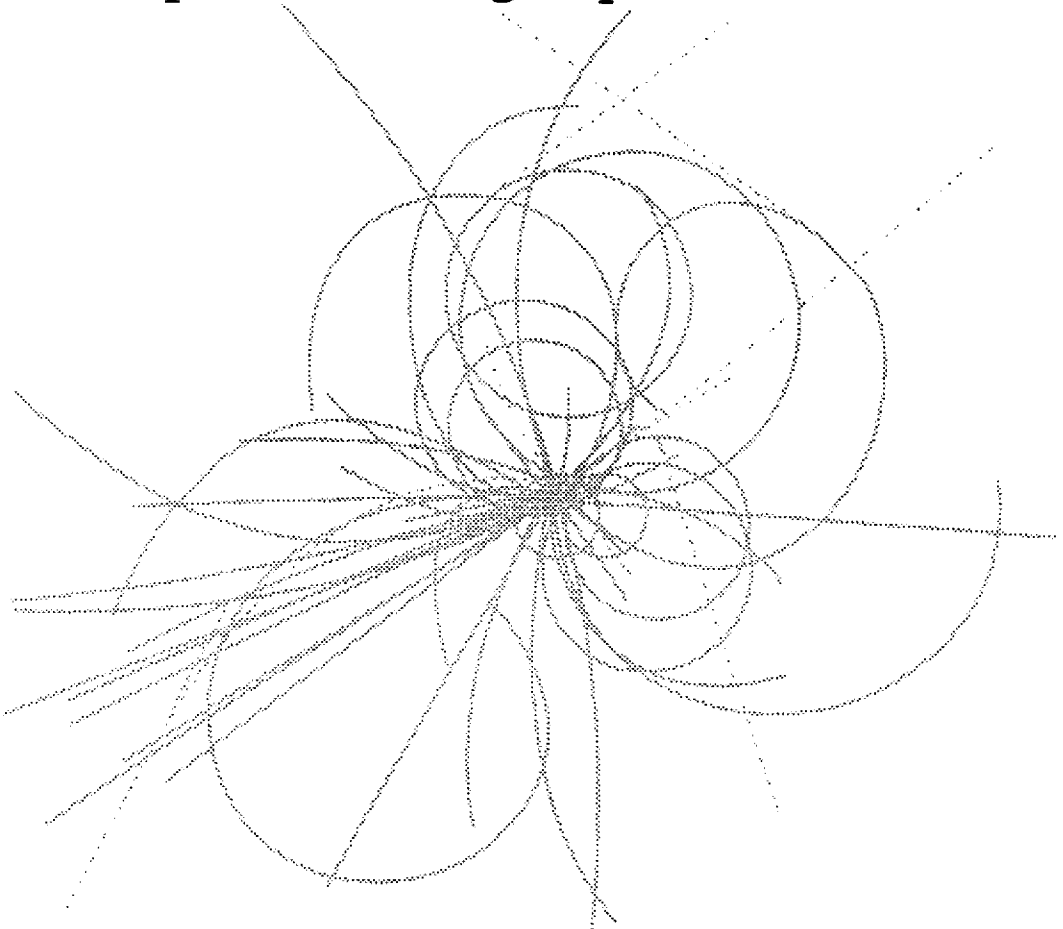
SSC-37

Superconducting Super Collider Laboratory

SSC-37



SSC Monthly Report

March 1985

SSC MONTHLY REPORT

MARCH 1985

CONTENTS

A. Project Summary

B. Project Report

C. Project Cost Data

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SSC MONTHLY REPORT

MARCH 1985

A. Project Summary

- Responses have been received to the Requests for Proposals for magnet cost estimating sent out last month to industrial firms with experience in superconducting magnets or similar electrical experience. Contracts will be let next month with delivery of final reports due June 30, 1985.

- The first draft of the Site Parameters Document was prepared on March 4 for internal review. Draft #2 was prepared on March 18 and presented to the DOE at meetings in Washington and Chicago. The final report is a major project milestone which is to be met in mid-April.

- DOE (Chicago) announced the selection of an A/E firm to assist in the conceptual design of the conventional facilities for the SSC. After interviewing finalists, the joint venture of Raymond Kaiser, Tudor, Keller-Gannon-Knight (RTK) was selected.

- The Accelerator Physics group has determined the aperture for the ideal test lattices in the absence of multipole field errors for both the nominal cosine theta and superferric magnets.

- BNL. Coil wedges and yoke laminations were received in preparation for constructing the first 4.5 m model dipole of 4 cm aperture (Design D). Tooling for winding inner coils was completed, with practice winding under way. Tooling for winding the outer coils made rapid progress. Yoke module block production began.

  A request for quotation on superconductor cable procurement has been sent to seven superconductor manufacturers in the U. S., Europe, and Japan.

- Fermilab. The six-meter magnetic effects model of the Design D cryostat and the 12 m heat-leak model will be ready for tests early next month. Cryostat and suspension design refinements on the Design D cryostat continued. A "cost design" was developed for the CDG to get an early indication of the cost of D relative to other designs.

With the arrival of the Design B specification conductor, two one-meter models were wound. These models can be wound at the rate of one per week. This brings to five the number of dry wound models that have been made. Practice end-windings have been made on the 4 cm aperture Design D coil to understand the problems of straight (non-dogbone) ends. Tooling for dry winding one-meter Design D models has arrived.

A highly instrumented one-meter model was used to study the origin of quenches, quench propagation, and several quench heater configurations.

- LBL. The first model magnet using 15 mm thick Nitronic 40 stainless steel collars, D12C-2, is nearly complete. Collaring proceeded without difficulty; assembly pressure and collar deformation agreed well with predictions. Construction of magnet D12C-3 was started.

  A Fluke datalogger has been installed to record strain gauge output; these gauges sense pressure in the winding and collar deformation.

  Fine filament superconductor development is on schedule; IGC's first stage seven-core billet was successfully extruded; Supercon's first stage single-core billet was also successful. Both billets incorporate a diffusion barrier between the copper and superconductor.

- TAC. A one-meter single channel magnet model following the final design of the superferric magnet has been constructed and tested. In addition, a seven meter two-in-one older design magnet model was completed and tested. The operation of these magnets is very successful; the magnetic multipoles are satisfactory except for a small amount of sextupole.

  A one-meter single channel magnet model of the final design has been assembled at the General Dynamics plant in San Diego and is now in transit to TAC for magnetic measurements. Several components for the 28 meter magnet have already been sent to GD. The beam tubes, the plastic spacers that go between the coils and the beam tube, and some of the half cores of the magnet steel have already arrived. The cable is behind schedule by a few weeks due to a delay in cabling at New England Electric.

B. Project Report

I. Central Design Group

Magnet Program. RFP's for magnet cost estimating by industrial firms with experience in superconducting magnets or similar electrical equipment were sent out last month and responses were received in March. Contracts will be let next month with delivery of final reports due June 30, 1985. These reports will complement cost-estimating activities being carried out by the CDG. Cost estimates for the various magnet designs being considered will be used in the selection process for the SSC magnet type. This selection will be made during the last quarter of FY 1985. Drawings for typical high-field and low-field magnets have been received for transmittal to the commercial estimators upon contract award.

In the model studies for high field magnets, the best magnets are usually tested at the normal helium boiling point, about 4.5 K and then again at about 2K. At the lower temperature, the current carrying capacity of superconductors improves. A magnet that produces 6T at 4.5 K typically produces 8 T at 2 K.

Accelerator magnet developers have long thought about actively operating magnets at the lower temperature in normal service to take advantage of the improved current carrying capacity. Several studies have been conducted in the past and concluded that low temperature operation is technically feasible. Remaining questions have to do with the reliability of the resulting system and the economics of low temperature operation. The most obvious of the several important questions concerns operating cost in the face of lowered Carnot efficiency. To help understand the possible potential of low temperature operation for the SSC, the CDG has appointed a Low Temperature Operations Task Force under the chairmanship of Michael McAshan of Stanford University.

