



Serving the Forest Products Industry in Products Development, Process Improvement and Training

**USE OF MICRO WAVE PREHEATING IN A
BATCH PRESS LVL MANUFACTURE
AN EXPLORATORY STUDY**

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April 29, 2005

INTRODUCTION

The first continuous press for the manufacture of LVL using microwave (MW) pre-heating started at Rocky Mountain, AB, Canada in October 1997. The basis for this installation was primarily theoretical with only cursory laboratory work conducted with respect to material behavior under MW, resin system characterization process economics, etc. With five such LVL mills operating in the world now, it has been demonstrated that the use of MW technology and continuous pressing of LVL is not only a technologically viable but also economically sound.

There is now a lot of in-mill experience about the use of MW systems as used in continuous press LVL manufacture. As well, there are several questions that are coming out with respect to the optimization of such processes with regard to technology updates, species of wood, resin system, veneer moisture content, glue spread levels, to mention a few. Besides getting some answers on these questions, we believe that it is logical to explore the advantages of MW technology in other forest products manufacturing applications. These include OSB, MDF, Particleboard, I-Joist, Gluelam, etc. The absence of a development laboratory with the appropriate technology MW technology had however, hindered further advancement of the technology into these products as well as further refinements of the existing systems in the field.

TTS Inc. is a forest products consulting operation with a products development laboratory in Edmonton, AB, Canada. While the principal was involved in the development of specifications, start-up and optimization of the first LVL operation using microwave (MW) pre-heating, TTS has been involved at the various stages in the start-up and optimization of three of the other plants. As a result, the company has established a recognized leadership position in MW applications in forest products manufacture. In order to maintain its leadership position in the application of MW technologies for forest products manufacture TTS installed the first laboratory continuous microwave pre-heating system in the world in January 2005 and several exploratory studies were conducted since then. This report briefly covers the results of one such study.

OBJECTIVES

This particular study was conducted to explore the potential of using MW pre-heating in batch press LVL manufacture. While the primary objective of the study was to familiarize TTS staff with MW control systems and safety procedures, secondary objectives included:

1. Exploratory study on the use of MW pre-heating in batch LVL manufacture
2. Demonstration of technology and TTS capabilities to potential customers
3. Demonstration of technology and TTS capabilities to resin suppliers

MATERIALS AND METHODS

While tests were conducted using D. Fir veneer no attempt was done to regulate or optimize energy distribution and other MW characteristics. Panels were pre-pressed cold, then subjected to MW before hot pressing in all cases. The assembly was then removed from the MW and loaded into a hot press. No attempt was made to simulate the actual open assembly times in a mill environment. The table below represents the current average industry hot-pressing cycles and targeted cycle times with MW treatment. Product thicknesses of 1 ¾ inch and 3 ½ inches were used during the study.

PRODUCT THICKNESS (IN)	GLUE SPREAD (LB/MSGL)	PRE PRESS (SEC)	HOT PRESS (SEC)
<i>CURRENT INDUSTRY AVERAGE</i>			
1 ¾	34 to 40	240	1065
3 ½	38 to 55	240	3120
<i>TARGETS DURING TEST</i>			
1 ¾	30	240	720
3 ½	34	240	2340

After a few preliminary runs to determine material flow, glue spreads, etc. the following lay-ups were constructed using the continuous MW preheating system and a 2' X 4' laboratory press.

1. 1 ¾ inch LVL using 3-5% moisture content veneer.
2. 1 ¾ inch LVL using 9-11% moisture content veneer conditioned to EMC.
3. 3 ½ inch LVL using 3-5% moisture content veneer.
4. 3 ½ inch LVL using 3-5% moisture content veneer.

In all cases glue was applied using a laboratory curtain cotter (used by all known LVL operations) and the lay-up was cold-pressed prior to being subjected to MW treatment.

RESULTS

Figures 1 and represent over 90% wood failure results following a short span bending shear test, which was typical of samples manufactured during this exploratory work. Figure 3 represents chisel test specimen.

