

CMU-Portugal
An international collaboration in graduate education and research

**Technical Annex to the Memorandum of Understanding towards a long term
collaboration**

(10 March 2006)

The Government of Portugal and the *Carnegie Mellon University*, CMU, agree to perform an assessment of possible areas for collaboration, exploring mutual interests in education and research projects oriented towards economic growth. The ultimate goal is to establish a long term collaboration, which requires the prior assessment of specific interests of CMU faculty, as well as of Portuguese faculty and institutions. As a result, this MoU defines the terms of reference for the short term assessment, which is to be performed during a period up to 5 months looking at long terms goals and objectives, as well as the drafting and discussion of a proposed contract.

The *College of Engineering* at CMU will be the lead academic and research unit for CMU during the assessment period and will also engage others at CMU whenever necessary. The *University of Aveiro*, UA, and the *Telecommunications Institute*, IT, will be the lead academic and research units for Portugal during the assessment period. UA, IT, and CMU will engage other Universities and Institutions in Portugal as specific areas, research topics, and interests emerge.

The assessment will be lead by Prof. José M. F. Moura from the Electrical and Computer Engineering Department at CMU, and the CMU's the Dean of Engineering, Prof. Pradeep Khosla.

1. Long term collaborative strategy

1.1 Goal: A strategy to strengthen the country's knowledge base, to foster economic growth and to enhance the quality of life in Portugal, by exploring international cooperation and industry-science relationships with leading institutions worldwide, in a way to sustain strategic investments in people, knowledge and ideas.

1.2 Objectives:

- To implement specific initiatives with high visibility and impact in select targeted constituencies, to start with a special focus on information networking, security and management;
- To develop advanced educational and research programs at an international level, oriented towards strengthening the science base, as well as fueling the economy and the social well-being and security;
- To make Portugal an attractive setting to study and perform research, as well as to invest in technology-based ventures, so that we recruit and sustain bright students, scientist and engineers from throughout the world and help mobilizing higher education institutions and the scientific community towards emerging challenges facing the knowledge economy;
- To reinforce the entrepreneurial capacity of those students, scientist and engineers through the commercialization of science and technology and the access to new and dynamic markets worldwide.

1.3 Rationale:

Portugal is an interesting country in challenging times. The country faces a range of possible futures from the inspiring to the bleak. Keeping the industrial status-quo, still heavily geared around a strategy of low-cost production, is not a sustainable option in the face of increasing competition from locations such as Eastern Europe and China. Industry must transform and new and qualified employment must be promoted. Fortunately, the evidence provided by a range of emerging technology-based firms created in the mid 90`s is demonstrating the usefulness of prior investments in the science base. But much more progress is needed. This requires Portugal to learn from international experience and to be engaged with international leaders in innovation systems and organizational transformation. Thankfully, Portugal's unique

national challenges are attracting international interest. This proposal aims to build upon that interest for the benefit of both the national economy and our collaborators in this endeavor.

The performance of the Portuguese economy is a complex and multifaceted challenge. It is clear that fostering the science base and the growth of emerging technology based firms, as well as breaking the overall cycle of low productivity/low innovation is beyond the power of any single entity. Still, a focused initiative, building on the reputation and accomplishments of leading institutions worldwide in conjunction with Portuguese university, research centers and firms could go a long way in meeting three important challenges. First, there is a gap in qualified people and a relative small critical mass of scientific institutions and of innovative enterprises, which exhibit difficult access to new and dynamic markets. Second, there is a gap in understanding about the specific problems, and possible solutions, that affect the performance of the Portuguese economy. Third, there is a gap in the number and effectiveness of concrete initiatives devoted to taking steps to improve the current situation. The program, with a structure outlined below, aims at bridging this triple gap. It will not, by itself, solve the problem, but it will take important steps to do so by itself, by the relationships it will propose, and by the demonstration effect it will provide.

CMU is well-suited to advance a relationship with Portugal. CMU is one of the world's leading research and educational institutions, particularly well known for its scientific and technological achievements, for its interdisciplinary and diverse culture, and for its leading role in the creation of many high-tech companies.

