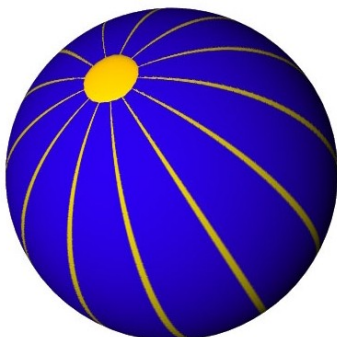
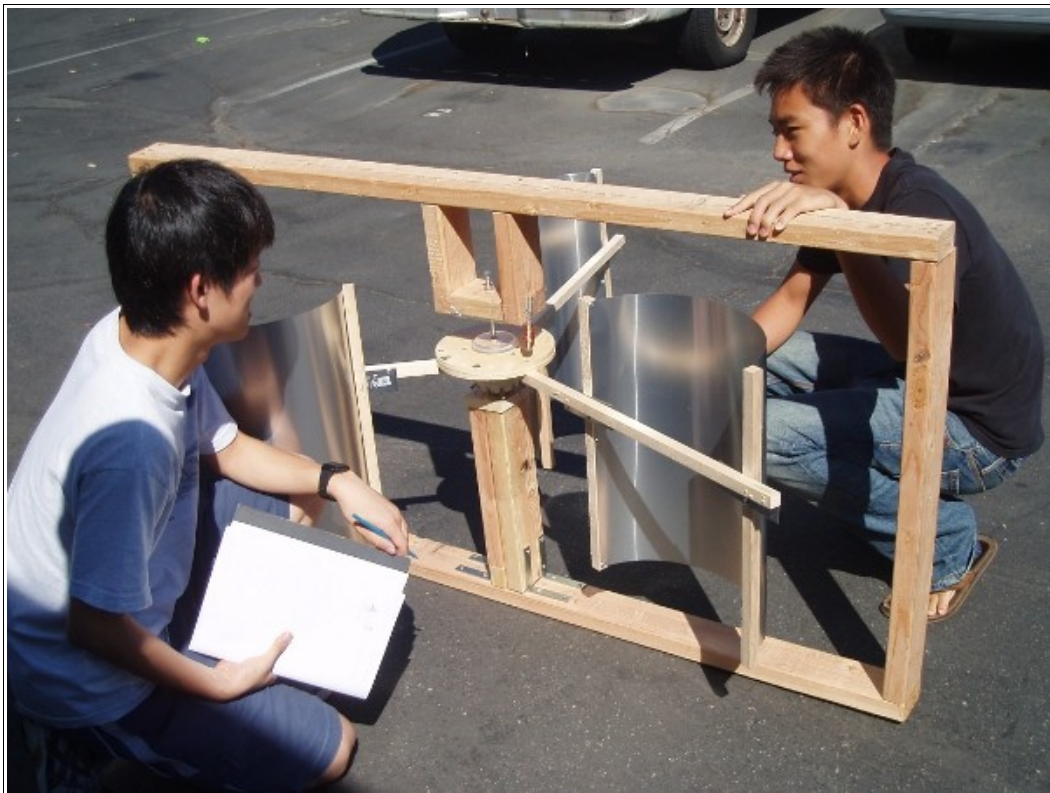


Summer Research Training Program

Exploring Science Through Innovative Summer
Research

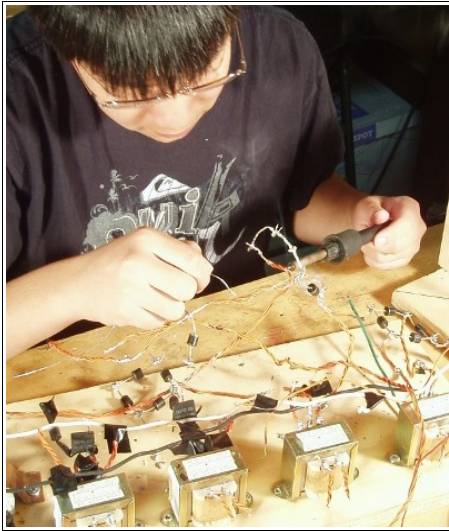
Jisan Research Institute



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Introduction to the Summer Research Training Program

From the moment that a young child begins to ask questions about things as simple as what a block is or how to stack them, the development of critical skills to scientists and engineers begins. Nearly all young people are capable of asking questions, demanding answers, and innovating. At the Jisan Research Institute, we recognize that the raw skills young people need to develop themselves into scientists and engineers, doctors and dentists, innovators and inventors exist in all of us.



