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# Independent assessment of achievements

Report by Access Economics Pty Limited for

**CRC HEAR**



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## 1. CONTEXT AND PROCESS

Access Economics was asked to undertake an independent evaluation of the performance of the Cooperative Centre for Cochlear Implant and Hearing Aid Innovation (CRC HEAR) in accord with the CRC Guidelines as a “new from existing CRC bid” to provide:

*“Evidence of the track record of the existing CRC including evidence from an independent review of the existing CRC’s achievements to support its claims.*

*“The track record must include but is not limited to a quantitative statement of the economic impacts of the CRC’s outcomes; key achievements of the research and education programs; the effectiveness of the collaboration (including in maintaining of enhancing participant involvement and contributions); and the effectiveness of governance and management arrangements.”*

The process for evaluation included review of a number of publications and documents including:

- ❑ Allen Consulting Group (2005) *The Economic Impact of Cooperative Research Centres in Australia: Delivering benefits for Australia*, A Report for the Cooperative Research Centres Association Inc.
- ❑ Buck, W (2004) *Independent Evaluation Report on CRC HEAR Evaluation Milestones*, 18 October.
- ❑ Ching T, Psarros C, Hill M, Brew J Incerti P (2005) “Binaural benefits from using a cochlear implant and a hearing aid in opposite ears” available on [www.nal.gov.au/Publications](http://www.nal.gov.au/Publications)
- ❑ Cochlear (2005) *Collaborative Research Report*.
- ❑ CRC Association (2005) *Reaping the benefits: innovation through collaboration* Recent highlights of the Cooperative Research Centres Program 2005, November.
- ❑ CRC Association (2004) *Winning new ways for Australia: Underpinning economic growth* Recent highlights of the Cooperative Research Centres Program 2004, November.
- ❑ CRC Association (2003) *CRCs – Connecting Communities* Recent highlights of the Cooperative Research Centres Program 2003, October.
- ❑ CRC Association (2002) *CRCs – Capturing Creativity* Recent highlights of the Cooperative Research Centres Program 2002, October.
- ❑ CRC Association (2000) *Research Results in Action* Recent highlights of the Cooperative Research Centres Program 2000, October.
- ❑ CRC HEAR (various) Annual Reports and Financial Statements for 2004-05, 2003-04, 2002-03, 2001-02, 2000-01, 1999-2000, 1998-99, 1997-98, 1996-97, 1995-96, 1994-95, 1993-94, 1992-93.
- ❑ HearWorks (2006) *Summary Report on Intellectual Property provided to Cochlear Ltd*, 20 March.
- ❑ HearWorks (2004) *Abridged Annual Financial Report*, 30 June.
- ❑ Letters in relation to CRC HEAR awards and prizes from Dynamic Hearing, Polaris, Cochlear, Telstra, Australian Hearing and others.
- ❑ Media articles (various).

- ❑ Roberts, C (2005) Nucleus Contour and Advance Electrode Arrays and Technology Suite Submission to the CRC Awards for Excellence in Innovation 2005 “Innovation in Application and Use of Research”.
- ❑ Shallop J (2004) *Research Program Evaluations*, 25 May – 3 June.
- ❑ Shallop J (2004) *Referee’s Report for the Business Case Selection Criteria Application*, for CRC HEAR, 11 August.
- ❑ Vaughan R (~2000) *Exploring CRC Research Highlights of Medical Science and Technology*, Cooperative Research Centres in Australia.

In addition, Access Economics has liaised closely with CRC HEAR in the past twelve months in relation to the report jointly commissioned with VicDeaf *Listen Hear: The Economic Impact and Cost of Hearing Loss in Australia* (May, 2006) and the *Sound Value* (report forthcoming) projects.

The claims of CRC HEAR assessed were those presented in the Stage 1 Bid Application under Section 5 “Key Achievements” (page A-15 of the document provided to Access Economics 11 August). Claims are evaluated below.

## 2. CLAIMS

### 2.1 COMMERCIALISATION

**CRC research has been commercially used by Cochlear in the C124M, C124R and RE cochlear implants, the Contour and Contour Advance electrode arrays, the ESPrit and 3G ear-level speech processors and the Whisper and ADRO speech coding. These outcomes have supported Cochlear’s market growth and share resulting in export earnings, job creation in Australia and royalties to the Commonwealth, University of Melbourne and directly to CRC HEAR (Currently \$300K per annum).**

Cochlear’s revenue was \$283 million with \$37 million in profit after tax, employing 850 staff, 550 of whom are based in Australia (mainly in Sydney) in manufacturing, market support and research (Roberts, 2005). The company’s CEO reports that:

*“Cochlear is under surprisingly intense competition, both in established markets like the Americas and Europe, but also in the growing Asia-Pacific market. Without sustained technological development and research, Australia’s position at the forefront of the cochlear implant field will be eroded. The biomedical, surgical, speech coding and clinical research at the CRC Hear is a vital underpinning to Cochlear’s strategic plan. CRC HEAR and Cochlear’s engineering teams have nurtured a seamless integration which has enabled us to develop and commercialise a range of products including the Contour and Contour Advance electrode arrays. Cochlear is relying on CRC HEAR’s expertise in biomedical engineering, speech coding for tonal languages and research into automated programming as a critical help in expanding the global cochlear implant market and ensuring that Australia benefits from its leading position in this market.”*  
Roberts (2005:1)

Cochlear (2005:14) discusses Whisper, ESPrit 3Gt and other technologies in the context of CRC HEAR development and benefits, eg the Peak Derived Timing strategy, which aims to better preserve fine-structure inter-aural time delays (ITDs) “has also been developed at CRC HEAR” (Cochlear, 2005:43).

