The Right Thing to Do: International Research Collaborations

James R. Mihelcic
Professor and State of FL 21st Century Worldclass Scholar
Civil & Environmental Engineering
University of South Florida
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- Peace Corps
- Many, Many, Many, Students
So why am I here?

Which way is the frontier?
Answer:

- I skate to where the puck is going to be, not to where it has been.

- Wayne Gretzky
Locations where our students conduct research

- Vanuatu
- Ghana
- Philippines
- Mauritania
- Mali
- Madagascar
- Panama
- Jamaica
- Kenya
- Uzbekistan
- Honduras
- Belize
- D.R.
- Macedonia
- East Timor
- Liberia
- Benin
- Ghana
- Cameroon
- Namibia
- Palau
- Samoa
- Bolivia
- Peru
- Zambia
- Madagascar
- fri

- Bolivia
- Fiji
- Peru
- Zambia
- Namibia
- Palau
- Samoa
- Vanuatu
- Fiji
So lets start the journey...
How do we get young people interested in their communities and the world, and in science and engineering?
What does NSF say?

• “International partnerships are essential to addressing critical science and engineering problems.

• In the global context, U.S. researchers and educators must be able to operate effectively in teams with partners from different nations and cultural backgrounds.”
Framing our research in areas that have broad and important societal impact
The 8 Millennium Development Goals

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Global partnership for development
Example of a non-Conventional University Partnership - Peace Corps Master’s International Program
What did this non traditional university graduate partner provide?

In country research expenses (2+ years) (travel, lodging, medical, safety supervision, etc).

Peace Corps provides extended hands-on training combined with experiential learning and an environment that shows trainees how their research benefits society, while also providing competency in:

1. foreign language,
2. incorporating gender, sociocultural context, and ethics into practice and research,
3. participatory planning and assessment, and
4. appropriate technology.
UCF alumni Ben Yoakum
Examples of Peer-Reviewed Scholarship

CARE & Catholic Relief Services through the USAID supported RANO-HP Project
CARE & Catholic Relief Services through
the USAID supported RANO-HP Project

NSF International Research Experiences for Students (IRES)

The International Research Experiences for Students (IRES) program supports development of globally-engaged U.S. science and engineering students capable of performing in an international research environment at the forefront of science and engineering. The IRES program supports active research participation by students enrolled as undergraduates or graduate students in any of the areas of research funded by the National Science Foundation. IRES projects involve students in meaningful ways in ongoing research programs or in research projects specifically designed for the IRES program.
So here is where I traveled for 7 summers.
La Paz, Population: 789,585, with the neighboring cities of El Alto and Viacha, has a population of over 1.6 million inhabitants. Altitude of 3,660 metres (12,008 ft), it is the world's highest capital city.
SUERO DE LA VIDA
SALES DE REHIDRATACION ORAL
BAJA OSMOLARIDAD

RECUPERA Y DA FUERZA
AL NIÑO CON DIARREA
We were joined by applied anthropology graduate students.
We integrated our research with computational fluids mechanics faculty and students.
We now partner with marine scientists
- Samples Collected to Assess Enteric Virus Removal -

- Sampling: 24 hr composite, collected in 3x

- 60 ml sample acidified to pH 3 – 3.5
- 0.45 μm filter

- qPCR
  - Rotavirus
  - Norovirus
  - PMMoV
And we found a research laboratory at the University San Simon in Cochabamba
And I always had happy students
Students took the leap of faith with me during those early years
USAID - NSF Partnerships for Enhanced Engagement in Research (PEER) Sciences

The United States Agency for International Development (USAID) is exploring new opportunities to use science and technology to meet the world’s development challenges. As part of its science and technology strategy, USAID is supporting various mechanisms to leverage the investments that other U.S. government agencies make in scientific research and training. In this context, USAID, in partnership with the National Science Foundation (NSF), have launched Partnerships for Enhanced Engagement in Research (PEER) Science. PEER Science is a competitive grants program that invites scientists in developing countries to apply for funds to support research and capacity-building activities on topics of importance to USAID and conducted in partnership with their NSF-funded collaborators.

