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MEDIUM TEMPERATURE, HIGH
EFFICIENCY TRACKING AND
NON-TRACKING SOLAR ENERGY
COLLECTORS FOR RURAL AND
INDUSTRIAL APPLICATION

SEVENTH SEMI-ANNUAL REPORT

July, 1984 to December, 1984

MEDIUM TEMPERATURE, HIGH EFFICIENCY TRACKING
AND NON-TRACKING SOLAR ENERGY COLLECTORS
FOR RURAL AND INDUSTRIAL APPLICATION

SEVENTH SEMI-ANNUAL REPORT

for the period 1 July 1984 to 31 December 1984

submitted by

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the Rural Poor. AID Project Grant No. 386-0465.

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ABSTRACT

In a collaborate research program between the Department of Science and Technology, the Government of India and the Agency for International Development, of the U.S. State Department, it is proposed to develop cost-effective parabolic, single axis tracking solar energy collectors and to use these collectors in demonstration systems such as agricultural pumping, industrial hot water and steam production, thermal power and/or space heating and cooling in rural India.

The collector and prototype system development is a three-year effort and constitutes the first phase of a proposed demonstration project. The second phase (also proposed for a three-year period but not yet funded) would begin after completion of the first phase and would be devoted to the commercialization appropriate to rural India. The collector and system development will stress the use of appropriate technology, on-site labor and materials and cost effectiveness relative to the site of intended use. It is intended that this project will lead to the development of a rural solar industry which will help to raise the standard of living in rural India by providing hot water, pumping and electricity as well as to establish an industrial base resulting in jobs and increased income.

The project is a collaborative effort between the Indian Institute of Science, Bangalore, on the Indian side and the University of Houston, Houston, Texas on the USA side.

SUMMARY OF STAFF

Principal Investigator

Richard B. Bannerot

Faculty Associates

Farrokh Mistree

Stanley J. Kleis

Halil M. Guven

PROGRESS ON OBJECTIVES

OBJECTIVES FOR THE PERIOD OF 1 JULY TO 31 DECEMBER 1984

The program description outline and timeline taken from the revised proposal, is reproduced as Appendix A of this document. The progress on objectives is presented below in a format paralleling that utilized in the program description outlines. This last nine-month's activity has been performed on a no-cost extension of the original contract. All technical work was essentially completed before July, 1984. The major activities of the last six-months have been documenting (four technical reports) and completing the equipment purchases for the IISc.

TRIPS: No international travel was taken in this time period except for the last week of Dr. Rao's and Mr. Thomas' summer visit.

I. LINEAR FOCUSING

Short Term Review of Concentrators:

Previously completed.

Long Term Review of Concentrators:

Previously Completed.

Model Development:

Completed. Two technical reports have been prepared.

Testing Facilities (Review):

Previously completed.

II. SELECTIVE COATING:

Technology Assessment

Previously completed.

III. NON-TRACKING OPTICS

Previously completed. A technical report has been prepared.

Collector Design

Due to increased activity in the design of the parabolic trough collector no activity has taken place in this area.

IV. THERMAL SYSTEM DESIGN

Tracking

A solar tracking system has been ordered from Solar Industrial Process Heat which has licensed the originally selected design (from Honeywell).

V. FLAT PLATE THERMO-SYPHON SYSTEM DESIGN

Previously completed. A technical report has been prepared.

VI. MATERIALS EVALUATION AND DEGRADATION

No activity was performed for this time period.

VII. AIR HEATERS TECHNOLOGY ASSESSMENT

No activity was performed for this time period.

VIII. EQUIPMENT SPECIFICATION

Purchase Orders processed during reporting period

Industrial Solar Technology	\$ 10,825.00
Hoffer Flow Controls	2,213.00
Hewlett Packard	18,545.60
Hewlett Packard	100.00
Thomas A. Reed	2,468.25
Hydro-Flex Corp.	10,820.12

Eleven Previous purchases:

Hydro-Flex Corp.	10,013.67
International Technology Corp.	5,919.50
Spectra-Physics	1,749.00
Glaverbel	9,011.00
Eppley Laboratory	7,776.00
Device and Services	13,106.00
MKS Instruments	1,754.00
Hoffer Flow Control	1,568.00
Olympic Solar Corp.	4,903.76
Hewlett Packard	325.00
Schott Optical Glass	309.00
TOTAL EXPENDITURES PLUS ENCUMBRANCES	<u>\$101,406.90</u>

Three requests to purchase have been received but the purchases could not be made (See Appendix B for letter of explanation).

Winsmith	19,100.00
Winsmith	13,800.00
Poellnitz Associates	4,550.00

The total budget for Indian equipment is \$106,250.00. See Variances in next section.

LITERATURE SURVEYS

Completed.

PLANS FOR THE NEXT SIX MONTHS

Even though the USAID-UHUP Contract period has officially ended and no more expenditures can be made, there are a few items unresolved. Work continues in India on completion of Phase II of the work. The IISc has requested continued support for the UHUP. As feasible, these requests will be acted upon. Since no importation documentation has been prepared on the Televideo monitor, the Hewlett Packard graphics plotter and the Industrial Solar Technology solar tracker, shipment has been delayed. Eventually a problem will arise when we cannot find funds to pay for shipment.

