



## **Final Technical Report (FTR)**

**DOE Contract Number:**

**FC36-02ID14315**

**Recipient:**

**Glass Manufacturing Industry Council**

**Project Title:**

**Carrying Out and Developing the Glass Industry Vision and Roadmap**

**Principal Investigator:**

**Michael Greenman, GMIC Executive Director**

**No Distribution Limitation**

**June 2007**

## **Executive Summary:**

In support of its obligations under the above-mentioned project, the GMIC performed the following tasks:

- a. Provided two-way communications liaison services between the U.S. glass industry and the D.O.E. to ensure the needs and concerns of each party are effectively communicated to the other.
- b. Updated and modified on a continuing basis and in response to evolving conditions within the glass industry, the goals and priorities outlined in the Glass Industry Vision and the Glass Technology Roadmap.
- c. Established relationships with a wide variety of government and non-governmental organizations with interests in further improving the levels of technology, productivity and environmental responsibility of the glass industry.
- d. Canvassed the glass industry on an ongoing basis to determine overall and specific sector needs for technological development.
- e. Fostered direct contacts between member companies and national laboratories to facilitate the development of individual company technology development.
- f. Advised the DOE on the key elements of the solicitation process in support of the Glass Industry Vision and Technology Roadmap.

In the course of this contract, the membership of the GMIC has grown to include over 70% of the glass industry. This gives it the ability to communicate persuasively with the vast majority of this energy intensive industry. One of the principal benefits of the existence of the GMIC is that, for the first time in this country, representative companies of all major sectors of the glass industry are now in regular communication with each other. Prior to the existence and activity of the GMIC, companies and individuals in the flat glass, container glass, fiber glass and specialty glass sectors rarely had contact with each other, in spite of the fact that they all face similar challenges and can benefit from pre-competitive research conducted to the benefit of the broad industry. The development of innovations in the industry under cost-shared DOE/industry research projects such as new melting technologies, sensors and controls, modeling programs, energy efficiency tools, etc. has led to substantial increases in energy efficiency in the industry.

Increased energy efficiency results in increased job opportunities in the industry that has been negatively impacted by increases in energy costs, globalization and increased environmental controls.

## **Actual Accomplishments Compared to Goals and Objectives of the Project**

A. Provided two-way communications liaison services between the U.S. glass industry and the D.O.E. to ensure the needs and concerns of each party are effectively communicated to the other.

Communications between the two parties were facilitated by a number of events and practices:

- Annual Technical Project Reviews permitting industry representatives, DOE personnel and project Principal Investigators to review and discuss progress towards project objectives and to modify projects as appropriate.
- Participation by DOE personnel routinely at GMIC Board and Annual Meetings providing two-way access to concerns of both parties on an ongoing basis.
- Forwarding all relevant DOE announcements and information media to all glass industry contacts.
- Conducting or facilitating numerous visits by glass industry executives to DOE for meetings with staff and management.
- Conducting visits by DOE staff and management to glass industry sites around the country to provide first-hand knowledge regarding industry operations, needs and accomplishments.

B. Updated and modified on a continuing basis and in response to evolving conditions within the glass industry, the goals and priorities outlined in the Glass Industry Vision and the Glass Technology Roadmap.

The period of this contract was not of sufficient duration to require modification of these documents. However, the research and development activities carried out in cooperative research projects cost-shared by DOE, industry and other parties, clearly followed the Technology Roadmap and moved actively towards the long-term objectives of the Vision document. This work continues beyond the period of the contract and independently from subsequent contracts.

C. Established relationships with a wide variety of government and non-governmental organizations with interests in further improving the levels of technology, productivity and environmental responsibility of the glass industry.

