



Detecting person borne concealed weapons



ISystems Solutions

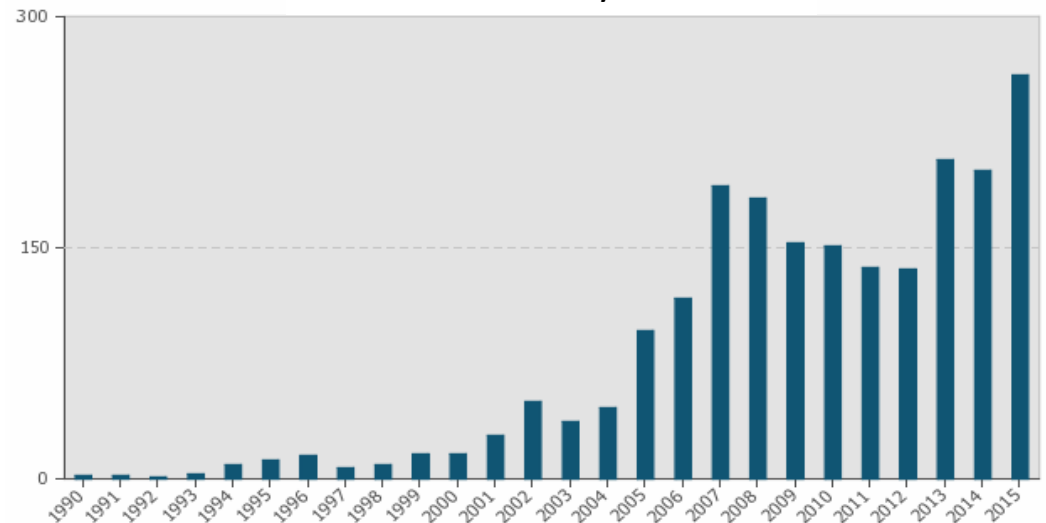
Detect Bomber

Introduction

- Protection of citizens & critical national infrastructure
- 2015 - 262 suicide attacks WW >9,500 fatalities/casualties
- RPS - stand-off person borne concealed weapon detector
- UK Home Office and MET funded initial development at MMU.
- Patent protected with worldwide IP rights assigned to commercialise technology

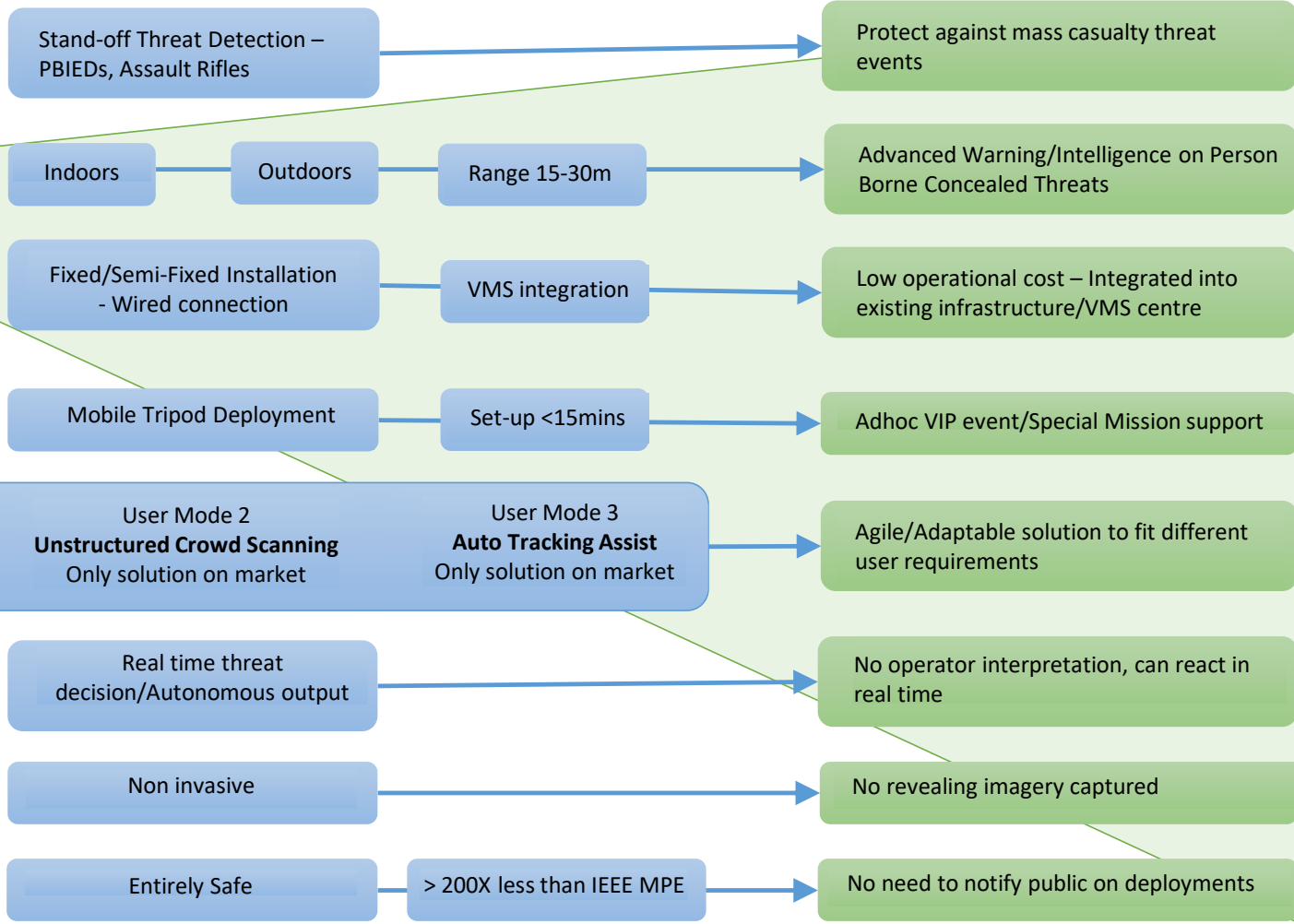
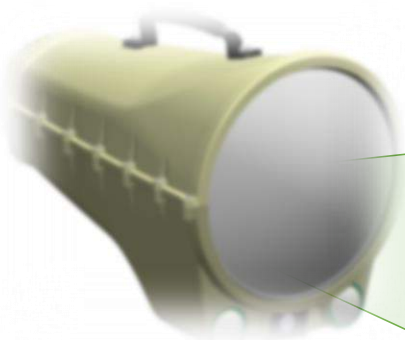


