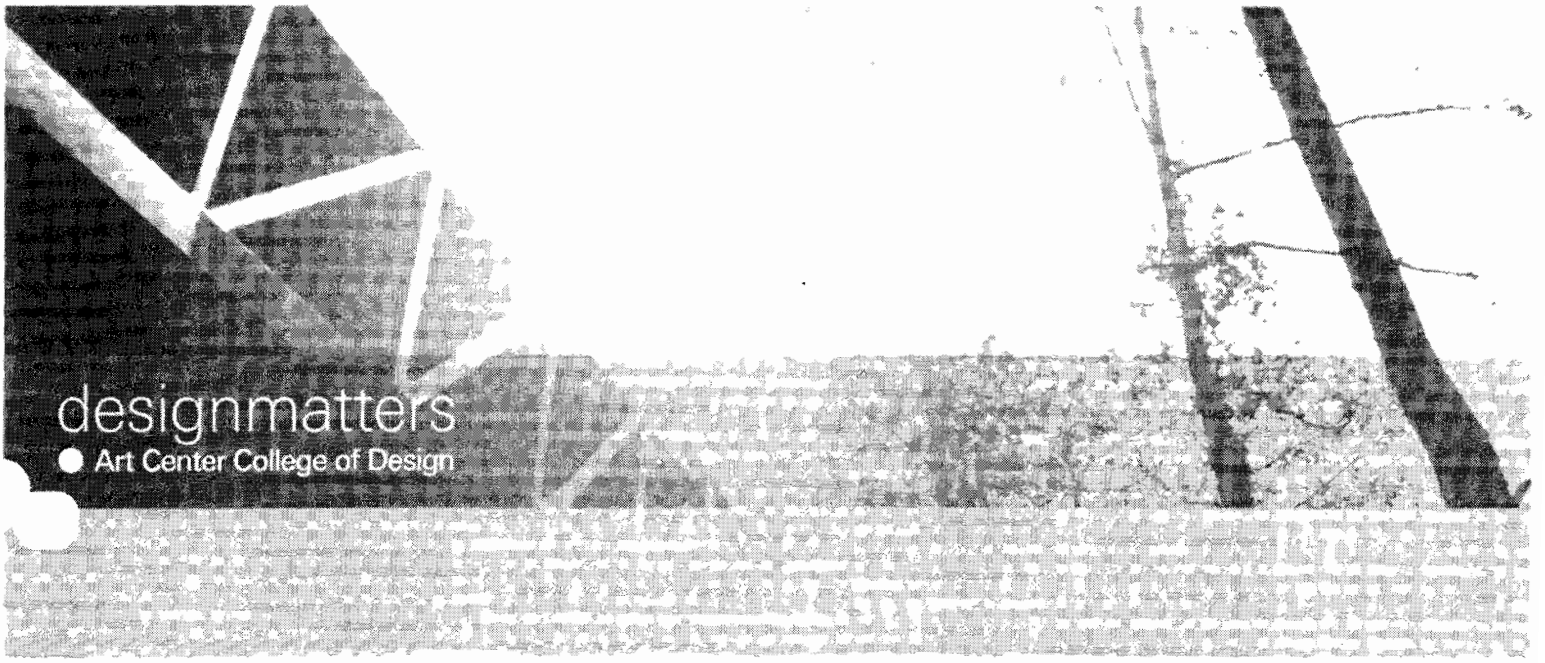
World Water Forum College Grant Program
2007 Grant Proposals

College	Art Center College of Design (2)
Faculty	Tony Luna
Project	Providing Access to Clean Water in Rural Guatemala: A Proposal for Low-Cost Solar Water Purifier

Providing Access to Clean Water in Rural Guatemala

A Proposal for a Low-Cost Solar Water Purifier



Proposal to the Southern California World Water Forum
Innovative Conservation Research and Technology
College Grants for Universities and Community Colleges

December 2007

A. College
Art Center College of Design
Designmatters
1700 Lida Street
Pasadena, CA 91103
Art Center: www.artcenter.edu; Designmatters: www.artcenter.edu/designmatters
Make Check Payable To: Art Center College of Design, reference Designmatters

B. First Time Applicant – Global Project

C. Student Project Manager
Gabriel la O'
Undergraduate
Product Design Department, Art Center College of Design
1700 Lida Street
Pasadena, CA 91103
626-771-3638 (Home)
646-250-4814 (Mobile)
gabelao@yahoo.com

