

TECHNICAL ANNEX

The University of Texas at Austin – Portugal
“International Collaboratory for Emerging Technologies”, CoLab

Program description

February 2007

The University of Texas at Austin – Portugal Technical Annex to the Agreement

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1. Overview

This document describes the long-term collaboration to be established between The University of Texas at Austin (UTAustin) and Portuguese research and higher education institutions, as agreed between the Portuguese Science Foundation (FCT) and UTAustin, on the basis of the Assessment Report submitted in February 2007 by UT-Austin to the Government of Portugal. The goal of the assessment was to identify beneficial partnerships in targeted areas of mutual interest for educational and research excellence as well as accelerated economic development within Portugal as an enabler for new jobs and sustainable wealth creation. Based on a 5-month (March-July 2006) assessment of a range of potential areas of cooperation it was decided to initially focus on two program areas: i) the development of an interdisciplinary research and advanced training program in Digital Media, including the development of Master and PhD programs; and ii) the creation of a University Technology Enterprise Network (UTEN). During August-November 2006 two additional program areas were considered for interdisciplinary research and advanced training, namely: Mathematics and Advanced Computing. In addition, it was decided to launch the necessary institutional framework to explore additional fields for cooperation and to enter into an open collaborative framework in order to foster collaborative actions in other emerging scientific fields, including nano and molecular science, robotics, and biotechnology. All program efforts will be subject to continuous monitoring, evaluation, and adjustments within the collaboration.

Consequently, an important component of the UTAustin-Portugal Program lies in its institutional framework. As such, all the activities launched under the auspices of the UTAustin-Portugal Program by UTAustin and by the FCT and partner institutions should be focused on creating a single governance structure, designated as the “**International Collaboratory for Emerging Technologies**”, or **CoLab**, which will be launched without a legal personality and has two poles: one in Portugal, the CoLab@Portugal, and other at UTAustin, the CoLab@UTAustin.

The activities of CoLab are divided in three major groups:

- i) Interdisciplinary research and advanced education activities in areas encompassing digital media, advanced computing and mathematics;
- ii) On-job training for entrepreneurs and technology transfer officers and related technology commercialization activities, including internships and an exchange program for entrepreneurs and technology transfer officers, in a way to form a “University Technology Enterprise Network”, UTEN; and
- iii) Continuous identification and promotion of cooperation in emerging technologies between UTAustin and Portuguese institutions.

Interdisciplinary research and advanced education

The first group above includes three different areas with the vision to foster interdisciplinary research and advanced education, in a way to help generate new knowledge leading to wealth creation. The goal is to develop a close agenda bringing together Digital Media, Advanced Computing and Mathematics, so that CoLab can build on existing competences and foster a new scientific agenda at an international level. The various components are described in the following paragraphs.

Digital Media

The Digital Media Program will focus on education, research, and business development in digital information content and new media production and distribution including:

- a. Digital and interactive media, and new distribution systems for small and large screens and over the Internet
- b. Online journalism
- c. Interactive documentaries and interactive systems
- d. Wireless technologies and systems for new media distribution leading to platforms to enhance digital inclusion, and learning systems for unskilled people with special emphasis on the handicapped and elderly

Master and PhD Programs will be formed at the New University of Lisbon and The University of Porto in collaboration with The College of Communication at The University of Texas at Austin. Digital Media emerging challenges in entrepreneurship and technology venturing will be associated with new media technology commercialization in international markets across a variety of initiatives.

The emphasis will be on the full value chain associated with advanced digital media. The overall goal is to have students explore media technologies and their design implications as well as evolving connections between technology, design, social and cultural domains, and business development. The curriculum for the planned MA degree will be stronger in hands-on production and experimentation, while the PhD degree will add theory and critical discourse to these subject areas that will function as core courses in the first two years of a PhD program. Courses in research methods will be important for both degrees and will encourage students to develop innovative and creative research projects.

Contributions to information society policy and pilot experiments in Portugal will also be explored through the participation of the Portuguese Knowledge Society Agency (UMIC), in particular in the areas of inclusion, accessibility to the handicapped and elderly, interactive learning environments, citizenship and public participation, rich interactive content development.

Advanced Computing

Advanced and grid computing enables the integration of widely dispersed computers, data repositories, and scientific instruments into a connected cyber-infrastructure that allows scientists, engineers, and information technology workers to become more productive through collaboration. The collaboration of researchers at UT-Austin and Portuguese Associate Laboratories (namely LIP and LAETA) and universities (namely The University of Minho, The New University of Lisbon, The University of Coimbra, the Instituto Superior Tecnico of the Technical University of Lisbon and other Portuguese universities) will include developing a PhD Program in Computer Science/Informatics with a particular focus on advanced and grid computing. The emphasis will be on using existing Portuguese PhD programs as opposed to creating a standalone new PhD degree. Students enrolled in this new UT-Austin/Portugal program will need to (i) attend specialized and advanced courses; (ii) study and work in research environments at the participating universities and their associated research centers, (iii) work on research projects that are related to advanced computing; and (iv) if appropriate prepare a PhD dissertation related to advanced computing

and the framework of the joint research agendas identified by the participating research groups at UT-Austin and the participating Portuguese universities.

All research programs will include faculty and student exchange, co-supervision of PhD students and hosting of exchange Post-Doc fellows. An annual workshop on advanced computing will be co-organized between UT-Austin and Portugal and will include a PhD doctoral consortium. The collaboration will also support a series of seminars by visiting and in-residence faculty and using the Internet will focus on Advanced Computing. UT-Austin, The University of Minho, The New University of Lisbon, and The University of Coimbra as well as other Portuguese universities, involved in the joint doctoral program, including the Instituto Superior Tecnico of the Technical University of Lisbon, University of Porto and The University of Aveiro, research centers, and companies will consider the following research areas:

- *Computational Science*: modeling, simulation, optimization, performance analysis and tuning, numerical methods for parallel and distributed computing;
- *Computer System*: paradigms and algorithms, system performance analysis, middleware, tools and technologies, and development of useful environments to the user.
- *Applications*: applications in science, engineering, economics, civil protection and risk management;

Furthermore, these Portuguese universities, research centers, and companies will also collaborate with the Texas Advanced Computing Center (TACC) at UT-Austin on deployment and operational issues for advanced computing, such as software, tools evaluation and secure access. All projects will include education, training, and outreach activities and will consider opportunities for technology transfer.

Contributions to policy measures connected to the Portuguese National Grid Initiative, launched in 2006 and prepared by the Knowledge Society Agency (UMIC), will be assured through the participation of this agency.

Mathematics

The project in the area of mathematics is aimed to develop advanced programs of research and education in specific areas of mathematics of common interest and expertise to:

- Reinforce the scientific and learning capabilities in Portugal, as well as to promote the internationalization of research and graduate programs in leading Portuguese universities;
- Stimulate mobility and scientific interaction of graduate students, researchers and post-docs among institutions;
- Attract to the involved Universities strongly motivated students who are able to integrate advanced research programs in Mathematics and applications;
- Optimize resources, by promoting a PhD program that involves the major universities in Lisbon and in Coimbra.

The cooperative initiative involves the Institute for Computational Engineering and Science (ICES) and the Department of Mathematics at UT-Austin and mathematical research centers and groups in four Portuguese universities, namely at the School of Sciences of UL (FCUL), the Instituto Superior Tecnico of UTL (IST-UTL), the School of Sciences and

Technology of UNL (FCTUNL), and the School of Sciences and Technology of U. Coimbra (FCTUC).

University Technology Enterprise Network (UTEN)

A University Technology Enterprise Network (UTEN) will work to accelerate wealth and job creation in targeted, science-based, new-generation Portuguese industries and firms, and will develop increasingly interrelated programs across organizational and institutional boundaries to support the common objective of world-class research and education leading to accelerated science and technology-based enterprise innovation and commercialization. It will be based on:

- i) Systematic on-job training and competence building of technology-transfer professionals from Portuguese institutions, together with continuous providing of internships in the Austin Technology Incubator, the IC² Institute and relevant leading institutions in Austin and the United States, as well as by a continuous exchange program with technology transfer offices in Portugal;
- ii) Systematic on-job training and competence building of technology-based entrepreneurs to be selected from Portuguese research and academic institutions in order to accelerate processes of science and technology commercialization, emphasizing overcoming key challenges in technology entrepreneurship;
- iii) Enhanced access to U.S. and international markets, namely through assistance to be provided by the Austin Technology Incubator and the IC² Institute.

UTEN will be initially composed of a virtual network of 15 Portuguese universities and their technology transfer offices, research centers, and incubators involved in S&T commercialization, as well as select S&T parks with relevant university research activities, and the national Innovation Agency, AdI. They will work with the Austin Technology Incubator and the IC² Institute at The University of Texas at Austin to:

- Have a unified management structure
- Coordinate activities and programs across institutional entities
- Leverage existing regional infrastructure and personnel located at the participating Portuguese institutions.

UT Austin will assist AdI and the management structure of UTEN in Portugal to select entrepreneurs and technology transfer officers on a competitive basis. It is expected that over time UTEN will develop increasingly interrelated programs across organizational and institutional boundaries to support the common objective of fostering world-class research and education leading to accelerated science and technology-based enterprise innovation and commercialization. UTEN will focus on technology commercialization while emphasizing key challenges in technology entrepreneurship and technology venturing for international markets. These activities will include short courses in Portugal and university-based internships in Portugal and at UT-Austin and company-based internships. Cooperative research projects involving Portuguese and UT-Austin faculty and students will focus on critical aspects of S&T research, commercialization, and international market access.

Other areas for future cooperation in emerging technologies

CoLab is launched to provide the necessary institutional framework to explore additional fields for cooperation and to enter into an open collaborative framework in order to foster collaborative actions in emerging scientific fields, involving UT Austin and Portuguese research and higher education institutions. All program efforts will be subject to continuous monitoring, evaluation, and adjustments within the collaboration.

While still in their infancy the fields of nanoscience and nanotechnology have already demonstrated that these research areas will have a tremendous impact on various and important aspects of human life, such as health, the environment, energy, transportation, information technology, and space exploration. Accordingly, this is considered a key emerging program area to be considered for inclusion in the overall UT-Austin/Portugal collaboration.

All program areas will work to build world-class research, education, and training programs that will involve professors and graduate students from the founding universities as well as top international talent. Training and for-credit classes will be offered in Portugal and at UT-Austin. Teaching Assistantships for graduate students will be offered in Portugal and at UT-Austin. Exchange programs will also be offered for Portuguese and UT-Austin faculty. Cooperative research workshops and training and doctoral seminars will be organized. Research projects will involve faculty and graduate students from Portugal and UT-Austin as well as other leading universities. Jointly authored research papers will be submitted to highly ranked, referred journals for publication. The possibility of dual or joint degrees will be pursued. Student recruitment will focus on highly qualified Portuguese students from Portugal and other Portuguese speaking countries as well as highly qualified non-Portuguese speaking students, especially UT-Austin students.

While S&T commercialization and business development will be an important component of all program areas, it will be the focus of the University Technology Enterprise Network (UTEN). A main function of UTEN will be to catalyze and facilitate the coordination and leveraging of S&T resources and assets across Portugal's regional and national academic, business, and government sectors in the pursuit of accelerated technology/knowledge-based growth.

As envisioned, all selected program areas will be built progressively over a 5-year time horizon through the realization of multilateral partnerships with the ultimate goal of building the necessary critical mass needed for Portugal's success in S&T research and commercialization in dynamic global markets. During the formation and operation of these cooperative programs, multiple sources of funding, including private sector sources and public sector grants, will be sought to sustain the programs and activities that achieve demonstrable success. Industry affiliates programs will be formed to promote business development services for established and start-up Portuguese firms. Operational structures will be designed to promote successful technology commercialization and business development activities including enhanced international market access, acquisitions, technology licensing, and accelerated start-up success. Operational guidelines will be developed that will specify how for-profit entities will financially support and otherwise contribute to non-profit activities such as education and research as well as benefit

participating universities and sustainability of the overall cooperative program between UT-Austin and Portugal.

Technology Partnerships & Industry Affiliations

Technology partnerships and industry affiliations between Portuguese universities and businesses, and Austin and US businesses will be vital for the success of the UT-Austin/Portugal cooperative programs. Such affiliations will significantly benefit the overall collaboration in terms of: (1) knowledge gains; (2) insight into global academic and business operations; (3) network contacts and opportunities; and (4) exposure to US and global markets.

2. Interdisciplinary research and advanced education activities in areas encompassing digital media, advanced computing and mathematics

Interdisciplinary research and advanced education will be developed and promoted through CoLab in a way to generate new knowledge leading to wealth creation. The goal is to develop a close agenda bringing together Digital Media, Advanced Computing and Mathematics, so that CoLab can build on existing competences and foster a new scientific agenda at an international level. The various components are described in the following paragraphs.

2.1 Digital Media

2.1.1. Overview

The New University of Lisbon, The University of Porto, and The University of Texas at Austin will collaborate to create digital media centers of education and research excellence to be located at each university as follows:

- **New University of Lisbon:** The Faculty of Science and Technology (FCTUNL); Faculty of Social Sciences and Humanities (FCSHUNL); and School of Economics (FEUNL).
- **University of Porto:** Faculties of Engineering, Fine Arts, Humanities and Economics, and INESC Porto.
- **The University of Texas at Austin:** The College of Communication Radio, Television Film Dept., along with the School of Journalism, the College of Fine Arts, the Computer Science Dept., and the Digital Media Collaboratory.

INESC Porto and related centers at FCTUNL will be key research institute participants in this program. The College of Communication at UT-Austin is the largest in the US with over 10,000 students and includes the Departments of Journalism, Advertising, Radio-Television-Film, Communication Studies, and Speech Disorders as well as the Strauss Institute for Civic Participation; UT Film Institute, Telecommunications and Information Policy Institute; and Knight Centre for International Journalism. PhD and MA programs include Filming for Media; On-Line Journalism; Digital Television; Multi-Channel Journalism; Globalization and International Communication; Technology, Policy, and Information; and History, Theory, Criticism of Film, TV, and New Media as well as a MFA in Production Screenwriting. Media Studies include theory, criticism, technology, history, and business; bridging disciplines program in digital arts, and communication, information, and cultural policy. IC² Institute, The University of Texas at Austin, will work with the Digital Media Program and associated industry affiliates programs to foster innovation and business development based on new media technologies and processes, and for access to international markets.

The overall goal is to have students explore media technologies and their design implications as well as the evolving connections between technology, design, social and cultural domains, and business development. The curriculum for the planned MA degree will be stronger in

hands-on production and experimentation, while the PhD degree will add theory, methodology and critical discourse to these initial areas. Core courses in new research methods for both degrees will allow students to start developing strategies and visions for medium-term research projects. The Digital Media Program will include post-graduate courses and professional workshops in new media. The emphasis will be on emerging challenges in entrepreneurship and technology venturing associated with new media technology content creation, production and exhibition, and applicable in international markets.

By the end of the first year, all students will show, through their work, that they have an understanding of the synergies possible among several media, stressing the social and environmental impact of media convergence and the process of writing for interactive media. By the end of the second year students should prove that they can work as part of an international team within commercial, cultural, social, institutional, and budget constraints with deadline dates for completion. A strong entrepreneurial and innovative culture will be encouraged during organized classes, internships, and self-study.

Research and education initiatives will focus on the creation, exhibition and distribution processes associated with new media as well as other intellectual areas of interest to Portugal and The University of Texas at Austin. These initiatives will include wireless and mobile industry technologies, digital information content, and new media production and distribution such as:

- Digital and interactive media and new distribution systems over the Internet for portable devices, large displays, and small screens;
- Video gaming and documentary media, including content amenable to wireless and mobile technologies;
- Digital journalism, participatory media, and interactive documentary media in interactive environments;
- Community-empowering technologies such as open-source and wiki-style content creation;
- E-Learning technologies with an emphasis on standards-compliant technologies for web accessibility;
- Advanced digital media solutions and systems, including wireless technologies and systems for new media distribution and technology for people unskilled in digital communication and processes;
- Research skills needed for developing or adapting technology to various systems and audiences or users;
- Innovation research and the process of technical change encompassing an understanding of the global media context, and the identification and cultivation of new ideas, processes, and markets for media technologies and content;
- Assessing and minimizing the digital divide in Portugal and perhaps other Portuguese-speaking countries.