Suicide Attacks by Year #



Product Market Fit

MiRTLE[®]: Product-Market Fit



Product Capability

Market Fit

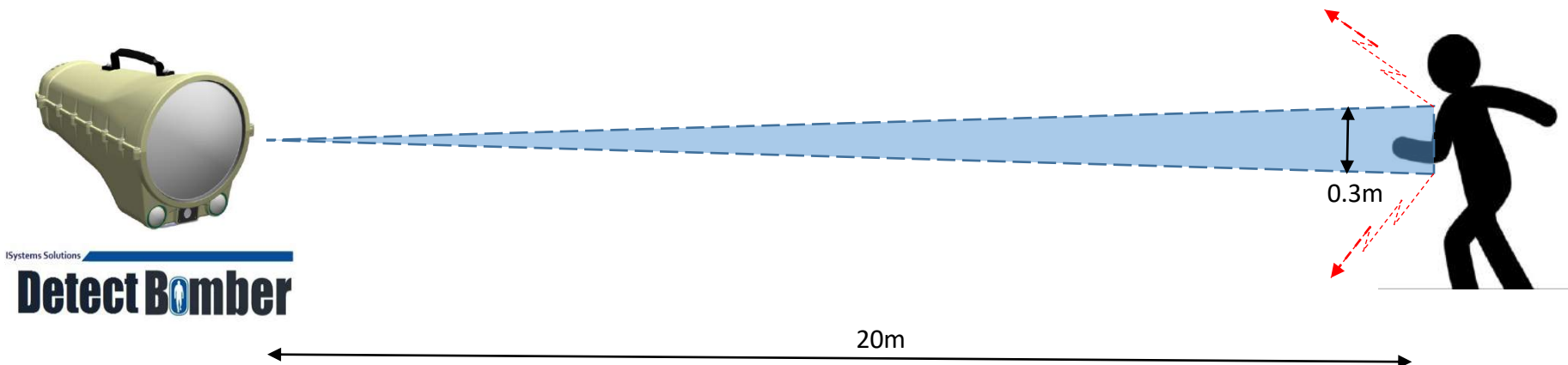


How it works

MiRTLE[®]: how it works

Transmit:

- Frequency modulated continuous wave signal operating over W-band frequencies
- At 20m range the beam size illuminates an area on the person with a diameter of ~0.3m.

