

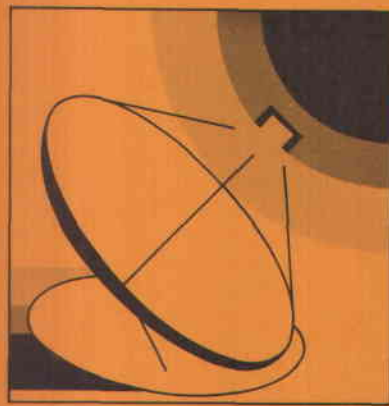
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5105-99
Solar Thermal Power Systems
Parabolic Dish Systems Development

DIST

JPL Parabolic Dish Development Bimonthly Technical Status Report

No. 52



February - March 1985

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U.S. Department of Energy
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Pasadena, California

JPL D-521, Issue 16

1201

JET PROPULSION LABORATORY
SOLAR THERMAL POWER SYSTEMS

PARABOLIC DISH
BI-MONTHLY TECHNICAL STATUS REPORT

FEBRUARY - MARCH 1985

JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CALIFORNIA

PARABOLIC DISH
BI-MONTHLY STATUS REPORT

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EXECUTIVE SUMMARY

MANAGEMENT

- o A presentation on dish status and uncertainties was given at the Solar Thermal Technical Issues Workshop.
- o Technical support was provided in the evaluation of the proposals for the Molokai experiment.
- o Participation was provided in the receiver and solar engine sessions at the Solar Thermal Research Annual Conference.

CONCENTRATOR DEVELOPMENT

- o Final disposition of DOE property at JPL is nearing an end. Residual mirror tooling was sent to Advanco Corporation and the Omnium-G dish in Anaheim was scrapped. Only a few minor items in storage await disposition instructions.

RECEIVER DEVELOPMENT

- o Computer code development was continued principally with mounting the Ford Aerospace CAV/CVT programs on PCs at both SNLA and JPL. Other codes are also being tested (e.g., COPS, a code developed by Honeywell, HEAP, a JPL-developed code, and others). This work will continue through the fiscal year.

STIRLING MODULE DEVELOPMENT

- o Advanco Corporation completed the fabrication of 30 mirror reflector facets for the test bed concentrators now at the DRTF. Advanco Corporation will fabricate another 90 mirror reflector facets for the TBCs.
- o Advanco Corporation operated the Vanguard Dish/Stirling Electric Power System Module each planned day during the period. Failure of an oil pump shaft on April 1 ended 71 days of successful endurance testing beginning January 18. 2606 kWh of net electricity were transmitted to the Santa Rosa substation in February for a net conversion efficiency of 22.1 per cent. The corresponding numbers for March were 3708 kWh and 21.5 per cent.
- o Advanco Corporation is now subcontracting to Stirling Thermal Motors the development of a hybrid Solar thermal/normal gas combustor Stirling engine power conversion unit for the DOE/Advanco Corporation Vanguard system. Stirling Thermal Motors will modify a double acting, 4-cylinder, swashplate-drive Stirling engine now being developed for heat pump applications. The development has been sponsored by the Gas Research Institute in cooperation with the STT Division, DOE.

- o McDonnell Douglas Astronautics Corporation has erected a second Dish/Stirling Solar Concentrator at their Huntington Beach, California facility. USAB has operated the model 4-95 Solar Mk I engine on the first Dish/Stirling module since late last year.

REPORTS PUBLISHED

February

"Activity and Accomplishments in Dish Stirling Electric Power System Development", F. R. Livingston, DOE/JPL-1060-82 (JPL Publication 85-8), February 15, 1985.

"Parabolic Dish Test Site: History and Operating Experiences", M. K. Selcuk, DOE/JPL-1060-84, (JPL Publication 85-18), February 15, 1985.

"Solar Walk-Off Protection", by H. I. Awaya and R. Bedard, (JPL D-2134,) February 1, 1985*.

March

"Control System for Parabolic Dish Concentrator No. 1", J. A. Stallkamp, (JPL 5105-156), March 15, 1985.

* Funded by SNLA

Note: The reports task is the only one which is funded by the carryover funds shown in the resources charts. The remainder of the tasks are in direct support of an funded by Sandia National Laboratories, Albuquerque.

CONCENTRATOR DEVELOPMENT

Accomplishments

- o Final disposition of DOE property at JPL is nearing an end. Residual mirror tooling was sent to Advanco and the Omnium-G dish in Anaheim was scrapped. Only a few minor items in storage await disposition instructions.
- o The report on mirror facet focal effects and slope errors derived from the small-scale optical model of a multifaceted concentrator continued at a low level. It is anticipated that this work will be complete by the end of the fiscal year.,
- o A report titled "Solar Walk-Off Protection" was provided to SNLA.

