

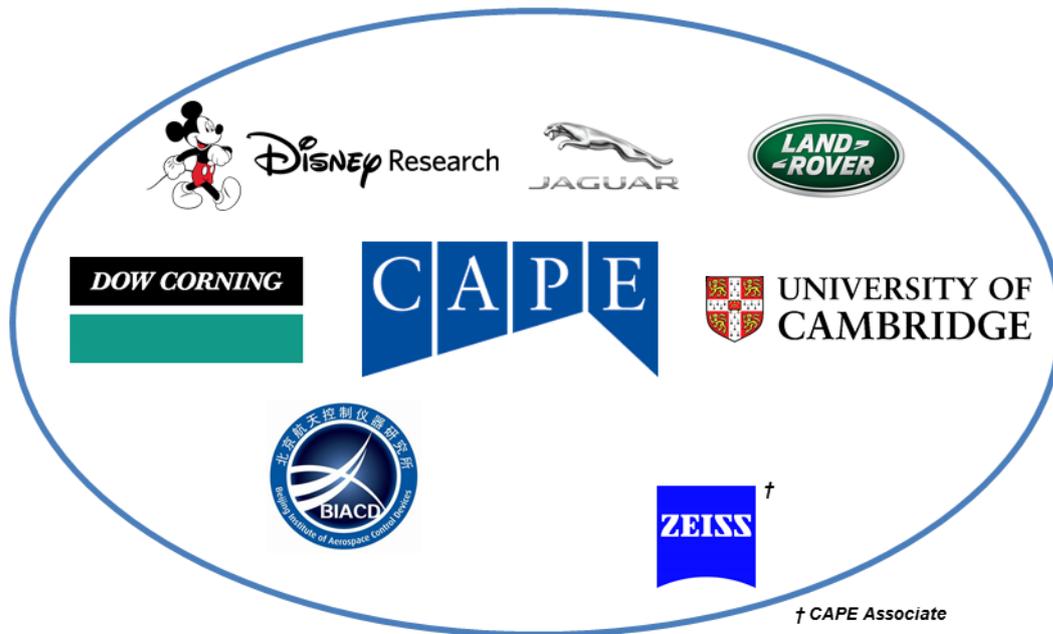


Centre for Advanced
Photonics and Electronics
www-cape.eng.cam.ac.uk



UNIVERSITY OF
CAMBRIDGE

Centre for Advanced Photonics and Electronics (CAPE)



Introduction to CAPE

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1. CAPE Overview

Summary

The Centre for Advanced Photonics and Electronics (CAPE) is a unique form of joint partnership between the University of Cambridge and a number of strategic companies of international importance in the supply chain for the photonics and electronics industries. Its aim is to explore the synergy in research activities for inventions, business interactions for commercial exploitation and outreach opportunities in different business sectors, government organisations and society.

The CAPE partnership is defined by a CAPE Partnership Agreement (CPA) negotiated between the University and the CAPE Partner companies, on which all CAPE strategy and procedures are based. Through joint governance and joint sponsored research, the CAPE Partnership has developed a research portfolio at the cutting edge of contemporary technology with very significant societal relevance in its focus on topical areas such as the Built Environment and business cost reduction. CAPE and its CPA are constantly evolving to adapt to internal and external environmental needs with the aim of enhancing academic research and creating added value for business.

CAPE is established around Cambridge University's world-leading facilities and expertise in electronics and photonics. It is housed within the University's Electrical Engineering Division although its activities are not confined to the Engineering Department.

The current phase of CAPE, which began on 1 April 2011, will build on its successful first phase and integrate with a wider area of the academic community; with a wider range of business enterprises including small and medium companies, thereby reflecting current trends in the industrial landscape in the UK; and with a broad range of organisations.

The CAPE mission is to invent and develop through multidisciplinary research; materials, processes, components and systems; to define future strategy and market implementation as well as to set the industry agendas for not only the convergence of photonic and electronic technology platforms but also across different supply chains; and to make our own contribution towards future policies and regulations.

The current CAPE Partners are Walt Disney Imagineering Research & Development, Inc., doing business as Disney Research (in the USA), Dow Corning Corporation (in the USA), Jaguar Land Rover (in the UK), and the Beijing Institute of Aerospace Control Devices trading as BIACD (in China).

Background

CAPE was first established on 1 October 2004 as a way in which the University could address global issues involving open innovation, in partnership with companies of international importance. The CAPE Partner companies were strategically placed in the supply chain in orthogonal relationships without conflict of interest.

Operating under the original CAPE Strategic Partnership Agreement it provided a new form of joint university-industry research that was leading edge, vertically integrated and commercially relevant. As well as the Partner companies there was also a CAPE Associate in the field of electronic imaging, namely Carl Zeiss SMT.