The Task Force is composed of university, industry, and national laboratory experts on this subject and will report by the end of June.

Conventional Systems. The first draft of the Site Parameters Document was prepared on March 4 for review within the CDG. It received the attention of the SSC Directorate and Division Heads in a series of concentrated meetings over a two-week period. Draft #2 was prepared on March 18 and presented to DOE at meetings in Washington by Jim Sanford and in Chicago by Tom Toohig. Comments were received from the CDG Steering Committee members, the URA Board of Overseers, and from personnel at the two DOE offices. An in-depth review session involved consultants Bill Alexander, Phil Livdahl, Bob Matyas, and Dick Neal. At the end of the month detailed plans were being made for the final draft of this document which consists of four parts: SSC Project Description, Features of the SSC Facility, SSC Siting Criteria, and Information Needed about Proposed Sites.

DOE (Chicago) announced the selection of an A/E firm to carry on the conceptual design of the conventional facilities for the SSC. After interviewing the four finalists mentioned last month, an Oakland, California, based joint venture of Raymond Kaiser Engineers, Inc., Tudor Engineering Company, and Keller & Gannon-Knight (RTK) was selected. Preliminary discussions have been held with the principals of RTK so that contractual details can be agreed upon.

Planning work during the month concentrated upon blocking out a program to cover several years of work within the division. Beginning with the current tasks on siting requirements, the program covers selected technical studies, environmental issues, and master plan concepts, leading up to preparing a non site-specific Conceptual Design Report in March 1986. Beyond that date, work will concentrate on a Preliminary Design for the SSC, one that

can be made specific to a site once one is chosen. Further planning work will concentrate on preparing written descriptions of tasks, related cost estimates, and schedules.

Accelerator Theory and Computation. Tracking efforts continued using the programs DIMAT, PATRICIA, and MARYLIE. The aperture for the ideal test lattices in the absence of multipole field errors has been determined for both the nominal cosine theta and the superferric magnets. To perform these tracking simulations, it has been necessary to rearrange the CRAY time previously allocated from Fermilab to the CDG.

The simulation program to study the coherent dipole beam-beam instabilities is being finished. The code deals with the very large number of bunches in the SSC. It also takes into account the long range beam-beam encounters away from the interaction points. Special cases have been run using this program and have been shown to agree with known results. Advances have also been made to solve this problem analytically using group theoretical techniques.

A sequence of optics allowing operation of the two SSC colliding beams with different energies, has been established. The study of overlap knockout resonance in this mode of operation shows that the resonances are weak although densely populated.

Accelerator Systems. Don Groom (University of Utah) joined the CDG the first of the month and will be responsible for assembly and editing of material produced by the Task Force on Commissioning and Operations which met at Fermilab on March 25-26. The final report is due next month.

A full-time resident scientist, David Bintinger (UCSD) has been placed at the BNL/NSLS to oversee the Photo-Desorption Experiment. It is anticipated the beam line will be set up by April 15. A task force meeting was held at

Gaithersburg, Maryland, to discuss details of the experiment and various phenomena that would contribute to direct photo desorption from cryogenic materials.

A workshop on power supplies and quench protection was arranged for April 1-5 at the CDG. About ten participants are expected.

II. Laboratory Programs

BNL. Work began on the design of a low field (3 Tesla) cosine theta dipole of small aperture (3 cm) in which iron saturation effects are controlled by means of an elliptical aperture in the circular iron yoke.

Wedges and yoke laminations were received from the vendors for the 4 cm aperture, 4.5 m and 16.6 m model magnets. The wedges were insulated and cut to length for use in the first 4.5 m inner coils. Practice winding of the inner coils began. In addition, approximately 6000 yoke laminations were received, and yoke module block production commenced, with 13 blocks completed during the month.

Concerning coil fabrication tooling, the coil winding fixture, with a mandrel for producing the first inner coils for the 4.5 m dipoles, became operational. The new 4.5 m coil curing press is now 95% complete; form blocks for curing inner coils are 50% complete; mandrel and form blocks for curing outer coils are 50% complete.

The first prototype multiwire sextupole trim coil was applied and thermally bonded to a model bore tube and successfully tested, achieving 11 A at 5 T, or the short sample limit, without training.

Requests for quotes for bore tube plating were issued to various vendors. Also a request for quotation for procurement of superconducting cable has been sent to several manufacturers in the U. S., Europe, and Japan. The request asks for quotations on production of sufficient inner and outer cable conductor to manufacture two 4.5 m long Design D model magnets. Deadline for reply is April 15.

FNAL. The assembly of the magnetic effects model was completed. The model was transferred to the test facility and will be physically ready for test in early April. Work continued on the test procedures, test loop apparatus operational schematics, and data-acquisition systems.

Work on the center section of the heat leak model was completed. The previously tested end vessels were moved from the test facility and prepared for connection to the center section. The model will be available for heat leak measurements beginning in early April. The single phase helium shell thermal bowing due to cooldown was evaluated under controlled conditions. The result of this test indicated that the thermal bowing during cooldown should not be a significant problem.

Work continued on the conversion of the heat leak suspension dewar for the measurement of multilayer insulation systems and their application techniques. Testing will begin in April.

Work continued on the development of the sections of the cryostat between suspension points. The cryostat will be designed for a five pipe system and incorporates 20K and an 80K thermal radiation shield. Evaluation of the cryostat design suspension system continues. Plans are to develop a design suitable for fabrication and testing for both a post and an elliptical arch support. The first revision of the SSC Design D Cryostat Design Criteria was issued on March 18, 1985.

Cable was received on March 20 and a 5 cm bore one-meter long model, SG-1001, was completed on March 29. Winding of a second unit, SG-1002, coils has begun with expected completion by April 1. Winding and completion of this series of models is projected at a rate of one per week.

Practice windings of a 4 cm Design "D" coil were conducted on a dummy mandrel. The cable negotiated the tight bend associated with the contemplated straight end windings without failure of the insulation. The expanding mandrel to be used for actual coil winding has been received and is ready for service. Work continues on design and fabrication of winding keys and end saddles. BNL expects to send Fermilab wedges and collars by mid April. Coil winding is scheduled to begin on April 25.

The BNL cable thickness measuring machine has been received and is being readied for installation in the cable insulating line. A FNAL machine is nearing to completion and both machines should be on line by the end of April.

Testing of a highly instrumented "Super Saver" prototype (R01001) collared coil assembly was carried out. This assembly was equipped with a set of voltage taps located strategically to determine the origin of a quench (the 2D or 3D high field point of the winding). Data indicate that the highest 2D body field turn in the straight section was the quench origin once all training was over. Also, one set of voltage taps in this magnet were used later to initiate quenches and quench velocities were subsequently measured. There have been many proposed heater configurations for the "SSC" coils; this magnet therefore contained a standard "Saver" heater, and a segmented heater (distributed). The minimum power to initiate a quench was measured for various heater configurations and geometries, and will be the subject of a later paper.

An experiment designed to measure gas desorption by synchrotron radiation in the cold SSC beam tube is underway. A cryostat containing a 5-m beam tube is being designed for use at the National Synchrotron Light Source at BNL. A warm aluminum beam tube for a preliminary experiment has been built and leak checked, and is being used in preliminary measurements using electron desorption. Two mass analyzers have been received and after being found faulty, were repaired by the manufacturer. A warm calibration setup has been built and used in a first calibration. Necessary modifications to the calibrator are now complete and a second calibration is scheduled for April 18. The assembly of the beam line at BNL is scheduled to start on April 22 with most components and stands on hand. The warm tube and analyzers will be shipped to BNL in April. The cryostat design is approximately 50% complete. The plated beam tube (Cu on S.S.) contract will be let on April 18 with expected delivery in the middle of May.

