# Capability Statement

## Immersive VR Training at a Fraction of the Cost

In the event of a developing emergency do you think you would make the right decisions? Would your own situational awareness allow you to keep a cool head or would you panic and make the wrong ones?

MMI Engineering has recently developed and patented a tool that allows for the real-time simulation of major hazard accidents and the injuries to individuals exposed to them. The tool was developed in the Unity game engine, which means it can be deployed across a range of operating systems including PC, Mac, Web, iOS, Android and, more recently, the immersive Virtual Reality platform Oculus Rift, now a Facebook product.


A screenshot from QUARTS


QUARTS experienced through the Oculus Rift at Hazards 24

QUARTS allows the user to navigate their own working environment in an immersive, virtual environment and to experience exposure to major developing incidents.

## Potential Applications

As soon as you don an Oculus headset you can't help but be amazed at how totally immersed in the model you are. Look over your shoulder, at your feet, up at the sky. It's as close as you can be to being there.

QUARTS was originally designed for situational awareness training for fire and explosion awareness but could be adapted for many different purposes, such as:

- Induction training
- Site orientation
- Fire fighting
- Emergency response training
- First responder training
- Evacuation analysis

The potential for deploying training on the Oculus format is almost unlimited, but in QUARTS we focus on response to an emergency. Of course, we recognise that emergencies, thankfully, rarely happen and we also see the potential of Oculus in providing:

- Pre-visit orientations
- Inductions
- Coxswain training
- Signage
- Optimisation
- 3D user interfaces


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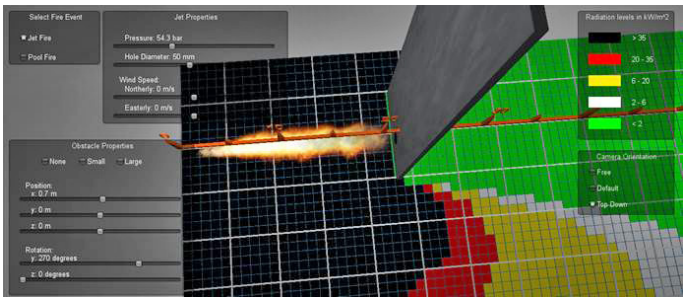
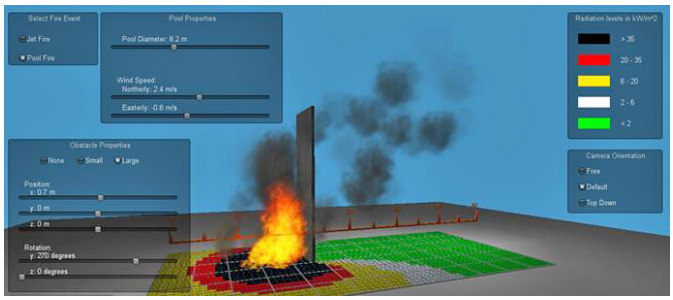
## The Science Behind QUARTS

For years, MMI has been providing situational awareness enhancement in the form of video representations of incidents based on industry-leading hazard modelling techniques. We understand the power of video; that 'seeing is believing', which is why the models in QUARTS are not just SFX. They were developed by engineers with many years' experience in consequence modelling and all QUARTS models were calibrated against industry accepted models for fire modelling.

So, how does it work? The fires are modelled by the emission of particles. Each particle represents a mass of fuel which burns at a prescribed rate, emitting radiation as a point emitter. For jet fires, the number of particles emitted per second is proportional to the mass flow rate (which itself is related to hole size and upstream pressure). The particle's initial velocity and lifetime are calibrated such that the length of the flame in QUARTS match those of industry accepted handbook models. For pool fires, the number of particles emitted depends on the fuel's burn rate and the area of the pool.



The effect of shielding



Pool fire with wind plus obstacles

To calibrate all of these models, MMI developed within QUARTS a 'sandbox' which allows the user to easily alter parameters such as fuel type, fire type, pressure, hole size, wind speed, proximity of obstacles, etc. The sandbox was used to calibrate the model against various handbook solutions for predicting fire consequences.

What advantages does QUARTS offer? Well, the particles in the model used to simulate the fire have an inbuilt facility to respond to external forces such as drag, wind and interaction with other objects. So, we have developed our model such that flames are deflected by wind and have implemented a crude model that allows for a first order estimate of the response of a flame when it impinges on solid objects. Additionally, the particles have an inbuilt ray-casting facility that makes it easy to calculate the contribution to incident thermal radiation at all points in the model; moreover, the raycasting facility allows us to define objects that are opaque or partially transparent to thermal radiation. It would also allow us to develop more complex attenuation relationships.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