ReliaWind & Supergen Wind
EWEC2010 Side Event

Towards the Offshore Wind Power Station

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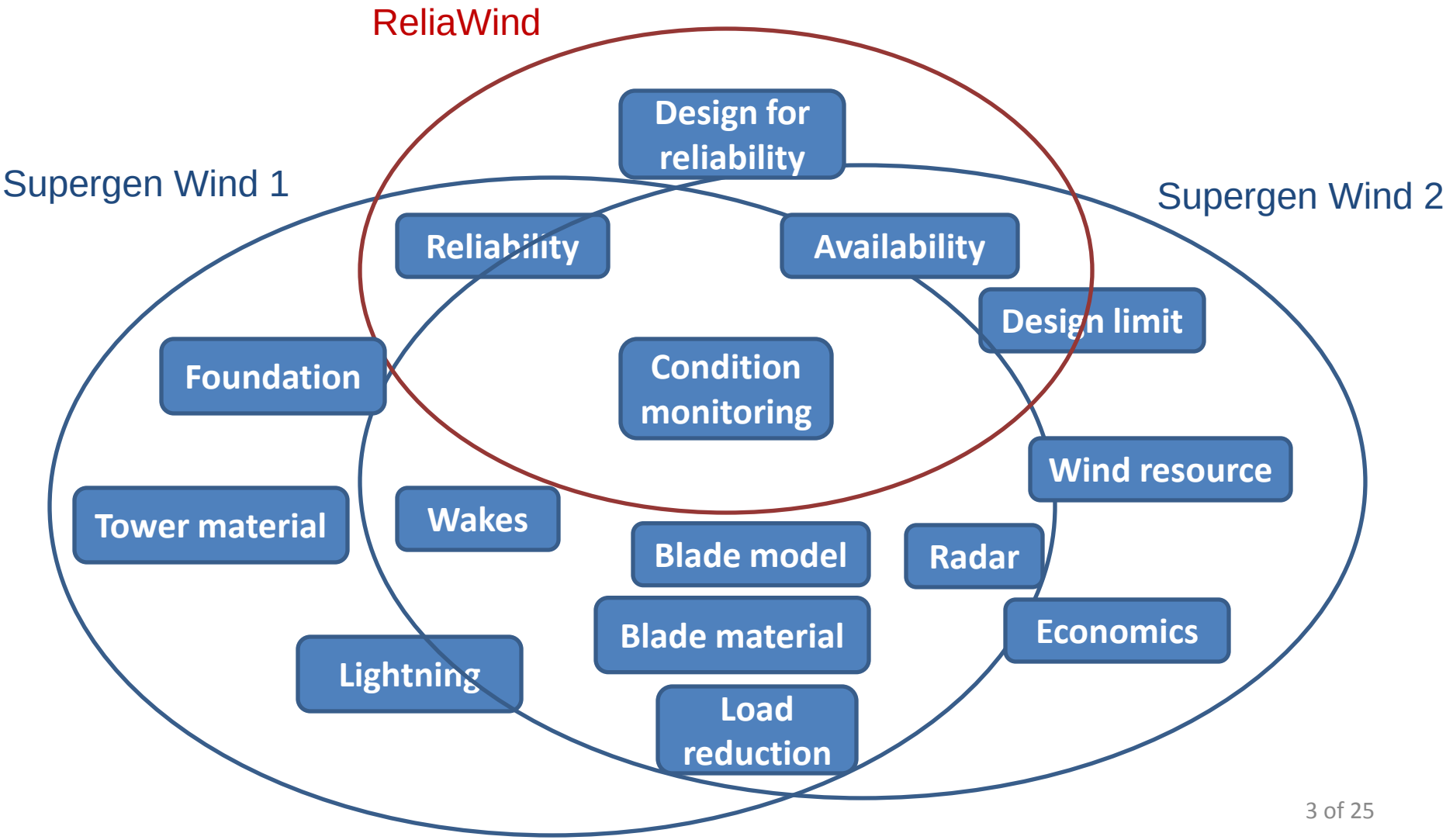
2 Projects