The first 5 year phase of CAPE was due to end on 30 September 2009, but by mutual agreement between the CAPE Partners, this term was extended for a six months until the end of March 2010. After that, CAPE entered into a further extended period of reconstruction and negotiation until the end of March 2011.

CAPE started its second phase on 1 April 2011 with confirmed continued interest in the negotiation of a new Partnership Agreement from two of the original CAPE Partners, Alps Electric and Dow Corning, as well significant interest in future membership from other parties.

The negotiations resulted in the new CPA, executed by the University in May 2011 with an effective start date of 1 April 2011, and endorsed by ALPS Electric Co. Limited (electronic devices and components manufacture), Disney Research (media and entertainment), Dow Corning Corporation (silicon based materials and services), and Jaguar Land Rover (automotive). Beijing Aerospace Times Optical-Electronic Co. Technology Ltd. (ATOE) joined the CAPE Partnership on 1 October 2013; however, with an effective date of 1 January 2014, following internal re-organisation, the name of this CAPE Partner changed from ATOE to the Beijing Institute of Aerospace Control Devices trading as BIACD.

The mix of Partner interests has shifted over the years, but the current Partners, Disney Research, Dow Corning Corporation, Jaguar Land Rover and BIACD, continue to represent business interest on a worldwide scale.

Carl Zeiss Microscopy Limited (formerly Carl Zeiss SMT) have confirmed their interest in continuing their CAPE association under the new CPA and it is hoped that other companies might also become CAPE Associates through investment in CAPE activities below the level expected from a full CAPE Partner.

The CAPE research portfolio during the first CAPE phase amounted to £7.5M. CAPE was also instrumental in the University being able to attract a further £6.9M funding from EPSRC through the successful bid for the Cambridge Integrated Knowledge Centre (CIKC). Additionally CAPE has been supported by an EPSRC Platform Grant in 'Liquid Crystal Photonics' totalling £1.4M over 10 years from April 2003.

Contact

Further information about the CAPE Partnership can be obtained from the CAPE Coordinator.

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2. The CAPE Model of an Academic - Industrial Partnership

The CAPE model for industrial/academic collaboration is specialised and unique, differing in many ways from existing arrangements between industry and other universities, e.g. programmes available in the USA at Stanford and UC Berkley. CAPE resembles a joint development agreement more closely than a university research club.

The key features of CAPE are:

1. CAPE is a Partnership between the University and a small group of international photonics and electronics companies whose market orientation places them in a non-competitive supply-chain or value-chain relationship with respect to each other.

It relies on the Partner companies being able to accommodate each other's business interests to allow this collaboration.

2. The executive body in CAPE is the Steering Committee which commissions all CAPE research. Its members are drawn from both academic and industrial Partners with equal voting rights between the academic and industrial interests i.e. the governance of all CAPE research within the University is shared with the industrial Partners.
3. All the financial contribution to CAPE is spent on jointly commissioned research that is directly for the benefit of the CAPE Partner companies, apart from a small percentage that is set aside for CAPE operational costs.

Each CAPE Partner will invest a minimum contribution per year in CAPE (some of which may be in-kind). Apart from a small percentage being set aside for CAPE operations, all this resource will be available for jointly commissioned research over which the Partner company has direct control through their representation on the CAPE Steering Committee.

4. CAPE offers wide access to engineers, scientists and post-graduate students within the Electrical Engineering Division, the Engineering Department and other areas of the University and also in the other CAPE Partners.
5. CAPE seeks to engage with business development processes in the CAPE Partner companies. Exchange of scientists and engineers between the industrial and academic Partners, including the possibility of the placement of an embedded researcher within the Electrical Engineering Division, is a rule rather than an exception.

Other benefits afforded by the CAPE Partnership:

In terms of devices and materials developed, patents granted, licenses agreed and engagement with business development processes in our Partner companies, we have an excellent record.

Because CAPE is sited within the Electrical Engineering Division, there are excellent opportunities to expand CAPE Projects by leveraging the industrial funds invested through CAPE via external bodies such as the UK government-sponsored Cambridge Integrated Knowledge Centre (CIKC), which, during the period 2007 to 2012, funded prototype development of several devices originally conceived in CAPE Projects. We are presently seeking support from the European Union for CAPE collaborations with Centres of Excellence in other European Universities.

Membership of CAPE can also provide networking benefits from existing links between Cambridge University and other academic centres, both in the UK and elsewhere. Already some CAPE Project research programmes have been assisted by consultative input from other universities.

