

# Science advice & risk management in government

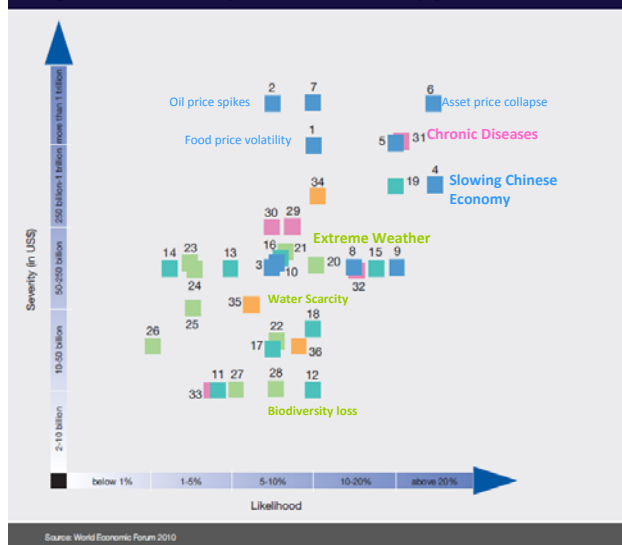
The Foundation for Science & Technology

Professor John Beddington  
 Chief Scientific Adviser to HM Government and  
 Head of the Government Office for Science

10<sup>th</sup> November 2010

## Global Risks Landscape

Figure 1: Global Risks Landscape 2010: Likelihood with Severity by Economic Loss





# Key Risks and themes in the past 5 years

Figure 4 Key risks and themes from the Global Risks reports over the past five years

2006	2007	2008	2009	2010
<ul style="list-style-type: none"> <li>Asset prices/indebtedness</li> <li>Chinese growth slowing to &lt; 6%</li> <li>Fiscal crises</li> <li>Oil price spikes/supply shocks</li> <li>US current account deficit/fall in US\$</li> <li>Critical infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>Asset prices/indebtedness</li> <li>Chinese growth slowing to &lt; 6%</li> <li>Fiscal crises</li> <li>Oil price spikes/supply shocks</li> <li>US current account deficit/fall in US\$</li> </ul>	<ul style="list-style-type: none"> <li>Asset prices/indebtedness</li> <li>Chinese growth slowing to &lt; 6%</li> <li>Fiscal crises</li> <li>Oil price spikes/supply shocks</li> <li>Rising and volatile food prices</li> <li>An abrupt, major fall in the value of the US\$</li> </ul>	<ul style="list-style-type: none"> <li>Asset price collapse</li> <li>Chinese growth slowing to &lt; 6%</li> <li>Fiscal crises</li> <li>Global governance gaps</li> <li>Chronic diseases</li> <li>Increase resource-related risk (water, land and energy)</li> </ul>	<ul style="list-style-type: none"> <li>Further falls in asset prices</li> <li>Chinese growth slowing to &lt; 6%</li> <li>Fiscal crises</li> <li>Global governance gaps</li> <li>Chronic diseases</li> <li>Underinvestment in infrastructure</li> </ul>



# Variety of Risks



Civil Contingencies



Climate Change

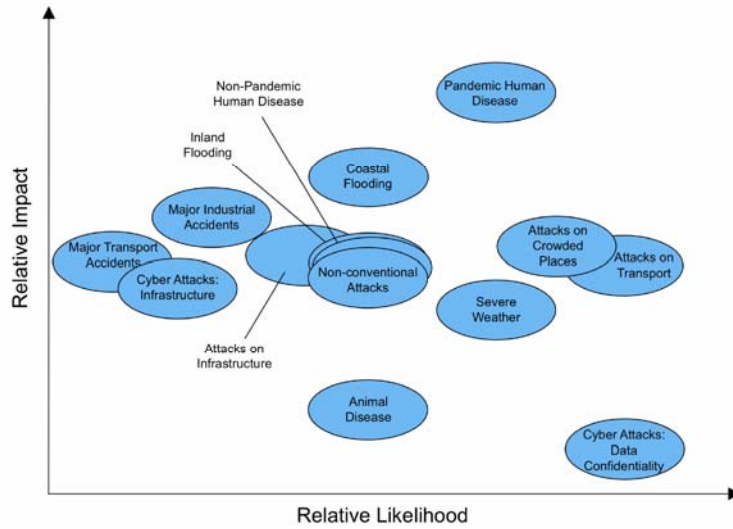


Financial Markets

- From risk to problem: how does the risk become reality?
- How does the Government respond?



