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PHOTOVOLTAIC DEVELOPMENT AND SUPPORT PROJECT

9365710

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STATUS REPORT

BY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LEWIS RESEARCH CENTER

FOR

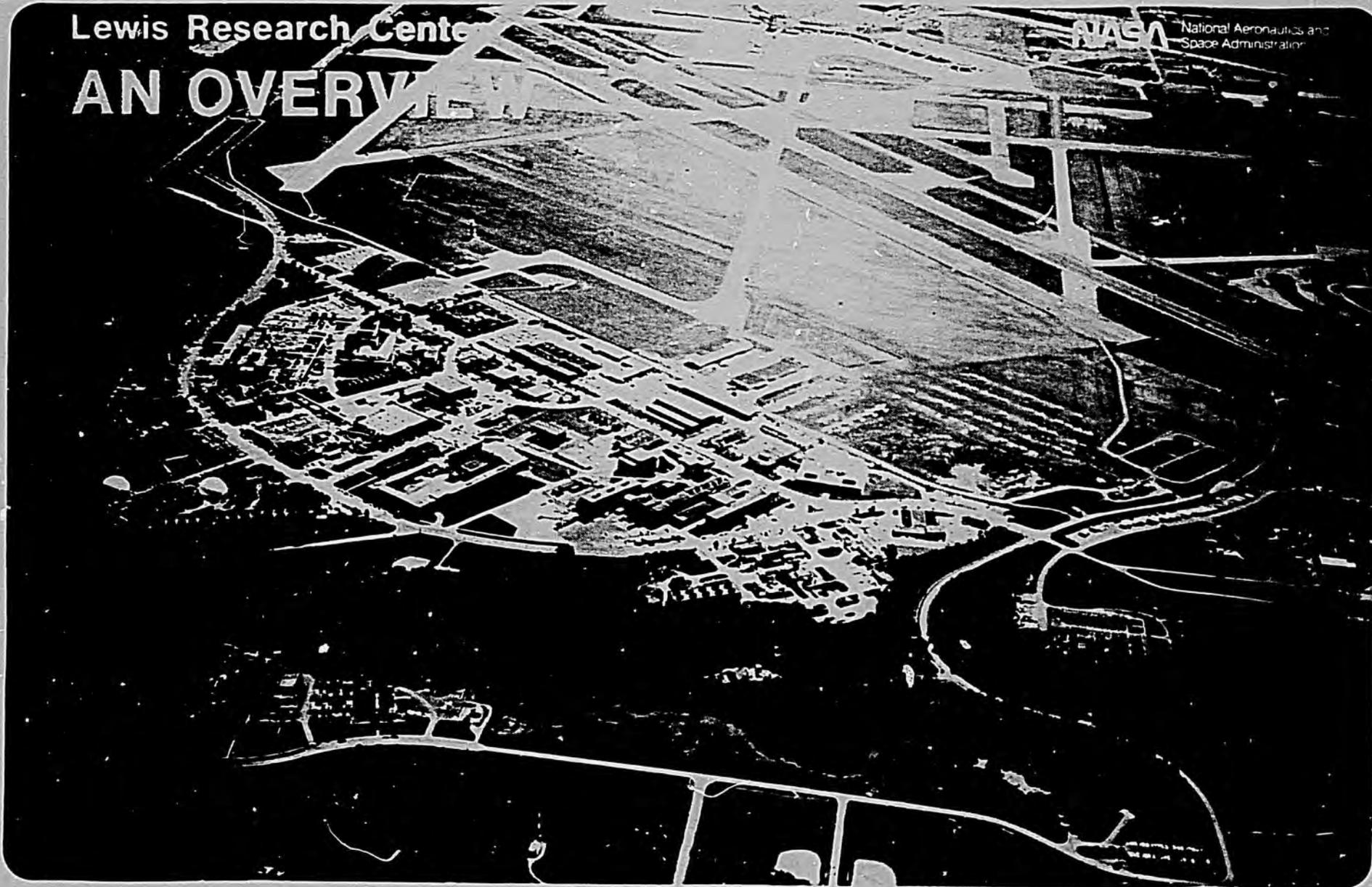
U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
BUREAU FOR DEVELOPMENT SUPPORT
OFFICE OF ENERGY

MAY 22, 1980

Lewis Research Center

NASA National Aeronautics and
Space Administration

AN OVERVIEW



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LEWIS RESEARCH CENTER

ROLE

THE MAJOR ENERGY CONVERSION TECHNOLOGY LABORATORY OF THE CIVILIAN GOVERNMENT
DEDICATED TO THE "SERVICE OF OTHERS" TO MEET NATIONAL NEEDS

CAPABILITY

BASIC RESEARCH
TECHNOLOGY DEVELOPMENT
SYSTEM DEVELOPMENT
FIELD DEMONSTRATION

STAFF

3000 CIVIL SERVICE: 50% SCI. AND ENG.; 15% ADM. AND CLER.; 35% MECH. AND TECH.
45% OF SCIENTISTS AND ENGINEERS HAVE ADVANCED DEGREES, EXPERIENCE AVG. = 15 YEARS
VIRTUALLY ALL DISCIPLINES: PHYS. SCI. AND ENGINEERING

FACILITIES

350 ACRES, ADJACENT TO CLEVELAND AIRPORT
• \$300 M INVESTMENT
LABORATORIES
PHYSICS, CHEM., ELECTROCHEM., PHOTOVOLTAICS AND MATERIALS
TEST FACILITIES
COMPONENT RESEARCH, FULL SCALE TEST
COMPLETE SHOPS
CENTRAL COMPUTERS

Lewis Research Center

NASA National Aeronautics and Space Administration

CHARTER

ENERGY CONVERSION RESEARCH
and TECHNOLOGY FOR:

AERONAUTICS



SPACE

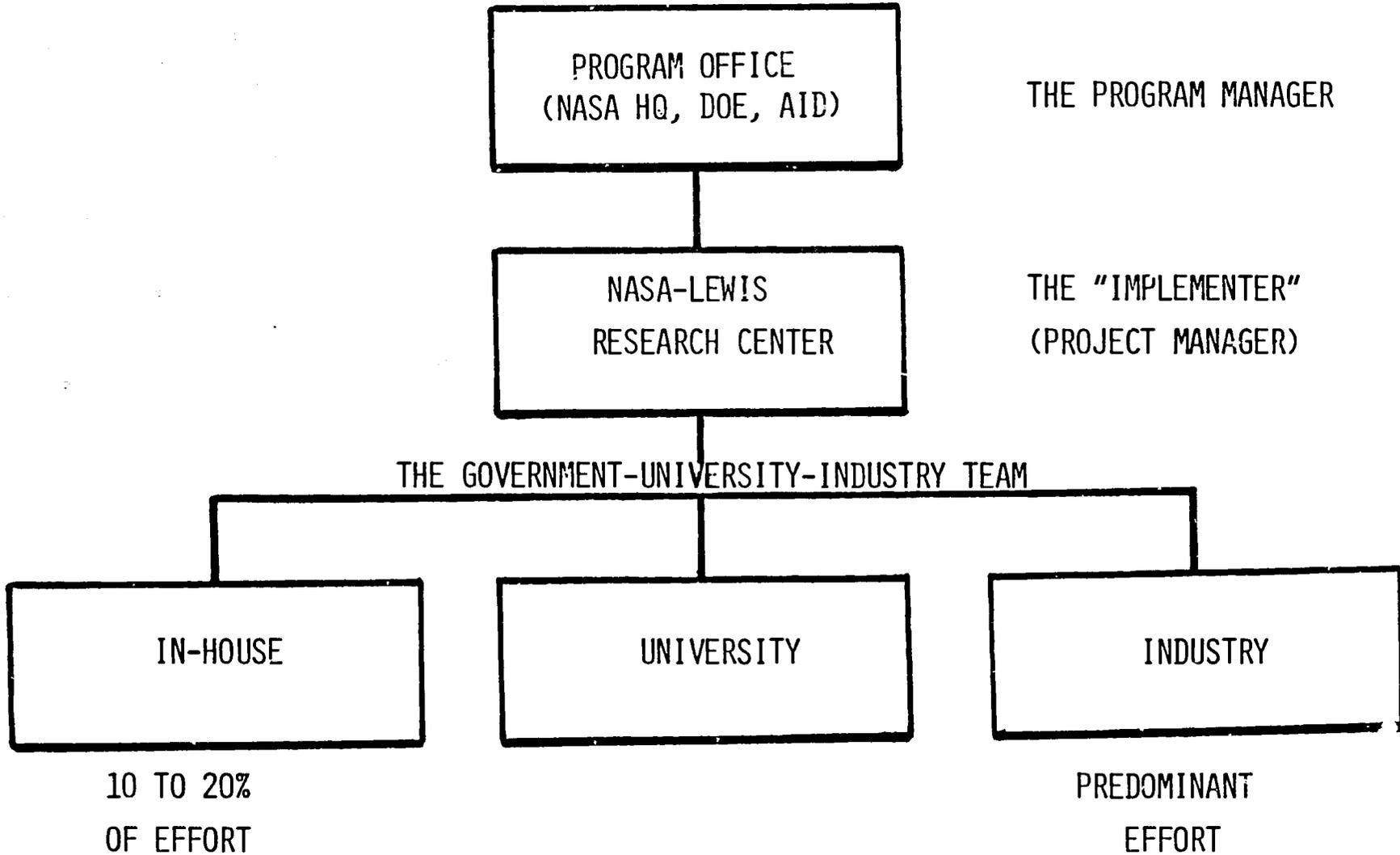


TERRESTRIAL APPLICATIONS



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ENERGY PROGRAMS ARE A TEAM EFFORT



ENERGY DIRECTORATE
G. M. Ault, Director
H. O. Slone, Deputy

SYSTEMS ANALYSIS AND
ASSESSMENT OFFICE
H. O. Slone (Act) Chief
K. A. Faymon, Deputy

TRANSPORTATION PROPULSION
DIVISION
M. H. Krasner, Chief
R. G. Ragsdale, Deputy

GAS TURBINE PROJECT OFFICE
W. E. Goette, Manager
R. C. Evans, Assistant Manager

STIRLING ENGINE PROJECT OFFICE
F. J. Kutina, Manager

ELECTRIC AND HYBRID VEHICLE
PROJECT OFFICE
H. J. Schwartz, Manager
P. A. Thollot, Assistant Mgr.