1.4 Strategy:

It is recognized that any development strategy for Portugal must be understood and enacted in a context of the country in an increasingly open and interconnected world. Several currently disjoint disciplines must join efforts to provide new solutions to mobilize **people, knowledge** and **ideas** to help to catalyse the strong progress in engineering applications and management skills needed to secure Portugal's future.

Thus a program is proposed to promote and develop new technological competencies to increase Portuguese innovative capacity. This will be accomplished through the development of **research, education and technology commercialization initiatives**, which should be implemented in a way to extend the enterprise value chain in mature and emerging sectors by facilitating strategies for improving competence and capability in two key areas for delivering innovation, namely: a) the new product development practices and related processes of larger, established enterprises and firms; and b) high technology entrepreneurship. In addition, the research programs should encompass activities oriented towards the **public understanding of science** and the social appropriation of the knowledge generated.

The collaborative agreement is to be established between Portuguese Universities and CMU with support from the Portuguese Government. The proposed program should be implemented in a **evolutionary and stepwise approach**, including short- and medium-term initiatives, in a way to guarantee current opportunities at a launching phase (i.e., 1st year), but also to sustain their competitive growth and the future development of other potential emerging opportunities that may appear in the years to come (from 2nd to 5th year, and beyond). The contractual arrangements to be made should make possible this approach.

1.5 Lines of Action:

The proposed program emphasizes three key aspects in the emerging society, namely:

1. *People*, by fostering **tools for understanding** and **building skills**
2. *Knowledge*, by developing **understanding for action**
3. *Ideas*, by promoting **action for results**

Each of these aspects is to be implemented through a specific line of action and in order to achieve a set of specific goals, including:

- *Attract people for knowledge base activities*, by fostering new advanced training actions;
- *Enhance the science base*, by promoting new research activities at the highest international level;
- *Engage Business*, by involving key corporate leaders with entrepreneurs and researchers;

- *Connect Universities*, by promoting industry-science relationships;
- *Promote Internationalization*, by fostering links with US and European collaborators, at university and corporate levels and by attracting foreign direct investments;
- *Improve intermediaries*, by supporting interface activities fostering industry-science relationships;
- *Foster Entrepreneurship*, by promoting entrepreneurial culture at the University system, identifying and helping nurturing new ideas, and by supporting the creation of new businesses;
- *Promote Capital structure*, by helping nurturing seed and risk capital venturing, namely in the form of a capital network;
- *Change culture*, by promoting exchange of ideas and the discussion of good and bad practices;

1.6 Main areas of application:

The proposed program will focus on *system thinking* and transdisciplinary research and education derived from relevant problems for Portugal and of interest to CMU at operational and strategic levels. It will foster engineering and management skills, through activities in the following specific fields in the short- and medium-terms:

- **Information networking, design and management**, including the optimization of information systems in complex operations in both telecom and other well established and emerging sectors and critical infrastructures;
- **Telecom infrastructures and systems**, encompassing technical, business and regulatory issues for the next generation of internet;
- **Information security**, and related software engineering issues;
- **Software engineering** and other computer science and computer engineering areas;
- **Basic science** supporting emerging developments in ICT's (e.g., applied mathematics).

These and **other** potential areas are to be agreed and any collaborative efforts should be implemented in a way to allow the continuous monitoring and evaluation of the program, as well as launching new areas of application, whenever they rely in well documented scientific principles and relevant problems for Portugal and CMU. This includes considering the **management of technological innovation and commercialization of information and communication technologies**, by promoting strategic visions for public and private ventures and developing the necessary skills to help developing collaborations for innovation at an international level.

2. The terms of a “quick assessment”

CMU will undertake with Portugal an assessment of possible areas for collaboration, exploring areas of mutual interest for the development of education and research projects oriented towards economic growth. The assessment will involve visits between faculty/researchers at CMU and in Portugal during **a period up to 5 months (March 1-July 15 2006)**. These include workshops, seminars or other interactions to explore mutual intellectual interests. The goal will be to determine what desirable areas of collaboration are and what would be required to frame successful projects.

The Government of Portugal and CMU will also explore ways to structure a collaboration including legal, governance, and institutional aspects.

The goal will be to develop a proposal for initiatives that can be considered as the basis for a longer term - 5 years agreement.