2.1.2. Research, Education, and Training

The Digital Media Program will catalyze world-class research, education, and training programs that will involve professors and graduate students from the founding universities as well as top international talent recruited from other sites as well. Student recruitment will focus on highly qualified Portuguese students from Portugal and other Portuguese-speaking countries as well as highly qualified non-Portuguese-speaking students. Classes will normally be taught in English with select courses being taught in Portuguese. The Program will emphasize transdisciplinary research, education, and teamwork among faculty, students, and practitioners. State-of-the-art content management systems and e-learning will support teaching activities in both individual and collective team-building projects. Portuguese students are expected to spend at least one semester at The University of Texas at Austin (or in some cases, at another foreign university) as well as serve as interns at related business partners in Austin, Texas and the U.S. as well as select foreign countries.

Many courses in the Digital Media Program will be based on teaching by immersion with students working on independent, collaborative projects; these may include Web 2.0 projects and experimental journalism, television and radio over IP projects, a multi-player game, and a gallery for interactive advertising. These projects will involve students and faculty from multiple sites whenever possible. The Digital Media Program will organize and implement graduate-level courses available to students seeking advanced degrees, both the Masters and the Doctorate, at the collaborating universities, as well as shorter, intensive workshops for professionals. The Program will help establish degree programs in Portuguese universities and advise on curriculum and research matters. The Digital Media Program will seek to develop advanced research programs to be conducted according to the highest scientific and professional standards, including publications in leading international peer-reviewed journals and exhibition of work in competitive venues.

Targeted Education and Training Activities

Various types of activities will be developed and incorporated into the Digital Media Program. A broad outline includes the following:

- Masters Program: A new one-year “Professional Masters” degree program to be offered by UNL and UP, in close collaboration with academic staff at the College of Communication at UT-Austin.
- Ph.D. Program: A new PhD degree program to be offered by UNL and UP in close collaboration with faculty members at The University of Texas at Austin to be conducted according to the highest scientific and educational demands.
- Contribution to existing Ph.D. Programs: Students of existing Ph.D. Programs, such as the Computer Science/Informatics program at FCTUNL and similar programs at U. Porto will be able to follow course work and develop research within the program. This allows for a closer collaboration between multiple disciplines such as the Advanced Computing area, also included in the overall program with The University of Texas at Austin.

- Continuing education programs: Professional graduate workshops and short courses to train future academic and business leaders in digital media.
- Student exchange: Promote international experience for quality graduate students through exchanges between Portuguese universities and The University of Texas at Austin.
- Research: Foster cooperative research projects in the context of Digital Media Program courses and independent study on such topics as online journalism, foundations of digital media, and research methods. Portuguese and UT-Austin students will be encouraged to engage in interdisciplinary research teams with faculty and practitioners outside the classroom. Faculty-led research projects will include graduate student mentors and undergraduate student researchers. A research practicum course should be a routine part of the curriculum.
- Internships: Create relevant internships for participating students in various organizational settings.
- Fellowships and Research Chairs: Develop fellowships and visiting research positions at The University of Texas at Austin and at Portuguese universities for professors to visit and teach at collaborating universities and engage in quality research and publishing.
- Distance Education: The collaboration between Portuguese public and private institutions and UT-Austin should be facilitated with the use of video and audio conferencing and computer-based educational and collaboration media. Particular attention will be given to the use of new media in online instruction and e-learning.
- Curriculum Development: Transfer successful course material and faculty expertise between UT-Austin and Portuguese institutions. Develop creative and innovative courses in such areas as digital narrative, animation, and advertising including short course formats such as five hours/day for five days for one-to-two week workshops.
- Develop studio-based environments for Digital Media projects wherever practicable – an open space mostly managed by students that is interdisciplinary and largely self-regulated can foster creativity.
- Develop integrated knowledge and virtual communities: Expand Digital Media research programs to other disciplines, deepening knowledge generation processes and enlarging the network of Portuguese and UT-Austin research groups. The objective includes fostering projects through which firms can engage in research and development activities, both in-house and through collaborations with university researchers. Attention should be focused on:
 - New ideas in digital media content as well as applied science, engineering, and broader technologies as they relate to digital media;

- Working on broad-based digital media problems that require innovative solutions, especially areas where comparison and knowledge sharing may be of particular relevance to new media development in Portugal;
- Broadening The University of Texas at Austin and Portuguese academic institutional collaborations where feasible to include leading US and European companies;
- Analyzing and finding solutions to problems and needs with research conducted according to the highest scientific demands, with publications in leading international peer-reviewed journals. Envisioned research programs may include the following:
 - Mobile content development
 - Advanced digital media production and distribution
 - Documentary systems in interactive environments such as interactive documentary
 - Technologies with a social impact such as bridging the digital divide or addressing issues for an aging population including the development of inclusive technologies and systems for the elderly
 - Fostering international collaborations between industry and academia in Portugal and the US that focus on technology entrepreneurship and commercialization

2.1.3. Business Interaction and Development

Beyond new media education and research, participants will receive training in entrepreneurship, innovation, and business development. While PhD research will be oriented towards foundational literature, research methods, and practice, the Digital Media Program will actively promote projects initiated by students in partnership with select industrial and financial partners. During the assessment period, expressions of interest have been set forth by leading Portuguese companies, including Y-Dreams, Innovagency and By-Design. In addition, exploratory contacts have been established with the daily newspaper Público. These companies should allow the practical implementation of an industrial affiliations program to be extended to other Portuguese, European, and American firms and media companies.

Through its collaboration with the College of Communication and the IC² Institute, The University of Texas at Austin, the Digital Media Program will explore the commercialization and marketing of digital media technologies and processes and the preparation of young digital media entrepreneurs and technology managers. One goal will be providing strategic advice and access regarding new and emerging markets in the United States and worldwide. These business development and commercialization activities will feature links with the Austin Technology Incubator and its market making activities in Austin, Texas, nationally, and internationally.

With respect to business applications and enrichment activities, the goal is to promote and guide technology transfer and entrepreneurial ventures and businesses in new media by attracting highly qualified students in the humanities, arts, and communication as well as in science, engineering, and business. Collaborations with new media technology-based firms

will promote joint initiatives involving Portuguese institutions and public and private institutions in Austin, Texas. These activities will include support and promotion of:

- Initiatives for the identification and mobilization of innovative technologies with commercial potential;
- The internship program (noted above) with Portuguese students in Texas start-up firms and Texas students in Portuguese start-up firms, which will occur primarily during summer academic terms;
- A series of training workshops on “technology-based entrepreneurship;”
- A “new media venture design competition” or festival that brings together leading academic institutions with graduate programs in the digital media area. A large-scale “show-and-tell” and roundtable environment can facilitate sharing across institutional boundaries;
- An annual prize for the best new ideas for new media-based firms developed cooperatively by students at Portuguese institutions and The University of Texas at Austin.

2.1.4. Contributions to Information Society Policy

Contributions to information society policy and pilot experiments in Portugal will be explored through the participation of the Knowledge Society Agency (UMIC) – the Portuguese governmental agency involved in information society policies – in particular in the areas of inclusion, accessibility to the handicapped and elderly, interactive learning environments, citizenship and public participation, and interactive content development.

2.1.5. Key Institutions and Personnel

In Portugal key institutions and individuals include Antonio Camara, Nuno Correia (FCT/UNL and Y-DREAMS) and Artur Pimenta Alves (University of Porto and INESC-PORTO). Participating faculty include Joao Mario Grilo, Antonio Granado; Rui Cadima; Nelson Traquina, and Jose Rodrigues all at FCSH-UNL. Important Portuguese companies include Y-DREAMS and the daily newspaper PUBLICO. From the Portuguese public sector, the Knowledge Society Agency (UMIC). UT-Austin key colleges and Departments include: The College of Communication and Departments of Radio, Television, and Film (RTF); Department of Journalism; College of Fine Arts including Theater, Dance, Art, and Music; College of Engineering, Department of Computer Science; and IC² Institute, Digital Media Collaboratory and Austin Technology Incubator. Participating faculty and instructors include Dr. Sharon Strover, Chair, RTF; Rosenthal Alves, on-line journalism; Bruce Pennycook, music and digital arts; Geoff Marslett, animation; Karen Kocher, nonlinear narrative; Ana Boaventura, interactivity and digital storytelling; Arie Stavchansky, compositing and special effects; Gary Chapman, LBJ School of Public Affairs; Ann Beamish and Michael Oden, School of Architecture; Don Turnbull, School of Information; Okan Arikan, College of Natural Sciences; and Joe Straubhaar, Stuart Kelban, John Leckenby, and Kathleen Tyner all of the College of Communication. Participating from the IC² Institute are Isaac Barchas, Director of the Austin Technology Incubator; and Sid Burbach, Director of the Institute’s Commercialization Program. Roy Jenevein, Director of the Digital Media Collaboratory (DMC) and Aliza Gold, Manager of the DMC, may also participate.

2.1.6. Governance

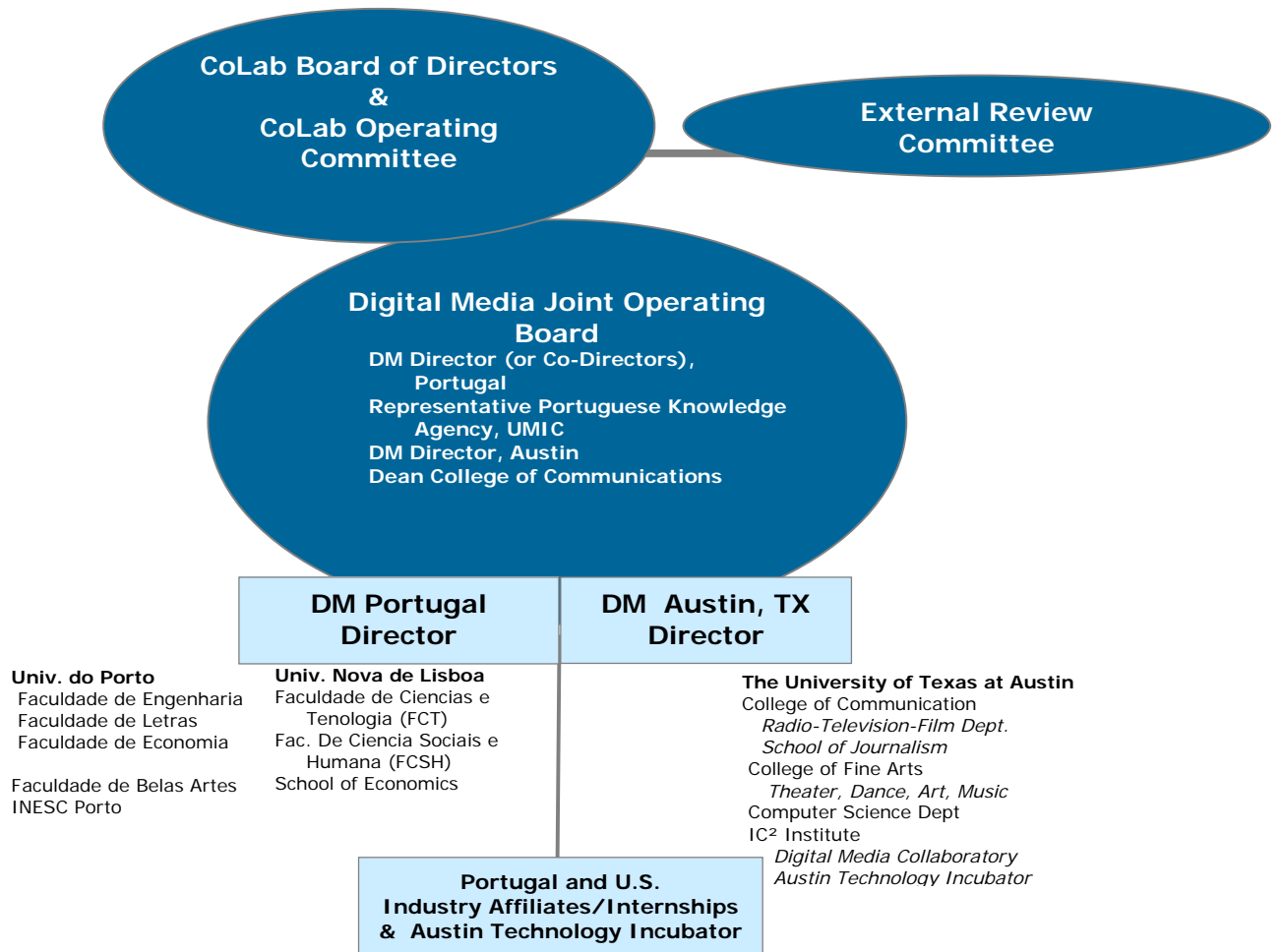
A vibrant Digital Media Program will be an important catalyst in Portugal's transition to an innovation-based economy through (1) facilitating quality research, education, and training related to new media, and (2) accelerating business development and international market access of Portuguese Digital Media products and services. The overall organization of the UT-Austin/Portugal collaboration will support the primary goal of achieving early success while fostering sustainable cooperative activities (Figure 1).

The Digital Media Program will initially be made up of representatives from The University Nova de Lisboa and The University do Porto in Portugal and at UT-Austin the College of Communication (Radio Television Film, School of Journalism); the College of Fine Arts (Theater, Dance, Art, and Music); the IC² Institute; and the Computer Science Department; and the Digital Media Collaboratory (DMC). The goal is to have a single Digital Media Program operating and management structure in Portugal with strong links to UT-Austin. The Digital Media Program will have a Joint Operating Board with four members, namely: the Portuguese Digital Media Program Director (who can be represented by his Co-Director), a representative from the Portuguese Knowledge Agency, the Digital Media Program Director from UT-Austin and the Dean of the College of Communications at UT-Austin.

There will be a CoLab Board of Directors (as discussed in section 5 of this document) to help coordinate all the UT-Austin/Portugal collaborations, including the Digital Media Program. Portuguese and UT-Austin CoLab Directors will be responsible for identifying possible additional areas of intervention and cooperation in education, research, and business development. The Board of Directors will be assisted by a CoLab Operating Committee, with representatives from all the areas.

There will be an External Review Committee composed of Portuguese and international academic, business, and government representatives that will advise the CoLab Governing Board and Digital Media Operating Board. The External Review Committee will be charged with evaluating and providing ongoing recommendations for the programs and activities of the UT-Austin/Portugal Digital Media cooperative programs. Structuring the proposed collaborations for research and education, including the possibility of double MA and PhD degrees, will invoke appropriate legal, governance, and institutional considerations. In terms of business development activities, the institutional framework governing Portuguese academic and for-profit organizations as well as The University of Texas at Austin and U.S. and Portuguese business communities need to be considered and assessed, including legal issues associated with public-private and international S&T collaboration such as intellectual property protection, and reliable and useful metrics for continuous monitoring and evaluation of Digital Media programs and activities.

