



# Drivetrain Reliability Collaborative Workshop and Current Events

Jonathan Keller

Wind Turbine Tribology Seminar  
Argonne, Illinois  
November 16, 2016

**NREL/PR-5000-67443**

# Drivetrain Reliability Collaborative Workshop

- Identified reliability state of the art
- Identified research and development needs with big payoff
  - Beyond gearboxes
- Obtained lots of positive feedback
  - Good open discussion
  - Good input on critical topics
  - Small break-out tables were effective.

U.S. DEPARTMENT OF  
**ENERGY** | Energy Efficiency &  
Renewable Energy

WIND AND WATER POWER PROGRAM

## Wind Turbine Drivetrain Reliability Collaborative Workshop

A Recap

Authors:

J. Keller, S. Sheng, and J. Cotrell  
National Renewable Energy Laboratory

A. Greco

Argonne National Laboratory

Sponsors:

National Renewable Energy Laboratory  
Argonne National Laboratory  
U.S. Department of Energy

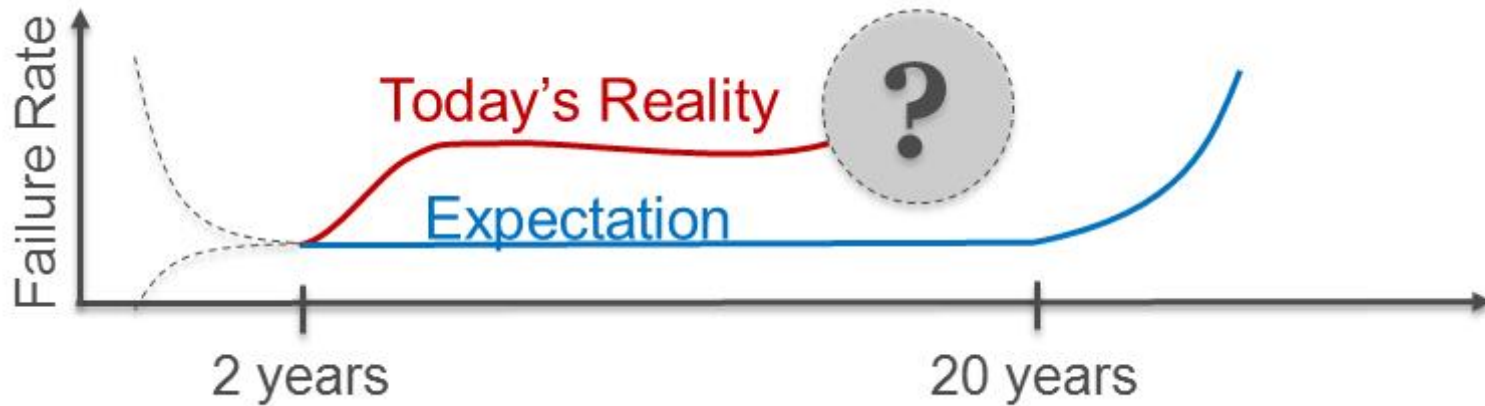
Held at:

National Renewable Energy Laboratory  
Golden, Colorado, USA  
February 16–17, 2016