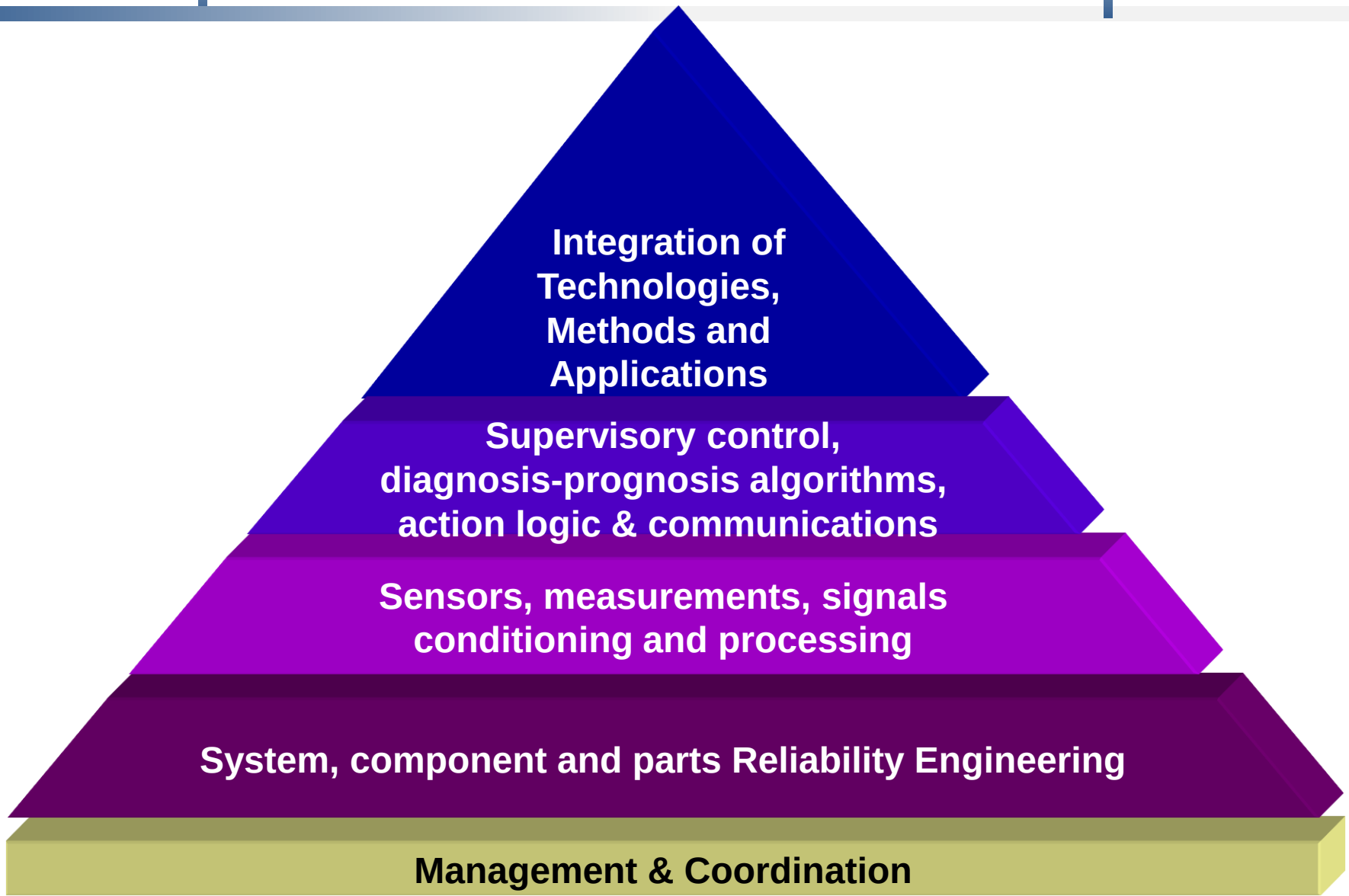
- ReliaWind, EU FP7
  - 8 Industrial Partners, 2 Academic Partners representing full WT value chain.
  - To achieve European technological leadership in WT reliability, availability & maintenance.
  - A fast track (36-months) project: start March 2008, finish March 2011.
  - Strongly results-oriented, 81 deliverables, 20 delivered to date.
  - Budget of €7,7M.
  - Proposed EC contribution of a maximum of €5,1M.
- Supergen Wind, UK EPSRC, Phase 1
  - 8 Academic Partners, 8 Industrial Partners
  - 48-month project: start March 2006, finish March 2010, £2.55M budget.
  - To undertake research to improve the cost effective reliability & availability of existing and future large scale wind turbine systems in the UK.
  - 35 Deliverables completed on time.
- Supergen Wind, UK EPSRC, Phase 2
  - 6 Academic Partners, 10 Industrial Partners
  - 48-month project: start March 2010, finish March 2014, £4.85M budget.
  - To undertake research to achieve an integrated, cost-effective, reliable & available Offshore Wind Power Station
  - 30 Deliverables.