# National Risk Assessment

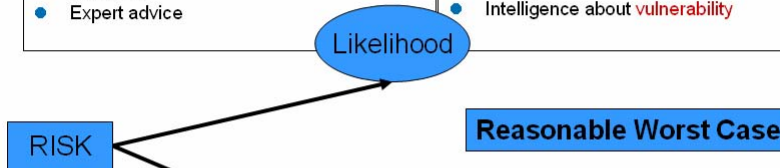


National Risk Register 2010 Edition Risk Matrix



# Assessing the Risks

<p><b>HAZARD: 'Likelihood'</b></p> <ul style="list-style-type: none"> <li>• Historical Evidence</li> <li>• Predictable events, for example weather forecasts</li> <li>• Expert advice</li> </ul>	<p><b>THREAT: 'plausibility'</b></p> <ul style="list-style-type: none"> <li>• "Plausibility"</li> <li>• Intelligence about <b>capability</b></li> <li>• Intelligence about <b>intent</b></li> <li>• Intelligence about <b>vulnerability</b></li> </ul>
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• <b>Fatalities</b>	1	2	3	4	5
• <b>Casualties</b>	1	2	3	4	5
• <b>Social disruption*</b>	1	2	3	4	5
• <b>Economic</b>	1	2	3	4	5
• <b>Psychological</b>	1	2	3	4	5

Impact

- \* Social disruption:
- Disruption to Transport
  - Disruption to supplies of drinking water, fuel, gas, electricity, communications, money
  - Disruptions to schools, health services
  - Environmental damage
  - Evacuation



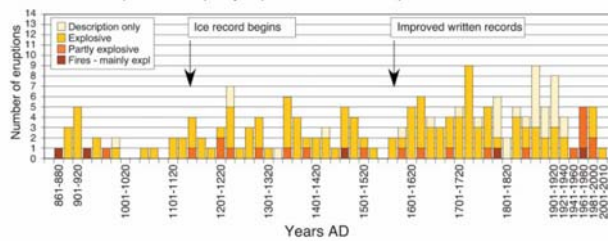
# The Difficulties of Risk Assessment: Volcanoes

## Iceland's Volcanoes

- 30 potentially active volcanic systems in Iceland
- 205 historical eruptions (average 25 per 100 years),
- 78% were explosive (due partly to ice-caps on central volcanoes), 13% part explosive, 9% effusive
- In last 1100 years: 79% basaltic, 16% intermediate, 5% silicic
- Periodicity of volcanism in SE Iceland of ~140 years.