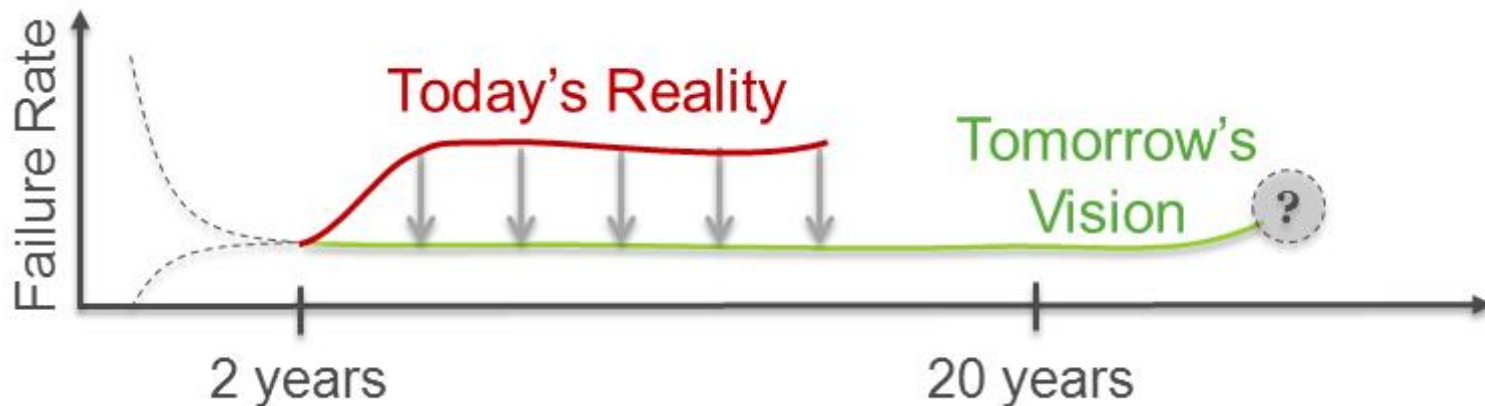
<http://www.nrel.gov/docs/fy16osti/66593.pdf>

# Improve Reliability, Reduce Uncertainty, and Extend Life

Where we are today



Where we want to be tomorrow



# Workshop Conclusions

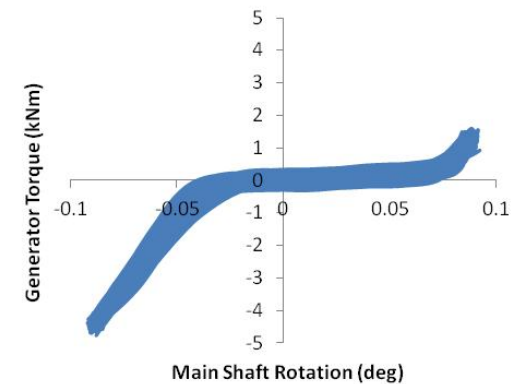
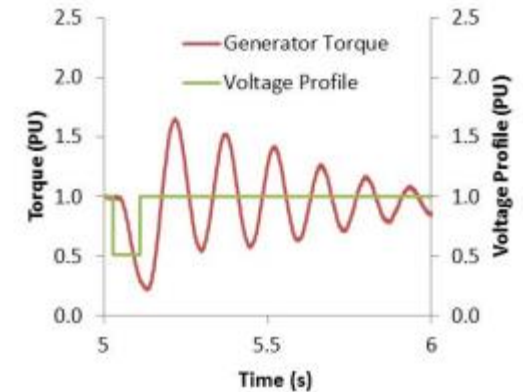
- Better understanding of main bearing failures and axial cracks
  - Industry product offerings and industry/lab projects
  - Material, coating, lubrication, design, and system solutions
- Prediction of remaining useful life
  - Physics-based and data-driven methods
  - Support with tests and expand failure data collection
- How to evaluate the risk of new technologies?
  - Offshore challenges, direct-drive, and journal bearings.

# Recent Events – Completed Journal Bearing Testing

- Journal bearing performance and durability tests



Photo by Mark McDade, NREL 36517



**Industry partners: Romax Technology, Miba, Brad Foote Gearing, DNV Kema, Cinch, CREE, Wolfsped, Powerex, and Vattenfall**

