1. Project title.

Training Roster And Materials (TRAM): Development of a syllabus, training materials, and a roster of collaborators to build capacity for designing, building, operating and using geophysical monitoring networks to support natural hazard risk identification and reduction

2. Time line of activities and budget (from #10 and 15 below).

Project Period: July 2006 – June 2009

Key Milestones:

2006 Aug	Terms of reference established
2006 Sep	Working Group appointed
2006 Dec	Working Group meeting 1
2007 Apr	Working Group meeting 2
2007 Jul	Key personnel participate in GRIP Science Workshop
2007 Oct	Working Group meeting 3
2008 Apr	Working Group meeting 4
2008 Jul	Key personnel participate in GRIP Science Workshop
2008 Nov	Working Group meeting 5
2009 Feb	Working Group meeting 6
2009 Apr	Key personnel participate in GRIP Science Workshop
2008 Jun	Publish training materials

Budget Estimates:

Year 1:	$146,615
Year 2:	$156,731
Year 3:	$198,640
Total:	$501,986

3. Key personnel (among all partner institutions) responsible for defining and implementing the project.

Raymond J. Willemann, IRIS Director of Planning – Project coordination
Art Lerner-Lam, Columbia University – Working Group chairperson

4. Where the required funds will be raised for this project.

Seed funding is requested to convene an international working group on the transfer of technical knowledge and the development of regional, sustainable capacity for natural hazard monitoring. Additional core and project funding will be leveraged as components of country assistance, post-disaster recovery and reconstruction, and international scientific and technological collaborations funded by national science agencies and development organizations.

5. Lead institution which is responsible for implementation of the project and all other institutions involved, along with respective roles.

Incorporated Research Institutions for Seismology (IRIS), 1200 New York Avenue NW, suite 800, Washington, DC 20005, susan@iris.edu, http://www.iris.edu – Responsible for establishing and maintaining the Working Group, organizing and hosting Working Group meetings, organizing travel to GRIP science workshops, coordinating project and planning materials as needed, and preparing draft and final versions of a training syllabus and materials and establishing and maintaining a roster of qualified training lecturers.

Founded in 1984, IRIS is a university research consortium dedicated to supporting earthquake research through the operation of global and regional seismograph networks and the management of seismological data. IRIS programs contribute to international scholarly research, education and training, and earthquake hazard mitigation. IRIS programs have also contributed to the activities of the United Nation's Comprehensive Test Ban Treaty Organization, and to the Indian Ocean Tsunami Warning System of the Intergovernmental Oceanographic Commission. The investment in the global technological infrastructure for IRIS programs over the last two decades stands at more than USD200M, and the US National Science Foundation has recently authorized continuing funding of approximately USD12-18M per year over the next five years.

The membership of the IRIS consortium comprises 120 universities, educational institutions and US government affiliates, and more than 55 foreign affiliates (list attached). Each of these institutions represents a resource base for collaborative research, education and training. IRIS provides the technological and administrative framework for accessing this resource base for training and capacity building throughout the world. The use of this framework leverages the considerable international investments already made in seismographic networks, data management systems, and risk reduction decision support. IRIS has a history of working with regional and national partners to promote sustainable operation of geophysical monitoring networks, and the use of the data in a standards-driven environment for supporting earthquake risk reduction policies and programs.

6. Area or areas of the GRIP to which the outputs of the project will contribute.

Capacity Development: The proposed work is directly relevant in the GRIP area of "develop training programs to assist local groups implementing GRIP projects."

Demonstration Projects: The proposed development of training materials could facilitate a demonstration project by working with an IRIS foreign affiliate if an opportunity to offer training in preparation for designing and building a network arose while the training materials were being developed.

7. The problem the project will address and its relevance to the GRIP.

It is frequently true that national natural hazard-monitoring facilities, such as seismograph networks, are established with recovery and reconstruction funds in the aftermath of a disaster. Too often the decision to install monitoring networks is made in a rushed, politically charged environment with little interaction with or knowledge of established systems. Further, training in the use of the data for decision support, research and risk assessment, as well as the establishment of sustainable operations with the participation of broad stakeholder communities, often do not follow a coordinated path and suffer from the lack of up-to-date materials.

To take advantage of the core capital investment in multi-scale monitoring technologies and the knowledge base supporting them, IRIS proposes to establish a Training Roster and Materials (TRAM) project that will provide the GRIP country programs with baseline resources for establishing and operating monitoring systems for use in risk reduction decision support. This will allow GRIP to implement a sustainable model for building capacity in hazard monitoring that leverages existing infrastructure and a large community of international collaborators. Such a project would provide a capacity building framework that parallels the technological and scientific one.

