

**2010 Andrew Heiskell Awards for Innovation in
International Education**

Cover Page

Heiskell Award Category: 3 International Exchange Partnerships

Name of Institution: California Institute of Technology

Name of Program: Dual Master's degree program in Aerospace Engineering or Aeronautics and Fluid Mechanics: A joint partnership between the California Institute of Technology and Ecole Polytechnique

Nomination Submitted by:

Name: Guruswami RAVICHANDRAN

Title: John E. Goode, Jr. Professor of Aeronautics and Mechanical Engineering
Director, Graduate Aerospace Laboratories (GALCIT)

Organization: California Institute of Technology

Address: Mail Code: 105-50, Pasadena, California 91125-5000, USA

Tel: +1 (626) 395-4525

Email: ravi@caltech.edu

Program Website (if applicable):

http://www.galcit.caltech.edu/academics/ms_aerospace.html

http://www.galcit.caltech.edu/academics/ms_aeronautics.html

http://www.enseignement.polytechnique.fr/mecanique/PA-MECA/MECA_index_MFFA_UK.html

Summary of Program (50-100 words):

The California Institute of Technology (Caltech) and Ecole Polytechnique (EP) in Paris, two world class institutions, successfully launched in 2007-2008 a dual Masters degree program in Aerospace Engineering or Aeronautics and Fluid Mechanics. The syllabus spans over two academic years, with the following original features: participating students spend one full year at each institution with two points of entry into the program. Internships in academic or industrial laboratories are an important component of the program. This model collaborative effort has been recognized and financially supported by the Partner University Fund (PUF) at the French Embassy in Washington, DC.

Nomination

Dual Master's program in Aerospace Engineering or Aeronautics and Fluid Mechanics: A joint partnership between the California Institute of Technology and Ecole Polytechnique

The California Institute of Technology (Caltech) in the USA and Ecole Polytechnique (EP) in France are widely recognized for the excellence of their research and academic programs. They are relatively small when compared with other major research universities and their admission policy consists in selecting a small student body highly gifted in all engineering and scientific disciplines.

In the academic year 2007-'08, Ecole Polytechnique and Université Pierre & Marie Curie in France jointly decided to launch a new two-year Master's program in Fluid Mechanics designed for a highly selective group of graduate students drawn from the best institutions in the field worldwide. In order to attract a significant number of international students, the following guidelines had been adopted from the start: all courses were to be taught in English; instructors were drawn from the pool of highly visible leading international scholars in the Paris area; the program would mainly emphasize fundamental fluid mechanics in order to prepare students for advanced research in the field at the PhD level. A six-month research internship in an academic or industrial laboratory was viewed as an essential component of the syllabus. During the time period (2007-'08), the Graduate Aerospace Laboratories (GALCIT) at the California Institute of Technology (Caltech) launched a one-year Masters degree program in Aerospace Engineering in addition to their existing Aeronautics Masters degree program. The new Masters program was specifically designed to address the emerging and urgent need for highly-trained engineers to prepare for research in the future space exploration activities. The courses in this program are jointly taught by faculty from Caltech and engineers from NASA's Jet Propulsion Laboratory (JPL). The launch of the two new Masters program one at Ecole Polytechnique and the other at Caltech provided a rare synergistic opportunity for both the institutions to form an international partnership and establish a unique dual masters program with global reach and impact.

In the Fall of 2007, extensive discussions took place between the faculty members of the Graduate Aerospace Laboratories (GALCIT) at Caltech and of the department of Mechanics at Ecole Polytechnique. An agreement was reached on a highly original interdisciplinary dual Masters degree program spanning over two years, with the following main features. Participating students spend one full year at each institution. There are two points of entry into the program, one for students entering at Caltech and a second for students beginning at Ecole Polytechnique. These two tracks follow somewhat different but fully equivalent programs. Students originating from Caltech follow the regular Master of Science

syllabus in Aerospace Engineering or Aeronautics at Caltech during the first year, and the Masters program in Fluid Mechanics at Ecole Polytechnique during the second-year. Conversely, students originating from Ecole Polytechnique follow the regular Masters program in Mechanics (in the European sense) syllabus at Ecole Polytechnique during the first year and the Master of Science syllabus in Aerospace Engineering or Aeronautics at Caltech during the second year. Upon successfully completing the two-year program, students are awarded a dual Master's degree in Aerospace Engineering or Aeronautics from Caltech and in Fluid Mechanics from Ecole Polytechnique.