LBL. Fabrication and assembly continued on D12C2, the first 1 m model with 15 mm stainless steel collars, and fabrication of a new 1 m model, D12C3, was started. The design features of D12C3 are very similar to D12C1, the only substantive change being the superconductor used in the cable.

The assembly of D12C2 proceeded well, and the schedule slippage that occurred in the early stages has been made up during part fabrication. Collaring of the coil was accomplished without any serious difficulties. A collaring press load equivalent to a coil pressure of 18,000 psi was used during the key installations. When the press load was removed, the coil preload dropped by 50% to 9,000 psi. As compared to the unloaded configuration, the collar vertical diameter increased 0.010 inches and the horizontal diameter decreased 0.002 inches. D12C2 utilizes stainless steel (Nitronic 40) collar material, while 7075 aluminum collars were used on D12C1. There was a

25% drop in preload coil pressure with the aluminum collars compared to the 50% drop in preload with the stainless steel collars. The increase in the vertical diameter of the aluminum collars, after coil collaring, was approximately twice that of the stainless collars, as predicted.

The following tasks have been completed or started on D12C3: physical measurements of cable size under a coil pressure of 10,000 psi completed; fabrication of G-10 coil end islands and aluminum wedges for coil straight sections completed; moulding of wedges of coil ends completed; fabrication of coil load cell gauge blocks completed; and winding of coils for the outer layer started.

Two superconductor manufacturers, IGC and Supercon, are working under subcontracts to LBL to develop the technology for fabrication of fine filament NbTi. If successful, this development may reduce the persistent current effects at the SSC injection field to a level such that the dipole correction coils can be eliminated. Both of these projects reached their first milestone this month. IGC extruded the first stage billet in their two-step extrusion approach for producing fine filaments. The NbTi rods in this billet were protected from reaction with the surrounding copper by a diffusion barrier. (It is essential to prevent this reaction from occurring in order to achieve fine filaments.) The extrusion was successful, and the diffusion barrier appears intact. IGC will draw this material to the appropriate size, restack, and extrude to produce the final product by mid-June.

Supercon also extruded their first stage billet consisting of a single NbTi core surrounded by a diffusion barrier. This material will be drawn to appropriate size and approximately 4000 pieces will be restacked to produce a second extrusion billet which should be complete by the beginning of May. Strand should be available for evaluation in July. If the first phase of these

programs is successful, both IGC and Supercon will begin a second phase aimed at producing both inner and outer types of superconductor for Design D models.

TAC. The assembly of the new short magnets with the modified design has gone extremely well. The main change in the new design was the insertion of a wedge-shaped iron piece on both sides of the coils where they fit into the iron half cores. This simplifies the assembly of the coils into the half cores. The multipoles are also easier to control and the field seen by the coils is reduced by about 15 per cent allowing operation with 15 per cent more current or at a higher temperature, e.g., 4.7°K.

Magnetic measurements indicate that there is a slight difference (the order of 3 to 5×10^{-4} units of sextupole) between the measurements and POISSON predictions. Part of this difference is believed to come from the mu table incorporated in POISSON, and therefore mu is being measured. Part of the discrepancy is due to the techniques of finite differences used in POISSON; this was analytically determined by magnetic field calculation and comparison to prediction using the program. Finally, it is believed that part of the difference may be due to a slight wobble in the magnetic probe as it rotates during field measurement. All systematic errors are being studied.

Recent studies indicate that quench propagation in TAC magnets is not well understood. The first measurements of quench propagation velocity in a magnet were not satisfactory. A one-meter model has been disassembled and voltage taps inserted in the coils at various places to extract signals and refine the measurement of the quench velocity. This should be completed during the next month.

The design for the one-in-one superferric magnet is nearly complete. A report should be forthcoming next month.

General Dynamics has assembled a one-channel, one-meter long magnet of the latest design. The original agreement with General Dynamics included winding a coil with copper cable; this is under way and will be continued. However, since assembling the one-meter magnet, General Dynamics is now ready to start on the 28 m magnet. All necessary materials, except the superconducting cable, for the first 28 m magnet have been shipped. The wire strand has been drawn at Oxford Airco and is waiting for cabling at New England Electric but will not get into their work schedule until the first of May. The end block design for the magnet has been completed and end blocks made and shipped to General Dynamics.

There have been very few changes in the tooling designs. The principal work has been on the magnet ends. The Turkshead for rolling a round beam tube into an elliptical shape works quite well on 40 foot sections of beam pipe and has been used to form all of the beam pipe for the General Dynamics magnets.

C. Project Cost Data

(Index)

SSC Program	Table	Figure
Central Design Group	C-1	1
Brookhaven National Laboratory	C-2	2
Fermi National Accelerator Laboratory	C-3	3
Lawrence Berkeley Laboratory	C-4	4
Texas Accelerator Center	C-5	5
SSC Program Summary	c-6	6
Related Accelerator Program		
Brookhaven National Laboratory	C-2	7
Fermi National Accelerator Laboratory	C-3	8
Lawrence Berkeley Laboratory	C-4	9
Related Accelerator Program Summary	C-7	10

TABLE C-1
CENTRAL DESIGN GROUP - SUPERCOLLIDER

MARCH 1985 COST REPORT (K$)

	PROGRAM ELEMENT	LABOR	MAT'L & SERVICES	G & A	MONTH TOTAL	YEAR TO DATE	ANNUAL BUDGET
1.1	ADMINISTRATION	105	66	83	254	857	1650
1.2	PROGRAM PLANNING & MANAGEMENT	24	1	12	37	99	425
1.3	ACCELERATOR R & D	128	46	84	258	377	2150
1.4	CONVENTIONAL SYSTEMS DEVELOP.	0	47	23	70	113	1100
	CDG TOTAL COSTS	257	160	202	619	1446	5325
	ESTIMATED COMMITTMENTS					410	

TABLE C-2
BROOKHAVEN NATIONAL LABORATORY - SUPERCOLLIDER

MARCH 1985 COST REPORT (K$)

	PROGRAM ELEMENT	LABOR	MAT'L & SERVICES	G & A	MONTH TOTAL	YEAR TO DATE	ANNUAL BUDGET
2.1	GENERAL	22	20	12	54	385	800
2.2	MAGNET MODELS	97	95	55	247	1168	2200
2.3	TOOLING	26	43	19	88	444	800
2.4	MAGNET MEASUREMENT & DEVEL.	19	11	8	38	223	400
2.5	POWER SUPPLIES & QUENCH PROT.	10	0	3	13	130	280
2.6	CRYOGENIC TESTING	28	5	12	45	273	500
	BNL SSC PROGRAM	202	174	109	485	2623	4980
2.7	SUPERCONDUCTOR DEVELOPMENT	25	25	14	64	403	900
2.8	CRYOGENIC SYSTEMS DEVELOPMENT	37	7	17	61	370	770
	BNL ACCELERATOR RELATED PROG.	62	32	31	125	773	1670
	BNL TOTAL	264	206	140	610	3396	6650
	ADDITIONAL COMMITMENTS					400	

TABLE C-3
FERMI NATIONAL ACCELERATOR LABORATORY - SUPERCOLLIDER

MARCH 1985 COST REPORT (K$)

	PROGRAM ELEMENT	LABOR	MAT'L & SERVICES	G & A	MONTH TOTAL	YEAR TO DATE	ANNUAL BUDGET
3.1	GENERAL	7.4	5.6	3.6	16.6	95.9	340
3.2	MAGNET MODELS	80.1	140.6	66	286.7	1649.9	3225
3.3	FACILITY DEVELOPMENT	35	16.8	14.5	66.3	191.7	340
	FNAL SSC PROGRAM	122.5	163	84.1	369.6	1937.5	3905
3.4	SUPERCONDUCTOR DEVELOPMENT	0	18.5	5.2	23.7	78.3	400
3.5	CRYOSTAT DEVELOPMENT	111.1	23.5	37.6	172.2	916.1	890
3.6	ACCELERATOR PHYSICS	-6.9	7.1	0.1	0.3	330.5	830
	FNAL ACCELERATOR RELATED PROG.	104.2	49.1	42.9	196.2	1324.9	2120
	FNAL TOTAL	226.7	212.1	127	565.8	3262.4	6025
	ADDITIONAL COMMITMENTS					479.3	

