

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

DATE: 1/19/88

MEMORANDUM

TO: AID/PPC/CDIE/DI, room 209 SA-18
FROM: AID/SCI, Victoria Ose *VO*
SUBJECT: Transmittal of AID/SCI Progress Report(s)

Attached for permanent retention/proper disposition is the following:

AID/SCI Progress Report No. 6.075
PR # 1

Attachment

2 up

DESIGN AND EVALUATION OF A LOW COST ELECTRONIC WATER LEVEL SENSOR
FOR IRRIGATION WATER MANAGEMENT IN SRI LANKA

USAID PROJECT IDENTIFICATION NO. 6.075

RESEARCH GRANT NO. 936 - 5542

PROGRESS REPORT NO. 1

BY

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PERADENIYA
SRI LANKA

DECEMBER 1987

Rec'd in SCI: JAN 10 1988

ACKNOWLEDGEMENTS

The support and help to complete the research project up to this stage provided by Mr. Oswin Silva, Special Assistant to the Director, USAID and Professor Y.D.A. Senanayake, Director, Post Graduate Institute of Agriculture by administering the grant, clarifying procedural details is gratefully acknowledged.

If not for the untiring efforts of Dr. Byler and his team from VPI & SU in Coordinating the Research at VPI & SU end, the project could not have achieved the reported progress up to date.

Also all the efforts of those who have directly and indirectly contributed to this work are very much appreciated.

1.0 INTRODUCTION

The research project to "Design and Evaluation of a Low Cost Electronic Flow Sensor and Its Application for Micro-Computer aided Irrigation Systems Management in the Dry Zone of Sri Lanka" is a collaborative research project between the Department of Agricultural Engineering, University of Peradeniya (UP), Sri Lanka and the Department of Agricultural Engineering, Virginia Polytechnic and State University (VPI & SU), USA. The project is funded by PSTC grants scheme of the USAID and the grant agreement was signed on July 25th 1986. The project was scheduled to commence from August 1986, however, due to unavoidable circumstances, which will be explained in a subsequent section, the project was implemented from April 1987. The aim of this report is to document the progress achieved up to December 1987 and provide a revised schedule of activities for approval by the USAID.

1.1 PROGRESS OF PROJECT WORK AT THE TWO UNIVERSITIES

In implementing the research project many difficulties were encountered which delayed the initially proposed work plan. Despite these setbacks, satisfactory progress has been achieved by both VPI & SU and UP up to December 1987.

Mr. Mahinda Alahakoon (Electrical and Electronics Engineer) was recruited as an Assistant Lecturer to the Department of Agricultural Engineering, UP. He was sent to VPI & SU for training as a Graduate Research Assistant (GRA) from October 1987. He has already completed 1 quarter of Course work (see annexure II) at VPI&SU. Dr. Byler and his team from VPI&SU together with Mr. Alahakoon has completed major part of review of components required for the investigation, and preliminary investigations of different types of sensing mechanisms.

The VPI & SU team of investigators have designed a capacitance type of water stage recorder. Which is promising from the point of view of its low cost and simplicity compared to what is available in the market. All the stated goals in the Phase I work plan of the detailed research proposal, has been achieved by VPI & SU team. Progress achieved by VPI & SU will be clear in examining the annexure III of the report prepared by Dr. Byler as a memo.

In the part of UP, Dr. A.R. Ariyaratne from the Department of Agricultural Engineering, UP visited VPI & SU in place of Mr. Jayatissa (Mr. Jayatissa was not available for the project by the time the project was approved and granted in 1986) and spent 1 month in November 1987

assisting Dr. Byler, his team and Mr. Alahakoon. His visit to VPI & SU had been most helpful in clarifying many confusions with regard to budget and scheduling of activities due to difficulties of communication as mentioned previously. Goal 4 of the Phase I work plan depended on the progress of work conducted at VPI & SU. Thus, as given in revised work plan now UP is in a position to complete this part of the project in January 1987. It is planned to work closely with International Irrigation Management Institute (IIMI) in Sri Lanka for field implementation part of the project. IIMI has two research locations in the North Central Province of Sri Lanka which is in the dry zone. IIMI has collected research data on the irrigation performance of both these sites over a period of 3 years. This data would provide a base line to assess the improvements that can be made through electronic monitoring and control. Details for this investigation will be worked out with IIMI scientific staff during January 1988 as a collaborative project to implement the Phase II of the investigation.

1.2 PROBLEMS ENCOUNTERED AFFECTING THE ORIGINAL WORK PLAN

From the beginning of the project many unforeseen problems cropped up which hindered the originally planned progress during the first quarter of the year. One of the primary problems was the release of funds for project implementation. Since the project has a collaborative component between UP, Sri Lanka and VPI & SU, many clarifications regarding the budget were required before the first installment of funds was released by USAID, Sri Lanka to the two Universities. This delayed the project implementation until April 1987. This was understandable, because, collaboration between a US University and a Sri Lankan University through a USAID research grant has been implemented for the first time by USAID, Sri Lanka.