Figure 1. Digital Media (DM) Cooperative Program



2.2 Advanced Computing

2.2.1. Overview

A network of research centers and academic departments will collaborate to create a program on advanced computing, with education programs at the Ph.D. level, and research to be located at the following universities:

- **LAETA, Laboratory for Energy, Transports and Aeronautics**, Associate Laboratory
- **LIP, Laboratory for Particle Physics** in Lisbon, Associate Laboratory
- **New University of Lisbon**: Department of Computer Science at Faculdade de Ciências e Tecnologia (CS-FCT-UNL);
- **Technical University of Lisbon**: Through the Instituto Superior Técnico (ISTUTL), including IDMEC-Institute for Mechanical Engineering, ICIST- Institute for Structural Engineering, Territory and Construction, and the Centre for Plasma Physics (PPC-IST)
- **University of Aveiro**; Through Research Units IT and IEETA and the Department of Electronics, Telecommunications and Informatics (DETI)
- **University of Coimbra**:
 - the Dependable Systems Group of the Department of Computer Science (DSG-CS-UC);
 - Centre for Computational Physics (CFC-UC).
- **University of Minho**: Department of Computer Science (CS-UM);
- **University of Porto**;
- **The University of Texas at Austin**:
 - Department of Computer Science (CS-UTA);
 - Department of Electric and Computer Engineering (ECE-UTA);
 - Institute for Computational Engineering and Sciences (ICES);
 - Texas Advanced Computing Center (TACC), Distributed & Advanced Computing Group

In Portugal, the Knowledge Society Agency (UMIC) and the Portuguese National Science Foundation (FCT) have recently launched the Portuguese National GRID Initiative (INGRID) and should be actively involved as governmental organizations.

Advanced and grid computing enables the integration of computers, data repositories, and scientific instruments into a vast cyber-infrastructure that will allow scientists, engineers, and information technology workers to become more productive, thereby stimulating the economy of nations. The mission of the UT Austin's Distributed & Grid Computing Group at the Texas Advanced Computing Center (TACC) is to develop and deploy new software technologies that help connect and aggregate advanced computing systems (HPC, storage, visualization, networks, etc.) into powerful computational grids.

The University of Texas at Austin (UT-Austin) and a number of Portuguese higher education institutions, research centers and companies plan to conduct research in the field of advanced and grid computing and to offer joint educational programs. Joint research to enhance and take advantage of advanced computing capabilities will be conducted by the

Department of Computer Science (CS-UTA), the Department of Electric and Computer Engineering (ECE-UTA), the Institute for Computational Engineering and Sciences (ICES), and the Texas Advanced Computing Center (TACC) at UT-Austin, together with the Department of Computer Science at Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa (CS-FCTUNL), the Dependable Systems Group of the Department of Computer Science at the Universidade de Coimbra (DSG-CSUC), and the Department of Computer Science at the University of Minho (CSUM), These Institutions will also pursue joint educational programs at the M.Sc. and Ph.D. levels. They will also engage in the development of applications that use advanced computing together with TACC, the Laboratory for Particle Physics in Lisbon (LIP), Critical Software S.A. (CSW) and the Center for Computational Physics in the University of Coimbra (CFC-UC).

2.2.2 Current Activities Conducted in Portugal and at UTA

In Portugal, the Knowledge Society Agency (UMIC) and the Portuguese National Science Foundation (FCT) have recently launched the Portuguese National Grid Initiative (INGRID). The objectives of this initiative include upgrading infrastructures at computing clusters and upgrading connectivity at both the backbone level and the local loop level. It also supports R&D projects in grid computing as well as demonstration projects that apply grid computing to other scientific areas, such as high energy physics, meteorology, oceanography, and health sciences, among others. Finally, INGRID also offers support for advanced training of human resources in ways that promote both multidisciplinary work and the internationalization of Portuguese projects in advanced computing.

Research centers, higher education institutions and companies that in Portugal work and conduct research in the field of advanced and grid computing include the Laboratory for Energy, Transports and Aeronautics (LAETA), the Laboratory for Particle Physics (LIP), the Center for Computational Physics at the University of Coimbra (CFC-UC), the Dependable Systems Group (DSG) of the Department of Computer Science at the Universidade de Coimbra (CS-UC), the University of Aveiro (UA), the University of Porto (UP), the Computer Science Department at Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa (CS-FCTUNL), the Department of Computer Science at the University of Minho (CS-UM) and Instituto Superior Técnico of the Technical University of Lisbon (ISTUTL; including IDMEC-Institute for Mechanical Engineering, ICIST- Institute for Structural Engineering, Territory and Construction, and the Centre for Plasma Physics). Also, the software company Critical Software (CSW), a spin-off from University of Coimbra.

LAETA, the Associate Laboratory for Energy, Transports and Aeronautics is developing a range of grid applications, including initiatives in “GRID-Turbulence”, parallel processing for concurrent structural and material optimization, the human motion “BioGrid”, parallelization algorithms for image processing and mesh generation in biomedical applications and error estimation for large scale problems. Some of these activities are under development in close collaboration with ICIST and other research units at ISTUTL.

LIP is a partner in the following international projects: Worldwide CERN-LHC Computing Grid, EGEE-2 - Enabling Grids for E-science, Int.EU.Grid - Interactive European Grid, and Project EELA - E-infrastructure shared between Europe and Latin America. LIP is the recognized Grid Certification Authority for Portugal. Under the EGEE-2 LIP shares responsibilities on operations, user and site support, global support, core services,

authentication services, pre-production, production cluster, dissemination, training and deployment coordination. LIP is deploying a TIER-2 Grid Computing Unit planned to integrate 1000 CPU's.

CFC-UC hosts and manages two HPC clusters (one soon to be managed by LIP and to be part of the EGEE/LCG grid). Its research topics, which use HPC/GRID resources, include Lattice Quantum Chromodynamics and Time-Dependent Density Functional Theory (TDDFT) applied to nano-systems. Members of the CFC-UC play an important role in the maintenance and development of the code OCTOPUS used in TDDFT applications.

At DSG-CS-UC the research topics include dependability benchmarking for advanced and grid middleware and grid services, self-healing techniques for grid middleware, fault-tolerance techniques for desktop grid middleware, sabotage-tolerance and trust-management and virtualization techniques for grid applications.

CSW developed WMPI II, an advanced version of Message Passing Interface (MPI) that supports code parallelization for high performance clusters. CSW participated in the HICOD2000 ESA project, an open architecture to produce JPEG2000 coded digital images from Earth Observation (EO) products using high-performance OGSA Grid environment. Currently CSW participates in the project "GODIS - Grid On Demand" project that aims to operate the advanced infrastructure used at ESRIN, which will provide external users the exploitation of high performance computing resources and easy access to earth observation data.

At University of Aveiro (UA), faculty and researchers at the Department of Electronics, Telecommunications and Informatics (DETI) and related Research Units IT and IEETA run research projects in the area of Grid Computing and Applications, namely the EU's funded projects AKOGRIMO and the project INFOGENEMED, which was coordinated by UA. In addition, it should be noted the involvement in the HealthGrid Association, which has been associated with the publication of a white paper on the subject, and the BIN network (Brain Imaging network, involving Universities of Minho, Porto, Coimbra and Aveiro and financed by the Portuguese Science Foundation), as well as the collaboration with the EEGE project and the use of Grid Computing in the healthcare. The DETI is also involved in a joint PhD program in the scientific Area of Informatics with the Universities of Porto and Minho, which considers the domain of Grid Computing. Applications are also under development in several other departments and research units (Mathematics, Physics, Environment, Biology).

At University of Porto, UP, several initiatives are ongoing concerning Advanced Computing, including the establishment and deployment of a University Campus Grid (the key contact person being Ligia Ribeiro), in order to support applied research in science and engineering, as well as several research projects on computational science and engineering and on emerging technologies for Advanced Computing (namely at FEUP - Faculdade de Engenharia da Universidade do Porto and in the FC - Faculdade de Ciências, the key contact person being Fernando Silva). In addition, the University of Porto is also involved in a collaboration with U. Minho and U. Aveiro in a joint doctoral degree in Computer Science, where emerging Advanced Computing technologies play an important role.

At CS-FCTUNL, research takes place in the context of the two research centers hosted by the department: the Center for Informatics and IT (CITI) and the Center for Artificial Intelligence (CENTRIA). At CITI, directed by Professor José Cardoso e Cunha, new paradigms for global, large-scale and distributed computing are being investigated with respect to the design of new abstractions, programming models, software concepts, tools and environments, system architectures, and networks (including mobile, overlay and peer to peer networks). Research in advanced and grid computing is ongoing at three main levels, both at FCTUNL and through international cooperation: (i) abstractions, methodologies, and tools to facilitate the development of large-scale and dynamic grid applications; (ii) distributed and advanced computing systems and their application in science and engineering through multidisciplinary partnerships, namely involving other faculty at FCTUNL such as those in environment, geology, and materials science, and Edisoft, a company close to the FCTUNL campus with a strong R&D component and expertise in advanced computing projects; (iii) education at M.Sc. and Ph.D levels, with the responsibility for a M.Sc. course on advanced and grid computing systems and Applications, in the FCTUNL Master in Computer Science, and also involved in an international project on curriculum development for advanced computing, involving graduation of PhD students.

CS-UM has been active in parallel and distributed computing for more than a decade. R&D follows software engineering approaches while keeping the original concerns on application-oriented performance and scalability and on the deployment of HPC systems for computational science. Research focuses on the theoretical and applied issues critical to parallel and distributed computing that allow for exploiting medium to large HPC and communications systems. Current applied R&D projects address the following issues: programming paradigms and tools for portable/pluggable parallel and advanced computing (Java and Aspect-oriented); grid-enabled frameworks to run multi-paradigm interactive applications; adaptive computing models for parallel global illumination in image rendering; computer vision techniques based on parallel vector co-processing (gpGPU's); models and tools to port advanced-enabled scientific applications; large scale distributed information retrieval and data mining applications; high-performance distributed dictionaries; simulation of huge computer networks protocols and applications; modeling and parallel simulation of large forest fires on a grid of clusters based on grid-aware geo-referenced data, to support real-time decisions in civil protection environments.

CS-UM is currently managing a multi-disciplinary computing infra-structure based on interconnected computing clusters of SMP nodes (EM64T-based CPU's) with fast internode links (Myrinet 10G), to be shortly linked to national and European Grids. UM is currently running the first joint doctoral program in Portugal in computer science, together with University of Oporto and University of Aveiro. Likewise, the development of a joint Ph.D. program between Portugal and UT-Austin in the area of advanced computing is a subject worth further consideration and implementation.

At Instituto Superior Técnico (IST), the Laboratory and Simulation of Energy and Fluids (LASEF) at IDMEC performs research in the field of fluid dynamics that resorts heavily to the use of high-performance and grid computing tools. In addition, IDMEC-Institute for Mechanical Engineering, is entering into a major research initiative with ICIST- Institute for Structural Engineering, Territory and Construction in grid applications. Also, the Centre for Plasma Physics at IST (PPC-IST) is developing an e-science program aimed at training

scientists to use grid computing tools and interfaces to access high-performance shared resources for simulation purposes and for aided visualization of scientific results, the key contact person being Luis Oliveira e Silva. These activities are developed in international consortia, namely the Osiris consortium, led by UCLA and IST, which develops applications for numerical simulation in plasma physics. PPC-IST has also recently established a new partnership with the super-computing Center MareNostrum in Barcelona, for simulation and analysis of scientific results from theoretical models for particle acceleration. PPC-IST is currently setting up its own grid computing cluster with 256 CPU cores.

At UT-Austin, research in the area of advanced and grid computing is mostly performed at The Institute for Computational Engineering and Sciences (ICES), the Department of Computer Science (CS-UTA), and the Department of Electrical and Computer Engineering (ECE-UTA). In addition, UT-Austin hosts one of the most powerful advanced computing centers in the world, the Texas Advanced Computing Center (TACC).

At ICES, several faculty members are involved in large-scale computational science simulations. For example, Professor Mary Wheeler has a large group that simulates oil-reservoirs, and Professors Tinsley Oden and Tom Hughes lead a group that is working on computational medicine in collaboration with the M.D. Anderson Cancer Center in Texas. Faculty in ECE, such as Professors Vijay Garg, Margarida Jacome, and Gustavo de Viciara are conducting research on a variety of techniques for fault tolerance to hardware, software and data faults, load balancing and resource allocation in physical and overlay networks, and sensor networking and ubiquitous computing involving different models for gathering information, and distributing computation and data in a physical environment. Faculty in CS, such as Professors Keshav Pingali and Chandrajit Bajaj, are working on application-level checkpoint-restart techniques for long-running computational science applications, and visualization.

TACC is engaged in grid computing research and development and acts as a key player in operational grids such as the TeraGrid and Open Science Grid to service national users and the Texas Internet Grid for Research and Education (TIGRE) to service users in Texas. At TACC, Dr. Edward Walker develops techniques for constructing virtual clusters, user-level file systems, and overlay networks. Dr. Warren Smith investigates performance prediction and scheduling of distributed systems. Dr. Ashok Adiga researches scheduling and desktop grids. Dr. Kelly Gaither develops methods for remote visualization. Dr. Kent Milfeld is a leader of the GridChem project that allows users to configure computational chemistry simulations, execute them across a number of distributed clusters, and analyze the results. Eric Roberts and Maytal Dahan build web portals for grids such as TeraGrid and TIGRE as well as science gateways for flood modeling and visualization.

The Grid Computing Group at TACC has several R&D projects in progress and receives funding from four federal agencies (NSF, NASA, DoE, and DoD) to support its work. The R&D activities are focused on four main objectives: Advanced resources information data storage/archival system; Web services for Grids; Grid-based portals; and deployment, configuration, and enhancement of Grid schedulers. These activities are targeted towards three main Grid deployment efforts: a UT campus advanced, the High Performance Computing Across Texas HiPCAT Texas Internet Grid for Research & Education

(TIGRE), and NSF Grid programs at NPACI, including the TeraGrid. The R&D projects will also contribute to emerging DoD and DoE Grids and to the NASA Information Power Grid (IPG).

2.2.3. Research Agenda for Further Interactions

The following areas will be jointly explored in order to find specific research topics of common interest:

- *Computational Science*: modeling, simulation, optimization, performance analysis and tuning, numerical methods for parallel and distributed computing;
- *Computer System*: paradigms and algorithms, system performance analysis, middleware, tools and technologies, and development of useful environments to the user.
- *Applications*: in science, engineering, economics, civil protection and risk management;

In addition, TACC and the Portuguese institutions will work together on deployment and operational issues for advanced computing, such as software, tools evaluation and secure access. All projects in these areas will include education, training, outreach activities and will consider opportunities for technology transfer, as Figure 2 shows.

In the area of *Computational Science*, work will be developed closely with teams of computational scientists and applied mathematicians from both UT-Austin and Portugal. Joint work will build on previous experience with interdisciplinary research at all the Portuguese universities involved in the partnership and will focus on the development of parallel numerical methods for science and engineering applications.

In the area of *Computer Science*, the main research issues to pursue include models and tools for programming, compilation, execution and debugging, web services, workflows, (utility driven) resource allocation in networks and global properties of large computer networks. Issues in fault-tolerance, like autonomic computing, self-healing, software aging, rejuvenation, dependability, and quality of service in advanced computing, will also be addressed. Overlay and peer-to-peer networks will also be studied as well as broadband wireless technology for advanced computing.

