6222

Sandia Laboratories
Solar Energy

1267

SOLAR THERMAL DISTRIBUTED RECEIVER
TECHNOLOGY DEVELOPMENT AND
APPLICATIONS PROJECT

DECEMBER, 1983 AND JANUARY, 1984

TECHNICAL STATUS

REPORT

SANDIA NATIONAL LABORATORIES
ALBUQUERQUE, NEW MEXICO
EDITED BY: J. A. LEONARD

December 1983 and January, 1984
HIGHLIGHTS

Project Management

The Fifth Annual Parabolic Dish Conference held by JPL and attended by SNLA provided an excellent transition opportunity for SNLA to become better acquainted with the dish community.

The Distributed Receiver Multiyear Program Plan and FY84 Annual Operating Plan were published.

Distributed Receiver Technology Development

A Sandia contract was placed with Barber-Nichols for 200 additional hours hot test on the Organic Rankine Engine.

The principal stresses in a stretched membrane were analyzed. The concentrator optical analysis code for parabolic dish analysis is operational.

The Closed Loop Energy Analysis project CO_2/CH_4 reforming cycle project plan was reviewed and initiated.

Construction of the foundation for TBC-1 was initiated and the TBC-1 structure was assembled.

Distributed Receiver Evaluation

The new stainless steel tubing on each Shenandoah collector was installed and insulation started.

Acurex representatives visited the MISR site and examined mirrors that had cracked. Acurex attributes the cracking to improper installation.

A contract was placed with Foster Wheeler for two rotary joints for use with high pressure water at MISR.

The SKI-MISR steam skid has been shipped to Yuma under a six month loan agreement for initial operation of a commercially sponsored SKI system.

The Program Opportunity Notice for the Small Community Solar Experiments at Molokai, Hawaii, and Osage City, Kansas were issued by DOE/AL and a pre-proposal conference was held. SNLA provides technical and mechanical support to DOE/AL on this effort.

Solar Concentrator Technology Development

The Innovative Concentrator Program Opportunity Notice was issued by DOE/AL. SNLA provides technical and management support to DOE/AL for this effort.

DOE/HQ, SERI, and SNLA representatives met at Sandia on January 24, 1984 for initial exchanges on future concentrator development needs.

PUBLICATIONS

R. W. Hunke, Ed. "Multiyear Program Plan Solar Thermal Distributed Receiver Development Project," SAND83-2025, November 1983.

R. W. Hunke, "FY 1984 Annual Operating Plan Solar Thermal Distributed Receiver Technology and Applications Project," SAND83-1600, January 1984.

PRESENTATIONS

J. A. Leonard, "Future Dish Project Activities," Fifth Annual Parabolic Dish Conference, Indian Wells, CA, Dec. 5-8, 1983.

C. P. Cameron, "Operational Experience from Solar Thermal Energy Projects," Fifth Annual Parabolic Dish Conference, Indian Wells, CA, Dec. 5-8, 1983.

Sandia Laboratories DISTRIBUTED RECEIVER TECHNOLOGY AND APPLICATIONS PROJECT

Solar Energy

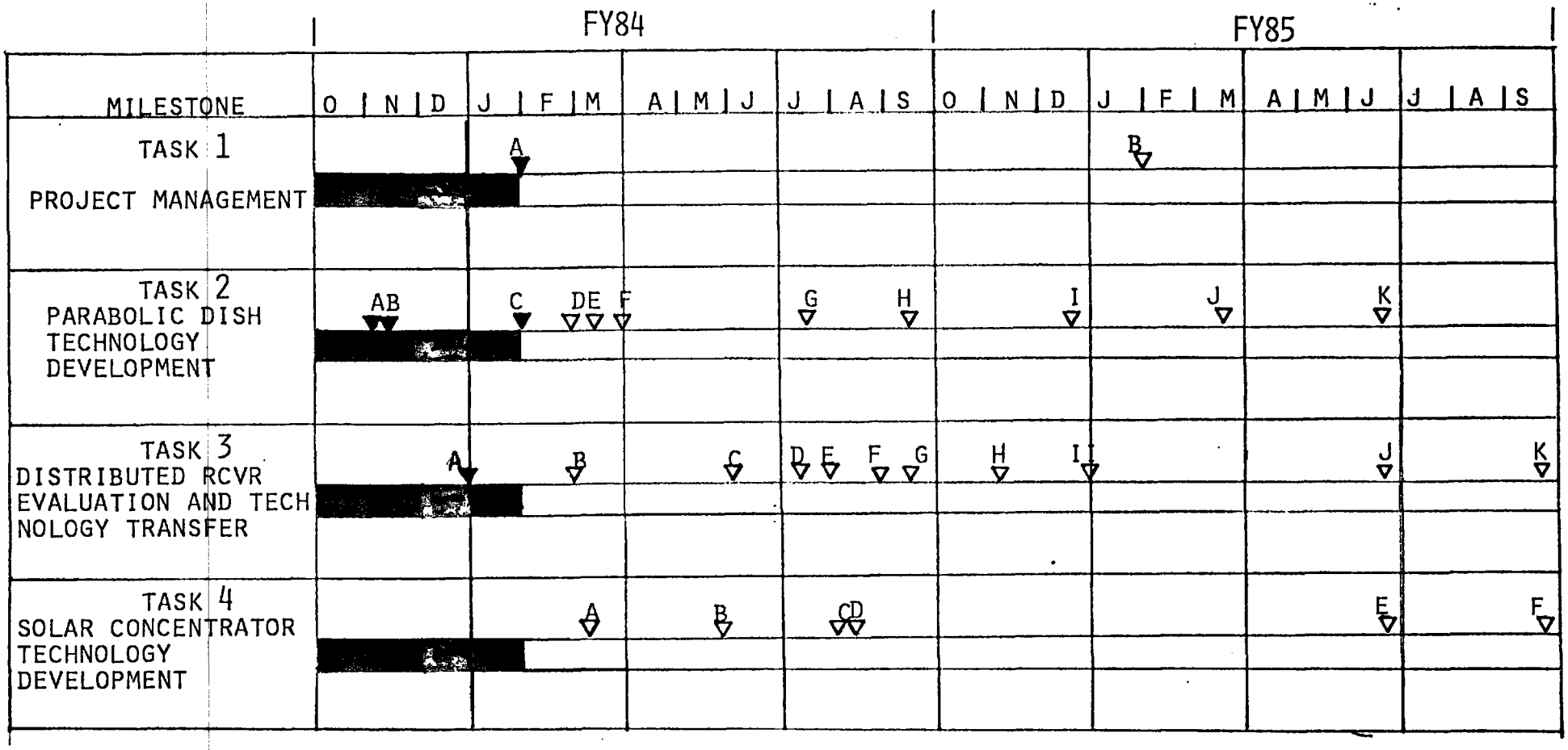

Figure 1

2a.

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TASK 1 - PROJECT MANAGEMENT

A. FY84 AOP (REVISED) PUBLISHED
B. FY85 AOP PUBLISHED

TASK 2 - PARABOLIC DISH TECHNOLOGY DEVELOPMENT

A. PDC-2 DESIGN REVIEW COMPLETED
B. ORC 100-HR TEST COMPLETED
*C. DRTF INTERIM CAPABILITY DESIGNED
D. CHARACTERIZE SABC DISH (LA JET)
*E. THERMAL TRANSPORT TECHNOLOGY REVIEW COMPLETED
F. VANGUARD/STIRLING PERFORMANCE EVALUATION
G. VANGUARD/STIRLING LIFE TESTS COMPLETED
*H. FIRST GENERATION BRAYTON MODULE ASSEMBLED
I. CONCEPTUAL DISH SYSTEM DESIGN FOR FUELS & CHEMICALS APPLICATION COMPLETED
J. INITIATE FABRICATION OF PROTOTYPE 550°C THERMAL RECEIVER
K. PROOF OF CONCEPT TC ENERGY TRANSPORT BASELINE LABORATORY EXPERIMENT COMPLETED.