2.1. Proposed activities (March-July 2006)

2.1.1 Preparation of main areas for advanced education and research

Inspired by professional graduate programs at the College of Engineering of CMU, it is proposed to attempt preparing one degree program, or a set of degree programs, aimed to train future leaders, offering students the opportunity to study advanced information and communication technologies. The study to be conducted will include the analysis of the possibility that one to two researchers/teachers from CMU will be placed full time in Portugal to help developing each of these programs.

The goal is to plan post-graduate degree program (professional) with a duration from 10 to 18 months, to be associated whenever possible to future doctoral programs in areas of information networking, security and management.

For this area, the assessment should consider the development of an advanced research program, to be conducted according to the highest scientific demands, including publications in leading international peer reviewed journals, and in a way to facilitate strengthening Portuguese research institutions.

2.1.2 – Institutional Building: developing “CyLab Portugal”

It is proposed launching a process of institutional building of a Portuguese effort aimed at creating with Carnegie Mellon CyLab a public-private collaboration to develop next-generation technologies in sustainable computing and communication systems and to educate individuals at all levels, including children in primary and secondary schools. This process will follow recent international experiences developed by CMU throughout the world, namely CyLab Athens, CyLab Korea and Cylab Japan.

2.1.3 – Assessing other areas and programs for potential collaboration

The aim is to study the feasibility of expanding the areas for collaboration mentioned above to other emerging fields and areas of knowledge. The following strategy will be considered for the quick assessment exercise:

- Software engineering;
- Sensor networking and applications, namely in critical infrastructures;
- Telecom infrastructures and systems;
- Embedded systems and related computer engineering areas;
- Basic science supporting emerging developments in ICT’s, including applied mathematics;
- Other potential areas of collaboration in computer science.

2.1.4 Potential instruments to be assessed for the medium-term

- Student exchange: a scheme to offer undergraduates in Portuguese institutions and CMU the opportunity to study at the other institution for 6 to 12 months. It may involve a program for internships of Portuguese and CMU students at leading American and Portuguese firms, in a way to promote new experiences to quality graduates.
- Research opportunities for students (undergraduate and postgraduate): to encourage students at Portuguese Institutions and CMU to step outside the classroom and engage in faculty research projects, respectively at CMU and at Portuguese Institutions.
- One-year post-graduate degree programs: Expand the offer of professional graduate programs, to be inspired in those at CMU in order to promote training of future leaders. All courses should aim to offer both technical depth and business breadth.
- Joint Ph.D. Program: develop a joint program at the Ph.D level, to be conducted according to the highest scientific and educational demands, bringing together key players in various Portuguese Universities and research centers, that will work in close collaboration with colleagues at CMU;
- “Research Chairs”: a scheme for fellowships for CMU and Portuguese Professors to exchange experiences and teach and guide research, through visits from 6 to 12 months.
- Technology management fellowships: for technology managers at Portuguese institutions and at CMU, providing schemes for visits from 3 to 6 months to foster new collaborative efforts with entrepreneurs at CMU and in Portugal.
- Curriculum Development: a scheme to sponsor projects that transfer successful course materials and faculty expertise from CMU to Portuguese Institutions, and vice versa, or establish new courses to be taken at both.

- Executive Education: Expand the offer of the “Executive Development Series” of short courses open to executives in internet and software industries and systems.
- Develop knowledge integrated communities, KIC’s, by expanding research programs to other areas, deepening knowledge generation processes and enlarging the network of Portuguese research groups working with researchers at CMU. The work to be developed in this area aims to foster projects through which firms can engage in research and development activities, both in house and through tight collaborations with the research system in Portugal and at CMU. They focus on new ideas in applied science, engineering and broader technologies. Attention should also be focused on:
 - Work in broad-based problems which require innovative solutions, or a better understanding, in order for policy recommendations to be suggested;
 - Choose areas where comparison and knowledge sharing with the US reality may be of particular relevance to Portugal;
 - Promote relationships with leading US and European companies , broadening the CMU-Portugal collaboration to international leaders and corporations;
 - Analyze and attempt to solve the problems with research conducted according to the highest scientific demands, with publications in leading international peer reviewed journals.

