1176

1.3.1

Sandia Laboratories
Solar Energy

San Francisco
Operations
Office

SOLAR THERMAL POWER

Large Power Systems Applications

STATUS LETTER FOR MARCH 1979

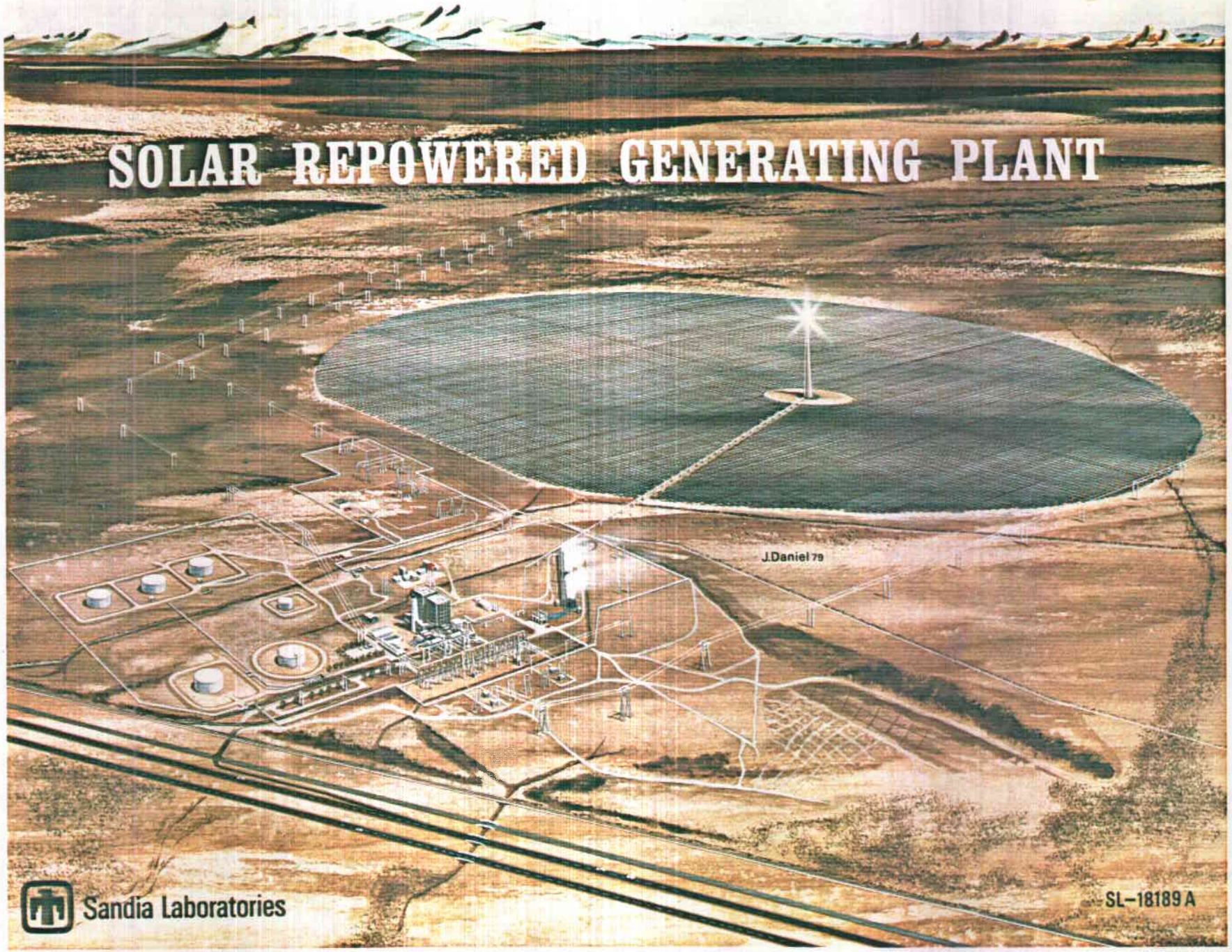
J. J. BARTEL, EDITOR
LARGE POWER SYSTEMS DIVISION
SANDIA LABORATORIES, LIVERMORE

Robert W. Hughey

ROBERT W. HUGHEY, DIRECTOR
SOLAR ENERGY DIVISION
SAN FRANCISCO OPERATIONS

The Photograph --

A solar repowered/industrial retrofit plant is one that uses solar energy to partially or completely replace fossil fuel as an energy source. Repowering may offer an excellent near-term application of solar technology that could lead to early commercialization.


