Terrascope

The Terrascope Program, one of MIT's learning communities for first-year students, employs the Earth system as a way to introduce basic concepts in science, engineering, the humanities, and social sciences, while providing experience in multidisciplinary research. The program was founded in the 2002–2003 academic year.

Program Description

All Terrascope students begin the year by enrolling in a nine-unit fall subject, 12.000 Solving Complex Problems (also known as Mission), in which they work in teams to propose solutions to a complex problem requiring a multidisciplinary approach. In spring, they broaden and deepen their understanding of the problem in 1.016 Communicating Complex Environmental Issues: Designing and Building Interactive Museum Exhibits. An optional 12-unit spring subject, Terrascope Radio (offered for the first time in spring 2005 in collaboration with the Comparative Media Studies Program) provides a way for Terrascope students to receive CI-H (Communication Intensive in the Humanities, Arts, and Social Sciences) credit as they write, record, and produce a radio segment on some aspect of their year's study.

The specific project changes each year. Past charges given to students have included devising a management system for the Amazon Basin that considers social, economic, and technical perspectives; designing the most environmentally conscientious way of extracting hydrocarbon resources from the Arctic National Wildlife Refuge, and conducting a cost-benefit analysis to determine whether the extracted oil and gas would be worth the economic, social, and environmental cost; and developing plans for an international bioreserve in the Galapagos Islands, along with plans for sustainable development and tourism and an ecomonitoring system. Last year the focus was on tsunamis in the Pacific Ocean basin. More detail on this experience will follow.

Terrascope offers an optional one-week credit-bearing subject on museum design and construction during Independent Activities Period. The highlight of the year is a one-week field experience when students complement classroom work with onsite exploration of the location of the year's topic. Another important component of Terrascope is a weekly lunch, when faculty and students gather to hear about current research in Earth system science and engineering. Terrascope students are advised by faculty and/or by staff from the program, providing strong mentoring opportunities. Faculty from Civil and Environmental Engineering and Earth, Atmospheric, and Planetary Sciences have provided the bulk of the advising so far. Students can pursue interests developed in their freshmen year in Undergraduate Research Opportunity Program (UROP) projects, under Terrascope sponsorship.

Program Highlights, 2005–2006

In fall 2005, 46 students opted to enroll in the year-long Terrascope Program as it turned its attention to tsunamis. Freshmen in 12.000 (since 12.000 includes non-Terrascope students, there were 71 in that class at the beginning of the semester) were asked to develop strategies for coping with the tsunami threat in developing countries in

the Pacific Ocean basin. Specifically, they were tasked with analyzing the risk in two tsunami-prone regions (Peru and Micronesia), proposing ways to limit the human and environmental impact of tsunamis, developing strategies for response in case of a tsunami event in these regions, and developing a model for relief response. To tackle this challenging problem students worked in teams, supported by upperclass teaching fellows (students who had taken 12.000 in previous years), a graduate teaching assistant, and MIT alumni mentors with expertise in some aspect of this topic. At the end of the semester, students unveiled their solution to the problem both through a comprehensive website of their design and in a formal presentation where their work was critiqued by a panel of international experts brought to MIT for the occasion. The presentation was also webcast live (http://web.mit.edu/12.000/www/m2009/finalpresentation/).

In the spring subject (1.016), small teams of students, again working with undergraduate teaching fellows, designed, engineered, and built exhibits to teach others about some aspect of the tsunami threat. The exhibits were opened to the public for two weeks in the Bush Lobby of building 13. High school students were brought to MIT to test prototypes, and museum design professionals consulted on design development and critiqued final projects. The exhibits were opened to visitors with high praise from the expert panel and general public. Many of the exhibit components have been adopted for use by museums, including the Aquarium of the Pacific (Long Beach, CA), the Science Discovery Museum (Acton), and the Needham Science Center.

Last year's Terrascope Radio (SP.360) students produced a radio segment on the Galapagos that public radio stations in Ohio and Minnesota have picked up and played. This year's class developed a piece using sound recorded during Terrascope's visit to Chile. The segment was broadcast as part of WMBR's "Dinnertime Sampler" show. Both years' radio broadcasts can be heard by going to http://web.mit.edu/terrascope/www/web_pages/terradio.html.