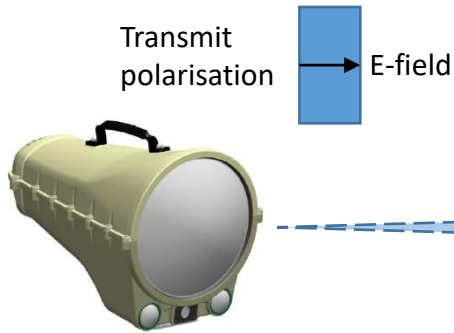


Receive:

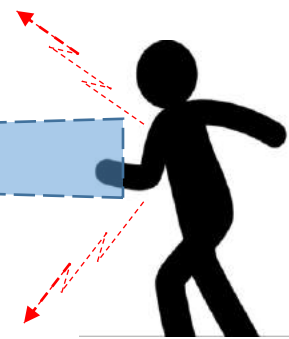
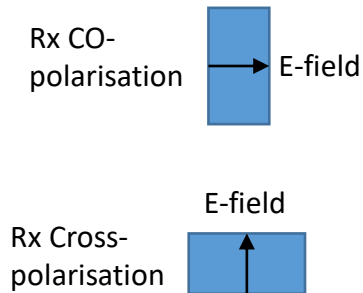
- Tx beam scatters off the target
- Two orthogonally polarized receivers provide two channels of target information
- Complex shaped items concealed on the body cause the scattered energy to undergo a change in polarisation

MiRTLE[®]: how it works

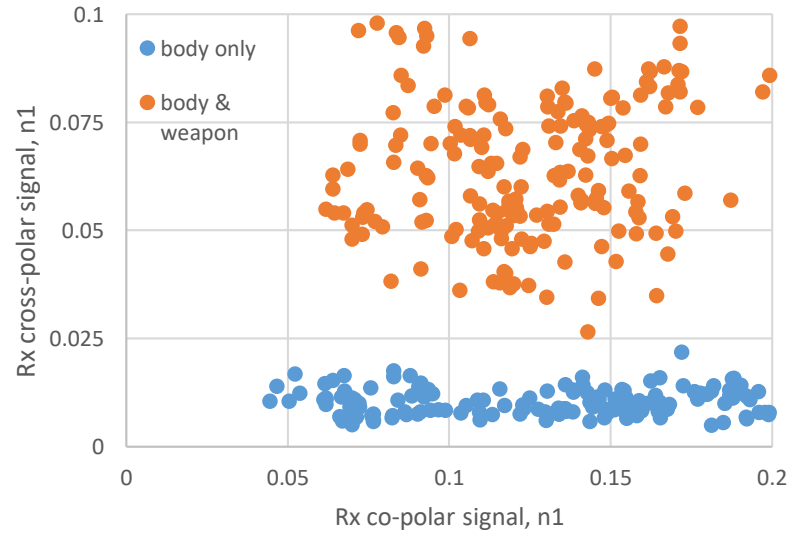
System operates at >20fps



iSystems Solutions
Detect Bomber

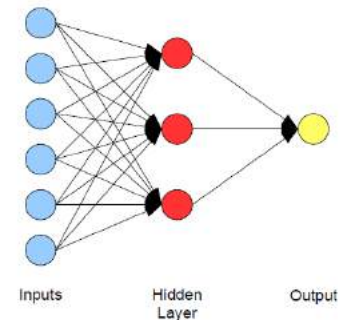
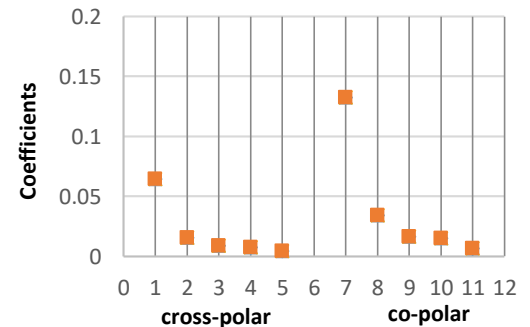
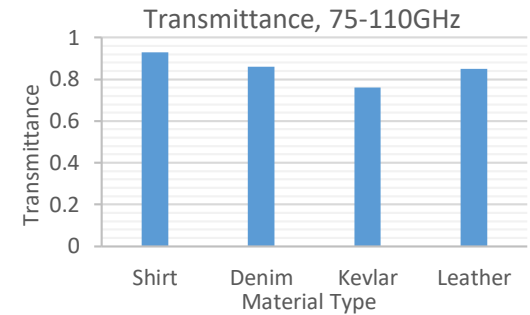


