Condition Based Monitoring

Bearing Diagnostics and Prognostics

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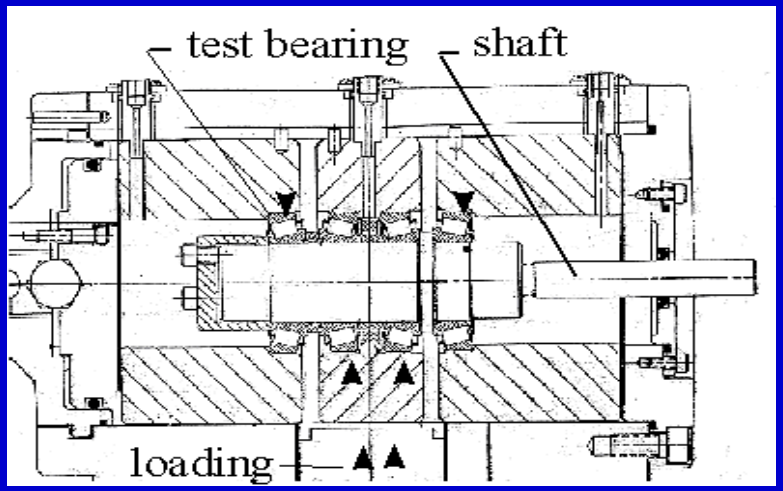
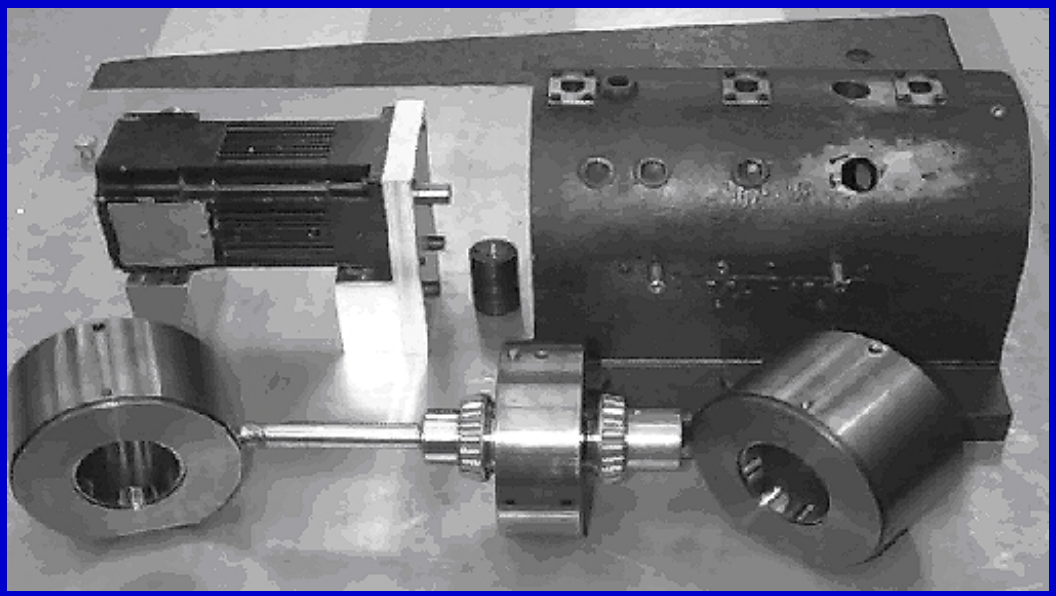
Outline

- Experimental Setup
- Past Work
  - Artificial Crack Experiments
  - Natural Crack Experiments
  - Theoretical Models
- Ongoing Work
  - Remote Monitoring Experiments
  - Accelerated Life Testing