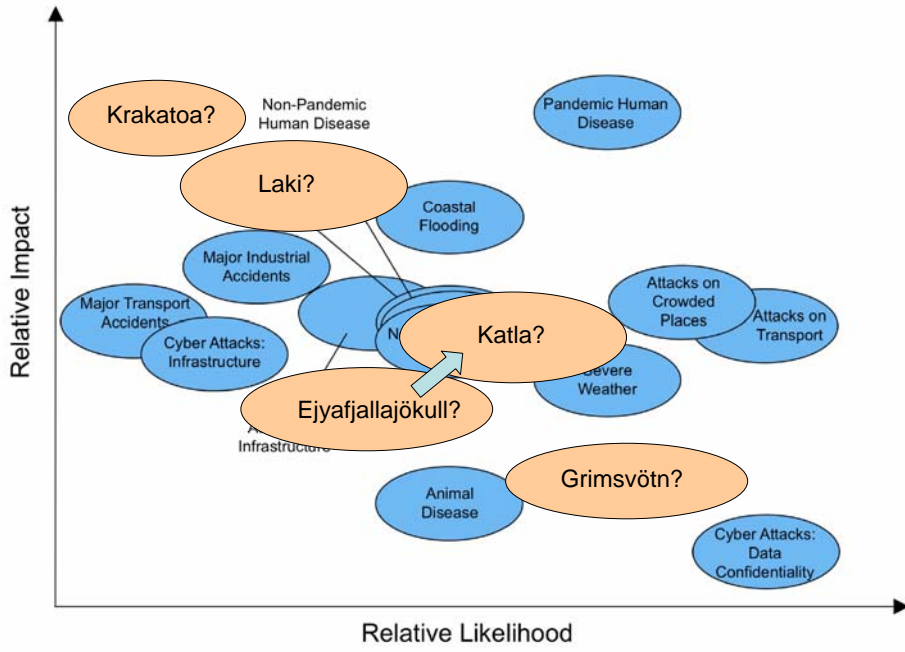
The Eyjafjallajökull Volcano

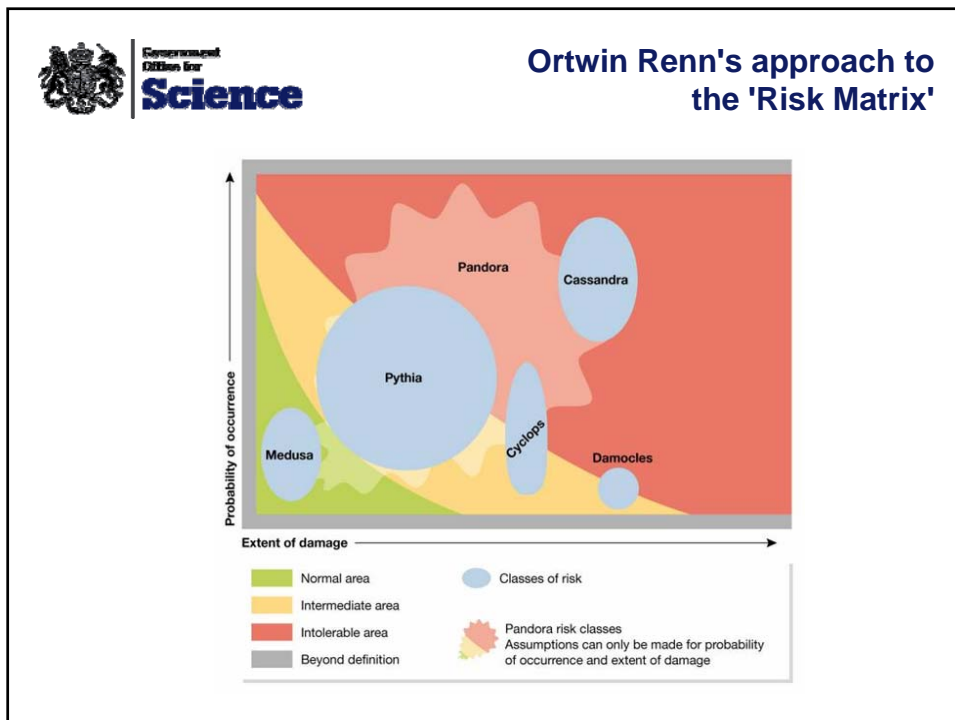
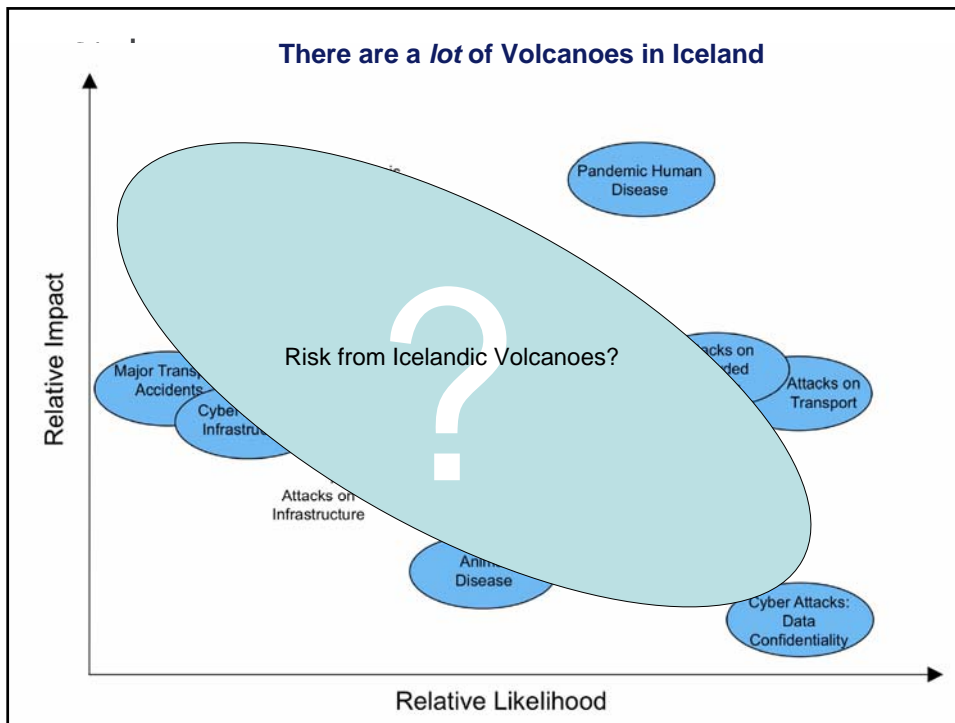