Plans for the Next Two Months

- o Support in the testing and property tasks will be provided to SNLA as required.

- o A paper titled "Solar Walk-Off Protection" will be presented at the Distributed Receiver Solar Thermal Technology Conference.

RECEIVER DEVELOPMENT

Accomplishments

- o Computer code development was continued principally with mounting the Ford Aerospace CAV/CVT programs on PCs at both SNLA and JPL. Other codes are also being test (e.g., COPS, a code developed by Honeywell, HEAP, a JPL-developed code, and others). This work will continue through the fiscal year.
- o Moderate duration (2 hours) storage within a solar receiver is being reinvestigated as a possible load-shifting device. New methods of latent heat salt storage are being considered as possible candidates.

Plans for the Next Two Months

- o Receiver enhancement via computer code development will continue. Code validation by using existing experimental data will begin.
- o Use of latent heat salt storage as an integral receiver component will continue to be investigated.

STIRLING DEVELOPMENT

Accomplishments

February

- o The DOE/Advanco Corporation Vanguard Dish/Stirling Electric Power System Module operated each planned day, weather permitting, during February. Hardware faults and software bugs interrupted the reliability demonstration operation on 17 days in minor ways. During the 173 hours of operational time accumulated during the month, the module generated 2983 kWh of electricity from the 11,788 kWh of direct insolation on the active dish aperture for a gross cumulative conversion efficiency of 25.3 percent. Some 377 kWh of generated electricity were used to power the engine water pump, the engine cooling fan, and the solar concentrator drive motors resulting in 2608 kWh of electricity transmitted to the Santa Rosa substation, Rancho Mirage, California. Cumulative conversion of direct insolation to electricity was 22.1 percent.
- o An energy conversion device workshop at the DOE/SERI Solar Thermal Research Annual Conference concluded that there were no firm STT Division plans to develop or modify another Stirling engine for Solar-electric application as was done with the USAB Model 4-95 engine. The conclusion was reported by participants from Advanco Corporation and JPL

March

- o Advanco Corporation completed the fabrication of 30 mirror reflector facets for the test bed concentrators now at the DRTF. Advanco Corporation will fabricate another 90 mirror reflector facets for the TBCs.
- o The Energy Technology Engineering Center, Rockwell International, completed a draft test report for EPRI describing the first year of operation of the DOE/Advanco Corporation Vanguard Dish/Stirling Electric Power System module. EPRI previously engaged ETEC to prepare an independent evaluation of the Vanguard project for EPRI member utility companies.
- o Advanco Corporation is now subcontracting to Stirling Thermal Motors the development of a hybrid Solar thermal/normal gas combustor Stirling engine power conversion unit for the DOE/Advanco Corporation Vanguard system. Stirling Thermal Motors will modify a double acting, 4-cylinder, swashplate-drive Stirling engine now being developed for heat pump applications. The development has been sponsored by the Gas Research Institute in cooperation with the STT Division, DOE.
- o McDonnell Douglas Astronautics Corporation has erected a second Dish/Stirling Solar Concentrator at their Huntington Beach, California facility. USAB has operated the model 4-95 Solar Mk I engine on the first Dish/Stirling module since late last year.
- o Advanco Corporation operated the Vanguard module each planned day during the month of March. A small oil pump shaft wore out on April 1 to end 71 days of successful endurance testing since January 18. During the month of March, the Vanguard module accumulated 263 hours of operational time and generated 4058 kWh of electricity from 17,257 kWh of direct insolation on the active dish aperture for a gross cumulative conversion efficiency of 23.5 percent. Since 350 kWh of generated electricity were used to power the auxiliaries 3708 kWh of net electricity was transmitted to the substation. Cumulative conversion of direct insolation to electricity was 21.5 percent.

Plans for next two months

- o Continue tests of Vanguard module at the Rancho Mirage, California site.
- o Participate in the Distributed Receiver Solar Thermal Technology Conference.
- o Continue the alternate Stirling engines task for SNLA.

REPORTS PUBLISHED

February

"Activity and Accomplishments in Dish Stirling Electric Power System Development", F. R. Livingston, DOE/JPL-1060-82 (JPL Publication 85-8), February 15, 1985.

"Parabolic Dish Test Site: History and Operating Experiences", M. K. Selcuk, DOE/JPL-1060-84, (JPL Publication 85-18), February 15, 1985.

