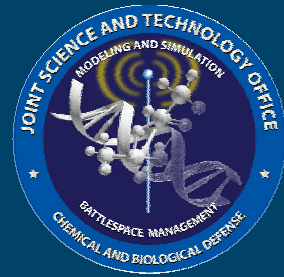# Impact Assessment Tool

Dr. Ben Swindlehurst, Dstl

Mr. Darrell Lochtefeld, Anteon Corporation

Mr. Andrew Solman, Dstl

Operational Research

1. Support technology and concept evaluation

2. Predict CB effects on personnel, equipment and operations

    – determine CB operational effectiveness

    – development of NBC operational requirements

    – support TTPs, doctrine and CONOPS development

3. Support BoI and BoR studies

4. Support real time operational decision making

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Making the World Safer

We need to be able to answer questions such as these:

1. Should the military procure the networked bio-detection system A, B or neither?

2. What are the key assets of an airbase that need to be protected in the event of a CB event in order to maintain operations?

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Current Capabilities

- Fixed Site operational effects models
    - E.g. STAFFS

- CBR OR Tools
    - E.g. UK CBR Virtual Battlespace (VB)

- Combat Models
    - E.g. JSAF/OneSAF
    - JWARS

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Background – STAFFS
(Simulation, Training, and Analysis For Fixed Sites)

- A DTRA CB sponsored Science and Technology developed program that calculates operational effects of WMD attacks on fixed sites

  - Solely government owned

- Transitioned to the Joint Operational Effects

  Federation (JOEF) program Sept 05

- A Monte Carlo system simulation

- High Level Architecture (HLA) compliant

- Complex data-driven model – primarily

  used by experienced analysts

STAFFS
Simulation Training and
Analysis For Fixed Sites

Background - STAFFS Modeling

- Capable of modeling operations at the individual resource level or at aggregate levels

- Two major fixed-site scenarios:

  - Fighter bases

    - Models major infrastructure, resources, and operations related to turning sorties for F16 and A10 aircraft

  - Aerial Ports of Debarkation (APOD)

    - Models major infrastructure, resources, and operations related to cargo throughput of an airlift operation