D. Faculty Project Manager
Tony Luna
Liberal Arts and Sciences and Photography and Imaging Departments
Art Center College of Design
1700 Lida Street
Pasadena, CA 91103
626-584-4000 (Work)
tonyluna@aol.com

E. Organizational Background

Art Center College of Design

For 77 years, Art Center College of Design, located in Pasadena, California, has been one of the world's leading institutions for design education. Art Center offers undergraduate and advanced degrees in a wide variety of design and fine art disciplines, and the college's pragmatic, real-world approach provides graduates with the education and experience to become creative leaders in their chosen professions. Art Center's curricula are multidisciplinary, rigorous, and dynamic in nature, responding to a fundamental belief that interchanges among disparate fields of knowledge and design disciplines have become essential to contemporary higher education in general—and to design education in particular. Today the college also maintains its top-ranked position by evolving its philosophy and practices in response to the rapid technological and socioeconomic changes of our era. The institution is a laboratory for innovation, a locus for partnerships and collaborations with industry and public sector

development agencies, and a center of international public dialogue on the larger role of design.

Designmatters at Art Center

Art Center College of Design has a long-standing tradition of teaching design with real-world relevance. This approach gained new focus and intensity in 2001 with the inception of the college-wide Designmatters Initiative, which oversees an ongoing portfolio of projects that address the convergence between design, business practices, and social responsibility. Under the direction of the International Initiatives Department at Art Center, Designmatters is an effective model of educational engagement that connects academic practices to design-based explorations of real-world issues. Designmatters' key areas of inquiry include issues of public policy, human sustainable development, global healthcare and social entrepreneurship as these relate to the design disciplines.

Among the key alliances forged by Designmatters, creative partnerships with many United Nations agencies, as well as international and national non-profits, have been especially productive in promoting designers' roles as advocates and strategic communicators of humanitarian issues of crucial urgency. In recognition of this international body of work, Art Center holds a series of prestigious affiliations, which are unique for any design institution today. These include non-governmental organization status (NGO) with the Department of Public Information of the United Nations; civil society organization membership with the Organization of American States, pending collaborative center status with the Pan American Health Organization and WHO, and membership in UNESCO's Global Alliance network.

Product Design at Art Center

The Product Design program at Art Center has a rich legacy and reputation for producing graduates with the ability to create appealing products that combine commercial viability with social responsibility. They are taught that good design can improve people's lives through a seamless blend of functionality, attractiveness, and relevance. Businesses have increasingly become attuned to the value of design as a vital part of their strategic planning. While our core mission is to prepare students for a professional career in design, we have expanded our focus to nurture our students' understanding of the value of design thinking for successful product development. Product Design at Art Center also fosters a spirit of innovation and risk in entrepreneurship, preparing our students to assume leadership roles in an increasingly competitive and design-friendly business environment.

California Institute of Technology

The mission of the California Institute of Technology is to expand human knowledge and benefit society through research integrated with education. The Institute investigates the most challenging, fundamental problems in science and technology in a

singularly collegial, interdisciplinary atmosphere, while educating outstanding students to become creative members of society.

The proposed project will continue the research and product development begun in the Institute's Fall 2007 E/ME105 (Product Design for the Developing World) course. This course was first offered three years ago, through collaboration with the California Institute of Technology chapter of Engineers for a Sustainable World. Since then, course participation has been extended to students from Art Center College of Design, and the course has undergone revisions following each offering in order to improve both the students' experience and the quality of the projects. The goal of the course is to design products that could benefit the one billion people in the world who live on one dollar per day.

In 2005, the class focused on designing products for Guatemala's rural poor. Research began with the collection of background material and a list of contacts with direct knowledge of the realities of life in the course's target market. In the following year, to further enhance the context and relevancy of the products, students studying Industrial Design and Agriculture from the Universidad Ferdinand Landívar, in Guatemala City, were incorporated into the product design teams. The instructor, course consultants, and teaching assistant traveled to Guatemala to meet with the Landívar students and conduct first-hand market research and product testing in rural areas. This field research was vital in the development of prototypes that could be successfully disseminated.