VEHICLE SYSTEMS AND
ALTERNATE FUELS PROJ OFFICE
R. P. Migra, Manager

PROPULSION SYSTEMS EXPERIMENTS
BRANCH
R. R. Roskilly, Chief

SOLAR AND ELECTROCHEMISTRY
DIVISION
L. Rosenblum, Chief
J. S. Fordyce, Deputy

SPACE PHOTOVOLTAIC BRANCH
H. W. Brandhorst, Chief

ELECTROCHEMISTRY BRANCH
L. H. Thaller, Chief

TERRESTRIAL PHOTOVOLTAIC
PROJECT OFFICE
D. T. Bernatowicz, Chief

PHOSPHORIC ACID FUEL CELL
PROGRAM LEAD CENTER OFFICE
L. D. Nichols, Manager
M. Warshay, Assistant Manager

WIND AND STATIONARY POWER
DIVISION
W. H. Robbins, Chief

WIND ENERGY PROJECT OFFICE
R. L. Thomas, Manager
D. H. Baldwin, Assistant Mgr.

POWER SYSTEMS BRANCH
L. I. Shure, Chief

MHD PROJECT OFFICE
G. R. Seikel, Manager

THERMAL AND MECHANICAL
STORAGE PROJECT OFFICE
W. J. Masica, Manager
A. W. Nice, Assistant Manager

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LEWIS RESEARCH
CENTER

SOLAR & ELECTROCHEMISTRY DIVISION
L. ROSENBLUM
J. S. FORDYCE, DEPUTY

PHOSPHORIC ACID FUEL CELL
LEAD CENTER OFFICE
L. D. NICHOLS
M. WARSHAY, DEPUTY

TERRESTRIAL PV PROJECTS
BRANCH
D. BERNATOWICZ

SPACE PV BRANCH
H. BRANDHORST

ELECTROCHEMISTRY BRANCH
L. THALLER

STAND-ALONE APPLI.
PROJECT OFFICE
J. DEYO

DEV. & SUPPORT
PROJECT OFFICE
W. BIFANO

PV APPLICATION SECTION
A. RATAJCZAK

PV RESEARCH SECTION
H. BRANDHORST, ACTING

PV TECHNOLOGY SECTION
A. FORESTIERI

REDOX PROJECT OFFICE
A. W. NICE

ELECTROCHEMISTRY
TECHNOLOGY SECTION
D. SOLTIS

PHOTOVOLTAIC ACTIVITIES

SPACE SOLAR CELL RESEARCH AND DEVELOPMENT, SINCE 1963

TERRESTRIAL SYSTEMS (NASA SUPPORTED), 1970 - 1975

NSF/ERDA/DOE NATIONAL PROGRAM, SINCE 1975

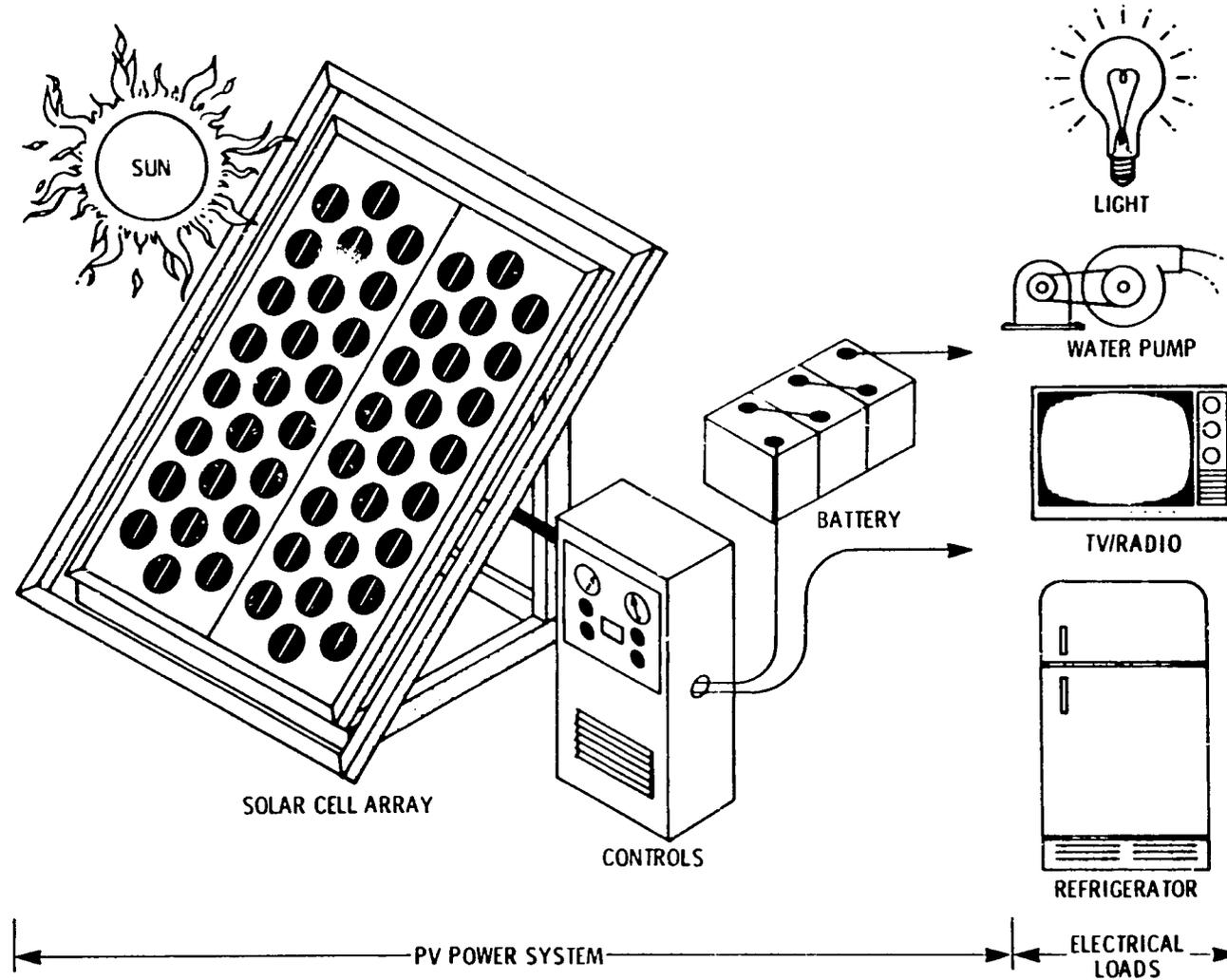
AID/UPPER VOLTA, SINCE 1977

DOE STAND-ALONE APPLICATIONS PROJECT (WITH EMPHASIS ON
INTERNATIONAL), SINCE 1979

AID PV DEVELOPMENT AND SUPPORT PROJECT, SINCE 1979

TUNISIA RENEWABLE ENERGY PROJECT, SINCE 1979

SCHEMATIC DRAWING OF A PHOTOVOLTAIC POWER SYSTEM



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WHY REMOTE STAND-ALONE PV APPLICATIONS ARE
IMPORTANT TO AID AND DOE PROGRAMS

AID ASSISTANCE

REMOTE STAND-ALONE SYSTEMS ARE THE ONLY PV SYSTEMS THAT
CAN SERVE THE PEOPLE OF RURAL AREAS OF DEVELOPING COUNTRIES

DOE COMMERCIALIZATION

REMOTE STAND-ALONE SYSTEMS ARE THE ONLY PV SYSTEMS THAT
ARE COST COMPETITIVE WITH ALTERNATE POWER SOURCES NOW OR
IN THE NEAR FUTURE

DEFINITIONS

REMOTE - FAR REMOVED FROM UTILITY ELECTRIC POWER
STAND-ALONE - OPERATING INDEPENDENTLY OF OTHER POWER SOURCES

DOE PHOTOVOLTAIC STAND-ALONE APPLICATIONS PROJECT

OBJECTIVE: ACCELERATE PENETRATION OF PHOTOVOLTAIC SYSTEMS IN NEAR-TERM AND INTERMEDIATE MARKETS (ESPECIALLY INTERNATIONAL) TO STIMULATE PV INDUSTRY GROWTH TOWARD DOE GOALS