- Addresses all pillars of Chem-Bio defense

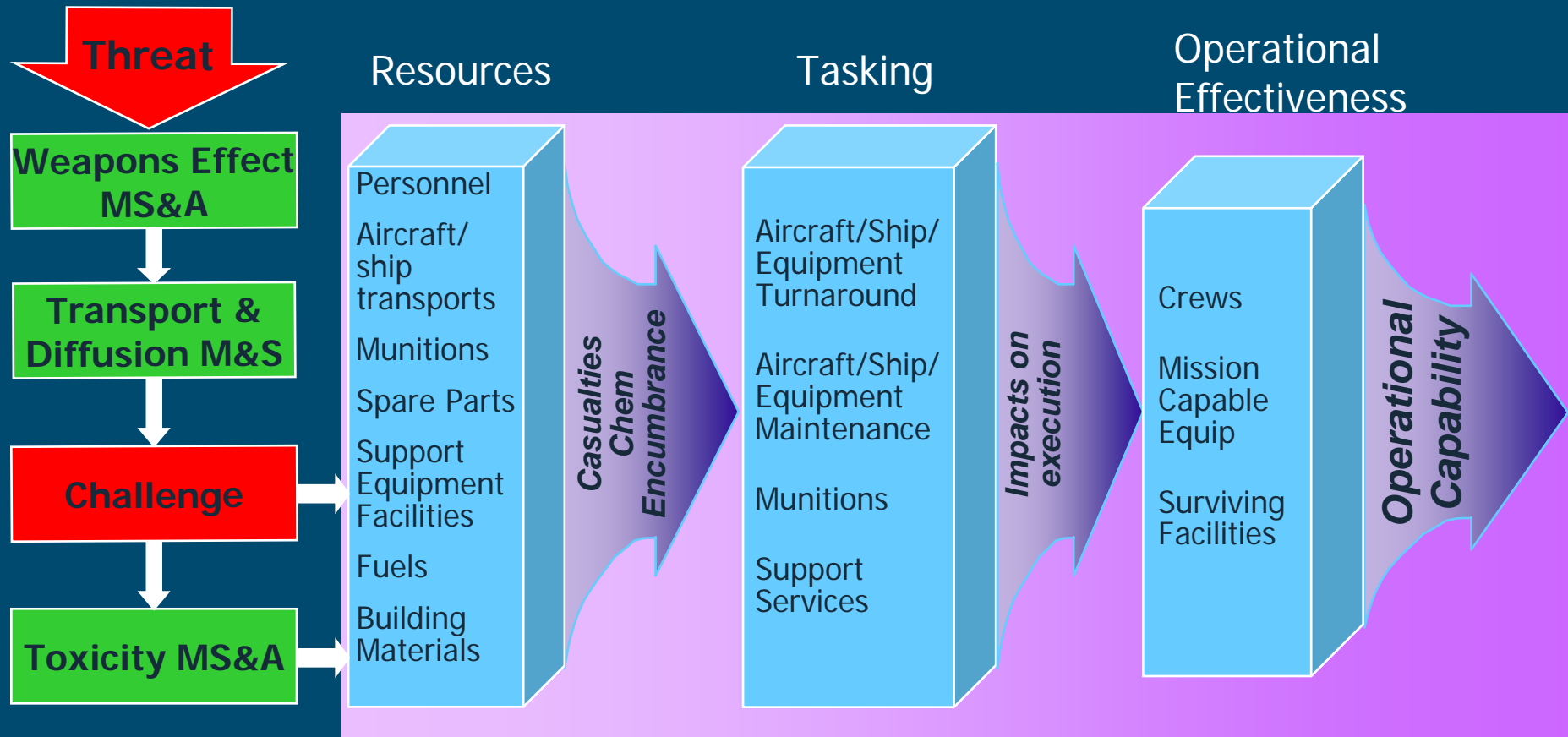# Background - STAFFS Methodology

Threat

Weapons Effect MS&A

Transport & Diffusion M&S

Challenge

Toxicity MS&A

Resources
- Personnel
- Aircraft/ship transports
- Munitions
- Spare Parts
- Support Equipment Facilities
- Fuels
- Building Materials

Casualties Chem Encumbrance

Tasking
- Aircraft/Ship/Equipment Turnaround
- Aircraft/Ship/Equipment Maintenance
- Munitions
- Support Services

Impacts on execution

Operational Effectiveness
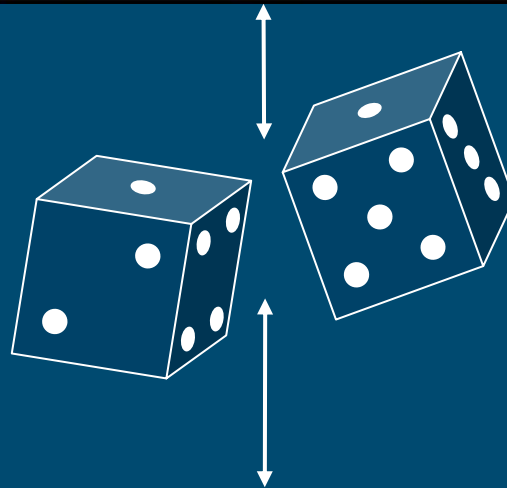- Crews
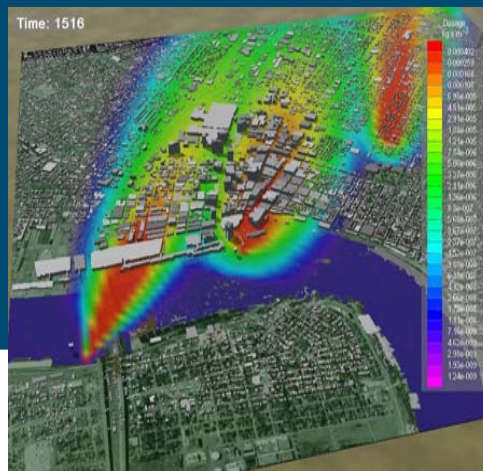- Mission Capable Equip
- Surviving Facilities

