Modelling Medical and Operational Effects of CBRN Usage

Oliver Lanning & Deb Fish

Defence Science and Technology Laboratory, UK

© Crown Copyright 2007. Published with the permission of the Defence Science and Technology Laboratory on behalf of the Controller of HMSO.
Introduction

• Decision support tools are developed to predict the effect of CBR events on personnel, equipment and operations

• Tools, such as JOEF and the MOD’s Virtual Battlespace, can be used to
  • support the equipment acquisition programme
  • aid pre-operational planning
  • assess the operational implications of concepts, doctrine and technology development
  • guide the research programme
  • aid CBRN training

• This talk will focus on recent work on casualty modelling, quantifying uncertainty and modelling operational effects
What is the Virtual Battlespace?

- A synthetic environment including (some under development)
  - State-of-the-art dispersion models (UDM & SCIPUFF)
  - Models of CBR defence system (detection, protection, MCMs)
  - Representation of movement of entities (aircraft, army units)
  - Links to combat & facility models (WISE, OneSAF, STAFFS)
  - Multiple run controller
  - Wargaming mode
The Virtual Battlespace Models

- Dispersion Modelling
  - CBR sources and hazard plumes (weapons, IEDs, RDDs, TICs & TIMs)
  - Urban and Rural (SCIPuff & UDM)
  - Concentration Realisation
- Meteorology
  - Terrain
  - Local Wind Turbulence
  - Sea Breeze
- Military Units/Personnel
  - Effects (casualties)
  - Inhalation & Contact Hazard (liquid pickup)
  - Medical Countermeasures
  - IPE
  - Physiological Burden
  - Aggregation
  - Value of Information
- Detectors
  - Simple (threshold)
  - Generic
  - Specific
  - Standoff
  - Biological Background
  - Single & Network Alarms
- Modes of Use
  - Wargaming
  - Assessment
Casualty Modelling

- Modelling physiological effects of a CBR attack or incident is crucial
  - Need to account for both inhalation and percutaneous ingestion of agent
  - Should include individual protection
    - Respirator
    - Suit
  - Predict effects of medical countermeasures
    - Nerve agent treatments
    - Vaccines
    - Antibiotics
    - Antitoxins/Antivirals
Medical Countermeasures (MCMs)

- The time to onset of symptoms is crucial for biological MCMs
  - Symptoms typically present days after exposure
- The efficacy of antibiotics, antivirals and antitoxins are strongly time dependent
- Therefore, the model accounts for the time that these MCMs are administered
  - Window of opportunity
  - Can assess concepts and doctrine and medical response
Time to onset and duration of symptoms

- Modelling the time to onset of symptoms can allow realistic training scenarios to be run
  - Commanders do not discover covert biological release until medical surveillance triggers
  - Speed of response then determines the effectiveness of treatment
  - Allows investigation of effect on operational outcome
Contact Hazards

- Both liquid and vapour hazards
- Data available from Porton Man
  - Helps drive research on future clothing
Operational Effects

- The Virtual Battlespace predicts the impact of CBRN on personnel, equipment and terrain
- Drive to determine the effect of CBRN on the operation & campaign
- In general, this will be done by linking or inputting to appropriate high-level modelling tools
  - This can include both simulations and wargames
  - Physical link was investigated to UK WISE (formation level simulation)
Operational Effects

- Initial focus on sea ports
- Using CBR Virtual Battlespace (CBVB) to determine effects of CBR attacks
  - Casualties
  - Contamination
- 17\textsuperscript{th} Port & Maritime Squadron will advise on work arounds
- Quantify effects on logistics chain using the Dstl Marflow model for EDPI
Effect of CBRN on Peace Support

• Aim – to develop capability to use CBVB to quantify effects of CBRN on Peace Support Operations (PSOs)
• Existing Dstl computer assisted wargame PSOM determines outcome of PSO
  – CBVB can determine casualties and contamination as input to PSOM
  – This then impacts on all members of the game
  – Can run scenarios with and without CBRN for comparison
Impact on Operational Outcome

• The Virtual Battlespace will be used to provide input for table top wargames
• Model dispersion of covert biological attack
  – Casualty chain will provide time to onset of symptoms for all exposed individuals
  – Commander will start to see units report illness
  – Medical response determines combat effectiveness
Conclusions

• A new casualty model chain has been developed
  – This accounts for
    • Respirator and suit
    • Medical countermeasures
    • Time to onset of symptoms and efficacy of MCMs
• The casualty models allow, in combination with other tools, for the operational effects of CBRN to be determined
• This provides invaluable pre-operational planning and training opportunities