Project Coverage



ReliaWind

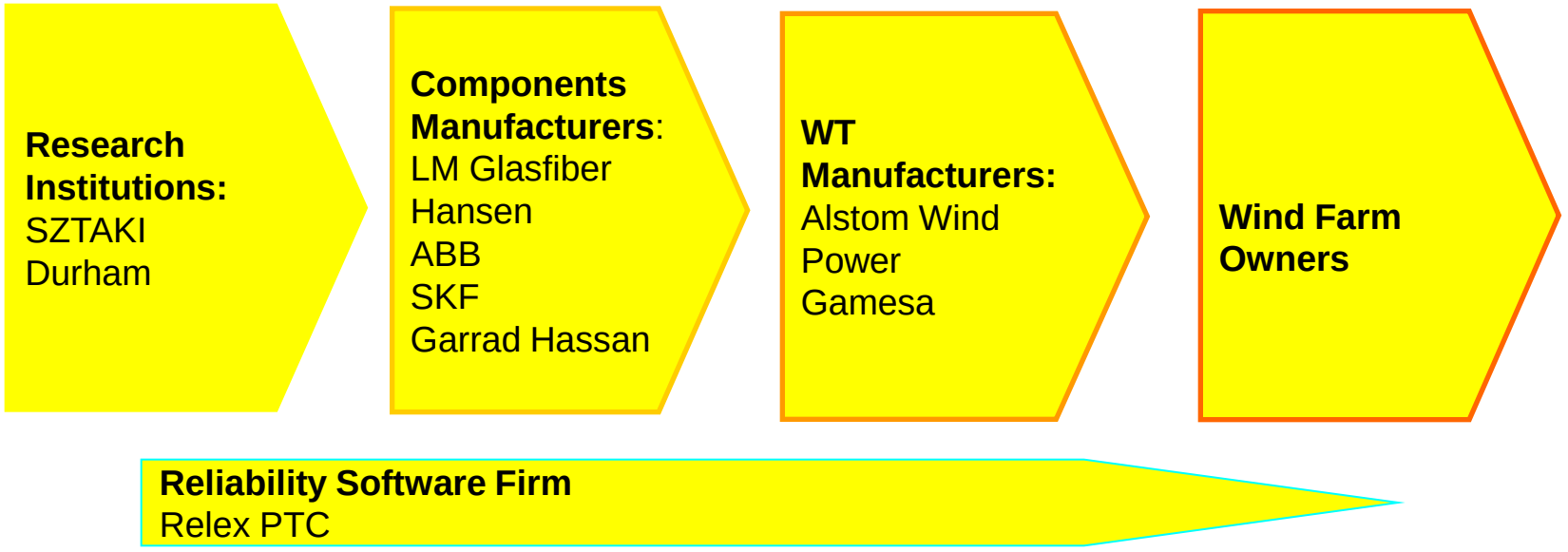
Project Architecture



Quantitative Objectives

- Mean Time Between Failures (MTBF):
  - Offshore: 20% increase
  - Onshore: 10% increase
- Mean Time to Repair (MTTR)
  - Offshore: 50% reduction
  - Onshore: 20% reduction
- Operational Availability (%)
  - Offshore availability: 97-98%, (currently 85-90%)
  - Onshore availability: 98-99% (currently 97-98%)
- Cost of Energy (CoE): < 0.04 €/kWh