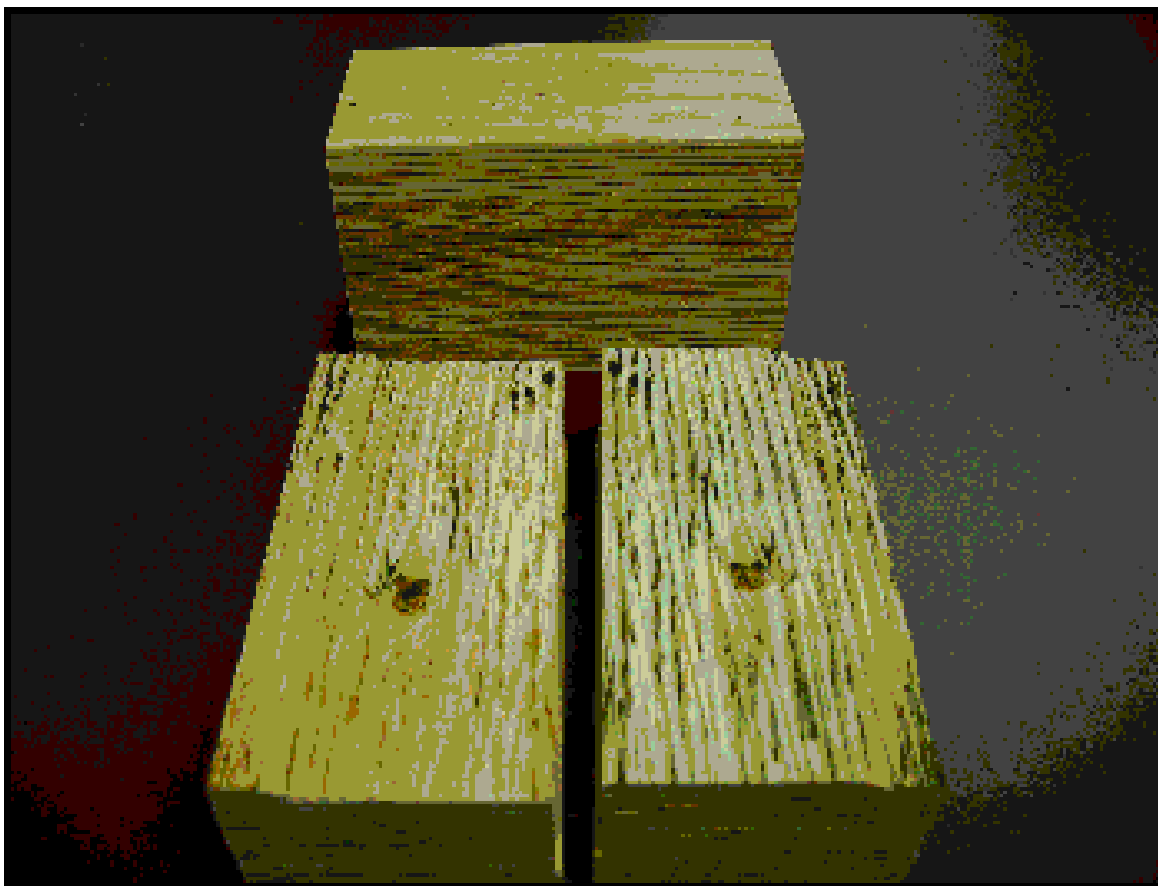


FIGURE 1: WOOD FAILURE - SHORT SPAN BENDING SHEAR TEST
(3 ½ INCH LVL PRESSED FOR 34 MIN.)