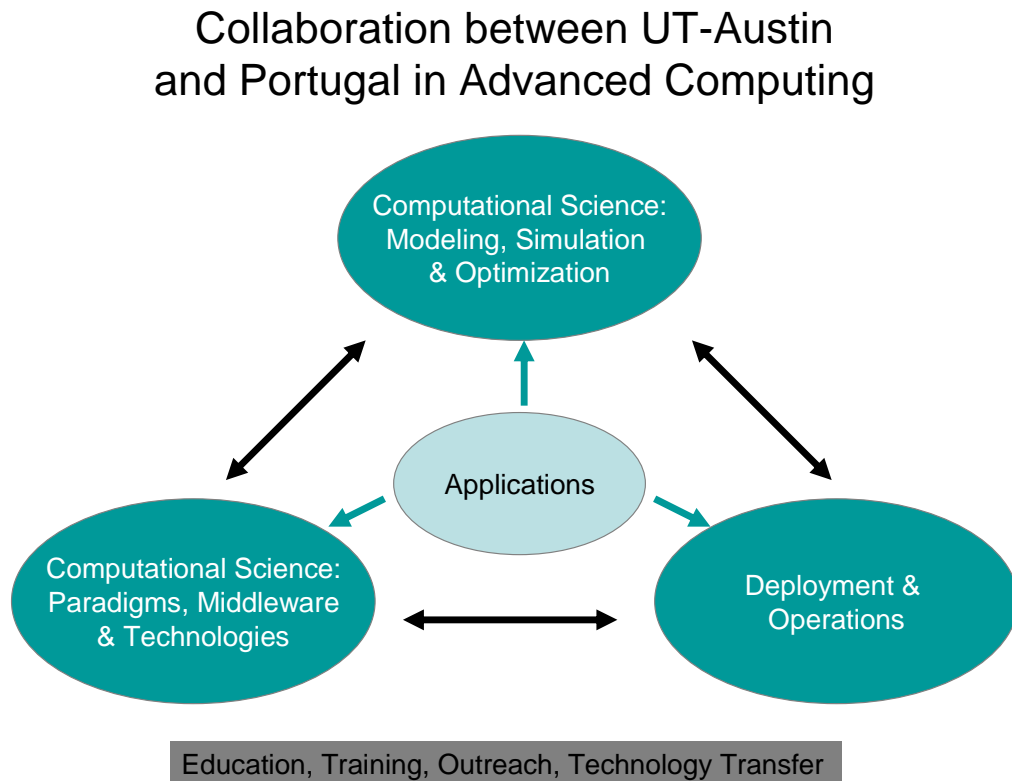
The research agenda will also include work on load balancing and resource allocation across a shared computing and communication infrastructure. For example, there is a need to extend traditional quality of service (QoS) metrics that have primarily been defined for communications services, so as to enhance the performance of an advanced and grid computing application, or multiple applications that share computing/communication infrastructure.

Research towards formulating and extending utility-based resource allocation for dynamic networks, and in particular for metrics that are relevant to the applications at hand, e.g., delays in transferring large amounts of raw data to remote sites, or approaches to routing and network caching of shared data among distributed sites will be pursued.

In the area of *Deployment and Operations*, collaboration will be aimed at improving cluster and grid computing environments by exchanging information about approaches and technologies, by developing best practices, and by investigating issues of U.S.-Europe

advanced interoperability. The collaboration will also provide guidelines for those performing R&D using clusters and grids so that technologies are usable and provide the needed functionality.

Figure 2: Organizational chart of joint activities between UT-Austin and Portugal in the field of advanced computing.



In the area of *Applications*, the collaboration will consider the following:

- Study the relationship between advanced computing and power systems, and how the former can be used to enhance the performance of the latter;
- Optimize models and simulations using the advantages offered by advanced and grid computing technology (in fields such as oceanography, new materials, nanotechnology, flooding, and forest fires);
- Develop distributed data warehouse for simulation data obtained from protein folding and unfolding;
- Develop algorithms for large-scale parallelization of image processing and visualization (for medical applications, cultural heritage);
- Solve challenges posed by the analysis of terabytes of raw data (e.g., telescope information data processing about stars);
- Apply advanced and grid computing to research in environmental sciences, material sciences and geological sciences;

- Develop software verification and validation methods for parallel algorithms and result analysis.
- Develop web portals for user-friendly access to grids and scientific results;
- Test existing parallel codes using different advanced environments;

All research programs will include faculty and student exchange, co-supervision of Ph.D. students, and hosting of exchange post-doc fellows. An annual workshop in the field of advanced computing will be co-organized between UT-Austin and Portugal in the second and following years, which should include a Ph.D. doctoral consortium. A series of regular seminars of visiting faculty and over the Internet on advanced computing between Portugal and UT-Austin is also intended.

2.2.4. Joint Educational Program

ICES and the Portuguese institutions aim to put together an educational program in the area of advanced computing to appear as a sub-field in existing programs in Computer Science. In a first phase, this program will consist of a series of advanced courses that students can take both in Portugal and at UT-Austin that are automatically recognized as part of existing M.Sc. and Ph.D. offerings. Therefore, a student engaged in an existing post-graduate program and working towards the research projects aforementioned will be able to plan and take coursework, including courses in both Portugal and at UT-Austin as part of the academic curriculum. This allows students to keep pace in completing the academic requirements of the degrees they are engaged in while traveling and spending time on student exchanges between Portugal and UT-Austin.

In a second phase, the coursework mentioned above and the joint research projects between Portugal and UT-Austin may converge into a joint Ph.D. degree offered by the Portuguese institutions and UTA/ICES in the field of advanced computing. Such a Ph.D. degree may be awarded to students that complete a set of requirements to be defined by the schools involved. A M.Sc. degree might be offered after an academic curriculum has been completed and enough research presented. Students willing to pursue the joint Ph.D. degree must then pass qualifying examinations and defend their thesis.

In order to enable the application and exploitation of advanced and grid computing technologies, the following education and training initiatives will be promoted:

- **Short courses and training seminars:** The focus will be on advanced computing tools, environments, and systems administration for presenting overviews of advanced computing systems and technologies. An additional objective is to promote the utilization, application development, and management of advanced computing environments. Besides individual course units, the Advanced Computing Program will also consider the organization of intensive summer classes with practical, hands-on laboratory facilities.
- **Advanced courses:** Individual courses, covering the main dimensions of advanced and grid computing including: (i) user interfaces, advanced portals, and problem-

solving environments; (ii) advanced application development, including parallel and distributed programming models, software environments, and tools; (iii) advanced middleware, services and resource management; and (iv) advanced distributed infrastructures, and operating systems management including clusters, heterogeneous resources for computation, storage and communication. Such themes can be complemented with other courses with a focus on computational science or scientific computing themes such as simulation, numerical methods and algorithms. Such advanced courses can be offered as individual teaching units and attended by students with different backgrounds including: (i) students with a master's degree in Computer Science/Informatics/Software Engineering who seek further specialization in advanced technologies; and (ii) students with a background on science and engineering who also seek complementary education on advanced technologies. For both kinds of students such advanced courses can contribute to course requirements for a PhD or to education on advanced technologies aiming at a professional integration in industry. By attending a collection of such advanced courses and obtaining a number of ECTS a student can obtain a certified 'Diploma de Formação Avançada.' Such a "Diploma" can also contribute to part of the course requirements for the 1st year of a PhD.

- **PhD Program in computer science and informatics with focus on advanced computing:** In Portugal, a PhD Program in computer science/informatics is a 3rd cycle graduate program defined in the context of the European Union "Bologna Treaty" reformulations of higher education. Such a program aims at enabling professional opportunities in fundamental research or research and development (R&D) in universities for both teaching and research activities and in industry. As such, it is required that the degree provides a specialization based on a broad and consolidated knowledge in computer science/informatics. Accordingly the cooperation between UT-Austin and select Portuguese universities will work toward a PhD program in computer science/informatics with a focus on advanced and grid computing instead of a new type of PhD degree. Such a focus will be achieved through: (i) specialized and advanced courses; (ii) studying and working in a research environment at the participating universities and research centers integrated in projects related to advanced and grid computing ; and (iii) the preparation of a PhD thesis on a theme related to advanced and grid computing. Potential candidates to such a PhD program should be students with a background including a masters (2nd Bologna cycle) on computer science, informatics, software engineering or in electrical and computer engineering. It is assumed that the students will have acquired a sound education on the foundations, abstractions, design and technological themes of computer science and informatics as well as a broad understanding and working knowledge of the area through the advanced program seeking further specialization and maturity at the level of a PhD.

Overall, PhD programs in computer science and informatics in Portuguese universities, have a typical duration of four years (with a minimal of three and a maximum of five) and are typically organized into three main phases: the preparation phase, the research phase, and the dissertation writing phase. In the preparation phase, typically 1 year, the student completes the required PhD courses. By the end

of the first year (or 18 months) the student, together with the candidate advisor, prepares and submits the “Doctoral Plan”. The doctoral plan and its presentation as well as the student’s course grades including qualifying exams are evaluated by the Scientific Committee in order to approve the student’s transition to the research phase. The student is expected to continue involvement in supervised research activities. Typically, after two years, the student prepares and submit the “Thesis Proposal” which will be orally and publicly presented and formally reviewed and evaluated by the Scientific Committee in order to assess the maturity and results of the work already produced and to determine whether the student will be able to produce the final written dissertation after an additional year of full-time work.

Overall there are some differences in the structure and operational details of the distinct PhD Programs of CS-FCTUNL, CS-UM, and CS-UC, and other universities that will be involved in this program, including University of Porto and University of Aveiro. In order to identify and define a common template for a joint PhD Program to be pursued under the cooperation protocol with UT-Austin the three Portuguese universities will prepare a joint proposal for a common program so that a participating student can transparently enroll in the Advanced Computing PhD Program by following a common and uniform model for PhD work independent of any one institution. Such a common template will also be used for meeting UT-Austin PhD program requirements and for the possibility of establishing a common protocol. It is a goal of the Advanced Computing Program to allow for a reasonable degree of flexibility in this mapping so that collaboration is enabled with UT-Austin without strong forms of a joint PhD Program that may require long-term discussions.

It is also an important goal that all PhD students are held to the highest scientific standards and satisfy the PhD program requirements that are defined by the participating universities. Such matching protocols will address the following issues: (i) student admission requirements; (ii) PhD course structure; (iii) requirements for accepting the doctoral plan and for assessment of work progress; (iv) joint co-advicing involving the Portuguese universities and UT-Austin; (v) residency requirements of the students and co-advisers at UT-Austin and in Portugal; and (vi) PhD thesis submission and defense.

It is understood that any joint degree program will require a specific protocol to be established by means of procedures to be determined and approved by the UT-Austin and the involved Portuguese partners. It is intended that these protocols be defined 'on top' of the existing PhD Programs and not by creating a new PhD program.

2.2.5. Contributions to Grid Computing Policy

Possible contributions to policy within the recently launched National Grid Initiative in Portugal will be explored through the participation of the Portuguese Knowledge Society Agency (UMIC) which planned the initiative and is involved in its monitoring.

2.2.6. Key Institutions and Personnel

At UT-Austin, ICES, the Department of Computer Science, the Department of Electrical and Computer Engineering, and TACC will participate in the joint research and education programs on Advanced Computing. The key people include Tinsley Oden, Margarida Jacome, Gustavo de Veciana, Vijay Garg and Keshav Pingali. TACC is engaged in advanced computing R&D, advanced applications and advanced software deployment and operations and key people include Jay Boisseau and Warren Smith.

In Portugal, José Cardoso e Cunha is the key contact person at CS-FCTUNL for educational and research programs. Other key people include Pedro Medeiros, Cecilia Gomes, Vitor Duarte, Joao Lourenco, Paulo Lopes, Hervé Paulino, and Adriano Lopes. Developments in the application and computational science areas will also involve other FCTUNL faculty from the Computer Science department and other departments. Nuno Correia will also be involved in exploring synergies with advanced computing and digital media.

The Knowledge Society Agency (UMIC) will participate as the policy planning and monitoring agency for the National Grid Initiative. Pedro Ferreira is the key contact person. At LIP, Gaspar Barreira is the key contact person for the development of applications to use high performance and grid computing and for connection to European advanced projects, such as EGEE. At LAETA, Carlos Mota Soares is the contact person. Pedro Alberto and Fernando Nogueira are the key contact people at CFC-UC for applications in the area of Computational Physics. Luis Silva is the key contact person at DSG-CS-UC for educational and research programs with UT-Austin. Other key people include João Gabriel Silva, Henrique Madeira, Paulo Marques, and Nuno Cunha from CSW.

Alberto Proença is the key contact person at CS-UM for education and R&D in computer science, while Antonio Pina is the key researcher in charge of deployment issues and Rui Ralha is an expert in parallel numerical computation. Other colleagues in CS-UM that conduct research in parallel and advanced computing include Joao Luis Sobral and Luis Paulo Santos. Other relevant CS-UM faculty study formal methods, computer communications, and distributed systems as well as faculty from physics and mathematics departments at UM.

2.2.7. Governance

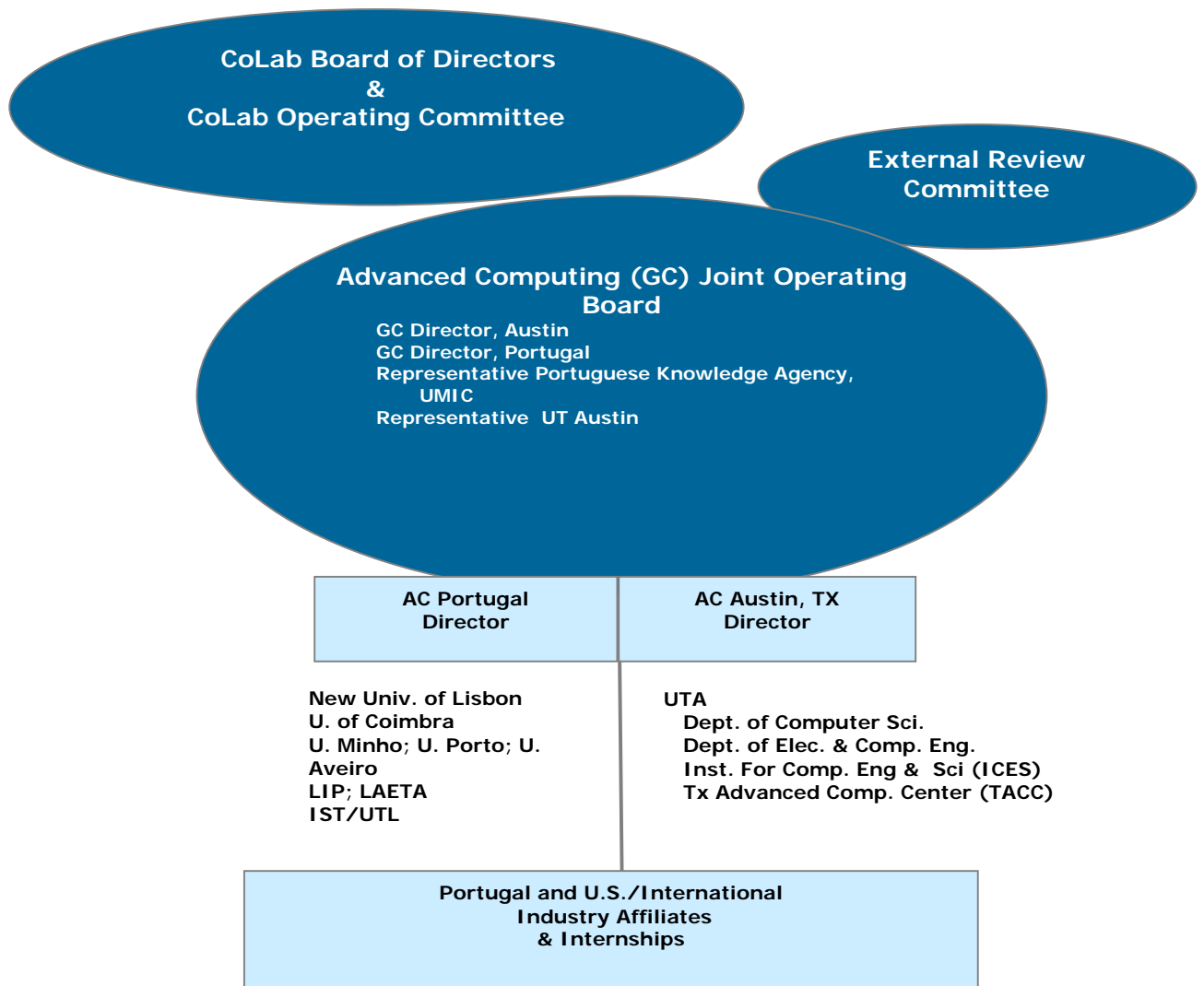
The Advanced Computing Program is expected to be an important catalyst in Portugal's transformation to an innovation-based economy through facilitating quality research, education, training, and application. Advanced Computing will have a Joint Operating Board that will have a Director based in Austin and a Director based in Portugal, together with a representative from the Portuguese Knowledge Society Agency (UMIC) and another representative from UT Austin. Both directors will organize and participate in Advanced Computing's Joint Operating Board. The Joint Operating Board will be responsible for structuring the proposed collaborations for research and education, including the joint PhD degree, and will invoke appropriate legal, governance, and institutional considerations.

