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The Secretary
Standing Committee on Science and Innovation House of Representatives
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Attn: Dr A Dacre

SUBMISSION TO THE INQUIRY INTO PATHWAYS TO TECHNOLOGICAL INNOVATION.

The Standing Committee has sought submissions detailing successful examples of Australian technological innovations. Submissions are also sought, with particular reference to successful innovations, on issues such as:

- 1 pathways to commercialisation;
- 2 intellectual property and patents;
- 3 skills and business knowledge;
- 4 capital and risk investment;
- 5 business and scientific regulatory issues;
- 6 research and market linkages;
- 7 factors determining success; and
- 8 strategies in other countries that may be of instruction to Australia.

INTRODUCTION

ANZAAS, the Australian and New Zealand Association for the Advancement of Science, welcomes the opportunity of making a submission to the Committee's current inquiry.

ANZAAS has promoted science and technology in Australia for over one hundred years.

Modern society is utterly dependent upon technology, and that technology was developed on a base of science.

Australia has a long history of successfully harnessing science for the development of society and the economy. There are numerous examples of innovation in agricultural science and engineering, mining, medicine and the manufacturing industry. In some areas of technology, developments from overseas are applicable to Australia, and for example, Australians are noted for their rapid uptake of digital technologies. In other areas, particularly in agriculture and mining, the unique features of the Australia environment mean that the desired technology has to be developed in this country.

History teaches us that innovation and commercialisation have rarely been predictable. New ideas can arise in the most unlikely to places, so that we need a culture that is receptive to and supportive of the new and radical. The pathway to successful innovation is essentially Darwinian rather than Lamarckian - just because we can see a need or market for some particular product does not necessarily mean that it will ever eventuate. Contrast for, example, lasers which when first invented were a curiosity with few obvious purposes, but which now are everywhere, and the blue rose, a holy grail for years, where success has been elusive and the best outcome is a sort of bluey mauve. Spin offs along the way may prove more important than the original goal. To take an Australian example, the orbital engine has over decades of development yet to enter commercial production but has resulted in major advances in fuel injection technology.

We would like to comment upon a number of specific issues raised by the Inquiry's terms of reference.

ISSUE 2INTELLECTUAL PROPERTY AND PATENTS

Historically a great deal of the research base for innovation in Australia has been in the public sector (universities and state and federal research organizations). The culture of public sector science was focussed on 'public good' and dissemination of knowledge was perhaps given priority over protection of intellectual property. Certainly, there are examples of public sector organizations securing patents over major inventions, but broader protection of intellectual property has been more limited.

The public sector institution remains a major driving force for scientific development in Australia. However, we suspect that many scientists in the sector are relatively ill informed about intellectual property protection and patenting processes. There are also tensions between the desire to publish in the freely available literature and possible commercial confidentiality. Promotion pathways in universities and government agencies are heavily influenced by success in publishing in journals with high citation indexes. More recently weight has been given to patents and commercialised software but there are not consistent regimes within and between institutions for assessing non-published achievement. We do not in anyway wish to downplay the importance of 'traditional' publication, but it is important to promote and reward other ways of reporting successful research. Given the diversity of possible innovations, there will doubtless need to be many individual arrangements, but nevertheless, we would hope that there could be a consistent framework in which individual arrangements would be accommodated, so that there was not a lottery such that researchers at university 'x' or government agency 'y' felt less incentive to protect intellectual property than those in university 'a' or agency 'b'.

ISSUE 3SKILLS AND BUSINESS KNOWLEDGE.

Few science graduates would have received formal training in their undergraduate degrees about intellectual property, patents or commerce. Similarly graduates in commerce or business are unlikely to have much understanding of science and scientific research. Even in double degrees (science/commerce) which are becoming increasingly popular there are unlikely to be courses dealing specifically with the commercialisation of research.

We would commend the Diploma of Innovation Management, offered by the Faculty of Science at the University of New South Wales, as an example of one successful program which attempts to fill the void.