Frequency of explosive and partly explosive Icelandic eruptions since 850AD (per 20-years)

Thordarson and Larsen 2007

## Volcanoes on the Risk Matrix?





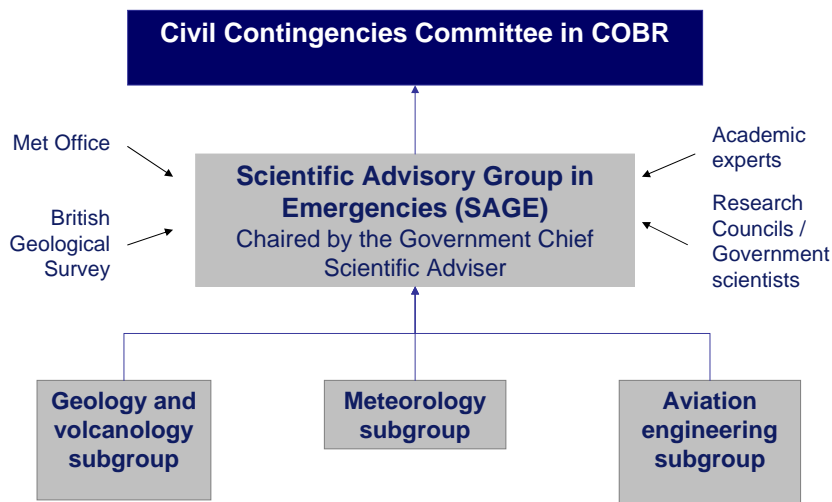


### Management Strategies

Management	Risk class	Extent of damage	Probability of occurrence	Strategies for action
Science-based	Damocles	High	Low	<ul style="list-style-type: none"> <li>•Reducing disaster potential</li> <li>•Ascertaining probability</li> <li>•Increasing resilience</li> <li>•Preventing surprises</li> <li>•Emergency management</li> </ul>
	Cyclops	High	Uncertain	
Precautionary	Pythia	Uncertain	Uncertain	<ul style="list-style-type: none"> <li>•Implementing precautionary principle</li> <li>•Developing substitutes</li> <li>•Improving knowledge</li> <li>•Reduction and containment</li> <li>•Emergency management</li> </ul>
	Pandora	Uncertain	Uncertain	
Discursive	Cassandra	High	High	<ul style="list-style-type: none"> <li>•Consciousness building</li> <li>•Confidence building</li> <li>•Public participation</li> <li>•Risk communication</li> <li>•Contingency management</li> </ul>
	Medusa	Low	Low	

