

technical solutions to tactical problems

Layer **3** Services

Using RF to Emulate Explosive Effects

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MD Layer 3 Services

Problem:



Problem:

How to demonstrate effects in a real-time, real-world environment without causing those effects:

- blast, and
- fragmentation.

Also:

- fires, and
- chemical, radiological and biological hazards.

Need = ability to simulate 'Hazard-over-Distance'.

Current solution - Modelling

Computer models (CFD, FEA) do not provide immediate feedback to participants nor are they easily modified in a timely manner.

Based on assumptions and computer built environment.

Modelling still important to give detailed indication of effects.

Use of lasers and other systems but not scalable or distance limited.

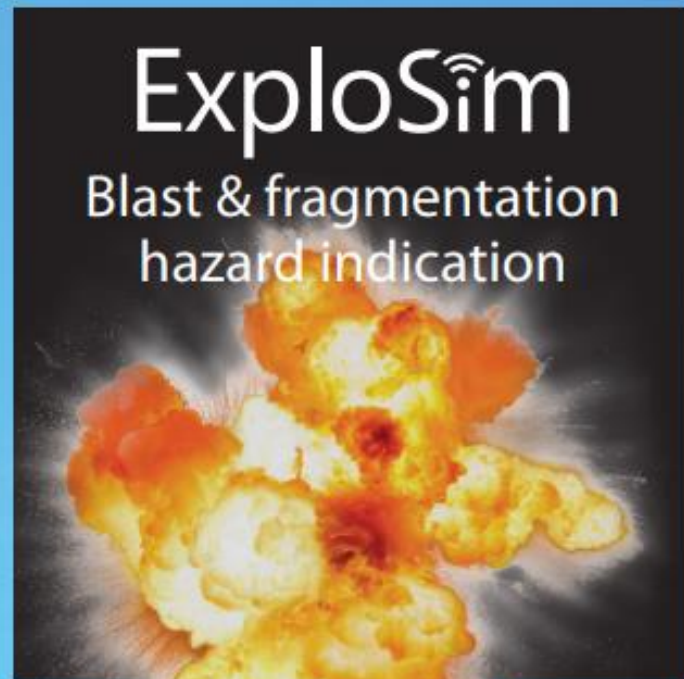
'Hazard over Distance' systems

Real-world
Real-time



FireSim

Radiant heat
hazard indication



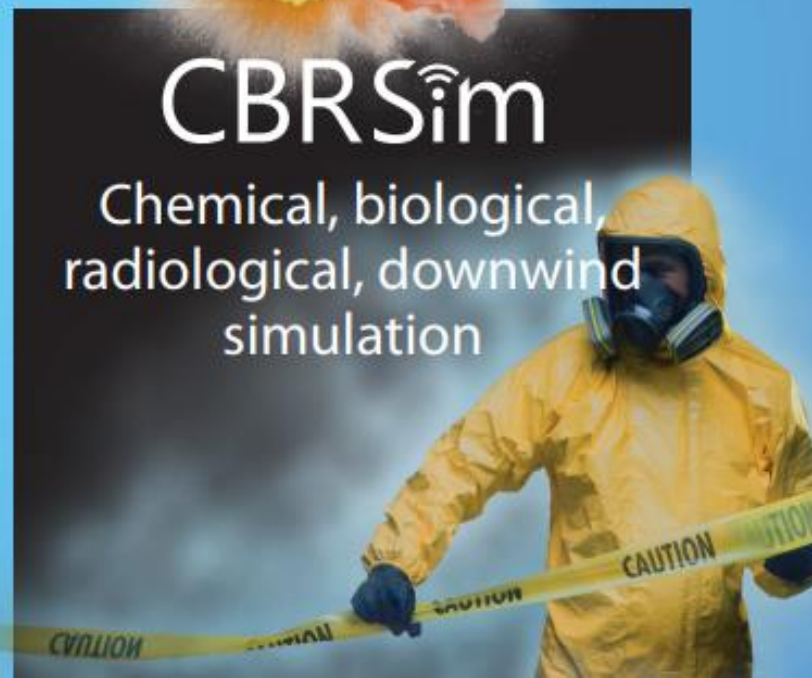
ExploSim

Blast & fragmentation
hazard indication



FragSim

High explosive munition
fragmentation indication



CBRSim

Chemical, biological,
radiological, downwind
simulation

Answer = Emulation using RF

RF energy can be used to emulate the effects of other forms of physics:

- hydrodynamics of blast,
- ballistics of fragmentation,
- thermal energy,
- down-wind spread of contaminants.