The Summer Research Training Program (SRTP) is designed to bring out the scientist in young people, irrespective of their prior research-related background. Building on JRI's pioneering Research Training Program, the summer program puts research tools in the hands of students ready and willing to experience what it is like to be part of a research program. The goal is that, by the completion of the summer program, students will realize the awesome power they themselves control in terms of their ability to make positive and meaningful contributions to the world, bringing forth new technologies that have never before been made.

Building on existing JRI technologies one or more teams of students design, fabricate, test, and characterize their own technologies under the guidance of one or more JRI scientists. The scientists provide direction for the project, as well as any technical support needed. The students provide ideas for technologies, construct the prototypes, and determine how well the designs function.



Summer 2012 Research Goals

Energy Harvesting Using Solar Chimneys



Solar chimneys are devices that absorb solar energy and direct it into heating air. Heated air rises. The heated air in a solar chimney is redirected into a tall “chimney”, which can be a long vertical tube or can have a variety of other shapes. Generally, the buoyant force of the rising column of air is strong enough to run a wind turbine embedded within the column, and this generates electrical energy. This means that a solar chimney is a passive system that is capable of generating clean renewable energy, requires little maintenance, and has little to no environmental impact.

The Jisan Research Institute has created a significant set of technologies including a “refrigeration” technology and a water distillation technology. These technologies utilize the *entrochemical effect* in which the differing chemical potentials of two water bodies containing different concentrations of the same dissolved substance induce a thermodynamically favorable temperature difference between the two water bodies. This temperature difference is maintained until the concentrations become equal or one body of water disappears altogether. Both technologies must “shed” the water that they use for the effect in order to keep it going.

As the input water to the refrigeration and distillation technologies can be simple ocean water, there is no shortage in water for use of the systems. However, one technical issue which requires a solution is the maintenance of high concentration salt water, with a salt concentration much higher than ocean water. This summer, JRI summer students will develop a solar chimney-based apparatus for concentrating the salt in solution so that it may be subsequently used in the refrigeration unit that drives the distillation unit. It is expected that the large air flow through the system will provide excellent opportunity for “drying” the salt solution. A small unit will be designed, built, and characterized. Projections for the function of a larger unit will be made and this second unit will be constructed and characterized. The project will finish with a write-up describing the requirements for a unit that would be needed for use with a domestic distillation and/or refrigeration unit. JRI summer students will design, test, characterize, and refine a low-cost high yield device within the summer timeline.



Student's Goals

Most students who participate in a summer research program have never participated in research before. As a result, they typically don't have any specific goals when entering a research program. In order to get the most out of the experience, however, it is important to carefully plan the summer. The primary student's goals have been listed below.

1. Students will learn how to begin a research or design project.

The beginning of a research project is to learn what has been done from sources in the field. Students will begin their research by determining what the important parts of their project are, what parts are open to innovation, and what kinds of innovations they (the students) are capable of putting into place.

2. Students will learn how to construct their own hardware.

Using JRI's machine shop, students will learn how to construct several of the things that will go into their designs. While the students will not become master machinists in one summer, a basic competence in the use of various pieces of machinery will be generated so that the students are capable of constructing simple pieces which may later be put together to build a complex device.

3. Students will produce their own design of a specific technology.

By far, the most exciting part of the research is the creation of some piece of the overall puzzle or new technology. Students will launch into a design phase, which may take a week or two (depending on the student team). This design phase, will focus not only on what will be built, but how. It should be clear, once this phase is done, what the steps for constructing the various parts of the technology will be.

4. Students will construct their own prototype technology.

Using the JRI machine shop, students will construct their own devices. Students will be assisted by JRI personnel, but the emphasis will be on the team actually constructing their own devices.