Project Consortium



Partner Responsibility

System / Component	Responsible Partner
Pitch System (Electrical & Hydraulic)	Alstom Wind Power–Gamesa
Blades	LM Glasfiber
Blade Bearings	SKF
Gearbox	Hansen & SKF
Hub, Main shaft, Main frame, Rear structure, Cover, Tower, Foundation, Yaw system	Alstom Wind Power
Converter, Transformer, Switch Gear, Generator	ABB
Control	Garrad Hassan - Gamesa
Auxiliary Equipment	Gamesa
Wind Farm Systems	Gamesa

Work Programme

Objectives and associated work plan		WP-1	WP-2	WP-3	WP-4	WP-5	WP-6
Objective 1	To identify Critical Failures and Components	Field Reliability Analysis					
Objective 2	To understand Failures and Their Mechanisms		Design for Reliability				
Objective 3	To define the Architecture of a Health Monitoring System			Algorithms			
Objective 4	To demonstrate the Principles of the Project Findings				Applications		
Objective 5	To train internal and external partners					Training	
Objective 6	To disseminate the new knowledge through Conferences, Workshops, Web Site and Media						Dissemination

Dissemination

- Published 7 Journal Papers, 20 Conference Papers
- Organised 9 Training Seminars
- High profile at EWEC 2010
- http://www.reliawind.eu/

Supergen Wind 1

Academic partners

University of Strathclyde Glasgow

Research Hub

Durham University

Finance Hub

Loughborough University

MANCHESTER 1824

Manchester Metropolitan University

Science & Technology Facilities Council
Rutherford Appleton Laboratory

UNIVERSITY OF SURREY

Imperial College London

LANCASTER UNIVERSITY

UNIVERSITY OF Hull

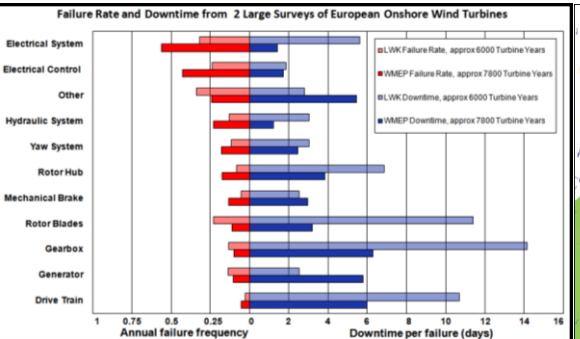
Industrial partners

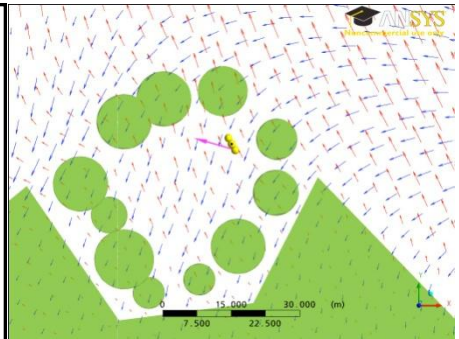
Research Programme

- Theme W: *Base-lining Turbine Performance*
- Theme X*: Condition Monitoring*
- Theme Y: *Loads & Materials*
- Theme Z: *Environmental Issues*

