Polyurethane Foam Mock Engine Blocks

Federal Manufacturing & Technologies

G. R. Lenox

KCP-613-5965

Published May 1997

Final Report/Project Accomplishments Summary
CRADA Number 95-KCP-1020

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United States Department of Energy

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Project Accomplishments Summary

CRADA Number 95-KCP-1020

Date: 5/7/97

Revision: 0

A. Parties

The project is a relationship between

AlliedSignal FM&T
2000 E 95th Street
PO Box 419159
Kansas City, MO 64141-6159

P-Ayr Products
19641 Santa Fe Trail
Leavenworth, KS 66048

B. Background

P-Ayr Products designs and manufactures polyurethane foam castings of automotive engines and hardware. P-Ayr Products identified a market need for lightweight "mock engines." The "mock engines" can be use in automotive displays and fit checks where an actual engine would result in greater cost investment or safety risk from the weight. P-Ayr has successfully marketed "mock engines" for automotive displays, amusement rides, racing teams, automotive repair shops, and motion picture studios. The "mock engines" come complete with all of the threaded holes of an actual engine so that the "mock engines" can be accessorized as a real engine. P-Ayr Products was experiencing inconsistency in their ability to produce acceptable product. The company's lack of experience in polyurethane foam formulation and subsequent processing was keeping the product line from reaching its full potential.

AlliedSignal's expertise in polyurethane foam formulating and foam processing was teamed with P-Ayr Products' expertise in tooling design and manufacturing to create an optimum foam system formulation and processing which will enhance the consistency of P-Ayr Products' "mock engines." AlliedSignal (the Department of Energy's Kansas City Plant - KCP) gained enhanced knowledge of commercial foam systems and enhanced ability to modify the foam systems for specific applications.

C. Description

The objective of this CRADA was to develop a foam system and foam processing which would consistently produce acceptable product. To this end, P-Ayr Products supplied KCP with samples of the foam system they were currently using. KCP performed chemical and physical testing of the foam system to baseline the material. Testing performed included water content, resin hydroxyl number, catalyst level, and stoichiometric relationship. Foam systems with low hydroxyl numbers yield tougher products at low densities. Next, KCP

and P-Ayr Products worked together to determine the shell volume of the mold, the density range of acceptable product, and packing factor for the foam material. Characterization of volume, density, and packing factors were important as polyurethane foam properties change with changes in part density. KCP and P-Ayr Products determined the requirements that the new foam system must meet. KCP determined low hydroxyl candidate materials. KCP determined strength properties of the candidate materials. P-Ayr and KCP chose three material blends, and KCP molded prototypes from each blend in molds supplied by P-Ayr Products. The KCP and P-Ayr Products analyzed the resulting products, and P-Ayr Products chose the formulation they thought was superior. The KCP wrote a material specification and delivered it to P-Ayr Products.

D. Expected Economic Impact

P-Ayr Products received a polyurethane foam formulation which should greatly enhance their ability to consistently produce "mock-engines." Processing recommendations made by KCP personnel which were immediately employed by P-Ayr Products also increased production yields. Examples of those recommendations were a change in mold releases and in-mold cure time. The increased yields aided P-Ayr Products in meeting tight production schedules, which delighted their customers. The resulting increased product yields and efficiency should maintain P-Ayr Products as the market leader in the supply of ultra lightweight engine replicas. Since this is an international market, US competitiveness should also be increased.

E. Benefits to DOE

This CRADA provided KCP the opportunity to work with low hydroxyl number polyurethane foams that it would not otherwise have the impetus to work on. Products made from polyurethane systems with high hydroxyl numbers are characterized by their high strength and their resistance to high temperatures. Weapon system parts require the resistance to high temperatures. However, with the high strength, the high hydroxyl systems produce parts that are quite rigid and prone to being brittle. The low hydroxyl number systems produce products that are tougher and less brittle. Results obtained from working with these types of foams will be applied to future work in the areas of storage and transport containers made from low hydroxyl foam systems. Containers of this type will provide better protection to delicate weapons assemblies during transport and storage.

F. Industry Area

Industries benefiting from this project include the automotive aftermarket parts industries and the automotive repair industry.

G. Project Status

This project was completed in October 1996 with the delivery of the product specification to P-Ayr Products.

H. Point of Contact for Project Information

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I. Company Size and Point of Contact

P-Ayr Products is a company employing approximately 7 persons and has an estimated annual sales of \$200,000 dollars.

Dean Ayres - President
Phone: (913) 651-5543

J. Project Examples

AlliedSignal has no tangible items to be used in a demonstration.

K. Technology Commercialization

Besides the establishment of a new material into P-Ayr's product line, the process improvements developed during this CRADA will help P-Ayr to lower their manufacturing costs by reducing scrap and rework.

L. Release of Information

I have reviewed the attached Project Accomplishment Summary prepared by AlliedSignal FM&T and agree that the information about our CRADA may be released for external distribution.

Dean Ayres, President of P-Ayr Products, gave verbal approval for the release of this report on 5/29/97.