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March

"Control System for Parabolic Dish Concentrator No. 1", J. A. Stallkamp, (JPL 5105-156), March 15, 1985.

* Funded by SNLA

Planned Reports

April

View-Limiting Shrouds for Insolation Radiometers

Program for Calculating Paraboloidal Dish Solar Thermal Power Plant Performance

May

Stirling Engine Test Data

Bearing Development Program for a 25-kWe Solar-Powered Organic Rankine-Cycle Engine

Summary Assessment of Solar-Thermal Parabolic Dish Technology for Electrical Power Generation

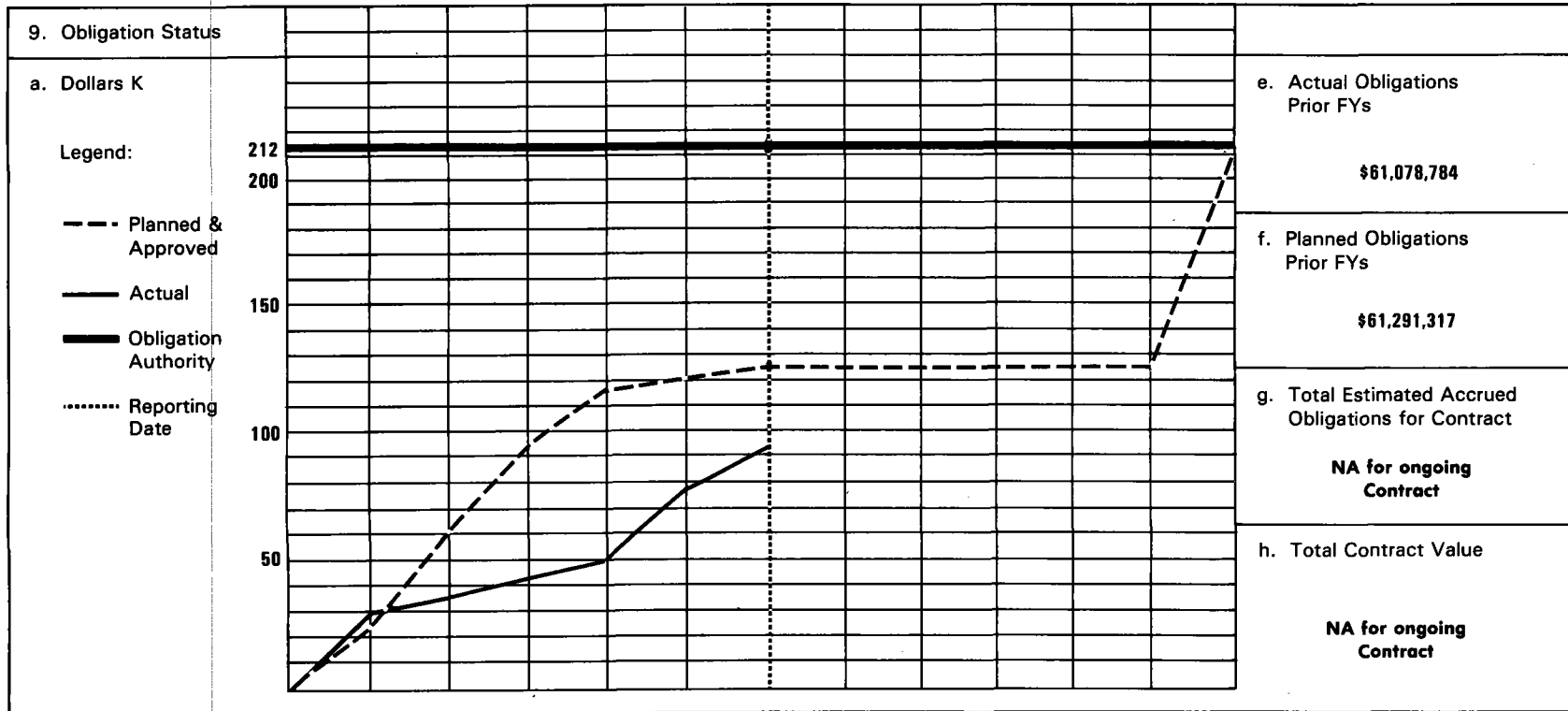
REMAINING REPORTS

- o The JPL Flux Mapper
- o Design and Testing of Cavity Solar Receivers
- o Projected Techno-Economic Characteristics of Solar Thermal Parabolic Dish-Electric Power Systems
- o Development Activities of a Brayton-Cycle Dish-Electric Module
- o Overview of Software Development at the PDTs
- o Comparison of Engines for Parabolic Dish Systems
- o Rapid Field Alignment Measurement Methods for Faceted Solar Concentrators
- o Calorimetry Testing of a Parabolic Dish Concentrator
- o Publications of the JPL Solar Thermal Power Systems Project, 1976 through 1985