SOLAR REPOWERED GENERATING PLANT
J.Daniel 79
Sandia Laboratories
SL-18189 A

PROGRAM ELEMENT SUMMARY

LARGE POWER SYSTEMS APPLICATIONS

This report, issued monthly, covers the portion of the Solar Thermal Power Systems which is directed toward large-scale systems applications --primarily Central Receiver system applications to electrical power generation at 10 MWe and above, but also with consideration of direct, high temperature thermal applications and of alternative collector configurations. The Central Receiver concept employs a field of individually guided mirrors called heliostats that redirect the sun's energy to a receiver mounted on top of a tower. In the receiver, the radiant solar energy is absorbed in a circulating fluid and is then transported to an electrical power generation subsystem or to an indistrial thermal process; excess thermal energy may be stored for later use, if operationally desirable and economically justifiable. Alternative systems for large-scale energy collection, such as linear central receivers with single-axis heliostats and individual, distributed collectors in manifolded arrays, are also under study.

Responsibility for managing the development and assessment of large solar thermal power systems for various applications has been delegated by DOE Headquarters to the San Francisco Operations Office; technical management is drawn from Sandia Laboratories, Livermore, the Aerospace Corporation, and other public and private organizations. The Large Power Systems Applications program element is organized according to a work breakdown structure which includes: Overall planning and coordination activities; storage-coupled systems; utility repowering/industrial retrofit systems; solar/non-solar hybrid systems; and programmatic support to the 10-MWe Solar Thermal Pilot Plant construction project.

HIGHLIGHTS

Major Accomplishments

- Repowering/Industrial Retrofit Concept Study RFP issued and preproposal conference held. (page 6)
- Large Power Systems Semiannual Review held. (page 2)
- Alternate Central Receiver Phase II scope of work coordinated with General Electric and Martin Marietta, Denver. (page 6)
- Responsibility for McDonnell Douglas 70-tube SRE tests transferred from SAN to SLL. (page 8)
- ACR Technical Preproposal meeting held with Martin Marietta, Denver and General Electric. The revised statements of work and cost proposals were received and are now in review.

MILESTONE STATUS

Milestones Accomplished

- Repowering/Retrofit Concept Study RFP was released on March 16, 1979.
- Preproposal conference was held on March ~~22~~ 28, 1979.
- MIRVAL, a computer code for modeling select heliostat - receiver configurations and heliostat performance, was released.
- The large power systems semiannual review was held March 21 and 22 in Reston, VA; about 180 people attended.

Milestones Missed

- Release a draft of the document A Description and Assessment of Large Solar Power System Technology was delayed.
- The initiation of the phase II alternate central receiver work by Martin Marietta and General Electric was delayed until April.

Milestones Due Next Month

- Initiate phase II ACR contract negotiations.
- Publish a preliminary draft of the LSPS technology document.

