Quarterly Progress Report #1

Project Title: Field Trial of a High Capacity Gas-Fired Paper Dryer

Covering Period: **July 20, 2004 to September 30, 2004**

Date of Report: October 20, 2004

Recipient Organization: Minnesota Department of Commerce

Partners: Gas Technology Institute; Western Michigan University; Liberty Paper Inc.; Groupe Lapperriere & Verrault Inc; Flynn Burner Corporation

Technical Contact: James Madson
Minnesota Department of Commerce
85 7th Place East, Suite 500
St. Paul, MN 55101-2198
(651) 297-2326
(651) 297-7891 (fax)
james.madson@state.mn.us

Business Contact Jeremy de Fiebre
Minnesota Department of Commerce
85 7th Place East, Suite 500
St. Paul, MN 55101-2198
(651) 297-1221
(651) 297-7891 (fax)
jeremy.defiebre@state.mn.us

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1. Project Objective: The primary objective of this two phase effort will be to field-evaluate and confirm the technical and economic benefits of an innovative, lower cost, gas-fired paper dryer. The key features of this technology are a rotating drum inner surface that contains a dimpled profile that intensively transfers heat from the combustion products produced by a flame sheet to the paper web.

2. Background: The drying of paper requires the evaporation of 1.0 to 1.5 pounds of water per pound of paper or paperboard produced. The conventional drying method, which has remained essentially unchanged over 100 years, uses a series of ~5 ft diameter by several feet long drums which are heated from the inside by steam. The use of steam requires the drums to meet ASME codes for pressure vessels which limits the steam pressure to 160 psia, and consequently, the shell temperature and the drying capacity are also limited. In practice, most drums operate at a lower pressure and temperature further reducing the drying capacity.

   GTI has developed and extensively tested a number of approaches to improving efficiency of gas-fired dryers. This approach combines a gas flame sheet and a dimpled profile on the inner surface of the drum to provide low-emission recirculation flow and a high heat transfer rate from the combustion zone to the paper web through the drum wall. The combination of this dimpling technique and the

design of the other internal elements (patent applied for) and the ribbon burner promotes high energy efficiencies and provides for increased productivity all with lower emissions. This type of dryer drum inner surface will help achieve shell surface temperatures of 600ºF resulting in drying rates 2.5 to 6 times higher than steam dryers that are limited to 300ºF. Using the recuperative approach, the combustion air can be preheated by hot exhaust gases, thereby resulting in thermal efficiency of over 75%.

3. Patents: **None**.

4. Publications/Presentations: **None**.

5. Progress in Past Quarter and Current Status:
a. Negotiated contract with Gas Technology Institute.

6. Plans for Next Quarter:
- Kickoff meeting scheduled for October 27.
- The acquired design data, including the performance data from the previous development and pilot-scale trial project, will be evaluated.
- The preliminary design of the full size gas-fired drum and the internal combustion system will be developed.