Envisaged research programs, among others, may include the following topics:

- Infrastructure, Markets and Strategies for telecom systems
- Innovation and productivity in software industries
- Aging and the development of inclusive technologies and systems for the elderly
- Globalization, diversification and technology in capital intensive sectors fostering Portuguese exports
- Exploring intelligent systems and infrastructures

All the research activities and programs should encompass activities of knowledge diffusion oriented for the population at large, in a way to promote the public understanding of science and to facilitate the social appropriation of the knowledge generated.

- **“Collaborations for Innovation”** involving researchers at Portuguese Institutions and CMU, working together with American, European and Portuguese companies in strategic areas.
- **Technology Transfer and Entrepreneurial ventures and businesses**, attracting science, engineering and management students, as well as investors worldwide and engaging technically sophisticated young people in new technology-based firms, by promoting joint initiatives involving Portuguese institutions and CMU, including:
 - Support and promotion of initiatives for the identification and mobilization of innovative technologies in Portuguese universities with commercial potential
 - Joint entrepreneurship competitions;
 - Support and promote a program of **internships** of Portuguese students in American start-ups and NTBF’s, namely during summer periods;
 - Support and promote a series of **training programs** on “technology-based entrepreneurship”, followed by a **“venture design competition”**;
 - Support an international **annual prize** for new ideas for technology-based firms developed cooperatively by students at Portuguese institutions and CMU;
- Develop joint research activities of public interest in a way to provide new and advanced knowledge for the **governance of public risks, including information security**, by involving researchers at CMU with those in Portuguese research centers and state laboratories.
- Extend the activities above to **science education for youngsters** in secondary schools by promoting the cooperation between schools and university research centers in Portugal and CMU. Potential actions may include:

- Support a national program for developing **new skills for secondary schools teachers**, namely in mathematics and in information security;
- Support a national **annual prize for collaborations** between secondary schools and research centers working cooperatively on new engineered products;
- Support and promote a “**Technology-enabling Learning Center**” for disseminating ideas and tools for secondary schools through the internet;

2.1.5 Planning Governance and institutional mechanisms

The assessment will involve analysing ways to structure a collaboration including legal, governance, and institutional aspects.

- Governance

The institutional framework governing the CMU-Portugal collaboration should be discussed and assessed, namely in terms of other practices followed by CMU worldwide. In particular, the establishment of a private foundation should be carefully assessed and adequate whenever necessary, as well as its organization and structure.

- Legal issues of property protection

Legal issues associated with the CMU-Portugal collaboration, including property protection aspects, should be discussed and defined.

- Continuous monitoring and evaluation

The overall collaborative program, as well as specific tasks, is to be monitored and evaluated making use of an external peer-review committee. An overall biannual review will be planned to guide the development of the program, as well as its restructuring whenever necessary. In addition, the launching of new actions is subject to the analysis of the external committee.

3. Action Plan and Timing

The objectives mentioned above require the establishment of an action plan. The parties' goals for the timing of the discussions and negotiation contemplated under this Technical Annex are as follows.

1. March-June 2006: Assessment of the potential areas of collaboration and the preparation and design of the potential terms of reference for a future contract.
2. March-June 2006: Discussion, preparation and design of governance system for a future contract.
3. March-June 2006: Discussion and design of legal issues for a future contract.
4. May-July 15 2006: Drafting and negotiation of a proposed contract.
5. July 2006: signature of official contract and public presentation of detailed action plan.

4. Outcomes

Before the end of the 5 month period specified for the assessment (and expected to occur before the end of June, as described in the proposed timeline above), CMU will submit to the Portuguese Government a report with the results of the work in the various topics described in 2.1 above, and including the following details:

- Preparation of the potential area for advanced education and research
- Institutional building: developing “CyLab-Portugal”
- Assessing other areas and programs for potential collaboration
- Potential initiatives to be assessed in all the areas of collaboration for the medium-term
- Planning governance and institutional mechanisms

The report should include the identification of the various consortia of Portuguese institutions and teams to be involved in each activity to be considered. It should also include a draft of the proposed contract and related technical annex for the expected long term collaboration to be established between the Government of Portugal and CMU. The parties will then discuss CMU's report and proposed draft contract with the goal of finalizing a mutually-acceptable contract by July 15, 2006.