APPROACH:

- o DEVELOP AND DEMONSTRATE, IN PARTNERSHIP WITH HOST COUNTRIES AND USERS, STAND-ALONE APPLICATIONS WHICH REPRESENT A POTENTIALLY LARGE MARKET FOR PHOTOVOLTAICS
- o CONDUCT MARKET ASSESSMENTS TO GUIDE DEMONSTRATIONS
- o DEVELOP THE SUPPORTING SYSTEM, SUB-SYSTEM, AND COMPONENT TECHNOLOGY

RESOURCES:

- o FY 80 FUNDS \$3 M
- o FY 80 PERSON POWER 24 PY

AID PHOTOVOLTAIC PROJECTS MANAGED BY NASA-LERC

OBJECTIVE

DEMONSTRATE THE SUITABILITY OF PV TECHNOLOGY FOR RURAL APPLICATIONS IN DEVELOPING COUNTRIES

UPPER VOLTA PHOTOVOLTAIC POWER SYSTEM DEMONSTRATION PROJECT

PROVIDE A SUITABLE AND RELIABLE PV SYSTEM FOR POTABLE WATER PUMPING AND GRAIN GRINDING IN THE VILLAGE OF TANGAYE

PHOTOVOLTAIC DEVELOPMENT AND SUPPORT PROJECT

DESIGN, BUILD AND DEPLOY PHOTOVOLTAIC POWER SYSTEMS FOR SELECT APPLICATIONS (E.G., HEALTH DELIVERY, EDUCATION, COMMUNICATIONS, WATER PUMPING) IN RURAL AREAS OF DEVELOPING COUNTRIES

TUNISIA RENEWABLE ENERGY PROJECT

PROVIDE ASSISTANCE TO THE GOVERNMENT OF TUNISIA IN THE DEMONSTRATION OF RENEWABLE ENERGY TECHNOLOGY IN RURAL SETTINGS (VILLAGE OF HAMMAM BIADHA)

NASA LEWIS RESEARCH CENTER PHOTOVOLTAIC APPLICATION SUMMARY

SINGLE PURPOSE APPLICATIONS

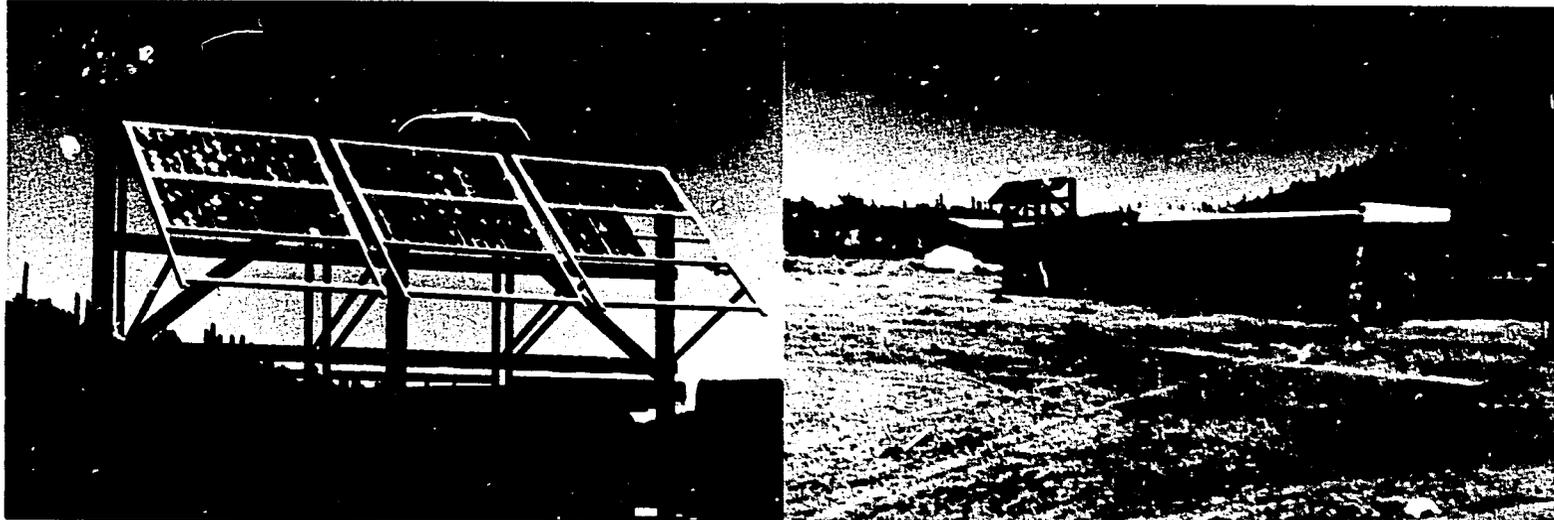
<u>APPLICATION CATEGORY</u>	<u>USE</u>	<u>USER</u>	<u>DATE OPERATIONAL</u>	<u>LOCATION</u>	<u>POWER LEVEL, Wp</u>
INSTRUMENT	WEATHER DATA	USCG	DECEMBER 1972	CLEVELAND, OH	30
INSTRUMENT	WEATHER DATA	NOAA	AUGUST 1973	MAMMOTH MT., CA	60
COMMUNICATIONS	RADIO REPEATER	USFS	JULY 1974	WHITE MT., CA	16
COMMUNICATIONS	EDUCATIONAL TV	GOVT. INDIA	JULY 1976	1) AHMEDABAD, INDIA 2) SAMBALPUR, INDIA	55 55
REFRIGERATION	FOOD PRESERVATION	USNPS	JUNE 1976	ISLE ROYALE, MI	220
REFRIGERATION	MEDICAL	VILLAGE RESIDENTS	JULY 1976	SIL NAKYA, AZ PAPAGO TRIBE	330
INSTRUMENT	WEATHER DATA	NOAA	APR-SEPT 1977	1) NEW MEXICO; 2) NEW YORK; 3) HAWAII; 4) ALASKA; 5) MAINE; 6) FLORIDA	75-150
HIGHWAY	DUST STORM WARNING SIGN	DOT-AZ	APRIL 1977	CASA GRANDE, AZ	116
INSTRUMENT	INSECT SURVEY TRAPS	USDA	MAY 1977	COLLEGE STATION, TX	23 & 163
REFRIGERATION	WATER COOLER	INTERAGENCY VISITOR CENTER	OCTOBER 1977	LONE PINE, CA	46
INSTRUMENT	AIR POLLUTION MONITOR	NJ-DEP	NOVEMBER 1979	LIBERTY PARK, NJ	360
INSTRUMENT	SEISMIC MONITORS	USGS	JANUARY 1980	KILAUEA VOLCANO, HI	18 & 18

NASA LEWIS RESEARCH CENTER PHOTOVOLTAIC APPLICATION SUMMARY

CLUSTER APPLICATIONS

<u>APPLICATION CATEGORY</u>	<u>USE</u>	<u>USER</u>	<u>DATE OPERATIONAL</u>	<u>LOCATION</u>	<u>POWER LEVEL, Wp</u>
FIRE LOOKOUT	2-WAY RADIO, REFRIGERATOR, LIGHTING, POTABLE WATER	USFS	OCTOBER 1976	1) PILOT PEAK, CA 2) ANTELOPE PEAK, CA	294 294
VILLAGE POWER	POTABLE WATER, LIGHTING, REFRIGERATION, WASHING MACHINE, SEWING MACHINE	VILLAGE RESIDENTS	DECEMBER 1978	SCHUCHULI, AZ PAPAGO TRIBE	3500
VILLAGE POWER	POTABLE WATER, GRAIN MILLING	VILLAGE RESIDENTS	FEBRUARY 1979	TANGAYE, UPPER VOLTA	1800

PHOTOVOLTAIC POWERED REFRIGERATOR AT PAPAGO INDIAN VILLAGE OF SIL NAKYA, ARIZONA



Solar Cell Powered Refrigerator Operating
at Remote Papago Indian Village

A 185 watt solar cell array is in operation powering a refrigerator in the Papago Indian village of Sil Nakya, Arizona. This system, installed July 8, 1976 by NASA-LeRC personnel, is one of several applications planned as part of the ERDA / NASA Tests and Applications Project.

