

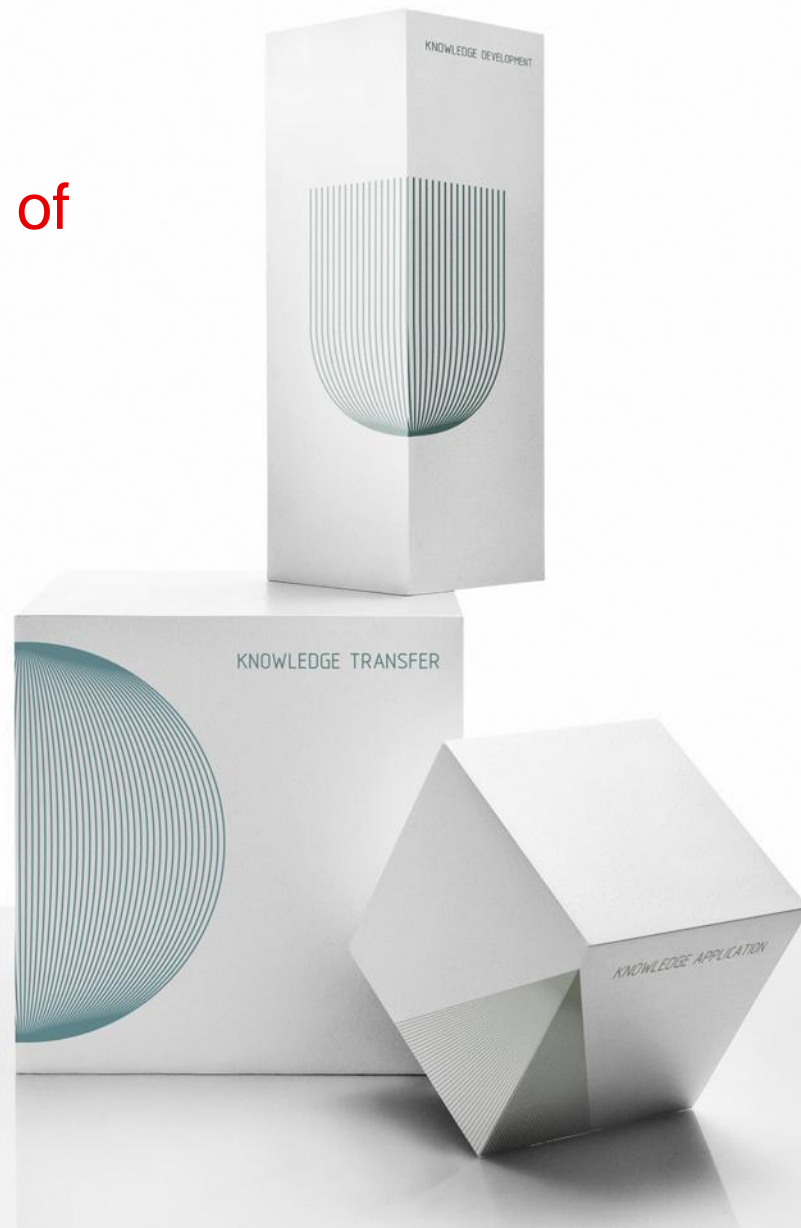


**DANISH
TECHNOLOGICAL
INSTITUTE**

Reliability and Performance of Hydraulic Systems

Project Application, EUDP 2010-I

Presented at
MEGAVIND KONFERENCE
Danmark som grønt teknologilaboratorium
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Why this project and why now?

- If pitch and yaw system problems could be solved, the global availability of wind turbines could be raised by 1%
- The placement of wind turbines in offshore and other remote locations accelerates the need for high availability through highly reliable and durable components.
- There are a severe lack of knowledge in designing for reliability (which is very complex due to numerous factors like Oil quality, System design, operating conditions, manufacturing quality of components/systems etc.)
- Danish suppliers are having a significant market share of hydraulic pitch, brake and yaw systems. The demand for new product development, low production costs and high reliability are increasing
- The sub suppliers acknowledge that it is impossible for each of them to establish this kind of test facility on their own and that they have to cooperate closely with their main competitors in order to develop their next line of more reliable and hence more competitive products.



How are we going to do it

- Strong cooperation between central partners from the industry, research organizations (universities) and technological centres (GTS institutes).
 - The combined competencies will be used to establish a test facility at the Centre for Wind Turbine Components (Risø-DTU) giving near-actual operational testing conditions for hydraulic systems including control devices.
 - Simulation tools will be used in conjunction with e.g. a full scale pitch actuator in a closed loop.
 - The Project is outlined as approx 75% industrial development/demonstration and approx 25% research.
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- Planed Start - August 2010
 - Expected End - July 2013
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- Budget: 14.061.017 Dkr
 - Requested Contribution: 7.353.945 Dkr.



Research

”Reliability and Performance of Hydraulic Systems”

The primary research questions:

1. How to design electro-hydraulic actuation topologies intended for wind turbines, to provide a specified reliability level?
 2. Using the test facility; how to design and conduct accelerated lifetime tests to determine component failure
- The research in the project amounts to 25 % of the resources and will concentrate on supporting the industrial developments.



Participants

Worldwide leading manufacturers of hydraulic windturbine systems (E.g. Pitch and brake solutions) and industrial knowledge/experience of component tests

- AVN Energy
- PMC Technology
- Svendborg Brakes
- Fritz Schur Energy
- HYDAC

Technological knowledge and experience in converting new knowledge into functional and practical utilisation.

- Danish Technological Institute
- Force Technology

Severe hydraulic related research and continuously advancement in modeling and simulation

- Aalborg University
- Risø DTU



Results

- New services, competencies and methodologies for development/testing of hydraulic systems under near-actual conditions will be created including a hydraulic test facility at the Centre for Wind Turbine Components (Risø-DTU).
- Methodology and facilities for testing critical components in determined operational environments chosen on basis of research and practical approaches.
- Simulation tools will be used in conjunction with e.g. a full scale pitch actuator in a closed loop.
- Methods for isolating hydraulic systems into sub-systems and dedication of Safety Integrity Levels for each system
- Guidelines describing test procedures for reliability tests on individual hydraulic components and integrated hydraulic systems.
- Unmatched level of knowledge and competencies about hydraulic components and systems in wind turbines on the theoretical level, combined with a thorough practical understanding.



Questions

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