

PD-AR-840
41456

CLASSIFICATION
PROJECT EVALUATION SUMMARY (PES) - PART I

Report Symbol U-447

1. PROJECT TITLE Zaire Photovoltaic Communications			2. PROJECT NUMBER 698-0407.35	3. MISSION/AID/W OFFICE Kinshasa
Part I			4. EVALUATION NUMBER (Enter the number maintained by the reporting unit e.g., Country or AID/W Administrative Code, Fiscal Year, Serial No. beginning with No. 1 each FY) <u>14-85</u>	
5. KEY PROJECT IMPLEMENTATION DATES			6. ESTIMATED PROJECT FUNDING	
A. First PRO-AG or Equipment FY <u>82</u>	B. Final Obligation Expected FY <u>82</u>	C. Final Input Delivery FY <u>85</u>	A. Total \$ <u>66,800</u>	B. U.S. \$ <u>32,300</u>
			7. PERIOD COVERED BY EVALUATION	
			From (month/yr.) <u>August 1982</u>	
			To (month/yr.) <u>August 1985</u>	
			Date of Evaluation Review <u>September 1985</u>	

8. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR

A. List decisions and/or unresolved issues; cite those items needing further study. (NOTE: Mission decisions which anticipate AID/W or regional office action should specify type of document, e.g., airgram, SPAR, PIO, which will present detailed request.)	B. NAME OF OFFICER RESPONSIBLE FOR ACTION	C. DATE ACTION TO BE COMPLETED
USAID should obtain a maintenance report on the Photovoltaic Equipment from CECA (Mr. Glenn Wilton) by September 1986	USAID	September 1986

9. INVENTORY OF DOCUMENTS TO BE REVISED PER ABOVE DECISIONS

- | | | |
|--|--|--|
| <input type="checkbox"/> Project Paper | <input type="checkbox"/> Implementation Plan e.g., CPI Network | <input type="checkbox"/> Other (Specify) _____ |
| <input type="checkbox"/> Financial Plan | <input type="checkbox"/> PIO/T | <input type="checkbox"/> Other (Specify) _____ |
| <input type="checkbox"/> Logical Framework | <input type="checkbox"/> PIO/C | |
| <input type="checkbox"/> Project Agreement | <input type="checkbox"/> PIO/P | |

10. ALTERNATIVE DECISIONS ON FUTURE OF PROJECT

- A. Continue Project Without Change
- B. Change Project Design and/or Change Implementation Plan
- C. Discontinue Project **as planned**

11. PROJECT OFFICER AND HOST COUNTRY OR OTHER RANKING PARTICIPANTS AS APPROPRIATE (Names and Titles)

Debra A. Rectenwald, USAID Evaluation Officer

12. Mission/AID/W Office Director Approval

Signature Richard L. Podol

Typed Name Richard L. Podol

Date 30 Sep 85

CLASSIFICATION
PROJECT EVALUATION SUMMARY (PES) - PART I

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<input checked="" type="checkbox"/> REGULAR EVALUATION <input type="checkbox"/> SPECIAL EVALUATION					
5. KEY PROJECT IMPLEMENTATION DATES <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; border-right: 1px solid black;"> A. First PRO-AG or Equivalent FY <u>82</u> </td> <td style="width: 33%; border-right: 1px solid black;"> B. Final Obligation Expected FY <u>82</u> </td> <td> C. Final Input Delivery FY <u>86</u> </td> </tr> </table>			A. First PRO-AG or Equivalent FY <u>82</u>	B. Final Obligation Expected FY <u>82</u>	C. Final Input Delivery FY <u>86</u>
A. First PRO-AG or Equivalent FY <u>82</u>	B. Final Obligation Expected FY <u>82</u>	C. Final Input Delivery FY <u>86</u>			
6. ESTIMATED PROJECT FUNDING A. Total \$ <u>33,200</u> B. U.S. \$ <u>31,200</u>		7. PERIOD COVERED BY EVALUATION From (month/yr.) <u>October 1984</u> To (month/yr.) <u>September 1985</u> Date of Evaluation Review <u>September 1985</u>			

8. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR		
A. List decisions and/or unresolved issues; cite those items needing further study. (NOTE: Mission decisions which anticipate AID/W or regional office action should specify type of document, e.g., telegram, SPAP, PIO, which will present detailed request.)	B. NAME OF OFFICER RESPONSIBLE FOR ACTION	C. DATE ACTION TO BE COMPLETED
1. Additional funds (local currency) for unforeseen expenses should be provided.	USAID	Nov 1985
2. Quarterly reports should be submitted by the Methodists. These reports should describe maintenance, the number of times the beacons have been successfully and unsuccessfully activated, and the distances at which the beacons are effective.	Methodists	Ongoing
3. USAID should consider expanding the photovoltaic project to other parts of Shaba after the beacons have proved reliable. Prior to any such expansion, however, the Methodists' aviation program should be examined by an expert.	USAID	Sept 1986
4. USAID should help the Methodists obtain the necessary GOZ authorization to use the selected frequencies for the beacons.	USAID	Oct 1985
5. If the proper authorization papers are obtained by October 1985, the Methodists should complete the project by the PACD, February 1986.	Methodists	Feb 1986

9. INVENTORY OF DOCUMENTS TO BE REVISED PER ABOVE DECISIONS <table style="width: 100%;"> <tr> <td><input type="checkbox"/> Project Paper</td> <td><input type="checkbox"/> Implementation Plan e.g., CPI Network</td> <td><input type="checkbox"/> Other (Specify) _____</td> </tr> <tr> <td><input type="checkbox"/> Financial Plan</td> <td><input type="checkbox"/> PIO/T</td> <td>_____</td> </tr> <tr> <td><input type="checkbox"/> Logical Framework</td> <td><input type="checkbox"/> PIO/C</td> <td><input type="checkbox"/> Other (Specify) _____</td> </tr> <tr> <td><input type="checkbox"/> Project Agreement</td> <td><input type="checkbox"/> PIO/P</td> <td>_____</td> </tr> </table>	<input type="checkbox"/> Project Paper	<input type="checkbox"/> Implementation Plan e.g., CPI Network	<input type="checkbox"/> Other (Specify) _____	<input type="checkbox"/> Financial Plan	<input type="checkbox"/> PIO/T	_____	<input type="checkbox"/> Logical Framework	<input type="checkbox"/> PIO/C	<input type="checkbox"/> Other (Specify) _____	<input type="checkbox"/> Project Agreement	<input type="checkbox"/> PIO/P	_____	10. ALTERNATIVE DECISIONS ON FUTURE OF PROJECT A. <input checked="" type="checkbox"/> Continue Project Without Change B. <input type="checkbox"/> Change Project Design and/or <input type="checkbox"/> Change Implementation Plan C. <input type="checkbox"/> Discontinue Project
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11. PROJECT OFFICER AND HOST COUNTRY OR OTHER RANKING PARTICIPANTS AS APPROPRIATE (Names and Titles) Debra A. Rectenwald, USAID Evaluation Officer	12. Mission/AID/W Office Director Approval Signature <u>Richard L. Podol</u> Typed Name <u>Richard L. Podol</u> Date <u>30 Sep 85</u>												

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PREFACE

Under the Zaire Photovoltaic Communications Project (698-0407.35) Part I, an Improved Technology Grant of \$64,500 was donated to the Evangelical Community of Central Africa (CECA) to improve communications in rural areas of the Haut-Zaire Region. Twenty-one solid state transceivers and 46 photovoltaic panels were to be purchased. After reviewing the project, a solar energy technician advised the project manager to purchase one 40-watt solar panel in lieu of the two smaller panels described in the project proposal. Execution of this recommendation, and of a suggestion to purchase a cheaper (but high quality) transceiver, reduced project expenses by approximately \$30,000. The solar systems were installed in isolated areas that had no regular communications because they had no power supply. The transceivers are used to facilitate educational, medical, and aviation work in the region.

The unexpended funds were donated to The United Methodist church in Shaba, which had previously submitted a proposal to construct four solar powered aircraft beacons (Zaire Photovoltaic Communications Part II). This pilot program was to establish the feasibility of using solar powered aircraft non-directional beacons in remote locations in Zaire, and to thereby introduce a basic safety system for air navigation.

This evaluation of the Photovoltaic Communications Project constitutes a Lessons Learned Evaluation. The evaluator visited both project sites in September 1985 and reviewed all documentation on file.