Theme W Achievements

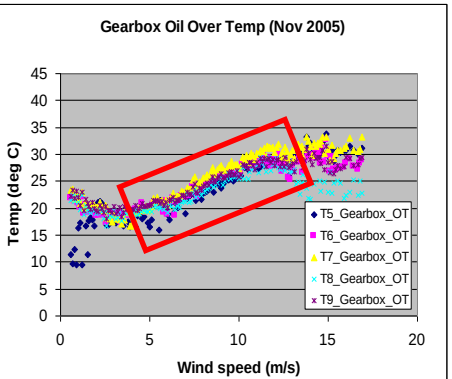
- Produced the most comprehensive analysis of turbine sub-system failures
- Wind turbine and wind farm availability models developed and effect of different parameters on failure rates studied
- Comprehensive wind tunnel measurements made of multiple turbine wakes for different array configurations
- CFD models of forest canopies validated against wind tunnel scale measurements

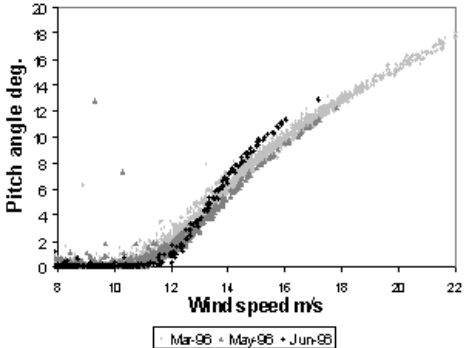


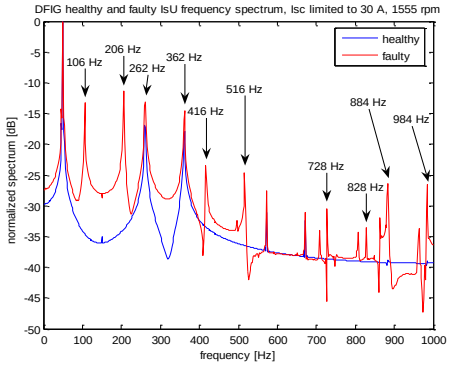


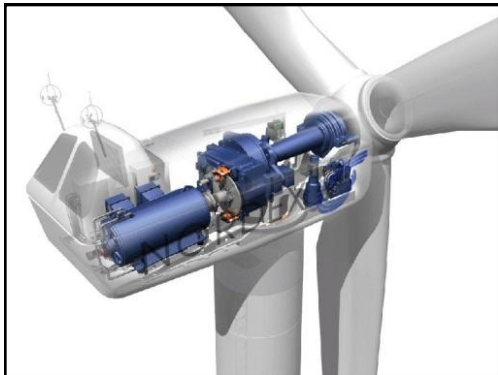
Theme X Achievements

- Identified how condition monitoring can improve turbine availability
- Developed of a detailed DFIG analytic model capable of modelling healthy and faulty states
- State of the art Condition Monitoring Test Rigs built and operational
- Detection of faults on the test rig using electrical signals
- Developed and demonstrated algorithms for tracking fault frequencies in variable speed turbines



