



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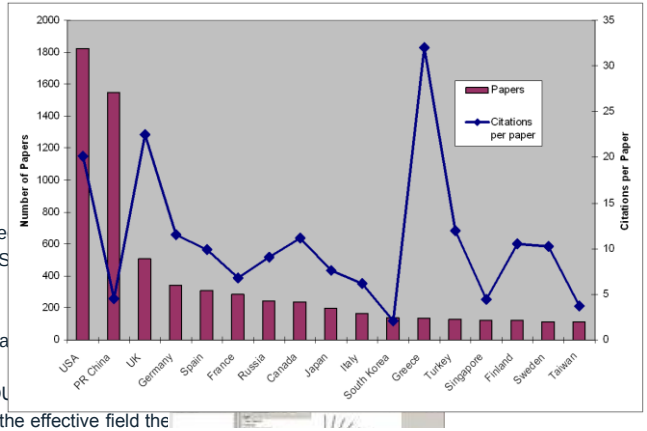
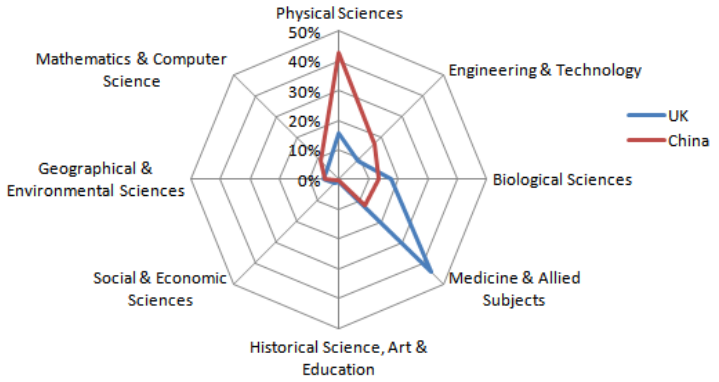
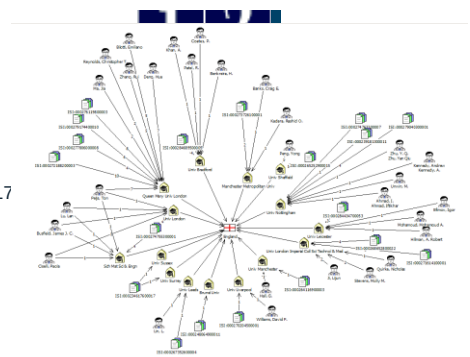
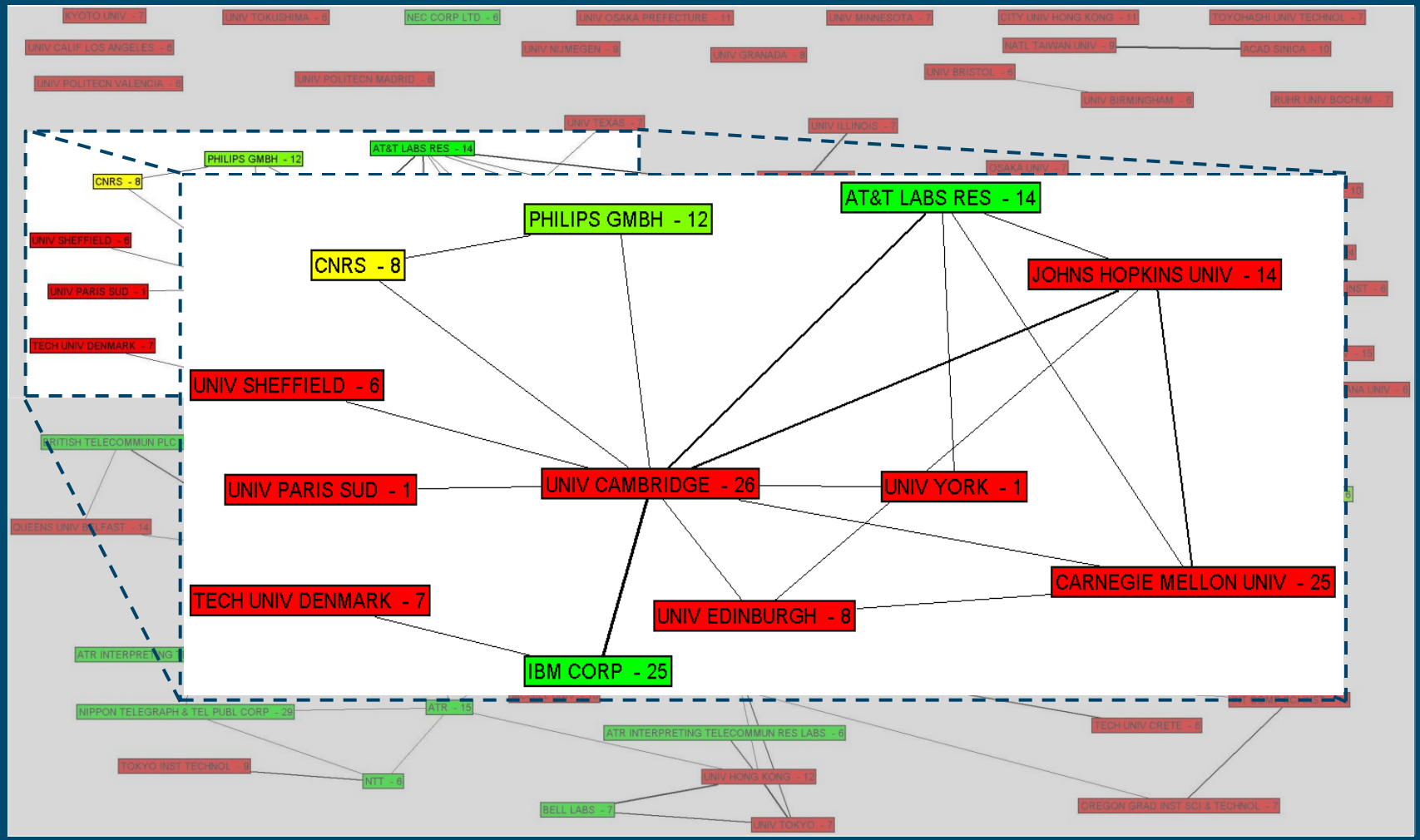