PARABOLIC DISH SYSTEMS

TOTAL \$K
(OBLIGATIONS)

7. Months	O	N	D	J	F	M	A	M	J	J	A	S	8. FY 85
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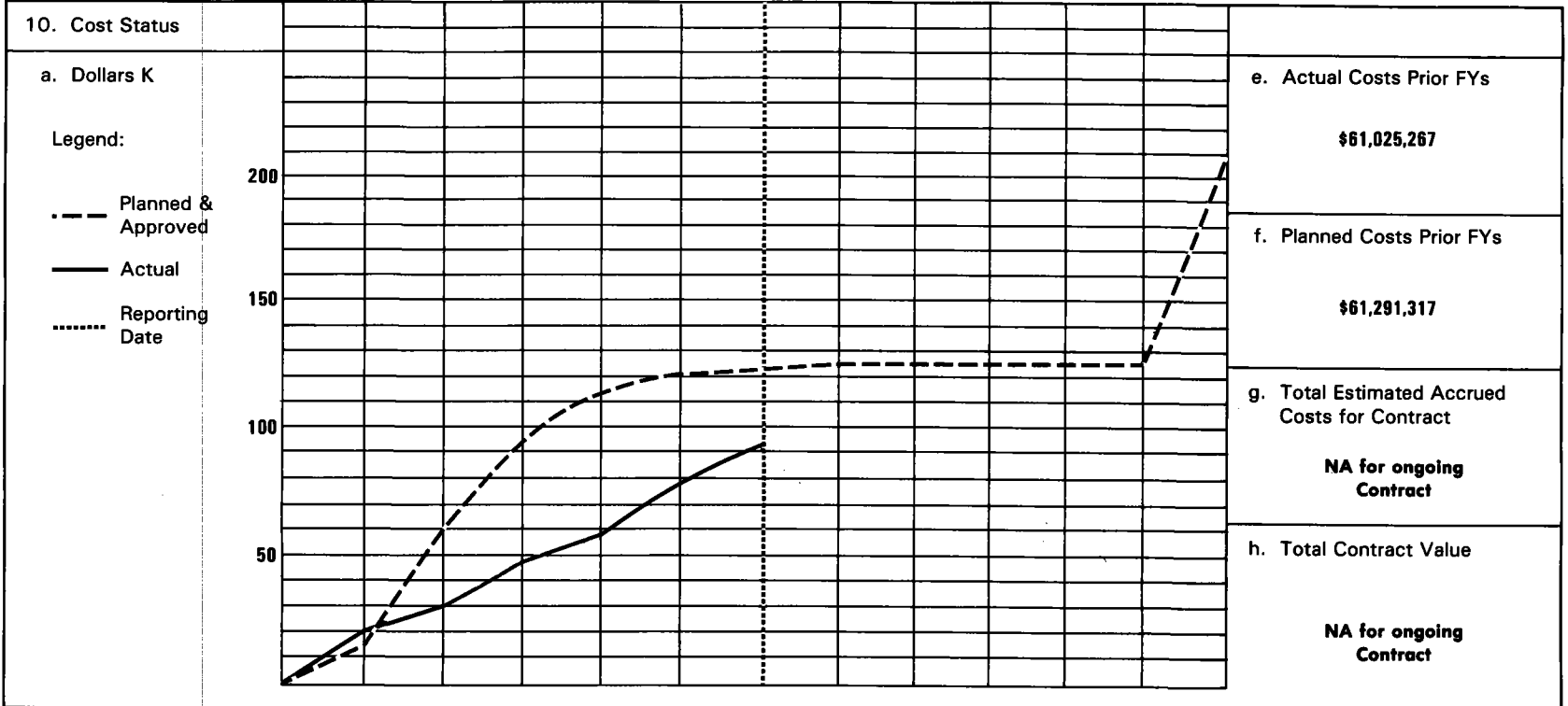
Accrued Obligations	b. Planned	23	37	34	20	8	4	0	0	0	0	0	87	b. Planned	
	c. Actual	30	6	12	12	18	15							c. Actual	
	d. Variance	7	<31	<12	<8	10	11							d. Variance	

12. Remarks

PARABOLIC DISH SYSTEMS

TOTAL \$K
(COSTS)