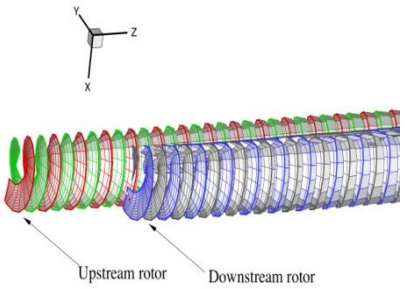


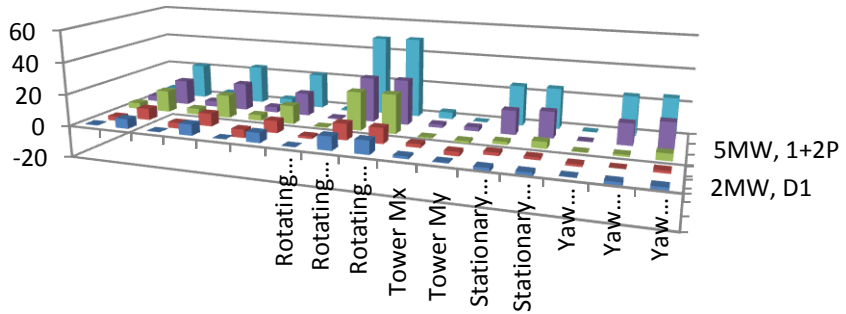


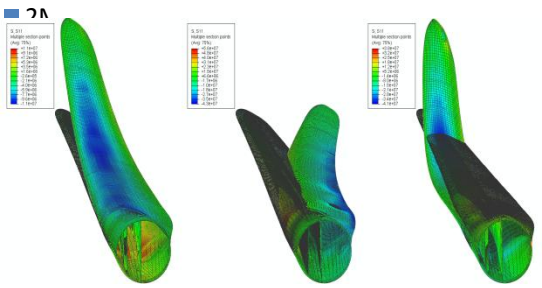


Theme Y Achievements

- Development of a two wake interaction model
- Investigated and tested new composite materials to improve blade strength and durability (hybrid veil and fibre toughened resins for shear web integration)
- Fully parametric blade model (including novel materials, quasi-static aerodynamics, certification test loads)
- Active regulation of tower and rotor loads with reductions up to 50%.



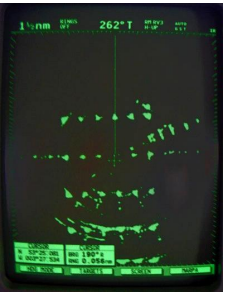


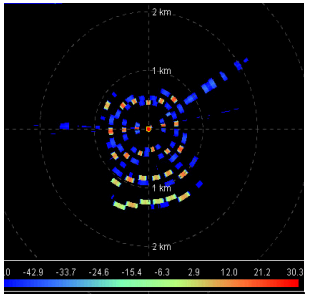


Theme Z Achievements

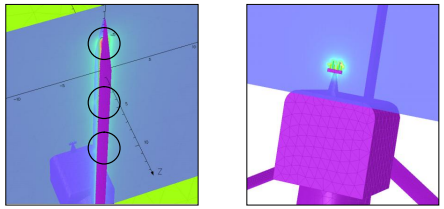
- New methods have been developed to support prediction and reduction of scour around monopiles
- The issues of lightning protection and radar cross-section have been addressed together for the first time
- Computationally efficient models of turbine and array have been developed for investigation of above
- New materials to improve former and reduce latter have been developed

Recent Modelling Results



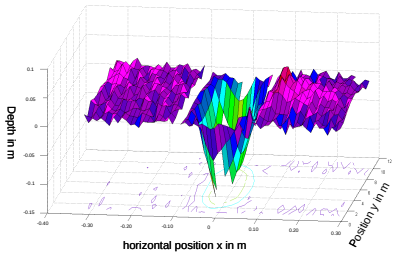


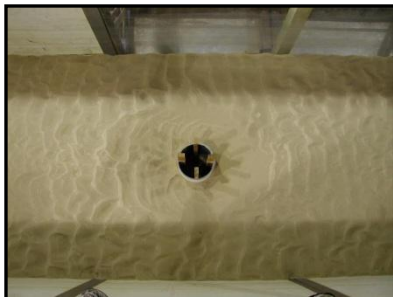
FEA Modelling - 2



Field Enhancement at Blades and Windvane

Mobile Bed





People Training

- 3 PhDs and 2 RAs are now working in wind related companies, Garrad Hassan(2), NaREC, Samtech, MLS
- 3 PhDs awaiting viva or preparing theses.
- 7 RAs and 7 PhDs (include 4 DTA) receiving training;
- Training events included
  - Attendance at two EAWE PhD Workshops (Pamplona 2007, Magdeburg 2008) in Europe and one hosted in UK (Durham 2009)
  - Three Supergen Wind Training Seminars held.
  - Consortium researchers participated in the UKERC Conference, Oxford UK, May 2008.
  - Training by host institutions in research and communication skills.