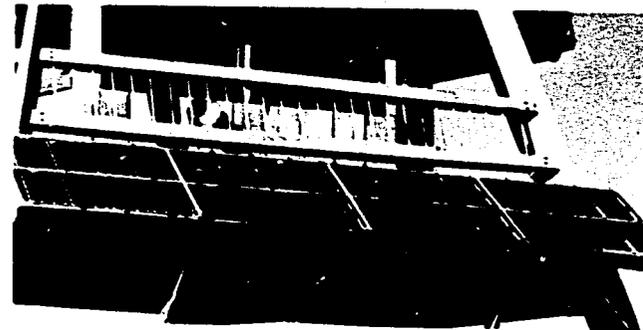
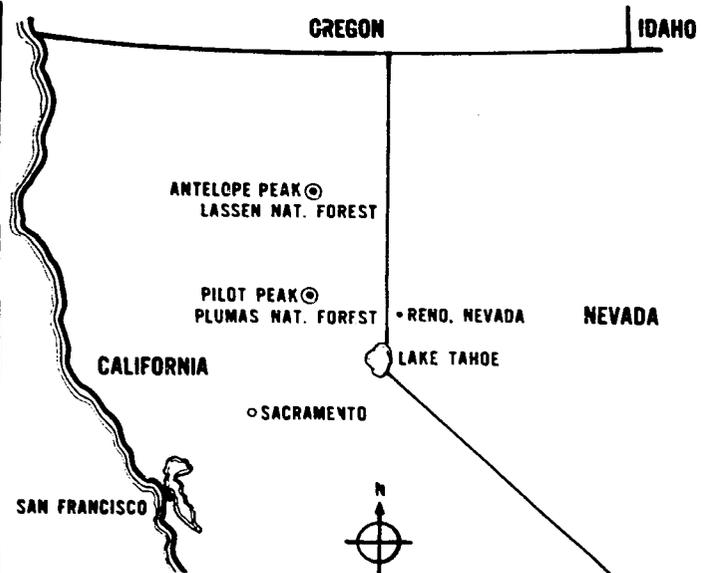
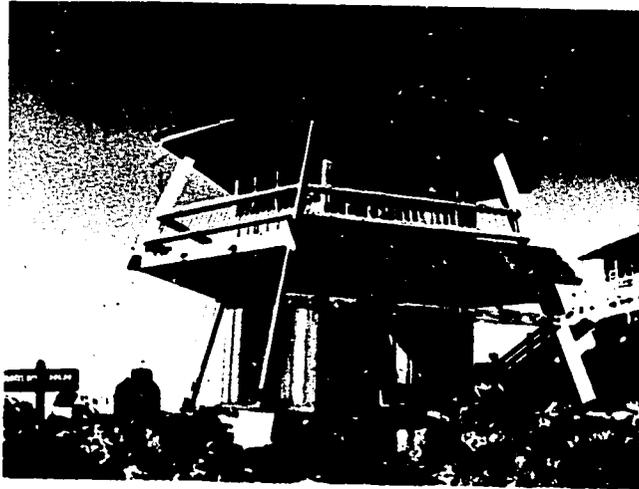
Sil Nakya, 60 miles northwest of Tucson, is home to about 25 people and does not have electrical service. Although the traditional Papago diet does not depend on foods needing refrigeration, several of the residents of Sil Nakya require medicines which must be kept at or below room temperature to preserve effectiveness. Until now these people had to travel 64 miles to and from the Public Health Service Hospital at Sells, Arizona for their medications.

The photovoltaically powered refrigerator will not only provide for better medical services, but will also allow perishable foods to be kept on hand thereby improving the diet of the whole village.

This demonstration which brings refrigeration to a people for the first time, provides a dramatic example of the potential impact of such a service on those living in less developed parts of the world.

PHOTOVOLTAIC POWERED FOREST LOOKOUTS

LASSEN AND PLUMAS NATIONAL FORESTS, CALIFORNIA



Photovoltaic Powered U. S. Forest Service Forest Lookouts

Three-hundred watt solar cell arrays are providing complete electrical power for each of two newly designed U. S. Forest Service forest lookout towers. The systems were installed in early October 1976 by NASA-LeRC personnel and are another of the applications being sponsored by the ERDA/NASA Tests and Applications Project.

Located on Antelope Peak in the Lassen National Forest and Pilot Peak in the Plumas National Forest (both in northern California), the towers are among the first of a new design which will eventually replace many old towers. The solar cell array was designed to blend harmoniously with the architecture of the building and provides power for a refrigerator, lights, water pump and Forest Service radio.

Each complete photovoltaic power system consists of a 300 watt solar cell array, 3000 ampere-hours of battery storage, a battery charge controller and instrumentation to indicate the status of the power system.

Photovoltaic power for forest lookouts will not only make living conditions considerably more pleasant for lookout personnel, but will also save the Forest Service the considerable time, trouble and expense of procuring, storing and transporting fuels to these remote locations for other types of electrical generators.



PHOTOVOLTAIC VILLAGE POWER PROJECT - SCHUCHULI, ARIZONA

PHOTOVOLTAIC VILLAGE POWER PROJECT

This is the world's first Solar Photovoltaic Village Power System. Designed to serve the basic needs of the people of Schuchuli, the system was put into operation 16 December 1978.

Power is generated by a 3.5 kilowatt (peak) solar cell installation which converts visible sunlight directly into electricity. Excess electrical energy is stored in a bank of batteries and withdrawn during the night or on cloudy days, as needed.

The system provides power for the following services:

- 40 lights, 20 watt fluorescent - distributed among the homes and community buildings;
- 1 water pump - up to 5000 gallons per day;
- 15 refrigerator/freezer units;
- 1 clothes washer;
- 1 sewing machine.

This project is one of several sponsored by the Department of Energy to stimulate near-term markets for solar cell power through cooperative, cost-shared experiments with potential users.

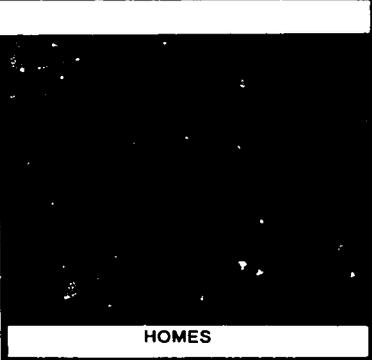
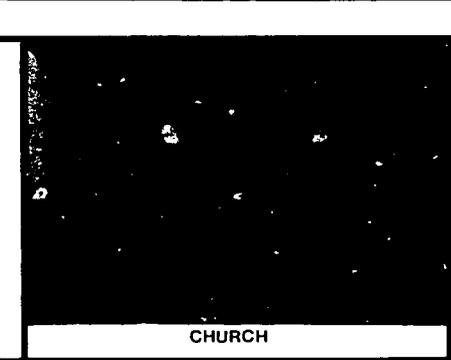
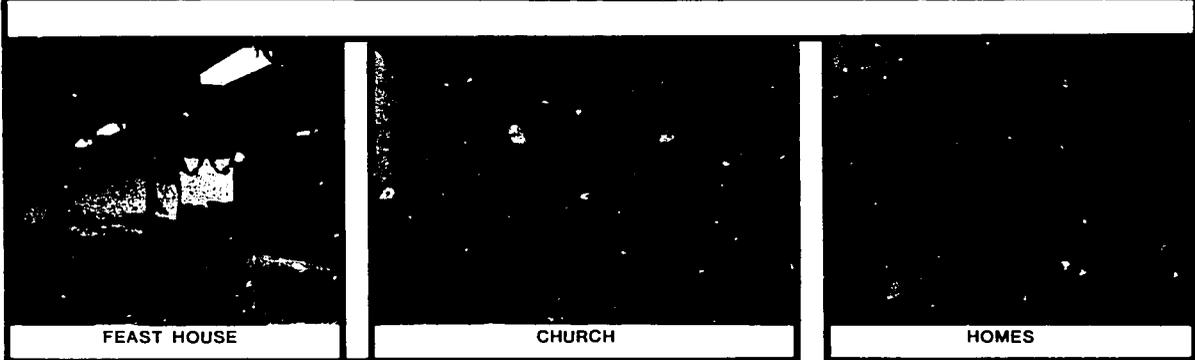
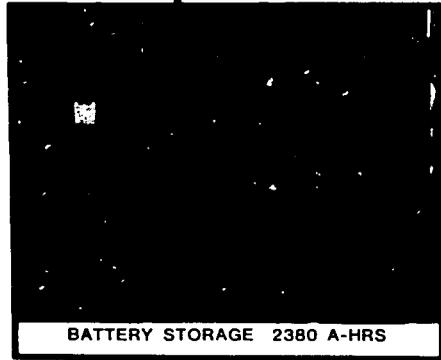
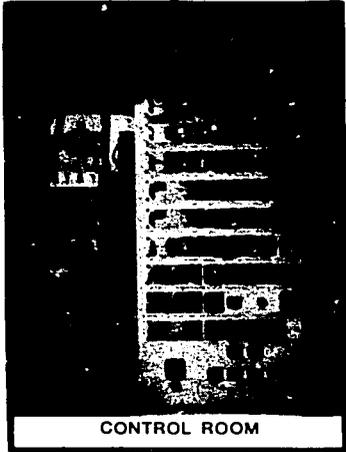
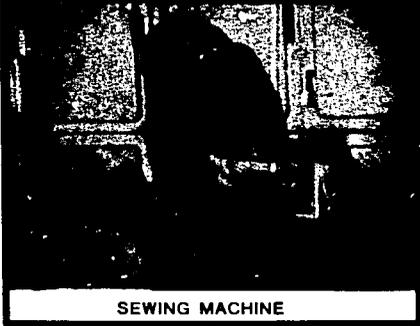
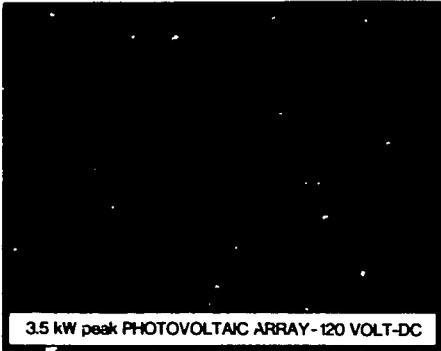
Principal participants: Papago Tribe; U.S. Department of Energy; U.S. Public Health Service; NASA, Lewis Research Center.