Experimental Setup

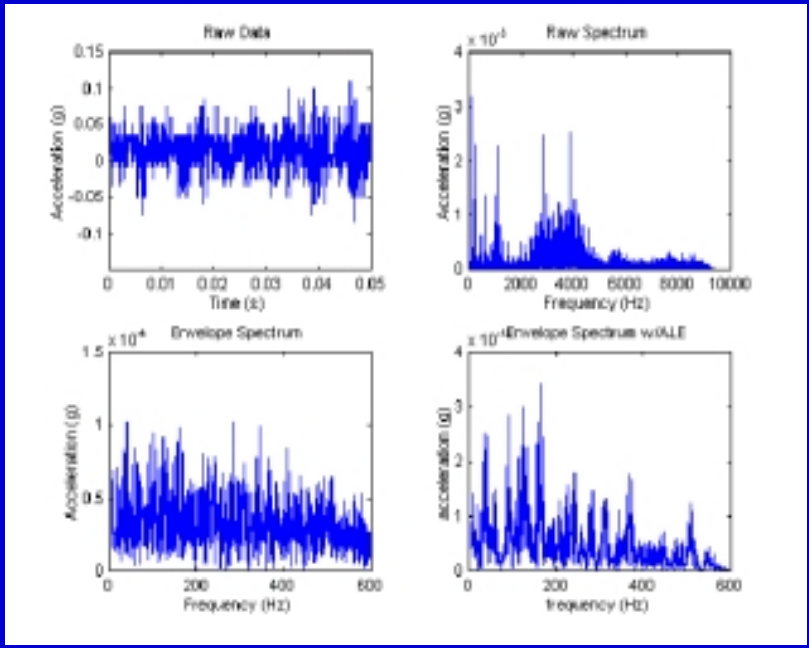




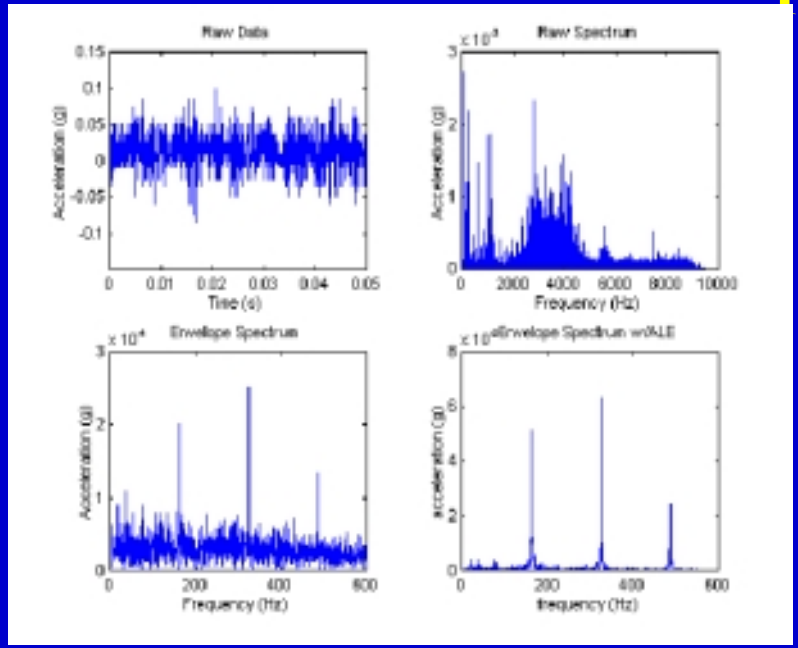
Past Work

- Artificial Crack Experiments
  - Objective: Explore system sensitivity and effects of system parameters
  - Results: clear detection of defect signals
- Natural Crack Experiments
  - Objective: demonstrate damage generation capabilities
  - Results: clear indication of damage in signals
- Diagnostic Models
  - Objective: model system based physics relationships
  - Results: relatively accurate prediction of defect sizes

