# Title Slide



- High Performance Valve Materials (HPVM) (Agreement 16304)
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  - Oak Ridge National Laboratory, Oak Ridge, TN
  - Tuesday, Feb. 26, 2008, morning session

"This presentation does not contain any proprietary or confidential information"

# Purpose of Work



- This new ORNL/Caterpillar CRADA project (NFE-07-00995) is defined to research innovative valve designs and advanced alloys to rapidly and efficiently enable production of trial valves with upgraded capability for valve rig and engine testing
- This new CRADA began in Sept., 2007 and will continue for about 2.5 years

# Barriers – DOE OVT



- This CRADA project is addressing the problems of valves/seats operating at the higher diesel engine temperatures necessary to achieve the program goals of higher fuel efficiency and lower emissions
- Higher engine temperatures are causing exhaust valve and seat wear to become unacceptable. Higher temperatures also reduce component durability

# Approach



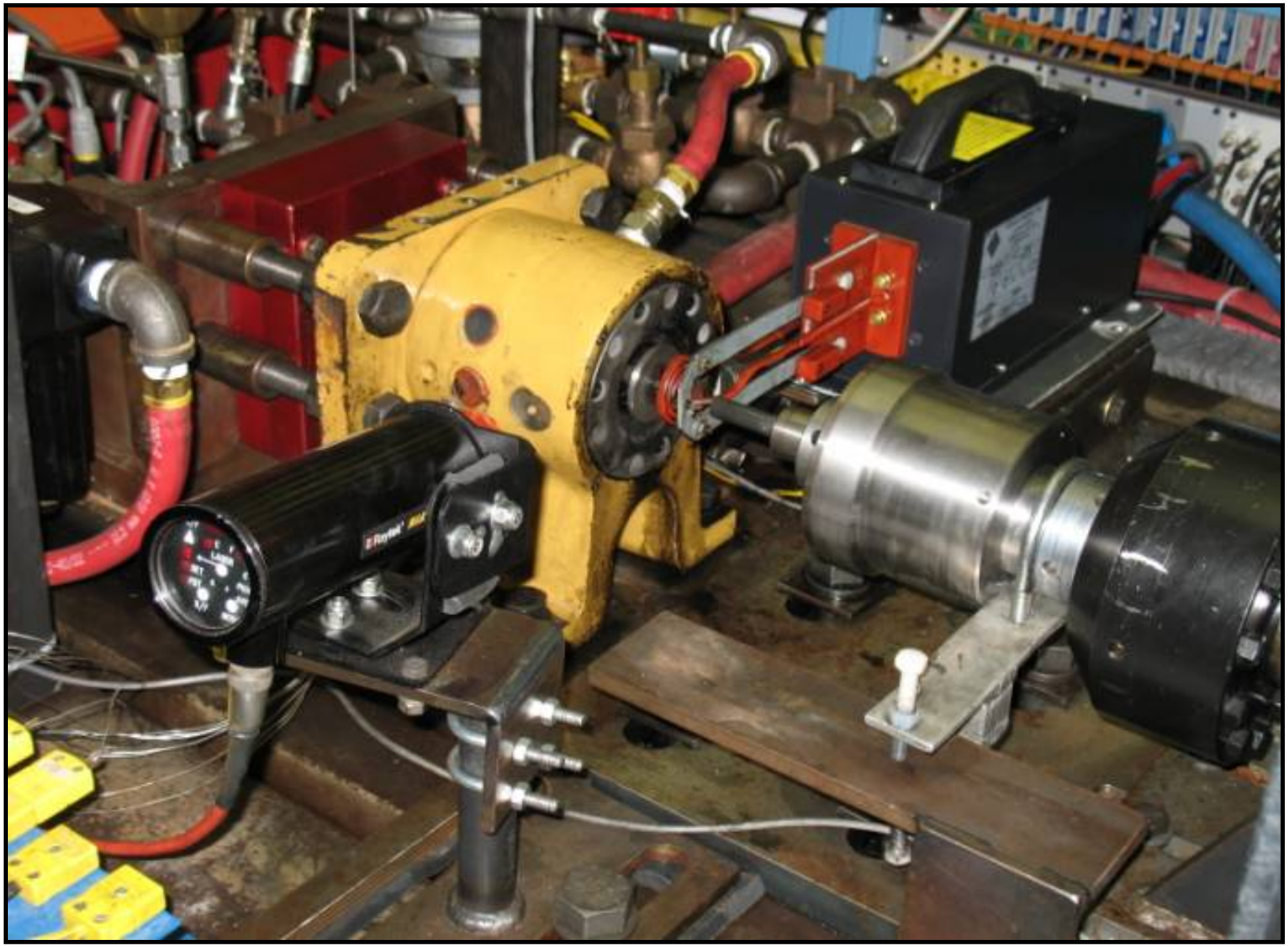
- Caterpillar has assembled a team that includes the engine business units, and the commercial exhaust valve and seat suppliers, and ORNL
- Caterpillar is defining the valve-seat wear issue by analyzing and comparing engine-tested and wear-rig simulation tested components
- ORNL is adding more in-depth microanalysis and materials behavior/mechanism understanding to completely define the problem, and help the team design solution options

