

# Simulation of Environmental Offshore Conditions

Weathering, Corrosion and Vibration



Testing equipment to  
measure your product  
characteristics



Equipment to improve  
your product  
characteristics



We help you with the  
best possible service

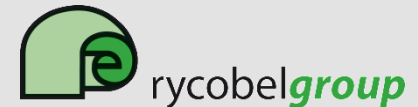
*by*

*Jorrit Hillaert & Mark de Waard*



**ascott**  
Corrosion Test Chambers

Testing climate resistance **to the limit**



# MISSION

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Rycobel brings competitive advantage by supplying and maintaining equipment to measure and improve product characteristics.



Testing equipment to  
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Equipment to improve  
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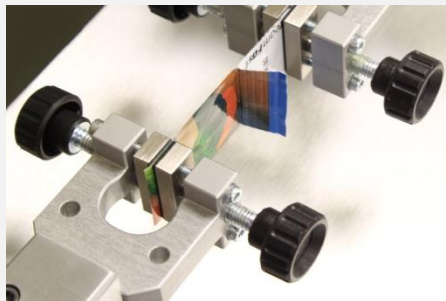




Meten

# MEASURE

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PHYSICAL TESTING



WEATHERING TESTING



TRANSPORT  
SIMULATION



BEVERAGE &  
PACKAGE TESTING



PACKAGE TESTING



TEXTILE TESTING



Verbeteren

# IMPROVE

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SURFACE  
TREATMENT



STATIC  
ELECTRICITY



AIR KNIVES



CONTACT-FREE  
CLEANING



DOSING  
SYSTEMS



Service

# SERVICE

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- Installation
- Calibration service
- IQ/OQ/PQ
- Repair and maintenance
- Training
- Technical support





# Offshore

## Environment or Weather

- Solar
- Salt Spray / Mist
- Rain / Snow / Hail
- Storm

## MECHANICAL LOADS

- Tidal Effect (waves)
- Wind
- Floating Ice
- Bio-fouling



# Environmental

## Why Test (*correctly*) ?

- material selection
- lifetime prediction

## Why Test to a Standard ?

- comparisons



✓ **FIELD TO LAB**


# Environmental

corrosion



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MATERIAL TESTING SOLUTIONS

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# Environmental

## corrosion

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
UV/condensation — ISO 11507			Salt spray — ISO 9227			Low-temp. exposure at (-20 ± 2) °C
						

- ISO 20340

- Paints and varnishes -- Performance requirements for protective paint systems for offshore and related structures
  - 72 hours (3 days) of exposure to UV-B
  - 72 hours (3 days) of exposure to salt spray, and
  - 24 hours (1 day) of exposure to low temperature (-20 C ± 2 C)
  - 25 cycles, total 4.200 hours

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# Environmental

corrosion

- Qualisteelcoat

- International standard for organic coatings on steel
- Corrosion: EN ISO 9227
  - 1440 hours (60 days) of exposure to neutral salt spray (NSS)
- Accelerated weathering ISO 16474-2
  - 1000 hours exposure to xenon, wetting and controlled conditions
- Natural weathering
  - 1 year Florida exposure



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# Environmental

## corrosion


- Qualicoat

- International standard for **liquid and powder** organic coatings on **aluminium** for architectural applications
- Corrosion: EN ISO 9227
  - **1000 or 2000** hours (60 days) of exposure to **ACETIC** salt spray (ASS)
- Accelerated weathering ISO 16474-2
  - 1000 hours exposure to xenon, wetting and controlled conditions
- Natural weathering
  - **1, 2, 3 or 10 years** Florida exposure



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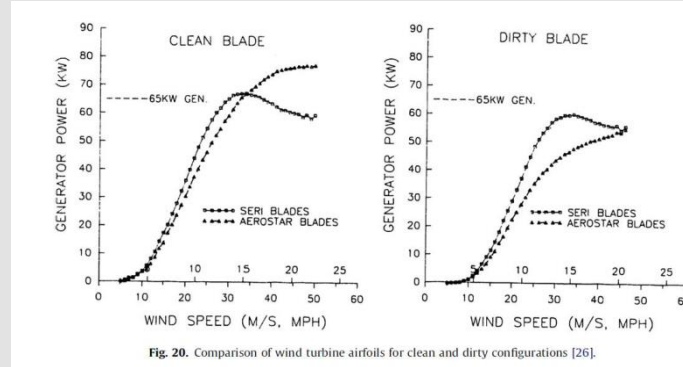
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# Environmental

weathering

## Rotor Blade Coatings


- The rotor blade is the most critical part as it greatly impacts efficiency



IMBALANCE → Failure

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# Environmental

weathering

## Offshore Corrosion Protection

- Paints and varnishes -Corrosion protection of steel structures by protective paint systems (ISO 12944)
- Surface preparation and protective coating (NORSOK M501)
- Paints and varnishes -Performance requirements for protective paint systems for offshore and related structures (ISO 20340:2009)