Artificial Crack Results

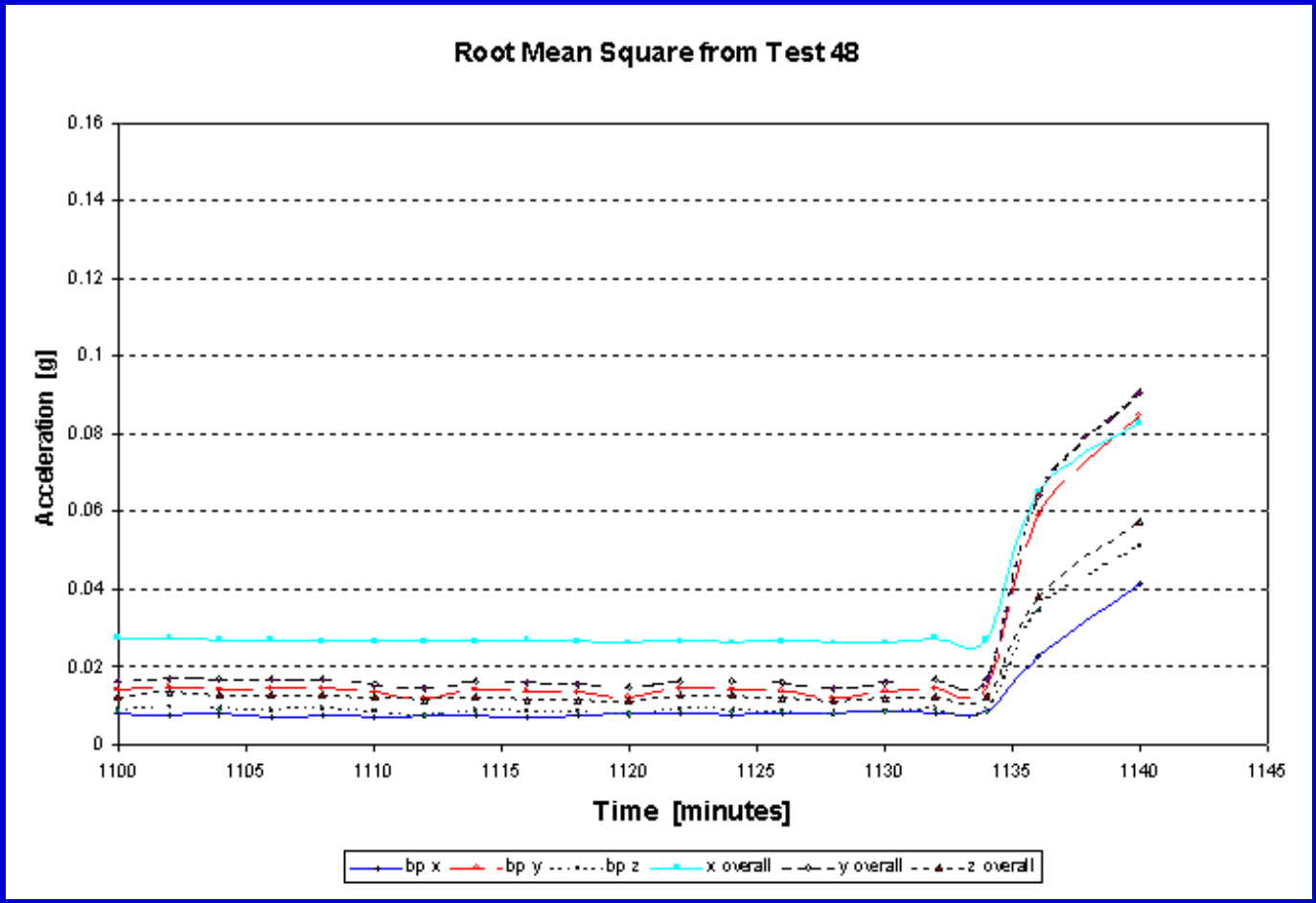


Accelerometer data from an undamaged tapered roller bearing at 1200 RPM