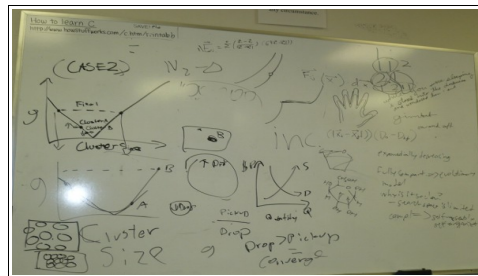
5. Students will characterize their own prototype technology.

Once each device has been constructed, students will test the device, providing important engineering characterization of the device. The students will not only determine how well it works, but also clarify ways in which it might be improved. The results will be collected in a design and research report at the end of the summer.

Students completing all of these steps will have a real idea of what it is to design, fabricate, and characterize new technologies. As former participants in the JRI Summer Precollege Research Program have discovered, once these skills have been assimilated, students are capable of designing and building a wide range of things they may independently design. Some students go on to design and build their own devices using the skills they learned during the summer programs.

Eligible Students

Students are eligible to apply to the Jisan Research Institute Summer Precollege Research Program if they are between the ages of 13 and 17 and enrolled in 8th grade (or about to enter 8th grade) or high school or equivalent. Selection is not done based on consideration of academic metrics.



2012 JRI SPRP Calendar

The JRI SRTP is a twelve week program that runs from June 19th, 2012 through September 8th, 2012. The tentative calendar is given below, though individual student efforts may cause changes to the overall calendar. All students will be expected to come to the Institute for six classes per week during operating hours of the Institute. Students must synchronize their schedules with other students in their research groups.

June 19, 2012	JRI SRTP begins. Students choose groups and get tour of facility, and choose research group.
June 20, 2012	Students begin working on prerequisite work with research group. Initial skill assessment by student group heads.
July 6, 2012	Students complete prerequisite training and begin work on designing their technologies.
July 13, 2012	Students design initial device. Construction begins.
July 20, 2012	Students complete initial device. Testing begins.
August 17, 2012	Students design second device and begin construction.
August 24, 2012	Students complete second device and begin testing.
August 31, 2012	Students begin preparing final report.
September 8, 2012	Final report due.

The cost of the JRI SPRP

The JRI SRTP has one flat fee of \$1750.00, due by the June 6th, 2012. This cost covers the entire program, including supplies and instruction. A limited amount of financial assistance may be available for students with financial need. Please inquire about the availability of spots when submitting your application.

Applying to the JRI SPRP

The application for the JRI SPRP may be found later in this packet. The application may be sent, emailed, or faxed to

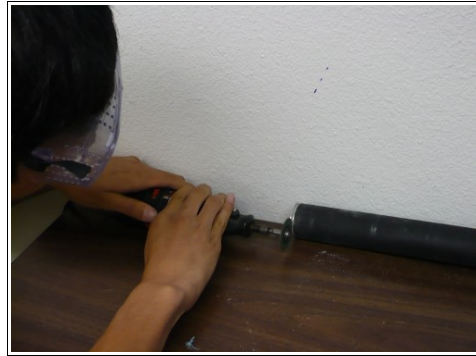
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What have prior students done?

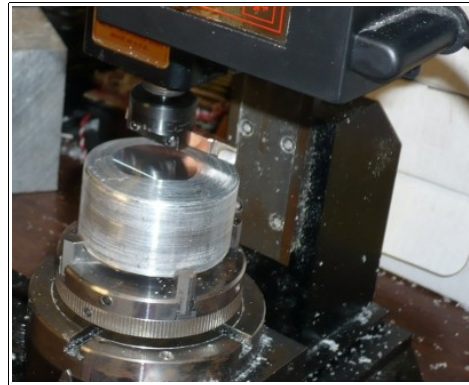
In 2007, Alex Park, Andrew Kim, and Nalae Kim all worked together to construct the parts of a solar pump.



Many small parts had to be machined before the whole pump could be put together.