# Recent Events—Completed Planet Bearing Testing

- Preloaded planet tapered roller bearing tests



Photo by Mark McDade, NREL 40432

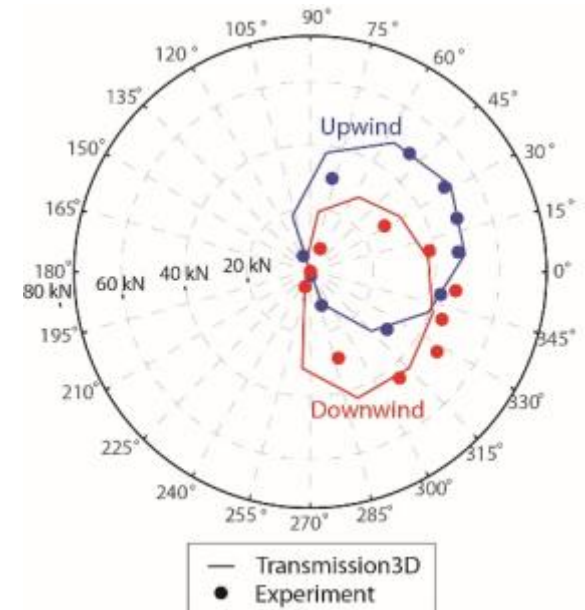


Photo by Jon Keller, NREL 36521

**Industry partners: Romax Technology, Powertrain Engineers, Timken, and Brad Foote Gearing**

# Recent Events—Progress Toward Uptower Testing

- Measure bearing roller sliding in operation

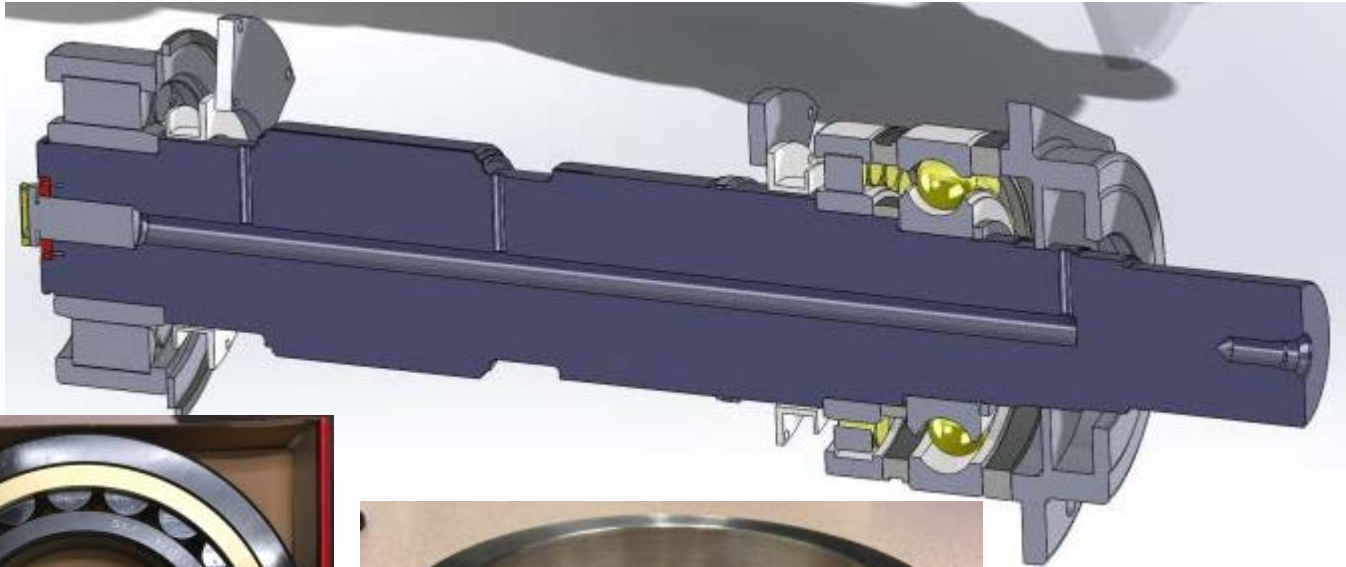


Photo by Jon Keller, NREL 40979



Photo by Jon Keller, NREL 40981



Photo by Jon Keller, NREL 40976

**Industry partners: SKF Group and gearbox manufacturers**

Ref: M. Volkmuth, K. Stadler, R. Heemskerck, Slippage measurements in roller bearings, Antriebstechnisches Kolloquium ATK, Aachen, Germany, 2009.

Thank you!

DRC Annual Meeting  
February 21–22, 2017  
NREL Research Support Facility  
Golden, Colorado

[www.nrel.gov](http://www.nrel.gov)

