Navtech 77GHz FMCW Imaging Radar

Designed for the exacting demands of outdoor surveillance

The Navtech radar system is ideally suited for surveying large outdoor areas that are vulnerable to terrorist attack, robbery or sabotage.

Tested and demonstrated as an intruder detection system by QinetiQ, our system is all weather, robust and reliable, designed to function without interruption even in difficult outdoor environments. Unlike other technologies, our imaging radar is unaffected by adverse environmental conditions, such as heavy rain, dust-laden atmospheres or desert conditions.
Originally developed for military applications, our imaging radar has now been adapted for civilian use. A high-resolution system with the ability to process 900 scans per second, it is capable of:

- Detecting moving vehicles up to a distance of 800m
- Monitoring for intruders at much greater range than other intruder detection technology

With a powerful ability to discriminate, the system can be adjusted to identify objects above a given size, so that irrelevant background movements can be filtered out. It can provide a record of movements over time across the entire survey area, or it can focus on a specific area.

**Potential Applications**

- Airport ground surveillance
- Perimeter security for high-risk installations e.g. chemical or nuclear plants, waterworks, new car compounds
- Mines – precious metals, gemstones
- Protecting oilrigs and pipelines
- Dockside and port security
- Piracy prevention
- Detecting illegal immigrants entering/leaving ships, vehicles or trains – the system can be programmed to ignore movements along the safe walkway of a cargo ship (illuminated and marked)
- Railway level crossing surveillance

Our computer system can be customised to provide:

- Audio warnings/signals
- Images on TV/computer screens
- Warning lights

We work in partnership with a number of software specialists, including QinetiQ, who can supply software for interpreting radar images to meet specific requirements.

**Technical Description and Specifications**

The Navtech 77GHz Millimetre Wave FMCW radar is a high performance radar system designed for use in industrial sensor applications. Intended for continuous use in harsh environments the system is extremely rugged with built in self-test, condition monitoring and calibration. Due to the possible positioning of the radar on vehicles when used in obstacle detection and navigation applications the radar enclosure and raydome are designed to withstand the impact from small objects such as stones etc. The recently
developed 100Mbps Ethernet interface enables complete images of the surrounding area to be displayed

With the scanner and raydome the unit provides a full 360 degrees scan at 2.5 revolutions per second. The radar system is able to send signal power in each 0.25m cell up to 800m every sensor beamwidth. Two configurations are available:

- 1.8 degree standard beam width
- 1-degree beam width with improved signal to noise performance

Millimetre wave radar is ideally suited for outdoor industrial sensing, where there is likely to be dust in the atmosphere or heavy rain. The 1-degree system is designed to detect a 5m² target at 700m in 16mm/hr rain and the specification is continually being improved.

The radar signal is digitised and processed within the unit by a high speed DSP system. An RS232 interface is used for firmware updates or customisations. All that is required is a PC or laptop. Software to do this is available and runs under Microsoft Windows. This software also enables maintenance updates to be performed in the field.

The main interface for data is the 100mbps Ethernet interface. With a suitable PC this allows a new radar power spectra to be acquired and displayed every 1.1mS. This is a sensible upper limit of the required system processing power since each radar frequency modulation takes place over 1mS.

**Graphical User Interface (GUI)**

There is an easy to use GUI for the radar, operating under windows. This connects to the radar via the Ethernet interface and can display raw or processed radar data from different viewing aspects. It is based on OpenGL. Some of the features of the GUI include:

- Change the viewing aspect by rotating in azimuth and elevation
- Zoom in and out
- Record avi files and raw data sets
- Record Screenshot bitmaps
- Record/Playback the raw data
- Coloured blocks, lines or wire mesh display
- Choose a sector to display

Features planned for the future include:

- Selection of a zone of interest to display
- Omit background areas from the display e.g. buildings or other static features
- Difference feature, to display only any changes to the display using an automatically acquired baseline
**Fig.2** Close radar image, shows the edge of and a building and a fence. A man shows up clearly in the radar image (not present when photograph taken). The colour scale denotes returned signal power.
Fig.3 Radar image to 800m. The radar is at the centre of the concentric grid circles. Both sides of a road can be clearly seen due North of the radar at about 500m. The tree lines visible in the photo can also be clearly seen.
Fig.4  Same scene as for Fig.2 but zoomed out and with a different viewing aspect angle.

Fig.5  Same scene as for Fig.2 but with a different viewing aspect angle and wire line plot.
## Specification

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Transmit frequency</td>
<td>76 to 77 GHz</td>
</tr>
<tr>
<td>Oscillator Bandwidth</td>
<td>up to 600MHz</td>
</tr>
<tr>
<td>Beam width</td>
<td>Antenna dependent, 1.8 or 1.0 degrees</td>
</tr>
<tr>
<td>Sweep time</td>
<td>1mS default (other sweep times optional)</td>
</tr>
<tr>
<td>Max Range</td>
<td>800 m</td>
</tr>
<tr>
<td>Range Accuracy</td>
<td>± 0.03m possible*</td>
</tr>
<tr>
<td>Scanner field of view</td>
<td>360 degrees</td>
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<tr>
<td>Scan Speed</td>
<td>2.5 Hz. (other speeds optional)</td>
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<tr>
<td>Interfaces</td>
<td>100 mbps Ethernet or RS232, (CAN optional)</td>
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<tr>
<td>Supply voltage</td>
<td>+24V nominal (18-36V)</td>
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<tr>
<td>Environmental</td>
<td>IP66, NEMA-4X</td>
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<tr>
<td>Temperature</td>
<td>-20 to +70 degrees C</td>
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<tr>
<td>Vibration</td>
<td>6.8g 5-200 Hz**</td>
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</tbody>
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* Please contact us for further details

** 1.8 degree system only