TASK 3 - DISTRIBUTED REVEIVER EVALUATION & TECHNOLOGY TRANSFER

A. ISSUE SCSE PON
*B. SHENANDOAH DOCUMENTATION COMPLETED
C. CROSBYTON DESIGN REVIEW
D. SCSE CONTRACTS AWARDED
*E. FY83 IPH ANNUAL REPORT
F. MISR TEST & EVALUATION REPORT
*G. MODIFIED MISR INITIAL QUALIFICATION TEST COMPLETED
*H. IPH FIELD TESTS COMPLETED
I. TRANSFER SHENANDOAH STEP TO GEORGIA POWER
J. SHENANDOAH OPERATIONAL REPORT
K. FY84 IPH ANNUAL REPORT

TASK 4 - SOLAR CONCENTRATOR TECHNOLOGY DEVELOPMENT

*A. HELIOSTAT RFP RELEASED
B. CASSEGRAINIAN DISH DESIGN REPORT
*C. HELIOSTAT CONTRACT AWARDED
D. INNOVATIVE CONCENTRATOR CONTRACTS AWARDED
E. INNOVATIVE CONCENTRATOR HARDWARE TESTS INITIATED
F. FABRICATION OF INNOVATIVE HELIOSTAT STARTED

*Controlled Milestone

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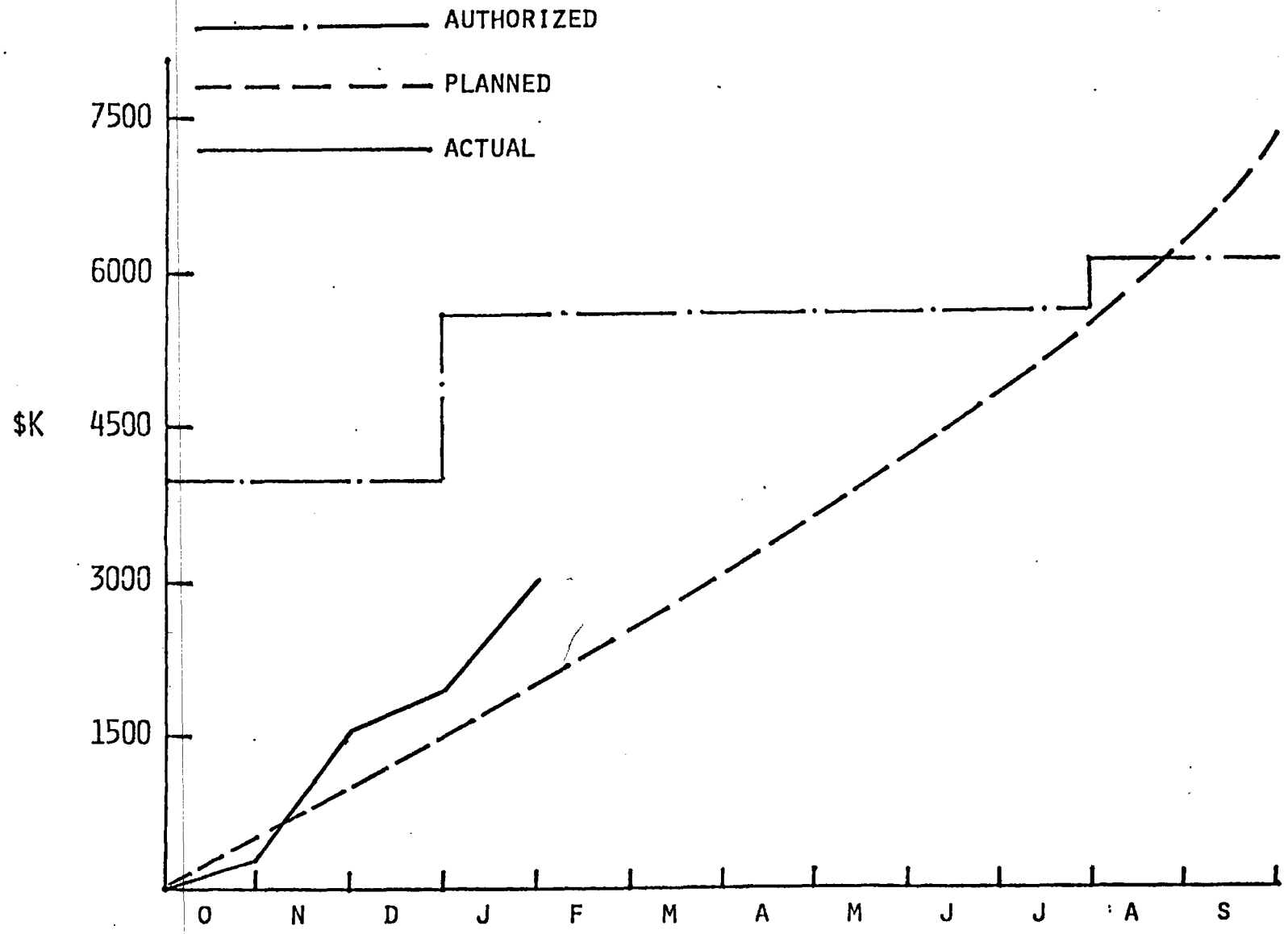
Solar Energy DISTRIBUTED RECEIVER TECHNOLOGY AND APPLICATIONS PROJECT
FY84 BUDGET SUMMARY



1/84

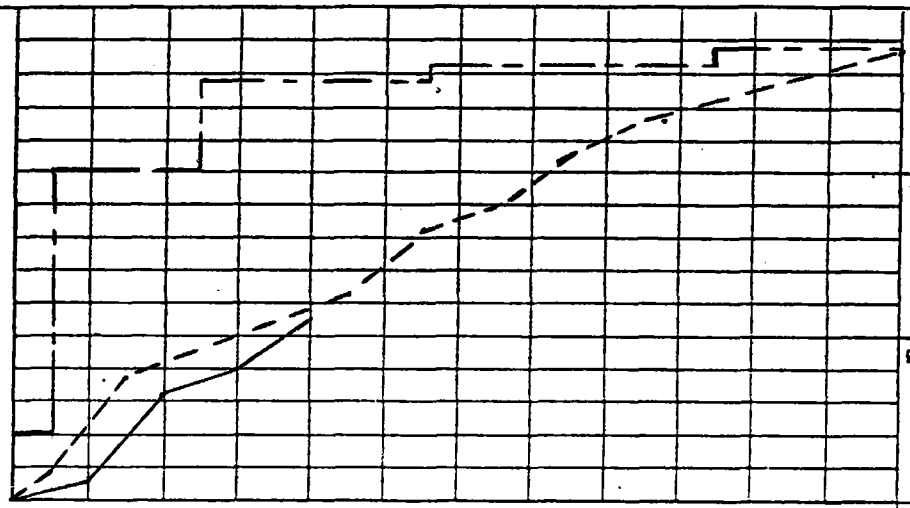
CONTRACT MANAGEMENT SUMMARY REPORT

1. Contract Identification	2. Reporting Period	3. Contract Number
Distributed Receiver Technology and Applications Project	12-1 through 1-31	0650 & 0903
4. Contractor (name and address) Sandia National Laboratories, Div. 6227 Box 5800 Albuquerque, NM 87185	**5. Contract Start Date** 10/83	
	6. Contract Completion Date Continuing	

7. Months	O	N	D	J	F	M	A	M	J	J	A	S	8. FY 84

9.

a. Budget Authority ($K) — Fin.Plan; Act. BA; Planned BA



e. Actual Costs Prior FYs: N/A

f. Planned Costs Prior FYs: N/A

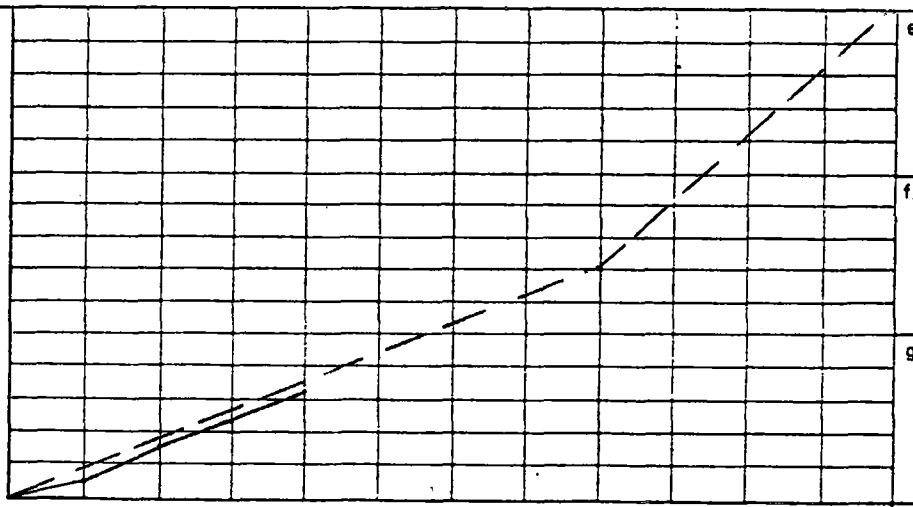
g. Total Estimated Accrued Costs for Contract: N/A

h. Total Contract Value: Continuing

Accrued Costs													
	b. Planned	461	1482	358	898	397	503	356	857	463	358	357	360
	c. Actual	282	1263	454	718								
	d. Variance	(179)	(219)	96	(180)								

10. Manpower Status

a. In-House Manpower (MM)



e. Actual Manpower Prior FYs: N/A

f. Planned Manpower Prior FYs: N/A

g. Total Estimated Manpower for Contract: Continuing

h. Total Contract Manpower

Manpower													
	b. Planned	22	22	22	22	22	22	22	22	50	50	50	51
	c. Actual	14.7	17.2	19.4	21.2								
	d. Variance	(7.3)	(4.8)	(2.6)	(0.8)								

11. Remarks

12. Signature

Number:	2
Date:	February, 1984
Period:	12/1/83 - 1/31/84
B & R Code:	EB-02-01
Project:	Distributed Receiver Technology Development and Applications Project
Title:	Project Management (AOP Task 1)
Contractor:	Sandia National Laboratories, Albuquerque, New Mexico 87185

ACOMPLISHMENTS

1.0 Project management - Resources will be provided to meet the work plan outlined in the AOP. Activities required to meet the project objectives will be identified and progress toward these objectives will be monitored. Budget allocations, manpower needs and milestone monitoring will be administered. Liaison with appropriate DOE offices, laboratories, and other agencies will be maintained to assure that a well integrated, balanced Distributed Receiver Project is conducted.

