



# Forging Industry Technology Plan 2010

Updated March 2, 2010

## Executive Summary

The FIA's and FIERF's vision remains: "A future in which the forging industry is a world leader in customer-focused, efficient, and cost-effective supply of high quality components. To achieve its vision the FIA and FIERF need to focus on four strategic imperatives: operational excellence, capability development, collaborative partnerships as well as product and market innovation. The technical committee plays an essential role in executing these strategic imperatives and guide the forging industry to be stronger and more competitive in the future.

### **Operational Excellence:**

To achieve this first strategic imperative, the technical committee will support and participate in plant engineering committee activities focusing on customer training and benchmarking. Furthermore, the technical committee will organize and facilitate process specific work groups that focus on solving current technical and economic problems. Also via frequent publications and organization of technical conferences the technical committee is the main driving force to communicate advanced methods, process innovation and taking the lead to transfer technology from research into the industry.

### **Capability Development:**

To achieve the second strategic imperative the technical committee will lead solicitation of projects to identify future technology needs and facilitate collaboration of partnerships to initiate funding and research.

### **Collaborative Partnerships:**

To achieve the third strategic imperative, the technical committee will foster and expand existing partnerships with academia, national laboratories, other associations and government agencies.

### **Product and Market Innovation:**

To achieve the fourth strategic imperative, the technical committee will benchmark advancements of related processes and technologies in un-related areas and identify applications for the forging industry to expand the customer base we currently serve.

## A. CURRENT FIERF PROJECTS

### 1. Modern Look at Carburization

Rensselaer Polytechnic Institute, Roger N. Wright; initiated by Canto Drop Forge

Status: At the present time, nano-hardness indentation is the main focus of the 300M decarburization characterization plan. A tube furnace is being outfitted to allow decarburizing exposures at varying levels of oxygen concentration



### 2. Effects of Process Parameters on Closure of Center Line Defects of Large Steel Open Die Forged Blocks

Illinois Institute of Technology, Philip Nash (Review on 2-23-2010 FIERF Board Meeting)

Status: Simulation of the casting process has been completed and results are loaded into the forge simulation system.



### 3. Forging Process Monitoring and Diagnosis through Signature Analysis of Tonnage Signals

University of Michigan, Jionghua (Judy) Jin

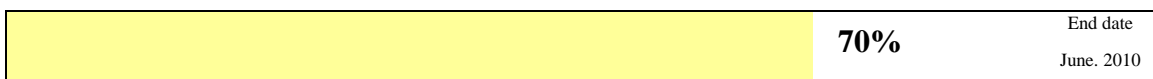
Status: Analyzing the tonnage signature signals for monitoring and diagnosis of a weak operation in a multi-operation forging processes. A new method has been proposed to integrate the advanced Independent Component Analysis method with Sparse Component Analysis for weak signature signal decomposition. The method is under the validation stage and a research paper is under writing now.



### 4. Feasibility Study of AI7075 Near Net Shape Superplastic Forging

Missouri University of Science & Technology, Rajiv Mishra

Status: Friction stir processing of 7075Al has been completed at a few combination of tool rotation rate and travel speed and characterization of microstructure is completed. Currently, high temperature tensile testing for superplasticity is in process. Target completion date: May 2010.



**5. Modeling and Microstructural Development of Incoloy 945 during Hot Deformation**

Colorado School of Mines, Kip Finley

Status: Several successful compression experiments completed to study flow stress and recrystallization behavior for Incoloy 945 in simulated forging conditions. The results have shed light on the types of recrystallization that occur for various conditions. Characterizing microstructures using optical microscopy is on-going. Target completion date: May 2010.

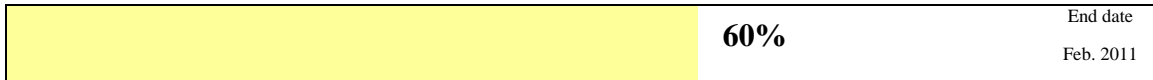


**6. Forged Surface Fatigue Studies**

University of Toledo, Ali Fatemi

Status: Good progress has been made on the experimental work and the experimental results show better than expected level of scatter. Target completion date: December 2010.