Collaborative enterprise visualisation



Mapping the S&T background

Application / Technology	missiles	golf clubs	anti-microbial	analgesic	App 5	App M
Superplastics	✓	✓				
Essential oils	✓		✓	✓		
Tech 3			✓		✓	
Tech 4	✓					✓
Tech 5					✓	
Tech N						

Horizon scanning: a definition

- “The systematic examination of potential threats, opportunities and likely developments including but not restricted to those at the margins of current thinking and planning.
- Horizon scanning may explore novel and unexpected issues as well as persistent problems or trends.”

Office of Science and Innovation

Techniques for information access

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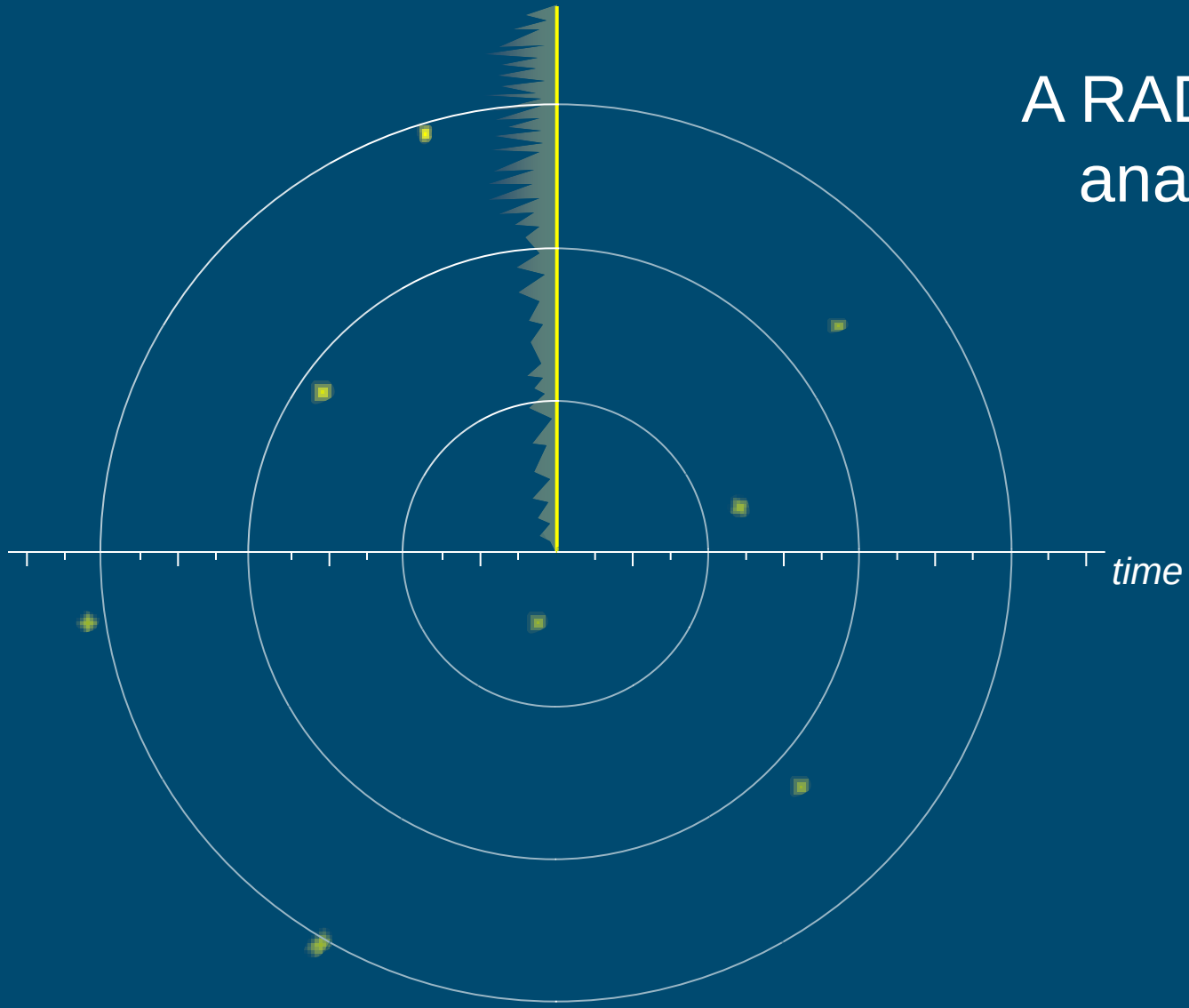
A RADAR analogy