- The Fifth Annual Parabolic Dish Conference was held in Indian Wells, California on December 5-8, 1983. The conference, which was organized and hosted by JPL, provided an excellent transition opportunity for SNLA and the various private and utility sector participants to become better acquainted. A conference highlight was a field trip to the nearby Advanco Corporation construction site where their Dish/Stirling module was in final checkout. Sandia presentations consisted of "Future Dish Project Activities" by Jim Leonard, Division 6227, and "Operational Experience from Solar Thermal Energy Projects" by Chris Cameron of Div. 6222.

- The Distributed Receiver Project at SNLA was strengthened last month with the addition of three new staff members to Jim Leonard's division. The new people have all transferred from within the Labs. They are Jane Diggs, Kevin Linker, and Jim Muir. Initially, Ms. Diggs will be involved with systems analysis, Mr. Linker with engine modules, and Dr. Muir with energy transport. All three are mechanical engineers.

1.1 Project Report

The Quarterly Project Review was held in Washington on January 10, 11, and 12, 1984.

1.2 Project Planning

The SNLA FY84 AOP and the Distributed Receiver MYPP which was developed last spring/summer with input from SNLA, JPL, and ALO were published as limited distribution "SAND" reports (see "Publications".

Comments were submitted to DOE/HQ through the TPI on the control milestone list. Suggestions were made regarding the order of the milestones and the assignments of responsibility.

TECHNICAL APPROACH OR WORK PLAN CHANGES

A financial plan change for $129K on EB-10 was received in January 1984 for the purpose of providing "technical monitoring" to the FMDF development contract between DOE and Texas Tech University. Due to the press of adding manpower to the solar project staff to accommodate the dish program, it will not be possible or appropriate to add manpower specifically to support this effort. Ad hoc support at about the level provided for the last two years will be absorbed within the existing staff.

VARIANCES

None

OPEN ITEMS

The SNLA financial plan for FY84 is short by $190K. It is our understanding that these funds will be furnished soon and that DOE/HQ is trying to get capital equipment money reprogrammed for this purpose.

FORECAST FOR NEXT REPORTING PERIOD

The FY85 AOP activities will be initiated.

Two or three additional staff members will join the Distributed Receiver project.

Another attempt at a Solar Thermal MYPP will be undertaken.

The next Quarterly Review is scheduled for March 27-29, 1984. SNLA participation will feature a technical presentation on chemical energy transport.

Number:	2
Date:	February, 1984
Period:	12/1/83 - 1/31/84
B & R Code:	EB-02-01
Project:	Distributed Receiver Technology Development and Applications Project
Title:	Distributed Receiver Technology Development (AOP Task 2)
Contractor:	Sandia National Laboratories, Albuquerque, New Mexico 87185

Accomplishments

2.0 DISTRIBUTED RECEIVER TECHNOLOGY DEVELOPMENT - The parabolic dish potentially has the highest energy collection capability of any distributed receiver system. The high concentration ratio reduces receiver area and thermal losses and two-axis tracking eliminates the cosine effect losses and provides a constant all day efficiency. This task seeks in the long term to provide a parabolic dish solar thermal capability in excess of 1200°C for process heat applications and with emphasis on industrial process heat, including fuels and chemicals production, electrical power, and cogeneration.

Three members of the Texas Tech staff visited Sandia on January 25, 1984 to discuss technical aspects of their procurement of replacement reflector panels for the Crosbyton bowl, and of a development effort on reflector panels for the larger (200 ft. diameter) bowl design. Sandia personnel reviewed our experience with glass/silver mirrors and several trough and dish applications.

2.1 Systems Engineering and Analysis

- A stress testing analysis was conducted at SNLA to determine the principal stresses of a parabolic membrane. it was determined that the tagential stress is approximately twice that of radial stress. These results indicate that a point focus collector might be more efficiently designed of rings than of petals. A "ring" type collector design is being evaluated.
- The DOE-developed solar ray trace code, "Concentrator Optical Performance Software (COPS)" was installed on one of SNLA's computers on January 6, 1984. This code will be used to conduct parabolic dish optimization studies.

- An analysis has been completed to determine optimum dish size for a dish/electric module. using the subatmospheric Brayton cycle engine (SABC) projected cost and Sanders Associates' projected receiver cost, along with projected parabolic dish antenna cost from RMI, the minimum cost module appears to be in the 14m to 16m diameter dish size. this is slightly larger than current dishes. For thermal energy use, since the cost of the engine is deleted, the minimum cost size is in the range of 12m to 14 m diameter.

2.2 Energy Transport and Storage

- Significant progress has been made in the planning of tasks to investigate the susceptibility of metals to high temperature corrosion and degradation in an SO_2/SO_3 environment. Two tasks will be undertaken in-house by support organizations in the Materials Group. One will address corrosion aspects and the other will address metallurgical aspects such as susceptibility to crack growth and creep fatigue.

  We also reviewed the plan of study for the Closed Loop Efficiency Analysis (CLEA) project to be undertaken by the Process Research Division in support of thermochemical transport for the dish program. CLEA will be supported by extensive laboratory experiments with the CO_2/CH_4 reforming cycle, as well as data forthcoming from the lab work on the SO_2/SO_3 system which we are currently sponsoring at New Mexico State University.

  Following discussions with DOE/HQ in January, we initiated the planning and coordination of a workshop on thermochemical transport being planned for March 6 and 7 at SNLA.

  We plan through the Chemical Transport Workshop mentioned above to solicit a critical evaluation of our efforts in thermochemical transport in order to provide a stronger direction for this work. Also, similarities, differences, and insights and problems in common between chemical transport and fuels and chemicals production should be identified to the benefit of both projects.

2.3 Receiver Development

No specific activities are scheduled in FY84.

2.4 Controls development

No specific activities are scheduled in FY84.

2.5 Distributed Receiver Test Facilities

- Phase A of the design of the DRTF has been completed and construction is underway. Phase A includes the grading and the foundation for TBC-1. The ninety percent design review for Phase B of the design was held at Black and Veatch. Phase B includes the foundations for the LaJet and Shenandoah collectors, the modifications to building 9981 to create control room space, the circulating water system, electric power, and instrumentation cable trays. Reassembly of the parabolic dish structure of TBC-1 has been completed and the tube matrix has been installed and aligned.

2.6 Engine Development for Dish-Electric

Continuing our assessment of candidate advanced heat engines, our attention during this period turned to direct conversion thermochemical heat engines. We have, in conjunction with the Storage Batteries, Division and the Eletromechanical Subsystems Department, evaluated all the published information on a Sodium Heat Engine (SHE) which Ford Motor Company has patented and experimented with for several years. This is a very promising but immature laboratory device which the Ford people admit needs much engineering to become a useful engine. The basic concept has been verified, its potential estimated, and some problems identified.

- A draft Working Agreement between Gas Research Institute and Sandia has been tentatively approved by GRI. GRI will transfer title to Sandia for the two subatmospheric Brayton cycle engines which are planned for use by Sanders Associates in their dish module development. It is anticipated this agreement will be finalized by April 1, 1984.

- A Sandia/Sanders Associates contract to continue the Dish/Brayton engine module development was to have been in place by February 1, 1984. This did not occur; a recent audit at Sanders resulted in a lower overhead rate and this allowed the JPL funding to extend their development until February 10, 1984. Every effort is being made to have the Sandia contract in place at this time.

- Sandia awarded Barber-Nichols a contract to conduct an additional 200 hours of hot operation testing on the Organic Rankine Cycle Engine. The procedure for testing was discussed with them on January 20, 1984. The recommendations of the DOE/AL Turbine-Alternator Pump Committee will be followed. New bearings are to be incorporated before this test begins. To insure that the bearings are of good quality, Sandia will conduct ultrasonic tests on them for Barber-Nichols. Testing off the engine is expected to begin the week of February 20, 1984.