"Cochlear Ltd returned sales of \$348 million in 2004/05, with royalty income to CRC HEAR of over \$1 million." [http://www.crca.asn.au/press\\_releases/2006/2006-2-28.htm](http://www.crca.asn.au/press_releases/2006/2006-2-28.htm)

"Cochlear Limited has a commendable record in commitment to R&D and in contributing to export growth for Australia," Senator Minchin said. "The company is at the forefront in cochlear implant technology and the Government believes Cochlear will continue to provide export growth and benefits to the economy through increased employment. Cochlear is committed to maintaining its Australian research and manufacturing base. ..."Over the last three years the Commonwealth has received royalty payments to the value of \$1.7 million from Cochlear..." <http://www.ausindustry.gov.au/content/content.cfm?ObjectID=703A193B-EDAA-419F-806394D31A507151&L3Keyword=employment>

## 2.2 HUMAN IMPLANTS

**CRC has met its milestones of first human implants of experimental electrode arrays for hybrid acoustic-neuroelectric hearing and a fully-implantable system.**

*"More than 50,000 hearing-impaired adults and children worldwide hear better, thanks to the Australia Design Award-winning Contour™ cochlear implant electrode array developed by Cochlear Limited in partnership with the CRC for Cochlear Implant and Hearing Aid Innovation." CRC Association (2005:19)*

The CRC Annual Report 2004-05 (p18) reports on advanced electrode arrays and the fully-implantable system but notes the obstacles identified and the need for further feasibility studies.

Access Economics reviewed two TGA CTN applications for the Hybrid-L (electro-acoustic cochlear implant) and the TIKI (totally implantable system) which have moved to first human implant trials. In addition, the CRC HEAR CEO Report to the Cochlear Ltd Board (p15) reports on current clinical trials and notes that the first three TIKI patients are undergoing ongoing assessment as well as the evaluation of a number of Hybrid-L patients. These documents verify the claim.

## 2.3 COMBINED USE OF AIDS AND IMPLANTS

**CRC research into combined use of cochlear implants and hearing aids by the same person has change practice world-wide, expanding the market for cochlear implants.**

The results of this research are reported in detail in the literature in particular the binaural benefits from using a cochlear implant and a hearing aid in opposite ears (eg, Ching et al, 2005). The reports mentioned in Section 2.2 above also provide further evidence in relation to this claim.

## 2.4 SPEAR3

**The SPEAR3 Cochlear Implant Research System has been licensed to Cochlear, 5 Australian and 12 international research groups, creating new collaborations and returning \$390k in revenue to HearWorks, all of which has been reinvested in research.**

Cochlear describes "the portable SPEAR3 research processor, developed by CEC HEAR..." in Cochlear (2005:16).

HearWorks revenue in FY2004-05 from ordinary activities was \$997,682 reported in the 2004-05 Financial Statements (p12), but the SPEAR component is not identified. However, given that in FY2003-04 SPEAR contributed \$152,147 of \$811,134 and in 2003 SPEAR contributed \$108,223 of \$700,918 and the financial statements also support reinvestment of the earnings, the claim is considered verified.

## 2.5 NEW HEARING AIDS

**A first-generation trainable hearing aid and anti-occlusion transparent hearing aid have been delivered to Siemens for implementation in its next generation of hearing aids. The HEAR-CRC master digital research hearing aid has been licensed to VAST Audio Pty Ltd for contract research (revenue of \$50K, plus potential for future royalties).**

*“Commercialisation of the CRC HEAR’s ‘trainable hearing aid’ concept is well advanced, and is expected to capture a significant share of the world market (total annual sales of over \$2 billion) and return significant royalties to Australia. As well as increasing quality of life, this technology should also produce efficiencies in health service provision.” [http://www.crca.asn.au/press\\_releases/2006/2006-2-28.htm](http://www.crca.asn.au/press_releases/2006/2006-2-28.htm)*

## 2.6 AID FITTING LICENSES

**NAL-NL1 non-linear hearing aid fitting has been licensed to 12 international companies returning license fees of \$452k to HEAR CRC and NAL.**

*“NAL-NL1 non-linear hearing aid fitting software, developed by CRC HEAR and partner Australian Hearing [is] licensed to major international hearing aid companies and audiology equipment manufacturers, and is used to fit more hearing aids world-wide than any other system.” Annual Report 2004-05, p4.*

Spreadsheets were reviewed to verify that the return on all NAL-NL1 software licences is \$451,549.02.