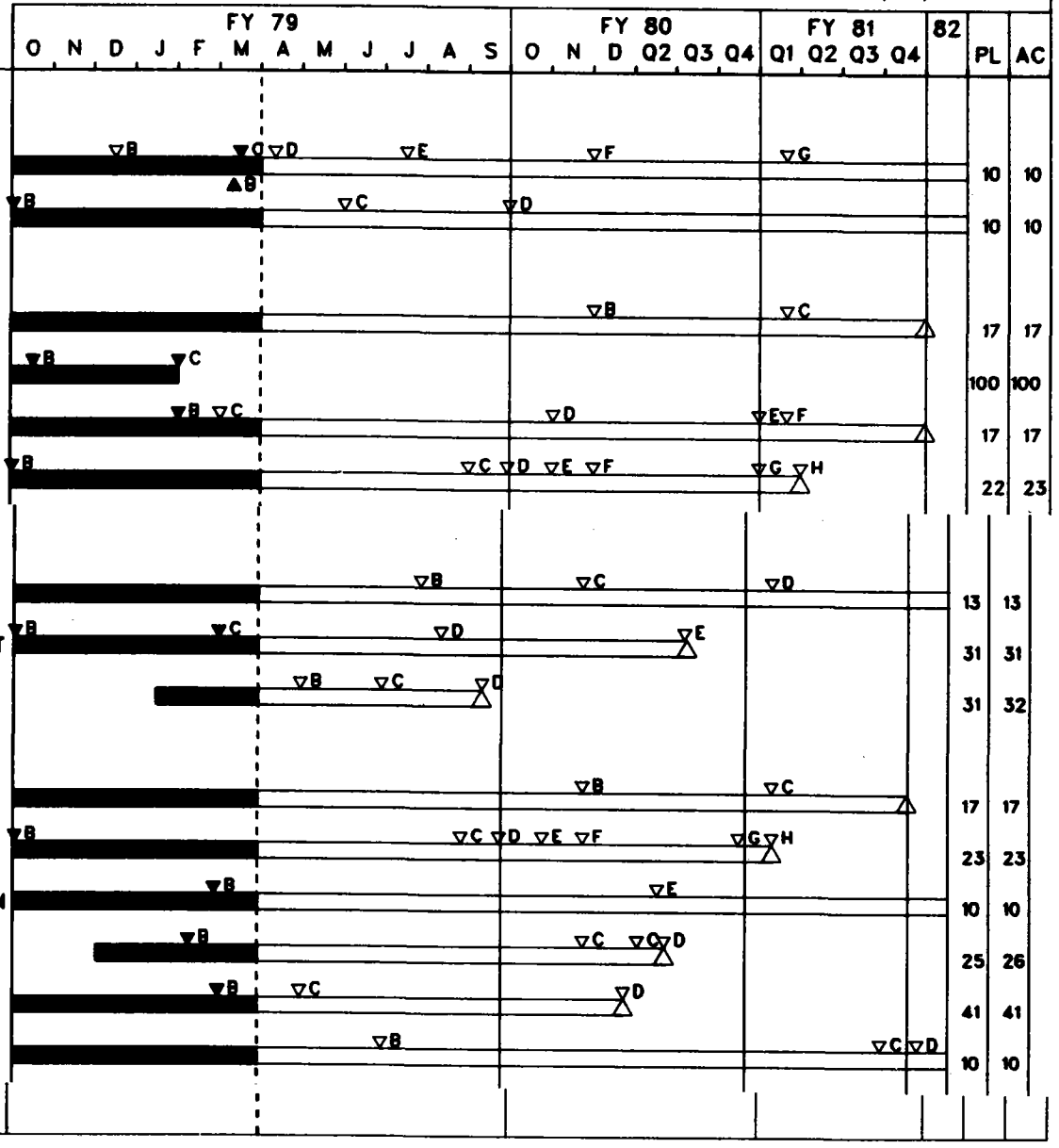
MILESTONE SCHEDULE AND STATUS REPORT

ID-- LARGE POWER SYSTEMS

WBS- 1.0 SYSTEM APPLIC

START 10/01/78 END 09/30/79

REPORTING PERIOD
03/01/79 THRU 03/31/79



LINE	FIELD 1 IDENT	FIELD 2 DESCRIPTION
01	01.01.00.A	GENERAL ACTIVITIES
02	01.01.01.A	---PLANNING AND AD-HOC TASKS
03	01.01.01.B	B MIRVAL CODE ISSUE
04	01.01.01.C	C TECHNOLOGY DOCUMENT DRAFT
05	01.01.01.D	D UTILITY DOCUMENT DRAFT
06	01.01.01.E	E AOP/APP DRAFT
07	01.01.01.F	F TECHNOLOGY COMPARISON
08	01.01.01.G	G TECHNOLOGY COMPARISON
09	01.01.02.A	---UNSOLICITED PROPOSALS
10	01.01.02.B	B START SRI MESOSCALE STUDY
11	01.01.02.C	C SRI STUDY/INITIAL RESULTS
12	01.01.02.D	D SRI STUDY COMPLETE
13	01.02.00.A	STORAGE COUPLED SYSTEMS
14	01.02.01.A	---SYSTEMS ANALYSIS/PLANNING
15	01.02.01.B	B TECHNOLOGY COMPARISON
16	01.02.01.C	C TECHNOLOGY COMPARISON
17	01.02.02.A	---RECEIVER TESTING
18	01.02.02.B	B BOEING TEST START
19	01.02.02.C	C BOEING TEST COMPLETE
20	01.02.03.A	---ALT CENTRAL RECEIVER SYSTEM
21	01.02.03.B	B SELECT PHASE 2 CONTRACTORS
22	01.02.03.C	C START PHASE 2 ACTIVITIES
23	01.02.03.D	D PHASE 2 STATUS REVIEW
24	01.02.03.E	E PHASE 2 COMPLETE
25	01.02.03.F	F DECISION TO CONT PHASE 3
26	01.02.04.A	---LINE FOCUS SYSTEM STUDIES
27	01.02.04.B	B START PHASE 1 ACTIVITIES
28	01.02.04.C	C PHASE 2 PROPOSALS DUE
29	01.02.04.D	D PHASE 1 COMPLETE
30	01.02.04.E	E PHASE 2 EVALUATION COMPLETE
31	01.02.04.F	F START PHASE 2 ACTIVITIES
32	01.02.04.G	G PHASE 2 COMPLETE
33	01.02.04.H	H DECISION TO COMPETE PHASE 3

	FIELD 1	FIELD 2
LINE	IDENT	DESCRIPTION
01	01.03.00.A	REPOWERING/INDUSTRIAL RETROFIT