It is anticipated for 90% of the experimental work to be completed by the end of 2010.



Concerns: Heat treatment of specimens has taken longer than initially anticipated due to amount and small lot sizes of batches for heat treat to ensure consistency as well as Chrysler's 2009 difficulties.

Furthermore, an additional goal of evaluating grain flow strengthening of forging was added to the project, by comparing forged & then machined samples with machined samples from bars.

**7. Identify variables involved in processing Ti-6-4 forgings and optimize heat treating parameters.**

Case Western Reserve University Cleveland, David Schwam; initiated by Wyman Gordon

Funding approved during FIERF Board Mtg. 2-23-2010.



## B. INDUSTRY COLLABRATIVE WORK GROUPS

- 1. RING ROLL GROUP:** Establishing basic design criteria for pre-form manufacture operation “indenting” and elimination of non-standard operation flattening to reduce cost and processing time as well as reduction of graphite lube usage to improve shop cleanliness.

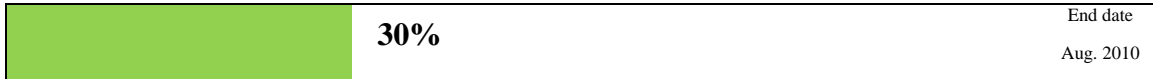
Project Partners:

McInnes, Frisa, Scot Forge, SFTC

Status:

Funding to be approved 1-14-2010, initial meeting held January 19 at Ring Master.

All input data collected. Baseline simulation McInnes part 08009200 is completed and indicates root cause of the sticking. Ringmaster’s and Frisa’s simulations are currently running. Next team meeting expected Early April. Also first series of lube trials completed.



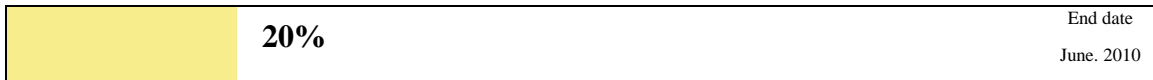
- 2. ALUMINIUM GROUP:** Identify impact of Ultra-High Magnetic field on paramagnetic materials. Phase #1: Aluminum. Identify potential of energy and emission reduction of aging process and develop proposal to initiate funding for phase #2.

Project Partners:

Weber Metals, Jorgensen, Queen City Forge, Scot Forge, Inductoheat, American Magnetics, Rotek Inc.

Status:

Initial conference call on 1-14-2010, initial trials scheduled late January. American Magnetics had equipment failure. Trials delayed until Mid March.



- 3. CLOSED DIE GROUP:** Die life improvement

Project Partners:

HHI-Forging, AAM, Hirschvogel, RSP, IQ Technologies

Status:

Initial meeting was held 1-15-2010. All NDA are signed. AAM issued PO to RSP to spray 3 gear tools. Trials scheduled Mid March. AAM is also setting up IQ trials. Delivery date to be confirmed.

HHI to advise test die. Hirschvogel is currently manufacturing tools for IQ trials.



**4. ENERGY WORK SHOP:**

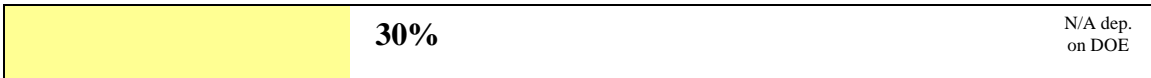
Planning Committee: Tech Committee, Bloom Engineering, Fives North American Combustion, Energy Industries of Ohio, Inductoheat, Timken  
Scheduled for March 24<sup>th</sup> at Timken



**5. JOB SHOP ENERGY:**

Project Partners: FDMC, SFTC, Inductoheat, Canton Drop Forge, Case Western Reserve University and Ohio State University.

Status: “White Paper” completed. Initial conference call held. In process of writing government proposal to secure DOE funding of \$2 million.



**6. SOLICITATION:**

Review Committee: Tech Committee

Status: Mailing End of January



**7. PROJECT “IN THE WORKS”:**

- Isothermal Ring Rolling (next project group mixed from group 1 and 2)
- Development of Non-Ferrous Metallurgy Course
- Development of Ring Rolling Course