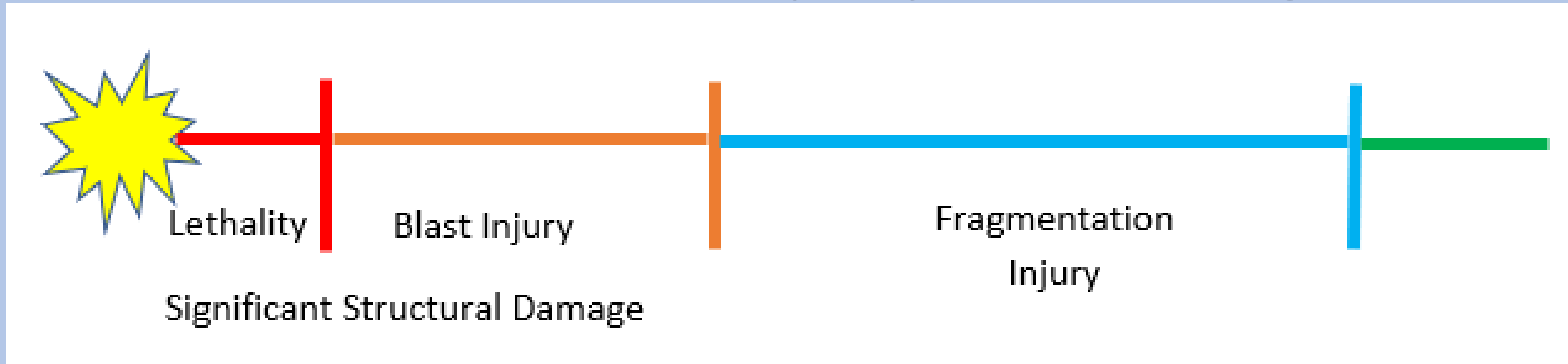
Proof of Concept

ExploSim:

- Choose one from 25 explosives or 9 predetermined IEDs.
- Choose amount of explosive: 100 grams (0.22 lb) to 20 tonnes (22 US tons).
- Issue/place receivers.
- Trigger the transmitter.
- Read results via LEDs on receivers.



What? Indication of Injury & Damage



Red LED (blast lethality) >207 kPa (30 psi).

Orange LED (blast injury) >34 kPa (5 psi).

Blue LED (fragmentation injury of 79 Joule).

Orange LED >70 kPa reflected pressure.

Red or Orange LED = significant local structural damage.

Why?

Physical emulation in the actual built and natural environments.

Real-time indication of effects while the participants are there.

Enhance tactical training of participants and their commanders.

Develop and validate operational plans and practices/tactics.

Immediate indication of casualties.

Plans and designs: safety, security and survivability.

Other uses?

How?

ExploSim uses RF energy to emulate the hydrodynamics of blast and the ballistics of fragmentation.

Uses globally available WiFi frequency of 2.4 GHz.

The technology works.

To emulate other hazards - change the inputs and outputs
i.e. why the LEDs illuminate.

History

Thought bubble late 1990's related to distance from breaching charges.



Design attempt 2004-6 - technology not up to concept.

Initial concept paper to Parari Conference 2005.

Project revived 2019.

Design criteria paper to Parari 2019.

Concept demonstrator to Fulmination (UK) 2022.

Design finalised mid-2022.

Safety

Cannot be used as a firing system.

Low power (~40 milliwatts).

The system can be used wherever WiFi devices are permitted.

Can co-exist with other WiFi networks.

The installed batteries are approved for transport, UN2800 and UN3481.

Designed to: IP65, EMI, EMC, CE, “Ruggedized Commercial”.

Emulation

Indicates effects, does not create them – hence people do not die.

Innovation is use of RF to indicate explosive effects and other hazards.

Real-world, real-time - not virtual.



Layer 3 Services

ExploSim app - Apple Store

Summary

The ability to emulate hazardous effects in a real-world, real-time environment without causing those effects has been demonstrated.

Feedback and comments/suggestions welcome:

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