This year, prior to the beginning of the course, 12 California Institute of Technology, Art Center, and Landívar students traveled to rural Guatemala for additional field research within the community to better understand the culture and assess their needs. Based on this research, a list of product needs was created. Ideas for prototypes were then developed by eight joint California Institute of Technology/Art Center/Landívar student teams. This project will be a continuation of one team's work.

Rafael Landívar University

The Rafael Landívar University (URL) is an independent, non-profit Catholic university in Guatemala. Taking the region as a stage, the community Landívariana seeks to contribute to the transformation of society in Guatemala and Central America by encouraging freedom and fairness.

The work of the URL responds to the demands of a Guatemala conceived as a multi-ethnic country. The University focuses on the urgencies of peace; sustainable economic and social development; political development within a framework of democracy and respect for human rights; and environmental sustainability.

Industrial Design and Agriculture students from URL collaborated with Art Center and California Institute of Technology in the Product Design for the Developing World course. The URL's Industrial Design Department will continue its partnership on this

project by providing support and guidance, as well as assistance in prototype testing and distribution in the region.

F. Project Description

The Challenge: Limited or No Access to Clean Water in Rural Guatemala

The concept for this project grew out of ideas developed in Professor Kenneth Pickar's Product Design for the Developing World course taught at California Institute of Technology. In August 2007, the team members had the opportunity to travel to Guatemala to learn first-hand the needs of those living in rural areas. One of the issues faced by many Guatemalans, including those living in the cities, is having access to pure and clean water. According to the Guatemala Ministry of Health, 98 percent of the country's water sources are contaminated with water-borne diseases such as typhoid fever, hepatitis A, cholera, giardia, and amebiasis. As a result, affected adults are absent from work or cannot be as productive, while children are unable to attend school and suffer from permanent developmental damage. Additional statistics show that 40 percent of Guatemala's population has no access to clean water, and of the 331 municipalities in Guatemala, only 24 have drinking water treatment systems, and of these 24, only 15 systems are currently in operation.

Proposed Solution

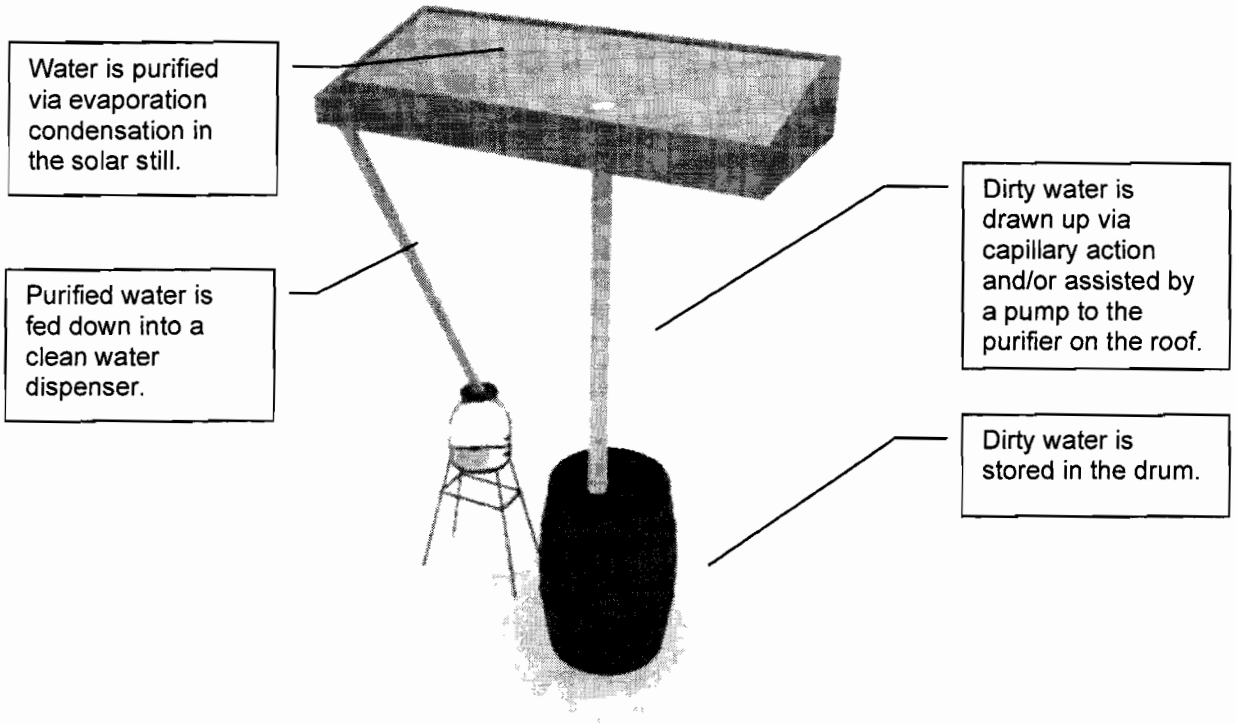
Clean water is ultimately dependent on how water is transported and stored. This project will develop a practical, low-cost system that passively purifies water while storing it. The first step will be to implement a sustainable low-cost solution in rural Guatemala, and then later apply this system to other developing countries where access to clean water is limited. The project will focus on a scalable solution which can grow into income generating opportunities for the local population while employing modern manufacturing and business standards through an international non-profit organization to be established in the U.S.