*Cycle for splash zone coatings: 72 h UV / 72 h salt spray / 24 h freeze (-20 °C)*

- Paints and varnishes -Determination of resistance to cyclic corrosion conditions (ISO 11997)

Part 1: Wet (salt fog)/dry/humidity

Part 2: Wet (salt fog)/dry/humidity/UV light

Latest revision allows Xenon (in Annex A)



# Environmental

weathering

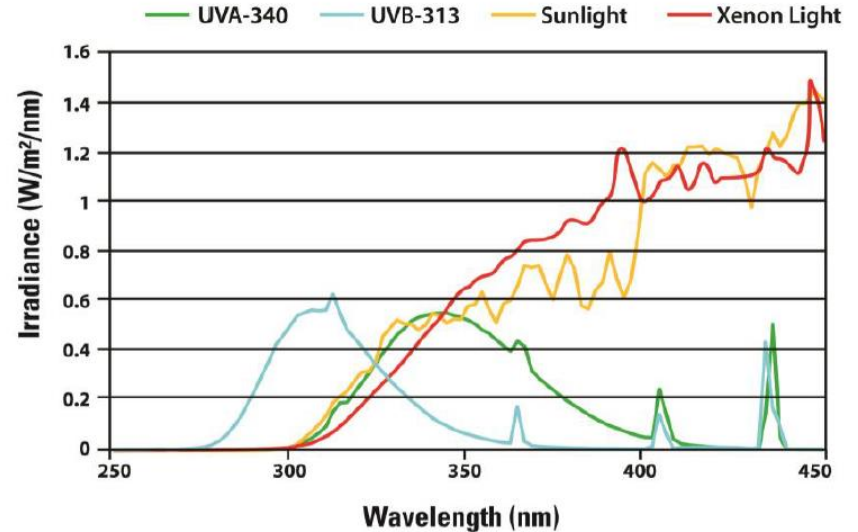
## Using the Right Light

UVB is commonly used in wind turbine industries *BUT...*

Major coating manufacturers openly distrust UVB

→ *UVB can cause failures that will not occur in natural sunlight*

Atlas UV fluorescent and filtered Xenon Arc Lamps Compared to Sunlight  
(Control Wavelength Normalized at 0.55 W/m<sup>2</sup>)



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# Environmental

weathering

## Full solar simulation over UVA and UVB only

- Only full solar simulation can reliably trigger all critical photo-degradation pathways of these complex coatings
- UVA fluorescent lamps just for screening
- correlation of UVB to field exposures is questionable



V-shaped samples for rain erosion testing



- ✓ testing according to ISO/FDIS 16474-2:2013 (XXL), Qualicoat and ISO 4892-2
- ✓ small, economic table-top instruments
- ✓ testing 3-D specimens
- ✓ special immersion unit for marine environments
  - simultaneous exposure to salt water (5%) and sunlight
  - no change between instruments as for cyclic tests (ISO/DIS 20340 and ISO 11997-2)
  - cycle frequency adjustable

# Vibration

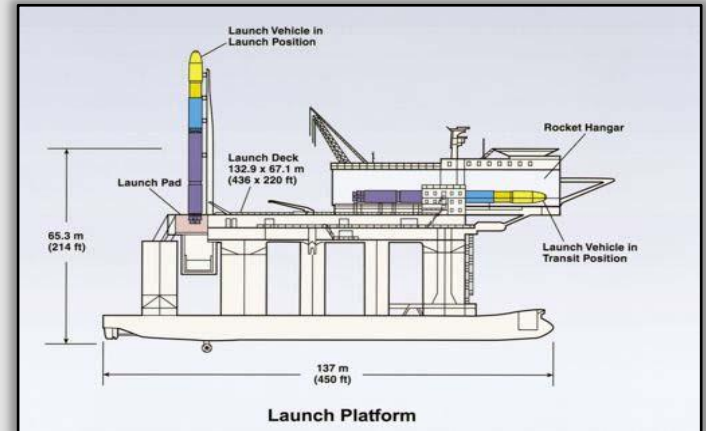




# Vibration

## The Challenge

- Ensure handling of mission critical assets are not compromised for spacecraft launch services from a mobile sea launch platform.
- Critical components are manufactured and distributed for final assembly in the western U.S.. Assembled assets are then distributed to launch site via sea launch system.
- Critical to evaluate shipping conditions that components and assembled assets must endure during shipment.