Operational Capability

Virtual Battlespace

Modelling Application User Interface (MAUI)

Monte-Carlo run controller

Synthetic Environment Modelling

[dstl] 2005

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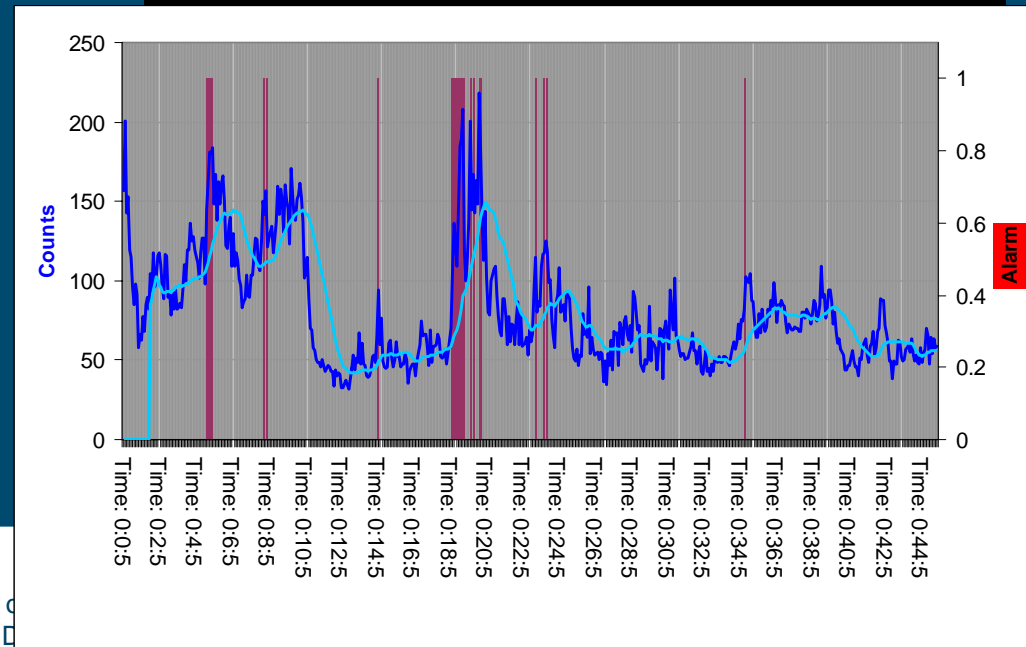# Application - ISMS procurement

- Dstl provided scientific support to procurement of an Integrated Sensor Management System (ISMS)

- Why?
  - ISMS aims to improve ability of biosensors to discriminate BW attacks from the natural aerosol background