Earthquake monitoring is an essential activity in building capacity for seismic hazard assessment and earthquake risk reduction. Constructing and operating a monitoring network has instigated development of indigenous expertise in all aspects of risk identification, assessment and mitigation in numerous countries. Earthquake locations are the most evident product from seismographic networks, but the benefits of well-designed networks extend far beyond mere event catalogs. Where geophysical monitoring networks have been built and are operated with a full sense of ownership, a complete panoply of skills can arise in instrument design, data processing, geophysical investigation, and earthquake engineering. Without a seismographic network, local capacity remains incomplete and dependent on outside contributions, including expertise.

Funding for an earthquake monitoring network in a developing country might become available for a variety of reasons, but usually as the result of post-disaster reconstruction and recovery. Under the time pressures of reconstruction and recovery, there are several motivations simply to purchase one of the “turn key” seismographic monitoring systems offered by commercial vendors:

- Designing and building a unique monitoring system is easily seen to require more time to complete than the installation schedules that a commercial vendor may promise.
- The recipient country may lack experience with the numerous components of a seismic monitoring system, and be anxious about the challenge of selecting effective and mutually compatible instrumentation.
- The commercial vendors are based in countries that are likely to be reconstruction fund donors.

There are several counterbalancing factors, but their importance may not be clearly seen in the short term, when the recipient is under pressure to respond quickly:

- The operation of turn-key systems may be too automated, in the sense that limited user intervention precludes an important learning process.
- Vendor systems may not be adapted to the monitoring requirements in the recipient country, which vary with the geographic and magnitude distribution of earthquakes, shallow soil and rock conditions, degree of urbanization and quality of construction and infrastructure.

In short, purchasing a turn-key system can vitiate capacity building. The purchase can result in a network that is capable, in principle, of producing data required for other activities but, in practice, is a "black box" that is never used for any activities other than those that were programmed in at the outset. Operations may deteriorate over just a few years to the point of no longer even producing products that are reliable or accurate enough for hazard mitigation activities.

Arguably, enough is known about the specific monitoring needs in most countries that such networks could be designed, built and employed in advance of the next major earthquake, in a rational, evidence-based environment.

Spurning commercial seismographic instrumentation is *not* the most efficient way of sidestepping the threat to capacity building. Seismometers and other geophysical instruments are unlikely ever to have large markets, and even in the most technologically developed countries instrumentation is often imported from one of the very few specialized companies around the world. Instead, when a seismographic or other geophysical network is planned, training should help stakeholders and institutions in the country to choose appropriate instrumentation, develop a network that serves their needs, operate the network, use data from the network, integrate their data with data from other networks, and develop the decision support tools needed for risk reduction. The need for this training is now recognized and, indeed, training courses were funded in several countries around the Indian Ocean following the December 2004 tsunami by the Intergovernmental Oceanographic Commission, US A.I.D., the German government and others. However, the materials in these workshops were prepared in an *ad hoc* and non-uniform manner, with little thought given to a comprehensive curriculum and sustainability.

Another factor not often addressed is the need to develop a sustainable monitoring enterprise. Sustainability arises from a continuing need for monitoring, which itself arises from continuous investigations of the hazards and risks of earthquakes. The continuous flow of information itself provides the motivation for sustained investment if there is the capacity to absorb the information and demonstrate its continuing utility for risk reduction. This requires sustained scientific and technical collaborations on risk identification and reduction. TRAM would encourage these collaborations by leveraging the scientific and technical interests of the IRIS US and international membership to study relevant problems and applications.

8. Goals and Objectives

The need to organize training rapidly, so that scientists and engineers from each country can participate in design and development of their own networks, has revealed an

underlying shortcoming: appropriate training material does not exist. While the national monitoring agencies have significant outreach programs for the general public and universities have educational capabilities that are effective in the long run, neither community has had a mission to train earthquake monitoring professionals. Typically, professionals are university graduates who learn the specialized aspects of their work on the job over several years.

The goal of TRAM is to develop a training capacity that will overcome this shortcoming. When a seismographic or other geophysical network is planned, training would be available to help stakeholders in the country to quickly choose appropriate instrumentation, develop a network that serves their needs, operate the network, use data from the network, and integrate their data with data from other networks.