Terrascope Field Expedition to Chile

At the heart of Terrascope is the commitment to couple classroom learning with real-world experience. As part of this mission, 48 members of the Terrascope community

(30 freshmen, 13 undergraduate teaching fellows—all alumni/ae of Terrascope—1 graduate student, and 4 faculty and staff) traveled to Chile during spring break, March 2006. The purpose of the trip was to visit sites that had experienced tsunamis and that are threatened by future events. All freshmen on the trip were concurrently enrolled in 1.016 Communicating Complex Environmental Issues; a subset of this group was also enrolled in SP.360 Terrascope Radio. In addition to allowing students to

rethink their solutions to fall's complex problem, the visit enabled them to enhance their plans for spring's museum exhibits. Terrascope is grateful to the Henry Luce Foundation for supporting the annual Terrascope Field Expedition that allows its students to visit the locale of the year's research.

Undergraduate Research Opportunities

A number of students undertook Terrascope-sponsored UROP projects during the year as a way to develop their interest in Earth systems research. UROP projects have expanded work begun or interests ignited in Terrascope and also have provided for interesting collaborations. Here are a few examples of 2005–2006 projects:

- Erika Erickson, in collaboration with the Environmental Programs Office, the Environmental Management Program for Energy and the Environment, and supported, in part, by the Paul E. Gray Fund for UROP, worked on a project to assess the efficiency and efficacy of MIT's recycling program.
- Patricia Martinez, with support from and in collaboration with the Laboratory for Energy and the Environment, designed and tested graphic materials to induce people to act in more environmentally sustainable ways in their work at the Institute.
- Zehra Ali worked on the design of seismic-tolerant and flood-tolerant housing for regions in her native Pakistan. The work has involved traveling within the affected regions and working with local citizens and nongovernmental organizations.
- A group of students is involved in an ongoing project to develop plans for a boat-based museum to be shared by a number of Caribbean nations lacking the population or resources to support science museums on their own.
- Several Terrascope students, in collaboration with the Center for Environmental Health Sciences and the MIT Museum, designed and helped to test prototypes for a new exhibit on the mechanics of DNA/RNA in the cell and on how various environmental factors can interfere with these mechanics.

Faculty and Staff Development

Ari Epstein, lecturer in Terrascope, presented a paper, "Terrascope: A Project-Based, Team-Oriented Freshman Learning Community with an Environmental/Earth System Focus," at the American Society for Engineering Education annual meeting (coauthored by Epstein, Alberta Lipson, Rafael Bras, and Kip Hodges). The paper received first prize in the freshman programs division and will appear in the proceedings.

Staff and Enrollment

At the end of the spring semester, Terrascope's leadership changed hands, as both codirectors, Professors Sallie Chisholm (Civil and Environmental Engineering and Biology) and Kip Hodges (Earth, Atmospheric, and Planetary Sciences), left the program to pursue other interests. Professor Rafael Bras (Civil and Environmental Engineering) has been named director.

Mission 2009 (12.000) was taught by Professor Hodges along with Professor Bras, with help from teaching assistant Jeremy Boyce. Professor Bras and Dr. Ari Epstein taught 1.016 with significant help from Steven Rudolph, technical assistant in the School of Engineering. Dr. Epstein, assisted by graduate teaching assistants Joellen Easton and Rekha Murthy, was in charge of SP.360.

Debra Aczel is the Terrascope program administrator, and Ruth Weinrib is the administrative assistant. Maria Shkolnik is the administrator for Mission 2009.

In AY2005—2006, Terrascope enrolled 46 students for fall and 31 in the spring. The distribution of majors declared in spring 2006 is shown in the table below.

Course	Number of Students
15	5
1E	5
12	4
5	2
8	2
16.1	2
1C	1
10	1
11	1
14	1
18	1
1	1
2A	1
6.1	1
6.2	1
Undesignated	1
Total spring 2006 enrollment	**30**

Rafael Bras
Director
Edward A. Abdun-Nur Professor of Civil and Environmental Engineering

More information about Terrascope can be found at http://web.mit.edu/terrascope/.