Contributors: Four Corners Regional Commission; Economic Development Administration; and Bureau of Indian Affairs.

Overall management: NASA, Lewis Research Center.



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WORLD'S FIRST VILLAGE PHOTOVOLTAIC POWER SYSTEM - PAPAGO INDIAN VILLAGE OF SCHUCHULI, ARIZONA

Schuchuli Village Power System

The village of Schuchuli is located on the western edge of the 2,750,000 acre Papago Indian Reservation in southwestern Arizona. The village's 15 families (95 people) are 27 km (17 miles) from the nearest available electric utility power. The villager's diet has been tied to traditional (i.e., nonrefrigerated) methods of food storage and preparation. Until the advent of the PV power system, water was provided by a diesel-powered pump; kerosene lamps and candles provided lighting in the homes.

On December 16, 1978, the world's first village Photovoltaic Power System began operation, providing the residents of Schuchuli with the following services: electric power for potable water pumping; lights in the homes and community buildings; family refrigerators; and a communal washing machine and sewing machine.

The Schuchuli Village Photovoltaic Power System consists of a 3.5kW, 120 volt, DC PV array, 2380 ampere-hours of battery storage, controls, regulator and instrumentation, and an overhead electrical distribution network. The batteries and controls are located in an electrical equipment building.

The system is all DC to avoid the losses associated with commercially available DC/AC inverters and to maximize system efficiency. The system voltage was set at 120 volts to limit distribution line losses and to enable use of commercially available DC switches and DC appliance motors. The load devices were individually selected on the basis of energy efficiency.

System design, exclusive of the overhead distribution network, was performed by LeRC. The power system was installed by the Papago Construction Company. The overhead distribution network was designed and installed by the Papago Tribal Utility Authority.

DOE PHOTOVOLTAIC STAND-ALONE APPLICATIONS PROJECT

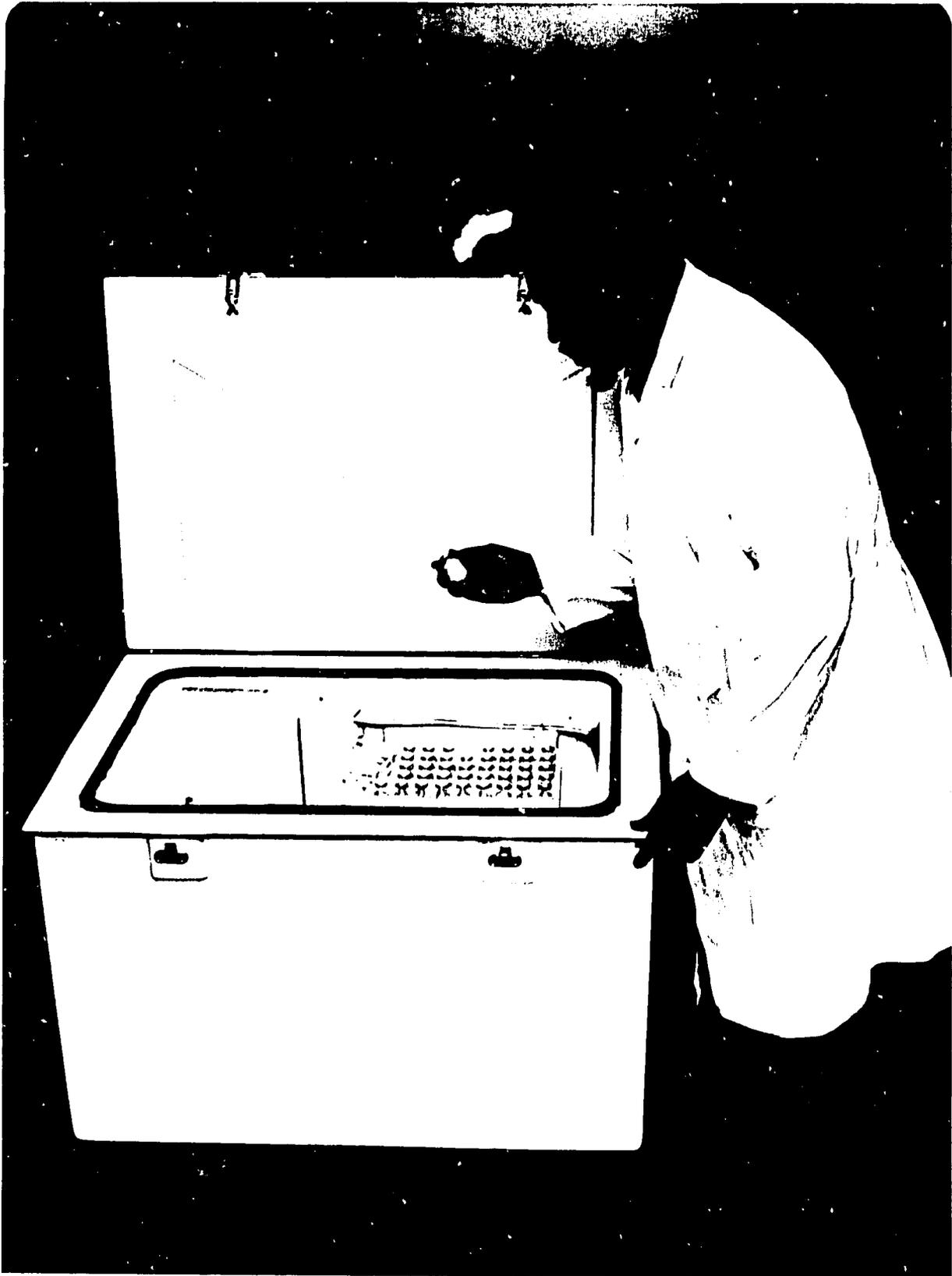
INTERNATIONAL DEMONSTRATIONS

MEDICAL REFRIGERATOR PROJECT

- o JOINT, COST-SHARED, PROJECT WITH CENTER FOR DISEASE CONTROL AND IN COOPERATION WITH PAN AMERICAN HEALTH ORGANIZATION
- o PV REFRIGERATOR/FREEZER FOR THE PRESERVATION OF THE COLD CHAIN OF VACCINES
- o FOR REMOTE MEDICAL POSTS: INDIA, MALDIVE ISLANDS, GAMBIA (2), IVORY COAST (2), COLOMBIA, PERU
- o INSTALLATION: MID 1981

GABON VILLAGE POWER PROJECT

- o LETTER OF INTEREST TO PROCEED WITH PROJECT FROM PRESIDENT OF GABON, 3 MARCH 1980
- o JOINT, COST-SHARED PROJECT WITH GOVERNMENT OF GABON
- o PV POWER PACKAGES FOR COMMUNITY SERVICES: MEDICAL, EDUCATIONAL, ADMINISTRATIVE, POTABLE WATER, PUBLIC LIGHTING
- o VILLAGES SELECTED: BOUGANDJI, AKOK, NYALI, BOLOSSOVILLE
- o FINALIZATION OF AGREEMENT DOCUMENT TARGETED FOR AUGUST 1980