Significantly, IRIS is presently engaged in the design and execution of prototype training programs under the auspices of international scientific federations, as part of a demonstration program but with minimal funding. Three training workshops have been held or scheduled for African, South American, and Southeast Asian seismologists. These programs have focused on highly technical aspects of data management, but could serve as the basis for expanding to GRIP objectives in risk reduction decision support.

The specific objectives are:

Training Syllabus: Create a set of modular topics in designing, building, operating and using data from a seismographic or other geophysical monitoring network and data center. A course to meet the needs in a particular case would be created by selecting modules based on the previous experience of stakeholders to be taught and the tasks facing those stakeholders and their institutions in the near future.

Training Materials: For each module, create printed notebooks, PDF documents, PowerPoint Presentations, videos, hands-on demonstration programs and other material as appropriate. Apart from the printed notebooks, material would be made available on CDs or DVDs and posted to the IRIS web site, each available free of charge.

Lecturer Roster: Create a database of people with experience required to lecture on the topics of each module, familiar with the training materials for that module, and prepared to travel to specified geographic regions to provide the training. The roster will be instantiated as a computer database that can be used to select lecturers based on a course location and the modules to be taught.

9. Inputs.

Expertise: A Working Group of 12 to 15 professional seismologists, primarily from IRIS member institutions, representing a broad range of seismological and geophysical monitoring operations and data analysis experience.

Staff: IRIS Director of Planning – 2 months per year
IRIS staff assistant for meeting support – 1 month per year
IRIS staff assistant for materials organization – 4 months per year

IRIS graphics designer – 2 months in year 3
IRIS web/database programmer – 2 months in year 3

Equipment: One laptop computer for meeting support and materials organization

Supplies and Services: Notebooks, meeting supplies, reproduction for panel, workshop, international telephone conferencing, shipping.

Travel:

Convene two working group meetings per year with 15 members and guests, supporting travel and two days of lodging and per diem.

Participate in one GRIP Science Workshop per year by the Working Group chairperson (supported by the Science Workshop project) and by the IRIS Director of Planning (supported by this project).

Participate in two relevant disaster meetings per year by the Working Group chairperson (supported by the Science Workshop project) and by the IRIS Director of Planning (supported by this project).

Evaluation and Impact Assessment:

IRIS Director of Planning – cost covered elsewhere
Working Group chairperson – cost covered elsewhere
At two relevant disaster meetings per year by the Working Group chairperson (supported by the Science Workshop project) and by the IRIS Director of Planning (supported by this project).

10. Activities to achieve objectives.

Objective to be achieved	*Activity*	*Timing requirement*
Draft Syllabus	WG meeting 2	required 2 months before WG meeting 3
Revised Syllabus, Draft Materials	WG meeting 4	required 2 months before WG meeting 5
Final Syllabus, Materials, & Roster	WG meeting 6	required 2 months before Publication
Publication	Design, printing, web programming and DVD production	

11. Deliverables.

Activity	*Deliverable*
WG meeting 1	Meeting report
WG meeting 2	Draft Syllabus
WG meeting 3	Meeting report
WG meeting 4	Revised Syllabus, Draft Materials
WG meeting 5	Meeting report
WG meeting 6	Meeting report
Publication	Final Syllabus, Materials, & Roster, with a subset of materials in print and complete materials on DVDs and a web site.

12. Users.

Projects in region to establish seismographic or other geophysical networks.

13. Indicators and targets: Provide between 1 to 3 measures by which you propose to demonstrate the extent to which each of the objectives is being achieved.

1. Number of projects where training courses were requested that were based on the lecture materials.
2. Number of individuals who report training using the lecture materials.
3. Number of networks that report being better able to design or operate their network better as a result of training based on these materials.
4. Independent assessment of global and regional improvements in earthquake monitoring and their role in improving earthquake risk reduction.

14. Critical factors.

There are no key critical factors that might prevent the objectives from being achieved:

- There is no single key partner, because experts from several dozen U.S. universities and foreign affiliates are qualified to participate in the proposed working group.
- There are no critical data sets, because training material can be developed from any of numerous data sets already collected at the IRIS Data Management Center.

15. Exit strategy.

The project could continue with a much lower level of funding, but the database of lecturers may not be kept up to date after the three-year development of a syllabus and lecture materials is completed.

Without ongoing funding after three years, IRIS would continue to make the materials available from its web site and distribute DVDs that had already been produced. But without an up to date database of lecturers, IRIS could not respond as promptly to requests for training courses.

Material should be kept up to date by periodic (perhaps once per 5 years), separately funded revision projects, which typically might be completed in one year at one-third the cost of the original development.