ISSUE 4CAPITAL AND RISK INVESTMENT

Scientific research is expensive, often needs a long time frame, and outcomes are uncertain. While, for the development of scientific understanding, negative results may be as important as successes, shareholders would not view favourably increased understanding without financial return. While appropriate incentives, through the taxation system and other mechanisms, are vital to encouraging research by industry, many companies do not have the resources to sustain research. It is essential that public sector research also be promoted, although links to the commercial world should be developed to take research outcomes through the development phase to the market. This will involve governments in a degree of risk.

Not all research will yield eventual return, but we would anticipate substantial return over the long term, not only from patents, but also from taxes on eventual earnings.

ISSUE 5BUSINESS AND SCIENTIFIC REGULATORY ISSUES.

We would like to raise two issues, one regarding scientific regulation the other from business.

One of the great potential growth areas for science to lead to major commercial returns is in development of products and processes from living organisms. Australia has a biota with a very high degree of endemism so that we have unique opportunities in this regard.

However, issues of access to the biota, and of ownership of genomes are uncertain in many cases. Different states have different rules and regulatory regimes. Contrast Queensland, where much work has been done in developing a regime, with NSW where there is no equivalent. The Commonwealth is a potentially important player, not only in regard to the biota of Commonwealth Territories, but also in regard to the extremely diverse biota of the marine Exclusive Economic Zone.

We are aware that there are strongly divergent views in the broader community about the ownership and use of biological resources.

We now have the tools to explore and exploit the genetic resources of the biota and. if these tools are to be used for social and economic benefit, there needs to be certainty and consistency in the rules for bioprospecting and subsequent development.

In regard to business regulation we feel it would be appropriate for companies to be required to report on Research and Development expenditure in their annual reports. Many do, but as we understand it there is no requirement that it be identified. This would enable shareholders to question Boards on this issue and highlight, to the wider public, which companies were active in research.

ISSUE 6RESEARCH AND MARKET LINKAGES

We would like to stress that, underpinning the development and commercialisation of research, there has to be a broad basic scientific education and research base.

We acknowledge the funding and other support provided to basic research by governments, state and federal.

Nevertheless we would express concern about the likelihood of serious shortages of science teachers, the lack of appropriately trained graduates in key areas and the aging research infrastructure in many fields.

Important new innovations may indeed start life as ideas on the back of envelopes, or as string and sealing wax experiments, but the follow up research and development requires substantial investment.

EXAMPLES OF SUCCESSFUL INNOVATION.

The experiences of Dr M (Mike) J Murray, BSc (Dunelm), PhD (Cantab), FTSE, FInstP, FIEAust.

These experiences illustrate successful innovations where public laboratories have cooperated with private companies and government.

Currently, Mike is Chairman of the Board of Directors of RFID Company, mems-ID Pty Ltd, and is a member of the founding group of the Australian Small Technologies Alliance and Chairman and Managing Director of Brightside Pty Ltd, a private family company with specialized interests in music, computing, and technology. He holds fellowships in the Academy of Technological Sciences and Engineering (FTSE), the Institute of Physics (FInstP), and the Institution of Engineers Australia (FIEAust). He is Deputy Chairman of the Federal Council of ANZAAS, a member of the Victorian Committee of ANZAAS and Chairman of Youth ANZAAS 2003

Mike joined CSIRO in 1975. He left CSIRO after 26 years when he set up Brightside. During his last five years at CSIRO he was Corporate Executive with responsibilities for seeking major initiatives to strengthen CSIRO's links to Australian industry and universities. For the ten years prior to his Corporate Executive role, Mike was Chief of the CSIRO Division of Materials Science and Technology.

1992, Mike was co-founder, together with colleagues Drs S P S Badwal and K Foger, of Ceramic Fuel Cells Ltd which recently floated on the ASX. In 1997, with other colleagues, X-Ray Technologies Ltd, currently being floated on the AIM in London as XRT. The foundations were also laid by Mike and his co-workers for the eventual spin out in 2001 of Optical Engineering Associates Pty Ltd.