3. CAPE Organisation

CAPE Steering Committee

The CAPE Steering Committee (SC) is the arbiter of every aspect of CAPE activity. It comprises leading academics representing the University and senior representatives of each of the Partner companies. Each Partner company has an equal vote on the SC, and the total number of votes from the academic SC members matches the total number of Partner company votes, with the SC Chairman (chosen from the academic members) holding the casting vote.

CAPE Intellectual Property Group (IP Group)

The CAPE IP Group comprises legal and technical representatives from the University and each Partner company and is chaired by the SC Chairman. On behalf of the CAPE SC, the IP Group manages the CAPE IP portfolio and other legal and contractual issues. To facilitate the provision of a neutral forum for the discussion of company sensitive IP information when appropriate, each IP Group member signs a special IP Group confidentiality disclosure agreement which restricts wider dissemination of that information within their own organisation to a need-to-know basis.

CAPE Technology Focus Groups (TFGs)

On behalf of the CAPE SC, the four CAPE TFGs oversee CAPE technology issues and road-mapping. Appropriate representatives from the University and all the Partner companies sit on each TFG which may be chaired by either an academic or an industrial member. Each TFG covers a specific technological area and oversees CAPE project progress, either at detailed or executive level as appropriate. The current four TFGs are:

1. Materials and Manufacturing Processes TFG

***Postulate:** CAPE must sustain an oversight of the materials and process needs of the broader electronics and photonics markets. Through a technology focus this requires a strong engagement in understanding the manufacturing processes, as well as the materials physics and chemistry and the influence of process variables and methods on component and system performance (inclusive of cost). Furthermore, as new physics or materials sciences offer new opportunities, this TFG will maintain a competence to consider how this may enable new approaches to solutions in technology for the electronics and photonics sectors.*

There will be a broad adherence to the CAPE-established principles of securing an oversight of the concerns of the supply-chain and value-chain participants in this market.

The TFG will ensure that it maintains an appropriate level of due diligence and secure confidentiality of its discussions and reports appropriate to the circumstances.

Cambridge University (CU) is very well respected in the field of radical materials advances and also in manufacturing paradigms, particularly in respect of the low temperature deposition and additive process evolution. This is very well supported by several of the expertise groupings such as the Cambridge Integrated Knowledge Centre (CIKC), Nanotechnology Centre etc. In order to sustain the necessary level of competency in the TFG, active support for the discussions will be sought from participants drawn from the wider community, both CU and industrial, to the extent that this may be kept within the CAPE needs to sustain due diligence and good control of intellectual property.

The TFG will sustain an expertise and report advances in the field to the CAPE principals. Through regular specialist meetings it will generate specific advice, vision statements and strategic guidance for the CAPE programmes and projects as well as the CAPE Partners. If agreed, these may be published subject to approval processes at CAPE Steering Committee level.

2. **Energy and the Environment TFG**

***Postulate:** The CAPE Partners are already engaged with many of the technologies and market sectors that will be harnessed to address the societal needs of: reducing energy usage, and adopting a responsible attitude towards environmental issues. They also have corporate policies to support these aspirations. We believe that there could be significant benefit to the processes of business development in taking a strategic overview of this area. It is proposed to seek the help and support of appropriate supply chain partners and take an active role in participation in relevant thematic initiatives such as Smart Façade and Energy City programmes.*

The CAPE White Paper, “A Vision for the 21st Century Built Environment”, outlines these proposals in more detail and asserts that technology, by manipulating wavelengths across a wide section of the electromagnetic spectrum, can actively control aspects of a building's fundamental operation, its aesthetics (appearance and outlook), the communication of information within and without it (including internal and external optical and wireless communications, privacy and municipal signage), and the energy and illumination balance between the building and its environment. Focusing on the scattering and control of radiation by the facades and apertures of buildings offers new insights into the impact of photonics and electronics on the environmental impact of the built environment.

We note that there are strong links between the enabling materials developments and fabrication processes involved in such areas as light control films, thin-film photo-voltaics, active wave-plate and antennae structures, transfective displays and advanced transparent conductor technology and that CAPE is already heavily involved in most of them. The use of nano-structure materials is being proposed in several of these areas. Stable laminated plastic structures containing active polymeric and/or liquid layers being developed under the Cambridge Integrated Knowledge Centre (CIKC) are a common feature across this applications space.

3. Communication Network and System Design TFG

Postulate: *It is desirable for CAPE to maintain a broad reaching knowledge and influence in the field of optical and electronic communications. This should embrace all of guided wave/signal (wired, traces and optical waveguides and microwave coaxial or waveguide communications) and free- space ('optical' and 'wireless', point-to-point and broadcast) signaling in the deployment of both telecommunications and data communications systems.*

There will be a broad adherence to the CAPE-established principles of securing an oversight of the concerns of the supply-chain and value-chain participants in this market.