02	01.03.01.A	---SYSTEMS ANALYSIS/PLANNING
03	01.03.01.B	B SERI STRATEGY ANALYSIS COMP
04	01.03.01.C	C TECHNOLOGY COMPARISON
05	01.03.01.D	D TECHNOLOGY COMPARISON
06	01.03.02.A	---REPOWERING/RETROFIT CONCEPT
07	01.03.02.B	B PNM STUDY COMPLETE
08	01.03.02.C	C RELEASE CONCEPT STUDY RFP
09	01.03.02.D	D START CONCEPT STUDIES
10	01.03.02.E	E CONCEPT STUDIES COMPLETE
11	01.03.03.A	---W SYN EPRI UTILITY-E STUDY
12	01.03.03.B	B START WORK
13	01.03.03.C	C UTILITY SELECTION
14	01.03.03.D	D STUDY COMPLETE
15	01.04.00.A	HYBRID POWER SYSTEMS
16	01.04.01.A	---SYSTEMS ANALYSIS/PLANNING
17	01.04.01.B	B TECHNOLOGY COMPARISON
18	01.04.01.C	C TECHNOLOGY COMPARISON
19	01.04.02.A	---HYBRID PWR SYSTEMS STUDIES
20	01.04.02.B	B START PHASE 1 ACTIVITIES
21	01.04.02.C	C PHASE 2 PROPOSLS DUE
22	01.04.02.D	D PHASE 1 COMPLETE
23	01.04.02.E	E PHASE 2 EVALUATION COMPLETE
24	01.04.02.F	F START PHASE 2 ACTIVITIES
25	01.04.02.G	G PHASE 2 COMPLETE
26	01.04.02.H	H DECISION TO COMPETE PHASE 3
27	01.04.03.A	---UTILITY COOPERATIVE PROGRAM
28	01.04.03.B	B EPRI/W MARKET SURVEY
29	01.04.03.E	E DOE/EPRI PP DECISION
30	01.04.04.A	---DOE/BU-REC HYB NETWK STUDY
31	01.04.04.B	B START NETWORK STUDY
32	01.04.04.C	C COMPLETE NETWORK STUDY
33	01.04.04.C	C STUDY COMPLETION RESCHEDULE
34	01.04.04.D	D FINAL REPORT
35	01.04.05.A	---W UTIL/TECH SENS ANALYSIS
36	01.04.05.B	B SCOPE OF WORK DEFINED
37	01.04.05.C	C START WORK
38	01.04.05.D	D STUDY COMPLETE
39	01.05.00.A	STMPO SUPPORT
40	01.05.00.B	B HELIOSTAT DESIGN
41	01.05.00.C	C START SOLAR FACILITY DESIGN
42	01.05.00.D	D PILOT PLANT OPERATIONAL

