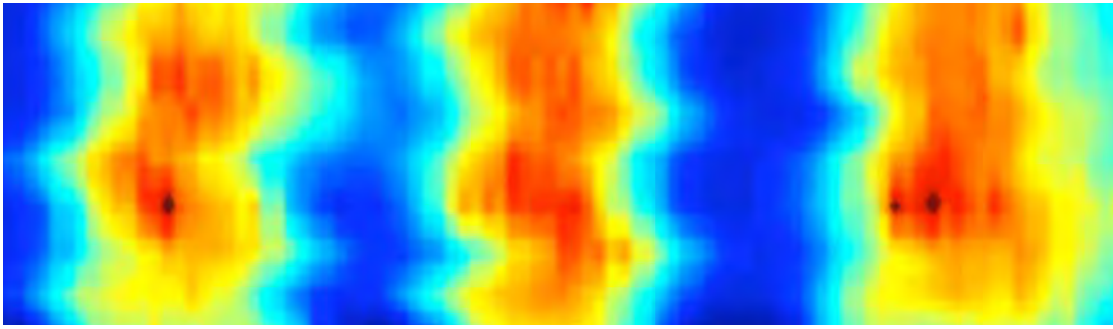


## Microwave imaging sensors

Safe, reliable and low-cost imaging technologies are growing requirements for the modern world.

Roke Manor Research provides research and development into non-intrusive microwave imaging sensors for defence, security and medical applications.





Microwave image of three people reveals hidden objects on two of them.

The majority of the electro-magnetic (EM) spectrum can be used for imaging with different operating frequencies providing different information about the object being imaged. Roke Manor Research is developing non-intrusive imaging technologies which use microwave frequencies between 1GHz and 300GHz.

These technologies can detect the radiation emitted, reflected or travelling through an object when illuminated. This radiation can provide a wealth of information about the object, such as what it is made of, and what is inside it, in addition to images of its external surface.

## Applications

### Healthcare

Less-intrusive imaging means making the equipment less physically intrusive upon a patient and using safer doses of radiation. These techniques could be used instead of traditional X-rays which have higher levels of radiation so have a limited usage per person. Microwave imaging techniques could one day be used to detect cancer in local health centres.

### Security

Scanning and surveillance of people cannot use ionising radiation for safety reasons. The current metal detection solution is limited as it cannot see underneath clothing. Roke's latest research into less-intrusive microwave imaging has obvious advantages in being more reliable, covert, and less disruptive to passengers at airports, railways, or to people entering buildings through security checkpoints.

## Non-intrusive imaging technologies include -

### MMW Scanner – Hand held unit for security checkpoints

Roke has completed a research project to develop a Millimetre-Wave (MMW) technology demonstrator for detection of weapons and metallic objects concealed on people. Funded by Roke, this project consisted of a market analysis to define the concept and requirements, followed by the design, build and test of the demonstrator.

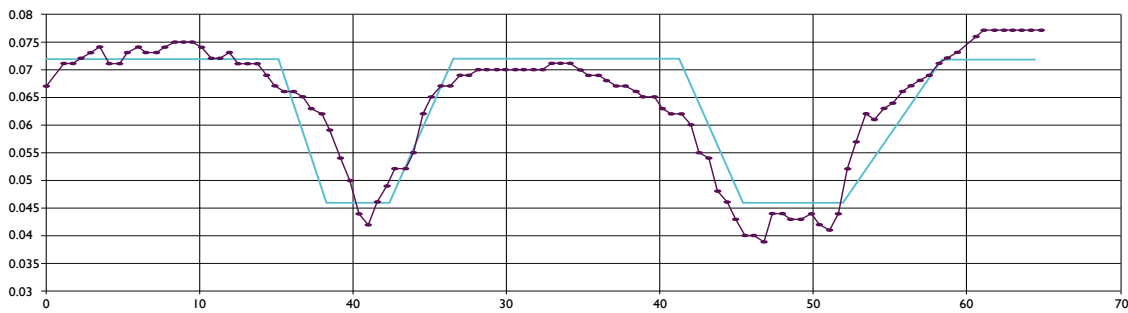
#### Key features & benefits:

- One to three metres operating range
- Difficult to counter
- Reduces the transit time through security checkpoints - meaning customers are not delayed unnecessarily and the terminal throughput and efficiency are increased
- Uses cost-effective, commercially available technology which exploit developments in the automotive radar.