PHOTOVOLATIC POWERED MEDICAL REFRIGERATOR
FOR THE PRESERVATION OF THE COLD
CHAIN OF VACCINES

PHOTOVOLTAIC STAND-ALONE APPLICATIONS DEMONSTRATION PROJECTS
NASA-LEWIS RESEARCH CENTER 1976-81



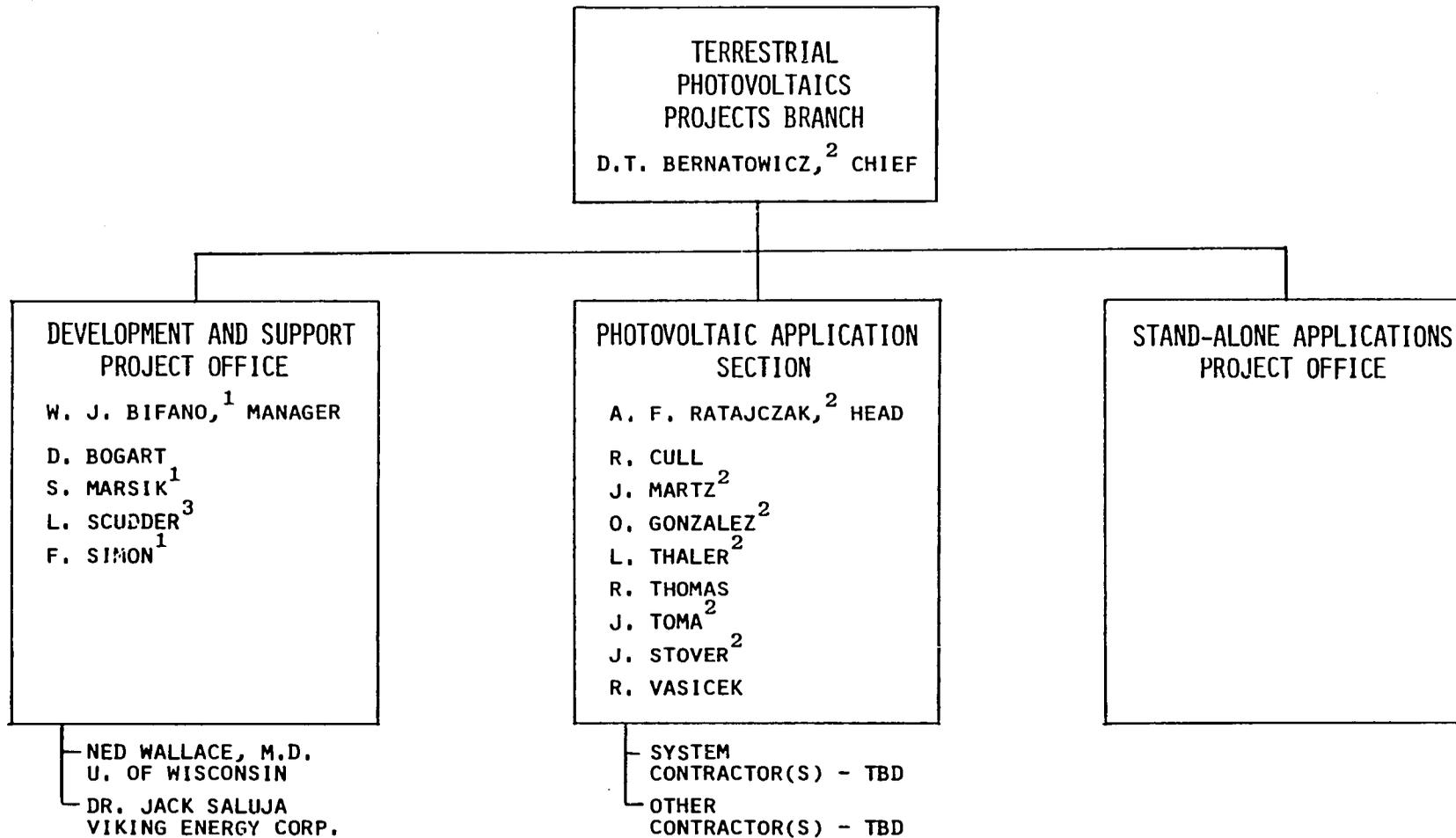
- FOR DEPARTMENT OF ENERGY
- FOR AGENCY FOR INTERNATIONAL DEVELOPMENT
- TECHNICAL ASSISTANCE TO SERI

PHOTOVOLTAIC ACTIVITIES MANAGED BY NASA-LERC FOR AID

- o UPPER VOLTA PV POWER SYSTEM DEMONSTRATION PROJECT
- o PV DEVELOPMENT AND SUPPORT PROGRAM
- o TUNISIAN RENEWABLE ENERGY PROJECT

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ORGANIZATION OF AID PV PROJECT TEAM AT NASA LERC



¹ FULL TIME AID

² PART TIME AID

³ TUNISIA PROJECT MANAGER

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UPPER VOLTA PV POWER SYSTEM DEMO PROJECT

AID PROJECT PURPOSE:

TO DETERMINE THE SOCIO-ECONOMIC EFFECTS OF REDUCING THE TIME REQUIRED BY WOMEN OF THE VILLAGE OF TANGAYE, UPPER VOLTA TO DRAW WATER AND GRIND CEREAL GRAIN, THEIR PRIMARY SOURCE OF FOOD

TECHNICAL OBJECTIVE:

TO DETERMINE THE SUITABILITY OF PHOTOVOLTAIC POWER SYSTEMS IN RURAL APPLICATIONS IN DEVELOPING COUNTRIES

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UPPER VOLTA PV POWER SYSTEM DEMO PROJECT

AID PROJECT PURPOSE:

TO DETERMINE THE SOCIO-ECONOMIC EFFECTS OF REDUCING THE TIME REQUIRED BY WOMEN OF UPPER VOLTA TO DRAW WATER AND GRIND CEREAL GRAIN

TECHNICAL OBJECTIVE:

TO DETERMINE THE SUITABILITY OF PHOTOVOLTAIC POWER SYSTEMS IN RURAL APPLICATIONS IN DEVELOPING COUNTRIES

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UPPER VOLTA PV POWER SYSTEM DEMONSTRATION PROJECT: CHRONOLOGY

- FEB 76: U.S. AID INITIATED PROJECT "STUDIES OF ENERGY NEEDS IN FOOD SYSTEM"
AUG 76: AID LETTER REQUESTING OPPORTUNITY TO PARTICIPATE IN ERDA/NASA TEST AND
DEMONSTRATION PROJECT
JAN 77: AID/NASA INSPECTION TEAM VISITED UPPER VOLTA
JUL 77: AID REQUESTED TECHNICAL ASSISTANCE FROM NASA-LEERC FOLLOWING ERDA POLICY
DECISION ON INTERNATIONAL ACTIVITIES
DEC 77: PROJECT ACTIVITIES INITIATED AT NASA-LEERC
FEB 78: AID/NASA TEAM VISITED TANGAYE, UV; DESIGN BEGUN
APR 78: PARTICIPATING AGENCY SERVICE AGREEMENT SIGNED BY NASA AND AID
SEP 78: SYSTEM SHIPPED FROM NASA-LEERC
JAN 79: SYSTEM INSTALLATION BEGAN
MAR 79: SYSTEM OPERATIONAL

UPPER VOLTA PV POWER SYSTEM DEMO PROJECT

STATUS:

- o PV SYSTEM OPERATIONAL EXCEPT FOR SOME NONCRITICAL INSTRUMENTS
- o MILL AND PUMP OPERATING SATISFACTORILY
- o LERC PERSONNEL TO VISIT SITE JULY 80 TO:
 - PERFORM SYSTEM INSPECTION
 - INCREASE SIZE OF INSTRUMENT AND CONTROL PV PANEL
 - REPLACE DAMAGED INSTRUMENTATION
 - INSTALL AUTOMATIC CASSETTE DATA RECORDER
- o ANTHROPOLOGIST TO CONDUCT FINAL ASSESSMENT FOR SOCIO-ECONOMIC IMPACT STUDY STARTING JULY 80.

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DEMONSTRATED SUITABILITY AND RELIABILITY
OF TANGAYE PHOTOVOLTAIC SYSTEM

- o MEETS LOCAL NEEDS
 - PUMPS WATER: 15,000 L/DAY (ENOUGH FOR 750 PEOPLE/DAY)
 - GRINDS GRAIN: 158 KG/DAY (ENOUGH FOR 320 PEOPLE/DAY)

- o OPERATES WELL IN SAHEL ENVIRONMENT
 - LOW POWER LOSS DUE TO DUST RECOVERABLE BY WASHING
 - NO PV SYSTEM PARTS WEAR OUT
 - ON-LINE DEPENDABILITY

- o COMPATIBLE WITH VILLAGERS' CAPABILITIES
 - MILLING CO-OPERATIVE FUNCTIONING WELL
 - SIMPLE MAINTENANCE REQUIREMENTS
 - SYSTEM OPERATION/TROUBLESHOOTING BY VILLAGER OPERATOR