END OF PLOTS

MAJOR ACCOMPLISHMENTS

Repowering/Industrial Retrofit Concept Study RFP
(WBS 01.03.02 Repowering/Retrofit Concept)

The Repowering/Industrial Retrofit RFP was issued on March 16, 1979, and a preproposal conference was held on March 28, 1979 at DOE/SAN. Written questions were collected and answered, and a formal conference record is being compiled for distribution on April 1, 1979 to all who received the RFP.

Alternate Central Receiver Phase II Work Scope Coordinated with Martin Marietta, Denver and General Electric
(WBS 01.02.03 Alternate Central Receiver System)

Meetings were held with General Electric and Martin Marietta to discuss the Phase II "scope of work". During this phase, experiments at the central receiver test facility and materials studies will be emphasized; system and parametric studies will be minimized.

Contractors have submitted revised proposals which are currently under review by SAN and Sandia.

Both contractors plan to start Phase II work on advance authorization in early April.

Line Focus System Studies - BDM (WBS 01.02.04)

Throughout March, efforts with BDM centered on a review of system designs which would provide turbine inlet steam temperatures above 550°F. It was concluded that the following revised design point conditions are worthy of DOE consideration.

Turbine inlet steam : 700°F @ 600 psig

Two stage collector field:

Stage 1 8.3 million sq. ft. with Therminol 55 coolant.

Stage 2 2.7 million sq. ft. with Syltherm 800 coolant.

150 MW_e turbine with reheat.

BDM has been directed to provide a conceptual design for these conditions in accordance with Task 4 of their contract ET-78-C-03-2073.

MIRVAL Computer Code Issued
Document Number SAND77-8280
(WBS 01.01.01)

MIRVAL is a Monte Carlo program which simulates the heliostats and a portion of the receiver for solar energy central receiver power plants. Models for three receiver types and four kinds of heliostats are included in the code. The three receiver types modeled are an external cylinder, a cylindrical cavity with a downward-facing aperture, and a north-facing cavity. Three heliostats which track in elevation and azimuth are modeled, one of which is enclosed in a plastic dome. The fourth type consists of a rack of louvered reflective panels with the rack rotatable about a fixed horizontal axis.

Phenomena whose effects are simulated are shadowing, blocking, mirror tracking, random errors in tracking and in the conformation of the reflective surface, optical figure of the reflective surface, insolation, angular distribution of incoming sun rays to account for limb darkening and scattering, attenuation of light between the mirrors and the receiver, reflectivity of the mirror surface, and aiming strategy.

Cost Estimating Class
(WBS 01.01.00, Planning and Ad-hoc Tasks)

A two-day cost estimating class was presented by Fluor Power Systems, Inc., to approximately twenty members of Sandia's technical staff. The subject matter included scope, estimating philosophy, scaling factors, risk analysis, and standard estimation. This background and revised cost breakdown structures will allow systematic comparison of common elements in the various large power system concepts, and should simplify contractor reporting requirements.

FISCAL STATUS

Obligations (B/A): The SAN Fin Plan was reduced by $100K in March, to $8770K in operating funds, reflecting (a) the $600 second increment in additional funding for the Repowering/Retrofit program element (WBS 1.3) and (b) a Fin Plan transfer of $700K to SLL (including $300K for assumption of responsibility for MDAC receiver tests under WBS 2.2, $150K for Technical Management of the Repowering/Retrofit program element under WBS 1.3, and $250K for STMPO support under WBS 1.5). Adding the total of $2780K transferred to SLL to date and the $850K of PE&D funds authorized in February, total obligational authority for Large Power Systems Applications is now $12,400K.

