Graeme Bullock, General Manager,
Sugar Research Institute, Mackay.

Mr. President, ISSCT committee, congress organising committee, special guests, delegates and partners.

It is a great honour for me to be invited to address you in this session of the ISSCT congress and to present a little of the history of Australia’s main sugar milling research provider, the Sugar Research Institute.

As many of you are aware, the institute was established in 1949 by key people in the sugar milling sector to increase the industry’s research focus on the problems being experienced at that time in sugar factories. Those problems were much the same as those experienced today - the need to improve sugar quality, boost throughput, improve factory efficiency and, of course, boost profits.

Backed solely by its members’ levy funds, SRI began work with a tiny staff with no home base, concentrating on processing and sugar quality issues, and progressing to engineering problems.

In its 50 years, the Sugar Research Institute’s range of research projects has broadened vastly. We employ a diverse research staff of about 50 mechanical, civil, electrical, electronics, computer, combustion, chemical and railway engineers, and chemists, scientists and microbiologists. Research has expanded into harvest and transport, extraction, energy issues, juice processing to syrup, syrup processing to sugar, computer modelling of factory processes, factory efficiency and environmental issues associated with raw sugar processing. The institute also undertakes consulting work and training as part of its technology transfer activities, along with preparation of design specifications and some manufacture of specialised instrumentation.

Any scientific researcher knows that the sharing of knowledge is the key to prosperity and that although a discovery might be attributed to one or two researchers, the groundwork is frequently laid by others, sometimes in different organisations.

It is the ability of technologists to share in each others efforts to solve technical problems which I would like to focus on in the future.

I would like you now to watch a short audio-visual presentation as a tribute to the achievements of the world’s sugar technologists - all of them - and I congratulate them on their efforts to improve the industry’s prosperity over the past 50 years since the Sugar Research Institute was established.

The first part of this presentation is by Sugar Research Institute chairman Dr. Ron Swindells who is well known to many of you. He is unable to be with us here but sends his best wishes for a successful conference.

Thank you.

VISUAL PRESENTATION

AUDIO (Reader - Ron Swindells)

ISSCT president and committee, congress organising committee members, special guests, delegates and partners. I apologise for my absence from this year’s congress, which I know from past experience will be tremendously stimulating. However, I am with you in spirit and you have my best wishes for a successful congress.

You may be aware that 1999 marks the 50th anniversary for the Sugar Research Institute. I am proud of the institute’s achievements over this period, but I am keenly aware that these achievements, significant though they may be, parallel similar accomplishments elsewhere throughout the international sugar industry.
At this point, I would like to mention that our fraternal organisation, the Sugar Milling Research Institute of South Africa, also reaches its 50th anniversary this year.

Achievements in research are born of a need to rise to challenges. Researchers around the world have proven consistently that they are well able to continue their tenacious search for the keys to the industry’s continued growth and survival.

The presentation you are about to watch focuses on the enormous scale of change which has characterised the Australian industry over the past half century. The Australian experience is a microcosm of the change which continues in the world’s entire sugar industry and which has demanded the most that sugar technologists can give.

**VOICE OVER (Dave Perkins)**

Sugar cane was grown in Australia as early as 1823 and, like its overseas counterparts, its cultivation has spread rapidly ever since. Cane growing was hard manual work. Milling was primitive with small mills established by planters to process their own crops.

Many of these mills were unprofitable and closed; some merged with others until, by the 1950s, many Australian mills were co-operatively owned by the growers who supplied them. Some were owned by large sugar companies.

In the 1950s, sugar milling was already a large scale operation. The average crushing rate was 90 tons per hour and the mills each processed an average of 260,000 tons each season.

In 1926, 23 years before the establishment of the Sugar Research Institute in Australia, a new mill was built for the Tully Sugar Milling Co-operative, the last complete sugar mill to be built in Queensland.

In 1926 Tully processed 65 tonnes of cane an hour. In 1998 Tully processed 625 tonnes of cane an hour and its capacity has been expanded over the years.

The changes which occurred within this mill are reflected on a larger scale throughout the world’s sugar milling factories.

The technology brought to bear on sugar milling is the key to this change.

The industry has watched the phasing out of the laborious hand-cutting and the successful introduction of mechanical harvesting, which has been responsible for significant changes in the delivery of cane to mills.

Mechanical harvesting has also brought a different set of challenges for millers and technologists, including the increased amount of extraneous matter or trash to the mills and the problem of cane stick deterioration and subsequent effects on juice.

Transport of cane to the mills has become more efficient, with the passing of the old flatbed wagons carrying whole stick cane and the introduction of bins to transport chopped cane. Technologists have dealt with a myriad of transport-related issues, including development of different types and sizes of cane bin, different couplings, development and introduction of remote-controlled brake vans and techniques to slave locomotives together for better operation.

Milling techniques have become more sophisticated, thanks to technologists’ work on improving understanding of milling theory, better mill feeding and the quest for harder-wearing roll shell materials.

Clarification work by researchers has resulted in improved clarifier design incorporating better flow patterns, more efficient settling out of impurities and greater efficiency of operation. The use of computational fluid dynamics has revolutionised design of the SRI clarifier in the past three years.
Evaporation has benefited from the introduction of multiple effects to get better throughput and lower energy usage. Now many factories have twin evaporator sets. Perhaps, surprisingly, technical change has been slow in this area.

Further down the processing line, vacuum pans have undergone a revolution, from the traditional batch pans to the modern continuous installations which are now essential to efficient production, for example, the Tully mill now uses continuous vacuum pans for its entire production of all three massecuities.

Crystallisation work has focussed on improved crystal formation and isolation and quantification of impurities within the massecuite. Research has also resulted in development of mathematical modelling to show the results of modifying the crystallisation process.

Continuous centrifugals have been used since the early 1960s; now they are a common item of factory plant for certain grades of sugar. While some factories use only continuous fugals, these are exceptions. Work continues on improving their design and operation to enable their use for all high-grade sugars.

Sugar drying has benefited from the researcher’s attention, with improvements in dryer performance, better understanding of temperature and air flow behaviour and closer automatic control resulting in a better quality product for shipment.

Knowledge of the behaviour of boilers and related energy issues has increased with study into boiler design, operation and maintenance. Research into environmental issues such as stack emissions has assumed greater priority.

Researchers have contributed to the logistics of bulk and bagged sugar loading and transport, with the modern installations a huge improvement on those of the 1950s, when manual loading of bagged sugar inhibited the supplier’s performance in domestic and export markets.

The changes in factory equipment have been mirrored by changes in analytical equipment in laboratories.

Techniques such as scanning electron microscopy, high resolution nuclear magnetic resonance spectroscopy, gas chromatography with mass spectrometric detection and various forms of high performance liquid chromatography are just some of the tools used to unlock the secrets of sugar chemistry.

Rarely are these techniques useful for real time process control, but there are exciting developments emerging in near infrared transmittance spectroscopy and low field NMR, which may dramatically improve direct process control.

However, without doubt the greatest change affecting the researcher’s world is the availability of powerful computational methods for analysing, simulating and enhancing equipment designs.

It doesn’t matter whether your interest is harvesters, boilers, milling sets, evaporators, pans, clarifiers or crystallisers, computational tools are enabling giant leaps forward in equipment design and performance.

Interestingly, many of these advances are in terms of increased throughput from smaller, lighter, less expensive equipment, suggesting at last that bigger is not always better.

In conclusion, this presentation recognises the evolution of sugar milling technology over the last 50 years and forecasts an even greater pace of innovation in the future.

Australia’s Sugar Research Institute salutes the researchers and technologists around the world who make this possible.