Comparison of threat/no threat data



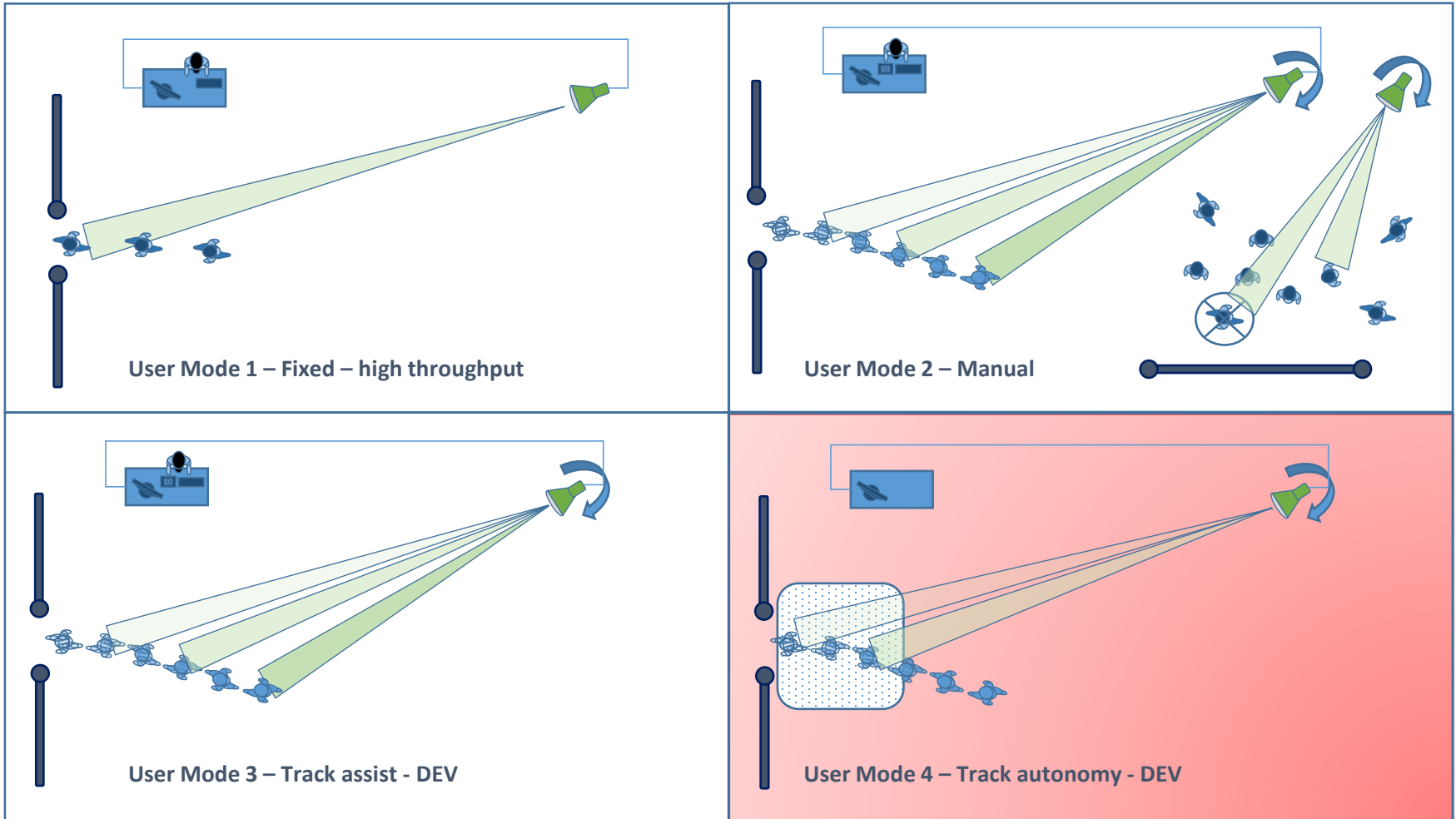
MiRTLE[®]: how it works

- Detection and discrimination of objects concealed under clothing is possible because typical clothing does not attenuate much at millimeter-wave frequencies.
- The system receives scattered radar waveforms in both co-polarized and cross-polarized states with respect to the transmitted beam.
- An IFFT operation produces components that describe each received signal – these form the input to the artificial neural network (ANN).
- The ANN type is a feed forward back propagation and uses sigmoid neurons.
- The ANN has input nodes, matched to input data format, output nodes in form of a threat probability and 10 hidden layer nodes.
- Using pattern recognition software to analyse the change in polarisation and depth information of the target, which is encoded in the scattered waveform, it is possible to determine the nature or class of object concealed