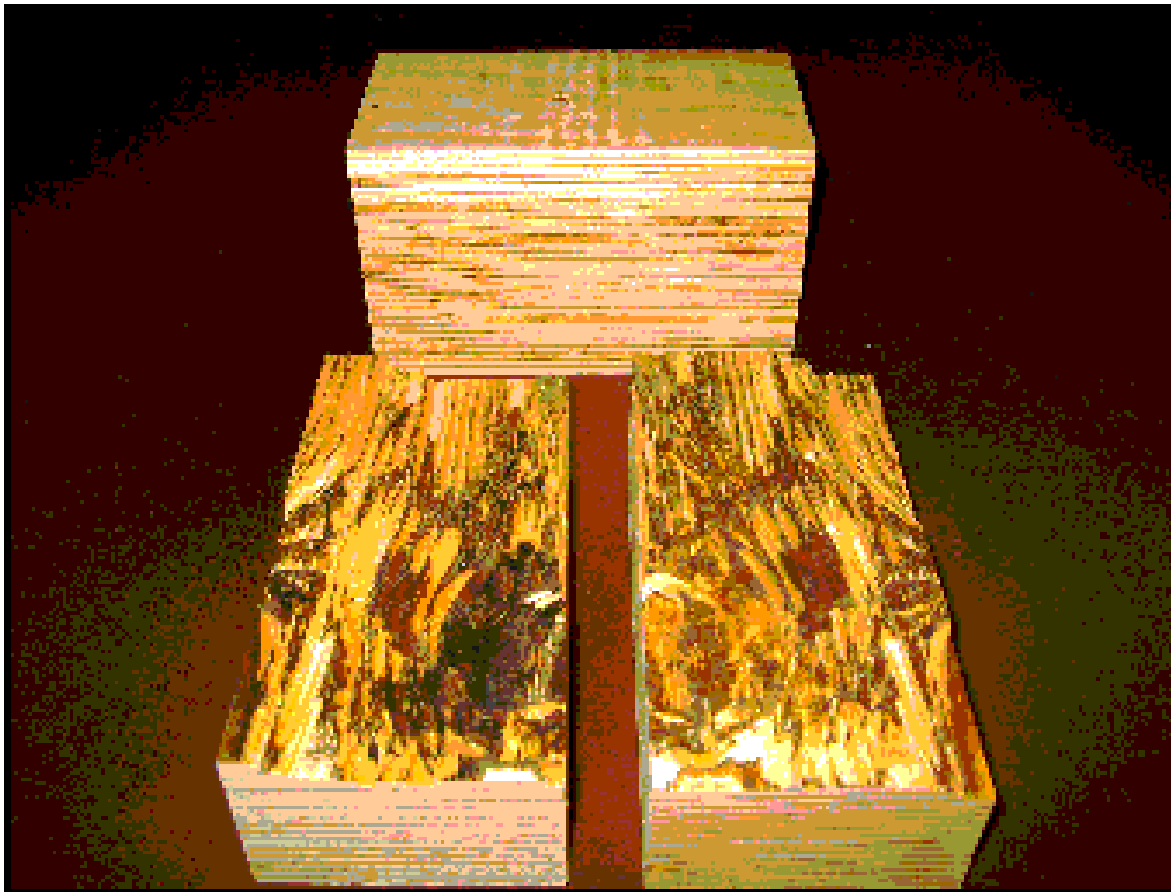


FIGURE 2: KNOTS & WOOD FAILURE-SHORT SPAN BENDING SHEAR TEST (3 ½ INCH LVL PRESSED FOR 34 MIN.)