Obligations for March (considered as of date of execution of contract or date of Fin Plan showing transfer) were $719K vs. a planned $200K; the LPSA program is currently underobligated by $4472K with respect to the January 5 revision to the Annual Procurement Plan, most of this reflecting delay in selection and award of the Alternate Central Receiver Phase II contracts. (Chart, p.9)

(A second revision to the APP was submitted on April 10, reflecting the additional $1450K authorized for WBS 1.3 and updating the procurement schedule for the remainder of FY 79. If approved, this revision will be incorporated into the April Status Letter.)

Cost Status (B/O): Costing authority was increased during March by $176K, to $12,860 in operating funds (or a total of $13,710 including PE&D) for the Large Power Systems Applications program element. Planned costs for FY 79 and actual costs through March for SAN-held contracts are now available; cumulative costs ($3091K) are currently $5K over planned costs. (Chart, p.10)

SLL Technical Management and Support is currently $124K over plan, reflecting heavy effort in support of the Alternate Central Receiver evaluation and the Repowering-Retrofit RFP. The SLL cost plan will be revised to reflect additional funds transferred from SAN in March. (Chart, p.11)

U.S. DEPARTMENT OF ENERGY

FORM DOE 536 (1/78)

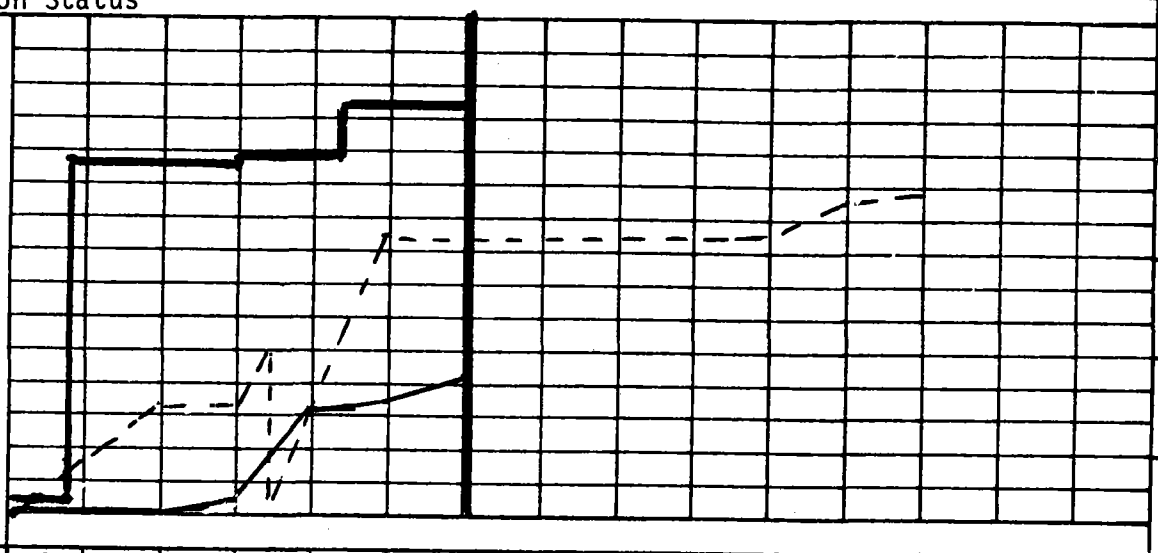
CONTRACT MANAGEMENT SUMMARY REPORT

FORM APPROVED OMB NO. 38R-0190

1. Contract Identification	2. Reporting Period	3. Contract Number
Large Power Systems Applications	1 Mar through 31 Mar	N/A
4. Contractor (Name and Address)		**5. Contract Start Date**
SAN FRANCISCO OPERATIONS OFFICE		N/A
		6. Contract Completion Date N/A