# Approach – Analyze components from engine tests



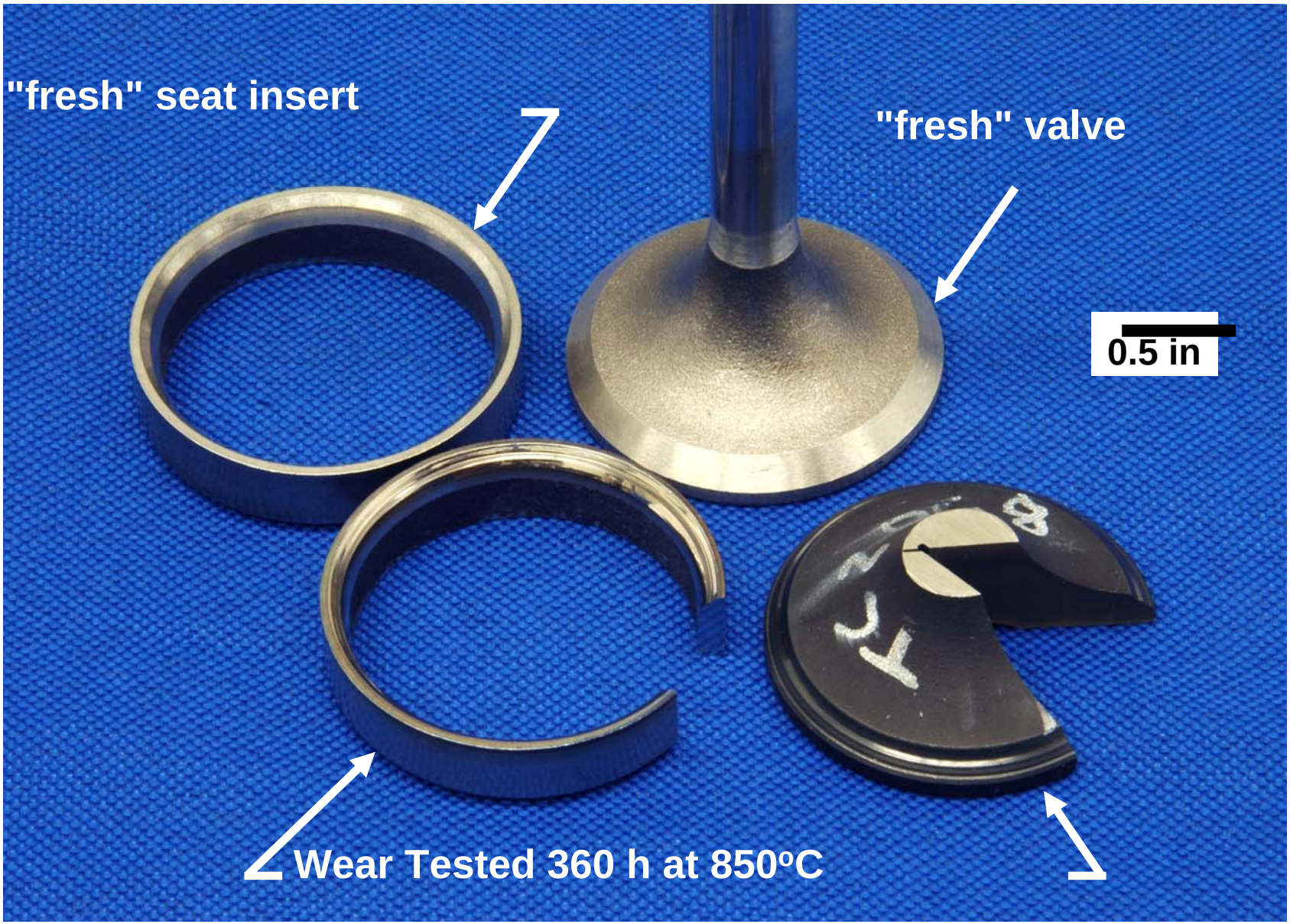
# Approach – Analyze Components from "Buettner Rig" Wear-Test