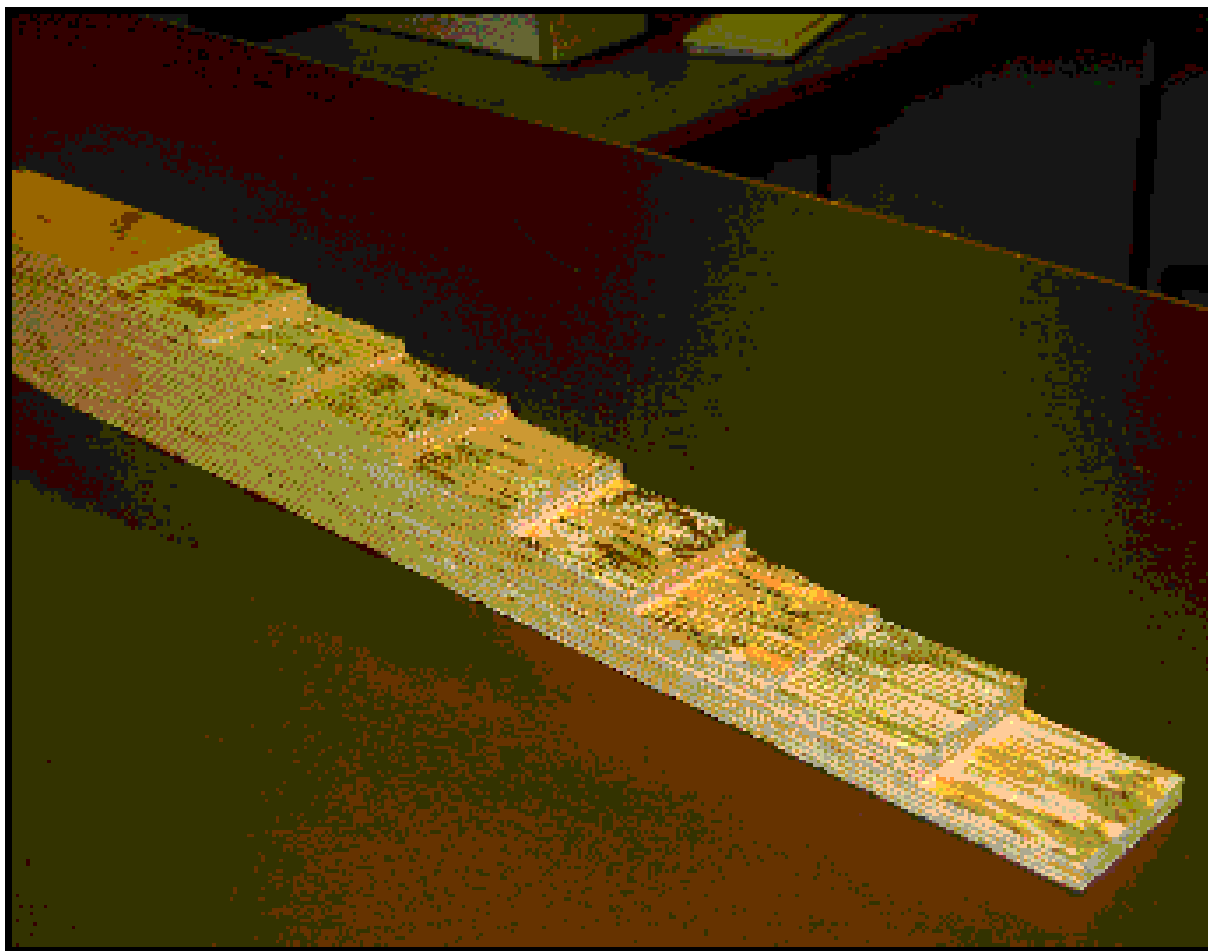
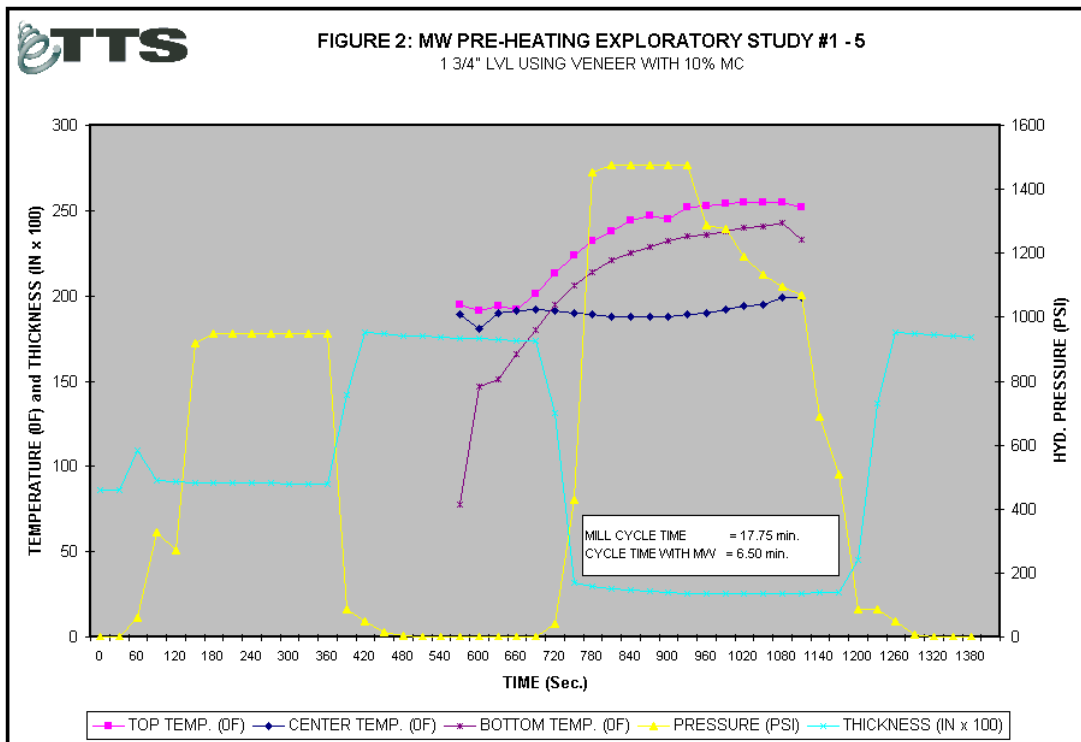