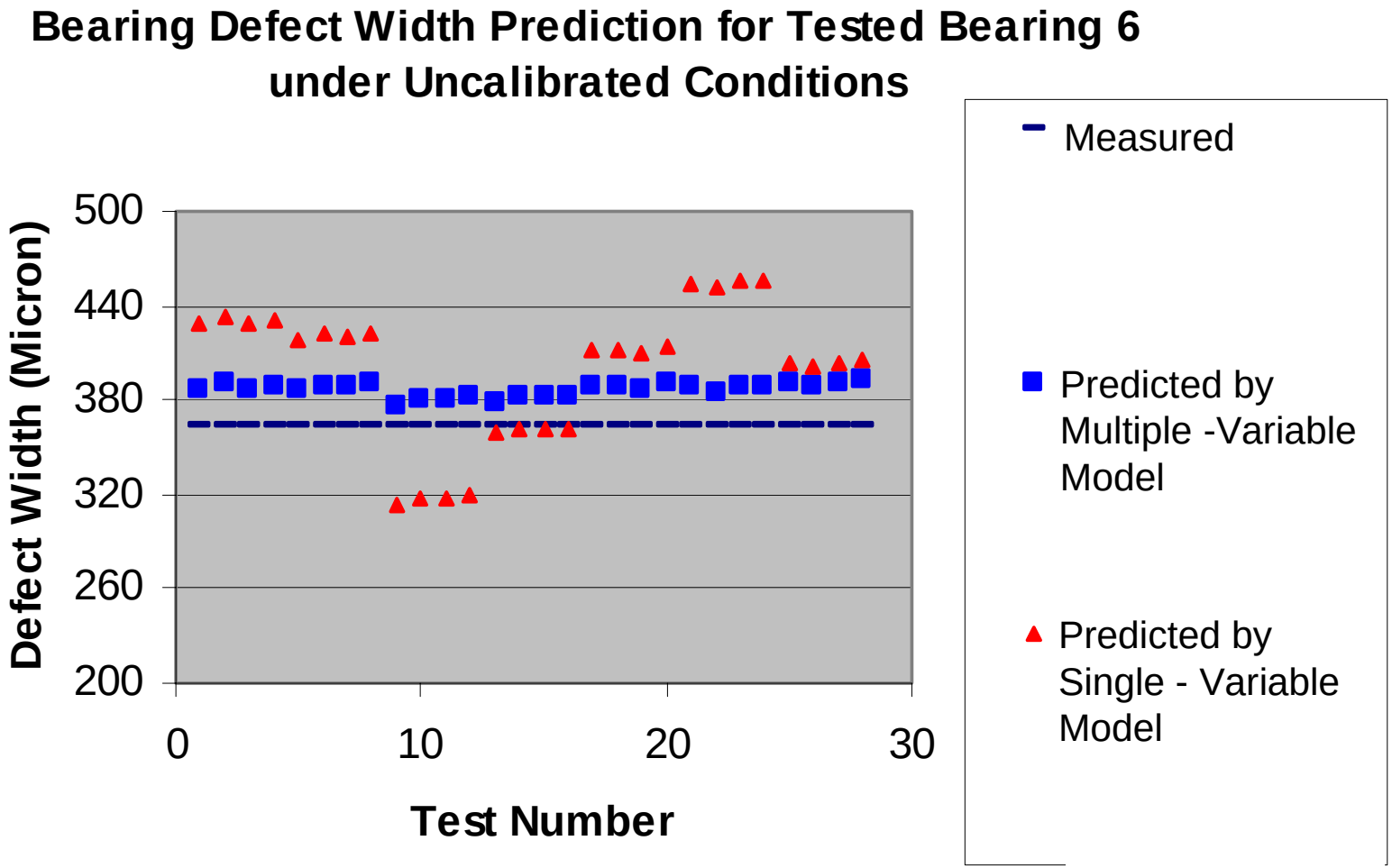


Accelerometer data from a tapered roller bearing with a 15.79 μm scratch at 1200 RPM