7. Months	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	8. FY 79
9. Obligation Status																

a. Dollars in Millions — Planned; Actual; Authorized (12M, 10M, 8M, 6M, 4M, 2M)



b. B&R Numbers: AD-03-01-01

Accrued Costs																
c. Planned	0	0	719	3211	4580	200	0	0	240	0	1500	500				
d. Actual	0	100	250	2849	320	719										
e. Variance	0	(100)	469	362	4260	(519)										
f. Cum. Variance	0	(100)	369	731	4991	4472										

g. Cost Plan Date	h. Planned Costs Prior FYs	i. Actual Costs Prior FYs	j. Total Estimated Costs for Contract	k. Total Contract Value	l. Unfilled Orders Outstanding	m. Estimate for Subsequent Reporting Period
1 Jan 79	8,337 K	8,337 K	N/A	N/A	N/A	N/A

Note: Total planned obligation authority of $12,400K is now on hand. Actual obligations have been changed from previous monthly reports to (a) include funds transferred to SLL for Technology Development ($600K) as well as for Technical Management/Support ($2,180K), and (b) take effective date of obligation as date of execution of corresponding contract or date of Financial Plan showing fund transfer. Revision #2 to the FY 79 Annual Procurement Plan was submitted to HQ April 10, and, if approved, will be reflected in revised "Planned" schedule in April Status Letter.

U.S. DEPARTMENT OF ENERGY

FORM DOE 536 (1/78)

CONTRACT MANAGEMENT SUMMARY REPORT

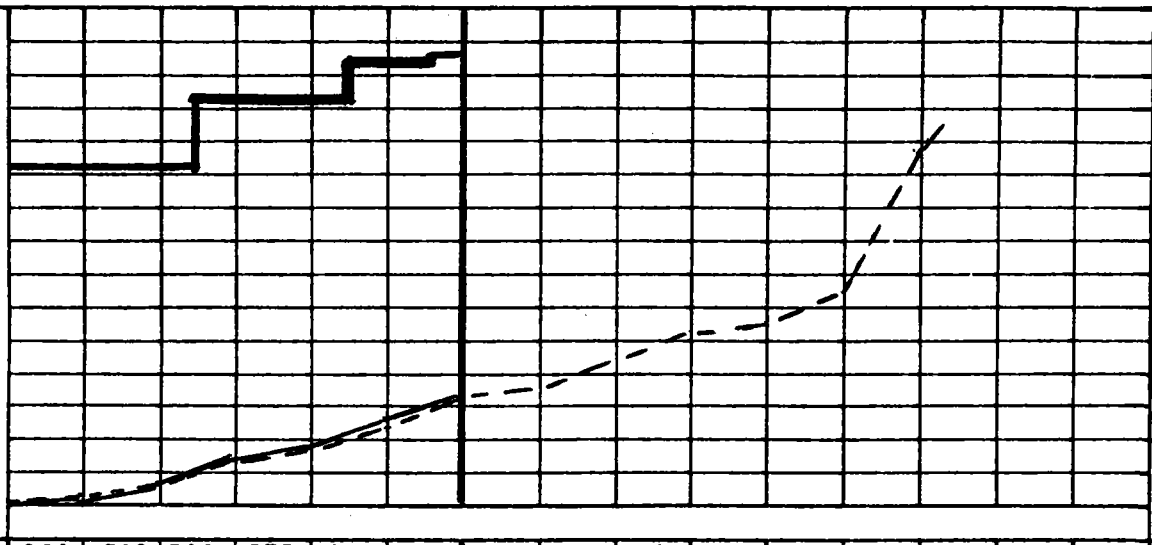
FORM APPROVED OMB NO. 38R-0190

1. Contract Identification	2. Reporting Period	3. Contract Number
LARGE POWER SYSTEMS APPLICATIONS (WBS-1.0)	1 Mar through 31 Mar	N/A
4. Contractor (Name and Address)		**5. Contract Start Date**
SAN FRANCISCO OPERATIONS OFFICE		N/A
		6. Contract Completion Date N/A

7. Months	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	8. FY 79
c. Planned	364	508	544	575	550	555	658	686	694	656	786	4070				
d. Actual	230	697	550	548	618	448										
e. Variance	134	(189)	(6)	27	(68)	107										
f. Cum. Variance	134	(55)	(61)	(34)	(102)	5										

9. Cost Status

a. Dollars in Thousands — Planned; Actual; Authorized



b. B&R Numbers: AD-03-01-01

g. Cost Plan Date: 1 Jan 79

h. Planned Costs Prior FYs: 4,345 K

i. Actual Costs Prior FYs: 2,650 K

j. Total Estimated Costs for Contract: N/A

k. Total Contract Value: N/A

l. Unfilled Orders Outstanding: N/A

m. Estimate for Subsequent Reporting Period: N/A

NOTE: Costing authority shown is total for Large Power Systems Applications program element; cost plan does not include $2,180K transferred to SLL for Technical Management/Support (see next chart), or $600K for Technology Development (see CRTD Status Letter).