VARIANCES FROM THE PROPOSED PLAN AND PROBLEMS

The major variance is the fact that only \$101,406.90 was spent for equipment for the IISc. Originally \$106,250 was budgeted. This under expenditure was due to the problems that developed with the Winsmith company as described in the letter in Appendix B. We were able to substitute the tracking guidance system from Industrial Solar Technology at the last minute by showing them to be a sole source for the system.

APPENDIX A

PROGRAM DESCRIPTION OUTLINE AND TIMELINE

INDO-US COLLABORATIVE PROJECT ON "MEDIUM TEMPERATURE, HIGH EFFICIENCY TRACKING AND NON-TRACKING SOLAR ENERGY COLLECTORS FOR RURAL AND INDUSTRIAL APPLICATION"

PROGRAM OF CENTRAL CAMPUS OF HOUSTON UNIVERSITY

	1981		1982		1983		1984
	June	Dec	June	Dec	June	Dec	June
<u>TRIPS</u>							
to USA	1	2	3	4	5		
to INDIA				2		3	
<u>REPORTS</u>							
to AID (UH)			2	3	4	5	6
Voucher Submission (UH)	1	2	3	4	5	6	7
I <u>LINEAR FOCUSING</u>							
Short Term Review of Concentrators	←						
Long Term Review of Concentrators		←	→				
Model Development		←	→				
Testing Facilities (Review)			←				

	1981 June	Dec	1982 June	Dec	1983 June	Dec	1984 June
II <u>SELECTIVE COATING</u>							
Technology Assessment	→						
III <u>NON-TRACKING</u>							
Optics	→						
Collector Design			→				
IV <u>THERMAL SYSTEM DESIGN</u>							
Tracking			→				
Non-Tracking					→		
V <u>FLAT PLATE THERMO-SYPHON SYSTEM DESIGN</u>							
			→				
VI <u>MATERIALS EVALUATION & DEGRADATION</u>							
VII <u>AIR HEATERS TECHNOLOGY ASSESSMENT</u>			→				
VIII <u>EQUIPMENT SPECIFICATION</u>	←						
IX <u>LITERATURE SURVEYS (periodic reports)</u>	←						→

APPENDIX B

**LETTER OF EXPLANATION CONCERNING
PURCHASES FROM WINSMITH**



University of
Houston
University
Park

Department of
Mechanical Engineering
4800 Calhoun Road
Houston, Texas 77004
713.749.2437

November 28, 1984

Dr. M. Ramakrishna Rao
Regional Instrumentation Center
Indian Institute of Science
Bangalore 560012
INDIA

Dear Dr. Rao:

The purchase orders were finally issued for the Hewlett-Packard Automatic Data Acquisition System. Because of the change in the order due to the reduction in cost and subsequent increase in the order, there were many administrative problems. I have enclosed a copy of the University of Houston purchase order. Since the final purchase order differs in form, but not really in substance, from the original ISc order, I thought you may need it for importation.

The Hydo-flex order was up-graded to its original statement on the Proforma Invoice (all attached).

The Swagelok order from Thomas Read Company is still being processed.

It is now apparent that we will be unable to purchase the Winsmith Speed Reducers with motors. There are many reasons which I shall attempt to explain. First, the order was originally delayed because Winsmith would not agree to the USAID requirement of 90% on shipment, 10% on delivery. We finally got that straightened out last summer. I discussed the order with Winsmith in August. Your estimate did not include packing, shipping or documentation. Winsmith was initially unwilling to handle shipping. Finally, they agreed and quoted a price over the phone. However, when their quotation came in September, they did not include the packing, shipping or documentation and our purchasing department was unwilling to accept a telephone quotation. The complete quotation finally came at the end of September. They required a 16-week (minimum) construction period. The University would not place the order because at that time the contract ended in less than three months (31 December). I sent a telegram to Mr. Berry. He clarified that payment could be made up to 31 March. Then Winsmith indicated that 16 weeks may not be enough time. (I talked with Al Lewandewski at SERI, and he said Sandia had ordered a set of Winsmith gears and it took over 9 months for delivery). The University is willing to issue a purchase order stating that shipment

must take place before 15 March. Winsmith would not accept this condition and wanted the University to pay before shipment. The University cannot do this. So we are at a stalemate.

When it became evident that we might have the Winsmith money available, I checked into ordering the electronic weatherstation from Poellnitz Associates in Duxburg, Massachusetts. I have called them about ten times in the last four weeks and they have never answered the telephone. Since the order from the IISc is now over a year old and no shipping or documentation was included in the quotation, we cannot even place an order until Poellnitz responds.

We have packed the Televideo monitor for shipment (see enclosed letter). The H-P graphics plotter is being converted to 220 useage in town and will be shipped when the work is completed (see enclosed letter). The letters will also be shipped with the packages.

Finally, Sandia Laboratories has denied permission for Mr. Rush to "officially" travel to India. I am still working through Bob Ichord's office to get the Department of Energy, which runs Sandia, to intercede. In any event Mr. Rush says he may be willing to take vacation time if AID furnished the travel. I still do not have confirmation from Mr. Berry that the travel grant has been approved. It looks unlikely that anyone will be traveling to Bangalore soon.

I believe that is all the news. I hope things are going better for you in your construction phase in Mysore. In any event I hope all is well with you and your family.

Sincerely

Richard B. Bannerot
Principal Investigator

RBB/dg

cc: R. K. Berry

Enclosure