

## GPS protection

Roke Manor Research provides technology to protect military systems from jamming. A particular example of this is GPS where the latest techniques are used to give the maximum protection and provide jammer direction information.



### Background

Roke Manor Research has a wealth of experience in the development of adaptive array technology. One specific application area of this is the protection of GPS. GPS is now extensively used in many systems for both timing and navigation. The low level satellite signals used in GPS make it especially vulnerable to low power jammers.

GPS receiver systems can be protected from interference using an adaptive array (controlled radiation pattern antenna – CRPA) to null jamming signals. The electronics employed to do this can be implemented using analogue or digital technology. Roke has recently exploited RF ASIC techniques to enable low cost, size, weight and power solutions to be achieved using analogue techniques. Exploiting fast real-time DSP (Digital Signal Processing) techniques offers increased performance due to:

- Much higher level of wideband cancellation by using Space Time Adaptive Processing (STAP)
- Improved satellite availability by beamsteering on the individual satellite signals
- Direction finding of the jamming signals



## Benefits

Integrating an analogue solution in an RF ASIC enables a compact solution to be achieved that avoids the size and power requirements of multiple analogue to digital conversions and high speed signal processing. However digital technology considerably improves the performance over an analogue system by maximising the signal to interference plus noise ratio. Analogue systems simply minimise the interference plus noise and the gain provided to the GPS satellites is relatively arbitrary. Forming beams in the direction of each GPS satellite maximises the signal to noise ratio in the absence of jamming. When jamming is present the beams are maintained but additional deep nulls are formed on the jammers. A digital processing approach enables each beamforming weight to be implemented as an adaptive transversal filter, allowing multipath and antenna frequency effects to be compensated and thus permitting much higher levels of wideband cancellation to be achieved. Also with the digital implementation the required beamforming weights are directly computed, avoiding the longer convergence times associated with analogue control loops.

As well as developing the DSP, Roke has experience in solving many of the associated issues in successfully adding GPS protection to a platform. These include:

- The design of small footprint antennas for confined locations
- The design of larger, higher performance antenna arrays for larger platforms
- The use of Epsilon for assessing the likely performance of different antenna sites on a platform
- The use of fibre optics for when the antenna array and the adaptive array electronics can be distantly sited
- The integration of the adaptive array electronics into RF and digital ASICs

## Our services

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



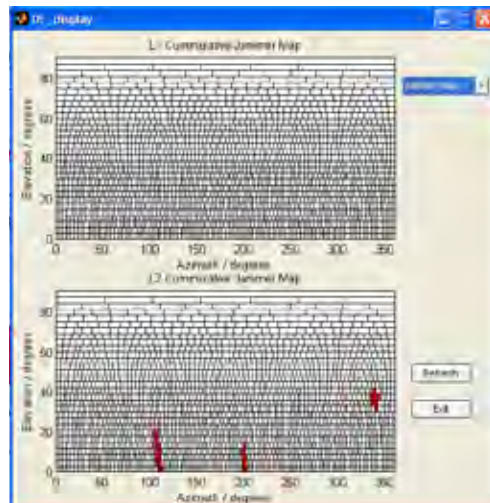
Analogue canceller implemented in an RF ASIC



Small footprint CRPA with analogue canceller integrated into its base



Single card implementing 8 STAP beamformers



Jamming signal direction finding

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