TECHNICAL APPROACH OR WORK PLAN CHANGES

None

Variances

The SNLA contract was not in place at Sanders Associates on February 1, 1984. Due to a reduced spending rate at Sanders, the JPL contract will carry them until February 10, 1984.

Open Items

None

FORECAST FOR NEXT REPORTING PERIOD

ORC hot testing under the SNLA contract at Barber-Nichols will be completed, or nearly so, by April 1, 1984.

The Cooperative Agreement between SNLA and Gas Research Institute will be in place.

THE SNLA letter contract with Sanders Associates for SABC module development will be awarded.

Material transfer from JPL to DOE and then to SNLA will be completed for Sanders Associates material and Barber-Nichols material.

J. Fox's Contractor Report on Thermochemical Energy Transport Systems Study is expected to be published.

A workshop on thermochemical transport will be held at Sandia Albuquerque to allow different experts in this field a chance to scrutinize our current efforts and should provide useful input and guidance for our work in this area.

Reassembly, installation, and checkout of TBC-1 will be completed. Phase B construction will be about fifty percent complete if delivery schedules can be held for several critical items.

PROBLEM AREAS

None

Number:	2
Date:	February, 1984
Period:	12/1/83 - 1/31/84
B & R Code:	EB-02-01
Project:	Distributed Receiver Technology Development and Applications Project
Title:	Distributed Receiver Evaluation and Technology Transfer (AOP Task 3)
Contractor:	Sandia National Laboratories, Albuquerque, New Mexico 87185

ACCOMPLISHMENTS

3.0 DISTRIBUTED RECEIVER EVALUATION AND TECHNOLOGY TRANSFER - This activity includes the technical management support and long term evaluation of existing field projects including the Shenandoah Solar Total Energy Project (STEP) and the Industrial Process Heat Projects; the completion of the MSR project and its follow-on system improvement developments; the Small Community Solar Experiments; the continued testing of privately-developed line-focus R & D in high-risk, high-payoff areas of technology, and the availability of a cadre of knowledgable personnel in line-focus technology to provide continuing technical advisory support to private sector developers.

3.1 Shenandoah Evaluation

- The tubing between the two flex joints which have the most corrosion have been replaced throughout the Shenandoah STEP solar collector field and the insulating materials are on site. The tubing was pressure tested at a temperature greater than 400^{o}F. The removal of the insulation, removal of corroded tubing, and installation of the new stainless steel tubing was accomplished during the week of January 13, 1984.

- The new version 4.1 system level software for the Control and Instrumentation Subsystem (CAIS) was installed by representatives of Digital Equipment Corporation. Two major problems were discovered by Digital; (1) a bad processor board in the central processing unit, and (2) a hardware/software incompatibility problem on writing to the magnetic tape during real time recording.

- Because of CAIS problems and a leaking bypass steam valve, operation of the plant was minimal and only occurred on four days during December and January. During this period 3519 kWh were generated and 19,145 pounds of process steam provided to the Bleyle plant. Two additional days of process steam were provided when Bleyle's boiler feed pump froze and broke when operation was attempted.

- The Test Operating Plan which is being written by ETEC has been reviewed several times and is being corrected before publication. The plan should be available by mid-February.

- The average direct normal insolation recorded at STEP during the reporting period was low both in December and January.

	Average (Btu/ft2/day)	Solar Model Year (Btu/ft2/day)
December	324	1163
January	461	926

3.2 Industrial Process heat

Reports attached.

3.3 Modular Industrial Solar Retrofit (MISR)

Acurex

Life cycling of the Acurex system was interrupted by failures of the bearings in the HTF pump motor. A replacement bearing set was installed but failed shortly because it had not been adequately lubricated at time of installation. A set of sealed bearings was then installed, but these have not yet been replaced. We will attempt to determine the reason for the premature failure of these bearings. We plan to purchase replacement bearings which can be lubricated through grease fittings on the motor.

John Schaeffer of Acurex visited the MISR site and performed some maintenance on the qualification test system. Several months ago, a technician from Acurex installed new mirrors throughout the QTS. It was later observed that some mirrors did not fully conform to the shape of the collector ribs and that some of the edges clamps were not tight. Mr. Schaeffer determined that some of the mirrors were contacting and overriding the steel backsheet of the adjacent mirror and as a result could not be fully clamped into position. He believes that improper installation has also caused cracks in the six mirrors which have them. No delamination has been observed among the panels which have three mirrors per panel. Acurex is also developing sagged glass for their collector and propose to install some on their MISR QTS.

We have observed intermittent operation of the tracking system in the Acurex QTS. At times, only one of the four drive groups has been tracking normally. Group one frequently oscillates in position between focus and the directed tracking position as determined by the STAR (Solar Tracking Angle Reference). Other groups also mis-track from time to time. We have consulted with Acurex about these problems, but we have not had sufficient time available to diagnose the specific problems. Acurex apparently has few is any spare parts for this tracking system and has decided to completely redesign the tracking system to improve its reliability. At the present time, they expect to continue to use the solar angle tracking reference (STAR) concept with a hybrid system incorporating rough directed tracking and a tracker head for fine tracking; however, the traker head will be much smaller than the current unit. The present system was designed under the DOE mass producible initiative.

BDM

A flexible hose which is part of a rotary joint assembly installed by BDM on the Acurex QTS has failed. The flexible hose connects the rotary joint to the stationary piping manifold and allows for the differential expansion of the collector structure relative to the manifold. It is connected through an elbow to an Aeroquip rotary joint and, by its resistance to flexing, must absorb the torque introduced by the friction in the rotary joint. The friction in this joint seems higher than when originally installed and is considerably higher than that of the other Aeroquip joint in the system or that of the Deublein joints. This stress could be eliminated by adding a mechanical restraint to the system to transfer the rotational force, and we intend to add such a restraint when we replace the flexible hose. However, we have also observed that there is insufficient clearance between the rotary joint mount and the collector pylon at very cold temperatures. Some of the bolts which support the joint have been bent by being rotated against the collector pylon. This may have caused the joint to be forced out of alignment, and thus caused the failure of the hose by increasing the rotational friction in the joint.

Custom Engineering

Tests of the CEI system at operating temperature show immeasurable difference between the performance of troughs equipped with sol-gel treated anti-reflective glazing and those with AR glazing prepared with the Corning etch process. There was some concern that the anti-reflective sol-gel coating might degrade when exposed to moisture, but laboratory measurements of the transmitivity of the the glazings after more than three months of operation show no measurable change.

Life cycling of the CEI system is now underway. One drive group was occasionally stopping at the north horizon and not returning until its manual controls were operated; however, after a check-out of the system, including removing and reinstalling a number of connectors, the problem has not recurred. A life cycle is completed about every twenty minutes.

Foster Wheeler

A contract was awarded to Foster Wheeler for design, procurement, and installation of two rotary joints suitable for use with high pressure water. They have initiated procurement of the rotary joints and have performed the design of the balance of the assemblies. The design includes two flexible hoses for each joint and a moment restrictor to prevent stress in the flexible hoses from rotational friction in the joint.

Solar Kinetics

Solar Kinetics has disconnected their steam skid and shipped it to Yuma, Arizona for temporary use during initial operation of a privately-funded industrial process heat system at the Mid--American Yarn Mills. A loan agreement between Sandia and SKI has been executed which provides for loan of the skid for up to six months. A valve has been ordered for installation in the heater piping between the SKI and CEI systems so that the SKI collectors may be operated from the CEI skid during the loan period.

MAINTENANCE HOURS SUMMARY

	BDM		ACUREX		SKI***		CEI	
	SKID	COLL*	SKID	COLL*	SKID	COLL*	SKID	COLL*
DECEMBER	0.5	0	6.1	0	0	0	0	0
JANUARY	0	0	2.0	2	0	0	0	1

* Average hours of maintenance normalized to one drive group. Manufacturer supplied parts unless otherwise noted.