TABLE C-4
LAWRENCE BERKELEY LABORATORY - SUPERCOLLIDER

MARCH 1985 COST REPORT (K$)

	PROGRAM ELEMENT	LABOR	MAT'L & SERVICES	G & A	MONTH TOTAL	YEAR TO DATE	ANNUAL BUDGET
4.1	GENERAL	3	4	4	11	74	115
4.2	MAGNET MODELS	14	10	12	36	198	395
4.3	ANALYSIS	8	2	5	15	75	125
4.4	INSTRUMENTATION/MEASUREMENTS	5	0	2	7	64	155
	LBL SSC PROGRAM	30	16	23	69	411	790
4.5	ACCELERATOR THEORY	49	11	29	89	472.1	800
4.6	SUPERCONDUCTOR DEVELOPMENT	4	5	4	13	158	410
	LBL ACCELERATOR RELATED PROG.	53	16	33	102	630.1	1210
	LBL TOTAL	83	32	56	171	1041.1	2000
	ADDITIONAL COMMITMENTS					154	

TABLE C-5
TEXAS ACCELERATOR CENTER - SUPERCOLLIDER

MARCH 1985 COST REPORT (K$)

	PROGRAM ELEMENT	LABOR	MAT'L & SERVICES	G & A	EQUIP	MONTH TOTAL	YEAR TO DATE	ANNUAL BUDGET
5.1	GENERAL	0	56.7	26.9		83.6	303.5	825
5.2	SHORT MAGNET MODELS	43.5	204.9	13.4		261.8	730.9	1150
5.3	LONG MAGNET MODELS	43.5	0	0		43.5	104.3	1660
5.4	TOOLING	0	0	0		0	0	630
5.5	THEORETICAL ANALYSIS	43.6	0	0		43.6	55.7	130
5.6	FACILITY DEVELOPMENT	0	0	0	111.7	111.7	265.7	605
	TAC SSC PROGRAM	130.6	261.6	40.3	111.7	544.2	1460.1	5000

*ADJUSTMENTS TO FIGURES REPORTED LAST MONTH HAVE BEEN MADE DUE

TABLE C-6
PROGRAM SUMMARY - SUPERCOLLIDER

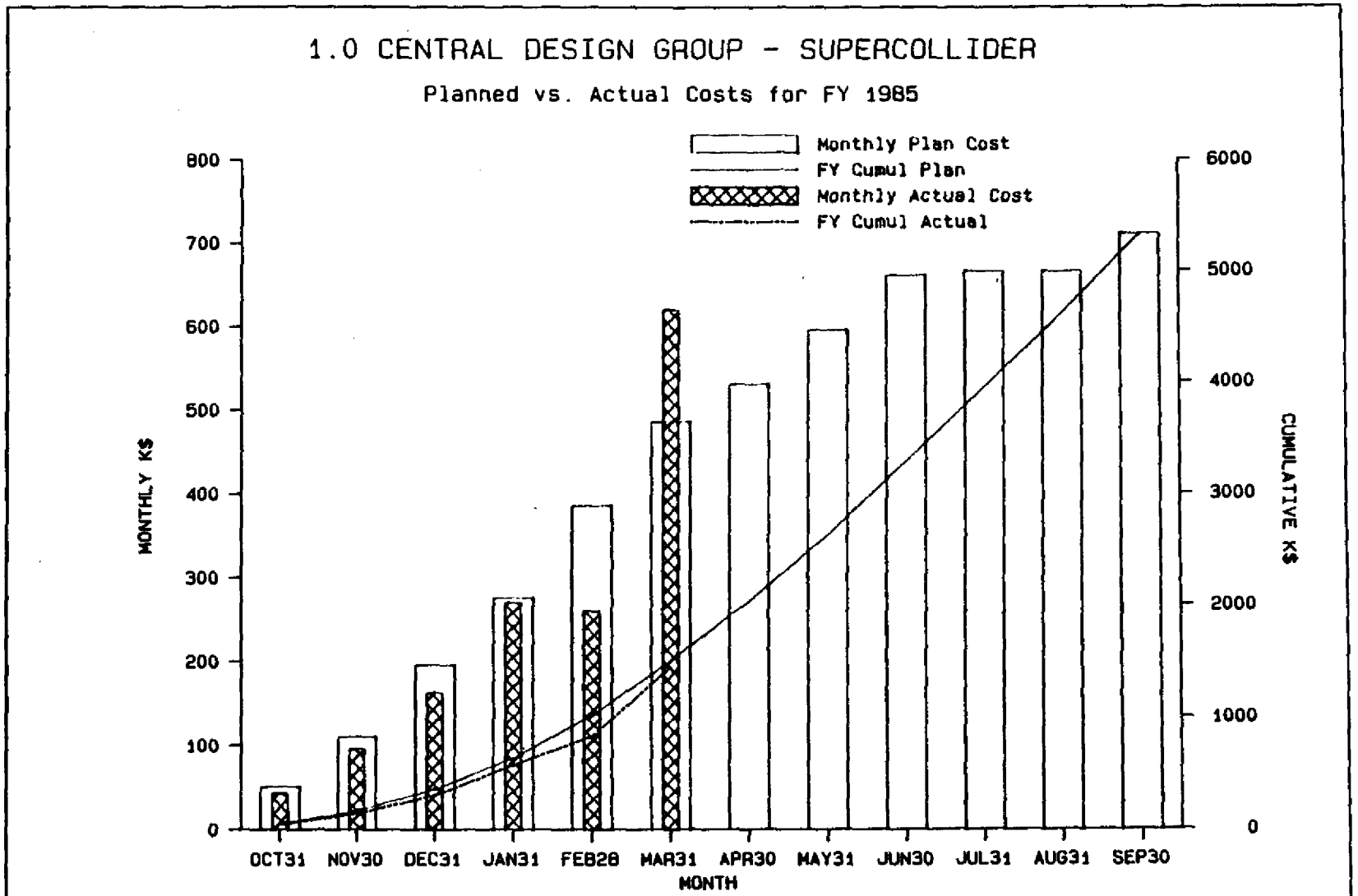
MARCH 1985 COST REPORT (K$)

	PROGRAM ELEMENT	LABOR	MAT'L & SERVICES	G & A	EQUIP	MONTH TOTAL	YEAR TO DATE	ANNUAL BUDGET
1.	CDG PROGRAM	257	160	202		619	1446	5325
2.	BNL SSC PROGRAM	202	174	109		485	2623	4980
3.	FNAL SSC PROGRAM	122.5	163	84.1		369.6	1937.5	3905
4.	LBL SSC PROGRAM	30	16	23		69	411	790
5.	TAC SSC PROGRAM	130.6	261.6	40.3	111.7	544.2	1460.1	5000
	TOTAL SSC PROGRAM	742.1	774.6	458.4	111.7	2086.8	7877.6	20000

TABLE C-7
SSC RELATED ACCELERATOR PROGRAM SUMMARY

MARCH 1985 COST REPORT (K$)

	PROGRAM ELEMENT	LABOR	MAT'L & SERVICES	G & A	EQUIP	MONTH TOTAL	YEAR TO DATE	ANNUAL BUDGET
1.	BNL SSC PROGRAM	62	32	31		125	773	1670
2.	FNAL SSC PROGRAM	104.2	49.1	42.9		196.2	1324.9	2120
3.	LBL SSC PROGRAM	53	16	33		102	630.1	1210
	TOTAL SSC RELATED ACCEL PROG	219.2	97.1	106.9	0	423.2	2728	5000