The overall organization of the UT-Austin/Portugal collaboration, The International Collaboratory for Emerging Technologies (CoLab), will support the primary goal of

achieving measurable success while fostering sustainable cooperative activities. CoLab will work to help coordinate all the UT-Austin/Portugal collaborations including Advanced Computing, Mathematics, Digital Media, and UTEN. Portuguese and UT-Austin CoLab Directors will be responsible for identifying possible additional areas of intervention and cooperation in education, research, and business development. The Board of Directors will be assisted by a CoLab Operating Committee with representatives from all collaborative programs.

There will be an External Review Committee composed of Portuguese and international academic, business, and government representatives that will advise the CoLab Governing Board and program operating boards. The External Review Committee will be charged with evaluating and providing ongoing recommendations for CoLab programs and activities.

Figure 3. Advanced Computing (AC) Cooperative Programs



2.3. Mathematics

2.3.1. Overview

The UT Austin-Portugal program will include a specific program in the area of mathematics with emphasis on a PhD program, together with a joint research agenda, which will be implemented through collaborative actions involving research centers and academic departments in the following institutions:

- **New University of Lisbon:** Through the Department of Mathematics and associated research centers at The School of Science and Technology (FCTUNL)
- **Technical University of Lisbon:** Through the Department of Mathematics and associated research centers at Instituto Superior Técnico (ISTUTL)
- **University of Coimbra:** Through the Department of Mathematics and associated research centers at the School of Sciences and Technology UC (FCTUC)
- **University of Lisbon:** Through the Department of Mathematics and associated research centers at the School of Sciences (FCUL)

Nonlinear analysis and partial differential equations, numerical analysis, combinatorics, probability and stochastic are some of the areas essential to modern science, engineering and finance in which the research groups in the institutions above have developed considerable expertise. The modeling of complex phenomena and applications in diverse areas such as computational biology, financial engineering, computer vision, the web, and the design of modern aircraft, for example requires sophisticated mathematics. Modern science rests on the dynamic interplay between experiment, modeling, simulation and theory as never before, in a constantly deepening interaction. As a result, the UT Austin-Portugal Program will bring together the complementary expertise of mathematicians and other scientists from several institutions into research interactions that will: (i) pull together the available scientific and mathematical expertise to contribute in a significant way to the modern challenges; and (ii) foster the education and development of scientists who can better respond to the challenges of these new scientific and technological realities.

2.3.2. Education and Research Agenda

In the context of the cooperative program between the Portuguese Government and The University of Texas at Austin (UT-Austin) a specific project is proposed involving the Department of Mathematics, UT-Austin, the Department of Mathematics and associated research centers at the School of Sciences of UL (FCUL), the Department of Mathematics and associated research centers (namely CAMGSD, Centro de Análise Matemática, Geometria, e Sistemas Dinâmicos) at the Technical Superior Institute of UTL (IST-UTL), the Department of Mathematics and associated research centers at the School of Sciences and Technology of UNL (FCTUNL), and the Department of Mathematics and associated research centers at the School of Sciences and Technology of UC (FCTUC). The project is to develop advanced programs of research and education in specific areas of mathematics of common interest and expertise to:

- Reinforce the scientific and learning capabilities in Portugal, as well as to promote the internationalization of research and graduate programs of the aforementioned university groups;

- Stimulate mobility and scientific interaction of graduate students, researchers and post-docs between the cited institutions;
- Attract to the involved universities strongly motivated students who are able to integrate advanced research programs in Mathematics and applications;
- Optimize resources, by promoting a PhD program that involves the major universities in Lisbon.

2.3.3. LUTAMath–PhD Program

The goal is to create an internationally attractive graduate program which will be organized along the following guidelines:

1. Students enrolled must satisfy the requirements of all of the participating universities. Therefore, upon completion of these academic requirements, the student will be allowed to submit his thesis both at the participating Portuguese universities and at UT-Austin and the student will be able to obtain a degree in mathematics from the participating institutions.
2. There is a long history of scientific interaction between the Department of Mathematics at UT-Austin and Portuguese universities namely in the areas of applied mathematics and partial differential equations. Furthermore, both UT-Austin and the involved Portuguese universities have strong and complimentary groups in geometry and topology providing the framework for strong intellectual cooperation to promote high quality scientific collaborations and research. In the near-term, collaborations will also include other areas such as mathematical finance and algebra.
3. Portuguese and UT-Austin students should be involved in these cooperative research activities as soon as possible so that they can obtain the most benefit from these bi-national collaborations.

Research activity resulting from this cooperative program should be monitored by established research centers at the participating universities and which employ the involved researchers including the following key Portuguese faculty and institutions: Diogo Gomes (ISTUTL); Luisa Mascarenhas(FCTUNL); Manuel Marques and Jose Rodrigues (FCUL), and Luis Nunes Vicente (University of Coimbra).

2.3.4. Graduate Program

The graduate program, whose typical duration is four years, will consist of up to two years of courses followed by up to two years of thesis preparation with possible advanced coursework. Taking into account the desired mobility of both graduate students and researchers, students are expected to spend two years in each country. In a typical program, the student would spend his/her first year in Lisbon, the second and third years at UT-Austin and the fourth year in Lisbon. Other arrangements would be possible upon agreement of the supervising committees.

A student may apply to LUTAMath if he/she meets one of the following conditions:

- Has concluded the “primeiro ciclo” in mathematics or any collateral area, with a minimum of 35 ECTS in mathematics, in any European university in accordance with the “Bolonha Process”, and the equivalent of 60 ECTS in a “segundo ciclo” in mathematics or collateral area
- Has the equivalent to the previous points in the context of the UT-Austin curricula, namely, a degree in mathematics or collateral area, like physics or engineering
- Has other degrees that are considered equivalent

Applicants should submit three letters of recommendation, the results of TOEFL and GRE general and subject tests, and their transcripts to both the UT-Austin and the Portuguese selection committees. A student will be accepted into the program if he/she meets the requirements of both committees. In this case, the student will be assigned an advisor from the Portuguese team and one from UT-Austin. These need not be the student’s future scientific advisors, but will be a “tutor” who will follow the student’s progress and will provide guidance within the first years of the program and should be encouraged to be completely independent from the future doctoral supervisors.

In the first year, the student, if in Portugal, will be enrolled in about 5 courses, totaling 60 credits (ECTS) at the Portuguese Universities. These courses, taught in English, will be selected from among those available at the graduate level by the student under the supervision of his/her Portuguese practical advisor. Possible examples of admissible courses, whose syllabus are to be accepted by the faculty of UTA’s Mathematics Department, are functional analysis, ordinary and partial differential equations, measure and integration and numerical analysis. During the first year, if in Portugal, students may also have access to UT-Austin courses through teleconferences.

The courses completed in Year 1 will be considered towards the requirements of the UT-Austin Master of Science Degree as well as the Portuguese degree of “Mestre em Matemática” or other academic diplomas, awarded by the Portuguese Universities.

During the second year the student will attend courses at UT-Austin under the guidance of his/her UT-Austin practical advisor. The syllabus of these courses should be accepted by the Portuguese team. By the end of this second year, the student should have acquired a level of knowledge that will enable him/her to begin research work. This basic knowledge will be tested no later than the beginning of the third year by means of a qualifying exam.

The student will now be in a position to select a scientific advisor from UT-Austin and one from the participating Portuguese university. If different from the practical advisor(s), the latter cease(s) his (their) functions. The student will spend up to two years at UT-Austin working on his/her PhD dissertation under the supervision of his/her UT-Austin scientific advisor. During his/her stay at UT-Austin the student will be eligible to be a teaching assistant. To this extent, he/she will be required to attend the International Teaching Assistant’s Workshop at the Mathematics Department and pass the corresponding ITA test.

Since one of the main goals of the UT-Austin/Portugal Mathematics Program is to reinforce research interactions between Portuguese and UT-Austin faculty, one of the advisors could join his/her student at Lisbon or UT-Austin for a period of up to a

semester's length in order to engage in a research collaboration with his/her Lisbon or UT-Austin colleagues. Short-term visits of the advisors to Portugal and to Austin are also encouraged.

The student's progress will be reviewed annually by a UT-Austin Committee and a Portuguese counterpart. Under exceptional conditions, the program can be extended for a sixth year, if recommended by both scientific advisors.

Each of the three Portuguese Institutions will, in turn, be in charge of student registration, records and other secretarial work, including Internet support, for a period of three years. A student enrolled in this program will be considered a graduate student of both UT-Austin and the Portuguese Universities. The student will be provided with office space and will have access to the libraries, computer facilities at all of the participating schools. In recognition of completion of the course of studies, the aforementioned Universities will confer on the student two degrees in Mathematics: A PhD in Mathematics conferred by UT-Austin and a "Doutor em Matemática" conferred by the Portuguese Universities in association (joint degree), in the terms of article 42° of "Decreto-Lei" 74/2006 of March 24.

Resources and Measure of Success

An effort will be made to recruit and attract international students to the UT-Austin Portugal Mathematics Program by publicizing it appropriately. In order for such a program to be viable, it is necessary that scholarships be made available for the selected students covering up to 4-years of studies in Portugal and in the USA.

The number of students in the program should be proportional to the number of UT-Austin and Portuguese faculty involved. Taking this into account, it is expected to have in all years of the program about 15 to 20 students enrolled. It is believed that additional faculty will join the program, so that, at a later stage, around 25 students will be enrolled. In any case, the number of students under UT-Austin's advisory guidance will be, at most, one-half of the total number of students in the collaborative program.

In accordance with the previously listed goals, financial aid should also be secured to allow for short-term visits of the scientific advisors. The advantages of these visits are twofold. On the one hand, they enable a closer monitoring of the student's progress by both advisors simultaneously and, on the other hand, they reinforce the scientific ties between the researchers. Similarly, in order to have a successful post-doc and junior faculty exchange program financial, partial funding will be provided in order to enable a reduced teaching load. Between one to two exchange positions per year are expected. Additionally, adequate funding for the workshops will also be important for at least one small workshop per year. It is crucial that the teaching and administrative duties of the Portuguese involved in this program match those of their UT-Austin counterparts. Therefore, it is suggested that the teaching load of these participating faculty, during their visits to UT-Austin be half of the norm and concentrated in one semester. The financing of the program will reimburse the Portuguese universities accordingly.

2.3.5. Post-doc and Junior Faculty Exchange Program

In order to build a successful UT-Austin Portugal Cooperative Program in Mathematics there needs to be a strong component of joint research at junior and senior levels.

Accordingly, it is proposed to have a regular exchange of post-doc and junior faculty as well senior faculty to organize workshops to foster the development of common research interests and projects.

In order to pursue the internationalization of Portuguese universities it is essential to have a post-doc and junior faculty exchange program. Such a program would attract talented recent graduates and junior faculty from UT-Austin to Portugal as well as send to Austin recent Portuguese graduates and junior faculty. In Portugal and at UT-Austin post-doctoral and junior faculty positions would be funded by the UT-Austin Portugal Program and post-docs would be expected to have a reduced teaching load. Furthermore, in order to foster joint research enterprise at the senior level yearly workshops will be organized alternating between Austin, Coimbra and Lisbon.

2.3.6. Supporting research projects

A number of the activities of the cooperation program require the specific support of senior faculty and, in particular, the support of ongoing and future research projects involving the interface with other sciences and the use of high performance computing. In these situations, the quality of learning and training is directly related to the enrollment of students and young doctoral researchers in the supporting research projects.

It is therefore mandatory for the success of the overall program to support specific research activities, besides the direct funding of PhD students, post-docs and junior faculty. This is particularly critical for mathematical research heavily dependent on interdisciplinary collaboration and scientific computing, and will play a key role in supplementing the Portuguese funding resources necessary for a true and effective collaboration with UT-Austin.

There are excellent opportunities for cross-fertilization of ideas between UT-Austin and the Portuguese university and research groups, in several areas of applied mathematics and computational science, in particular in the modeling of complex systems and phenomena and their subsequent analysis, simulation and optimization. The resulting models pose extremely difficult mathematical problems due to their inherent complexity and nonlinearity, the appearance of singularities, or an intrinsic stochastic nature. Moreover, their computational solution results in challenging problems involving large scale PDE simulations, irregular domains and interfaces, noise and uncertainty in data, scarce information for optimization, or hard combinatorial structures.

Many of these problems have significant societal and scientific importance, such as parameter estimation for global climate change and astrophysics modeling, optimal design of the next generation linear accelerator, optimal control of the next generation plasma fusion device, optimal configuration of clusters and nanostructures, analysis and design of smart materials and structures.

In all of these areas, there is a great opportunity to leverage the strengths of the groups in Portugal involved and UT-Austin to address these problems with better prepared teams and, simultaneously, to engage training at the highest level. The Department and Center of Mathematics of the University of Coimbra are particularly interested in pursuing this activity

under the advanced and high performance computing cooperation program, in collaboration with the other UC Departments involved (Physics and Computer Science) and the Institute for Computational Engineering and Sciences of The University of Texas at Austin.

2.3.7. Key Institutions and Personnel

To begin the coordination of activities for the coming five year period, it is proposed that a Scientific Committee for the Programmatic Area of Mathematics: Analysis, Modeling, Optimization and Simulation be formed. The committee would consist of Efraim Armendariz, Luis Caffarelli, Bjorn Engquist, Irene Gamba, Omar Ghattas, (liaison to other Portugal-U.S. programs), Keshav Pingali (liaison to the Advanced Programmatic Area). Portuguese mathematicians include Rui Loja Fernandes (ISTUTL), Diogo Gomes (ISTUTL), Luísa Mascarenhas (FCTUNL), Manuel Margues (FCUL), José Francisco Rodrigues (FCUL), Luis Nunes Vicente (UC) as well as Luís Trabucho (UCUL), Jose Miguel Urbano (UC), and Jean Claude Zambrini (FCUL). The joint Scientific Committee will work towards the development of interactions in research areas of common interest, the formal establishment of a joint training program for graduate students and postdoctoral associates involving senior faculty, and the pursuit of funding opportunities.

The core already exists in UT-Austin's Department of Mathematics that will contributing the available human resources to coordinate and develop a program that will bring together the already existing centers including those with greater emphasis on the applied/applicable side. The modeling component by Mathematics Department members includes Irene Gamba, Oscar Gonzalez, and Thaleia Zariphopoulou. Faculty members involved in scientific computation include Todd Arbogast, Bjorn Engquist, Felipe Voloch, Richard Tsai and Lexing Ying. Faculty members William Beckner, Luis Caffarelli, Takis Souganidis, Mikhail Vishik, and Rafael de la Llave represent analysis with applications involving nonlinear phenomena.

The Mathematics Department maintains an extensive advanced curriculum, including about fifty graduate courses a year, the mentoring of one hundred Ph D students who graduate at a rate of eighteen a year, and about eighteen postdoctoral fellows that come to UT-Austin for a three year period.

As a starting point to develop joint areas of interest we suggest a series of workshops to find common areas of interest and shared expertise. The workshops will bring together senior and junior scientists, emphasize current research and will provide prospective graduate students with a perspective of the opportunities and activities afforded by the exchange program as well as putting them in contact with prospective advisors.