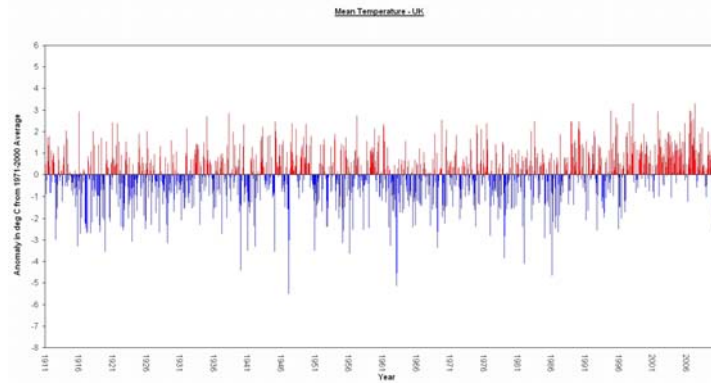


### Scientific and engineering input to the volcanic ash emergency





### Climate Change Risks: UK Mean temperature example



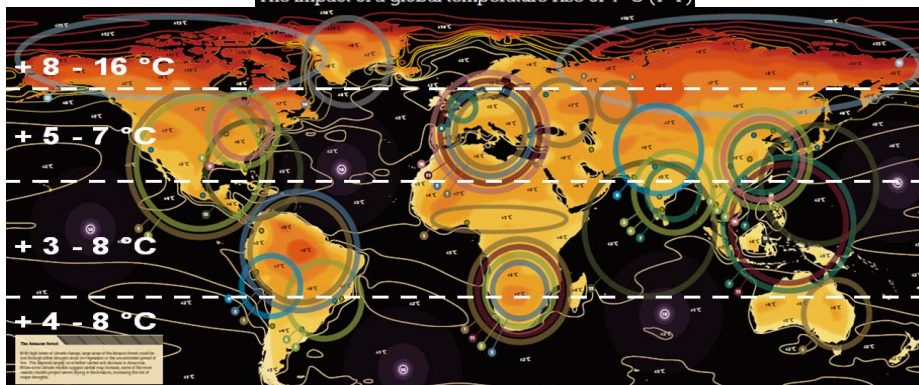
Source: Met Office

- Shows extent of natural variability and how occurrence of more extreme events is part of this
- Extremes of hot weather becoming more frequent
- Extremes of cold weather becoming less frequent



### The Risks of Climate Change

The impact of a global temperature rise of 4 °C (7 °F)



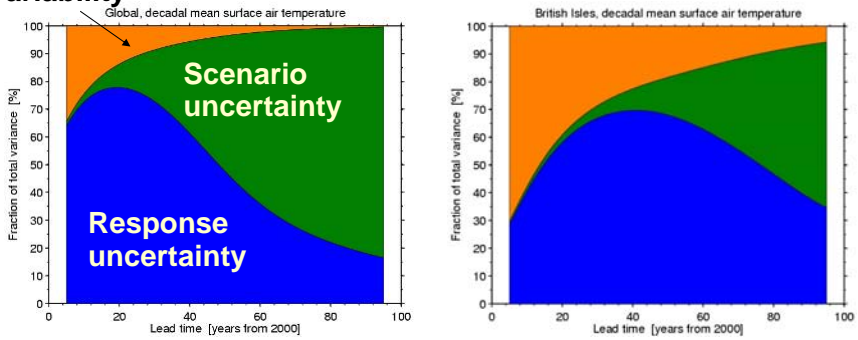
- Sea level rise
- Water scarcity and drought
- Increased risk of "tipping points"
- Ocean acidification
- Food productivity
- Ice melt
- Risk to large areas of Amazon forest
- Tropical cyclones more intense

Source: Met Office Hadley Centre



## Sources of uncertainty in Climate projections

### Internal variability

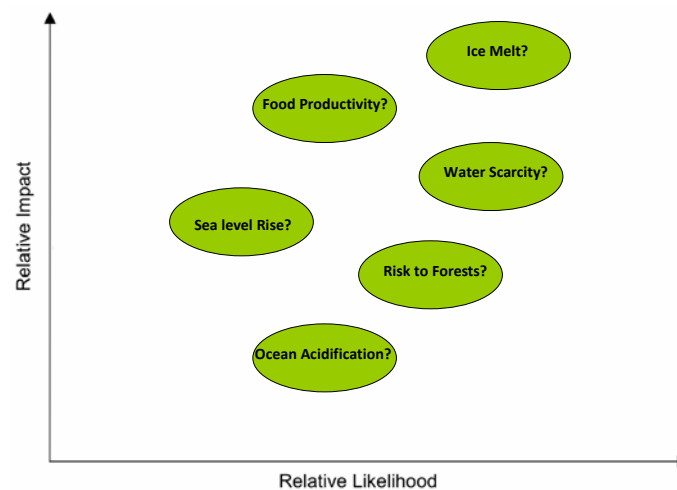


Hawkins & Sutton, BAMS, 2009

Response uncertainty and internal variability dominant contributions for predictions of the next few decades (+ contribution to scenario uncertainty from aerosol precursors)



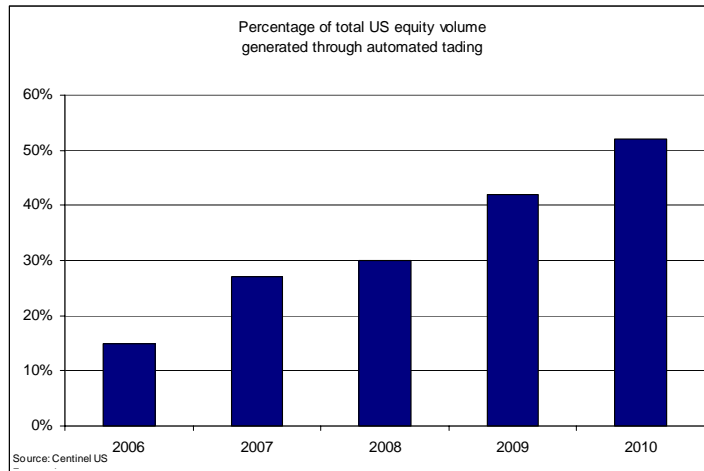
## Where does Climate Change fit?