Design Concept

The concept for this project is to develop a solar water purifying system. This product will draw impure water into a treatment area where the sun's heat will help evaporate the water through a sheet of glass. Next, the water vapor will condense on the glass, bead, and drip down into a clean water storage area. The purified water can then either be collected or routed into an indoor container.

The following is an initial depiction of the prototype that will be further developed.

Rooftop Solar Still



Expected Benefits

The expected benefits of developing this natural water purification product include:

- A decrease in harmful water-borne diseases (typhoid fever, hepatitis A, cholera, giardia, and amebiasis) caused by protozoa, viruses, bacteria, and parasites that affect a large percent of the rural Guatemalan population
- Purchasing, using, and maintaining the product will save money in comparison to the costly method of boiling
- Time saved by using this purification system will allow adults in the household to spend more time generating extra income

Business Plan and Project Activities

Upon completion of this project, a full functioning prototype of a solar water purifier will be created and tested in Guatemala.

Preliminary Research and Ideation (Fall 2007):

- Identification of Problem – In August 2007, we conducted field research in the rural areas of San Jose Poaquil and San Jose La Laguna, Guatemala. We observed and experienced first-hand water consumption issues facing rural Guatemalans. These communities, totaling approximately 10,000 inhabitants, gathered water directly from contaminated wells, rivers, and lakes, and the majority of the water was being consumed without any treatment. If water was treated, it was mostly through boiling. The problems with using this method include the high cost of firewood and the cause of pulmonary diseases, a leading cause of death amongst children, due to boiling indoors without proper ventilation. We also observed that people were spending an average of 6 to 10 hours gathering and boiling water every week. This is time taken away from earning almost a full-day's income.

- Research – To have a better understanding of the actual problem, we performed primary and secondary research which involved interviewing different stakeholders, reading publications on the status of water in Guatemala, studying successful and unsuccessful water projects, and analyzing competing products. Below is a list of the in-depth interviews that were conducted during the course:

    - Magali Salazar – Coordinator, Centro Ri Palamax Project
    - Empagua – Guatemalan water company
    - Paula Paz – Landívar graduate who wrote a thesis on water purification in Guatemala
    - Red Cross LA – regarding their water purification project in Guatemala using chlorine
    - Kim Glick – Representative, Fundacion Solar, a nonprofit which focuses on rural renewable energy and water management

- Preliminary Ideation – Using the findings from our research, we brainstormed many ideas and then drew mock-ups. Through this ideation exercise, we identified the ideas that had the most potential. Next, we examined the viable concept designs to determine which would satisfy the needs discovered in the research phase before beginning a prototype.

Final Design Ideation, Prototype Design, and Testing (Spring-Summer 2008):

- Design Ideation, Refinement, and Evaluation – Continuing to build on research conducted in the course, we will refine product design specifications as well as reevaluate the activities downstream of the design stage–manufacturing, sales, transportation, etc., to ensure affordability. Also examined will be the user interface, including how culturally and age appropriate the product will be. Upon receipt of the grant, the project will be refined and developed in detail as an Art Center independent study course in Summer 2008. More research will be done and mock-ups will be developed at Art Center and California Institute of Technology campuses.

- Detail Design – The concept will be designed in detail to include all the dimensions, specifications, and local materials necessary to make the product.