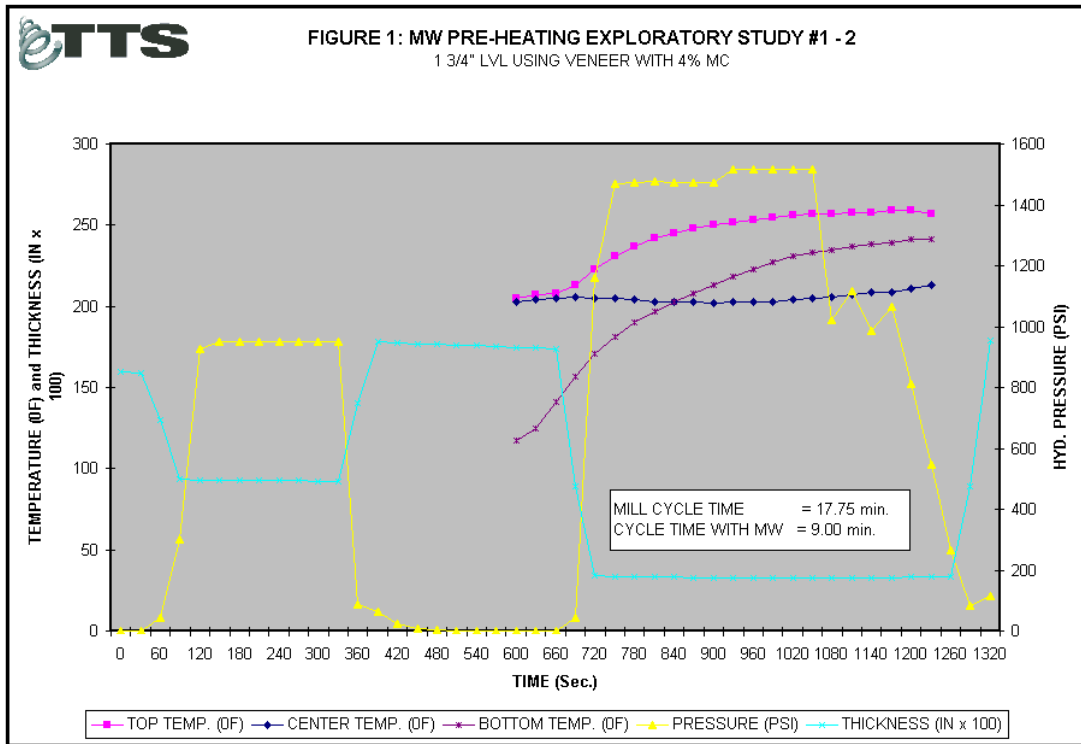