** HTF pump bearings replaced. $21 parts.

*** SKI was not operated during December or January.

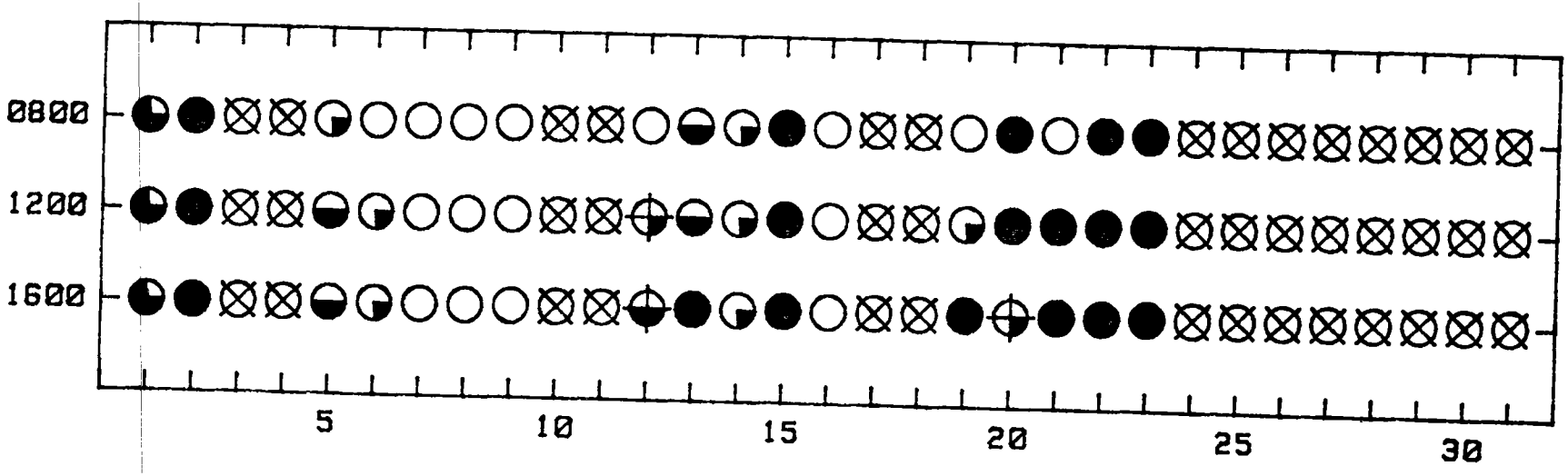
LIFE CYCLE SUMMARY

	BDM	ACUREX		SKI	CEI	FOSTER WHEELER		
		HOSES	ROT JNTS			ROT JNTS	HOSES	COLL
PRIOR MONTHS	875*	3156	1158	0	6	1161**	339	1500
DECEMBER	0	129	129	0	0	0	0	0
JANUARY	0	412	412	0	701	0	0	0
TOTAL	875	3697	1699	0	707	1161	339	1500

* Life cycling suspended due to flexible hose failures

** Life cycling suspended pending installation of new rotary joints; at that time, it will be continued with two rotary joints and two flexible hoses.

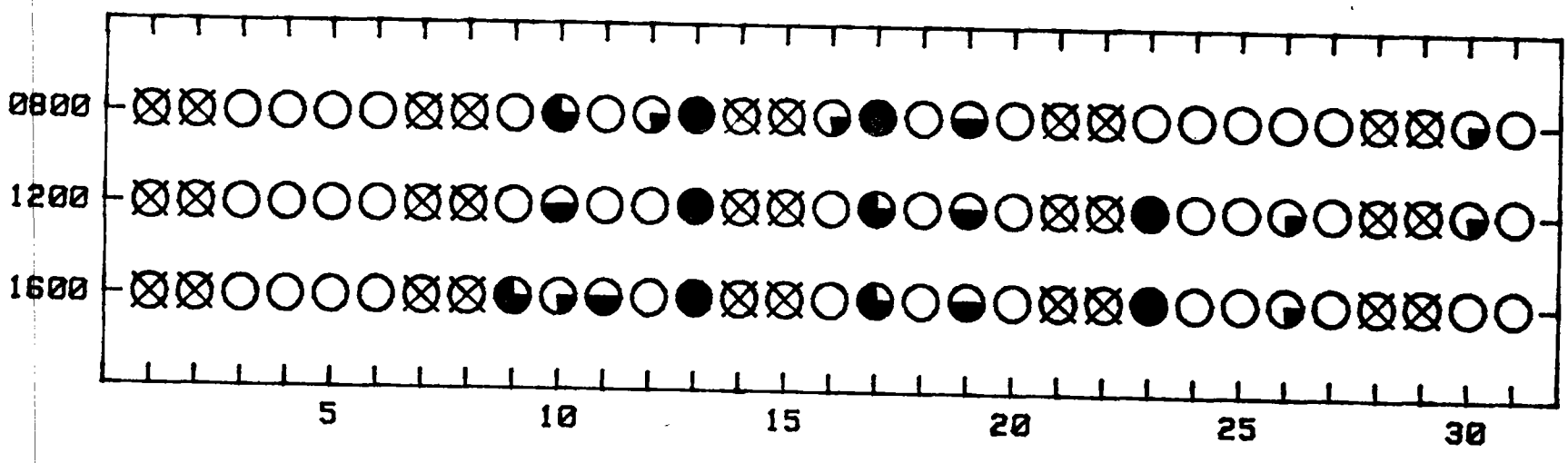
MISR SITE WEATHER DATA
DECEMBER 1983



KEY

- ○ CLEAR
- ◔ MOSTLY CLEAR
- ◒ PARTLY CLOUDY
- ◕ MOSTLY CLOUDY
- ● CLOUDY
- ⊕ HIGH WINDS
- ⊠ TEST SITE NOT MANNED

MISR SITE WEATHER DATA
JANUARY, 1984



KEY

- ○ CLEAR
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- ◒ PARTLY CLOUDY
- ◕ MOSTLY CLOUDY
- ● CLOUDY
- ⊕ HIGH WINDS
- ⊠ TEST SITE NOT MANNED

3.4 Dish Electric Field Experiment Support - Two Small Community Solar Experiments (SCSE's) are planned for evaluation of solar electric 100 kWe plants in a small community environment. The DOE has selected Osage City, Kansas and Molokai Island, Hawaii as sites for these experiments. Each SCSE will use point-focus concentrators and heat engines. new development of components and subsystems is not envisioned as part of the SCSE's. A competitive solicitation for proposals was issued for the DOE/AL in FY1984. SNLA will provide technical and management support to DOE/AL for these projects.

- Proposal receipt of the SCSE PON by DOE/AL has been extended to February 29, 1984. Proposal formal evaluation will commence on March 5, rather than as earlier scheduled.

- The Program Opportunity Notice (PON) was issued by DOE/AL on December 30, 1983. In preparation of the PON, the work scope and system specification was prepared and subsequently modified for support of both the Osage City, Kansas and Molokai, Hawaii installations. Technical support was provided to DOE/AL at a pre-proposal conference on the SCSE's. Answers to questions were provided, and written responses were provided to DOE/AL for their formal response to all attendees.

3.5 Technology Transfer

- In response to suggestions made by the DOE/HQ staff at the January Quarterly Review meeting, a study has been initiated to identify areas in which further trough development or other aspects of DOE assistance would help to make trough systems economically compe- titive sooner (or more certainly) than under the present program.

TECHNICAL APPROACH OR WORK PLAN CHANGES

None

VARIANCES

Open items

None

FORECAST FOR NEXT REPORTING PERIOD

Technical review and evaluation of proposals for the SCSE's will be star- ted and completed.

Discussion on the work scope for the site for the DOE/AL Cooperative Agreement will be held with Osage City representatives and a definitive work scope will be completed.

The insulation of the solar collector tubing installed on the Shenandoah STEP should be completed.

Testing per the Shenandoah STEP Test Operating Plan will be in full swing.

MISR

Life cycle testing of the Acurex qualification test system will continue.

Performance measurements at operating temperatures will continue for both the FEK-244 and silver film reflective surfaces.

Life cycle testing of the Custom Engineering qualification test system will continue.

Foster Wheeler will procure two rotary joints and install them in their qualification test system at SERI.

Efficiency measurements on the Solar Kinetics 160 ft. drive group will be initiated.

Number: 2
Date: February 1984
Period: 12/1/83 - 01/31/84
BR Code: EB 0201

PROJECT

Title: Solar IPH Projects (AOP Task 3)

CONTRACT
Number: --
Start Date: 1977
Completion Date: Continuing
Contractor: Sandia National Laboratories, Albuquerque, NM 87185

ACCOMPLISHMENTS

3.0 Solar IPH Project

Objective--The objective of the solar IPH project is to evaluate the technical feasibility of solar thermal energy for industrial process heat applications. For this project, Sandia provides technical and administrative support to DOE/ALO who manages a group of experiments that are currently in the operational phase. The task provides a focal point for reporting system performance and operation and maintenance (O&M) data for the IPH experiments.

- Project summaries reporting physical characteristics, system performance, and O&M data are included with this report. Four DOE supported Phase III projects are operational and are routinely producing energy for their respective industrial participants. One project, Lone Star Brewery, is non-operational while it is being converted from a high-temperature system using an organic heat transfer fluid to a low-temperature water system. A summary of activities at each site during December 1983 and January 1984 follows, along with information concerning owner operated systems formerly supported by DOE under the solar IPH program.