The TFG will ensure that it maintains an appropriate level of due diligence and secure confidentiality of its discussions and reports appropriate to the circumstances.

To the extent that this is already a very large activity pursued through the research interests of CAPE and the Electrical Engineering and other Divisions of Cambridge University Engineering Department, and is also more generally a strong core competence in the wider university, it is proposed that the Communications and Networking TFG will seek expertise from within and without CAPE to secure a knowledgeable community of interest to participate in the discussion and review of CAPE strategy in this area. In certain cases this wider community will also be invited to participate in project review.

The CAPE Communications and Networking TFG will review and have oversight of the proposed communications test-bed, together with low-cost telecom and networking solutions, and their usage by CAPE Partners and others. The TFG will produce reports and guidance on key developments or trends in the field. These will be provided to the CAPE principals and published, subject to approval processes at CAPE Steering Committee level.

4. Devices and User Interfaces TFG

Postulate: *The cross-supply chain relationship between the CAPE Partners offers a unique opportunity to take an overview of the developments in the display, user interfaces and sensors industries in general, to ensure that the research projects undertaken are timely and effective in building a basis of intellectual property, technology demonstrations and prototypes to facilitate business development cases in our CAPE Partner companies.*

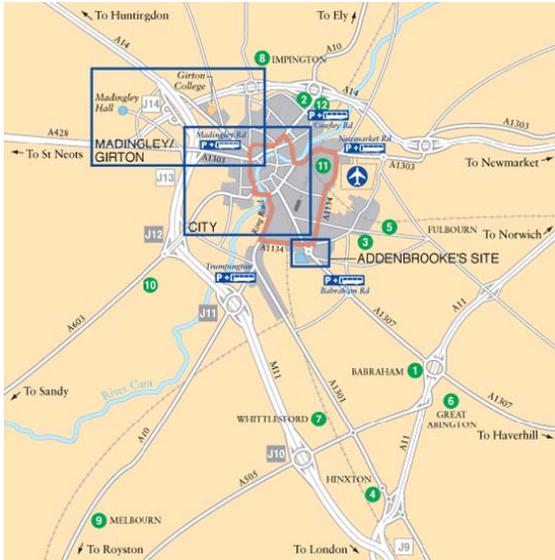
The display industry constitutes a large and strategic part of the global photonics market and is important to the business interests of the CAPE Partners. It is also an area where both the UK generally and Cambridge University in particular have in-depth skills and long established strong core competence e.g. in active matrix circuitry, liquid crystals, OLED and field emission technology.

Significant developments proceeding within CAPE and the sister projects of the Cambridge Integrated Knowledge Centre (CIKC) now include: next generation active matrix technologies (organic and inorganic) for plastic display structures, holographic image projection devices using liquid crystal over silicon (LCOS), investigations of liquid crystal laser technology for potential applications display systems, bright reflective colour systems for electronic posters and signage and electronic print displays, and novel CMOS sensors.

The degree of success achieved could now, (subject to the judgment of the CAPE Partners and the TFG Chairmen), enable us to influence the industry bodies that are setting the future agenda.

Appendix A Directions to CAPE Building / Electrical Engineering

9 JJ Thomson Avenue, Cambridge CB3 0FA, UK (Reception Tel: +44 (0)1223 748300)



By car:

- Driving north on the M11 from London/Stansted, leave the M11 at Junction 13, and turn right along Madingley Road (A1303) towards Cambridge.
- *If travelling by car from the north towards Cambridge, drive south on the A14 and continue going south onto the M11. Because it is not possible to leave the M11 at Junction 13 when travelling south, you should continue along the M11 to junction 12 (Cambridge, Wimpole and Barton), and double back to Junction 13, by negotiating the two roundabouts to re-join the motorway going north so that you can take the exit off the M11 towards Cambridge at Junction 13 as above.*
- Take the second turning on the right (JJ Thomson Avenue - signed to the Cavendish Lab).
- Take the first left, between the Whittle Building and the William Gates Building.
- Follow the road around to the Electrical Engineering/CAPE building (marked as Building 10 on the map above) which is on the left after the Microsoft building. The Reception Desk is at the front on the Building, just inside the main entrance.
- There is a small visitors' car park at the front of the Electrical Engineering building next to the fountain. Alternatively, if this is full, you may use the larger staff car park at the rear. To get through the barrier leading to the rear car park either call in at our Reception Desk first or press the button at the barrier to ask our Receptionist to open the barrier for you.

By train:

If you are arriving by train, it takes about 20 minutes by taxi to reach the Electrical Engineering/CAPE Building from Cambridge Station.

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