Other successful CSIRO spin out business opportunities that were supervised by Mike included Transformation Toughened Partially Stabilised Zirconia (TT-PSZ), the toughest ceramic ever developed, now manufactured by Carpenter Advanced Ceramics Pty Ltd; the SIRO2 oxygen sensor manufactured by two companies, Novatech Controls (Aust) Pty Ltd, and Ceramic Oxide Fabricators Pty Ltd; and nano-sized UV light absorbing zinc oxide powders for use in clear sun screen oils, varnishes, and plastics, manufactured by Micronisers Pty Ltd. He also led several other commercialising ventures including; the establishment (via novel work on polymeric active packaging films) of the CRC for International Food Manufacture and Packaging Science; environmentally friendly starch-based water-degradable polymers, through early work which ultimately led to the establishment of Plantic Technologies Ltd; and the optically variable high security device, Exelgram, that has been adopted for use on many banknotes and security documents worldwide including American Express travellers' cheques. He also initiated the excimer laser work at Swinburne University of Technology that led later to the formation of MiniFAB.

By mid 1995 CSIRO Division was earning half of CSIRO's total royalty revenue.

The Division was also responsive to requests for help from companies. A good example was a request for urgent help from ACL Bearing Company in 1994. The problem was efficiently resolved co-operatively over several months, but the experience led to a further co-operative R&D programme over several years which has resulted in quite new and improved bearing materials. These novel products are now sold globally.

In earlier times (the mid 1980s), as a consequence of the commercial success of the TT-PSZ project Mike persuaded the CSIRO Executive Team to acquire a company located in the USA (Ionarc), which made zirconia powder from mineral zircon using a novel process, and which was being sold by its Australian owner, (Associated Minerals Consolidated) to complement the new PSZ business. This purchase would have been CSIRO's first ever commercial step of this type, undertaken with the intent to provide Australian industry with a strategic value adding opportunity based on CSIRO's own downstream research. Due to unforeseen circumstances this acquisition failed at the eleventh hour, but the purchase was later concluded instead by ICI Australia. Mike had already made arrangements for a sister CSIRO Division to undertake work in this field and a collaboration began with ICI Australia which resulted (1988) in the establishment of a zirconia fine chemicals plant at Rockingham in WA. This plant is today owned by Doral Minerals and forms a significant link in the mining/mineral processing, value adding and export industries in that State.

More recently, Mike was founder (in 1997) and co-chairman of the Industrial Synchrotron Roundtable (ISRt), the industry/university/government group whose work over five years provided the critical input to the Victorian Government's decision in 2001 to establish a Synchrotron Light Source in the Monash Precinct. In an independent economic report on the Synchrotron by Victoria University's Centre for Strategic Economic Studies it was concluded that over a 25 year operating life the expected return to the Australian economy from the estimated $750 million capital and operating expenditure would be in excess of $30 billion.

The development of Altium Limited

We wish to draw to your attention the case of Altium, (Altium Limited, Level 3, 12a Rodborough Road, Frenchs Forest, NSW 2086 Australia, Telephone: +61 2 9975 7710 Facsimile: +61 2 9975 7720 http://www.altium.com).

The growth of this company illustrates issues 1, 3, and 6 in the above listing. It shows how commercial success has come from the development of discoveries made in university laboratories and how the company has, in turn, strengthened the efforts of the laboratories.

Altium (formerly Protel International Limited) was founded by Nick Martin in 1985 in Hobart, Tasmania, to develop PC-based software to aid in the design of Printed Circuit Boards (PCBs). His initial DOS PCB design tool was readily accepted by the Australian electronics industry, and by mid-1986 Altium was exporting the design package through distributors to the United States and Europe. As a result of the success of this PCB design package, Altium extended its product range to include schematic capture, PCB autorouting and automatic PCB component placement software.

In the late eighties Altium recognized that an opportunity existed to develop Electronic Design Automation (EDA) software utilizing the Microsoft Windows platform. There was little EDA software available for the Windows platform at the time, despite advances in its processing capabilities and reliability, and there were increasing numbers of design engineers using Windows-based operating systems. Consequently, in 1991 Altium released the world's first Windows-based PCB design system, Advanced PCB. Over the next few years, and with the benefit of various product additions and enhancements, Altium established itself as an innovative developer of EDA software.