- Site Activities (DOE Supported)

  Caterpillar Tractor Co., San Leandro, CA (SWRI)

  The solar IPH system at Caterpillar Tractor Co., San Leandro, California, began operating at full capacity during December. Through the summer only 1/3 of the collector field was needed to meet the energy demand from the Caterpillar plant, which was on a reduced production schedule. During the winter months, the full collector field, which is oriented north-south, is required to meet the reduced energy demand of the plant. Weather limited operation of the system during December, and only minor proglems were encountered. New hydraulic circuit components were installed and two drive rows were taken out of service, pending checkout of those new components.

The system continued to operate throughout January with no significant problems. Instrumentation was recalibrated, and the new hydraulic circuit components were checked out, returning all drive rows to service during the month.

Dow Chemical Co., Dalton, GA (Foster-Wheeler Development Co.)

The solar IPH system at Dow Chemical Co., continued to operate well in December. However, early in the month, a number of heat-transfer fluid leaks developed in the piping and a flex hose failed. Three rows were shut down until repair of the leaks on December 15. The flex hose was replaced from available spares. The pyrheliometer tracker also failed, hence, insolation data could not be recorded during the month. The system was in service throughout January with some tracking problems being experienced due to failures in two control boards. Evidence of deterioration of the pump seal was detected, and replacement of the seal will be required in the near future. The pyrheliometer tracker is still at the manufacturer for repair.

Lone Star Brewery, San Antonio, TX (SWRI)

The solar industrial process steam system at the Lone Star Brewery is being modified to a boiler water preheat system. The changes will result in a more reliable and efficient system since the maximum operating temperature of the solar energy system will be reduced from approximately 425°F to 275°F. This modification will also allow removal of the collector loop heat transfer oil that attacks the tar roof when it leaks from the collector field. The modifications include removal of the existing boiler and collector loop pump and installation of a new water-to-water heat exchanger and two new pumps. Modifications to the piping and controls are required in the change. Also, the collector hydraulic drives will be modified.

During December, the solar energy system instrumentation was removed and recalibration was initiated. Parts and equipment orders for the upgrade were also placed, and flex hoses were installed.

Work on the repiping tasks was begun in January. The start of other upgrade activities is dependent upon the receipt of parts and long-lead-time items such as the heat exchanger.

Southern Union Oil Refining Co., Lovington, NM (Energetics)

Upgrade of the receivers was completed by mid-December for the IPH system at Southern Union Refining Company, Lovington, New Mexico. The upgrade consisted of (1) replacing the receiver support brackets with brackets of a new design to prevent glass breakage, (2) replacing broken glass jackets on about 25% of the field, and (3) removing spiral ribbons from the receiver tubes. The spiral ribbons were originally used to

provide better heat transfer characteristics. Because their effect was negligible, they have been removed to reduce the pressure drop in the system.

When collectors damaged by wind were replaced, new receiver support brackets were installed on one drive string on a trial basis while the original brackets were used on an adjacent drive string. Four out of 12 glass tubes subsequently broke on the installation using the original brackets while none have broken on the installation using new brackets.

Continuing upgrade activities include: (1) rework of hydraulic drives, (2) procurement of spare flex hoses, and (3) installation of search-mode trackers.

During the cold weather in December, the feedwater line to the IPH system froze causing minor damage. The system was put back into operation in January after repairs to the feedwater line. Operation during December was limited to six days. During January, the system was down 15 days due to a combination of bad weather and the freezing of the feedwater line. On 5 days, an operator was not available, and steam was produced on 5 of the remaining 11 days. The system was checked out in detail to detect any problems resulting from the recent upgrade modifications.

The system is showing new highs in energy production because of replacement of broken receiver tube pyrex jackets, piping changes, and days of high insolation. The system has produced hourly averages of 1450 lbs/hr in contrast to 1200 lbs/hr maximums produced previous to the modifications.

U.S.S. Chemical Co., Haverhill, OH (Columbia Gas Service)

The solar IPH system at U.S.S. Chemical Company continues to operate well and was in service during December and January. Operational data for the two month period is not yet available.

Columbia Gas Service obtained cost estimates for new flex hoses and spare parts in response to a request for a new proposal. The proposal was received in early January, requesting funds for a new Solar Kinetics Inc. flex hose with all stainless steel parts and ceramic felt insulation. The contract modification to permit procurement of spare parts and the new flex hoses was completed in late January and sent to Columbia Gas Service for signature.

- Site Acitivities (Owner Systems)

Campbell Soup, Sacramento, CA (Acurex)

The solar energy system continues to function well. However, energy production was low during December and January because of poor weather conditions.

The Autodata 10 Data Acquisition System recently repaired by Acurex operated satisfactorily in December but behaved erratically during January. Acurex is being contacted to assess the problem.

A service agreement for continued reporting and for spare parts procurement is being finalized.

Capitol Concrete Products, Topeka, KS

The solar IPH system at Capitol Concrete Products, Topeka, Kansas, has been shut down since November 23, 1983 because of failure of the system controller. The controller was sent to Power Kinetics, the manufacturer, for repair. Repairs have been completed, but PKI is upgrading the controller with heavier duty components to prevent a similar failure in the future.

Georgia Power, Atlanta, GA (Herry/Jacobs Engineering)

The solar energy system at the Georgia Power Office Building in Atlanta, Georgia sustained major damage during the recent cold weather. The freeze protection system failed as a result of a valve malfunction and a large number of collectors were damaged. Damage to receiver tubes and flex hose connections was sustained on about 377 of the 1482 collectors. Two of the six collector groups have been made operational at the Georgia Power Office Building solar Project. Repair of the damaged receiver tubes has been initiated at the Forest Park, Georgia, facility. About 30 serviceable receiver tubes were obtained from the Home Laundry project. Several flex hoses were also damaged and have been replaced. Joe Sitz, Maintenance Manager at the project, has indicated that a schedule to startup and checkout the entire system by April 1 is being pursued.

Herry and Jacobs Engineering have fulfilled their contractual obligations, and the project was formally turned over to Georgia Power on January 3, 1983. ETEC has awarded a service contract for continued monitoring and reporting by Georgia Power through FY 1984.

Home Laundry, Pasadena, CA (Jacobs Engineering)

Opportunities for moving or using the solar equipment from the IPH system at Home Laundry in Pasadena, California have not materialized. Therefore, Jacobs engineering engaged a salvage company to remove the system. A small portion of the equipment will be retained by Jacobs as spare parts to support their four-year warranty of the system at the Georgia Power office building in Atlanta.

Johnson & Johnson, Sherman, TX

The solar project has been shut down for the winter months with restart scheduled for mid-March. The reporting service agreement has been modified to include funding for spare parts.

Lamanuzzi and Pantaleo, Fresno, CA (California Polytechnic State University)

A modification to the service agreement authorizes Ed Carnegie at Cal-Poly to purchase spare parts for the L&P Solar Project. Repairs to the storage tank have been completed, and startup and checkout of the system will be performed as soon as weather permits.

Riegel Textile Corp., La France, SC (SWRI)

All items on the acceptance test punch list have been corrected with the exception of the hose replacement. The supplier furnished the wrong size and will deliver the correct size by mid-February. Hose replacement and SWRI checkout of contractor work should be completed in February and final inspection by ETEC in March. A service agreement for monitoring and reporting activity at the Riegel project has been awarded to Conservation and Resource Recovery Engineering (CARRE, Inc.) in Seneca, SC. CARRE is familiar with the project and has previously performed monitoring and maintenance functions at Riegel when the project was managed by General Electric Company.

Veterans Administration Medical Center, Albuquerque, NM (Jacobs Engineering)

The system is operating well, but steam production is reduced because of the low sun angle during the winter months. Jacobs Engineering will make their final presentation on March 8. Future disposition of the system will be made after review and evaluation of the Jacobs report.

York Building Products, Harrisburg, PA (AAI)

The system continues to operate on a reduced level with one of the seven collector strings isolated. The contract for monitoring and reporting and for establishing a stock of spare parts has been finalized by ETEC. A schedule for upgrading and checkout of the system is being prepared.

OPEN ITEMS

Open IPH project activities include:

(1) completing the final report for Ore-Ida by TRW, and (2) completing the final report for the Home Laundry IPH experiment by Jacobs Engineering.

PROJECT DESCRIPTION AND STATUS

Table 1 provides a physical description of each project and Table 2 the current status.

PERFORMANCE

Performance of solar IPH projects is summarized in this section for those projects that are currently operating under DOE funding. For these projects, data is collected and reported monthly to DOE in accordance with contractual requirements that specify a special SERI format.* Monthly totals from the contractors reports are reported in this section so that readers may follow current energy production from the projects. Both long-term (Tables 3 and 4) and short-term (Clearday, Table 5) performance is summarized. Reliability of the solar energy equipment and the operational efficiency of a particular application are determined by the portion of available solar energy that is converted to useful thermal energy over the long term. Hence, long-term energy production is of prime interest.