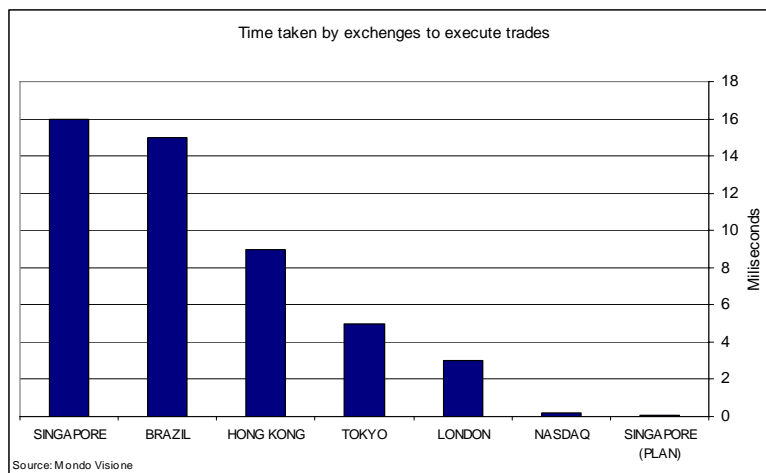
## High Frequency Trading: A Risky Business



**HFT trading volume has increased dramatically**



## Trades are being executed faster - HFT





## The move to fast trading continues

**REUTERS**

### LSE says Turquoise glitch suspicious

Tue, Nov 2 2010

By [Gwynne Miedema](#) and [Luke Jolls](#)

LONDON (Reuters) - The London Stock Exchange (LSE) said a glitch on its Turquoise cross-border share trading platform may have happened under "suspicious circumstances," forcing it to delay the adoption of the same technology for its main trading system.

Turquoise, a pan-European multilateral trading facility, was down for two hours early on Tuesday.



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Business > London Stock Exchange

### Turquoise trading shutdown may have been sabotage, LSE says

London Stock Exchange delays shift to new computer system as police and FSA investigate Turquoise problems

Treasure  
guardian.co.uk, Tuesday 2 November 2010 20:12 GMT  
Article history



The London Stock Exchange had been planning to transfer its entire share trading business to a new system today. Photograph: Linda Nylind for the Guardian

The London Stock Exchange tonight delayed a major update of its computer system amid concern that one of its key trading platforms had been targeted by a saboteur.

**FT.com** FINANCIAL TIMES

FT TRADING ROOM  
**Trading Technology**

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### Trading on Turquoise halted for two hours

By Philip Stafford  
Published November 2 2010 11:20 | Last updated November 2 2010 11:20

Trading was halted for two hours on Turquoise, the share trading platform owned by the London Stock Exchange on Tuesday morning, in the second technical glitch to hit the LSE in five weeks.

The problem emerged shortly after trading began and led to the exchange halting use of the market at 8.30am. Continuous trading in all markets resumed at 10.30am. The LSE described it as a "networking-related issue."



## The Risk becomes a Financial threat



*"What took a few days in August 2007 can unfold in a few minutes today given the amount of high frequency trading that now exists."*

Andrew Lo Director of the MIT lab of financial engineering.

- The U.S. equity markets experienced the worst price decline and reversal since 1929 on May 6 2010. This has since been dubbed the **"flash crash"**.
- The cost of the Flash Crash: confidence has been shattered and roughly \$70bn has been pulled out of US equity funds since May 6.



## New Foresight project: The Future of Computer Trading

New project on the future of computer trading in financial markets.

Aim: to explore how advances in computer trading may evolve in the future and how this will affect:

- **Financial stability** (across networked markets)
- **Integrity of financial markets** including price information and liquidity
- **Competition**
- **Market efficiency for allocating capital**



## Looking to the Future: There will always be new threats

### Christmas Day bombing December 2009



*Understanding the threat*



*Response*

### Cargo Bomb Plot October 2010



30 October 2010 Last updated at 20:09  
 The Prime Minister has said he believes the device found on board a cargo plane at East Midlands airport was designed to go off on the aircraft.  
 Earlier, Home Secretary Theresa May said the bomb was visible and could have brought down the plane if it had exploded.  
 It was one of two packages from Yemen placed on board US bound cargo planes.



Government  
Office for  
**Science**

*“Probabilities direct the  
conduct of the wise man”*

*Marcus Tullius Cicero  
106- 43 BC*