- Prototype Development and Testing – Test trials will be performed on the final prototype developed. The full-scale working prototype will be tested in Guatemala with the help of URL. We will analyze the test data and refine the design based the test results. We will rebuild the prototype taking into account these findings.

- Educational and Outreach Materials – Culturally appropriate manuals and outreach materials will be designed to educate on the use of this product and the benefits of clean drinking water.

Project Timeline April 1 - August 15, 2008

Design Ideation, Refinement, and Evaluation	April 1 – May 20, 2008
Detail Design	May 21 – May 27, 2008
Prototype Development and Testing	May 28 – June 28, 2008
Design Refinement Based on Findings	June 29 – July 29, 2008
Rebuild Prototype and Test	July 30 – August 15, 2008
Create Educational and Outreach Materials	August 10 – August 15, 2008
Present Project to MWD	August 2008

Conclusion and Anticipated Outcomes

The anticipated outcome of the research and final design is the development of a practical and affordable water purifying system that will decrease harmful water-borne diseases (e.g. typhoid fever, hepatitis A, cholera, giardia, and amebiasis) caused by protozoa, viruses, bacteria, and parasites that affect a large percent of the poor in the developing world (rural or urban). The system developed will apply a physical solution to water purification rather than a chemical one, and will distill water naturally, eliminating the need for complex technology. This is a product that we anticipate will be beneficial to other regions of the world where easy access to clean water is essential to the health and well-being of the community.

The product will adhere to the following design guidelines:

- Provide safe drinking water–eliminates microbial contaminants
- Provide better tasting water–reduces mineral content
- Affordability–costs less than what they are currently spending for clean water (approximately $2 for 5 gallons)
- Adaptability–works in both rainy and dry seasons
- Ease of use for filtration–an adult should be able to filter water
- Ease of dispensing–a child, age 5 and up, should be able to access the clean water
- Ease of maintenance–parts are easy to replace, low frequency of replacement
- Durability–withstands natural weathering, temperatures up to 100°F without loss of functionality, and temperature of 130°F without permanent structural damage; uses

materials that do not naturally biodegrade within the lifespan of the product; uses structural materials with a half-life >100 years; withstands a drop from a height of almost 7 feet without any permanent damage; contains less than 5 movable parts
- Provide adequate amounts of water–1.5 to 2 liters per human each day
- Locally available–all input materials can be found within Guatemala City
- Ease of assembly–assembly requires only those tools and equipment that are easily accessible in the rural areas of Guatemala
- Portability–weighs less than 10 pounds when empty
- Efficient purification process–a maximum of 6 hours is needed to purify water

Team Experience and Capabilities

The project will be implemented by a team of two students from Art Center, one student from California Institute of Technology, and one student from Rafael Landívar University. This team make-up is quite unique and well-rounded, representing different disciplines and expertise in product/industrial design, graphic design, and mechanical engineering. Team members also represent different cultural backgrounds and have experienced living in developing countries (e.g. Guatemala and the Philippines). The team's technical capabilities include:

- Rapid Visualization (Gabe, Armie, Mariella)
- 2-D/3-D Rendering (Gabe, Armie, Mariella)
- 3-D Modeling (Gabe, Armie, Mariella)
- Model Building (Gabe, Armie, Amit)
- Graphic Design (Armie)
- Product Design (Gabe, Armie, Mariella)
- Market Research, Business Plan Writing (Gabe, Mariella, Tony, advisors)
- Mechanical Engineering (Amit)
- Intellectual Property Generation (Gabe, Tony, advisors)

Team Member Profiles

Gabriel la O' – *Student Project Manager*
Gabe holds a Bachelor of Arts degree in International Studies from De La Salle University in the Philippines and is a candidate to receive his Bachelor of Science degree in Product Design from Art Center College of Design. In between degrees he successfully managed projects for J.P. Morgan Chase, Taylor Nelson Sofres Media, and Northstar Interactive. Gabe has also designed performance and lifestyle footwear for K-Swiss which will be available to the public early 2008.

Amit Gandhi – *Mechanical Engineer*
Amit is a junior in Mechanical Engineering at the California Institute of Technology with a passion for engineering for the developing world. He was a participant and helped organize the inaugural International Development Design Summit, co-hosted by California Institute of Technology, MIT, and Olin College, where he worked on designing microbial fuel cell powered lights for the developing world.