Long-term performance is compared with theoretical performance (Tables 6 and 7) to give the reader a better understanding of what might be expected in the way of energy production at each location. Theoretical performance was calculated by SERI using their SOLIPH code and Typical Meteorological Year (TMY) weather data. Actual weather conditions might vary plus or minus 10% from the TMY data. To compensate for this variation, the theoretical values used in this report for energy delivered have been adjusted by multiplying them by the ratio of the measured energy in the plane of the collector to the theoretical energy in the plane of the collector. (Efficiencies are based on energy in the plane of the collector.) Another variation between measured and theoretical insolation results from the location of the instrumentation. At some of the sites, insolation in the plane of the collector is measured by pyranometers mounted on the collectors and is measured only when the collectors are in focus. TMY data provides statistically derived insolation from sunrise to sunset. This is one reason why the theoretical values are, in general, significantly

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* SERI/MR-632-714, "Monthly Reporting Requirements for Solar Industrial Process Heat Field Tests", C. f. Kutscher and R. L. Davenport, September 1980.

TABLE 1

PHYSICAL CHARACTERISTICS
IPH SOLAR PROJECTS SUMMARY

PROJECT	COLLECTOR TYPE	COLLECTOR AREA m^2	HEAT TRANSFER FLUID	COLLECTOR FLUID TEMPERATURE	STEAM PRESSURE PSI	RATED CAPACITY, STEAM PRODUCTION LB/HR	PERCENT OF TOTAL PLANT LOAD	DESIGN ENERGY DELIVERY MBTU/YR
CAPITOL CONCRETE TOPEKA, KS	Power Kinetics Point focus	80.4	Water	300°F	45	174.5	3.0	100
CATERPILLAR TRACTOR SAN LEANDRO, CA	Solar Kinetics T-700 Parabolic Trough	4682.2	Water	235°F	--	--	60.0	14,000
DOW CHEMICAL CO. DALTON, GA	Suntec/Hexcel Parabolic Trough	922.5	Dowtherm LF	510°F	150	1,500	2.5	2,536
HOME LAUNDRY CO. PASADENA, CA	Jacobs/Del Parabolic Trough	603.5	Water	420°F	110	900	15.0	1,200
LONE STAR BREWERY SAN ANTONIO, TX	Solar Kinetics T-700 Parabolic Trough	877.9	Therminol T-55	425°F	125	1,200	3.4	3,200
ORE-IDA FOODS ONTARIO, OR	Suntec-SH1655/ Hexcell Parabolic Trough	884.4	Water	486°F	300	1,930	1.9	2,700
SOUTHERN UNION REFINING CO. LOVINGTON, NM	Solar Kinetics T-700 Parabolic Trough	936.5	Texatherm	375°F	170	1,800	9.0	3,300
USS CHEMICALS CO. HAVERHILL, OH	Solar Kinetics T-700 Parabolic Trough	4682.3	Therminol 60	425°F	52	10,430	0.5	12,000
CAMPBELL SOUP CO. SACRAMENTO, CA	Western Solar Develop., Flat Plate,, Acurex Parabolic Trough (Upgrade)	371.6 278.7	Water	195°F				180
GILROY FOODS GILROY, CA	GE TC-100 Evacuated tube (Upgrade)	552.8	Water	194°F				2,400
JOHNSON & JOHNSON SHERMAN, TX	Acurex 3001-03 (Coilsak) Parabolic Trough	1068.0	Water	375°F	125	1,200	2.0	1,500
LA COUR KILN CO. CANTON, MS	Flat plate, Chamberlain (Upgrade)	234.1	Water/Air	200°F				
RIEGEL TEXTILE CO. LA FRANCE, SC	Flat plate, Hyperion (Upgrade)	620.6	Water/glycol	100°F			2.0	
YORK BUILDING PRODUCTS MIDDLETOWN, PA	AAI Concentrating Collectors	836.1	Water/glycol				33.3	

TABLE 2

IPH PROGRAM STATUS

PROJECT	PHASE I STARTED	PHASE I COMPLETE	PHASE II COMPLETE	UPGRADE COMPLETE	ACCEPTANCE TEST	END OF CONTRACT	ACTIONS PENDING
CAMPBELL SOUP CO. SACRAMENTO, CA				6/82	7/82	9/82	
CAPITOL CONCRETE TOPEKA, KS	1/81	9/81	5/82		8/82	12/82	
CATERPILLAR TRACTOR SAN LEANDRO, CA	9/79	7/80	11/82		2/83	9/84	
DOW CHEMICAL CO. DALTON, GA	9/78	9/79	1/82		11/81	3/84	
GILROY FOODS GILROY, CA				10/81		9/81	
HOME LAUNDRY CO. PASADENA, CA	9/77	1/81	4/82		4/82	9/83	
JOHNSON & JOHNSON SHERMAN, TX	7/77	12/78	12/79	---	2/80	3/81	
LA COUR KILN CO. CANTON, MS				5/82	5/82	3/82	
LONE STAR BREWERY SAN ANTONIO, TX	9/78	9/79	12/81		1/82	11/84	CONVERSION FROM OIL TO WATER
ORE-IDA FOODS ONTARIO, OR	9/78	7/80	8/81		6/81	3/83	
RIEGEL TEXTILE CO. LA FRANCE, SC				6/83	10/83	8/83	
SOUTHERN UNION REFINING CO. LOVINGTON, NM	9/78	9/79	1/82		1/82	4/84	
USS CHEMICALS CO. HAVERHILL, OH	9/79	11/80	3/82		5/82	7/84	FLEX HOSE REPLACEMENT, AND SPARE PARTS PROCUREMENT

TABLE 3

IPH MONTHLY PERFORMANCE STATUS
FOR NOVEMBER 1983

PROJECT	COLLECTOR ARRAY SIZE M^2	INSOLATION IN PLANE OF COLLECTOR GJ	ENERGY DELIVERED GJ	SYSTEM THERMAL EFFICIENCY %	COMMENTS
CATERPILLAR TRACTOR SAN LEANDRO, CA	4,682.3				PORTION OF COLLECTOR FIELD DEACTIVATED TO
Current Month		121	23	19.0	MATCH PLANT DEMAND;
Cumulative, 13 Months		5291	1641	30.5	SYSTEM DOWN 17 DAYS DUE TO CENTRAL CONTROLLER FAILURE
DOW CHEMICAL CO. DALTON, GA	922.5				SYSTEM OPERATIONAL ALL MONTH, BUT FAULTY RTD
Current Month		--	--	--	READINGS PRECLUDED
Cumulative 6 Months		1633	247	15.1	DATA COLLECTION. ABOUT 30,000 lb of STEAM WAS PRODUCED
SOUTHERN UNION REFINING CO. LOVINGTON, NM	936.5				SYSTEM OPERATED 25 DAYS-IDLE 5 DAYS;
Current Month		165	38	23.0	DAS FAILED TO
Cumulative, 20 Months		2959	566	19.1	RECORD DATA ON 6 DAYS
USS CHEMICAL CO. HAVERHILL, OH	4682.3				DATA NOT AVAILABLE
Current Month		--	--	--	
Cumulative 8 months		12608	3141	24.9	

TABLE 4

IPH MONTHLY PERFORMANCE STATUS
FOR DECEMBER 1983

PROJECT	COLLECTOR ARRAY SIZE M^2	INSOLATION IN PLANE OF COLLECTOR GJ	ENERGY DELIVERED GJ	SYSTEM THERMAL EFFICIENCY %	COMMENTS
CATERPILLAR TRACTOR	4,682.3				ENTIRE COLLECTOR FIELD
SAN LEANDRO, CA					PUT IN SERVICE, BUT
Current Month		151	4	2.7	BAD WEATHER LIMITED
Cumulative, 14 Months		5442	1618	29.7	OPERATION TO 12 DAYS
DOW CHEMICAL CO.	922.5				SYSTEM OPERATED 25
DALTON, GA					DAYS BUT MALFUNCTION
Current Month		--	--	--	OF PYRHELIOMETER
Cumulative 6 Months		1633	247	15.1	TRACKER PRECLUDED DATA COLLECTION
SOUTHERN UNION REFINING CO.	936.5				SEVERE WEATHER
LOVINGTON, NM					LIMITED OPERATION TO
Current Month		75	12	16.0	6 DAYS AND CAUSED
Cumulative, 21 Months		3034	578	19.1	PIPES TO FREEZE AND DAS PROBLEMS
USS CHEMICAL CO.	4682.3				DATA NOT AVAILABLE
HAVERHILL, OH					
Current Month					
Cumulative 8 months					

Table 5

Clear Day Performance

Project	Energy Incident in Plane of Collector (GJ)	Energy Delivered To Process (GJ)	System Thermal Efficiency (%)
	NOVEMBER		
Caterpillar Tractor Co.	31.5	7.1	22.5
Southern Union Refining Co.	17.9	5.1	28.5
	DECEMBER		
Caterpillar Tractor Co.	27.6	4.4	15.9
Dow Chemical Co.	--	1.9	--
Southern Union Refining Co.	18.8	3.3	17.6

TABLE 6

COMPARISON OF ENERGY PRODUCTION WITH THEORETICAL - NOVEMBER 1983

Project	Energy in Plane of Collector (GJ)	Energy Delivered To Process (GJ)	Comments
Caterpillar Tractor Co.			
Theoretical:	942	384	EXTRAPOLATED TO FULL-FIELD SIZE;
Adjusted Theoretical:	158	64	SYSTEM NOT OPERATIONAL 17 DAYS;
Actual:	158	30	DUE TO CENTRAL CONTROLLER FAILURE
Southern Union Refining Co.			
Theoretical:	497	159	SYSTEM OPERATED 25 DAYS-IDLE 5
Adjusted Theoretical:	165	53	DAYS; DAS FAILED TO RECORD DATA
Actual:	165	38	ON 6 DAYS

NOTES: (1) Data not reported for Dow Chemical Co. and USS Chemical Co.
(2) The theoretical values for energy collected and delivered have been adjusted for the difference between TMY and measured data by multiplying them by the ratio of the measured energy in the plane of the collector to the theoretical energy in the plane of the collector.