Also hiring of a Graduate Research Assistant (GRA) to commence his training and research work VPI & SU which a responsibility of UP was delayed until October because of the recruitment rules and regulations of the UP. The UP rules and regulations for training abroad, which is a project component, require a permanent member of the academic staff for the purpose. As such official rules and regulation had to be followed in recruitment and obtaining overseas leave which delayed this component until October 1987.

Next major problem was the communication between the two Universities as is apparent from annexure IV (Memo by Dr. Byler). It despairing to note the impossibility of communication through telephones between the two

Universities because of the poor telephone facilities at the UP end. Much of the communication had to be done through either telex or postal service which caused considerable delays due to misplaced or mishandled telexes and mail. Thus, effective communication is seen as a critical problem throughout the project duration.

Lastly, as apparent from annexure V, a serious problem which will hinder the progress of Phase II of the project will be the purchase of equipment. Most of the funds for purchasing the equipment is allocated to UP portion of the budget. However, this equipment needs to be tested and modified at VPI & SU prior to sending them over to be installed in Sri Lanka for the field evaluation of Phase III. In keeping with USAID regulations all equipment purchased should be of US origin. VPI & SU being an education institution is in a position to purchase most equipment within budget in comparison to UP. Also presently weak dollar may not allow the planned purchase of equipment by keeping within budget limitation. This problem could be overcome if USAID approval is granted to purchase these equipment items through VPI & SU by transferring the required funds from UP budget to VPI & SU budget. This needs urgent attention if project is to move into Phase II as planned.

1.3 REVISED WORKING SCHEDULE

Dr. Byler has prepared a revised work plan (Annexure I) of the project for 1988/89 period. As a consequence of unforeseen delays and problems the revised work plan is extended till September 1988 to accommodate the lost time. This revised work plan is within the approved funds, therefore USAID approval is requested for this extension.

Annexure I

Revised Work Plan for the Project 1988/89

January 1988 UP personnel mail requested information on the sites and product availability to VPI.

February Final site selection. One project with three sites. We plan to have three stilling wells attached to one intake tube at each of the three sites. VPI will send well construction details to UP. Construction will probably be of large diameter plastic pipe for the stilling wells.

March Begin construction of the structures.

May 15 Phillip McClellan leaves for Sri Lanka. He will help finish the stilling wells and begin the installation of electronics.

May 25 Saied Mosthagimi and Mahinda Alahakoon leave for Sri Lanka. Saied will work mainly on the irrigation data and Phil and Mahinda will work mainly on the electronics and data retrieval.

June 23 Saied Mosthagimi and Phil McClellan return to VPI. They will confer with Richard Byler before he leaves for Sri Lanka.

July 6 Richard Byler Leaves for Sri Lanka. He will assist Mahinda with any problems with the electronics and will work on the software necessary to display the data.

August 6 Richard Byler returns to VPI.

December 6 Mahinda returns to VPI. He needs to complete 9 credit hours of courses during spring term and analyze the data collected during the summer. He will then write his thesis.

January 1989 through May Mahinda finishes his course work and begins writing his thesis.

May through July Mahinda finishes his thesis and defends it.

August 1989 Mahinda rewrites thesis and finishes all requirements of Masters degree.

September 1 Mahinda returns to Sri Lanka.

December Project completed and all reports submitted.

Annexure II

PROGRESS REPORT

NAME : P. M. K. ALAHAKOON
STUDENT NUMBER : 990-02-1721

GRADUATE COURSES AND GRADES OBTAINED
FALL QUARTER = 87/88

DEPT.	COURSE NUMBER	TITLE	CREDIT HOURS	GRADE AF/PF
AGE	4160	Water Resources Engineering	03	P
AGE	5940	Ag. Engineering Seminar	01	P
AGE	5990	Research and Thesis	01	
STAT	5051	Statistics in Research I	03	B
EE	4501	Digital Systems Design I	04	B

GRADUATE COURSES PLANNED FOR THE WINTER QUARTER = 87/88

AGE	4150	Hyd. Systems and Controls	03	
AGE	5990	Research and Thesis	02	
STAT	5052	Statistics in Research II	03	
EE	4502	Digital Systems Design II	04	

RESEARCH ACTIVITIES :

First, the operation of available water level sensing devices and their cost-performance trade-off were studied. The following types were selected for further testing purposes.

1. Capacitive level transducer.
2. Bubbler (pressure sensing type)
3. Float (resistance sensing type)

After doing a theoretical analysis on the capacitive type sensor, laboratory experiments were carried out to observe the operation of the device. Capacitances which are equivalent to the calculated values were used in these experiments.

It was decided to use a set of Aluminium pipes to build the transducer for laboratory testing. The pipes were insulated by applying paint, and at the same time, several types of paint were tested for their water resistive and electrical non conductive properties.

