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COLLEGE OF MARINE STUDIES
ROBINSON HALL

"Advanced Scientific Research" (proj. title)

August 5, 1983

Mr. Harold LeSieur
The Office of Engineering (ST-ENGR)
USAID
Building SA18, Room 208D
Washington, DC 20523

Dear Mr. LeSieur:

Here is the second part of our first annual report on Contract No. AID/SCI/172/82, which describes recent work in Puerto Rico. I propose to break this down into three parts: 1) Achievements, 2) Problems that became apparent, and 3) Projection into the near future.

Achievements

1. I was able to thoroughly examine the system containing the pump with the modified gland, which had been at sea for a full month at the time it was withdrawn for examination. I am pleased to report that the new gland sealing rings were not worn to any detectable extent and no other parts of the assembly showed signs of short term or even medium term failure except the embedded anchor and the wire tether. In the case of the wire tether, ungalvanized flexible wire had been mistakenly substituted for galvanized wire. As we have pointed out previously, corrosion is not as big a problem as we had previously believed it would be, and galvanized wire has been tested on previous systems and found quite adequate. This failure can therefore be written off as accidental.

The movement of the embedded sand anchor was slow and steady, a fraction of an inch a day, and although it was still embedded to a depth of 6' at the time we withdrew the pump, I had no confidence that it would serve over a period of years. Alternatives were discussed, and I chose to go back to a format which we had tried in the past and which can be used with a much higher confidence level: the reaction plate. (References exist in previous papers). This was a chance to take a big step towards an appropriate technology, and with this in mind we deployed a 1967 Impala body and motor at the test site to serve as a reaction plate. This was reasonably time-consuming, but most of the time was dissipated working out how to do this safely, since the car had to be launched with some dignity at the public launching ramp in the village of La Parguera, and then towed 2.5 miles to the site off Magueyes Island.

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In retrospect, I feel that we could do this safely and confidently now, in much less time. The cost of the reaction plate including the preparation for the tow and the tow itself would be less than \$300 in most parts of the world. We have been unable to come up with any other reaction plate designs that cost as little as this. The design that will be placed in Anguilla is a prefabricated metal skeleton containing concrete blocks, and will probably have a finished cost of around \$750. In my experience, useless automobiles are commonly found in corners in developing countries and can be acquired cheaply.

From an ecological point of view it is important to note that coral growth on the car will be extremely rapid, and it will form a natural reef within a few years. This is most desirable since it removes any anxiety concerning the ultimate corrosion of the metal, which will be embalmed in coral.

2. We were able to construct a prototype buoy. As you know, the Puerto Rico installation has been running with inflatable vinyl buoys. It was most appropriate to change to a basic design which could be fabricated in a developing country. I chose to go with plywood and the "stitch-and-glue" technique often recommended for the construction of fishing boats, and I found it most satisfactory. The buoy design is a hexagon with the sides 4' in length (conveniently cut from 4' sheets of plywood) and it has an exoskeleton of 1.5" steel angle which holds it to the upper tether. This exoskeleton may be protected from corrosion in various ways. Presently it is phosphated and covered in resin.

3. The components of the first Anguilla system were put together, with the exception of the reaction plate, which is being built in situ. The decision was made that Mr. Dobbs (who has learned very quickly and proved a first class assistant) should fly to Anguilla with the pump and plumbing early in August, to oversee the layout of the complete system. Mr. George Mitcheson, the diving officer of the University of Puerto Rico, who has been monitoring the DELBUOY for the last year, will meet him there in mid-August to deploy the system.

Problems that became apparent during the recent visit

1. Even in Puerto Rico the logistics of change or modification are a continuing problem. We have found that both supply and equipment cost and time should be factored by approximately 3 in order to give realistic values. In fact, slightly facetiously, we are beginning to talk about the " π " factor: if we make the best possible estimate of the time it will take us to achieve a certain end point, the actual time to completion will almost certainly be close to the assumed number, multiplied by 3.1416.

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2. The budget should be marginally adequate, but it is being spent in a format that differs substantially from that expressed in our proposal. The bottom line should remain the same, however, we would like permission to rework the format on the basis of our experience and resubmit, so that more realistic comparisons can be made between budget milestones and the point we have reached within the project. Note that the margin on the budget will be so tight that we cannot afford extensive deployment of reverse osmosis modules until at least the first part of the third year.

3. We need a "design pause" or period of consolidation before moving into the final phase of the project. This is becoming increasingly evident as the gland on the pump ceases to appear as the primary problem, and the team has time to examine the peripheral structure. To explain the implications of "consolidating": presently the plumbing which connects the high pressure pump to the accumulator and the check valves is a mass of brass connecting nipples and adaptors of various sizes which allow the monitoring equipment such as pressure gauges and the functional components such as pressure relief valves and flow valves to become part of the system. Not only are these connectors relatively expensive and not necessarily easily available in less developed countries, but the cost is high. We see it as most desirable to consolidate these fittings into large blocks of an inexpensive material such as polyvinylchloride, into which valves and gauges can be screwed if required. It is also time to begin to think of the pump, accumulator and check valve as a whole, rather than as separate and independently functional parts of the system. We wish to do this before committing ourselves to building a large number of systems to complete the last phase of the project. If we do not, we believe that we shall be beset by constant minor modifications, which will slow us down disproportionately. If we pause now to consolidate the design, and test one prototype carefully, I believe that we shall then be in a position to construct all the pumps and other system components required to complete the project, and concentrate on deployment techniques and the addition of reverse osmosis modules on site.

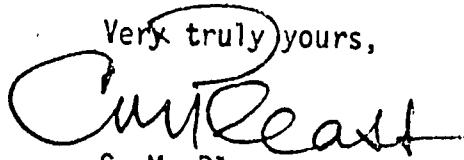
Projection

1. By September, 1983, we hope to have installed the first system in Anguilla and to have reinstalled the Magueyes Island pump which was recently removed for examination, with a new buoy and the automobile as a reaction plate. By November we hope to have completed the consolidated design and built and tested a prototype. By Christmas we hope to have installed a second system in Puerto Rico, so that efficiencies may be compared in the same wave field. Over Christmas break (in January, 1984) we hope to be able to install a second system in Anguilla.

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I trust that this completes the first annual report to your satisfaction. As I have indicated, I would like your permission to rebudget and to create a new set of milestones within the same boundaries. I would like to emphasize that we expect to finish in the same time with the same total expenditure. Your previous questions about the details of the expenditures to date seem to best addressed during this process of rebudgeting. I look forward to hearing from you to confirm that this is acceptable.

Very truly yours,


C. M. Pleass

CMP/r1

cc: Dean W. S. Gaither
Douglas Hicks
Richard Schneider
Thomas White