PHOTOVOLTAIC COMMUNICATIONS
PART I

Under the Improved Technology Project 698-0407.35, USAID purchased 22 solid state 100-watt transceivers (SS-1) and twenty-three solar panels to expand the communication infrastructure of the Evangelical Community of Central Africa (CECA) in Haut-Zaire*. CECA itself contributed nine additional units (SS-40). The solid state transceivers replaced the missionaries' Heathkit model, an older "tube" radio, which consumes four times as much energy as the SS-1 and requires more maintenance. One 40-watt solar panel provides sufficient energy for five hours of transmission and enables the radio to be installed in areas that have no other reliable power source.

The new radios transmit and receive on two frequencies. The first frequency is reserved for the aviation program. Mission pilots use this channel to arrange flight schedules and to be "flight-followed" by their wives during the day. The church, schools, hospitals, and missionaries share the second frequency. The radio is used to inform teachers when their salaries are coming, order church, school, and medical supplies, and transmit emergency information, particularly for medical cases. The photovoltaic communications program is fully integrated with CECA's aviation program: the two programs have been coordinated to offer assistance to most of the local populace in the CECA community.

A central radio committee, composed of two expatriate missionaries and four Zairian church leaders, supervises the communications program. The committee members establish and enforce the rules guiding the use of the radio. A schedule for each of the "nets" has been posted (i.e. aviation - 0700, education - 1500, etc.). The central committee held training seminars at the beginning of the project to teach radio operators to use the radio equipment and to read the meter board (i.e. voltage meter). The operators keep a log book in which they record the time and purpose of their transmissions.

Committee members spot check transmissions to ensure that the radio is being used for appropriate reasons, at appropriate times, and in appropriate languages (messages are allowed to be transmitted only in French, English, and Swahili). If a radio is misused, the head pastor of the mission is warned. If the violation continues, the central committee will confiscate the radio's microphone for a month. (No such enforcement has yet been necessary.)

The radios are monitored at each mission by a local radio committee. Pastors, teachers, and nurses serve on the committee. They are responsible for ensuring that the radio is properly used and for raising revenue for operating expenses (e.g. Z 200 for the annual radio tax). Before CECA installed the radio and solar equipment, each local committee was required to collect Z 10,000 to purchase a 12-volt battery and to build a small, secure facility to use as a radio room. All committees but one have succeeded in

*A list of the twenty-one missions in which the radios were installed (the remaining radio serves as a spare), along with all radio-equipped stations in the CECA network, has been provided by CECA. The list is attached at the end of the evaluation.

meeting these requirements; CECA missionaries are waiting for Faradje Mission to build a radio room before they install radio equipment (the mission has already contributed Z 10,000).

The SS-1 radios have been installed for at least a year (in some cases two years). The radios and solar panels are operating efficiently** with minimal maintenance; there have been no major breakdowns. The most frequent repair concerns the microphones. The wires connecting the microphones to the radios must all be replaced and the contact wires in the mouthpieces must be adjusted because the microphones are not sturdy enough to endure five hours of use, seven days a week. At present, only CECA missionaries are capable of repairing the radios. In two years, a Zairian school teacher, who has been sent to Kinshasa to study electronics, will assume responsibility for radio maintenance.

The Photovoltaic Communications Projects in Haut-Zaire has been successful. The radios, placed primarily in missions where there were few activities, have served as an incentive for development. Because of the project, mission leaders, previously isolated, now have daily contact with pilots, medical personnel, and school officials. This has encouraged them to start development activities in their communities. For example, Ara and Luanoli Missions have recently built airstrips, Maghi Port has built a dispensary, and several other missions have requested help to build secondary schools and medical facilities. Many people in these isolated missions have expressed their appreciation for the radios.

Next year the Central Radio Committee will prepare a status report on the radios describing maintenance requirements and performance. USAID should obtain a copy of this report by September 1986.

The main lesson learned from this project demonstrates how indigenous private voluntary organizations that are well-established and well-organized frequently offer the best assistance for project implementation. CECA missionaries have been working in Zaire since the early 1900's. They have successfully implemented health, education, and communications programs in response to local problems. In this particular project, CECA missionaries proposed and managed the entire project efficiently and effectively with minimal assistance from USAID/Kinshasa.