7. Months	O	N	D	J	F	M	A	M	J	J	A	S	8. FY 85
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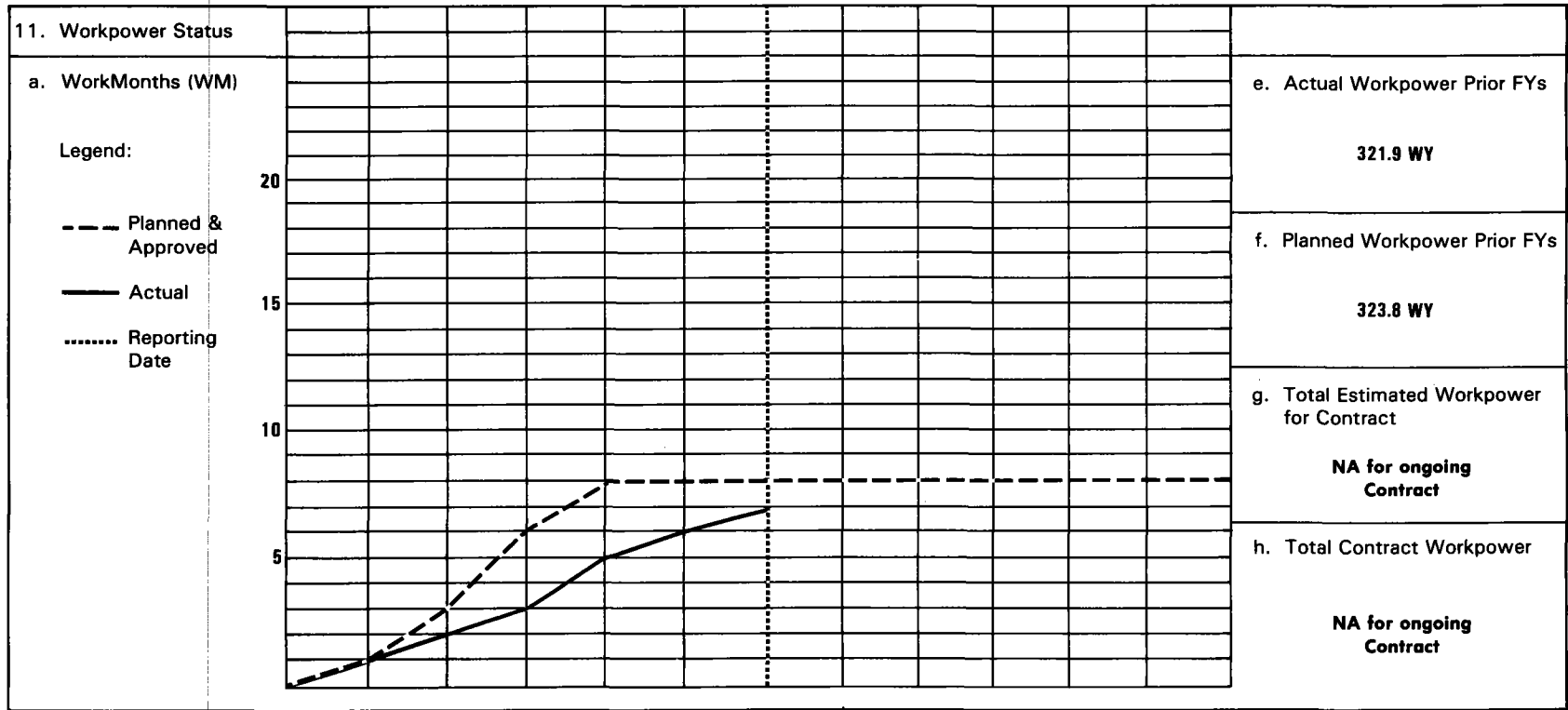
Accrued Costs	b. Planned	23	37	34	20	8	4	0	0	0	0	0	83	b. Planned	Accrued Costs
	c. Actual	21	9	13	14	21	15							c. Actual	
	d. Variance	<2>	<28>	<21>	<6>	13	11							d. Variance	

12. Remarks

PARABOLIC DISH SYSTEMS

TOTAL WORKPOWER (MANMONTHS)

7. Months	O	N	D	J	F	M	A	M	J	J	A	S	8. FY 85
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Workpower	b. Planned	1	2	3	2	0	0	0	0	0	0	0	0	b. Planned	Workpower
	c. Actual	1	1	1	2	1	1							c. Actual	
	d. Variance	0	<1>	<2>	0	1	1							d. Variance	

12. Remarks

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