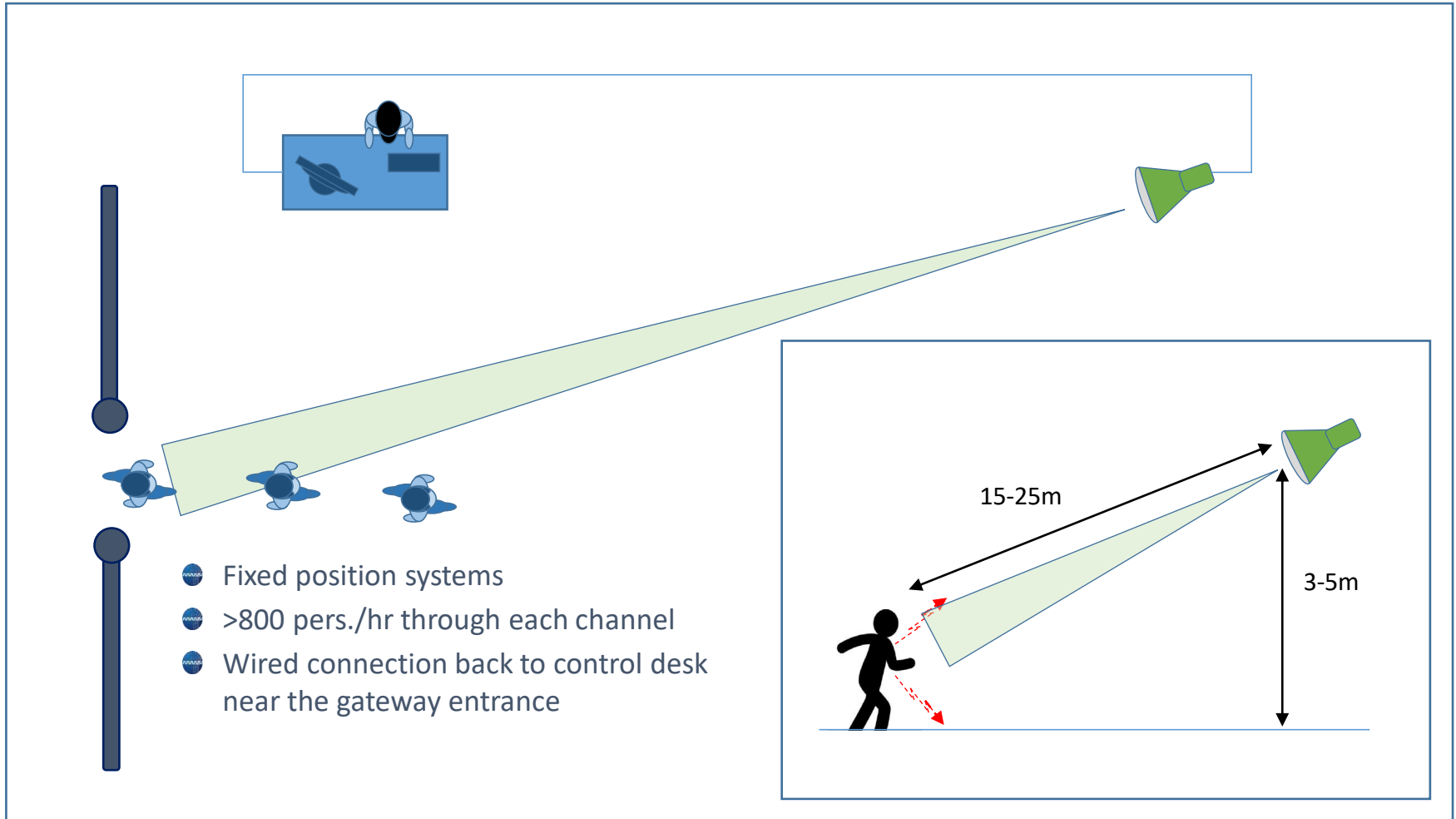


User modes

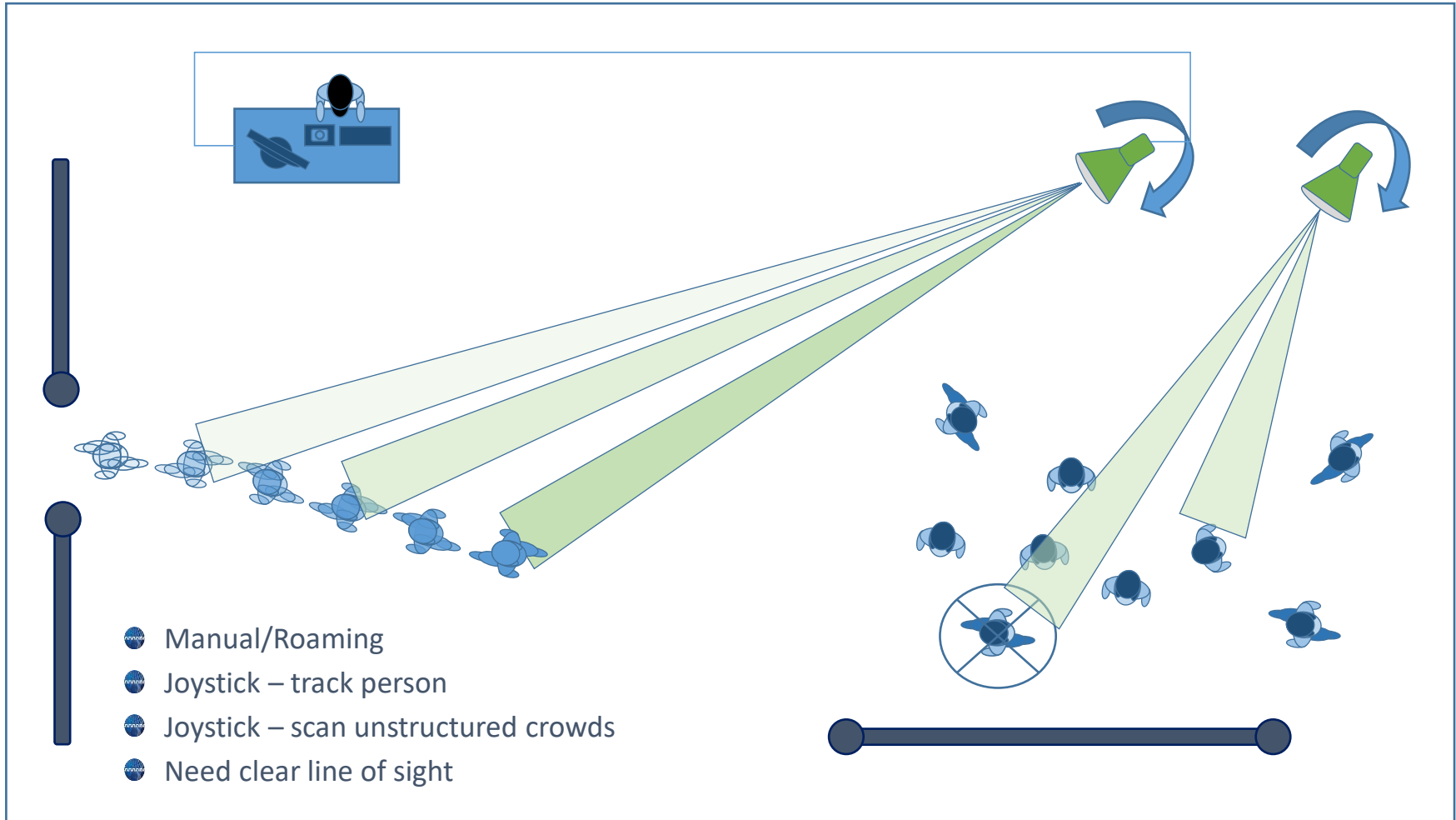
User modes



User Mode 1 - Fixed position: high throughput



User mode 2 - Roaming: unstructured crowds



User mode 3 - Autotrack: user assist (Dev)