**Often transmission between missions close to one another is hampered by poor atmospheric conditions; hence messages must be relayed through missions miles away. The CECA missionaries expressed their desire to have a technician specialized in two-way communication systems to visit the area and determine if there is a way to alleviate the problem.

PHOTOVOLTAIC COMMUNICATIONS

PART II

A. Equipment

Under this Improved Rural Technology Project, USAID also granted \$31,200 to the Methodists in Shaba to construct four navigational beacons. The automatic direction finding/non-directional beacon system (ADF/NDB) transmits a non-directional signal in a low or medium frequency range. It is a low-cost navigational system that has been used world-wide for many years. The beacon designed in this project, however, represents the only known case where the system has been adapted to solar power.

To activate the beacon, a pilot clicks the microphone of a VHF transceiver (standard aviation equipment) on a selected frequency. Radio waves then are emitted by the beacon for one minute for each click (up to nine minutes for nine clicks). The system can be activated twenty times a day given the amount of power available. A VHF receiver picks up the pilot's signal and sends it to the computer. If the signal is valid (the computer distinguishes the pilot's signal from radio waves caused by natural phenomena), the computer activates the NDB transmitter.

The NDB transmitter produces the radio waves which pass through a tuner box that couples the transmitter with the antenna. An automatic direction finder in the cockpit (standard aviation equipment) picks up the radio waves emitted from the antenna. An arrow on the ADF display points to the direction of the transmitter so that by tracking a course, a pilot can locate the airstrip.

A solar-powered beacon has several advantages over a beacon that operates on conventional energy sources. First, it is more reliable. During a thunderstorm it is unlikely that a power shortage will occur, unless lightning strikes the antenna. Second, the solar-powered system is more accessible. It may be installed in any remote area that has enough sun. Third, the system is practically maintenance free. Routine maintenance is limited to changing the 12-volt battery every four years. And finally, the photovoltaic system is energy efficient. The computer remains in "hibernation mode" until it registers a specific identification code; energy is not expended unless the system is activated.

B. Beneficiaries

The beacons will permit safer aviation programs in Shaba. They will guide pilots who are lost or hampered by poor visibility conditions. Any pilot can activate the system if he knows the correct frequency. The frequencies and the airfields to which they correspond will be published as soon as all the beacons have been installed and tested for reliability.

Eight missionaries are employed part-time as pilots by the Methodist church. The Methodists currently own four planes and plan to purchase two more. The planes are used to transport emergency patients to the hospitals and to carry salaries and supplies to the schools. The planes also serve the logistic needs of the missionary community.

C. Pilot Project

The Improved Technology Project in Shaba is a pilot project. The photovoltaic beacons were designed and tested by Mr. Lee Ricky of the Matric Corporation (Ricky has a patent on the beacons's computer) and Mr. Lowell Wertz. Both men are skilled in electronics. After several trial tests, the beacon was redesigned, necessitating the additional expenditures described below.

1. In the original proposal, Mr. Wertz envisioned the antenna as a simple pole attached to a roof with a few wires. After experimenting with Mr. Wertz's idea in the United States, however, Mr. Ricky recommended that a 24-meter antenna/tower be constructed. Because no money was budgeted for the antennas in the project proposal, Matric Corporation financed the building materials, as well as the research and development costs for the antennas. Mr. Wertz, loathe to have Matric Corporation also support the transport and crating fees for the antennas (estimated to be \$2500), is searching for additional funding.

2. The non-directional beacon at Luena had been functioning for a week at the time of the evaluation. The beacon emits radio waves over a radius of 20 to 30 miles. Mr. Wertz is experimenting with different ideas to maximize the antenna's efficiency. He is convinced that one hundred twenty 100-meter wire radials must be buried under the antenna/tower. These wires would lower the ground resistance and allow the antennas to emit radio waves up to 50 miles. This expenditure, estimated to be \$1000 for each beacon, was not included in the project's original budget. The Methodists have been gradually purchasing the wire; Mr. Wertz has already installed 32 wires under the Luena beacon.