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U.S. AID PHOTOVOLTAIC DEVELOPMENT AND SUPPORT PROGRAM

PROJECT MANAGEMENT: NASA LEWIS RESEARCH CENTER

OBJECTIVE: TO DEMONSTRATE THE SUITABILITY OF PV TECHNOLOGY TO PROVIDE ENERGY FOR DEVELOPMENT APPLICATIONS

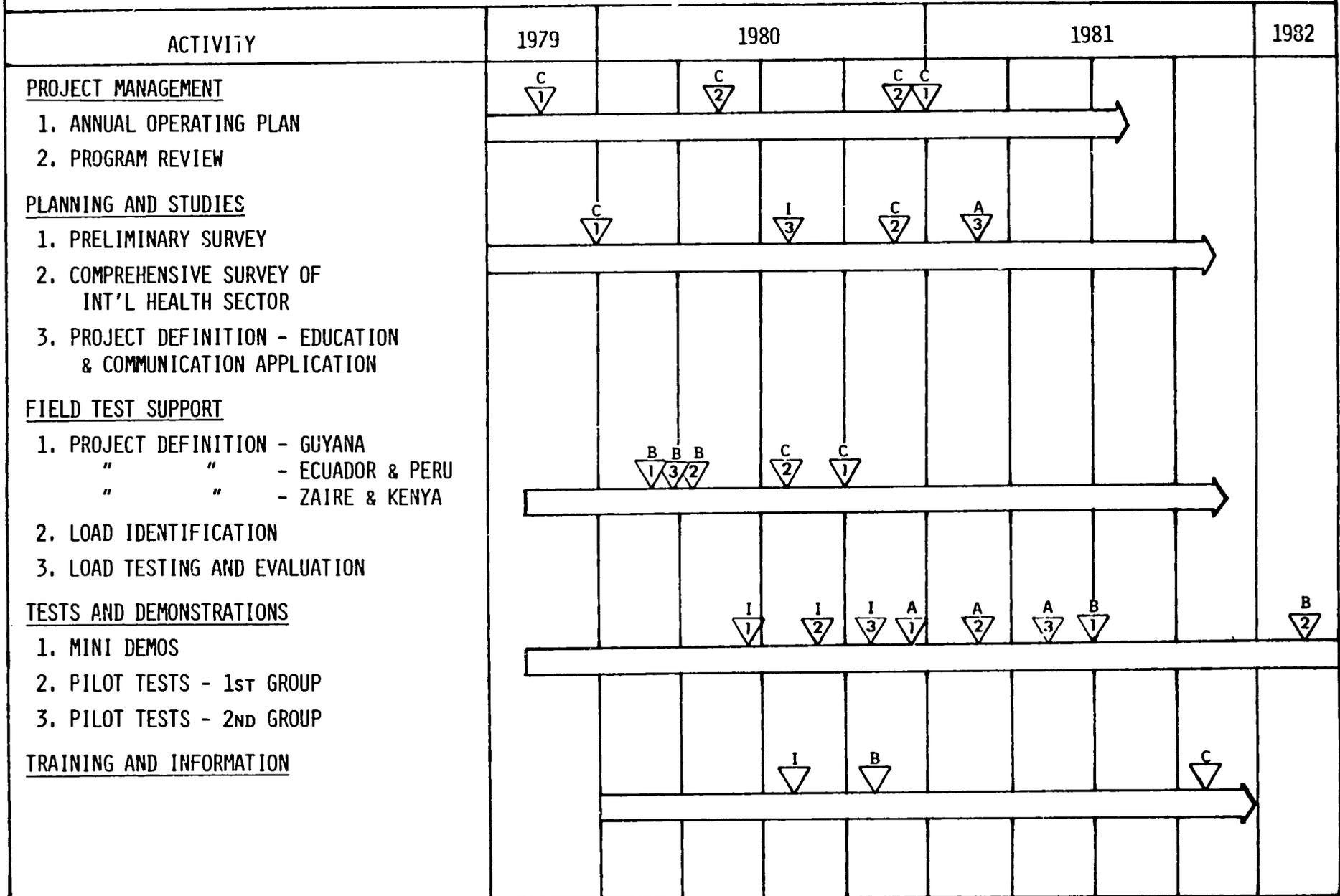
APPROACH:

- o DEFINE REQUIREMENTS FOR SELECTED APPLICATION CLASSES (E.G., HEALTH DELIVERY, EDUCATION, COMMUNICATION, WATER PUMPING, FOOD PROCESSING) BY NASA AND UNDER CONTRACT
- o DESIGN, BUILD, AND DEPLOY RELIABLE PV POWER SYSTEMS THROUGH CONTRACTS
- o PROVIDE TRAINING AND INFORMATION SERVICES IN SUPPORT OF PV DEMONSTRATIONS UNDER CONTRACT

EXPENDITURES: IN-HOUSE 20% CONTRACT 80%

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MASTER SCHEDULE
PHOTOVOLTAIC DEVELOPMENT AND SUPPORT PROGRAM



I = INITIATE PROCUREMENT
A = AWARD CONTRACT
B = BEGIN
C = COMPLETE

PV DEVELOPMENT AND SUPPORT PROJECT
PROJECT MANAGEMENT

DESCRIPTION: CONTROL, DIRECTION AND INTEGRATION OF ALL ACTIVITIES NEEDED TO ASSURE ACCOMPLISHMENT OF STATED OBJECTIVES IN ACCORDANCE WITH ESTIMATED FISCAL, MANPOWER AND SCHEDULAR ESTIMATES PROVIDED IN OPERATING PLAN.

STATUS

- o PASA SIGNED FOR 5 YEARS, \$9.75 M PROGRAM
- o OPERATING PLAN FOR SEPTEMBER '79 - DECEMBER '80
APPROVED BY AID JANUARY 11, 1980
- o 8 MONTH MANAGEMENT REVIEW MAY 22, 1980
- o HELD REVIEW AND COORDINATION MEETINGS WITH AID REGIONAL BUREAU REPRESENTATIVES ON DECEMBER 13, 1979, AND JANUARY 21, 1980, REGARDING THE SUBJECT PROJECT

PLANS

- o 15 MONTH REVIEW SCHEDULED FOR DECEMBER 1980
- o ANNUAL OPERATING PLAN FOR 1981 DUE JANUARY 1981

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PV DEVELOPMENT AND SUPPORT PROJECT

PLANNING AND STUDIES SUBPROJECT

DESCRIPTION: ACTIVITIES WHICH PROVIDE THE INFORMATION BASE
NECESSARY TO SELECT AND IMPLEMENT PV FIELD TESTS
& DEMONSTRATIONS IN DEVELOPING COUNTRIES

STATUS

- o PRELIMINARY SURVEY OF INTERNATIONAL HEALTH ASSISTANCE COMMUNITY
CONDUCTED TO IDENTIFY TARGETS OF OPPORTUNITY FOR PV
DEMONSTRATIONS
- o COMPREHENSIVE FOLLOW-UP SURVEY UNDER WAY BY DR. NED WALLACE,
UNIVERSITY OF WISCONSIN
- o DRAFT STATEMENT OF WORK FOR PROJECT DEFINITION STUDY FOR RURAL
EDUCATION/COMMUNICATIONS APPLICATIONS IN REVIEW

PLANS

- o COMPLETE SURVEY, DEFINE BASIC ELECTRICAL NEEDS AND REQUIRE-
MENTS OF RURAL HEALTH CLINICS BY FALL OF 1980
- o AWARD CONTRACT FOR RURAL EDUCATION/COMMUNICATION PROJECT
DEFINITION STUDY IN LATE CY 1980

dfp

PV DEVELOPMENT AND SUPPORT PROJECT

FIELD TEST SUPPORT SUBPROJECT

DESCRIPTION: THIS WORK DIRECTLY SUPPORTS IMPLEMENTATION OF MEDICAL SERVICES TESTS AND DEMONSTRATIONS

STATUS

- o INITIAL SITE VISITS TO INVESTIGATE POSSIBLE MEDICAL PV DEMONSTRATION PROJECTS COMPLETE FOR ECUADOR, PERU, GUYANA, ZAIRE AND KENYA
- o INFORMATION ON AID PV D&S PROJECT SENT TO BOLIVIA AND JAMAICA
- o CONTRACT AWARDED TO SMALL BUSINESS FIRM FOR DEVELOPMENT OF CATALOG OF ELECTRICAL APPLIANCES FOR RURAL HEALTH DELIVERY APPLICATIONS
- o INITIAL TESTING OF ONE MEDICAL REFRIGERATOR COMPLETE, ONE IN PROGRESS, A THIRD IS BEING ACQUIRED FOR TEST AND EVALUATION
- o DRAFT SCW FOR TESTING AND EVALUATION OF LOAD DEVICES IN REVIEW

PLANS

- o FOLLOW-UP VISITS TO SELECTED SPECIFIC SITES TO DEVELOP AGREEMENTS AND IMPLEMENTATION PLANS SCHEDULED FOR JUNE '80 FOR ECUADOR AND GUYANA
- o INITIAL VISIT TO JAMAICA PLANNED FOR JUNE '80
- o PRELIMINARY CATALOG OF ELECTRICAL APPLIANCES TO BE COMPLETE IN 3RD QUARTER OF CY 1980
- o AWARD CONTRACT FOR TEST AND EVALUATION OF LOAD DEVICES IN 3RD QUARTER OF 1980

PV DEVELOPMENT AND SUPPORT PROJECT
TESTS AND DEMONSTRATIONS SUBPROJECT

DESCRIPTION: DESIGN, FABRICATION, TESTING, SHIPPING AND
INSTALLATION OF PV POWER SYSTEMS AT VARIOUS
RURAL SITES IN DEVELOPING COUNTRIES

STATUS

MINI DEMOS: PROCUREMENT OF MEDICAL REFRIGERATORS WAS CANCELLED
BECAUSE OF AMBIGUOUS SPECIFICATIONS

CONSULTATION WITH CDC AND WHO HAS LED TO NEW
SET OF SPECIFICATIONS

PROCUREMENT TO BE RESUBMITTED TO ACQUISITION
DIVISION FOR 6 TO 10 PV-POWERED REFRIGERATOR -
LIGHT(S) MINI DEMOS (DESIGN, FAB, TEST & DEPLOY)

PILOT TESTS: A GENERAL SOW FOR PROCUREMENT OF PILOT PV SYSTEMS
HAS BEEN DRAFTED

PLANS

MINI DEMOS: WILL DEPLOY 6 TO 10 MINI DEMOS IN MID CY '81

PILOT TESTS: CONTRACTS WILL BE AWARDED FOR PILOT TESTS IN
ECUADOR AND GUYANA IN EARLY CY 81

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PHOTOVOLTAIC DEVELOPMENT AND SUPPORT PROJECT

TRAINING AND INFORMATION SUBPROJECT

DESCRIPTION: TRAINING OF HOST COUNTRY PERSONNEL IN OPERATION,
MAINTENANCE AND REPAIR AND MONITORING OF PV SYSTEMS
AND DISSEMINATION OF INFORMATION

STATUS

- o WORKING WITH POTENTIAL UNIVERSITY GRANTEE TO ESTABLISH TRAINING
AND INFORMATION NEEDS AND THE FORMULATION OF A PROGRAM TO MEET
THOSE NEEDS

