Overview

Timeline
- Start: 10/01/2006
- Finish: 09/30/2010
- %75 Complete

Barriers
- Barriers addressed:
  - Component and system performance is too low
  - Safety, durability, and reliability
  - Higher vehicular operational demands

Target:
- Select surface modification technologies and optimized lubricant-surface interactions to achieve superior efficiency and durability.

Budget
- Total project funding
  - DOE - $325K
- Funding received in FY08 - $125K
- Funding received in FY09 - $100K

Partners
- Galleon International – Technology Maturation
- Hauzer Techno Coating – Coating process development and scale-up
- Lead: Argonne National Laboratory
Objectives

• Design, develop, and implement superhard and low-friction coatings to increase durability, fuel economy, and environmental compatibility of engine systems.
• Demonstrate commercial-scale production of such coatings.
• Characterize and verify performance through bench-top and engine studies.
Milestones or Go/No-Go Decisions

**FY08:**
- Go/No-Go Decision: Completion of bench-top testing and component level studies

**FY09:**
- Go/No-Go Decision: Demonstrate feasibility of larger scale deposition. Demonstrate performance by field testing in fired engines.
- Go/No-Go Decision: Complete scale-up and field studies. Demonstrate cost competitiveness.
**Approach**

- Optimize deposition parameters that are most effective in physical, mechanical, and tribological properties of nanocomposite coatings
  - Superior bonding and surface smoothness
  - Super-hardness and low friction
  - Extreme resistance to wear and scuffing

- Demonstrate large-scale production and cost competitiveness.

- Demonstrate reliability and performance in engine applications.
Technical Accomplishments/Progress/Results

- Deposition of optimized coatings on actual engine components with strong bonding and surface smoothness in a commercial-scale deposition system at Hauzer Techno Coating Company.

- Verification of their superior mechanical and tribological properties by bench-top studies.

- Completion of initial screening tests by engine company partners.
  - Compared to 2008 activities, in 2009 most of our attention has been shifted to scale-up and field testing of optimized coatings and validation of their performance and durability in actual engines.
Technical
Accomplishments/Progress/Results

There is a significant reduction in both the friction and wear of coated tappets through deposition process optimization over the last year.
**Technical Accomplishments/Progress/Results**

- **Scale-up and Commercialization**
  - Working with Galleon International and Hauzer Techno Coating (one of the largest industrial coating companies), in FY2009, we concentrated on scale-up and production of these coatings on tappets, piston pins, piston rings, and fuel injectors for testing by many companies.

- **Technology Transfer**
  - Galleon International initiated licensing talks with Argonne to commercialize the technology.
Future Work

- Validate **production** of optimized coatings in the **commercial-scale deposition systems** of our coating partner (Hauzer) (FY2009).

- Validate their **durability and performance under actual engine conditions** (motored/fired) (FY2009).

- Concentrate on **technology transfer and commercialization** (FY2010)
  - Increase collaboration with industrial partners
  - Demonstrate cost-competitiveness and benefits
  - Finalize licensing talks and commercialize the coatings.
Summary

- Successfully demonstrated the production of superhard and low friction coatings using lab- and commercial-scale deposition systems.
  - By virtue of their superhardness, these coatings prevented wear and scuffing failures in piston pins and tappets.
  - Because of their low-friction character, they can increase fuel economy of future engines.
  - Less fuel consumption means less green-house and other hazardous gasses released to environment.
  - These coatings are applicable to numerous engine components (can also be used in manufacturing for machining, metalforming, etc.)
- Technology transfer and commercialization efforts are currently underway and will further intensify in 2010.