- Dstl's contribution
  - To test two prototype systems using a realistic simulation, rather than field trials
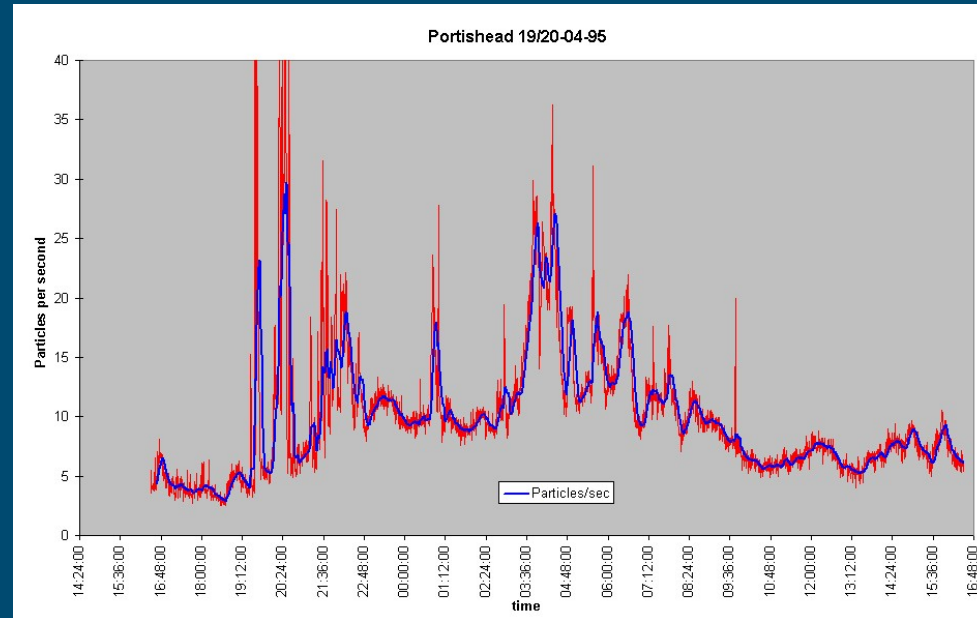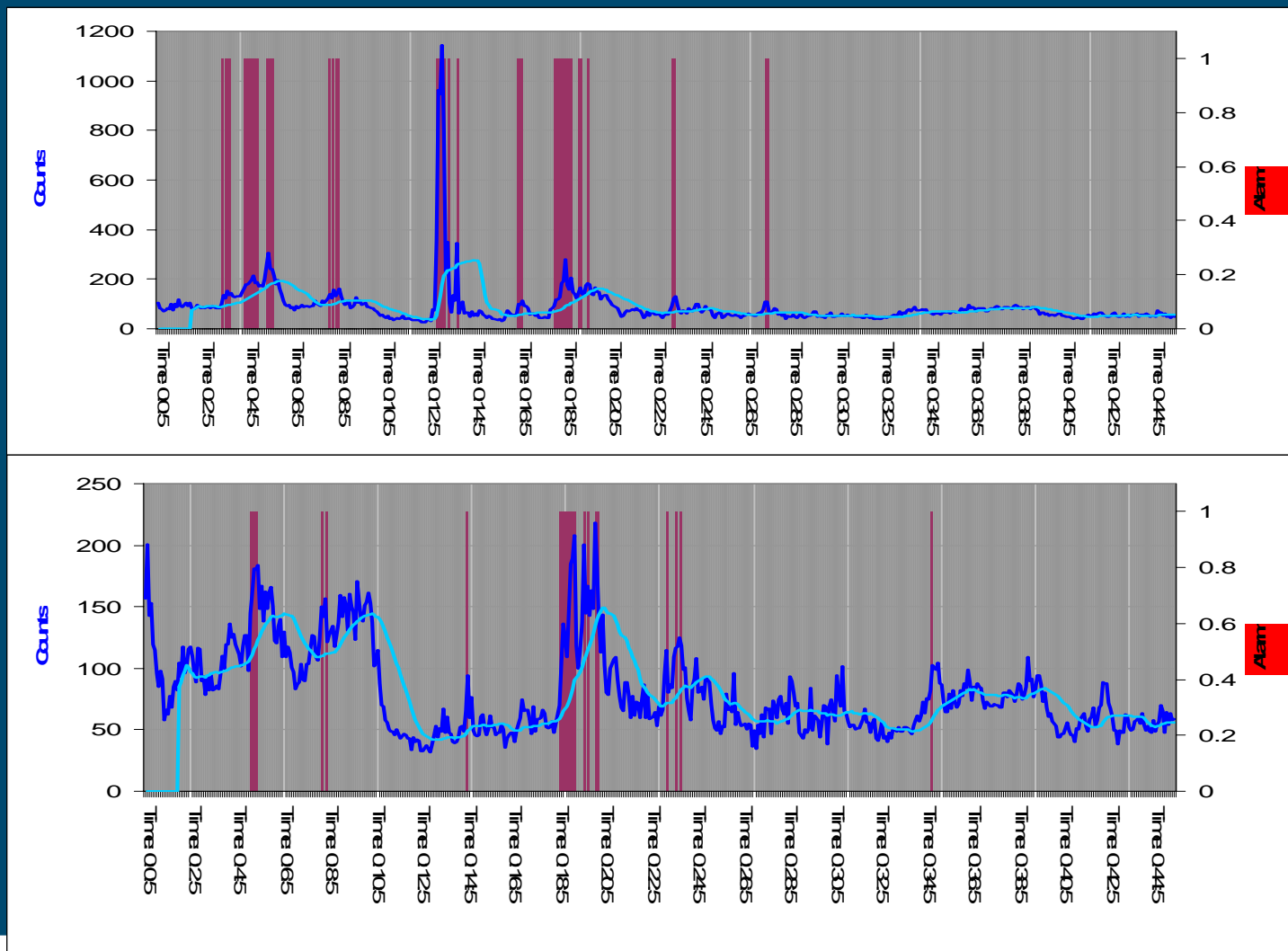

