Radar Innovation

& the development of Wind Energy

Conference “Energie éolienne et innovation”

MEDDTL, Paris, 5 July 2011
Content

- Who we are
- Wind Energy plans
- Impacts on radar

- Thales and Wind Energy
  - Modelling and impact studies
  - Overview of Thales solutions
  - Wind Farm Filter
  - Dedicated Gap-Filler

- Way forward
Thales Group

- 68,000 employees, €13.1 billion in revenues
  - Aerospace & Transports (40%)
  - Defence & Security (60%)

N°1:

- ATM Systems & Navaids
- Civil Radars & Battlefield Radars
- (In Europe): Naval & Ground Based Surveillance Radars

285 ATM centres in 85 countries, 640 Air Surveillance Radars in 85 countries
10,000 Navaids and landing systems in 180 countries
320 Air Defence Radars in 26 countries, 350 Naval Defence Radars in 27 countries
10th March 2010 WWEA report:

- “The trend continued that wind capacity doubles every three years”

- “A total wind capacity of 200 GW will be exceeded within the year 2010”

- “WWEA increases its predictions and sees a global capacity of 1900 GW as possible by the year 2020”

Multiplied by 10 in the next 10 years!
Impacts on Radars

- Masking (MTO & DEF)
- False Plots (ATC & DEF)
- Angular errors and ghosts (ATC & DEF)
- Sidelobe effects (All)

Windfarm area
Position:

- Thales is committed at developing solutions to allow:
  - Wind Energy to achieve their objectives
  - Radar Operators to maintain their operational missions
- Thales encourages a tri-partite team working

Activities:

- Develop and validate models, conduct impact studies
- Define, evaluate, develop and deploy mitigation solutions
Modelling

- **Necessary to:**
  - generalize models and make them durable from consecutive samples
  - predict unobserved situations

- **Needs to:**
  - understand physical phenomena
  - Interpret radar data

Impact Studies

- **Required to:**
  - quantify effects of a future situation
    - new windfarms around a given radar
    - new radar (or new radar location) amidst existing windfarms
  - provide evidence for application process
### Detailed propagation and RCS “in-situ”

#### Advanced 4D diffraction
Modelling and impact studies: examples

STAR 2000 at Manston

Visibility 150m AGL, 10 Nm range circles

- Gunfleet Sands q=48
- Kentish Flats q=30
- Greater Gabbard q=140
- London Array I q=175
- Thanet q=100

Source windfarm data: 4C Offshore June 2011

Windturbines

493

Thales Air Systems  July 5, 2011
Modelling and impact studies: an example

STAR 2000 at Manston

- Expected impacts on Thanet

PPF at middle bearing

PPF at 200ft ASL
STAR 2000 at Manston

- Expected impacts on Thanet

**Blade RCS in-situ**

**Blade Max. PoD**

+ dynamic parameters -> nb. of false plots/time, false tracks/time
### Overview of Thales solutions

<table>
<thead>
<tr>
<th>Example of mitigation</th>
<th>Mitigated Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>False plots/ readings</td>
</tr>
<tr>
<td><strong>THALES Solutions</strong></td>
<td></td>
</tr>
<tr>
<td>Processing upgrades</td>
<td><strong>Wind Farm Filter (WFF)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>BS (3D) Optimisation</strong></td>
</tr>
<tr>
<td>Gap-Filler (existing radar)</td>
<td>✓</td>
</tr>
<tr>
<td>Gap-Filler (dedicated)</td>
<td>✓</td>
</tr>
<tr>
<td>Next Generation Radars</td>
<td>✓</td>
</tr>
</tbody>
</table>

Solutions for all situations, at short, medium and long term
A filter to:

- remove false plots generated by windturbine blade flashes
- maintain detections of aircraft

It allows to:

- initiate true tracks in windfarm areas
- avoid initiation of false tracks
- avoid deviation of true tracks (by false plots)

Applied only in windfarm zones

- zones can be updated when new windfarms appear

The WFF allows to remove NAI
“Method For Filtering The Radar Echoes Produced By Wind Turbines”
Typical performance: 70-80% rejection of WT false plots, 80-90% maintenance of true plots, ~100% maintenance of true tracks
An additional radar to provide a replacement coverage for an existing radar facing windfarm impacts

- Two cases:
  - an existing radar
    - e.g. and airport radar to replace a part of an en-route radar
  - a dedicated small radar
Solutions

♦ exist thanks to a team working spirit
  - Wind Energy Developer,
  - Radar Operator/ Safety Regulator,
  - Radar Industry

♦ available to-day, already deployed:
  - Tools for impact studies/ STAR 2000 Gap-Filler/ Wind Farm Filter

♦ ready for development: Dedicated Gap-Fillers
  - Counter mask (Low altitude coverage)
  - Counter windfarm clutter (Zenithal coverage)
  - Applicable to:
    - all types of radars (weather, civil, military, coastal)
    - on-shore and off-shore applications

Thales proposes solutions at short, medium and long term