Manual mode with tracking assist – in development

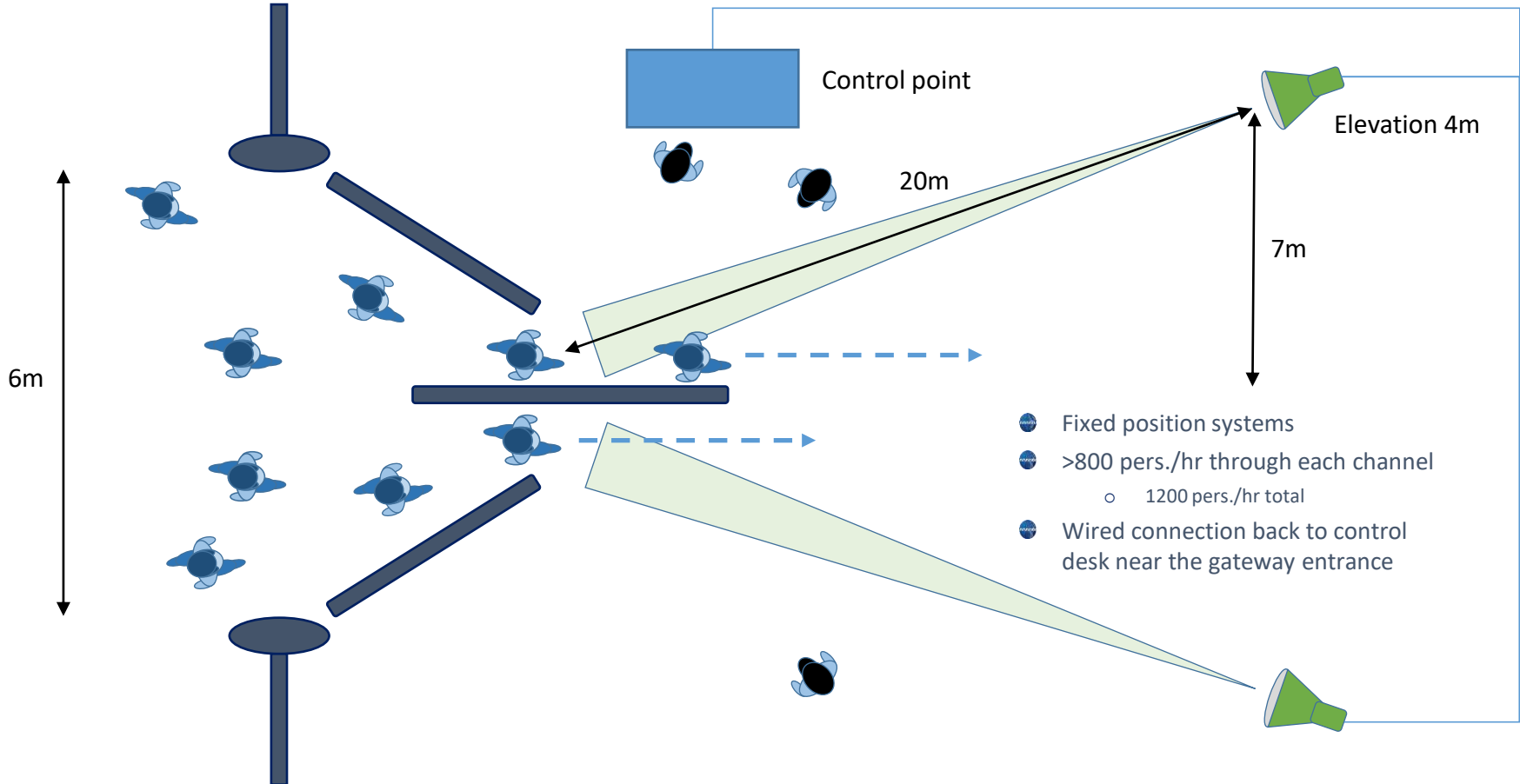
Autotrack – track person

Joystick override – scan unstructured crowds

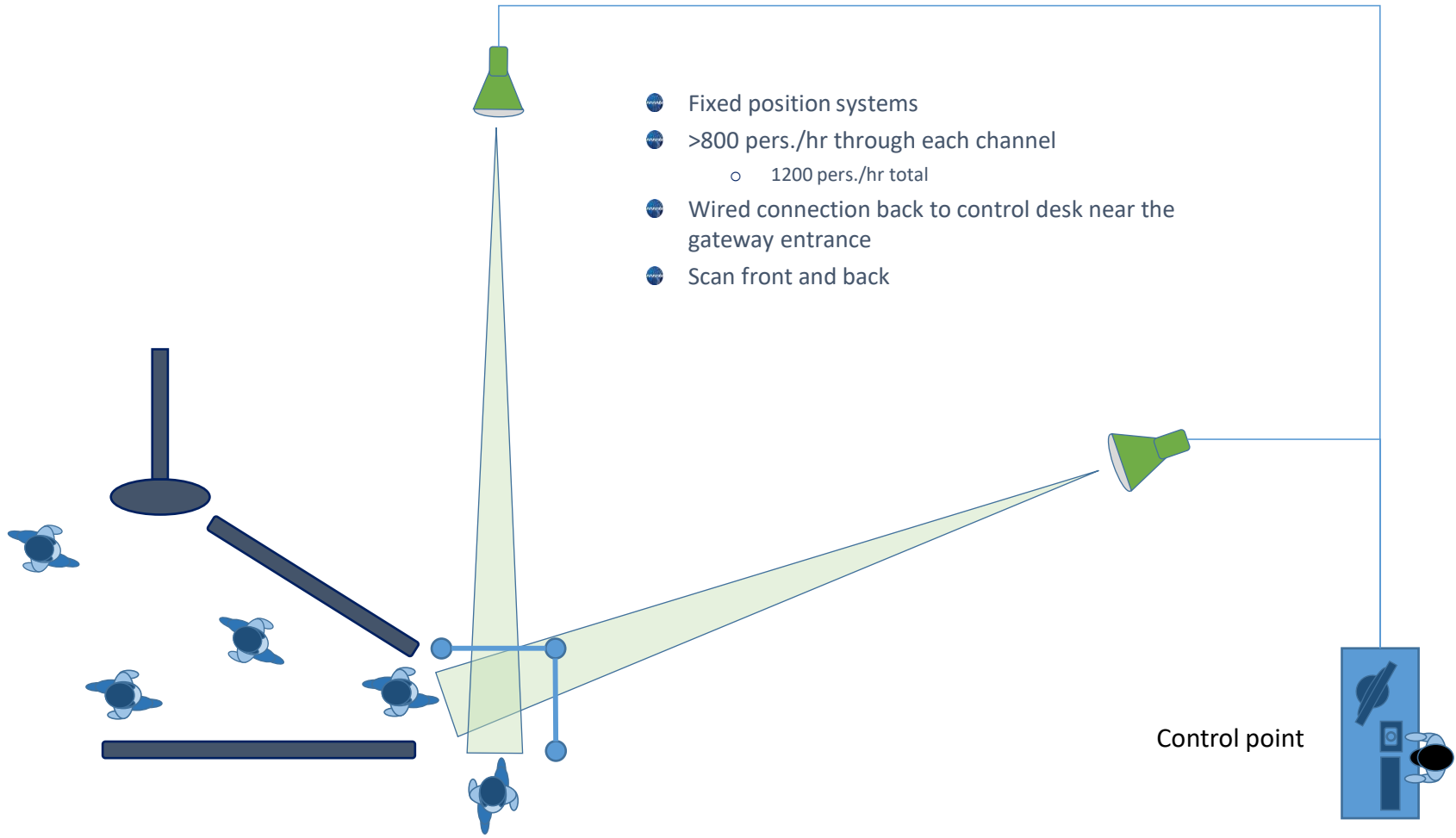


Scenarios

Scenario 1 - 2 flow channels



Scenario 2 - front and back



Competitive Landscape

Competitive Landscape

- There is a need to detect mass casualty threat items in high throughput environments.
 - Radio Physics has the most **low cost, adaptable, lightweight** and **portable** threat detection system - that can detect concealed bombs and large assault weapons at a distance up to 30+ metres with a throughput > 800 pers./hr
 - MiRTLE has 3 user modalities – fixed (high throughput – structured crowds), roaming (joystick control – unstructured crowds) and autotrack (person tracking & detection).
 - Competing solutions comprise fixed location (like portals) or shorter range stand-off (passive systems). These systems are not as adaptable as MiRTLE to different CONOPS
 - MiRTLE detection technology unmatched by anything else in the market - machine learning to recognise differences in the polarimetric scattering of incident mm-waves from the surfaces of the target and provide an automated threat decision output
 - Competing solutions require image interpretation by the operator