TABLE 7

COMPARISON OF ENERGY PRODUCTION WITH THEORETICAL - DECEMBER 1983

Project	Energy in Plane of Collector (GJ)	Energy Delivered To Process (GJ)	Comments
Caterpillar Tractor Co.			
Theoretical:	842	298	WEATHER LIMITED OPERATION TO
Adjusted Theoretical:	173	61	12 DAYS
Actual:	173	5	
Southern Union Refining Co.			
Theoretical:	470	144	SYSTEM WEATHER LIMITED OPERATION
Adjusted Theoretical:	75	23	TO 6 DAYS AND CAUSED PIPES TO
Actual:	75	12	FREEZE AND DAS PROBLEMS

NOTES: (1) Data not reported for Dow Chemical Co. and USS Chemical Co.
(2) The theoretical values for energy collected and delivered have been adjusted for the difference between TMY and measured data by multiplying them by the ratio of the measured energy in the plane of the collector to the theoretical energy in the plane of the collector.

greater than the measured values. Comparison of measured energy production with theoretical energy production is not a requirement of the SERI reporting format.

In addition to the energy production summaries, "availability" and "utilization" for each of the projects is reported (Table 8). Availability is the measure of mechanical reliability of the solar energy system. Utilization is an indication of the extent to which the industrial plant makes use of the solar energy system when it is available.

OPERATION AND MAINTENANCE SUMMARY

An O&M summary (Table 9) is included with this report.

Table 8

Availability and Utilization

Project	Availability (%)	Utilization
	NOVEMBER	
Caterpillar Tractor	43	43
Dow Chemical Co.	100	100
Southern Union Refining Co.	100	83
	DECEMBER	
Caterpillar Tractor	100	39
Dow Chemical Co.	81	100
Southern Union Refining Co.	71	95

TABLE 9

IPH MONTHLY SUMMARY
OPERATION AND MAINTENANCE DATA
THRU DECEMBER 1983

PROJECT	O&M ACTIVITY ($) ROUTINE	O&M ACTIVITY ($) NON-ROUTINE	O&M TOTAL	TAXES (PROPERTY) OR INSURANCE	PARASITICS	TOTAL COSTS	FOSSIL FUEL SAVINGS
CATERPILLAR TRACTOR SAN LEANDRO, CA							
Current Month			486.61				
Cumulative, 11 Months			6,153.16				
DOW CHEMICAL DALTON, GA							
Current Month			1,046.00		19.00	1,065.00	72.00
Cumulative, 8 Months			7,825.00		167.00	7,992.00	1,992.00
SOUTHERN UNION REFINING CO. LOVINGTON, NM							
Current Month				154.92	25.60	180.52	67.61
Cumulative, 15 Months	1145.00	396.00	1,541.00	2,323.80	459.21	4,324.01	2,540.99

Number:	**2**
Date:	**February, 1984**
Period:	**12/1/83 - 1/31/84**
B & R Code:	**EB-02-01**
Project:	**Distributed Receiver Technology and Applications Project**
Title:	**Solar Concentrator Technology Development (AOP Task 4)**
Contractor:	**Sandia National Laboratories, Albuquerque, New Mexico 87185**

AOMPLISHMENTS

4.0 SOLAR CONCENTRATOR TECHNOLOGY DEVELOPMENT - A major problem inhibiting the growth and application of central and distributed solar thermal technology is the cost of the concentrator field. A major breakthrough in concentrator technology to reduce costs by a large factor is needed. The objective of this task is to determine the feasibility and potential cost effectiveness of innovative type concentrators for use in solar systems for electrical systems or process heat applications.

4.1 Dish Concentrators

- We have developed a matrix of processes to be investigated in developing a sheet metal structural mirror. Suppliers of mirror-polished metals have been identified, samples have been obtained, and material has been purchased. Some sources of ion plating and/or sputtering of silver and protective layers have been identified; discussions of process initiated, and quotes obtained. Specularity measurements are being made of polished samples, both before and after silver plating.

- The Innovative Concentrator Program Opportunity Notice was issued to nearly 100 prospective proposers. Proposal receipt date at DOE/AL is scheduled for March 30, 1984. The proposal evaluation panel membership is from JPL, SNLL, SERI, and SNLA and will be convened in early April to consider these inputs.

- The BDM study of the Cassegrainian dish is nearly complete and is being detailed in a report which covers the design analysis, comparison with a "standard" dish, the structural analysis, thermal effects, and materials study. The possible use of a stainless steel substrate for the secondary and for a tertiary reflector are being investigated in a joint BDM/Sandia study.

  Custody of the master patterns and associated equipment for the PDC-1 dish reflector panels has been transferred from JPL to Sandia. Arrangements are being made to ship it to Sandia from G.E for storage pending further possible use in future development efforts.

  A RFQ for a design study was sent to Acurex. The objective of the study is to investigate alternate, low cost, high volume reflector panels for the PDC-2 dish. This study will furnish SNLA/DOE with valuable input regarding feasibility and cost to complete development of PDC-2. Acurex has requested and been granted an extension in the response deadline until after the Innovative Concentrator PON due date.

4.2 Central Receiver Heliostats

Representatives of DOE/HQ, SERI, and SNLA met on January 24, 1984 at Sandia Albuquerque for initial discussions on future concentrator development. Prime emphasis was on heliostats. A review of past heliostat development provided a common basis for planning. The various groups presented their lists of development areas which should be pursued. The interchange was very beneficial.

An RFQ for a development project to investigate a stressed membrane heliostat has been prepared by SNLL for issuance in the 2nd Quarter, FY84. The objective is to determine feasibility and potential cost effectiveness of a large heliostat formed by a large steel ring with a thing steel membrane stretched and welded to each side. Silvered polymer film reflector will be applied to one side. Pressure between the two membranes is actively controlled to maintain proper focal length.

TECHNICAL APPROACH OR WORK PLAN CHANGES

None

VARIANCES

None

Open items

None

FORECAST FOR NEXT REPORTING PERIOD

A contract will be initiated for ion plating of coupons to support matrix of process investigations in the Metallurgy Department

PROBLEM AREAS

None.

SOLAR THERMAL DISTRIBUTED RECEIVER TECHNOLOGY DEVELOPMENT AND APPLICATIONS PROJECT MONTHLY TECHNICAL STATUS REPORT

December 1983 and January 1984

JPL	A. Marriott
SERI	B. L. Butler
SERI	B. Gupta
SERI	J. Thornton
DOE/HQ	M. R. Scheve
DOE/HQ	J. Greyerbiehl
DOE/HQ	C. Carwile
DOE/HQ	C. Mangold
DOE HQ	K. O'Kelley
DOE/HQ	F. Wilkins
DOE/AL	D. Graves
DOE/AL	J. Hanson
DOE/AL	D. L. Krenz
DOE/AL	G. N. Pappas
DOE/AL	J. Weisiger
DFVLR	C. Selvage

0143	H. A. Romme
0400	R. P. Stromberg
1513	D. W. Larson
1810	T. G. Kepler
1820	R. E. Whan
1830	M. J. Davis
1840	R. J. Eagan
2540	K. Gillespie
3160	J. E. Mitchell
8450	J. B. Wright
8544	J. B. Woodard
6200	V. L. Dugan
6220	D. G. Schueler
6220	J. Hanna
6221	E. L. Burgess
6222	J. V. Otts
6222	C. P. Cameron
6224	E. C. Boes
6225	R. H. Braasch
6228	J. F. Banas
6246	B. Granoff
6227	J. A. Leonard (3)