FROM THE CEO’S DESK

I am pleased to say that CRC Wood Innovations is now fully operational. Agreements have been signed off and reporting and communications processes are in place. A funding model based on project needs and institutional equity has been agreed and implemented. The nine core projects of the CRC are all underway and internal links operating successfully, bringing a sense of unity to the CRC.

A three-day planning meeting held in October 2001, involving all the CRC members and staff has fine-tuned our mission statement, and reaffirmed our objectives and deliverables. The meeting successfully cemented a culture of innovation, high-quality science and determination to commercialise new technology and underpin industry needs in education and training.

Excellent staff and post-graduate appointments have been completed for the first year and are now in hand for year two. News on these new CRC members will appear in future editions of Wood Innovations.

In equipment purchases for the current year have been finalised and an order has been placed for a 300 kW microwave to be housed in a new building provided by The University of Melbourne. We are proud that this microwave (which will be used for whole-log modification) will be the largest experimental microwave facility in Australia.

International links are a high priority for the CRC and strategies are already in place for expanding our international activities. Membership of Eurologia and developing research capabilities in Europe, market intelligence and technology commercialisation are key to realising these objectives.

The Centre is also spear-heading solutions for forest industry resource problems by expanding the utility of eucalypt plantations for high-value uses. Excellence, The Australia Centre for Advanced Wood Processing™ is being initiated to focus on research, training and expand and these activities with other interested organisations.

In addition we are undertaking research to substitute traditional wood resins and wood preservatives with less toxic active ingredients.

We are also collaborating with the University of Melbourne in hosting a national workshop on termites. This workshop will coordinate our national effort in research education and training in this important area.

PROFESSOR PETER VINDEN

RECENT NEWS

CONGRATULATIONS OF THE CRC GO TO OUR BOARD CHAIRMAN MR THORRY GUNNERSEN ON RECENTLY BEING APPOINTED A MEMBER OF THE ORDER OF AUSTRALIA. THE AWARD WAS MADE ‘FOR SERVICE TO THE FOREST INDUSTRY, PARTICULARLY TO SUSTAINABLE TIMBER RESOURCE MANAGEMENT AND DEVELOPMENT, AND THE WELFARE OF COMMUNITIES DEPENDENT ON THE TIMBER INDUSTRY’. OUR CONGRATULATIONS ALSO GO TO MR GUNNERSEN ON HIS MAGNIFICENT WIN IN THIS YEAR’S MELBOURNE TO HOBART RACE. MR GUNNERSEN SKIPPED HIS YACHT ‘TILTING AT WINDMILLS’ ACROSS THE FINISHING LINE IN HOBART TO BE PLACED FIRST IN THE INTERNATIONAL MEASUREMENT SYSTEM DIVISION OF THE RACE, WHICH IS CONDUCTED EACH YEAR BY THE OCEAN RACING YACHT CLUB OF VICTORIA.

MAXIMISING THE POTENTIAL OF WOOD PRODUCTS

The current trend in forestry in Australia toward managed plantation resources has been driven by environmental concerns which focus on the cessation of native forest logging and replacing this industry with plantations for industrial wood production. This has been a worldwide trend in recent years, initiated as a consequence of public pressure to reduce harvesting in native forests, and to utilise these lands for the purposes of conservation and recreation.

Critical to the success of plantation forestry is maximising the recovery of the resource in high value products. To achieve this, CRC researchers at the Queensland Forestry Research Institute (QFRI) are leading research into the development of high quality wood products for long-term service in a wide range of environmental conditions. By linking products’ serviceability and lifetime performance requirements with design, the research will assist in developing design criteria for performance of the products under conditions of changing temperature and relative humidity. This will be achieved through qualitative and reliable information concerning the true service life of wood products in time, its appearance and behaviour over time.

The research will investigate time and climate dependent characteristics of wood and wood based materials through the simulation of various environmental conditions which they may encounter during transport, storage and use. This will lead to the ability to develop and adopt mathematical models to predict the long-term performance of wood products under various climatic conditions. A number of variables will be studied including creep, load-rupture, stability and joint fatigue of microwave modified wood and various wood combinations. The models will enable the development of guidelines on how to incorporate this data into design and construction of wood products and how to maintain suitable performance during the expected service life.

The CRC researchers at QFRI are committed to developing optimal parameters for wood products to maintain long-term high performance and quality during transport, storage and use in a variety of climates. The core team of researchers comprises Ms Amanda Yeates, Mr Enda Lyons and Mr Gary Hopewell. Ms Yeates is a civil engineer and is the manager of the Forest Products Program. She has over 10 years experience in the forest products industry, including three years in timber design. Mr Hopewell has an honours degree in structural engineering which he obtained in his native country, Ireland. After graduation My Lyons worked as a design engineer before moving to Australia. Mr Hopewell has worked in the forest industry for over twenty years, including forest management and for the past ten years, utilisation of forest products. The team is part of the CRC Wood Innovations Program Two, ‘High Value-Added Wood Products’ and will work closely with other CRC researchers and industry members to achieve the objectives of the project.

MS AMANDA YEATES, PROJECT MANAGER
WOOD BENDING FOR HIGH VALUE WOOD PRODUCTS

Bending, as a means of producing curved parts in timber construction, has many advantages over other methods of manufacture, the principal one being greater strength and recovery of timber. Up to 100% higher yields can be gained compared to the traditional techniques used in shaping wood. This, combined with remarkably higher quality and durability of the finished product, leads to lower production costs and an improved cost benefit to the industry.