3. As soon as the authorization papers are received, Mr. Wertz will begin installing the second beacon at Manono. He has trained a Zairian team to install all but the electronics component of the system. It has been difficult, however, to test the beacon after it has been installed. To activate the beacon Mr. Wertz has had to coordinate trial tests with a pilot sitting in a plane. This has inhibited Mr. Wertz from performing routine checks on the beacons. The problem could be alleviated if the Methodists purchased a remote control device which would activate the beacon from the ground, next to the tower.

D. Lessons Learned

The lessons learned from the first part of this project also holds true for second part: Indigenous private voluntary organizations that are well-organized and well-established frequently offer the best assistance for project implementation. Additional lessons learned from this pilot project should be added after the navigational beacons have demonstrated their reliability.

E. Recommendations

1. The Methodist Church and the Matric Corporation have made significant contributions to the project. The Church has covered supplementary expenses such as transport fees, paint, etc. and has provided the labor for installation and maintenance. Mr. Ricky has taken a personal interest in the project (he flew to Luena to inspect and assist the project);. Matric Corporation has supplied the Methodists with building materials for the antennas.

Because this project represents an original attempt to adapt the ADF/NDB system to solar power, it is normal that unexpected expenses should arise. USAID should take this into account to provide additional funds (local currency) to the Methodists for the additional expenditures described in Section C.

2. The non-directional beacon has proved feasible. The equipment at Luena has been installed and is operating, but now the system must be tested for reliability. Can the electronics equipment remain operational in a tropical climate? Does the system activate without failure? USAID should obtain quarterly reports on the system's reliability for at least one year. Included in these reports should be information on maintenance, the number of times the beacons have been successfully and unsuccessfully activated, and the distances from which the beacons have been activated. Mr. Wertz has promised to send USAID this information.

3. USAID should consider expanding the photovoltaic project to other parts of Shaba after the beacons have proved reliable. Before any such expansion, however, the Methodist's aviation program should be examined by a recognized expert to ensure that the Methodists are abiding by standard aviation operating and safety regulations.

4. USAID should aid the Methodists in obtaining the necessary authorization papers from the GOZ to use the selected frequencies for the beacons.

5. If the proper authorization papers are obtained by October 1985, the Methodists should complete the project by February 1986.

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Summary of new C.E.C.A. Radio Equipment as of February 1985

	US-AID donated:				C.E.C.A. purchase:			
	SS-1 D.C.	Solar Panel	Battery Prot. only (on meters)	Meter board	SS-40	SS-1/AC	Battery	Solar Panel
1. Assa		X		?	X		X	
2. Banda		X		X	X		X	
3. Mapedi	X	X		X			X	
4. Napopo	X	X		X			X	
5. Dungu	X	X		X			X	
6. Njangara	X	X		X			X	
7. Aba			X		X			X
8. Todro	X	X		X			X	
9. Paradje	X	X		X			X	
10. Watsa							X	installation
11. Maitulu	X	X		X			X	
12. Adi		X	X		X		X	
13. Abedju	X	X		X			X	
14. Adja		X AS16	X		X			
15. Aru	X	X		X			X	
16. Lanza	X	X		X			X	
17. Aungba		X		X	X		X	
18. Rabu	X	X		X			X	
19. Rethy					X			
20. Linga	X	X		X			X	
21. Blukwa		X AS16	X		X			
22. Kasengu	X	X		X			X	
23. Mahagi Port	X	X		X			X	
24. Ara	X	X		X			X	
25. Bunia								
26. Mongbwalu						X		
27. Bogoro						X		
28. Chyekele	X	X		X			X	
29. Kasenye						X		
30. Beni	X	X		X			X	
31. Oicha		X AS16	X		X		X	
32. Mangina	X	X		X			X	
33. Mwenda	X	X		X			X	
34. Luanoli	X	X AS16		X			X	
35. Kisangani						X		
36. Isiro						X		
37. Nyankunde						X		

X SS10 (owned by C.E.C.A.)

- Spares: 1 SS-1 AC/DC (either at Maizie's or MAF)
 1 Antenna (either with Don Dix, or MAF)
 3 extra mikes (with Glenn Wilton)
 2 packets of SS-1 spare parts (with MAF)
 1 Battery protector (with Glenn Wilton)
 3 unpainted meter boards and several toggle and pole switches (with Glenn Wilton)