

# CUDOS

The Centre for Ultrahigh bandwidth Devices for Optical Systems (CUDOS)

2005  
Annual Report



# Governance

## Structure

CUDOS is a collaborative research program between the University of Sydney, the Australian National University, Macquarie University, Swinburne University of Technology and the University of Technology, Sydney, funded under the ARC Centre of Excellence program. The University of Sydney manages the ARC grant and disburses funds in accordance with an agreement signed off between the Universities. The agreements covering the management of the Centre are the ARC Funding Contract, the Collaborator Agreement and the CUDOS Intellectual Property Agreement. The University of Sydney has also signed a Deed of Agreement with the state government of New South Wales (through the Department of State and Regional Development) for the disbursement and management of state government funds.

## Centre management

Centre research programs and administrative aspects are managed by an Executive team comprising Prof Eggleton (Research Director), Prof Kivshar (Deputy Research Director and Canberra node coordinator), Prof de Sterke (Sydney node coordinator), Prof. Gu (Melbourne node coordinator) and Dr Chris Walsh (Chief Operating Officer). During 2005 the Centre Executive met by teleconference on at least a quarterly basis and undertook the following major initiatives:

- Initiated a new research project structure incorporating four Flagship research projects. These projects are described elsewhere in this report, but they represent key demonstrators of aspects of the Centre's ultimate goal, a photonic integrated circuit.
- Commissioned a review of the Centre's scientific program by four independent external experts (see below)
- Convened two meetings during the year of the Centre's Chief Investigators. The first meeting was a strategic planning meeting held in advance of the ARC review; the second was a formal review of the progress made during the year in the flagship projects and other related activities.

## Advisory Board

The Centre's Advisory Board met on two occasions during 2005. The first meeting (April 2005) featured an extensive discussion of the landscape, both nationally and internationally, in which the Centre operates. As part of this discussion four Board members gave brief presentations on areas of activity or research groups relevant to CUDOS: Dr Simon Poole on the state of the telecoms industry", Dr Steve Duvall on optical interconnects, Prof Rod Tucker on NICTA and Prof Simon Fleming on the Photonics Cooperative Research Centre. The second meeting (September 2005) was concerned principally with a discussion of the Centre Strategic Plan prepared for the ARC review in October. The aspect of the plan that received the most attention related to protection and eventual commercialisation of Centre intellectual property. Board members have extensive experience in industry, venture capital and commercialisation,

and their input and advice are highly valued by the Centre. The composition of the Board is:

Dr Simon Poole (Chairman), a photonics industry pioneer who co-invented the Erbium-doped fibre amplifier (EDFA) and who has established two successful photonics companies;

Professor Beryl Hesketh, Professor Jim Williams, Professor Jim Piper and Professor Sue Rowley, representing different universities in CUDOS;

Dr Mike Sargent, formerly CEO of ACTEW, a former Board member of the ARC and currently chairing the DEST NCRIS and e-Research Coordinating Committees;

Dr Scott Rashleigh, formerly CEO of Australian Optical Fibre Research Ltd, a company he established in the early 1980's;

Professor Rod Tucker, Director of CUBIN and a key researcher in National ICT Australia (NICTA);

Dr Ian Ritchie, Chairman of Redfern Polymer Optics and Engana and formerly CEO of JDS Uniphase (Australia);

Professor Simon Fleming, CEO of the Australian Photonics Cooperative Research Centre;

Mr Warwick Watkins, Director General of the Department of Lands, Registrar General and Surveyor General (NSW);

Dr Steven Duvall, Intel Fellow and Head, Intel Capital (Australia).



▲ **The CUDOS Advisory Board.**  
**Standing:** Beryl Hesketh, Steve Duvall, Ian Ritchie, Rod Tucker.  
**Seated:** Jim Piper, Warwick Watkins, Simon Poole, Simon Fleming.  
**Not shown:** Mike Sargent, Jim Williams, Scott Rashleigh, Sue Rowley.

## CUDOS Scientific Review

We are committed to validating our research performance by peer review. The CUDOS Advisory Board contains a number of photonics experts (Dr Poole, Professor Tucker, Dr Rashleigh, Dr Ritchie) who are kept well-briefed on the Centre's research activities but whose main focus is on strategic management. To assist in benchmarking our science we convened in July 2005 a review by international peers that focused exclusively upon the Centre's science program. The members of the Science Review Committee are listed below. They cover the full spectrum of CUDOS research with representatives from industry (systems and components level) and academia (theory and experiment):

- Professor M. M. Fejer, Stanford University (USA) - Experimental nonlinear and guided-wave optics;
- Professor Costas Soukoulis, Iowa State University and Ames National Laboratory (USA) - Analytical and numerical studies of ordered and disordered systems including photonic crystals;
- Professor Lothar Moeller, Bell Laboratories, Lucent Technologies (USA) - High speed optical networks;
- Dr Steve Frisken, CTO Engana Ltd (Australia) - Innovative photonic components for optical networks.

The principal outcome of the review was a strong endorsement of the quality and strategic direction of the Centre's research program. The Review highlighted several areas where the Centre's achievements or capabilities were world-leading:

- The development of 3D polymer photonic crystals using two-photon photo-polymerisation.
- The development by of a chalcogenide program with integration from material production through to device fabrication.

- The strong complementarity across the Centre between the theory teams, whose strengths range from conceptual ideas through to detailed device modeling, with the capability to make real breakthroughs in the development of novel designs for photonic devices.
- The successful application of gap solitons to a range of optical processing functions including slow light, pulse generation and signal re-generation.
- The development of a compact waveguide amplifier, with direct application to the current generation of optical communications systems.
- The work in tunable optical lattices, which has established an impressive and versatile platform that has been and will be used for demonstrating a range of fundamental nonlinear optical phenomena.

## ARC Review

One of the conditions of the Funding Contract with the ARC is that in the third year of operation there be a "review of the Centre's performance against the objectives outlined in the Centre Application, the specific performance targets or milestones identified in the Centre Application and the objectives of the ARC Centres of Excellence Program". The review of CUDOS took place in October, with the key finding that the Centre's performance to date had been strong, and that funding for the remaining two years of operation was approved. The ARC also considered that the Centre would be a worthy candidate for an extension funding for a further period beyond 2007.



▲ The CUDOS Scientific Review Committee (left to right): Lothar Moeller (Lucent), Costas Soukoulis (Iowa State), Ben Eggleton (CUDOS), Marty Fejer (Stanford), Steve Frisken (Engana).