FISCAL YEAR 1985	OCT31	NOV30	DEC31	JAN31	FEB28	MAR31	APR30	MAY31	JUN30	JUL31	AUG31	SEP30
Monthly Plan	50	110	195	275	385	485	530	595	660	685	665	710
FY Cumul Plan	50	160	355	630	1015	1500	2030	2625	3285	3950	4615	5325
Monthly Actual	42	95	162	269	259	619						
FY Cumul Actual	42	137	299	568	827	1446						

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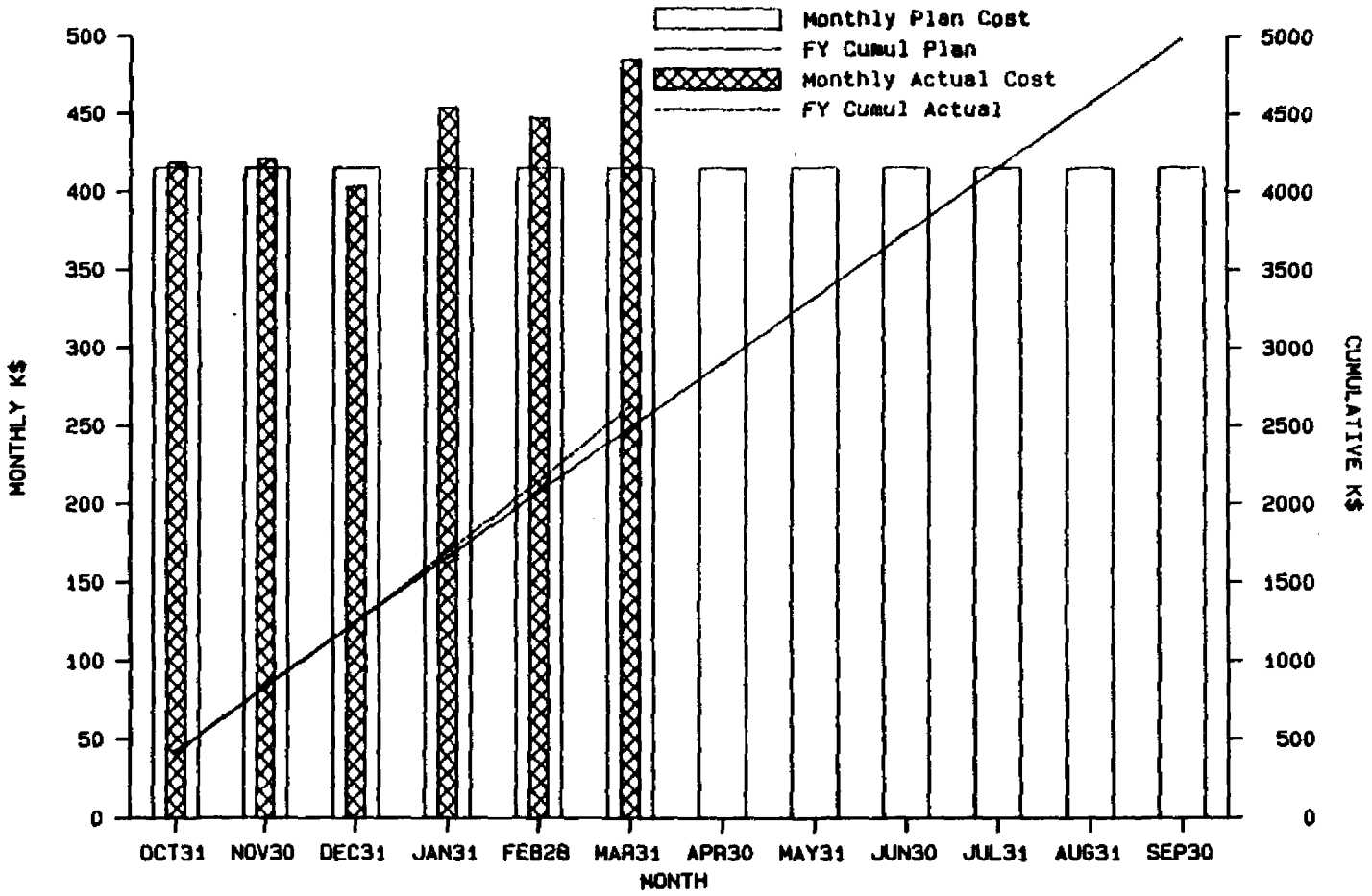
4:25 pm
24-APR-85

Figure 1



	FISCAL YEAR 1985											
	OCT31	NOV30	DEC31	JAN31	FEB28	MAR31	APR30	MAY31	JUN30	JUL31	AUG31	SEP30
Monthly Plan	415	415	415	415	415	415	415	415	415	415	415	415
FY Cumul Plan	415	830	1245	1660	2075	2490	2905	3320	3735	4150	4565	4980
Monthly Actual	418	420	403	454	447	485						
FY Cumul Actual	418	838	1241	1695	2142	2627						

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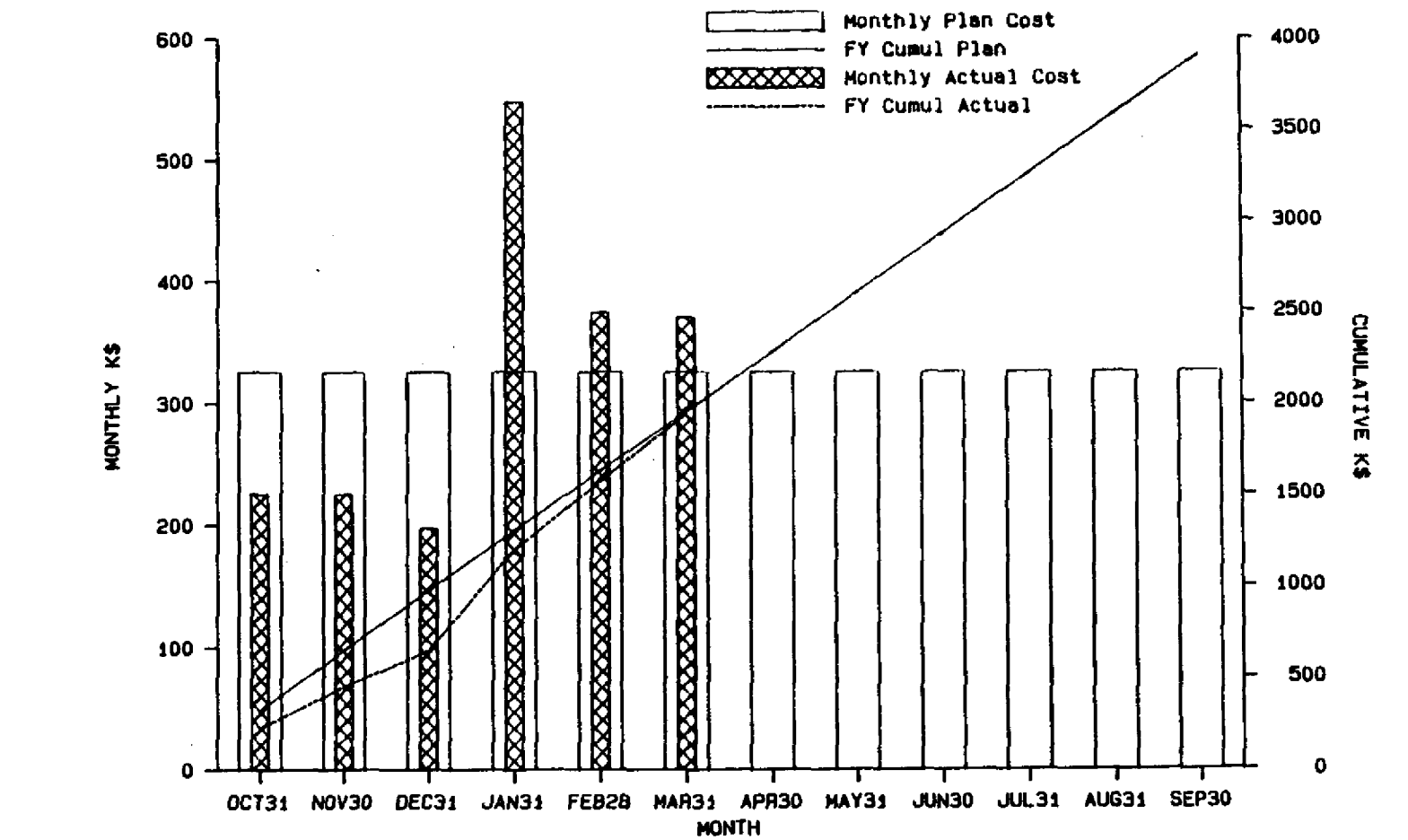
24-APR-85