The GMIC, independently, and in conjunction with other industry groups has established and maintains ongoing relationships with a number of federal, state, and non-governmental organizations. A selection of these organizations includes:

- Department of Commerce
- Environmental Protection Agency
- Air Force Research Laboratory
- National Association of State Energy Officials
- American Council for an Energy Efficient Environment
- Alliance to Save Energy

- Glass Packaging Institute
- International Commission on Glass
- California Energy Commission
- Ohio Department of Development
- New York State Energy Research and Development Authority
- New Jersey Commerce, Economic Growth and Tourism Commission
- Energy Industries of Ohio
- Glass Association of North America
- American Ceramic Society
- Center for Glass Research
- Glass Art Society
- Society for Glass Science and Practices

D. Canvassed the glass industry on an ongoing basis to determine overall and specific sector needs for technological development.

The GMIC, through its sub-committees (Energy Efficiency, Production Efficiency, Environmental/Health and Safety, and Innovative Uses) as well as in the course of period project reviews, workshops, conferences, member and industry surveys, and Board, Annual and Executive Committee meetings, has continually considered the changing needs of the industry and its various sectors.

An October 2004 publication: "Glass Melting Technology – A Technical and Economic Assessment", (ISBN 0-9761283-0-6) was the result of a broad industry survey carried out over an extended period which yielded a wide range of challenges and opportunities for our industry to pursue. The document has been widely distributed throughout the industry and academia and is used as a text for studying the glass industry and its evolution.

A 2005 "Bandwidth" analysis project involving public and confidential discussions with a range of industry professionals identified specific opportunities for technology needs and opportunities that are leading to developments in specific sectors and in the industry as a whole of new technologies and processes.

E. Fostered direct contacts between member companies and national laboratories to facilitate the development of individual company technology development.

In the course of our annual Project Reviews, frequently held at national laboratories, member companies were able to visit a number of our nation's premiere research facilities. Visits were made to Sandia, Lawrence Livermore, Lawrence Berkeley, Argonne, Oak Ridge, National Renewable Energy, and the Savannah River National Laboratories. Additionally, an ongoing relationship exists with the National Energy Technology, Pacific Northwest and Idaho National Laboratories. In all cases, glass industry professionals met with appropriate scientists and researchers able to offer expertise and opportunities for specific research initiatives either towards private CREDAS or collaborative industry projects. As much industry research in collaboration with laboratories is done under proprietary agreements, it is difficult to estimate the

extent of specific work that resulted. However, it is certain that such meetings led to ongoing contacts and relationships.

F. Advised the DOE on the key elements of the solicitation process in support of the Glass Industry Vision and Technology Roadmap.

Over the course of this contract the GMIC and its member companies had frequent contacts with the Department of Energy with regards to the solicitation process. The industry's involvement in the analysis of procedures and communications means, in conjunction with associates in other industry sectors, has led to recommendations and proposals for future solicitations that continue to be considered within the DOE as policies and practices evolve. The reduction of research budgets that were experienced over the course of this contract led to a gradual drop in number and breadth of research that could be carried out, but substantial accomplishments were achieved to the benefit of the industry and the DOE during the 2002 to 2005 period.

## **Products Developed under the Award**

“Glass Industry Technology Roadmap” – (Brochure) – April 2002

“Glass Manufacturing Issues Symposium Proceedings” – (CD); April 2002

“Glass” – Industry Brochure illustrating broad range of glass products – (Brochure) – January 2003

“Allied Partnership” – Memorandum of Understanding between DOE and GMIC formalized in April 2003 for the purpose of facilitating and accelerating the transfer of DOE products and services to the glass industry. Program currently inactive.

“Glass Melting Technology – A Technical and Economic Assessment”; (Softbound Book) October 2004 (ISBN 0-9761283-0-6)

“Glass Art and Science – A Voyage of Exploration” – (CD); November 2004

[www.gmic.org](http://www.gmic.org) - Web site – resource for DOE and GMIC publications, programs, research programs, industry developments.

“Alliance for Materials Manufacturing Excellence” – Multi-industry association (Aluminum, Chemicals, Forest Products, Glass, Metalcasting, Steel) initiated by GMIC to improve relationships between industry and DOE, and to improve effectiveness of DOE programs designed to support U.S. industry.

GMIC Glass Industry Database – Growing database of glass industry professionals from all U.S. and many international companies and personnel. Currently at 2,000+ listings. Used for dissemination of DOE program information.