Project Objectives - First Quarter
- Initiate materials testing for optimum energy savings
- Establish physical constraints for final system through prototype development
- Develop testing protocols and methods for feasibility studies

Technical Milestones
- Possibility of major time-savings for materials selection
- Two prototypes in production
- Initial testing of energy-saving heating bands with potential for applying to current manufacturing process
- Invitation to publish journal article about project

Summary
Projected timeline for projection completion appears to be correct in spite of delay in receiving government funds. Design iterations for rotary prototype already beginning. Areas of concern regarding testing equipment and techniques must be addressed.
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Objective 1: Materials Testing

As part of the initial development of the rotary furnace, a main focus has to be the selection of the best materials for insulation. There are two main criteria that these materials must meet: retaining the maximum heat possible within the furnace and have excellent mechanical integrity. The second parameter is important due to the real possibility of physical impact from the steel tools used by the operator (molder) during the paddling stage.

- We have teamed with a consultant from Philbrico Inc. who specializes in material for high temperature furnaces. As part of his initial recommendations, we will be visiting a facility for steel heating that has just constructed a rotary furnace for their applications using products that he has suggested for our furnace. By using their experience, we should be able to eliminate some problems and shorten our timeframe for this aspect of the project.

A major area for opportunity for reducing energy waste in our current process has been identified in this first phase. The area where the glass blank is pressed in our current gas furnaces is non-insulated. The die and punch are heated by a separate gas burner which means obvious heat losses.

- We have purchased and begun experimenting with electric metal heating bands that can be wrapped around the tooling used for pressing. This modification will allow us to set and monitor temperature (through visual readouts) during pressing. That data will be used as a learning curve for the rotary furnace. Additionally, it is possible that we can apply this technique to our gas furnaces.

Objective 2: Prototype Development

We are currently building two prototypes: a gas furnace significantly modified from our current furnace design and an electric rotary furnace. For reference purposes, the gas furnace will be labeled #1 and the rotary will be designated #2.

#1 prototype has been altered from our current design. The framework has been increased so that the area where the glass is heated can be made larger. This added space will allow us to test the “best candidates” for the insulating materials and obtain zone temperature data with more accuracy than would be possible in the smaller furnaces. The simplicity of this design will also allow us to test reflective materials which are planned for use in the electric furnace. Our ability to have this prototype made quickly means that we can be testing ideas and projections for #2 on #1 as we build #2. We are incorporating the electric band heaters into the setup for #1 before we add them to the design for #2.
In typical small business style, we are cannibalizing a totally different kind of machine that has a rotary table that we believe will work for prototype #2. We have already ordered the materials and begun building the framework for #2. There has already been the first of probably many design modifications. We are building the frame so that a top section can be lifted off to allow access to the very heavy rotary table.

- Both prototypes are being built without "bells and whistles" in order to keep our expenses minimized. However, we are concurrently developing the specifications for the more sophisticated aspects of the final design such as the revolving door and the parts conveyor.

**Objective 3: Testing Protocols and Methods**

Some areas of concern have appeared as we have begun the actual construction of our prototypes. An area of key concern is how do we measure the temperatures in our prototypes accurately, but without the expense associated with the final design? Additionally, we expect the rotary furnace to allow us to expand the parameters of the design of blanks that we can produce as well as the quality (in terms of powder contamination). However, we do not have testing equipment for verifying these improvements. We are exploring options for best method/least cost for developing these measuring abilities and for addressing data retrieval. Specific areas of concern:

- Obtaining accurate temperature readings up to and including zones within prototype #1.
- Maintaining data files for correlation’s and historical information for material studies.
- With the potential for producing blanks of non-standard dimensions (to us), address the lack of testing equipment for measuring flatness, curvature and angles for both tooling and finished blanks.
- The need to develop methods/protocols for measuring the role that technique (variance based upon an individual operator) plays in the final blank geometry (ex.: wedge/warp/folds).
Summary and Technical Milestones

- Original project schedule being met and exceeded with two prototypes in production
- Material testing begun and possible short-cut in place through linkage with supplier for refractory materials
- Incorporation of energy-saving heating bands into current fabrication process being explored
- Invited to publish journal article on project

We believe that this quarter has shown solid promise that we can follow our projected timeline for finishing this project. With the delay in receiving our first advance on the grant funds (received at the end of the quarter). We were limited as to how much time and effort we could devote to this project while still running our business. With funding in place, we expect the next quarter to be even more successful.