# Vibration

## The Solution

- Lansmont SAVER's with DC accelerometer instrumentation were used to record dynamic conditions during test shipments.
- Predominant structural resonances were identified within low frequency ranges.
- Cradle design was evaluated utilizing data collected during study. Rolling motion could be damaging to critical assets.



# Vibration

## Monitoring Instruments



VS

## Measuring Instruments



- ✓ Our Environment is Known
- ✓ We want to Evaluate
- ✓ Make sure everything goes OK



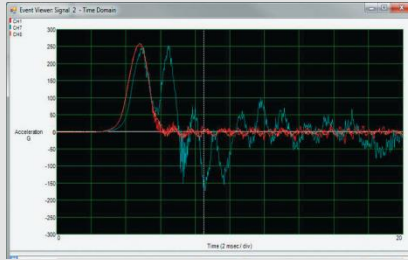
- ✓ Our Environment is UNKnown
- ✓ Fact-Finding
- ✓ Analyze Shipments

# Vibration

## Monitoring Instruments



**Test Partner™ 4**  
Data Acquisition Instruments



**Test Partner 4 (TP4)** is Lansmont's latest generation data acquisition system designed to capture and analyze dynamic events. TP4 incorporates a processing engine to capture substantial amounts of dynamic data and an intuitive interface to quickly analyze data parameters. TP4 provides data acquisition through analog and/or bridge input channels which support a variety of voltage-based and Wheatstone bridge-type sensors. All channels can be configured for sample rates up to 2.5 MHz providing versatility to acquire data attributed to drop, shock, impacts, strain, as well as pyro-shock and blast impact events where captured data is rich with high frequency content.

Analog channels support IEPE-type or voltage-based sensors for performing measurements of acceleration or event detection. The voltage-based event detection provides capabilities to define test constraints for electrical connections and determine when those design constraints have been exceeded.

Bridge/strain channels support quarter-, half-, or full-bridge and DC-based sensors to measure acceleration, force, strain, pressure, and voltage levels.

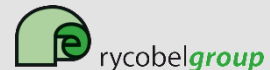
An External I/O channel can be configured to trigger or arm the system and an Ethernet interface allows the user to operate TP4 remotely over the network or connected locally to a PC.

### Hardware Features

- Valid bandwidth up to 200 kHz for analog channels; 100 kHz for bridge/strain channels
  - Up to 2.5 MHz sampling rate per channel
  - 24-bit Sigma-Delta ADC per channel
- High channel count capability
  - Up to 40 dynamic analog or 20 dynamic bridge/strain channels per standalone system
  - Link multiple systems for higher channel count configurations
  - Analog channels support IEPE sensors
  - User configurable analog channels for acceleration or event detection acquisition
- External arm or trigger capability
- Gigabit Ethernet interface
  - Local or remote system management
  - Efficiently manage large data files
  - Fast re-arm & re-trigger functionality - "rapid fire" mode



table





# Vibration

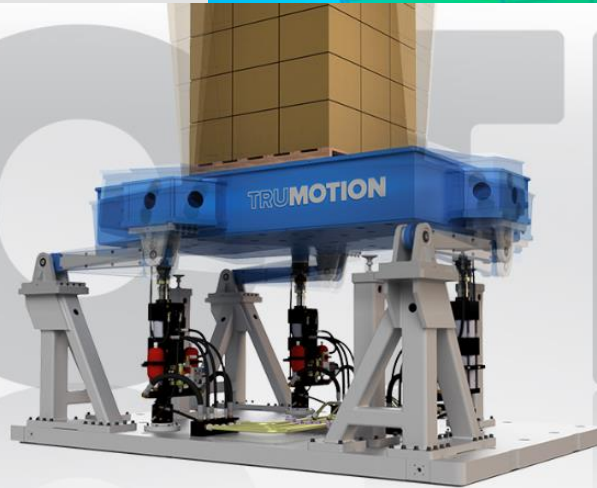


Field-to-Lab  
Professional Services



**TruMotion™**

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systems, delivering high fidelity,  
multi-degree of freedom motions.



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