Searching for excitement

Look for developments described as, e.g…

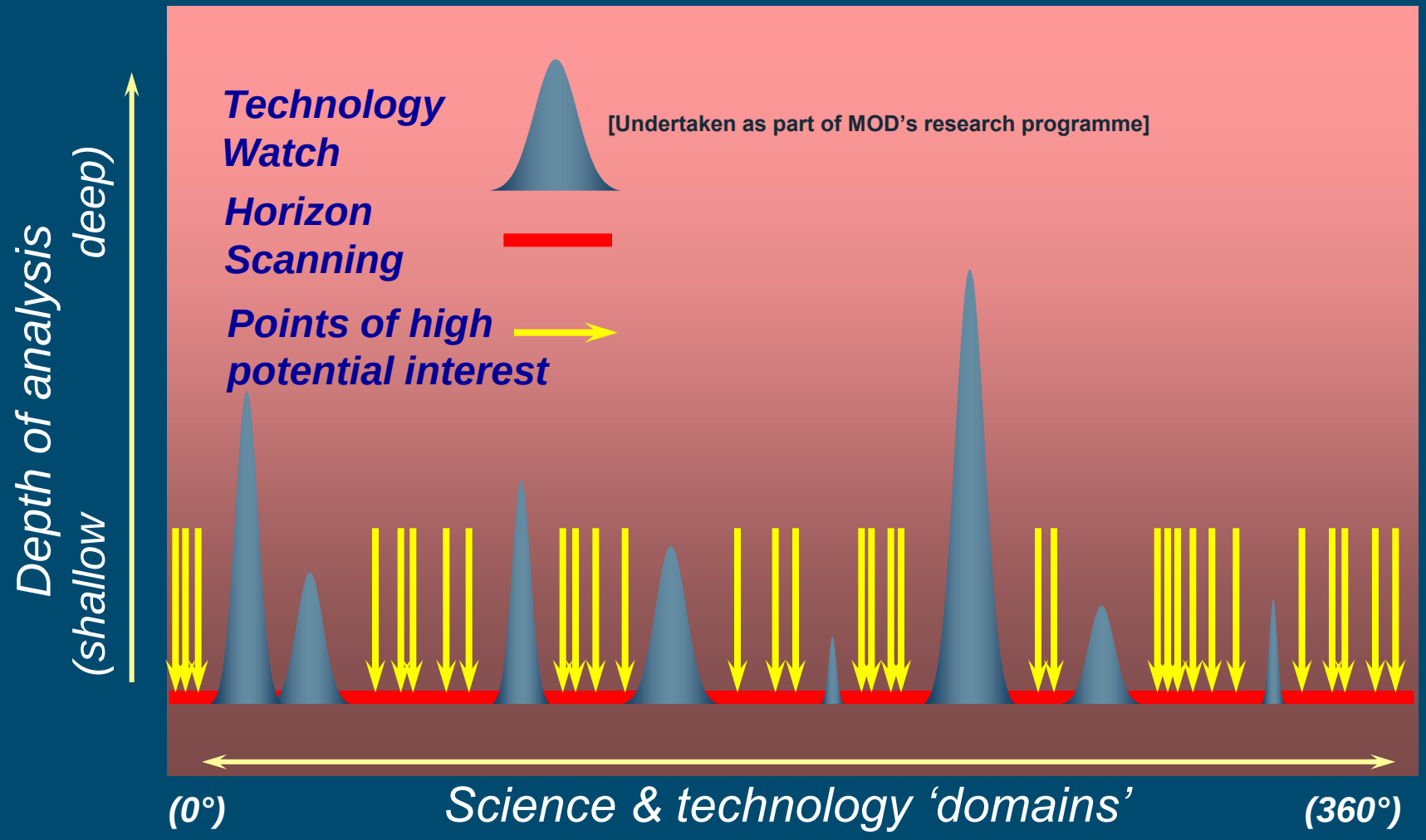
- ✓ revolutionary
- ✓ unprecedented
- ✓ world's first
- ✓ first time
- ✓ orders of magnitude
- ✓ paradigm
- ✓ previously impossible
- ✓ ground-breaking
- ✓ paves the way
- ✓ closer to reality
- ✓ …

Credit: Flickr

Sentiment surveillance

"INNOVATIVE BREAKTHROUGH*"
OR "MAJOR BREAKTHROUGH*"
OR "MUCH-NEEDED BREAKTHROUGH*"
OR "REAL BREAKTHROUGH*"
OR "RECENT BREAKTHROUGH*"
OR "REVOLUTIONARY BREAKTHROUGH*"
OR "SIGNIFICANT BREAKTHROUGH*"
OR "TECHNOLOGICAL BREAKTHROUGH*"
OR "TECHNOLOGY BREAKTHROUGH*"
OR "BREAKTHROUGH DISCOVERY"
OR "BREAKTHROUGH IDEAS"
OR "BREAKTHROUGH RESULT"
OR "BREAKTHROUGH REVEALS"
OR "BREAKTHROUGH SCIENC*"
OR "BREAKTHROUGH TECHNOLOG*"
OR "BREAKTHROUGH THINKING"
OR "BREAKTHROUGH* CAN DELIVER"
OR "BREAKTHROUGH FOR BASIC"
OR "BREAKTHROUGH FOR APPLIED"
OR "POSSIBLE BREAKTHROUGH*"
OR "BREAKTHROUGH* USING NEW"
OR "BREAKTHROUGH* IN FUTURE"
OR "BREAKTHROUGH* IN QUALITY"
OR "BREAKTHROUGH* IN SCIENC*"
OR "BREAKTHROUGH KEY ENABLERS"
OR "BREAKTHROUGH* TO HARNESS"
OR "BREAKTHROUGH FOR UNDERSTANDING"