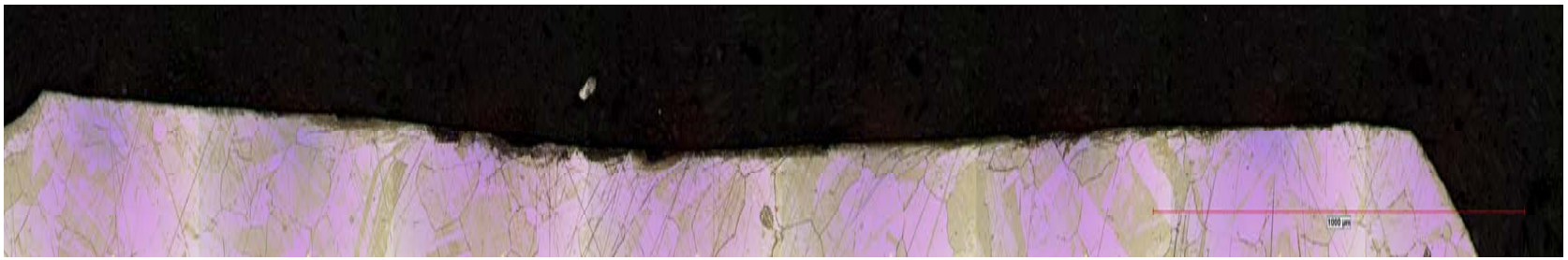
# Valves and Seat Inserts In Both New and Tested Conditions Are Being Examined



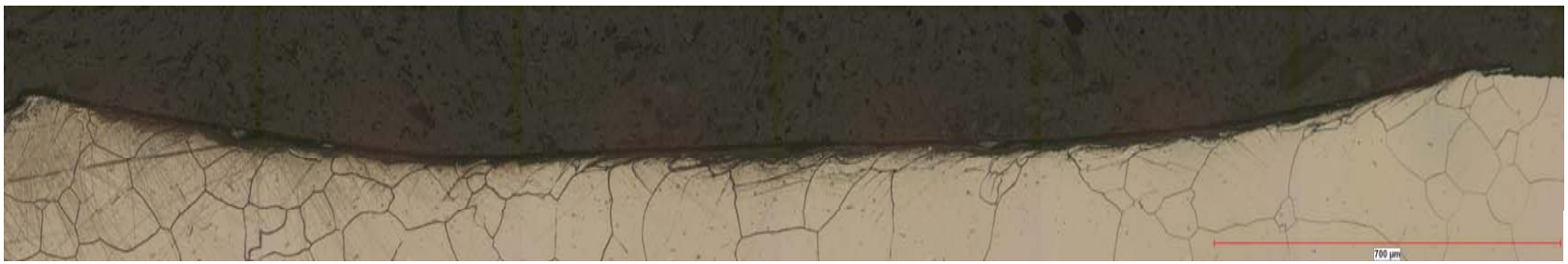


# Technical Progress – Valve Wear

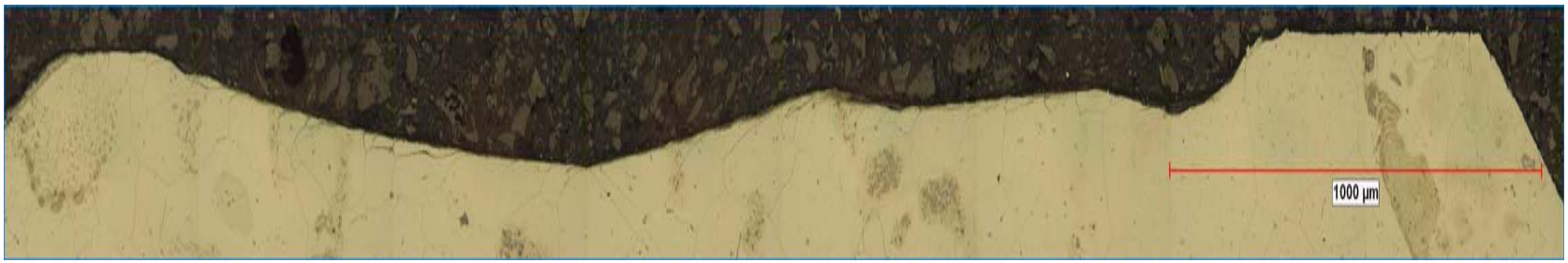




**T1**



**T2**




**T3**

**T1<T2<T3**

# Technology Transfer/Application



- Caterpillar has formed a team of component suppliers who provide parts to and receive data from this CRADA project
- Improvement options from understanding of failure/degradation mechanisms will be down-selected that are commercially viable and appropriate for engine-testing
- Successful wear-rig and test-engine data will provide a rapid path to on-road diesel engine trials

# Activities for FY2008/FY2009



- The next steps are to identify and characterize seat wear corresponding to valve wear
- Components suppliers have already identified some candidate seat-valve upgrade alloys
- Testing and Characterization of upgraded alloys will quantify improvements and enable further alloy modifications based on mechanistic understanding

# Publications, Presentations, Patents



- New project – so no new publications, presentations or patents generated to date.

- U.S. Patent 6,647,770 – Apparatus and Method for Testing Internal Combustion Engine Valves (Nov. 18, 2008) was obtained for the “Buettner Rig” used by Caterpillar.