#### Potential applications include:

- Security screening at transportation terminals (railways, airports, bus stations and subways), for the detection of concealed weapons at passenger gateways.
- Military ground forces for the detection of concealed objects on insurgents
- Security and law enforcement agencies, e.g. UK and US police forces and customs
- Building access security (complementary to CCTV) for government, public and commercial premises

Miniature metallic objects  
detected using terahertz imaging.



### UWB 3D Imager - Real-time 3D imaging of stationary or moving objects

The research programme aims to build a demonstrator capable of imaging in 3D at ranges up to ten metres and resolutions down to 25mm. This is a new microwave imaging technology, offering greater effectiveness through higher resolution and sensitivity. This is a collaborative research programme funded by the DTI, Thales Research & Technology (UK) Ltd and Roke Manor Research Ltd.

#### Key features:

- Penetration of optically opaque materials (e.g. walls and clothing)
- Operates day or night and in all weather conditions (e.g. fog and smoke)
- Covert with through-wall imaging capability
- Inexpensive engineering.

#### Key benefits:

- For medical applications, the early detection of diseases at the point of patient entry into the healthcare system would improve system efficiency and reduce costs associated with referrals and check-ups
- Uses safe, non-intrusive microwave imaging technology. No licence costs, because it uses unlicensed frequency bands
- For security applications, the increased effectiveness and reduced operator workload would result in reduced operating costs; 3D imaging should be more suitable for automatic operation than 2D imaging
- In many security applications, the operating cost of surveillance equipment rapidly exceeds the installation cost, but automatic operation will ensure low operating costs.

#### Potential applications include:

- Medical imaging for cancer detection in doctors' surgeries and health centres
- Security screening of baggage in transportation terminals
- Ceiling mounted antenna arrays for security scanning without interfering with the movement of people
- High-resolution, fully polarimetric 3D imaging of moving or stationary targets
- Automated analysis of 3D images for detection of concealed weapons and explosives.

### Terahertz imaging – High resolution for miniature object imaging

Roke investigated the feasibility of detecting very small metallic objects concealed on people such as miniature explosives. This project used our existing passive terahertz (THz) equipment with data analysis performed off-line.

- Roke's existing terahertz imaging system uses passive radiometric technology
- Roke's next generation terahertz imaging system uses active radar technology.

#### Key features & benefits:

- High resolution images
- The terahertz field is still relatively young and is primarily being driven by the availability of technology.

There are very few terahertz components, such as high power sources, and detectors. Research and development is needed in these areas before low cost, efficient and compact terahertz systems become widely available.



#### Potential applications include:

- Security screening, including the detection and identification of explosives and drugs at airports
- Atmospheric and climatology measurements for environment research studies
- Medical imaging at molecular level for cell analysis
- Complementary technology to infra-red (IR) vision cameras.

#### Land mine detectors

Roke is researching and developing technologies for the detection of landmines around the world:

- United Nations estimates more than 100 million landmines are currently undetected in dozens of countries
- Most detection and removal is currently done by hand, or with dogs, which is time-consuming, inefficient and highly dangerous
- Roke is researching and developing a more accurate method to detect and, as the technology grows, disarm landmines.

#### Experience

Roke has been supplying customers with ground-breaking imaging and sensing solutions for over 30 years. We have experience covering radiometer design, imaging system design, radar design, radio frequency (RF) design, system design & integration (including requirements capture), signal processing, digital beam forming and design for manufacture.

We can provide feasibility studies, modelling and simulations, technology demonstrators, prototypes, product development and small volume production to meet your requirements.

#### For further information please contact:

##### Brett Harker

T +44 (0)1794 833272  
F +44 (0)1794 833640  
info@roke.co.uk

#### Roke Manor Research Limited

Roke Manor, Romsey, Hampshire SO51 0ZN UK  
T +44 (0)1794 833000  
F +44 (0)1794 833433  
info@roke.co.uk  
www.roke.co.uk  
Part of the Chemring Group

#### Marketing department

T +44 (0)1794 833455  
F +44 (0)1794 833433  
info@roke.co.uk  
www.roke.co.uk

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