## 2.7 ACOUSTIC SHOCK

Acoustic shock limiting algorithms licensed to Telstra and subsequently Polaris Communications for use in their SoundShield device, has enabled Polaris to make significant sales and create a new manufacturing capacity in Victoria. Royalty income to CRC HEAR is over \$500k to date.

*“CRC HEAR has devised a means of protecting workers through development of shriek-limiting software... [and] has licensed the software to Telstra and Polaris Communication. Polaris, a Victorian company has manufactured a device, known as SoundShield, incorporating the CRC’s software for use in Australia and overseas. Polaris, which was formerly an importer and distributor of telephony equipment has now become a manufacturer.” CRC Association (2002:5)*

*“Polaris, previously an importer/distributor of foreign products, has now sold over \$15million worth of SoundShield product, and made a significant royalty return to CRC HEAR (to date totalling \$600,000).” Allen Consulting Group (2005:16).*

## 2.8 HEARLAB

The HearLab computer-based audiology test suite received a \$250k BIF grant for commercial development, and commercial negotiations are progressing with three international companies.

The 2004-05 Annual report (p24) discusses the clinical innovations projects including the Computer-based Audiological Test Suite and notes that "HearWorks' collaboration has succeeded in obtaining a BIF grant of \$250,000 to assist in prototype development."

## 2.9 CONTRACT RESEARCH

**CRC HEAR has undertaken contract research for 2 international hearing aid companies (cumulative value of \$800K), one of which will lead to commercial royalties in future.**

FY2004-05 lists research contract income of \$156,421 for HearWorks and \$285,000 "other income for Siemens"; for 2004 Contract income is \$250,000 for the HA project and for 2003 \$125,000 for HA and \$153,675. Thus the financial data support the claim.

## 2.10 OTICON GRANT

**CRC HEAR and NAL were successful in gaining a research grant from the Oticon Foundation.**

Letter from Oticon Foundation Board Chairman, Knud Sorensen, advising of the research grant, was sought and sighted, dated 24 August 2000, as well as the Phase II funding advice, dated 12 December 2001.

## 2.11 ADRO

**The ADRO technology was licensed to CR spin-off Dynamic Hearing, established with venture capital financing. Dynamic Hearing employs 21 staff and report FY05 turnover of \$2 million.**

*"After seven years of research... CRC HEAR has developed an innovation solution... ADRO is a signal processing software system... ADRO was first developed for the cochlear implant and licensed to Cochlear Limited. To facilitate the widespread application of ADRO in hearing aids, CRC HEAR established a spin-off company – Dynamic Hearing Pty Ltd – through funding from GBS Ventures and Nanyang Ventures." CRC Association (2003:10)*

*"Dynamic Hearing, an innovative digital speech and hearing technology provider and a second-year EMDG recipient, has achieved significant increases in export earnings over the past year. A spin-off from the Co-operative Research Centre (CRC) for Cochlear Implant and Hearing Aid Innovation, the company received a commendation in the 2004 Victorian Export Awards in the Emerging Exporter category. ...The company's first product, the ADRO™ processing strategy, is a hearing aid software that uses digital signal processors to automatically place output levels of a hearing aid into the audible and comfortable range of a hearing-impaired listener. The substantial increase and the further budgeted export earnings increase expected for 2005 has led to two additional staff members being hired in 2004". <http://www.austrade.gov.au/australia>*

Verification obtained for staffing and turnover from Dynamic Hearing Michelle Lopez, Finance Manager.

## 2.12 HEARWORKS

**HearWorks reported revenue for FY05 of \$997,000 and these funds have been reinvested in research projects. Further research flows are anticipated.**

The financial statements show \$997,682 for FY2004-05. See Section 2.4 re reinvestment.

## 2.13 EDUCATION

**In education, 24 PhDs, 4 MEng and 6 MSc have been supported, as well as minor theses support for MCLinAudiology students and over 2,500 cochlear implant workshop attendees.**

These staffing and education claims have been verified in the context of the *Sound Value* cost benefit analysis project. In 2004-05 alone there were 10 PhD students; further details of each student and their projects, as well as the Master of Clinical Audiology program and other professional education activities are provided in the 2004-05 Annual Report (p26-29).

## 2.14 SHALLOP REVIEW

**An independent External review in 2004 by Professor Jon Shallop (Mayo Clinic) confirmed “CRC Hear is a world class research effort that has produced respected quality results among peers throughout the world.” “It is truly remarkable how far this technology has advanced in the last 5 years and the CRC has had a major impact on hearing aid and cochlear implant innovations throughout the world. Research outputs (and outcomes) have clearly been achieved.”**

Research program evaluation document has been investigated (May 23-June 3, 2004) and the quotation is accurate.

## 3. CONCLUDING COMMENTS

The distinguished achievements of CRC HEAR are to be commended; this investigation has confirmed the deserved reputation of the CRC as an Australian centre of excellence of the highest calibre, with exciting future potential.

**Lynne Pezzullo**  
**Director, Economic Advisory**

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