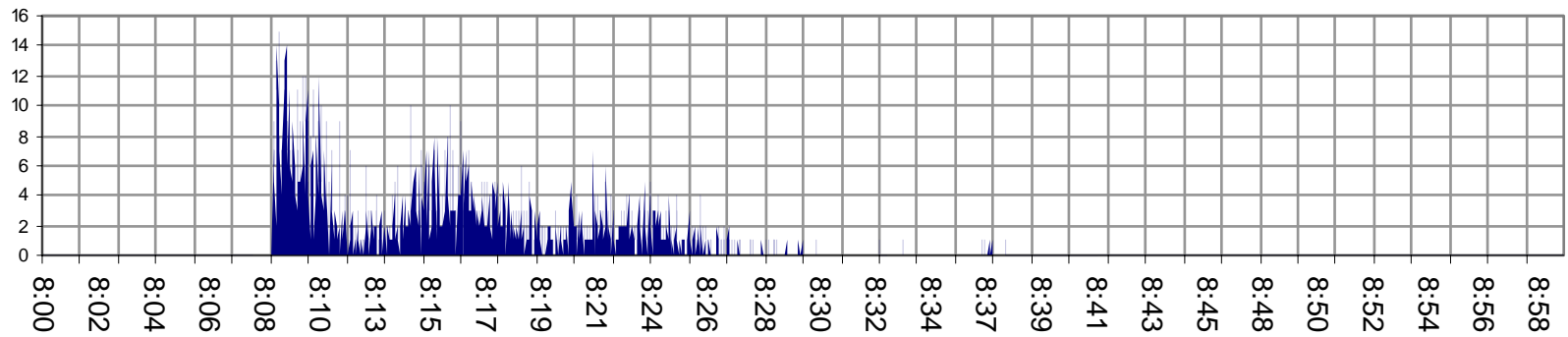Particle number measured over

24 hour period at Portishead

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Models

- Meander turbulence model linked with UDM to provide a simulation of meandering plumes

  - required for realistic stimulation of detectors etc.