U.S. DEPARTMENT OF ENERGY

FORM DOE 536 (78)

CONTRACT MANAGEMENT SUMMARY REPORT

FORM APPROVED OMB NO. 38R-0190

1. Contract Identification	2. Reporting Period	3. Contract Number
SOLAR - LARGE POWER SYSTEMS APPLICATIONS	1 Mar through 31 Mar	AD 03 01 -837
4. Contractor (Name and Address)		**5. Contract Start Date**
Sandia Laboratories, Livermore, California		FY - 75
		6. Contract Completion Date N/A

7. Months	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	8. FY 79
9. Cost Status	Dollars in Thousands															g. Cost Plan Date 1 Oct 78
a. Planned 2100 / Costed / 1800 / 1500 / 1200 / Committed / 900 / 600 / 300																h. Planned Costs Prior FYs 6,755K
																i. Actual Costs Prior FYs 6,695K
																j. Total Estimated Costs for Contract N/A
b. B&R Numbers AD 03 01																k. Total Contract Value N/A
																l. Unfilled Orders Outstanding N/A
Accrued Costs c. Planned	160	160	150	150	160	150	150	140	140	145	145	148	140	140	140	m. Estimate for Subsequent Reporting Period N/A
Accrued Costs d. Actual	158	123	202	110	231	205										
Accrued Costs e. Variance	2	37	(52)	40	(71)	(55)										
Accrued Costs f. Cum. Variance	2	39	(13)	27	(44)	(99)										
10. Manpower Status (Direct Labor)																e. Manpower Plan Date 1 Oct 78
a. BASE FTE X 12 / 350 / 300 / 250 / 200 / 150 / 100 / 50																f. Planned Manpower Prior FYs Base 54 FTE
																g. Actual Manpower Prior FYs Base 54 FTE
																h. Total Estimated Manpower for Contract N/A
Manpower b. Planned	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	i. Total Contract Manpower N/A
Manpower c. Actual	23	23	22	27	28	28										
Manpower d. Variance	1	1	2	(3)	(4)	(4)										

NOTE: Cost plan will be revised next month to reflect $400K transferred from SAN in March for support of WBS 1.3 and 1.5; funds transferred for use under WBS 2.2 and 2.4 ($600K) will be reported in Central Receiver Technology Status Letter.

DISTRIBUTION

DOE/HQ

H. Coleman
G. W. Braun
G. M. Kaplan
J. Weisiger, Jr. (3)
L. Melamed
J. E. Rannels
M. U. Gutstein
D. Campbell
S. M. Hansen
R. A. Miller
R. H. Annon
J. Flynn
F. Goldner
R. L. Bigham

DOE/SAN

R. A. DuVal
R. W. Hughey
S. D. Elliott (3)
L. E. Prince
S. M. O'Brien
R. N. Schweinberg (STMPO)

DOE/ALO

D. K. Nowlin

SERI

J. C. Grosskreutz
J. Doane
K. Touryan

JPL

V. C. Truscello

Aerospace Corporation

E. L. Katz

SLL

T. B. Cook, 8000
A. N. Blackwell, 8200
P. J. Eicker, 8326
L. Gutierrez, 8400
R. C. Wayne, 8450
J. F. Genoni, 8450
D. N. Tanner, 8450A
W. G. Wilson, 8451
A. C. Skinrood, 8452
J. D. Gilson, 8452

SLA

J. H. Scott, 4700
G. E. Brandvold, 4710
B. W. Marshall, 4713
V. L. Dugan, 4720