Natural Crack Results



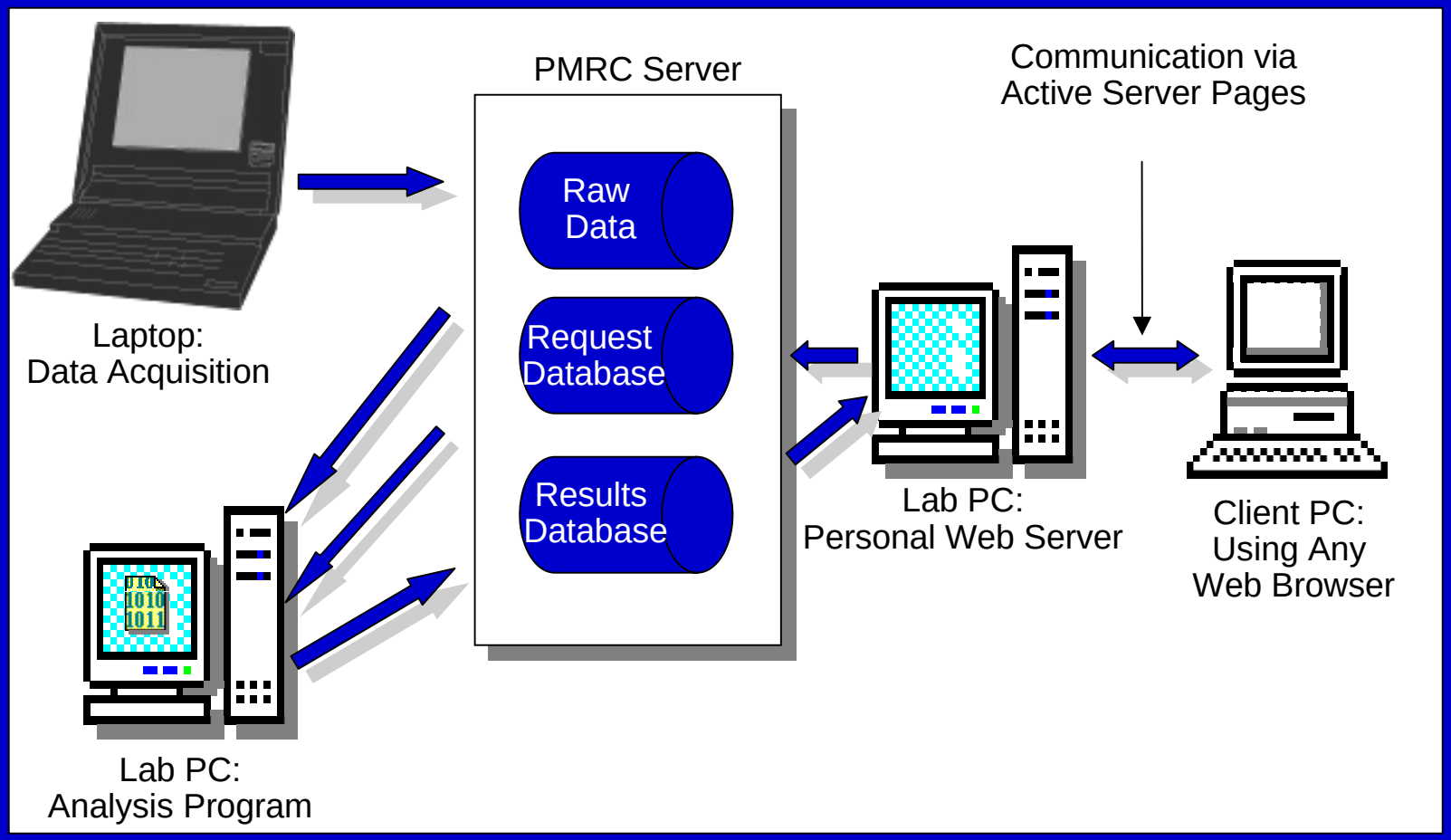
Diagnostic Model Results



Ongoing Work

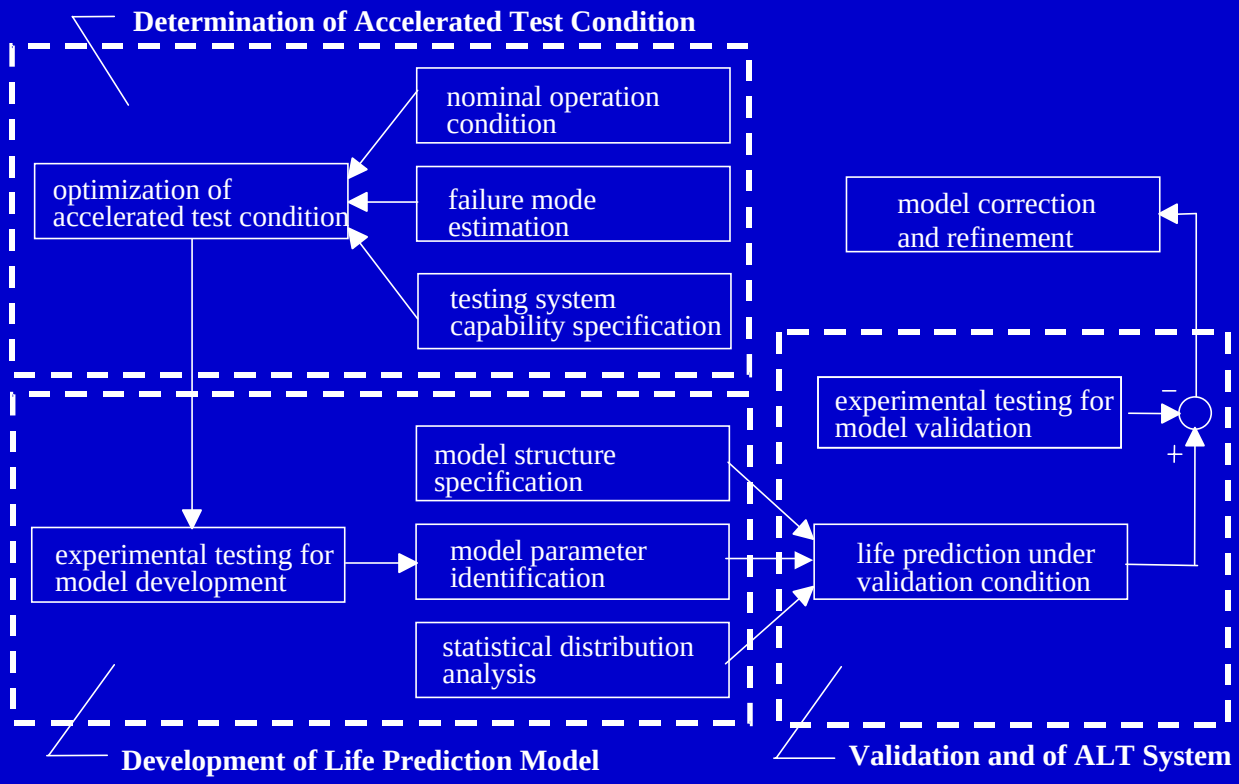
- Remote Monitoring Experiments
  - Utilization of an existing experimental setup
  - Moderation of testing conditions for longer bearing life
  - Verification of on-line analysis system
- Accelerated Life Testing
  - Part 1: ATL methodology development
  - Part 2: Case study demonstration
  - Final Step: Implementation at a user site