- Biological background model developed

  - based on field data

- Generic biological detector models developed

  - size, shape, fluorescence
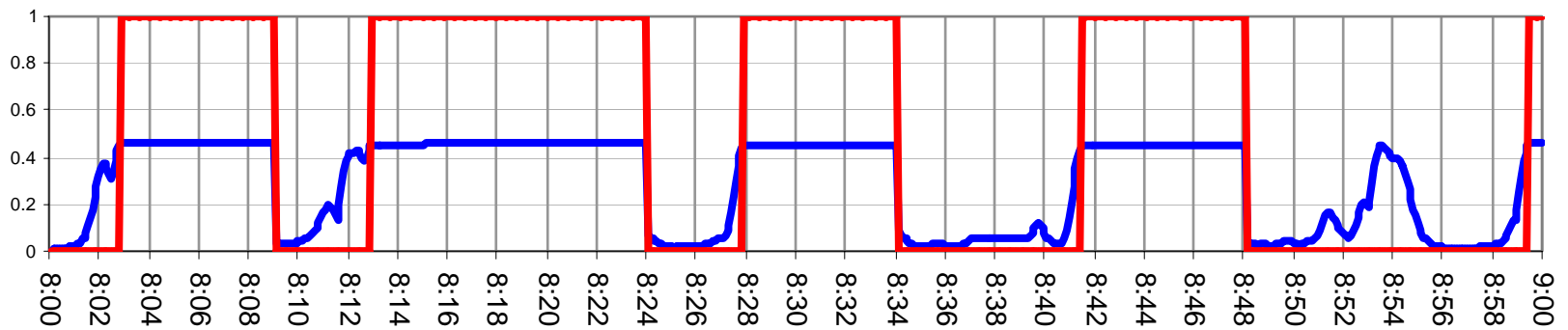
  - include measurement noise and sampling noise

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Application - ISMS procurement

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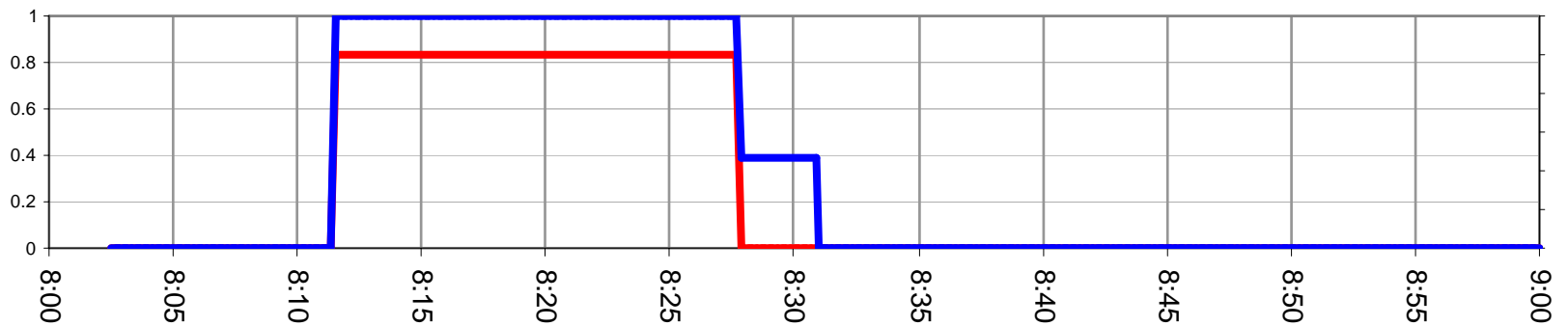
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Challenge data

Contractor 1 Test B

Contractor 2 Test B

Application - Outcome

- This study demonstrated a sophisticated Test and Evaluation system for stimulating sensors and simulating equipment performance

  – ISMS performance quantified across 152 scenarios

  – Able to differentiate between two systems

  – Effective detection limits for the *network* determined

  – Performance quantified as a function of the number of sensors

    - around 10 sensors optimal to protect 5x5km area

  – Results informed Main Gate decision (June 05)

  – System is flexible and available to other studies

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Programme Aims

- The Impact Assessment Tool will link STAFFS and the VB to allow:

  - a user to predict the number and location of casualties in the event of a CB release

  - a user to predict how defensive equipment and procedures moderate casualties

  - a user to investigate how these factors affect mission objectives

- Linking the VB to STAFFS will allow both models to benefit from the strengths of the corresponding model