The workshops will focus on emphasizing the development and application of areas of mathematics in which there has been increasing usage in science, engineering, finance and economics. An example of the type of workshop is in the area of nonlinear differential equations and simulation. This workshop would bring together interacting groups from the different divisions of participating institutions with a common interest in the mathematical sciences.

An important component of the workshops consists of incorporating the expertise present in mathematics as well as other disciplines; the Mathematics Department has strong working

relationships with members of other Schools/Departments, such as Physics, Chemistry, Biology, Engineering, Economics, MSIS and Finance. These ties will augment and enhance the quality and content of workshops. Given the already existing interest in these subjects for a larger mathematical input, the cooperation basis will enlarge considerably, especially if there is an organized and coordinated effort through the auspices of ICES.

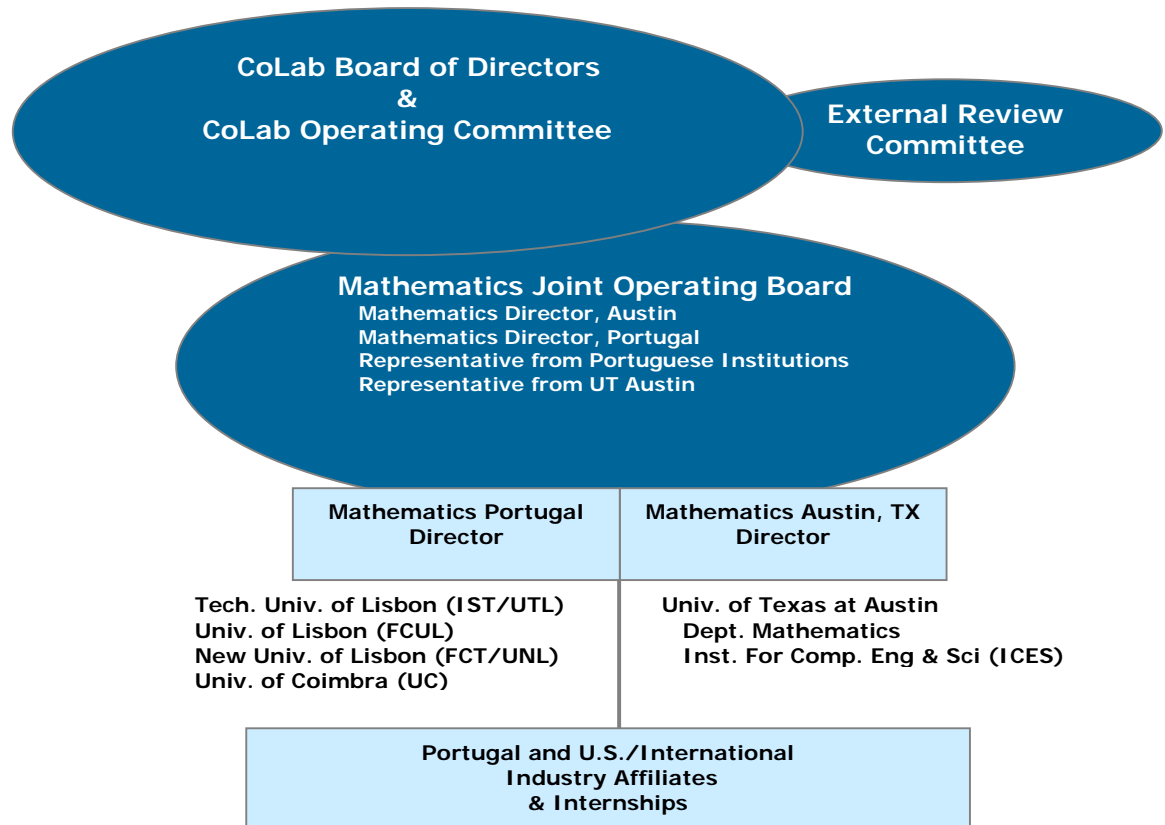
2.3.8. Governance

The Mathematics Program is expected to be an important catalyst in Portugal's transformation to an innovation-based economy through facilitating quality research, education, and training. There will be a Mathematics Program Director based in Austin and a Director based in Portugal. Both directors will organize and participate in the Mathematics Joint Operating Board, which will include two other representatives from Portugal and from UT Austin. The Joint Operating Board will be assisted by the Scientific Committee for Mathematics, which will include representatives from the participating programs at UT-Austin and in Portugal (Figure 4). The Joint Operating Board will be responsible for structuring the proposed collaborations for research and education, including the PhD degree, and will invoke appropriate legal, governance, and institutional considerations.

The overall organization of the UT-Austin/Portugal collaboration, Collaborative Laboratory in Emerging Technology (CoLab), will support the primary goal of achieving measurable success while fostering sustainable cooperative activities. The CoLab Board of Directors will help coordinate all the UT-Austin/Portugal collaborations including Mathematics, Advanced Computing, Digital Media, and UTEN. Portuguese and UT-Austin CoLab Directors will be responsible for identifying possible additional areas of intervention and cooperation in education, research, and business development. The Board of Directors will be assisted by an Operating Committee, with representatives from all areas.

There will be an External Review Committee composed of Portuguese and international academic, business, and government representatives. The External Review Committee will be charged with providing ongoing recommendations for the programs and activities of the UT-Austin/Portugal Mathematics cooperative programs.

Figure 4. Mathematics Cooperative Program



3. University Technology Enterprise Network

3.1. Overview

The UTAustin-Portugal program will include a consortium of Portuguese universities and research centers with The IC² Institute (www.ic2.org) of The University of Texas at Austin to accelerate processes of science and technology innovation and commercialization focusing on US market access. Selected Portuguese universities and research centers will form a University Technology Enterprise Network (UTEN). Initially these institutions will include all the main technology transfer offices (i.e., “OTIC”) and also the main offices for promotion of industrial property (i.e., “GAPI”) in Portuguese universities and main science parks, as well as research centers involved in technology commercialization and incubation. Table 1 gives the proposed complete list of institutions to launch UTEN in Portugal, which will be coordinated by a national secretariat at the Innovation Agency, AdI, in order to facilitate the cooperation with UT-Austin and the necessary allocation of funds among the various institutions on a competitive basis.

The University Technology Enterprise Network (UTEN) will work to have a unified management structure that will coordinate activities and programs across universities and research centers and to leverage existing regional infrastructure and personnel located at the participating institutions. It is expected that over time the institutional members of UTEN will develop increasingly interrelated programs across organizational and institutional boundaries to support the common objective of world-class research and education leading to accelerated science and technology-based enterprise innovation and commercialization. UTEN activities and programs will be directly linked to the IC² Institute at The University of Texas at Austin. Particularly relevant IC² Institute activities and programs include:

- The Austin Technology Incubator (<http://www.ati.utexas.edu>)
- Technology Commercialization Training Programs (<http://commerce.ic2.org>)
- MS Degree in Science & Technology Commercialization (<http://msstc.ic2.org>)
- The IC² Fellows and Global Programs (www.ic2.org)

IC² Institute, The University of Texas at Austin, will collaborate with the Portuguese Innovation Agency and the designated Portuguese entities to develop and implement science and technology commercialization and enterprise innovation research, education, and training programs that will be customized to specific technology sectors and regional needs in Portugal. This will involve sector-specific entrepreneurship and S&T commercialization training. Forms of collaboration will be developed through specific programs that involve faculty, graduate students, and industry as well as finance experts with deep experience and technological specialization in the fields concerned.

Table 2: Institutions for launching UTEN@Portugal

Institution	Main centers involved
Universidade da Beira Interior	UBIACTIVA (Oficina de Transf. de Tecnologia e de Conhecimento da UBI) ¹
Universidade da Madeira	TECMU (Transf. de tecnologia e Conhecimento Madeira/Universidade) ¹
	GAPI at Madeira Tecnopolo ²
Universidade de Aveiro	Uatec (Unidade de Transf. de Tec. da Universidade de Aveiro) ¹
	GAPI at grupUNAVE ²
Universidade de Coimbra	IPN (Instituto Pedro Nunes), including GAPI
	OTIC UC (Oficina de Transferência de Tecnologia e de Conhecimento) ¹
Universidade de Évora	OTIC-UNE (Oficina de Transf. de Tecnologia e de Conhecimento da Univ. de Évora) ¹
	GAPI at Universidade de Évora (Fundação Luís de Molina) ²
Universidade de Lisboa	TTC@UL (Oficina de Transf. de Tecnologia e de Conh. da Universidade de Lisboa) ¹
	ICAT (Instituto de Ciência Aplicada e Tecnologia)
	IMM (Instituto de Medicina Molecular)*
Universidade de Trás-os-montes e Alto Douro, UTAD	OTIC-UTAD (Oficina de Transf. de Inovação e Conhecimento da UTAD) ¹
	GAPI -UTAD ²
Universidade do Algarve	Algarve TransferTECH (Of. de Transf. de Tecn. e de Conh. da Univ. do Algarve) ¹
	GAPI at Universidade do Algarve ²
Universidade do Minho	TecMinho (includes OTIC-Minho ¹ and GAPI ²)
	Spin-Valor (Consultoria em Gestão Empresarial e Desenv. Científico)
Universidade do Porto	INESC Porto (Instituto de Eng. de Sistemas e Computadores do Porto)*
	OTIC@UP (Oficina de Transf. de Tecn. e de Conh. da Universidade do Porto) ¹
	GAPI at UP (Fundação Gomes Teixeira) ²
	UPTEC – Associação de Transferência de Tecnologia da Asprela
Universidade dos Açores	UPTEC – Associação de Transferência de Tecnologia da Asprela
	GAPI Universidade dos Açores ²
Universidade Nova de Lisboa	GAPI at MadanParque ²
	OTIC UNL (Of. Transf. de Tecn. e Conh. da UNL – C. Inovação e Criação de Valor) ¹
Universidade Técnica de Lisboa	INOVisA (Assoc. para Inov. e Desenv. Empresarial – Inst. Sup. Agronomia)
	IN+ (Centro de Estudos em Inovação, Tecnologia e Pol. de Desenvolv.)*
	GALTEC (GAPI at Instituto Superior Técnico) ²
	CPIN-BIC (Centro Promotor de Inovação e Negócios)
	OTIC UTL (Oficina de Transf. de Tecnologia e de Conhecimento da UTL) ¹
ISCTE	INDEG/Audax (Empreendedorismo e Empresas Familiares)
UCP: Esc. Sup. Biotecnologia	TRANSMED (Valorização de Tecnologias e Conhecimentos Biomédicos) ¹
Avepark	Avepark (Parque de Ciência e Tecnologia, SA)
	Spinpark (Incubadora de Base Tecnológica)
Madan Parque	Parque de Ciência e Tecnologia Almada/Setúbal
Taguspark	Taguspark (Parque de Ciência e Tecnologia), including GAPI ²
Parkurbis	Parque de Ciência e Tecnologia da Covilhã, s.a.
AdI, Innovation agency (national secretariat)	

¹ OTIC (Oficina de Transferência de Tecnologia e de Conhecimento)

² GAPI (Gabinete de Apoio à Promoção da Propriedade Industrial)

* Laboratório Associado (Associated Lab)

A main function of UTEN will be to catalyze and facilitate the coordination and leveraging of resources and assets across Portugal's regional and national academic, business, and government sectors in the pursuit of accelerated technology/knowledge-based growth. UTEN will work to attract and network the best Portuguese science, engineering, and management talent in collaborative initiatives with the partner Portuguese institutions and the IC² Institute at The University of Texas at Austin. In short, UTEN will focus on S&T commercialization to highlight the competitive space that UTEN intends to dominate by being:

- An important catalyst bridging Portuguese university S&T research and commercial activities
- A means to accelerate US and international market access for Portuguese S&T for business development and the creation of wealth and jobs in Portugal
- A major catalyst in Portugal's transformation to an innovation-based economy
- A recognized world leader in S&T commercialization success as well as leading-edge education and research on global enterprise innovation and commercialization

A key objective will be to train Portuguese educators and managers so that lessons learned will be ultimately "owned" by the Portuguese entities and so that their operation will be sustainable. UTEN financial sustainability will also be strengthened by developing for-profit activities that will focus on venture development, technology licensing, alliance building, and related business development activities. Operational guidelines will be developed that will specify how such for-profit entities will help financially support and otherwise contribute to UTEN non-profit activities such as education and research as well as benefit participating universities and sustaining and growing the UTEN program. The overall objectives for the 5-year UTEN Program are to enhance and accelerate:

- Portuguese university-industry knowledge/technology transfer and application through on-job training of professionals and entrepreneurs in Austin and through the development of entrepreneurial projects by students and researchers (incubation and international team building)
- Access to US and international markets for Portuguese knowledge/technology
- The education, attraction, and retention of entrepreneurial Portuguese talent
- Research and education excellence on challenges and facilitators for S&T commercialization in global markets
- The creation of wealth and jobs in Portugal

Science and technology sectors to be added during this 5-year program will focus on sectors where there is a good fit between Portuguese research institutions, The University of Texas at Austin, and US market access, such as:

- Information and computer technologies (ICT) where there is considerable educational, research, and business development in both Portugal and Austin
- Biotech and bio-engineering – The UT System ranks Number 1 for biotechnology patents among 424 international universities (Mind to Market: A Global Analysis of University Biotechnology Transfer and Commercialization, Milken Institute, 2006).

- Fabless semiconductor business development – Austin and UT-Austin are global players in semiconductor research and production
- Clean Energy – IC² Institute’s Clean Energy Incubator (CEI) is a nationally and internationally recognized leader in the field.
- Health Systems – The University of Texas School of Public Health in Houston is globally recognized and is expanding its regional office in Austin to a full degree-granting institution.

3.2. Background

On the one hand, University Technology Enterprise Network (UTEN) knowledge transfer will foster and support objectives that are becoming more and more important for universities in Europe, the US, and elsewhere: (1) excellence in education and research, (2) enhanced interaction with the local region, and (3) enhanced internationalization.

On the other hand, it is realized that Portugal has already undertaken significant activities in the area of knowledge transfer at specific university campuses, some of which are expected to be part of this UT-Austin/Portugal UTEN cooperative program. It will be important for IC² Institute to learn about and partner with the ongoing S&T commercialization activities and experiences of relevant Portuguese universities and institutions to build on Portugal’s existing talent and knowledge base to help meet Portugal’s most critical challenges in the area of university-industry collaboration and S&T commercialization

For example, the activities carried out for the last decade at Instituto Superior Tecnico (IST) through the Center for Innovation, Technology and Policy Research, IN+, several of which were in close collaboration with the IC² Institute, have been at the leading edge of knowledge transfer and commercialization and, as a result, several technology-based companies have been launched in the US and international markets. The IMPACT program, 1998-2000, was particularly successful in promoting new businesses and links with industry. Evidence of the effectiveness of this program is illustrated by such Portuguese companies as Critical Software, Innovagency, and Biotecnol. More recently, the VECTOR^c program, also promoted by IN+ with the participation of the IC² Institute, has achieved interesting progress in technology commercialization and in building a network of young entrepreneurs. Such programs with successful track records should continue and be extended to other Portuguese universities in the context of the proposed UTEN UT-Austin/Portugal collaboration.

It should also be noted that ICAT/FCUL and INDEG/ISCTE share the vision of creating a Portuguese University Technology Enterprise Network (UTEN) with the mission of supporting technology knowledge transfer, fostering global enterprise innovation, and playing a major role in Portugal’s transformation to an innovation-based economy. In this view, UTEN should involve several OTICs (Technology Transfer Offices) from different universities that are capable of coordinating and leveraging Portugal’s existing entrepreneurial, incubator, innovation, and science and technology programs.