Mariella Paredes – *Research Director*
Mariela is a candidate to receive her Bachelor's degree in Industrial Design from Rafael Landívar University in Guatemala. She has a Master's in Advanced 3-D Modeling and Animation in Alias Maya software from Aire Academia. Mariella has worked on web design and 3-D modeling for Jungla Guatemala. Her work also includes corporate image designing for Kandy Creamery, Teach Me School, and Entreverdes, among others.

Armie Pasa – *Design Director*
With great interest in culture, travel, and design, Armie returned to Art Center College of Design where she earned a B.F.A. in Graphic and Packaging Design in order to pursue a second degree in Product Design. Armie has worked in the design field for over six years specializing in branding and packaging. Part of her experience includes collaborating with other designers for the Meals on Wheels Association of America. She has also been a volunteer advisor for Friends of the Earth in Hong Kong.

Faculty Project Manager and Advisors

Tony Luna – *Faculty Project Manager*
Instructor, Liberal Arts and Sciences and Photography and Imaging, Art Center

Tony Luna is the President of Tony Luna Creative, a creative consultancy founded in 1971, and Artist Representative/Executive Producer with Wolfe and Company Films. Mr. Luna has been a faculty member at the Art Center College of Design since 1985 where he teaches "Career Perspectives" in the Photography and Imaging Department, and "Crafting a Meaningful Career" and "Living the Dream" in Art Center's Public Programs. He is the author of *How to Grow as a Photographer: Reinventing Your Career* (Allworth Press) an informational and inspirational guide to career evolution. Tony has helped well over a thousand artist-entrepreneurs begin, sustain, and enhance their careers, and hundreds of companies to grow and prosper. Mr. Luna received his BA in Psychology from California State University, Los Angeles.

Mariana Amatullo – *Project Advisor*
Director, Designmatters and Director, International Initiatives, Art Center

Mariana Amatullo, co-founder and director of the College-wide initiative Designmatters, is the Director of the International Initiatives Department of Art Center College of Design. She works closely with Art Center President Richard Koshalek and the educational leadership of the College to develop strategic partnerships that enhance Art Center's commitment to be at the forefront of international design education and contribute solutions to humanitarian issues of critical urgency. Examples of prestigious alliances brokered under her direction include civil society membership with the Organization of American States (OAS), NGO status with the United Nations Population Fund (UNFPA), and membership in UNESCO's Global Alliance Network. Currently, she is at the helm with Mr. Koshalek of "The Los Angeles Earthquake," a cross-institutional initiative to establish new paradigms for communication outreach and earthquake preparedness in Southern California.

Kenneth Pickar – *Project Advisor*
Visiting Professor, Mechanical Engineer and Entrepreneurship, California Institute of Technology

As a visiting Professor in the Mechanical Engineering Department, Professor Pickar teaches entrepreneurship, the engineering design of products, and the management of technology. From1999-2003 he was named the J. Stanley Johnson Professor at California Institute of Technology. Dr. Pickar has served on a number of university advisory committees including Stanford, Berkeley, Cornell, and Illinois and the Technical Advisory Committee of the Council on Competitiveness. He was Vice Chairman of the Microelectronics and Computer Consortium, on the Board of Directors of the Semiconductor Research Corporation, and a Director at the Albany Medical Center. At GE Corporate R&D, he was responsible for all electronics research from semiconductor materials through large medical imaging systems, lighting, radar, etc. At AlliedSignal Corporation he was Senior Vice President for Engineering and Technology and Chairman of the Corporate Technology Board.

Mario Blanco – *Project Advisor*
Director, Process Simulation and Design Collaborations, California Institute of Technology

Dr. Mario Blanco joined California Institute of Technology in 1993 as the Director of Process Simulation and Design Collaborations to teach how to conduct industrially sponsored research. In 2002, he was the first prize winner in Nanotechnology Design from the Institute for Molecular Manufacturing, and in 2007, he received the NASA Technical Award & Certificate of Recognition. He is the co-inventor of the LiF Dual Ion Intercalating Battery and the International Space Station Electronic Nose. He co-designed, with Prof. Kenneth Pickar, a course on engineering for human development at California Institute of Technology. E105 students create products for sustainable development and income generation for third world poor who make under 2 dollars a day. The students are challenged to work with constraints on product costs and pricing, availability of local materials, lack of manufacturing and product standards, and a 10-week design cycle.