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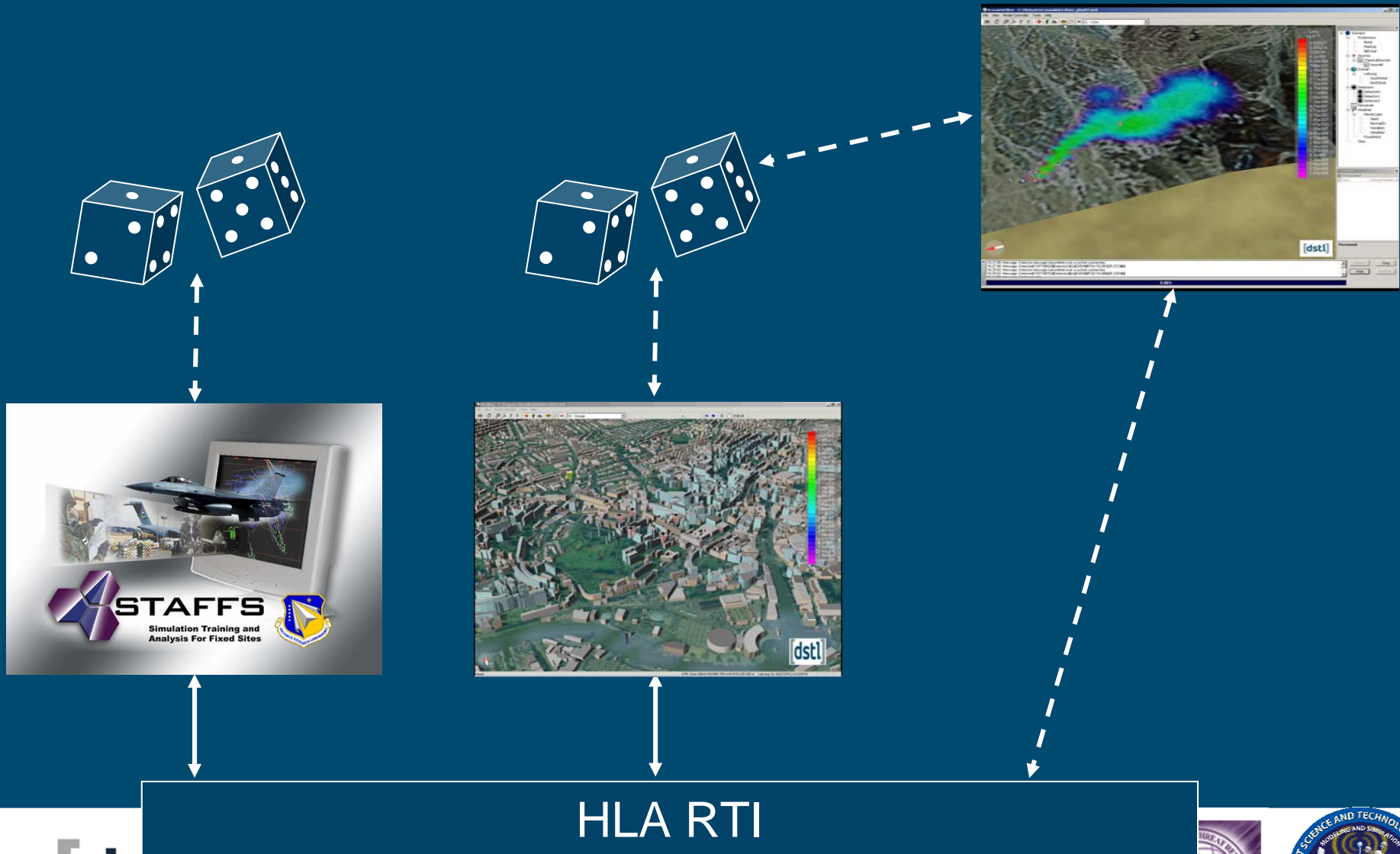
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Benefits of System Linkage

- State of the Art Dispersion modelling

- Enhanced visualisation

- High resolution plume data taking into account high resolution fluctuations within the puffs

- Highly configurable CB modelling chain

- Interoperability with the latest CB capability through agreed interfaces

- Real-time entity simulation

Potential Linkage Methods

- Considered

  - File based

  - API based coupling

  - Web services

  - HLA

- Current plan is to use HLA

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Proposed Method - HLA

HLA RTI

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Future Challenges

Is operational effectiveness achieved with better detection systems or better medical countermeasures?