Areas in which both NSF and USAID have strong mutual interests include, but are not limited to, the following:

- **Food security** topics such as agricultural development, fisheries, and plant genomics
- **Climate change** impacts such as water sustainability, hydrology, ocean acidification, climate process and modeling, and environmental engineering
- **Other development topics** including disaster mitigation, biodiversity, water, and renewable energy
The fate of enteric pathogens in fluids, fields, and food products: On-farm solutions for the safe reclamation of water and nutrients from sewage

The geographical realities of wastewater reuse in Cochabamba, Bolivia
Irrigation canals (shown in blue) from Totora Khocha, Laguna Robada, and Lluska Khocha-Muyu Loma reservoirs, only provide irrigation water for some families on the northeastern side of the urban center.
Pond System in Punata with Irrigation Canals
Crops irrigated with reclaimed wastewater
100% of effluents reused directly for irrigation between May and November.

500 Bs. fine for using water out of turn.

Farmers place a value of ~$0.25 per m$^3$ of treated wastewater (estimated based on costs for pumping water to fields, not including labor invested to build canals).
Health Implications and Risk of using different sources of water

Log$_{10}$ Removal of Pathogens

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<th>Pathogen</th>
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<th>UASB System</th>
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<td>Bacteria</td>
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Effluent Pathogen Concentrations

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Giardia/Cryptosporidium

Ascaris spp.

Trichuris spp.

Taenia spp.

Examples of Peer-Reviewed Scholarship – work in Bolivia

Partnerships for International Research and Education (PIRE) is an NSF-wide program that supports international activities across all NSF supported disciplines. The primary goal of PIRE is to support high quality projects in which advances in research and education could not occur without international collaboration. PIRE seeks to catalyze a higher level of international engagement in the U.S. science and engineering community.

International partnerships are essential to addressing critical science and engineering problems. In the global context, U.S. researchers and educators must be able to operate effectively in teams with partners from different nations and cultural backgrounds. PIRE promotes excellence in science and engineering through international collaboration and facilitates development of a diverse, globally-engaged, U.S. science and engineering workforce.

This PIRE competition will focus exclusively on the NSF-wide investment area of Science, Engineering, and Education for Sustainability (SEES). The SEES effort focuses on interdisciplinary topics that will advance sustainability science, engineering and education as an integrative approach to the challenges of adapting to environmental, social and cultural changes associated with growth and development of human populations, and attaining a sustainable energy future. Additional details are provided in the Summary of Program Requirements below.
Our PIRE project: $3.9 million for 5-yr project, *Context Sensitive Implementation of Synergistic Water-Energy Systems*

- Can effective, geographically-appropriate, and culturally relevant engineered systems be established that utilize wastewater as a resource for recovery of energy, water, and nutrients?
Our NSF PIRE Partners
The Bonus...

Back in late 2012, Environmental Protection Agency had competitive solicitation to create national Centers for Water Research on National Priorities Related to a Systems View of Nutrient Management
The Bonus...

The University of South Florida department of Civil and Environmental Engineering in partnership with the University of Texas Resources for the Future, Yale University, University of Florida, University of Maryland, and Corporation to Develop Communities of Tampa have been awarded a $2.2 million competitive grant by the U.S. Environmental Protection Agency (EPA) as part of its Science to Achieve Results (STAR) program to establish a Center for Reinventing Aging Infrastructure for Nutrient Management (RAINmgt).

As a national research center, RAINmgt will tackle a dire issue plaguing our nation’s waterways that is critical to Florida’s and the Nation’s economic and social well being: nutrient inputs such as nitrogen and phosphorus from domestic wastewater and stormwater. The National Academy of Engineering has identified managing the nitrogen cycle and restoring and improving urban infrastructure as two of their Grand Challenges.