Figure 2



	FISCAL YEAR 1985											
	OCT31	NOV30	DEC31	JAN31	FEB28	MAR31	APR30	MAY31	JUN30	JUL31	AUG31	SEP30
Monthly Plan	325	325	325	325	325	325	325	325	325	325	325	325
FY Cumul Plan	325	651	976	1302	1627	1953	2278	2603	2929	3254	3580	3905
Monthly Actual	225	225	197	547	374	370						
FY Cumul Actual	225	450	647	1194	1568	1938						

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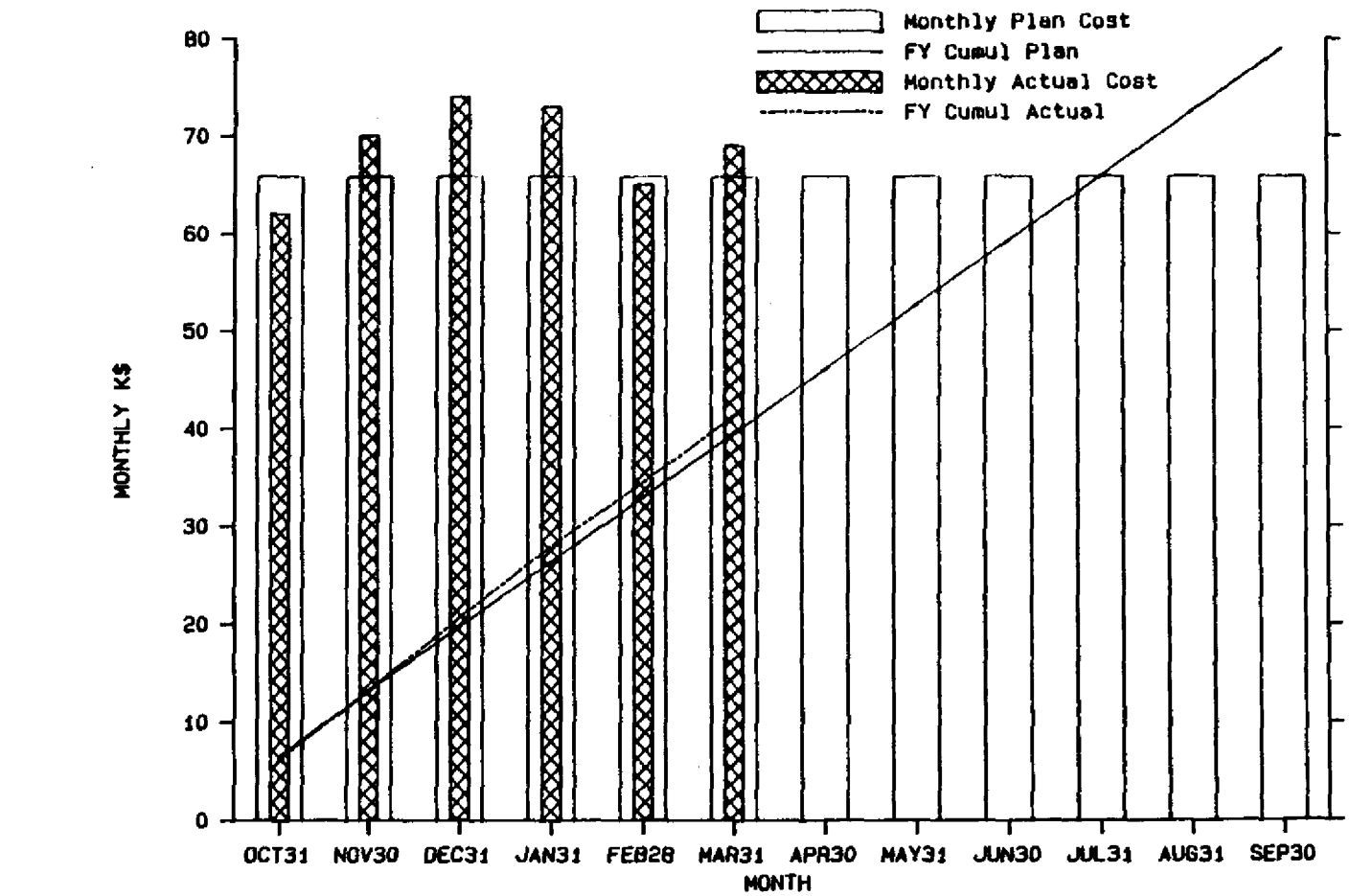
24-APR-85

Figure 3



	FISCAL YEAR 1985											
	OCT31	NOV30	DEC31	JAN31	FEB28	MAR31	APR30	MAY31	JUN30	JUL31	AUG31	SEP30
Monthly Plan	66	66	66	66	66	66	66	66	66	66	66	66
FY Cumul Plan	66	132	198	263	329	395	461	527	593	658	724	790
Monthly Actual	62	70	74	73	65	69						
FY Cumul Actual	62	132	206	279	344	413						