Balance of research requires

- – simulation of entire CBRN defence system

- – probabilistic modelling framework

- Work in progress...

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Future Challenges

How should the military react to a specific real time CB event?

- Support to real time operational decision making requires

  – very fast operational version of Virtual Battlespace

  – optimisation algorithms

  – probabilistic modelling framework

- Work in progress...

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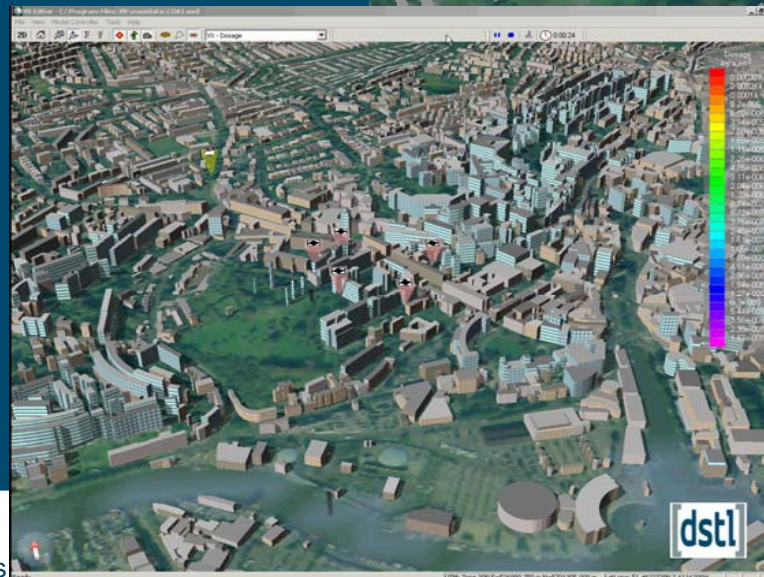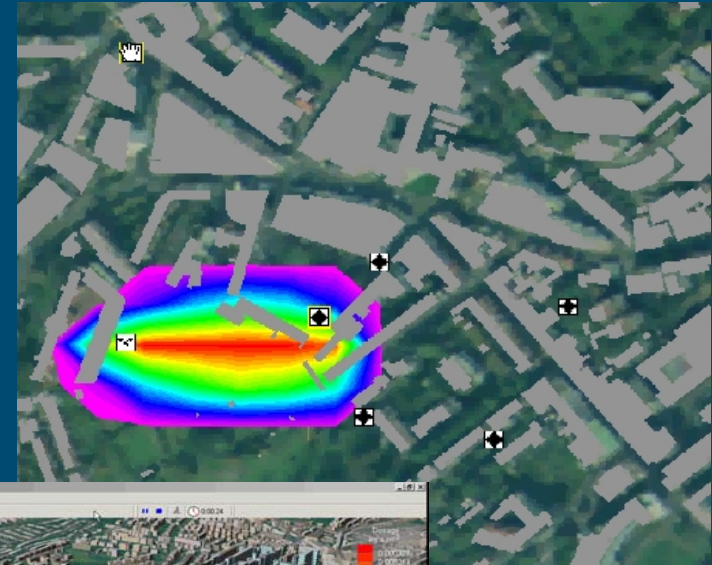
Summary

- CBRN OR can provide benefit across the full spectrum of the domain

- Have and improving capability to conduct OR
  - The Impact Assessment Tool contributes to this capability

- Clear benefits from linking systems
  - Reduced effort, cost and time to develop capability
  - Increased flexibility and functionality of capability

- Much work still to be done

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