

Y-12

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Y-12
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DEPARTMENT OF ENERGY

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Project Accomplishment Summary
for
Project Number 91-Y12P-073-A1

C/Y-12-92-0078

DEVELOPMENT OF PRECISION MACHINING AND
INSPECTION TECHNOLOGY FOR STRUCTURAL
CERAMICS

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PROJECT ACCOMPLISHMENT SUMMARY

Title: Development of Precision Machining & Inspection Technology for Structural Ceramics

DOE TTI Number: 91-Y12P-073-A1

CRADA: Y1292-0078

Partner: Coors Ceramics Company

BACKGROUND

Finish machining operations contribute the majority of the costs associated with fabricating high quality ceramic products. These components are typically used in harsh environments such as diesel engines, the defense industry, and automotive applications. The required finishing operations involve a variety of technology areas including process controls, process analysis, product certification, etc. and are not limited only to component grinding methods. The broad range of manufacturing problem solving expertise available in Oak Ridge provided resources that were far beyond what is available to the Coors manufacturing sites. Coors contributed equipment, such as the computer controls and part handling mechanisms associated with a state-of-the-art inspection machine plus operation-specific experience that allowed Oak Ridge personnel to significantly expand their knowledge and experience base. In addition, addressing these challenging tasks enabled Oak Ridge personnel to maintain familiarity with rapidly advancing technologies, such as those associated with machine vision equipment, process monitoring techniques, and computer control systems.

DESCRIPTION

The purpose of this CRADA was to support Coors' needs in fabricating precision components, from difficult to machine materials, while maintaining and enhancing the precision manufacturing skills of the Oak Ridge Complex. Oak Ridge and Coors personnel worked in a team relationship wherein each contributed equally to the success of the program. In general, Oak Ridge contributed a wider range of expertise to a given task while the Coors personnel provided operations-specific equipment and shop-floor services. Process characterization and control technologies were the primary focus areas. Coors was very pleased with the results of the CRADAs; however, some of the project tasks were not carried through to completion due to changing commercial market requirements. Discussions are underway on continuing other tasks under a Work for Others agreement.

BENEFITS TO DOE

Process control technologies, such as machine vision, provide critical in-process characterization data in weapons manufacturing operations. This near real-time feedback information enhances product quality and provides an important element in the process assurance/predictive maintenance system. These capabilities were the basis for the development of specific solutions to manufacturing challenges that are shared by both the nuclear weapons complex and U.S. industry. In accomplishing these CRADA tasks, Oak Ridge personnel enhanced their capabilities for optical inspection of components and tooling such as cutting tools and thread gages. An optical tool inspection and compensation system had been developed for the Enhanced T-base Lathe (ETB) under DOE's Precision Flexible Manufacturing Systems Program. However, the ending of the Cold War caused a significant change in production requirements and

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the ETB was never placed into production.

Recent Stockpile Stewardship and Management concerns have re-emphasized the need to understand and control the manufacturing operations that support the enduring stockpile and the capabilities of the ETB are once again important to Y-12's manufacturing operations. Unfortunately, the existing process monitoring and machine tool control systems are rapidly becoming obsolete due to the continually evolving capabilities associated with newer generations of optical inspection equipment, desktop computers, and computer numerical control systems. In some instances, the manufacturers no longer produce the equipment that was originally used and in other cases some of the companies have gone out of business. This CRADA, and others like it, enabled Oak Ridge personnel to maintain critical process control skills with up to date equipment and to be ready to apply these skills in support of the Advanced Design and Production Technologies (ADaPT) Program. Specifically, the optical tool inspection and general skills that have been maintained through this CRADA are being used in the Agile Production Operations portion of Y-12's ADaPT program.

ECONOMIC IMPACT

The commercial impact has been limited for Coors. While they have successfully developed the ability to apply advanced process monitoring capabilities at several of their plants, the changing commercial market focus has limited the application of optical inspection equipment. In addition, while they have retained the equipment used in the pilot systems, several key technical personnel have left the company either for personal reasons or because of downsizing activities. Discussions are still underway on continuing a portion of the optical inspection technology effort under a Work for Others agreement.

PROJECT STATUS

The CRADA is complete and the final report has been distributed to the appropriate parties.

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PROJECT EXAMPLES

At this time, there are no project examples that the partners are ready to release.

TECHNOLOGY COMMERCIALIZATION

Results of this project still have potential market advantage to Coors and involve business sensitive issues.