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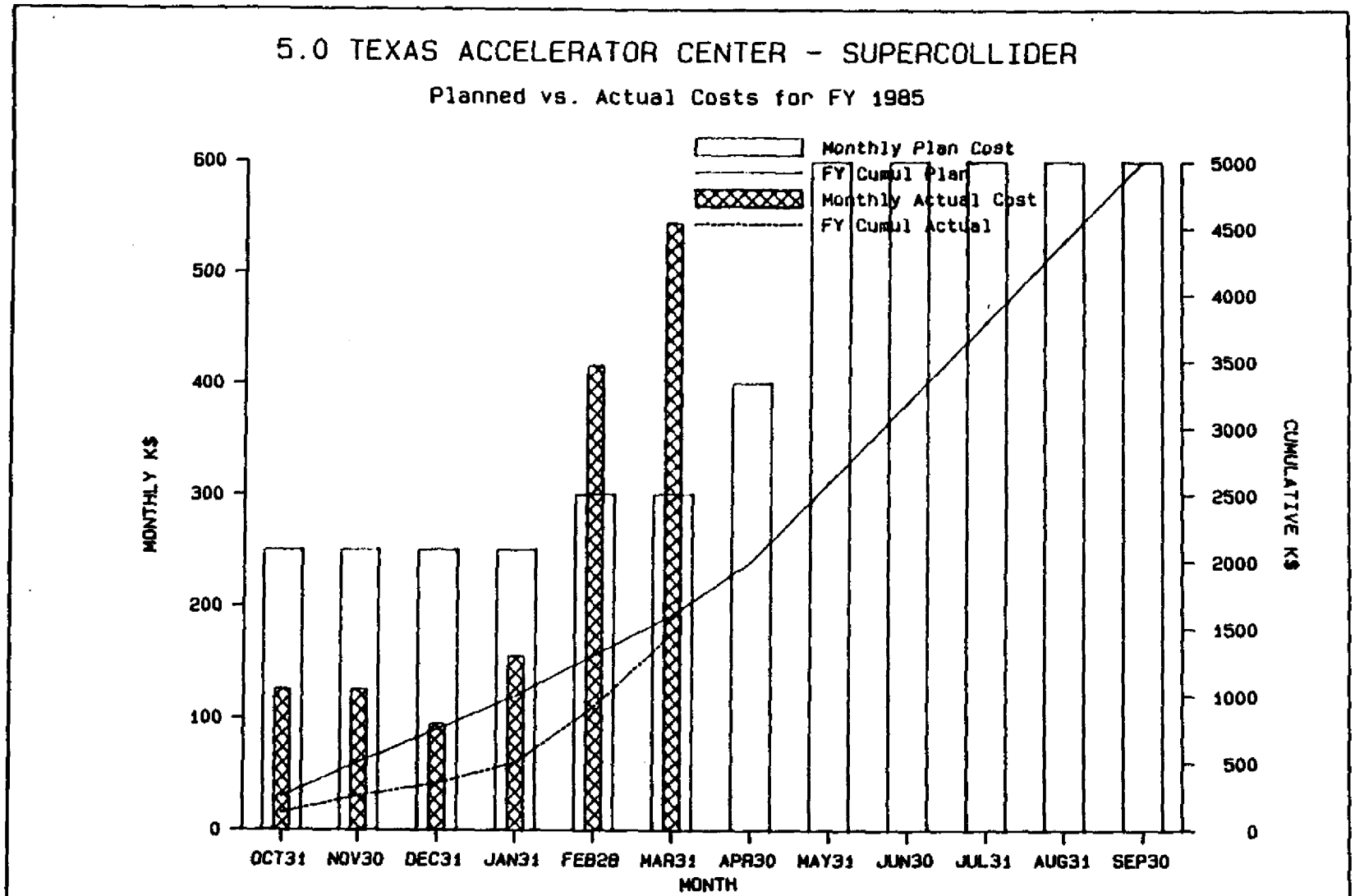
(JSZ)
4:27 pm
24-APR-85

Figure 4



	FISCAL YEAR 1985											
	OCT31	NOV30	DEC31	JAN31	FEB28	MAR31	APR30	MAY31	JUN30	JUL31	AUG31	SEP30
Monthly Plan	250	250	250	250	300	300	400	600	600	600	600	600
FY Cumul Plan	250	500	750	1000	1300	1600	2000	2600	3200	3800	4400	5000
Monthly Actual	125	125	94	155	416	544						
FY Cumul Actual	125	250	345	500	916	1460						

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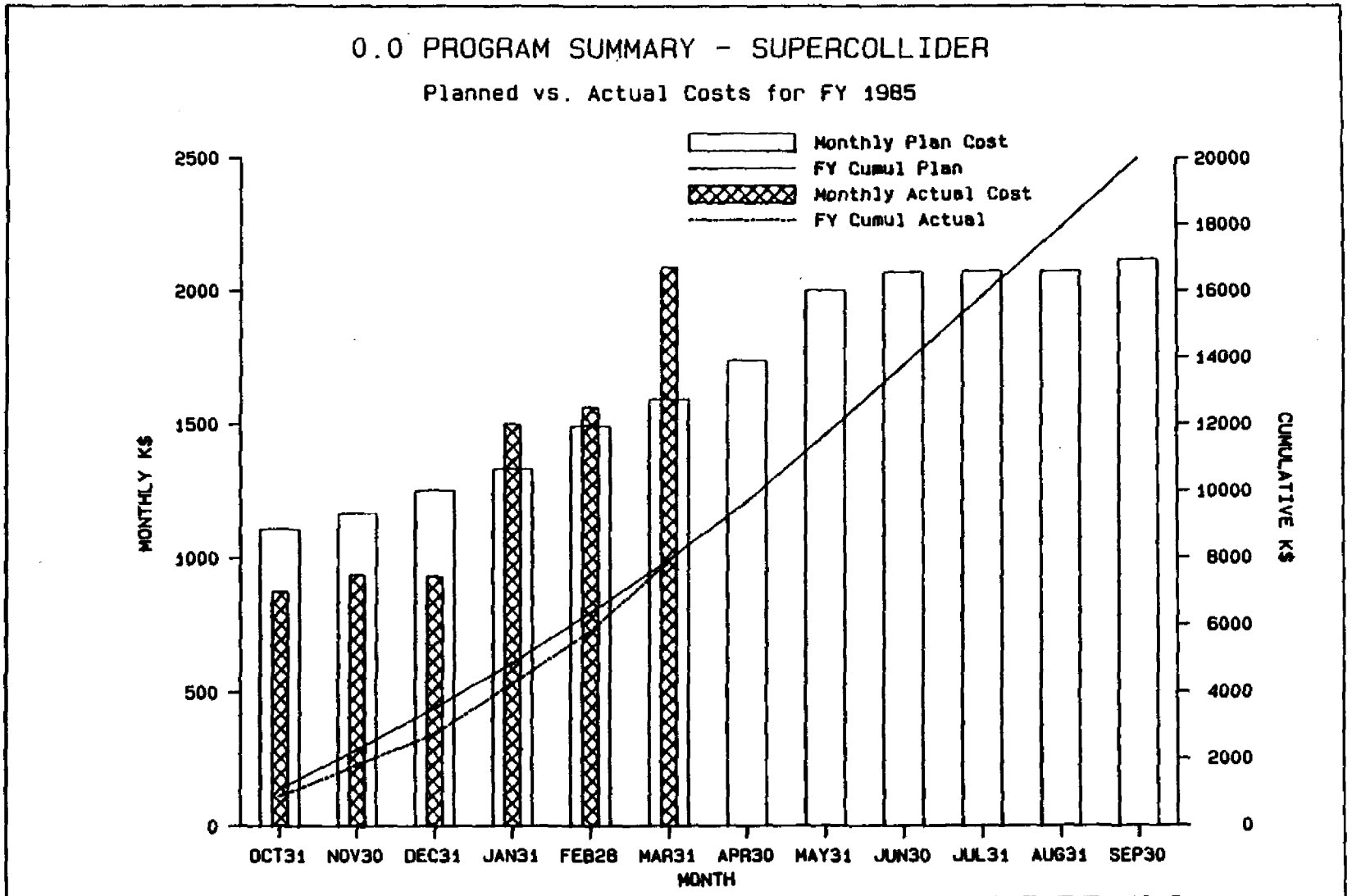
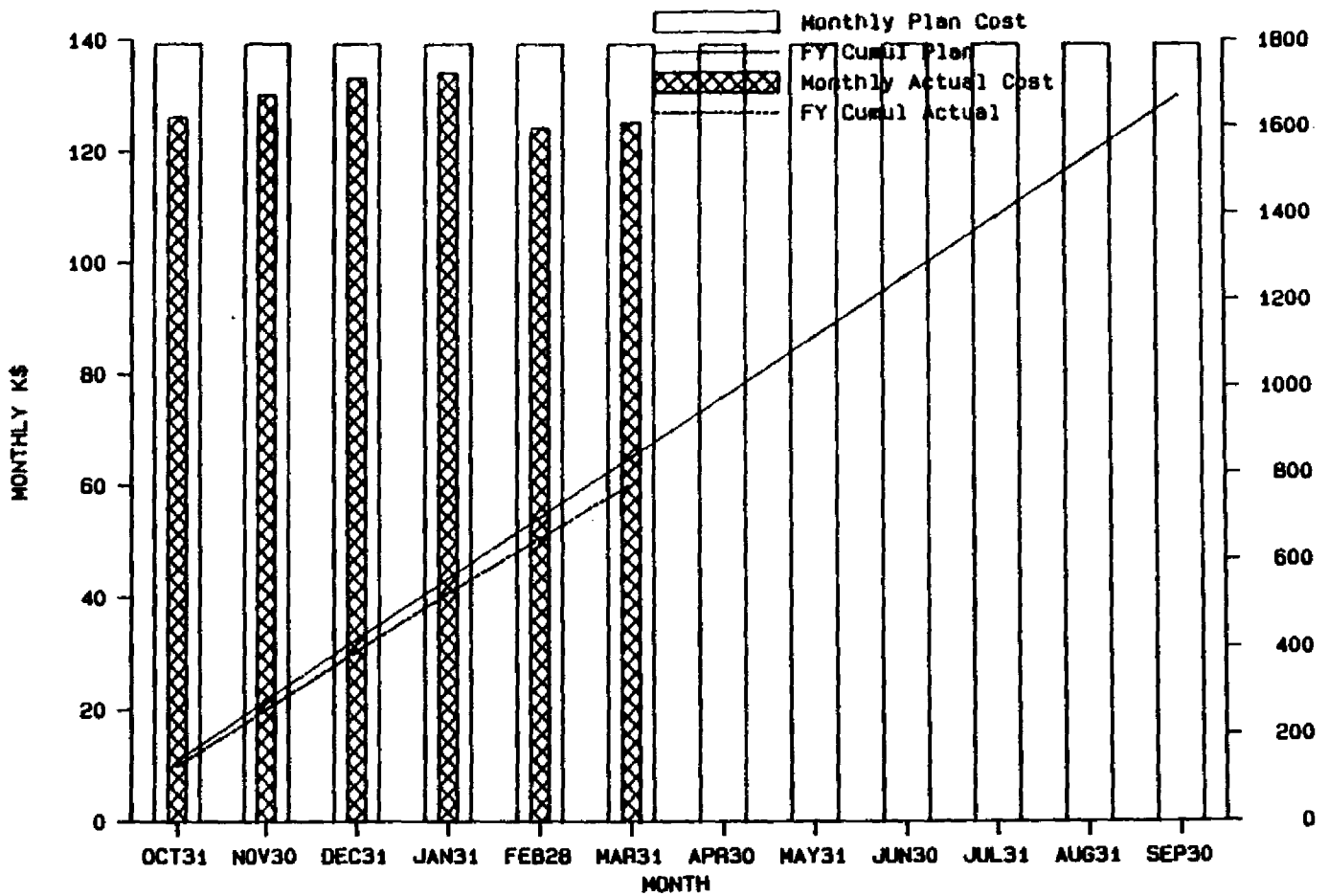
24-APR-85