 - MiRTLE can detect both metal and plastic based weapons – threat discrimination not based on material type
 - Competing solutions use metal detectors for detection and so would not always alarm off plastic based items
 - Competing solutions use lower frequency radar and can only detect explosives >0.5Kg
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Competitive Landscape

PRODUCT	—	—	—	—	—	<u>MiRTLE 30</u>
Company	Competitor 1	Competitor 2	Competitor 3	Competitor 4	Competitor 5	Radio Physics
Range (m)	1 – 3	5 - 12	<1	5 - 12	5 - 12	15-25
Throughput (pers./hr)	2500	200	800	400	2500	800
Approach	Active	Passive	Active	Passive	Passive	Active
Threat detection - explosives	✓ (*)	✓	✓	✓ (#)	✓ (#)	✓
Threat detection – assault rifles	✗	✓	✓ (\$)	✓ (#)	✓ (#)	✓
Automated detection	✓	✓	✓	✗	✗	✓
Gateway (fixed) screening	✓	✓	✓	✓	✓	✓
Unstructured screening	✗	✓	✗	✗	✗	✓
Indoor use	✓	✓	✓	✓	✓	✓
Outdoor use	✗	✗	✗	✗	✗	✓
People tracking	✗	✗	✗	✗	✗	✓
Manual joystick control	✗	✓	✗	✗	✗	✓
Integrated facial recognition	✗	✗	✓	✗	✗	✗
Network integration	✓	✗	✓	✗	✗	✗
Covert use	✗	✗	✗	✗	✗	✓
Portable	✗	✓	✗	✗	✗	✓
All weather	✗	✗	✗	✗	✗	✓
MARKET PRICE	--	--	--	--	--	--

(*) Weight >0.5Kg, uses radar for dielectric/explosives detection

(#) Subject to image interpretation

(\$) Uses metal detector for assault rifles and radar for dielectric/explosives detection

Confidential