Remote Monitoring: Networking Diagram



ATL: Plan of Action

- Part 1: Methodology Development



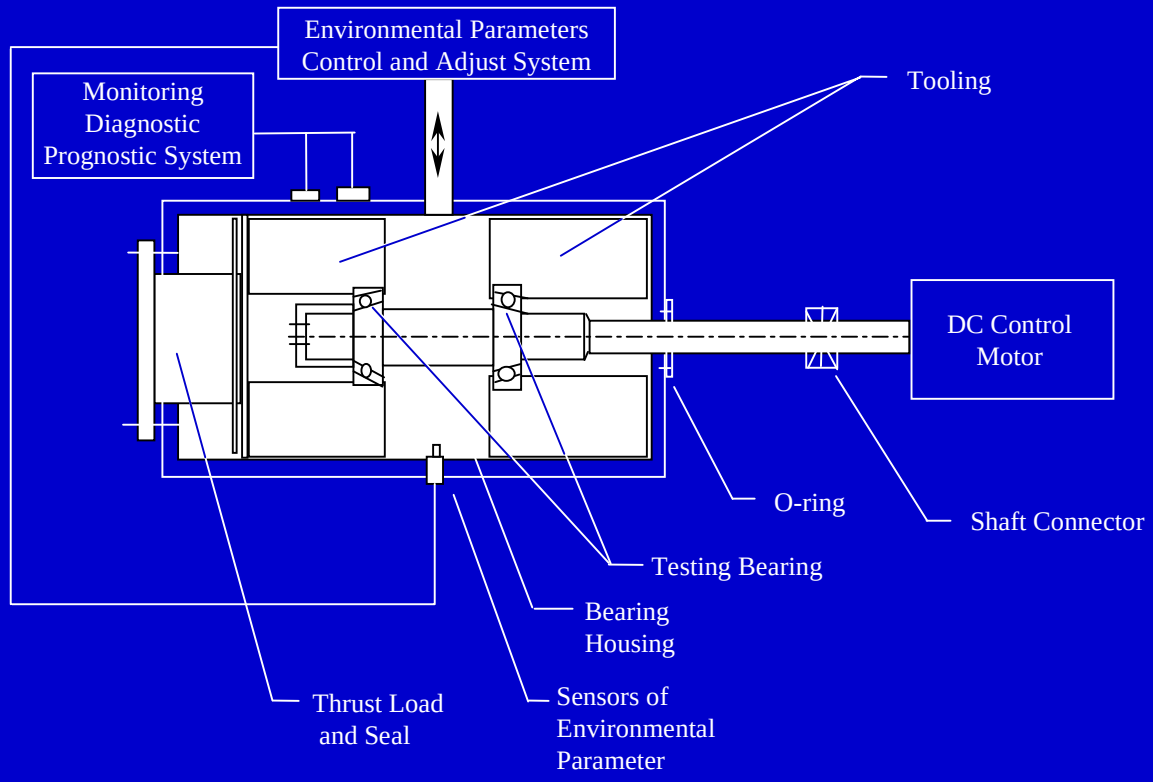
ATL: Proposed Model

- $$f(T, \mathbf{V}) = \prod_{i=1}^{m} e^{-\left[\frac{T}{\eta(V_i)}\right]^{\beta}}$$

- $$\eta(V_i) = K_i \left(\frac{1}{V_i}\right)^{n_i}$$

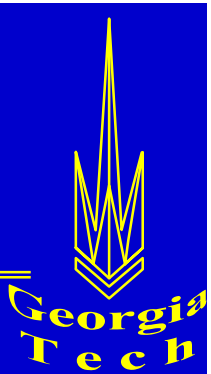
ATL: New Experimental Setup

- Part 2: Case Study Demonstration



ATL: Deliverable

- Demonstration of Technology
  - Model development
  - Model validation
  - Case Study
- Implementation at a User Site
  - Presentation and demonstration
  - Delivery of documentation and code
  - On site assistance with implementation process



Thanks for your time!

Any Questions?