FUTURE PLANS

- o AWARD ONE-YEAR GRANT, RENEWABLE ANNUALLY

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PHOTOVOLTAIC DEVELOPMENT AND SUPPORT PROJECT

SPECIFIC PV PROJECT TEAMS

<u>COUNTRY</u>	<u>PROJECT MANAGER</u>	<u>PROJECT ENGINEER</u>
TUNISIA	LARRY SCUDDER	JIM MARTZ
GUYANA	STAN MARSIK	JOHN TOMA
ECUADOR	FRED SIMON	OSCAR GONZALEZ

PHOTOVOLTAIC DEVELOPMENT AND SUPPORT PROJECT

RESOURCES SUMMARY

FOR PERIOD SEPTEMBER 1979 - DECEMBER 1980

ACTIVITY	EXPENDITURES TO DATE (\$K)	PROJECTED EXPENDITURES (\$K) (JUN - DEC 80)
PROJECT MANAGEMENT (INCLUDES TRAVEL)	130 (3.0 PERSON YEARS)	220 (5.0 PERSON YEARS)
PLANNING AND STUDIES	85	200
FIELD TEST SUPPORT	35	180
TESTS AND DEMONSTRATIONS	0	2000
TRAINING AND INFORMATION	0	150
COMMITMENTS	250	2750

TUNISIA RENEWABLE ENERGY PROJECT

AGREEMENT BETWEEN THE REPUBLIC OF TUNISIA AND U.S.
SIGNED AUGUST 31, 1979.

GOALS

- (1) THE DEMONSTRATION OF RENEWABLE ENERGY TECHNOLOGIES IN A RURAL SETTING, AND
- (2) TRAINING TO DEVELOP TUNISIAN CAPABILITY TO DETERMINE WHERE, WHEN, AND HOW RENEWABLE ENERGY CAN BE APPLIED IN THE FUTURE

TUNISIA RENEWABLE ENERGY PROJECT

MAJOR PROJECT ACTIVITIES

- o DISTRICT ENERGY APPLICATIONS SUBPROJECT
 - GOT PROJECT MANAGER - STEG
 - U.S. AID PROJECT MANAGER - NASA, LEWIS
- o TRAINING SUBPROJECT
 - U.S. AID MANAGED VIA CONTRACT WITH
 - RESOURCES FOR HUMAN DEVELOPMENT, INC.

TUNISIA RENEWABLE ENERGY PROJECT
DISTRICT ENERGY APPLICATIONS SUBPROJECT

OBJECTIVE: TO DEMONSTRATE THE ABILITY OF SOLAR AND WIND TECHNOLOGY TO PERFORM WORK AND SUPPLY THE MINIMUM SERVICES NECESSARY IN A VILLAGE AND IN RURAL AGRICULTURAL SETTINGS.

APPROACH:

- o DEFINE SYSTEM REQUIREMENTS FOR SELECTED VILLAGE (HAMMAM BIADHA) AND AGRICULTURAL APPLICATIONS USING WIND, PHOTOVOLTAIC, AND SOLAR HEATING TECHNOLOGIES.
- o PREPARE CONCEPTUAL DESIGN OF SYSTEM FOR AID AND GOT APPROVAL.
- o PROCURE APPROVED SYSTEMS FROM U.S. AND TUNISIAN CONTRACTORS (DESIGN, FABRICATION, TESTING, SHIPPING, AND INSTALLATION)

FUNDING: TOTAL \$1.9M AID 75% GOT 25%

STATUS:

- o INITIAL SITE VISITS CONDUCTED
- o SYSTEM CONCEPTUAL DESIGN COMPLETED
- o PROJECT IMPLEMENTATION PLAN IN PREPARATION

TUNISIA RENEWABLE ENERGY PROJECT
SOLAR TECHNOLOGY DEMONSTRATIONS FOR HAMMAM BIADHA

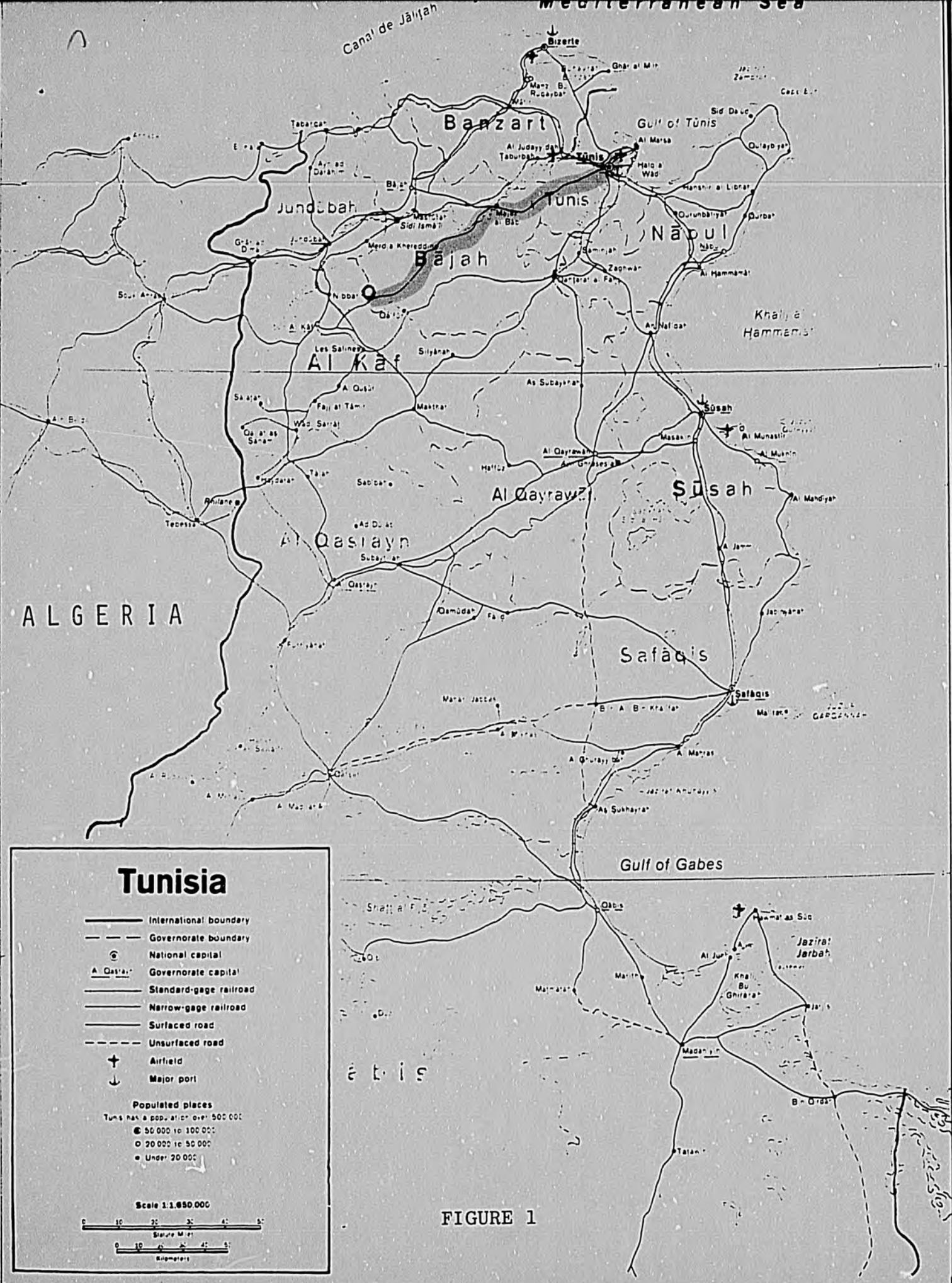
AGRICULTURAL APPLICATIONS

- o WATER PUMPING FOR SOLAR HEATED GREENHOUSES
 - 12' DIAMETER WIND POWERED PUMP (3)
 - 600 WP PV POWERED PUMP (1)
- o PV POWERED DRIP IRRIGATION
 - 600 WP PV ARRAY
 - 1 HECTARE ORCHARD
- o PV ELECTRIFICATION OF REMOTE FRAMHOUSE
 - 1 KWP PV SYSTEM, 3 DAYS BATTERY STORAGE
 - 240 V, 50 HZ

VILLAGE APPLICATIONS

- o CENTRAL PV ELECTRICAL SYSTEM
 - 10 KWP PV ARRAY, 3 DAYS BATTERY STORAGE
 - 240 V, 50 HZ
 - WATER PUMPING, LIGHTS, REFRIGERATORS, TVs
- o SOLAR HEATING SYSTEMS FOR VILLAGE CLINIC
 - HOT WATER FOR CLOTHES, DISHWASHING & PERSONAL HYGIENE
 - HOT AIR FOR NURSE'S QUARTERS AND PATIENT EXAMINING ROOM





Tunisia

- International boundary
- - - Governorate boundary
- ⊙ National capital
- ⊙ Governorate capital
- Standard-gage railroad
- Narrow-gage railroad
- Surfaced road
- - - Unsurfaced road
- ✈ Airfield
- ↓ Major port

Populated places
 Tunisia has a population over 500 000
 ● 50 000 to 100 000
 ○ 20 000 to 50 000
 • Under 20 000

Scale 1:1,650,000



FIGURE 1

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