As an additional example, ISCTE has a strong interest and expertise in management and social sciences important to the development of technology projects and new business

launching. ISCTE Business School and ICAT, through their joint Center Audax, agree that the University Technology Enterprise Network (UTEN) will be an important vehicle for collaboration that will support the goal of contributing to the development of Portugal's intrapreneurship, entrepreneurship, and technology transfer activities (Esperanca, July 28, 2006). Within MIETE (a Masters Program in Innovation and Technological Entrepreneurship), a joint initiative of the Faculty of Engineering and the Faculty of Economics of the University of Porto with a partnership of Nimbas Univ. in Holland and Sheffield Univ. in UK, students are launching their own start-ups following to the scholar part of the program. Other important Portuguese initiatives in S&T commercialization have been successfully implemented, including IPN at the University of Coimbra, INESC-Porto at the University of Porto, UNAVE at the University of Aveiro, and INOVISA at ISA of the Technical University of Lisbon.

As envisioned, UTEN networks, activities, and programs will be progressively built over a 5-year time horizon through the realization of joint projects designed as multilateral partnerships. A critical objective is to build the mass needed for success of Portuguese S&T commercialization in global markets. Key objectives of the University Technology Enterprise Network are two-fold. First, UTEN needs to respond to the fact that Portugal's national market is too small for accelerated company growth in general and especially for novel technologies. A second objective, however, is much more complex and arguably more important, and that is to stimulate and foster successful university-industry collaborations. Accordingly, UTEN projects will include training and "learning by doing" in the following areas:

- Training in technology commercialization
 - Training of technology-based entrepreneurs to stimulate new technology-based spin-outs from Portuguese universities and research centers and train and support existing start-up companies that are developing novel technologies for which the Portuguese market is too small.
 - Training of technology managers and technology transfer officers at an international level so they are better prepared to facilitate international S&T commercialization activities
- Market Access
 - Identify and train Portuguese talent to champion selected technologies to U.S. commercialization opportunities
 - Identify and select Portuguese and American SME's with complementary products/services for joint collaboration and access for US and EU markets
 - Assist in due-diligence (market and technology assessment) in specific areas of expertise of ATI
 - Accelerate US market access and the general internationalization of Portuguese technology-based startups and established firms
- Public-Private Collaboration
 - Research challenges and facilitators to academic-business collaboration

- Train Portuguese researchers and managers in how best to facilitate and sustain company-university collaborations regionally, nationally, and internationally

3.3. Accelerating Commercialization & Market Access of Portuguese S&T

University Technology Enterprise Network (UTEN) commercialization activities will help incubate and accelerate global marketing of Portuguese knowledge-based start-up and established firms and prepare young entrepreneurs and technology managers to be competitive in the global knowledge economy. Emphasis will focus on company growth by providing strategic advice and access to new and emerging markets in the United States and worldwide and by exploring the possibility of incubating and accelerating the growth of Portuguese technology-based start-up firms. This will require entrepreneurship and commercialization training. Forms of collaboration need to be developed through specific programs that involve faculty, students, and industry experts with valuable experience and technological specialization in the fields concerned.

UTEN technology commercialization fellowship and internship programs will enhance Portuguese commercialization and entrepreneurship know-how by focusing on technology industry sectors that have the greatest potential for job and wealth creation for Portugal. In general, Portuguese university graduates and entrepreneurs lack opportunities to obtain hands-on experience in world-leading technology companies. While UTEN will promote university interaction with US industry in Austin, Texas and nationally, an equally important activity will be to accelerate the universities' and Portuguese industry's interaction and market access internationally. In an effort to afford such opportunities for selected Portuguese talent, UTEN will launch the Technology Fellowship and Internship Program (TIP) with leading international public and private institutions and companies to offer value added know-how concerning technology/knowledge entrepreneurship, marketing, and management.

This internship program will, whenever possible, be instituted collaboratively with IC² Institute and The University of Texas at Austin and seek a broad range of industrial and academic partners. There will be a special focus on "career development programs" in particular industry sectors. Initially internships will be targeted for highly educated Portuguese scientists and practitioners to work in commercial settings in Austin, Texas (including global firms) and over time in other US and worldwide locations. This training will utilize state-of-the-art models and concepts of innovation and entrepreneurship and will emphasize business development for the targeted industry sector.

The internships could be from 3-months to over a year in duration depending on industry realities and the desires of the participating companies and interns. The activities of each participating intern will be monitored by IC² Institute, UT-Austin via regular contacts with the participating company and the intern. Interns will be required to write quarterly reports on their work and progress. On completion of an internship program the interns will return to Portugal to transfer their S&T commercialization know-how to colleagues in Portugal.

Overall UTEN Objectives

Assist in the formation of spin-out /start-up companies by identifying competitive technologies and introducing them to the US and international markets through training, internships, and network building

Focus on US market access and business development by using industry sector experts

Promote joint business ventures in the US and internationally

Research structures and processes for industry-university collaboration, from funding specific researchers to S&T consortia including:

- Sharing best practices between corporate (commercialization) professionals and academics
- Researching how different models for collaboration may shape different expectations on the part of key players and therefore harbor different criteria by which success can be defined and evaluated
- Devising metrics for university-industry collaborations that will assist the Portuguese government in granting funds such as knowledge transfer grants linked to specific outcomes. Given the increased prevalence and importance of university-industry collaborative research partnerships it is important that corporate managers, university scientists, and decision makers better understand how to evaluate these endeavors in terms of the causes for successful or unsuccessful partnerships. Quantifiable metrics for such private-public collaborations are difficult to devise; however, they are important to assess the impact of governmental funding as well as for benchmarking for universities and corporations engaged in such collaborations.

Leveraging the benefits of Portugal's existing incubators and science and technology parks as integrated environments for the growth of companies

Having participating Portuguese universities demonstrate the increased importance of knowledge transfer for wealth and job creation and societal impact through educational benefits, workshops, conferences, and publications as well as the creation of wealth and jobs, and career development

Gaining financial benefit for participating universities to help:

- Fund knowledge transfer activities and research
- Sustain the universities ability to commercialize internally developed research

Establishing gateways and networking for clients that want access to university expertise and/or technical services and/or reinforcing existing structures that already undertake such functions

Promoting the improvement and sharing of university policies that affect knowledge transfer to commercialization, such as intellectual property concerns including patenting and financial gains for faculty and the university

3.4. Education, Training, and Research

Education and training programs will explore academic, business, and government differences when adapting US S&T commercialization models to Portugal. It is believed that European, Portuguese, and North American university cultures and operations, as well as regional institutions, are different in important aspects relevant to S&T commercialization. The development of successful technology commercialization initiatives and mechanics and even the mindset at Portuguese research institutions and personnel requires an in-depth and

long-term collaboration with Portuguese champions from select Portuguese public and private sectors that will work together with IC² Institute personnel to:

- Catalyze change and build entrepreneurial capacity within Portuguese universities and other related institutions
- Identify select technologies with international market potential as they are being developed
- Assist Portuguese researchers in successful S&T commercialization and entrepreneurship and international market access
- Transfer technology expertise and know-how to Portuguese personnel and institutions

Industry-specific training and education will emphasize knowledge acquisition by immersion through internship programs for:

- Technology managers and staff
- Incubator managers and staff
- Entrepreneurs and intrapreneurs within large firms
- Technology transfer officers (TTOs)
- University faculty and students working on Portuguese industry-supported research and commercialization projects

Select innovation and entrepreneurship courses will be a combination of “think” and “do” and will assist Portuguese “talent” to become (1) successful entrepreneurs, and/or (2) successful mentors, teachers, and trainers of Portuguese entrepreneurs in established and start-up firms. Again, the experience of IST through its VECTORE Program and the leading role of the Center for Innovation, Technology and Policy Research, IN+, should be used for these purposes and arranged in way to be expanded at a national level. Innovation and entrepreneurship program courses will leverage and build on IC² Institute’s established and innovative Internet and class-based MS in Science and Technology Commercialization (MSSTC). IC² Institute’s MSSTC student teams are international, with team members working on real S&T commercialization projects. The hands-on-the-job experience of MIETE in University of Porto, which contains many of the envisaged features, should also be taken into account and fully used to boost UTEN’s activities. With the UTEN Program these teams could focus on select Portuguese technologies and entrepreneurs for US and global market access.

Quality training, internships, and research related to S&T commercialization will:

- Encourage Portuguese participants to gain important insights into US and global marketplace realities in relation to Portuguese S&T commercialization realities within the framework of the European Commission
- Benefit Portuguese university and The University of Texas at Austin faculty and students in terms of research collaborations and education exchange
- Contribute to quality education and training programs by informing current curricula and developing new courses and course content
- Encourage research programs that are conducted according to the highest academic demands, including publications on science and technology commercialization processes and capacity building in leading international peer-reviewed journals

Select courses will be taught by Portuguese faculty with IC² Institute and UT-Austin faculty consultation, whereas other courses will be taught by UT-Austin and other US and international faculty. Industry-specific courses will be taught by faculty and practitioners most knowledgeable in the targeted industry. Select courses will be compressed for 1-2 week deliveries. An integrated environment will be developed that will accommodate the existing videoconference capacities of institutions involved while offering state-of-the-art collaborative tools for file sharing and content management. Over the course of this 5-year program education and training programs will contribute to the development of state-of-the-art professional, globally linked Portuguese academic and business communities dedicated to S&T commercialization.

Integrated knowledge communities will work to expand research programs to deepen knowledge generation processes and to enlarge the network of Portuguese research groups working with researchers at The University of Texas at Austin. This work will foster projects through which firms can engage in research and development activities, both in-house and through collaborations with the research system in Portugal and at The University of Texas at Austin. There will be a focus on new ideas in applied science, engineering, and broader technologies. Attention will also be focused on:

- Work on broad-based problems that require innovative solutions, or a better understanding, in order for policy recommendations to be developed
- Models and structures for collaboration: better understanding of the different models currently existing in Portugal and the differences between these models and models in the US and in other nations
- Areas where comparison and knowledge sharing with the United States may be of particular relevance to Portugal in terms of wealth and job creation
- Partnerships with leading US and European companies, broadening The University of Texas at Austin-Portugal collaboration to international leaders and corporations
- Curriculum Development by sponsoring projects that transfer successful course materials and faculty expertise from The University of Texas at Austin to Portuguese institutions and vice versa
- Analyzing and attempting to solve problems associated with the commercialization of university research conducted according to the highest scientific demands, with an objective of having publications in leading international peer-reviewed journals

Considerations in structuring the proposed collaborations for S&T commercialization, and training and education will include legal, governance, and institutional aspects. The institutional framework governing Portuguese academic and for-profit organizations as well as The University of Texas at Austin and US and Portuguese business communities need to be considered and assessed. Of particular interest are:

- Legal issues associated with public-private and international S&T collaboration including intellectual property protection
- Reliable and useful metrics for continuous monitoring and evaluation of UTEN programs and activities. In addition to specific tasks, the overall collaborative program needs to be regularly monitored and evaluated. As needed reviews will guide the development of the UTEN program as well as its restructuring when necessary.

3.5. Key Institutions and Personnel

At UT-Austin, key entities and personnel participating in the UTEN Program include at IC² Institute: Dr. John Sibley Butler, Director; Dr. Larry Secrest, Director MS program in Science and Technology Commercialization; Dr. David Gibson, Director Visiting Scholars and Fellows programs; and Dr. Bruce Kellison, Director, Bureau of Business Research. At the Austin Technology Incubator (ATI) at UT-Austin key participants include: Isaac Barchas, Director; Erin DeFosse, Director, ATI Wireless; Joel Serface, Director and Kurt Faulhaber, Assistant Director, ATI Clean Energy; and Sid Burbach, Director, Technology Commercialization, IC² Institute. At UTA's Office of Technology Commercialization key people involved will be Dr. Neil Iscoe, Director and Bill Catlett, Associate Director.

In Portugal select participants in UTEN include Jose Manuel Mendonça, University of Porto and INESC-Porto, and Teresa Mendes and Paulo Santos, Instituto Pedro Nunes, at the University of Coimbra; Rui Baptista at IST/IN+ and his team of VECTORE (namely Maria José Francisco) ; José Pinto Paixão at FCUL-ICAT; Rui Ferreira (AUDAX-ISCTE), Luis Reto and José Paulo Afonso Esperança, at ISCTE; and the team working with Vice-Rectors Francisco Vaz at University of Aveiro and Manuel Mota at the University of Minho (TecMinho). Vasco Varela and the team at Taguspark should also be involved due their unique experience in enterprise incubation in Portugal. Portuguese institutional participants include: The Universidade da Beira Interior; Universidade da Madeira; Universidade de Aveiro; Universidade de Coimbra; Universidade de Évora; Universidade de Lisboa; Technical University of Lisbon; Universidade de Trás-os-Montes e Alto Douro; Universidade do Algarve; Universidade do Minho; Universidade do Porto; Universidade dos Açores; Universidade Nova de Lisboa; Universidade Técnica de Lisboa; ISCTE; Universidade Católica Portuguesa; Universidade de Aveiro as well as Instituto Pedro Nunes (IPN), Taguspark, Avepark, and AdI Innovation Agency, National Secretariat.

3.6. Governance

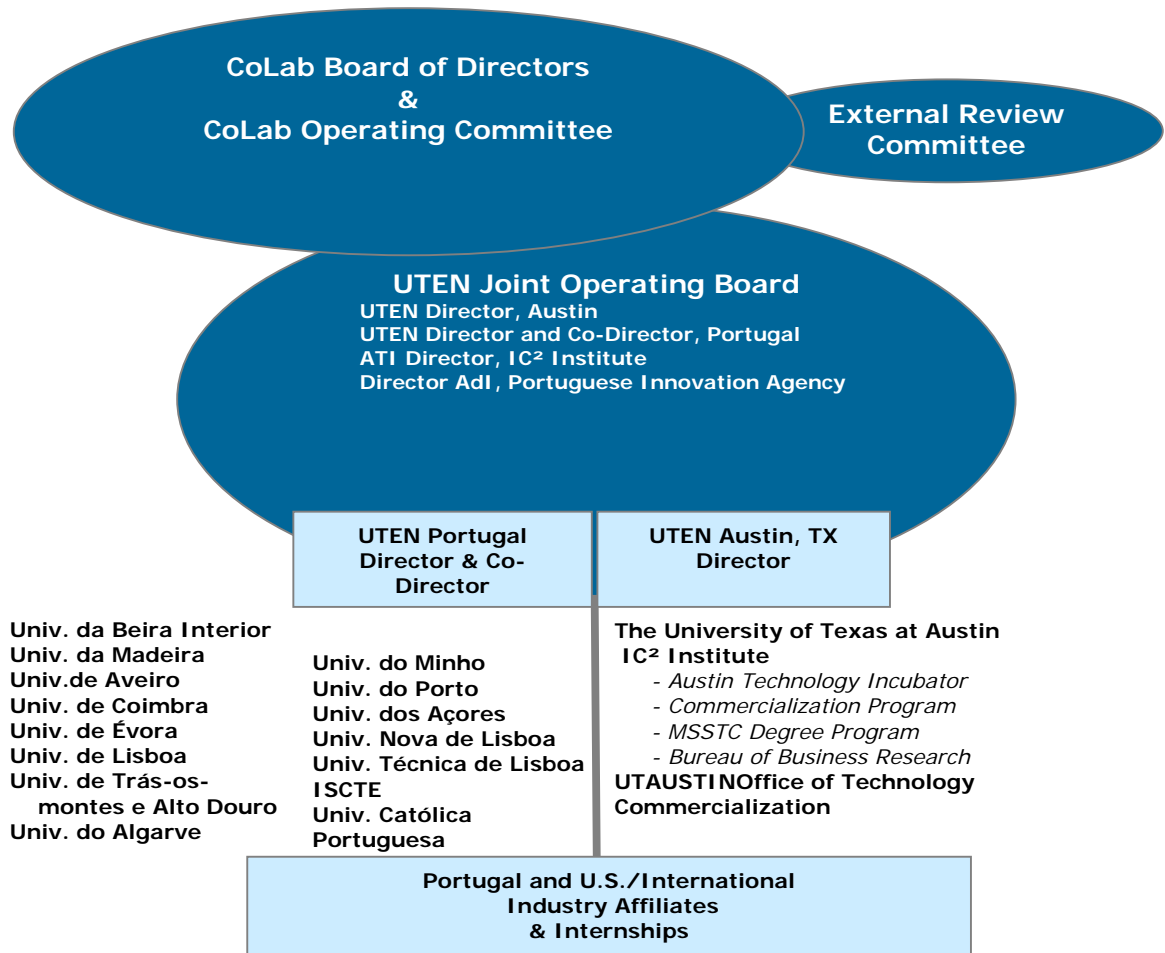
A key UTEN program goal is to be an important catalyst in Portugal's transformation to an innovation-based economy through (1) accelerating commercialization and international market access of Portuguese S&T, and (2) facilitating quality research, education, and training related to S&T commercialization. Accordingly a main objective of UTEN governance is to minimize obstacles while maximizing successful outputs. The overall organization of the UT-Austin/Portugal collaboration will work to keep bureaucratic procedures to a minimum, with the primary goal of achieving early successes while fostering sustainable cooperative activities.

