THRUPUT

Analogue Clutter Mitigation
GF MIDAS III

The moving blades of a wind turbine can cause interference to Air Traffic Control Radar.

Many Civil and Military airports are equipped with Primary Surveillance Radars to safely manage their air traffic movements and provide radar navigation services to pilots. An essential tool in ensuring air transport safety, these radars are particularly adept at the detection and tracking of moving targets.

The rotating blades of a wind turbine mimic the radar signatures that these radars are designed to detect, so they can appear in the radar picture as areas of clutter.

For a small wind farm, or one with widely spaced turbines, there can be situations where the radar clutter only occurs in certain wind directions or that targets over-flying the wind farm are only partially affected. In this case, the safety of the radar service will be improved if the effects of turbine clutter on the radar display are controlled at the point of display.

Control of the turbine clutter

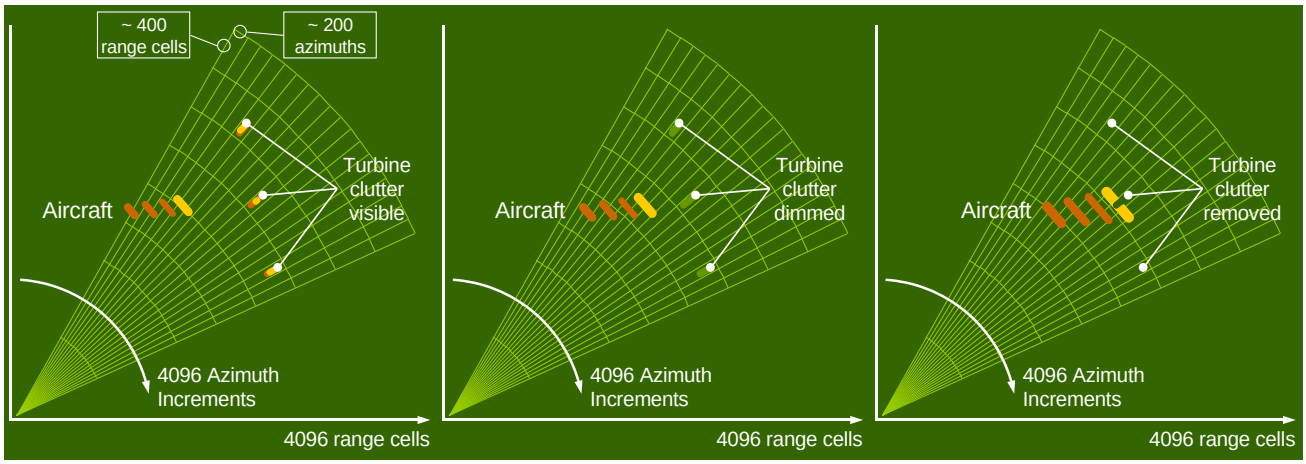
One aspect of Air Traffic Control service provision is that the Safety Regulation Group of CAA regulates the colour set used. This means that the colours of radar clutter are well defined.

In addition, the turbine position is precisely defined during construction.

By virtue of these factors, the affected pixels on the radar display may be identified, for each of the ranges and offsets that are in use.

By logic control of the individual pixel colour, it is possible to identify the clutter and either: Render it dimmer when compared to normal clutter, or change it to the background colour, so it disappears altogether, with the result is that overflying targets are more easily visible.

If the pixel is not a clutter colour, but is for instance an SSR target or label then it is unchanged.



Primary Radar, perceives the world in terms of range and azimuth cells. If a target appears in a range-azimuth cell, then the cell is illuminated, otherwise it is empty.

Left: The diagrams show areas of clutter caused by the moving blades of individual wind turbines, this may be distracting to the controller. Centre: By dimming the clutter, distractions are reduced. Right: By removing the clutter it clarifies the radar presentation, although aircraft targets will have small gaps, as they pass over the clutter.

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Technology Solution
The Key technical requirements of this application are:

- Utilise existing operational data, to benefit from the pre-existing safety cases at the ATC unit.
- Avoid any data manipulation that could invalidate the existing safety cases.
- Calibrate the site, to identify: Areas of interest, their shape and position in all conditions of weather, display range and display offset.
- Import the range and offset settings of the radar display, and reflect these settings in the configuration that is used.

To achieve the high integrity level, throughput and response times, the solution completely avoids mathematical computations. Rather, the solution is based on parallel assemblies of field-programmable gate arrays (FPGA) and takes advantage of their inherent high speed logic processing to compare and control each pixel from every input.

At every stage, the system performs cross channel synchronization and ensures each internal process always has a complete video frame available from its preceding stages.

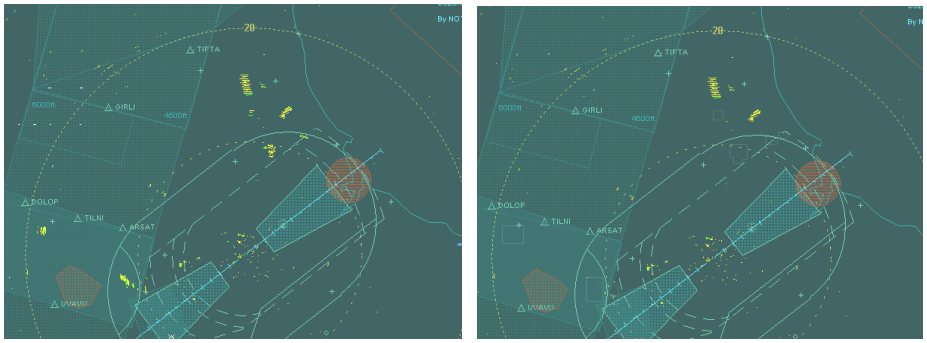
Specification

- Measured throughput: 32.8ms to 56.0ms.
- MTBF: 127,220 hrs (MIL HDBK 217F Notice 2 Appendix A Parts Count Reliability Prediction model).
- Form factor 19” rack mount, 1U high.
- Power supply: Dual redundant, 12V 5A (peak).
- CE certification: EN 45014:1998
- ROHS compliant: 2002/95/EC
- Interoperability certification: EC 552/2004

Left: The MIDAS hardware is a rack mount unit that fits in the ATC console. The photograph shows its dual redundant power supplies and universally standard video interfaces. Right: MIDAS clutter reduction indicator panel.

Front view: The MIDAS is IU high, 19” rack mount assembly.

Rear view.



Areas of radar clutter (4 due to wind farms and 3 due to road traffic). Left: Before clutter reduction and Right: After clutter reduction.

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