Systematic and efficient scanning…



Intrasights and the future of search

Records are linked if:

1. They represent alternative ways to achieve a particular function
2. One is thought to present a countermeasure to another
3. They complement one-another, i.e. within the context of a system

“Future search” example sightings

Credit: DARPA

Credit: Robert Ludlow, Wellcome Images

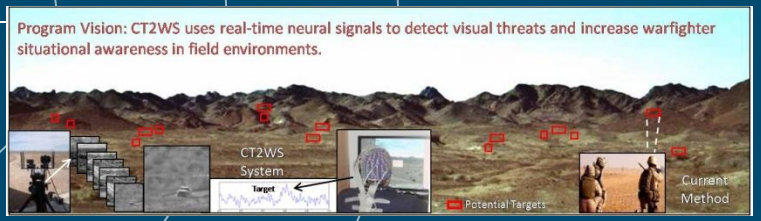
Credit: DARPA

Credit: University of Leicester

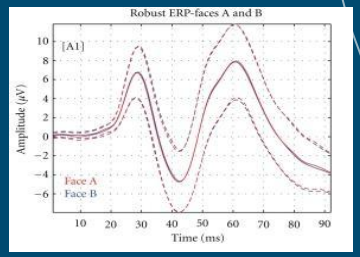
Quian Quiroga R, Reddy L, Kreiman, G, Koch, C and Fried, I. Invariant visual representation by single neurons in the human brain. Nature, 435: 1102-1107, 2005.

Credit: DARPA

Fast pattern matching for large social networks (UoM, 2010)
Solving linear equations (CMU, 2010)
Max Flow Algorithm (MIT, 2010)



Credit: DARPA



Credit : Cyril R. Pernet et al

The Cognitive Technology Threat Warning System combines high resolution digital imaging, an electroencephalogram (EEG) and cognitive visual processing and signal processing algorithms.

1964: Chapman and Bragdon find that ERP responses to visual stimuli differed depending on whether the stimuli were meaningful or not. Becomes known as P300 response.

Please note: the appearance of this technology in no way constitutes an endorsement by Dstl or the MOD. The original authors’ claims for the efficacy of their developments are taken at face value.

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The key to prediction (according to Petersen, 2008)

- "We are prisoners of our mental images of what we think might happen…
- … The trick is to build a spectrum of plausible futures that are… as broad as possible.
- [So] there is a high probability that the 'real' future is in our mental database…"
- … and the indicators will be read more accurately as the future approaches.

Illuminating the art of the technologically possible (over time)

A selection of reactions to progressive developments

"Such startling announcements as these should be depreciated as being unworthy of science and mischievous to its true progress." -- Sir William Siemens, on Edison's light bulb, 1880.

"Louis Pasteur's theory of germs is ridiculous fiction." --Pierre Pachet, British surgeon and Professor of Physiology at Toulouse, 1872.

"There is no likelihood man can ever tap the power of the atom." -- Robert Millikan, American physicist and Nobel Prize winner, 1923.

"X-rays will prove to be a hoax." -- Lord Kelvin, President of the Royal Society, 1883.

"Very interesting Whittle, my boy, but it will never work." -- Cambridge Aeronautics Professor, when shown Frank Whittle's plan for the jet engine.

"Space travel is bunk." -- Sir Harold Spencer Jones, Astronomer Royal of the UK, 1957, two weeks prior to Sputnik orbiting the Earth.

Rockets are "... too far-fetched to be considered." -- Editor of Scientific American about Goddard's idea of a rocket-accelerated airplane bomb, 1940 (German V2 missiles came down on London 3 years later).

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www.dstl.gov.uk

http://www.science.mod.uk/events/current_calls.aspx