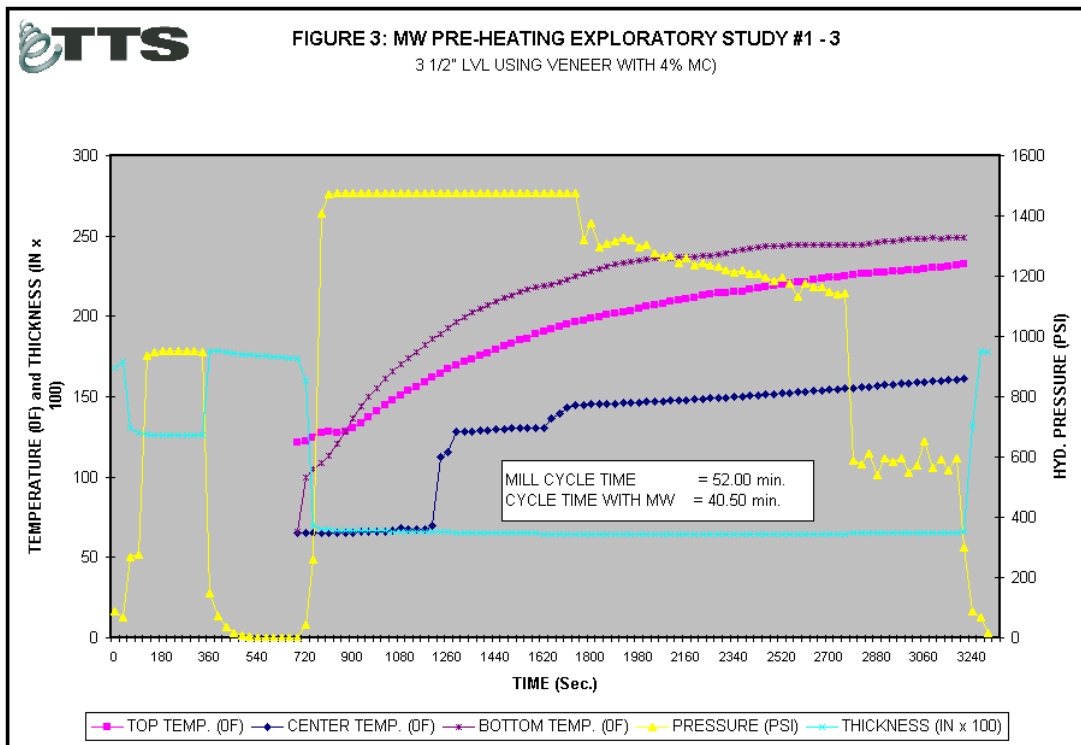
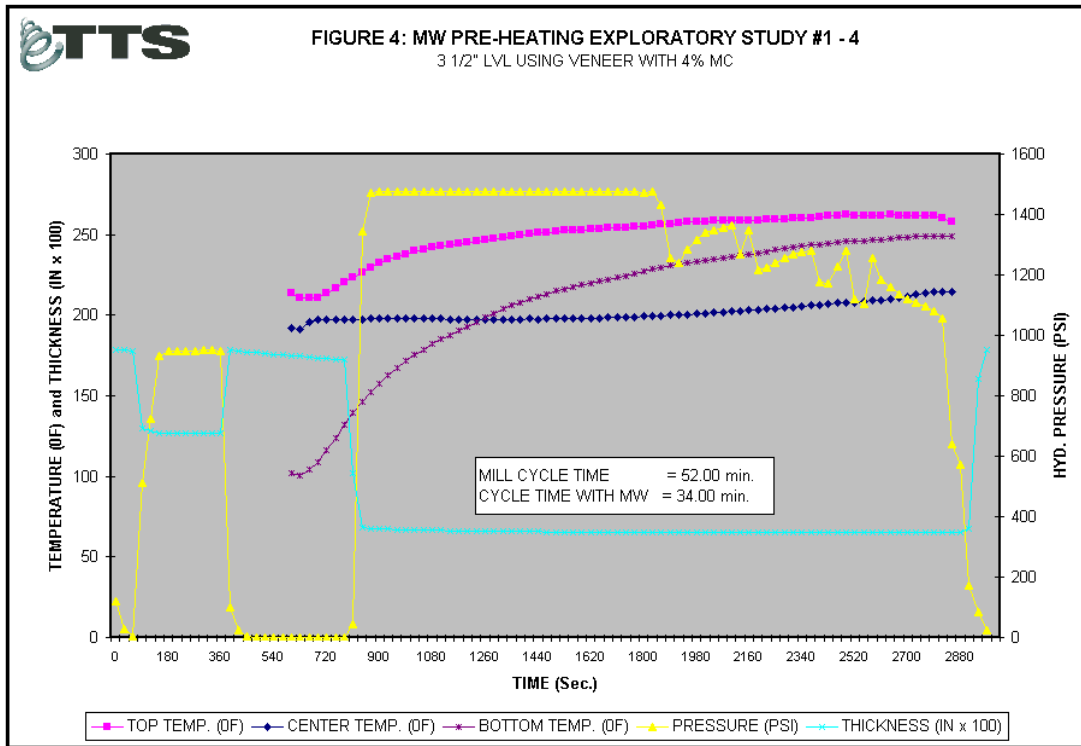
FIGURE 3: CHISEL TEST - 3 ½ INCH LVL PRESSED FOR 35 MIN

The table below is a summary of pressing cycles used for each test compared to industry average cycle times.

PRODUCT (LVL)	TEST NO.	1	2	3	4
		THICKNESS (IN)	1 3/4	1 3/4	3 1/2
PRESSING CYCLE (SEC)	CONVENTIONAL	1065	1065	3120	3120
	MW PRE-HEAT ACTUAL	540	390	2430	2040
% IMPROVEMENT		49%	63%	22%	35%

Graphs 1 to 4 are press and data outputs for each of the four tests.





PROPOSED STUDIES

The current results are very encouraging and we at TTS believe this and associated studies would be of interest to all parties in this industry:

PRODUCT MANUFACTURERS

- Efficient means to increasing press production
- Improvements in veneer drying efficiency including production, energy consumption, dryer downfall as well as drying quality.
- Reduce glue consumption
- Stress graded veneer yield efficiency
- Consistency of LVL product properties

EQUIPMENT MANUFACTURERS

- New technology development
- Improved business through upgrades

GLUE MANUFACTURERS

- New resin technology development
- New product development

While we are currently working with industry customers, TTS is actively working towards creating partnerships with equipment and resin manufacturers in the development of the technology applications as identified.