The CoLab Board of Directors will assist with coordination of all UT-Austin/Portugal collaborative programs. CoLab directors from UT-Austin and Portugal will be responsible for assisting UTEN programs and activities and for identifying and fostering additional links among select national and global institutions and industry (see Figure 5). There will be an External Review Committee (ERC) that will report to the CoLab Board of Directors. The External Review Committee will be charged with evaluating on-going UTEN programs and activities and providing recommendations for enhanced effectiveness.

UTEN will have a Joint Operating Board, which will report to the CoLab Governing Board. There will be a UTEN Director based in Austin and a Director and a co-Director based in

Portugal. Both directors and the Portuguese Co-Director will organize and participate in UTEN's Joint Operating Board which will include the Director of the Portuguese Innovation Agency, AdI, and the Director of the Austin Technology Incubator, ATI. The Operating Board will be chaired by the UTEN Director in Portugal.

Figure 5. University Technical Enterprise Network (UTEN) Cooperative Program



UTEN Portugal will initially be made up of representatives from the 15 Portuguese universities with the goal of achieving a single operating and management structure achieved through the Portuguese Innovation Agency, AdI. In this context, AdI will provide the national secretariat for UTEN@Portugal and will facilitate all the necessary coordination tasks among the various parts in Portugal. UTEN@Austin will be initially composed of IC² Institute programs including the Austin Technology Incubator (ATI), Commercialization Programs, MS in Science and Technology Commercialization (MSSTC), and the Bureau of Business Research as well as UTA's Office of Technology Commercialization. UTEN will also have an Industry Affiliates and Internship Program that will be directed by UTEN's Directors (Figure 5).

3.7. Main Tasks for Year 1: March-August 2007

The planning for year 1 includes three main objectives:

1. Competitive Selection for US and Global Markets of: i) Technology-based projects at Portuguese universities and research centers; and ii) Existing technology-based Portuguese businesses.
 - Promotion, March-April 2007:
 - Promotion and invitations to Portuguese (1) faculty, students, technology transfer officers, entrepreneurs and intrapreneurs, and research centers, and (2) small and mid-sized businesses to participate in national S&T business competitions to be held in Portugal May-July 2007 leading to competitive selection for accelerated US and International Market Access;
 - Technology and Business Team Workshops, Selections, and Mentoring in Portugal for business plan competitions;
 - Competitive Selections, April-August 2007:
 - S&T evaluation for international markets: Workshops and competitive selections in Portugal of select Portuguese (1) S&T from universities and research centers, and (2) small businesses. The objective is to select best candidates for regional and national S&T business competitions in Portugal leading to US and international market access;
 - National S&T Business Competition in Portugal.
2. Technology Fellowship and Intern Program:
 - Training conducted by UTAustin personnel in collaboration with Portuguese partners
 - Internships and Fellowships: Competitively selected participants from the UTEN Training Program will receive funded Technology Commercialization Fellowships and Internships in Austin and possibly other US and global institutions.
3. Monitoring UTEN processes for continuous observation of science and technology commercialization:
 - Establish Metrics for and collect data on UTEN activities and programs;
 - Develop case studies.

4. Fostering an open framework for cooperation in emerging technologies between UTAustin and Portuguese institutions

As mentioned above, CoLab is launched to provide the necessary institutional framework to explore additional fields for cooperation and to enter into an open collaborative framework in order to foster collaborative actions in emerging scientific fields, involving UT Austin and Portuguese research and higher education institutions. All program efforts will be subject to continuous monitoring, evaluation, and adjustments within the collaboration.

In this context, CoLab is expected to continuously identify and assess potential areas for collaboration. A possible focus on a future collaborative action for UT-Austin/Portugal, as identified in the Assessment Report submitted by UT Austin to the Government of Portugal, is on nano and molecular science and technology, which may be expected to be based on support for the development and internationalization of a network of researchers in nano sciences, including the design and development of the recently established “International Iberian Nanotechnology Laboratory”, INL, which has been created by the Governments of Portugal and Spain.

It should be noted that detailed conversations with the Portuguese community and key players in the field of nano and molecular science and technology did not take place during the assessment phase, so that any collaborative effort in this area should be subject to a proper analysis. The assessment should be continued in the coming months.

5. Governance

An *International Collaboratory for Emerging Technologies* (CoLab) will be formed to provide overall support and governance for all the UT-Austin/Portugal collaborative programs, as in Figure 6. The CoLab Board of Directors will be composed of the president of the Portuguese S&T Foundation (or a representative), as Chair, the President of the Portuguese Knowledge Society Agency (or a representative), The VP and/or Associate VP for Research at UT-Austin, CoLab Directors from Portugal and UT-Austin. The directors, in Portugal and in Austin, form the Directorate of the Board of Directors.

The CoLab Board of Directors will be assisted by the CoLab Operating Committee, which will include the CoLab Directors in Portugal and in Austin, as well as the Portuguese and UTAustin-based directors of UTEN, Digital Media, Mathematics, and Advanced Computing programs as well as other program areas as added to the overall collaboration such as nano and molecular science and technology. The CoLab Operating Committee will be chaired by the CoLab Co-Directors in Portugal.

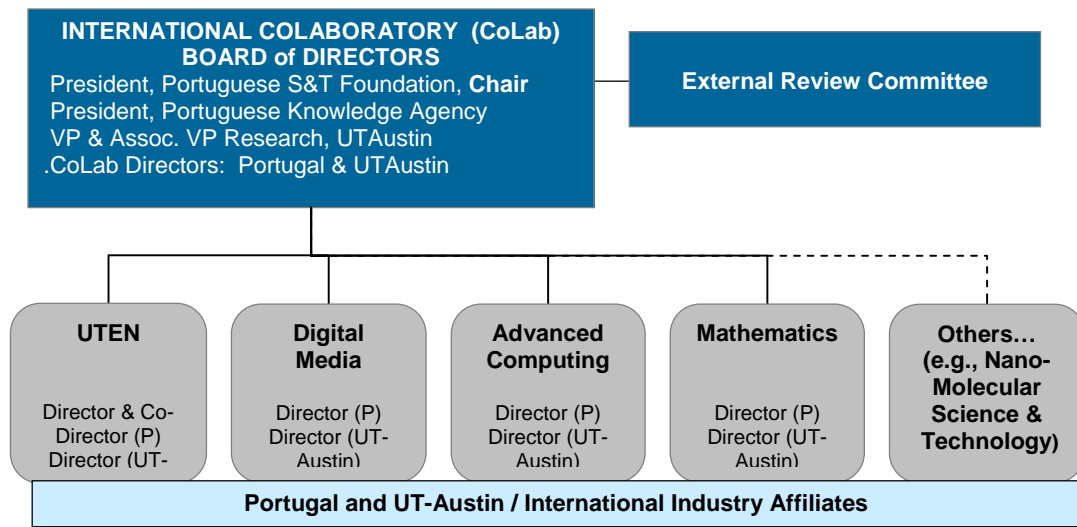
The CoLab Directors based in Portugal and at UT-Austin will assist with coordination of existing programs and activities and will also be responsible for identifying additional areas of intervention and cooperation in education, research, and technology commercialization. The CoLab Directors will report to the Portuguese government through the Portuguese S&T Foundation and to The University of Texas at Austin through the VP and Associate VP for Research.

UTEN, Digital Media, Mathematics, and Advanced Computing will each have directors in Portugal and in Austin, as described above in this document and schematically represented in Figure 6. All program areas will have Joint Operating Boards as well as industry affiliates and internship programs. All programs will be monitored for possible adjustments to and improvements to the collaborations which are intended to develop over 5-years for continuing and sustainable collaborations. Important to this effort will be an External Review Committee (ERC) composed of international academic, business, and government representatives. The ERC will be charged with evaluating and providing recommendations for all UT-Austin/Portugal cooperative programs.

Portugal's pole of the "International Collaboratory for Emerging Technologies – CoLab" (i.e., CoLab@Portugal), shall be resident in the FCT until such time as another unit is designated by the FCT to serve in this role. Following the Assessment Report submitted by UTAustin to the Government of Portugal in February 2007, the FCT will designate the School of Science and Technology of Universidade Nova de Lisboa (i.e., FCTUNL) as the first coordinating unit in Portugal that is responsible for launching CoLab in Portugal and leading the implementation and coordination of Portuguese partner institutions' activities in the UTAustin-Portugal Program, namely in the areas of digital media, advanced computing and mathematics, as well as to guarantee the continuous identification and promotion of future cooperation in emerging technologies among UTAustin and Portuguese institutions.

In addition, FCT will also designate the Portuguese Innovation Agency (i.e., AdI) to guarantee, within CoLab, a national secretariat to coordinate the specific activities towards the “University Technology Enterprise Network” described in this agreement.

Figure 6. Governance and Organizational Structure of the International Collaboratory for Emerging Technologies (CoLab)



During the assessment exercise the various teams from UT Austin had the opportunity to meet several Portuguese counterparts and discuss their relative involvement in the UT-Austin/Portugal programs. In this context, the following people have been identified to guarantee launching CoLab and the UT Austin-Portugal Program.

CoLab Board of Directors: CoLab’s Board of Directors is composed of the following six members:

- i) The President of the Portuguese Science and Technology Foundation, FCT, **João Sentieiro**, Professor, (who shall chair the Board);
- ii) The President of the Portuguese Knowledge Agency, UMIC, **Luis Magalhães**, Professor;
- iii) VP for Research, as designated by the President of UT Austin, **Juan Sanchez**, Professor;

- iv) **Robert Peterson**, Professor, Associate VP for Research, as designated by the President of UTAustin;
- v) **António Camara** and **Jose Cardoso e Cunha**, as Co-Directors of CoLab@Portugal, both Professors at the School of Science and Technology of *Universidade Nova de Lisboa* (i.e., FCTUNL);
- vi) **David Gibson**, The Director of CoLab@UTAustin (i.e., the UTAustin Director).

Directorate of the Board of Directors:

- i) **António Camara** and **Jose Cardoso e Cunha**, as Co-Directors of CoLab@Portugal, both Professors at the School of Science and Technology of *Universidade Nova de Lisboa* (i.e., FCTUNL);
- ii) **David Gibson**, The Director of CoLab@UTAustin (i.e., the UTAustin Director).

Focus Area Directors and Joint Operating Boards:

- o Digital Media:
 - o Director in Portugal: **António Camara**, Professor, School of Science and Technology of *Universidade Nova de Lisboa* (i.e., FCTUNL), who will be assisted by two co-Directors, **Artur Pimenta Alves**, at INESC-Port and the University of Porto and **Nuno Correia**, at the School of Science and Technology of *Universidade Nova de Lisboa* (i.e., FCTUNL);
 - o Director at UTAustin: **Sharon Stover**, Professor, Chair RTF Department, UTAustin College of Communication
 - o Joint Operating Board:
 - **António Camara**, who may be represented by one of the two co-Directors, **Artur Pimenta Alves** and **Nuno Correia**, as above;
 - **Sharon Stover**, as above
 - **Manuel Ricou**, Representative from the Portuguese Knowledge Society Agency, UMIC
 - **Rosenthal Alves**, Journalism, College of Communication, UTAustin

- Advanced Computing:
 - Director in Portugal: **Jose Cardoso e Cunha**, Professor, School of Science and Technology of *Universidade Nova de Lisboa* (i.e., FCTUNL), who will be assisted by two co-Directors, **Pedro Medeiros**, at FCTUNL and **Luís Silva**, at the School of Science and Technology of *University of Coimbra*;
 - Director at UTAustin: **Keshav Pingali**, Professor, Chair of Advanced and Distributed Computing, Department of Computer Science;
 - Joint Operating Board:
 - **Jose Cardoso e Cunha**, who may be represented by one of the two co-Directors, **Pedro Medeiros** and **Luís Silva**, as above;
 - **Keshav Pingali**, as above
 - **Pedro Ferreira**, Representative from the Portuguese Knowledge Agency, UMIC
 - **Warren Smith**, UTAustin/TACC
- Mathematics:
 - Director in Portugal: **Diogo Gomes**, Instituto Superior Técnico, Technical University of Lisbon
 - Director at UTAustin: **Luis Caffarelli**, Department of Mathematics, UTAustin
 - Joint Operating Board:
 - **Diogo Gomes**; as above
 - **Luis Caffarelli**, as above
 - **Luís Nunes Vicente**, University of Coimbra
 - **Irene Martinez Gamba**, UTAustin
- University Technology Enterprise Network, UTEN:
 - Director in Portugal: **José Manuel Mendonça**, Professor, University of Porto and INESC-Porto, who may be represented by the co-Director, **Teresa Mendes**, University of Coimbra and Instituto Pedro Nunes;
 - Director at UTAustin: *to be defined*
 - Joint Operating Board:
 - **José Manuel Mendonça**, who may be represented by the co-Director, **Teresa Mendes**, as above;

- *to be defined*, Director at UTAustin
- **Lino Fernandes**, President, Portuguese Innovation Agency, AdI
- **Isaac Barchas**, Director of the Austin Technology Incubator, ATI

CoLab Operating Committee:

- **António Camara** and **Jose Cardoso e Cunha**, co-Directors of CoLab@Portugal;
- **David Gibson**, The Director of CoLab@UTAustin;
- **António Camara**, Director for Digital Media in Portugal, who may be represented by one of the two co-Directors, **Artur Pimenta Alves** or **Nuno Correia**, as above;
- **Sharon Strover**, Director for Digital Media at UTAustin;
- **Jose Cardoso e Cunha**, Director for Advanced Computing in Portugal, who may be represented by one of the two co-Directors, **Pedro Medeiros** and **Luís Silva**, as above;
- **Keshav Pingali**, Director for Advanced Computing at UTAustin;
- **Diogo Gomes**, Director for Mathematics in Portugal;
- **Luis Caffarelli**, Director for Mathematics at UTAustin;
- **José Manuel Mendonça**, Director for UTEN in Portugal who may be represented by the co-Director, **Teresa Mendes**;
- *to be defined*, Director for UTEN at UTAustin;

Coordination and national secretariats in Portugal

FCT will designate the **School of Science and Technology of Universidade Nova de Lisboa (i.e., FCTUNL)** as the first coordinating unit in Portugal that is responsible for launching CoLab in Portugal and leading the implementation and coordination of Portuguese partner institutions' activities in the UTAustin-Portugal Program, namely in the areas of digital media, advanced computing and mathematics, as well as to guarantee the continuous identification and promotion of future cooperation in emerging technologies among UTAustin and Portuguese institutions.

In addition, FCT will also designate the **Portuguese Innovation Agency (i.e., AdI)** to guarantee, within CoLab, a national secretariat to coordinate the specific activities towards the “University Technology Enterprise Network”, described in this agreement.