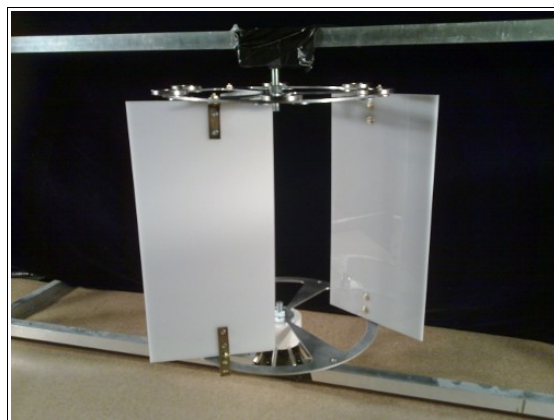


Some of the work was done with hand-held tools. Some had to be done on precision machines.



After constructing the individual parts, the three work together to put the parts all together. (Left) Putting together the tower.

In 2008, Abraham Ho and Justin Park constructed a floating windmill (picture on the front cover) using JRI's magnetic axle technology (Pat. pending). Abraham Ho continued with JRI after the summer and refined the design, publishing a paper on its design in 2010.



Can you tell this one is floating?

Summer Research Mentor

Dr. Sanza T. Kazadi



Dr. Kazadi obtained his BS from Caltech in Physics and his PhD from Caltech in Computation in Neural Systems with a concentration in Swarm Engineering. Though Dr. Kazadi has worked in areas that are quite diverse (numerical optimization, evolutionary computation, swarm engineering, robotics, computer vision, fuzzy logic, green technologies), he considers himself a physicist first and approaches his research from the point of view of a physicist – insisting on theoretical verification of the processes behind each advance.

Dr. Kazadi has worked as the principle scientist at the Jisan Research Institute since completing his graduate studies at Caltech in 2000. Dr. Kazadi applies his expertise in the areas of evolutionary computation, computational research, and renewable energy use to develop projects for students, and then guides the students through their completion. At present, Dr. Kazadi is particularly interested in developing a variety of new technologies that are green in nature. This area of research has become the most active in Dr. Kazadi's repertoire.

Dr. Kazadi is the author of more than 50 scientific papers ranging from computer vision to swarm engineering to floating wind turbines. Dr. Kazadi currently has two patents issued for technologies arising from his research at JRI and has eight patents pending.

Miscellaneous Details

- The program is limited to thirty students.
- The program is open to advanced eighth grade students and to high school students of all levels. No preference is given to any particular race, creed, orientation, or any other type of classification. Students must have their applications and payments to the program in to the Jisan Research Institute by June 6, 2012.

Students will be added to the program on a first-come first-served basis.

- All work is done on our Linux workstations, in our in-house machine shop, or in our in-house wet-lab. Students are taught to use both the computer workstations and the machine shop tools, as well as a variety of other analysis tools in the laboratory. Students wishing to have Linux installed on their home computers are welcome to. This tends to enable students to take some of their computational work home with them when needed.
- Students will work side by side with JRI researchers and students. This gives students the opportunity to collaborate with people doing things that are similar to the things students will be doing. Discussions with these and visiting scientists from outside institutions can be very influential in helping a student to shape his or her understanding of what science is and how it can be investigated. Moreover, it is an opportunity to build relationships with other students and scientists which have the potential to be influential for years to come.



Section 1: Personal Information

In this section, you will be asked to provide several pieces of information of a personal nature. Please answer all parts completely. In addition, please provide a most recent school transcript with this application.

First Name	Middle Initial	Last Name	Phone
Home Address			E-mail

Date of Birth	Gender (M/F)	SSN
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Father's Name

Father's Occupation

Mother's Name

Mother's Occupation

Siblings?

Hobbies

Year in School	GPA (Approx.)
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Class Rank (Approx.)

Extracurricular Activities

Awards/Honors

Section 2: Short Answer Questions

In this section, we will ask several questions particularly relevant to research at JRI. We ask you to answer completely and truthfully. These questions are used to evaluate you as a student as well as to understand how best to provide a successful research opportunity to you. You may wish to work out answers to these questions on another paper.

1. Please describe what you believe scientific research is and why you would like to undertake it

2. What science training have you had either in or out of school?

3. Please describe any experience you have with computers or engineering.

4. What area of science interests you most? Why?

5. Have you had any experience in carrying out scientific research? If so, please describe.

6. Success of a student at JRI oft times is affected strongly by the support of a student's parents. Please indicate how your parents view the value of scientific research.

7. Please describe your future educational and career goals, if possible.