Dissemination

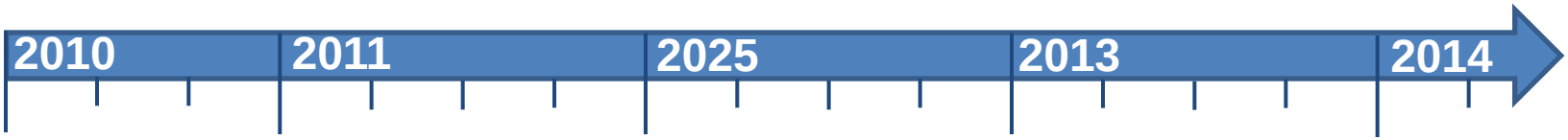
- Published 24 Journal, 58 Conference papers
- Organised 8 Workshops, including 3 training seminars
- High profile at EWEC
  - EWEC2008: 2 Oral Presentations + 4 Posters Including Best Poster
  - EWEC2009: 3 Oral Presentations + 6 Poster Presentations
  - EWEC2010: 3 Oral Presentations + 7 Poster Presentations
- http://www.supergen-wind.org.uk

International Connectivity

- Members of European Wind Energy Academy
  - Tavner is Vice-President 2009-2010
- Members of various European projects
  - Loughborough: EAWE Marie Curie WAUDIT Initital Training Network
  - Durham: EU FP7 RELIAWIND
- Members of EPSRC UK-China Energy Research Collaboration
  - Durham: Future Renewable Energy Conversion Systems & Networks Consortium
  - Strathclyde: Sustainable Electric Power Supply Consortium
- Participation in EU Wind Technology Platform (Strathclyde)
- Associate partner NOWITECH Norwegian Research Centre for Offshore Wind Technology (Strathclyde)
- Participation in EERA Wind Energy Initiative (Strathclyde)

Supergen Wind 2

Research Programme



Theme 1 The Farm

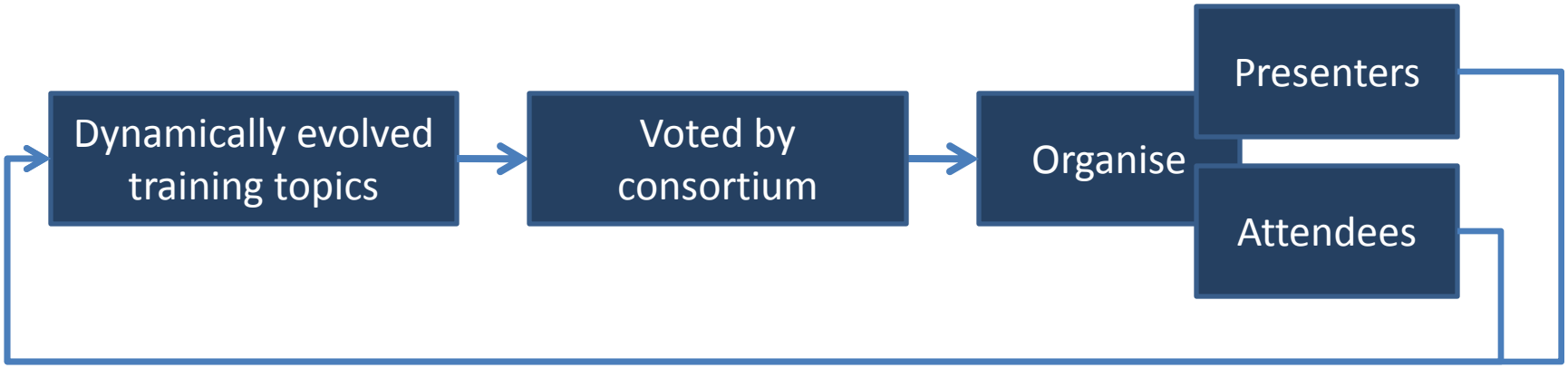
Theme 2 The Turbine

Theme 3 The Connection

Theme 4 The wind farm as a power station

Training Scheme

- The Scheme will function not only for training, but as a forum for RAs and students to communicate and develop.
- Requirements based.
- Two days events, every six months.



Thank you

Side Event is an opportunity for you to see the outcomes of these two important projects