Hannah Huang – *Project Advisor*
Research Coordinator, Designmatters and Research Coordinator, International Initiatives, Art Center

Hannah Huang is the Research Coordinator for Designmatters and International Initiatives at Art Center College of Design. Prior to joining Art Center, Hannah was a Student Affairs Officer at UCLA, in the departments of Musicology and Writing Programs. Her work experience also includes coordinating publications, website content, and events as the Communications Associate for the External Relations Department at The Asia Foundation headquarters in San Francisco.

G. Project Management Team

Name	Title / Role	Address	Phone / Email
Gabriel la O'	Industrial Designer/ Project Manager	300 W. Grand Ave., #13, Alhambra, CA 91801	626-771-3638 (H) 646-250-4814 (M) gabelao@yahoo.com
Armie Pasa	Industrial & Graphic Designer/ Design Director	9629 Gerald Ave., Northridge, CA 91343	818-924-9358 (H) 818-442-7112 (M) ninjamida@gmail.com
Amit Gandhi	Mechanical Engineer	MSC 423 California Institute of Technology, Pasadena, CA 91126	818-625-4823 (M) amit@caltech.edu
Mariella Paredes	Industrial Designer/ Research Director	Villas del Pinar 78-8 Kilometer 19.9 Guatemala	502-6634-7693 (H) 502-5974-4646 (M) p.mariella@gmail.com

H.1 Budget
Total Cost of Project: **$19,800**
Amount Requested from MWD: **$9,800**
Matching funds from Art Center, California Institute of Technology, and URL in the form of volunteered staff and faculty time, donated equipment, and supplies: **$10,000**

H.2

Personnel	Description	Cost per Item	Total Cost
Student Project Manager	stipend	$800	$800
Industrial Designer	stipend	$800	$800
Mechanical Engineer	stipend	$800	$800
Research Manager	stipend	$800	$800
Faculty Project Manager	stipend	$1,000	$1,000
Guatemalan Partners (2)	Assembly and product testing in Guatemala	$200	$400
Total			**$4,600**

Materials and Tools	Used for building mockups and prototypes	$1,200	$1,200
Custom Parts	Used for building mockups and prototypes	$500	$500
Water Testing Kit (3)	Used to test water quality	$300	$900
Brochures, posters, and manuals	Used to educate and promote product	$600	$600
Total			**$3,200**

Water Purification Products	Competitor products	$1,000	$1,000
Conference Fees and Expenses	4th IWA Young Water Professional Conference	$500	$500
Rent	Shop to assemble products in Guatemala	$300	$300
Office Supplies	Pens, sketch pads, markers, etc.	$200	$200
Total			**$2,000**

Grand Total			**$9,800**

I. Signature Block

	Name	Signature	Date
Faculty Project Manager	Tony Luna	Tony Luna	12/07/07
Student Project Manager	Gabriel b. la O'	Gabriel b. la O'	12/7/2007
Member Agency Representative	Nancy Long, Pasadena Water and Power	Nancy Long	12/5/07

12-05-2007

Universidad Rafael Landivar
Vista Hermosa III,
Campus Central, zona 16,
Apartado postal 39-C,
Edificio "M" oficina M-307
01016 Guatemala, C. A.
PBX: (502)2426-2626 Ext.2426

This is a support letter for the project
'Designing a low-cost solar water purifier that will provide access to clean water in rural Guatemala'

Gabriel la O' - Art Center College of Design

Armie Pasa - Art Center College of Design

Amit Gandhi – Caltech University

Mariella Paredes - Rafael Landivar University

The Rafael Landivar University (URL) is an independent, non-profit Catholic university in Guatemala. Taking the region as a stage, the community Landivariana seeks to contribute to the transformation of society in Guatemala and Central America by encouraging freedom and fairness.

The work of the URL responds to the demands of a Guatemala conceived as a multi-ethnic country. The University focuses on the urgencies of peace; sustainable economic and social development; political development within a framework of democracy and respect for human rights; and environmental sustainability.

URL will provide support this project in the form of volunteered staff and faculty time, donated equipment, and supplies.

MDI Ovidio Morales
Director, Industrial Design Department

Oscar Arce
Director, Indis, Design Research Institute