P. M. K. Alahakoon

P. M. K. ALAHAKOON

Dr. R. K. Byler

Dr. R. K. BYLER
(Course Adviser)

Annexure: III

Date: December 5, 1987

To: Kapila Goonasekera

From: R. K. Byler *RB*

Re: Progress report

I feel that we have been making good progress during the past several months. Mahinda Alahakoon is working out well and is progressing well in all areas. Dr. Ariyaratne has been helpful and we hope he will be able to assist us further over the next several months.

In reference to the goals of Phase I listed on page 9 we are progressing in all areas. We have completed most of the review of components. We need to obtain some additional data on pressure transducers, it looks now like the price and performance of these devices has not improved much since we wrote the proposal, and they are still marginal. We will be looking closely at them over the next several months.

The design of the data logger has proceeded well. I am concerned about the current weakness of the US dollar and how it may affect the price of the system components. We need to design an analog/digital interface but cannot do that until we have decided on the stage transducer.

Mahinda and I have designed a capacitance type of stage transducer. It is low cost and will be easy to interface to a digital circuit, it will not require any special components other than the microprocessor. The conversion will be done in time domain and the microprocessor system is inherently good at measuring time accurately.

Goal 3 of Phase I is proceeding well with Mahinda's course work.

We hope that you will proceed with goal 4 of Phase I. The final selection can be put off a little longer, but the cooperation with HMI sounds ideal. I feel that we will have enough problems without the additional problem of obtaining a history of the agriculture of a project. We are pleased that we could work on a project where there are 3 years of data on water problems and crop yields.

We are proceeding with Phase II also. We have begun some field testing of the data logger, and of the stage transducers. The design and testing of the first type of transducer as described on page 10 of the proposal has been done here over the past several years. We plan very minor redesign for use in Sri Lanka. The bubbler type of transducer now looks less viable because of the limits of the pressure transducer. It is currently our third choice, but further evaluation will be done. The capacitance type of transducer has replaced the third type described in our proposal. It looks very encouraging at this time, but further evaluation is necessary. The components for the capacitor transducer are currently being tested for durability.

Annexure IV

Date: December 5, 1987
To: Kapila Goonasekera
From: R. K. Byler *RKB*
Re: Communication problems

I have been trying to contact you about the equipment problems but we have been unable to get a telex to you this past month. When we try to send a message we get the reply that there is an equipment failure at your end. I thought that perhaps the equipment was turned off, but recently no messages have gotten through.

We have set up an account on our mainframe computer for you to use and have shown Dr. Ariyaratne how to log on to it. If you have a 300 baud modem hooked to an IBM-pc compatible computer you will be able to send and receive files and messages. We will check your account for messages regularly. We don't know if you will be able to use this or not, but if you can it will provide a way to get messages through. Any other suggestions as to how we can communicate will be appreciated.

Until we find a reliable way to communicate we will try to send the messages two ways, by mail and any other way which may work. I hope you will get the message twice.

Annexure V

Date: December 5, 1987
To: Kapila Goonasekera
From: R. K. Byler *RKB*
Re: Expenditure of your money

We would like to assist you with the expenditure of some of your money. I have been trying to send you a telex about this problem but we have not been able to get it through. I understand the following items would be good for us to purchase.

Campbell Loggers	\$6600.00
Transducers for use with loggers	\$1800.00
Data Retrieval Devices	\$2000.00
Personal Computer	\$ 3000.00
Software	\$1020.00

We cannot purchase your computer or data logger equipment without written approval from AID. Mr Silva has not replied to my telex messages. If AID would send approval in writing we believe that the university would allow us to purchase items for you and be reimbursed by AID.

Some vendors will let us order and bill you. They will charge about 20 percent extra for this and you will have to set up a line of credit.

AAPC Inc. will arrange purchasing for a fee. They have experience working with AID and have an agent in Colombo. He will, or already has, be in touch with you.

We feel it would be ideal for AID to allow us to purchase the items for you. We will be able to get a considerably better price than you can, we will be able to test the equipment here before we send it to you and we need some of the equipment here before it is sent to you. This problem is urgent. We will not have the equipment if it is not ordered soon. My second choice is to work through AAPC, because they may be able to get the equipment in time. I doubt we will be able to get the equipment in time to complete the project as proposed any way other than these two possibilities.

We have a contract regarding this proposal and VPI will not allow us to purchase the above items without a written change in our contract. Please advise as to how to proceed.

I understand that you are interested in purchasing two computers rather than one more powerful one. We can get two personal computers for the \$3000 in your budget. We could possibly get an oscilloscope in addition, but that would take some careful purchasing. If AID will allow us to assist you by purchasing items and then be reimbursed make sure that the letter they send does not restrict us from changing the specific items we purchase if you want the flexibility required to get two computers plus an oscilloscope. I agree that the project would be aided by the purchase of two computers and an oscilloscope.

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