Bentwood componentry is used extensively overseas in a broad range of applications such as furniture, joinery, musical instruments, sporting goods, etc. Wherein, in Australia, bentwood has been limited to a handful of manufacturers, craft producers and individual designers.

Research Focus

As part of the CRC, this project aims to investigate innovative techniques for the manufacture of bent components from Australian furniture timbers, in particular young, fast grown timbers. Research will focus on:

- the use of microwave technology for softening and modifying timber to improve its bending characteristics, and as a process for setting bends
- producing bends of radii typically used in furniture production
- experimenting with very tight and complex bends leading to radical designs previously confined to craftmarkets
- determining optimal process parameters and structural properties of bent components.

PROGRAM 1 “MW MODIFICATION OF WOOD”

Technical specifications of the MW plant

1. Parameter of timber:
   - Max. log thickness: 350 mm
   - Timber length: 3-6 m
   - Microwave power: 30-300 kW (frequency 0.922 GHz)
   - Heating speed: 1-20 cm/sec
   - Air dynamic system
   - Heater (variable): 5-30 kW
   - Fan (variable): 5-10 kW
   - Air temperature: 20-200°C
2. MW applicator
   - Opening: 400 mm
   - Diameter of working zone: 450 mm
   - Length of working zone: 1000 mm
   - Electric field strength: parallel to wood grain
   - Vector E orientation

The MW plant operates utilising a conveyor system. Sawmill or round timber is fed by cross conveyor to a sluice which rotates the timber to a feeding and centering conveyor. This conveyor moves the timber through the MW applicator. A fan activates and MW energy is supplied by 3 generators to the timber. Water heating and boiling in wood occurs very quickly to provide the required pressure in the cells. Excessive pressure results in selective modification of wood tissue to increase wood permeability. Afan removes vapors and dust from the zone of the application.

A combination of the manipulation of MW power supplied to the applicator and the controlling speed provides the control mechanism. MW treated timber is transported by the receiving conveyor from the applicator to the second sluice. The second sluice rotates timber to the second cross conveyor.

The facility will be used for scale-up experimental work to test the feasibility of MW processing for a variety of applications. These include the preservative treatment of logs for electricity poles and telegraph poles, accelerated drying of hardwood species and the production of new composite materials. The CRC Technical Committee has already approved a $1 million generator and other equipment for 310 kW experimental plant. The next step will be the design of the plant. We anticipate commissioning the plant at Creswick later in 2002.

Andrew Rozsa

VINTORG A NEW MATERIAL

An exciting investigation into the manufacture of a new type of composite product “Vintorg” forms the core of the CRC’s projects. Project 1.4, Microwave Modified Solid Wood Products. Vintorg is a composite material which has been modified by the application of microwaves.

Project 1.4 is evaluating the production of timber from microwave modified timbers for treating timber with new resins that take advantage of the unique properties created during and by the microwave conditioning process. Modification of the intensity of microwave treatment and the careful selection of resins will make it possible to produce microwave modified composite timber products that tailor performance to application requirements. Perceived advantages of the new timber composite include greater strength, increased durability, improved process uniformity, greater dimensional stability and more efficient use of timber resource. To achieve this outcome the project is starting from the ground floor. We are developing new resins and sealers that are designed for microwave modification.

As heating occurs inside the specimen, complete softening is obtained very quickly. Large specimens whose pretreatment may take hours with steaming is reduced to minutes. Temperature can be easily controlled in order to obtain the best processing conditions.

Why Study Wood Bending Today?

- The technique of bending wood has not changed significantly since the 19th Century.
- Bending is restricted to some wood species with straight grain and no defects.
- Decreasing supply of low, bending quality softwoods.
- Improved performance, durability and safety in curved constructions.
- Malaysian furniture timbers and next to no research has been undertaken on Malaysian timbers.
- The Australian furniture industry needs to promote unique strength and durability characteristics of Australian timbers.

Advantages of Microwave Technology for Wood Bending

- Air heating occurs inside the specimen, complete softening is obtained very quickly.
- Large specimens whose pretreatment may take hours with steaming is reduced to minutes.
- Temperature can be easily controlled in order to obtain the best processing conditions.

Where to from here?

Two postgraduate students, Lisa Whiting and Andrew Rozsa, have already begun research investigating the potential of using microwave heating for the production of bent components in an industrially process. Lisa’s project involves a comprehensive investigation of the “the optimal softening conditions for bending solid wood using microwave heating.” The experimental work will initially be carried out using a 5 kW microwave. The parameters to be investigated include wood temperature, timber dimension, microwave irradiation time, microwave power and timber moisture content.

In addition, the effect of variables such as density on the bending properties of solid wood will also be explored.

Lisa Whiting and Andrew Rozsa

Andrew’s Project

When wood is heated and bent, the structural elements are stressed in ways that are not yet fully understood. A part of this research will be to define and measure the nature of the changes in the wood structure so that the information can be used to predict the behaviour of wood during the bending process. The effect of differences between bending wood with traditional steaming and microwave heating will be compared for different moisture contents and heating regimes.

PROGRAM 1.4 MANAGER: JEFF HAWKINS

PROJECT 1.4 MANAGER: GREGORI TORGUNNIKOV

Diagrams of the microwave plant for timber modification

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PROJECT 1.4 MANAGER: GREGORI TORGUNNIKOV