An essential component of the program is a research internship preferably conducted under joint supervision, in laboratories affiliated with Caltech, Ecole Polytechnique, NASA Jet Propulsion Laboratory, French Space Agency (CNES) and French Aerospace Laboratory (ONERA). Such cooperation is meant to attract a significant number of students in the graduate programs of each institution and also to increase the number of diploma-seeking graduate students between both institutions in a vital area of engineering with global reach. It should be emphasized that the program design was submitted to severe constraints as a result of the strict academic and residency requirements of each MS degree. An excellent collaborative spirit prevailed throughout the negotiations to overcome these barriers, with the strong support of the Presidents and administrations from each partner institution. This dual Masters program was first of its kinds at Caltech and provided a blueprint for broadening the reach of international education at the graduate level.

In addition to the funds provided by the administrations of Caltech and Ecole Polytechnique, the joint Masters program sought external funding from the Partner University Fund (PUF) which supports research and graduate education partnerships between French and American Universities, with up to one third of total costs. PUF is administered by the French Embassy in Washington, DC. With its emphasis on novel, innovative and interdisciplinary approaches involving exchanges across national and disciplinary boundaries. The present dual degree project met all PUF selection criteria and was successfully selected for a three-year grant (2008-'11).

The program was well positioned for a head start from the beginning because of the solid foundations that had been laid in the joint agreement and the spirit of international collaboration between the participating institutions. A gradual build-up of the dual degree project was envisioned over three academic years (2008-'11) with successively one, two, and three entering students each year from each partner institution. Such a number may appear to be rather modest, but one should bear in mind that graduate classes in Aerospace Engineering at Caltech and in Fluid Mechanics at Ecole Polytechnique are typically of the order of ten to fifteen students.

Present status of this dual degree program: The first two students in the period 2007-'09 have successfully graduated this Fall. Two students originating from Caltech and one originating from Ecole Polytechnique are presently beginning their second year at the partner institution. Finally, the selection of two incoming students from each partner for the next two years is in progress. At the end of academic year 2010-'11, 9 students are expected to have been awarded dual degrees from Caltech and Ecole Polytechnique. At the same time, internships under joint supervision are being planned in 2009-'10, which will greatly enhance academic exchanges between faculty members and mobility for engineering graduate students of each institution. The dual Masters program is widely publicized to the students and faculty at the respective institutions and is coordinated by Prof. Daniel Meiron (GALCIT, Caltech) and Prof. Patrick Huerre (LadHyX, Ecole Polytechnique), who are responsible for the selection of students and administration. This partnership is encouraged and supported by the respective administrations of the two institutions from its inception because of the many benefits it brings through the internationalization of higher education in engineering. A letter of endorsement from the President of Caltech and a supporting letter from the Director General of Ecole Polytechnique are attached.

Main achievements of this collaborative effort: First and foremost, a unique multidisciplinary dual degree program in Aerospace Engineering or Aeronautics and Fluid Mechanics has been established for the long term, involving two world class institutions with an exceptional student body. Caltech and GALCIT bring to this collaboration their unique reputation in Aeronautics and Aerospace Engineering. They are well situated in the aerospace corridor of the Los Angeles area, with leading industries and the renowned NASA's Jet Propulsion Laboratory, which is managed by Caltech. Ecole Polytechnique and the department of Mechanics offer a challenging program firmly grounded in fundamental fluid mechanics as well as multidisciplinary electives to broaden the student academic interests. Caltech students have been able to interact with European aerospace agencies (CNES, EADS, ONERA) and industry. They bring back with them to the Caltech campus a spirit of international collaboration and mutual understanding of the aerospace engineering culture in France/Europe. The establishment of the dual degree already has had a highly positive impact on student enrollment in the Fluid Mechanics Masters program jointly operated by Ecole Polytechnique and Université Pierre & Marie Curie: student enrollment has doubled to nearly 30 in 2009-'10 when compared with 2008-'09. Finally, this project and its success are likely to serve as a model for the development of future collaborative ventures with international partners in higher education in engineering with other European or American countries. Recognizing the exemplary nature of the dual Masters degree program, Caltech was invited by the French Embassy in Washington, DC to present the program as a model for collaboration at the French-US Universities workshop on higher education held at the University of Southern California (USC), Los Angeles in May 2009.