In 1997, Altium identified a growing need to present all core EDA software tools as one integrated package, thereby allowing a seamless progression from design concept through to production. In the next two years several products were released which culminated, in 1999, in the "Design Explorer" platform which allows seamless integration of all aspects of electronic design – design tools, document management, component libraries etc.

Altium undertook a successful Initial Public Offer, and listing on the Australian stock market in August 1999. The funds raised were used to make suitable company and technology acquisitions in 2000/01, including the purchases of ACCEL Technologies, Metamor Inc, Innovative CAD Software and TASKING BV. With these technologies Altium was able to enter the FPGA (Field Programmable Gate Array) Design and Synthesis market in 2000, and the Embedded Software Development market in 2001.

To better reflect the company's new market position of having multiple brands in the embedded and FPGA as well as EDA markets, on August 6, 2001 Protel International was renamed Altium Limited. This new corporate master-brand was designed to equally represent all product brands and provide a unified platform for future growth.

In 2002 Altium re-engineered the Design Explorer (DXP) platform and with Protel DXP launched the first product on the new DXP platform. Protel DXP was the first product in the EDA industry to address the entire board-design process within a single application.

Today Altium has approximately 300 employees worldwide, with its head office located at Frenchs Forest in Sydney, Australia. Research and development activities are conducted in Sydney and Europe. The company operates sales and support offices in Australia, the United States, Japan and Europe, and maintains a network of resellers in all other major markets including China, India and the UK. Altium's customers include IBM, NASA, Motorola, Hewlett-Packard, Canon, Fujitsu, Bosch, Siemens, Delphi, NEC, Sony, BMW, Alcatel, Daimler-Benz, Philips, CSIRO, Nokia and Telstra. Altium's industry partners include Mitsubishi, Infineon, Intel, STMicroElectronics, Atmel, Analog Devices and Philips.

Mr David Warren, non-executive director, is another link between Altium and the University of Tasmania. He has an Honours degree in Physics from that University. He worked in the field of electronics research and development for several years prior to joining Altium's management team in 1987.

The beneficial results of the relationship between the company and the university are shown in the following press release which reads (in part):

At an event held on April 19, 2005 at the University of Tasmania, Altium Limited announced one of the largest corporate sponsorships to date for the School of Mathematics and Physics with the donation of cash, software, hardware, and support to the value of $158,000 to the University of Tasmania Foundation. The donation presented to the university by David Warren, non-executive director of Altium, is to be distributed over a three year period. It is for the development and completion of two projects – a radio transient detector and high-bandwidth interferometer both relating to advanced radio astronomy research being undertaken at the School of Mathematics and Physics.

"Today's announcement demonstrates Altium's ongoing commitment to supporting and equipping the next-generation of electronic designers and engineers," said Nick Martin, founder and CEO, Altium.

"The nature of computations required in the projects results in immense data analysis tasks," said Larry Forbes, head of school in mathematics and physics, University of Tasmania. "Both projects need to crunch data in real-time, but the technology up until now has not been available. It was Altium's industry-leading FPGA technology that met our needs. Altium's 'LiveDesign' methodology provides the ability to interact with circuitry in real-time before actually building devices. Furthermore, Altium's technology is easy to use -- it can be fully utilized without the need for advanced FPGA design skills and frees up time for our professors to concentrate on their core competencies."

The radio transient detector project, led by Professor John Dickey, involves the search to identify transient, giant bursts (pulses) of radio energy. There are numerous sources of pulses in the sky like collapsed stars and cosmic rays, so by using the radio telescope located at the university, the detector will enhance the ability for researchers to find those sources and detect the pulses. The high-bandwidth interferometer project, led by Professor Peter McCulloch, will enable the professor and his team to prove that a class of variable radio sources are giant black holes at the centres of distant galaxies. The interferometer (linking two telescopes to use as one) will bring signals from two antennas and combine them in different ways. Professor McCulloch and his team will use this data to monitor the variable sources that are suspected of being giant black holes.

ABOUT THE SUBMISSION.

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