Figure 5



	FISCAL YEAR 1985											
	OCT31	NOV30	DEC31	JAN31	FEB28	MAR31	APR30	MAY31	JUN30	JUL31	AUG31	SEP30
Monthly Plan	1106	1166	1251	1331	1491	1591	1738	2001	2066	2073	2071	2116
FY Cumul Plan	1106	2273	3524	4855	6346	7938	9674	11675	13741	15813	17884	20000
Monthly Actual	872	935	930	1498	1561	2087						
FY Cumul Actual	872	1807	2738	4236	5797	7884						

Figure 6



	FISCAL YEAR 1985											
	OCT31	NOV30	DEC31	JAN31	FEB28	MAR31	APR30	MAY31	JUN30	JUL31	AUG31	SEP30
Monthly Plan	139	139	139	139	139	139	139	139	139	139	139	139
FY Cumul Plan	139	278	418	557	696	835	974	1113	1253	1392	1531	1670
Monthly Actual	126	130	133	134	124	125						
FY Cumul Actual	126	256	389	523	647	772						

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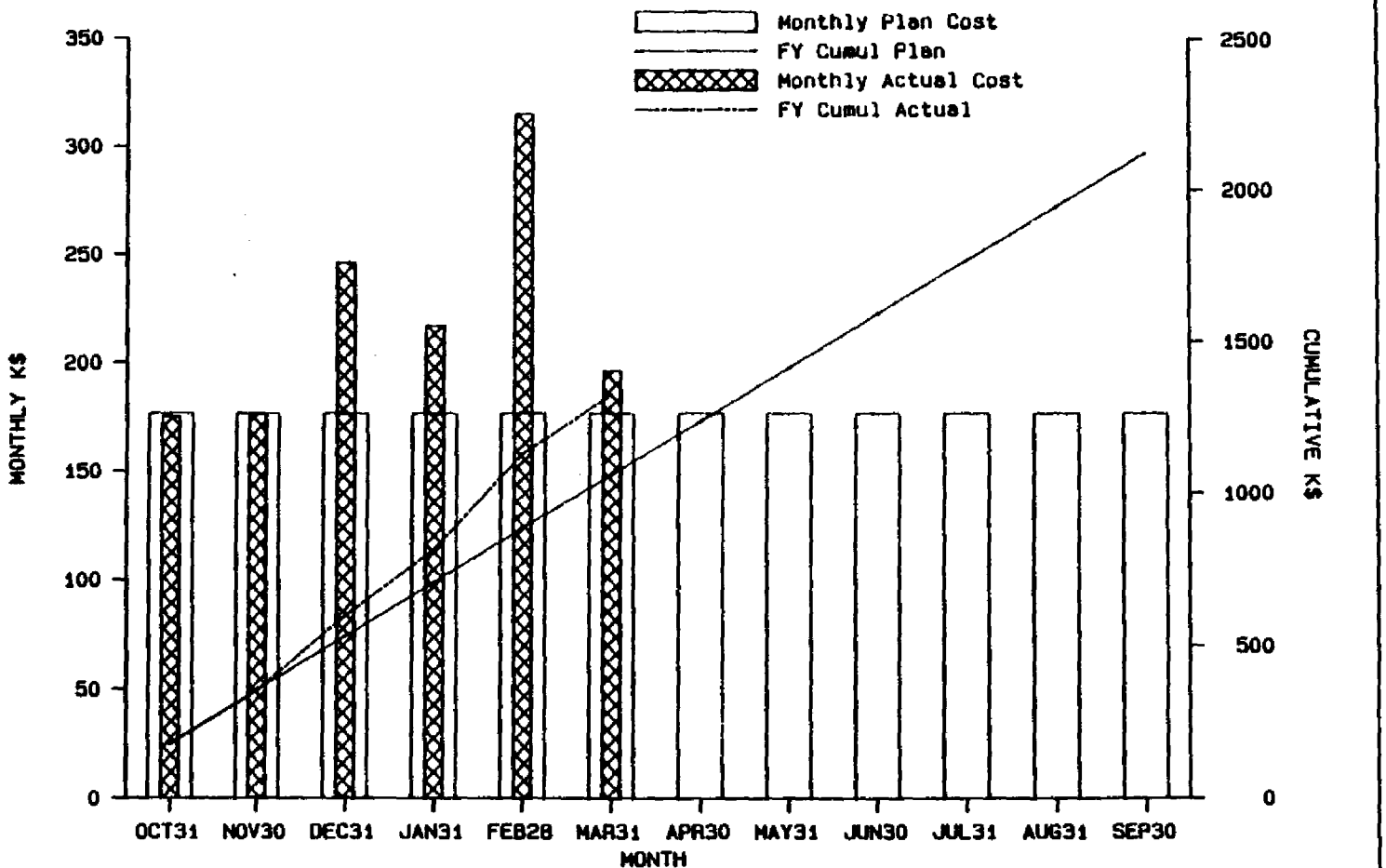
24-APR-85

Figure 7



	FISCAL YEAR 1985											
	OCT31	NOV30	DEC31	JAN31	FEB28	MAR31	APR30	MAY31	JUN30	JUL31	AUG31	SEP30
Monthly Plan	177	177	177	177	177	177	177	177	177	177	177	177
FY Cumul Plan	177	353	530	707	883	1060	1237	1413	1590	1767	1943	2120
Monthly Actual	175	176	246	217	315	196						
FY Cumul Actual	175	351	597	814	1129	1325						

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(JSZ)
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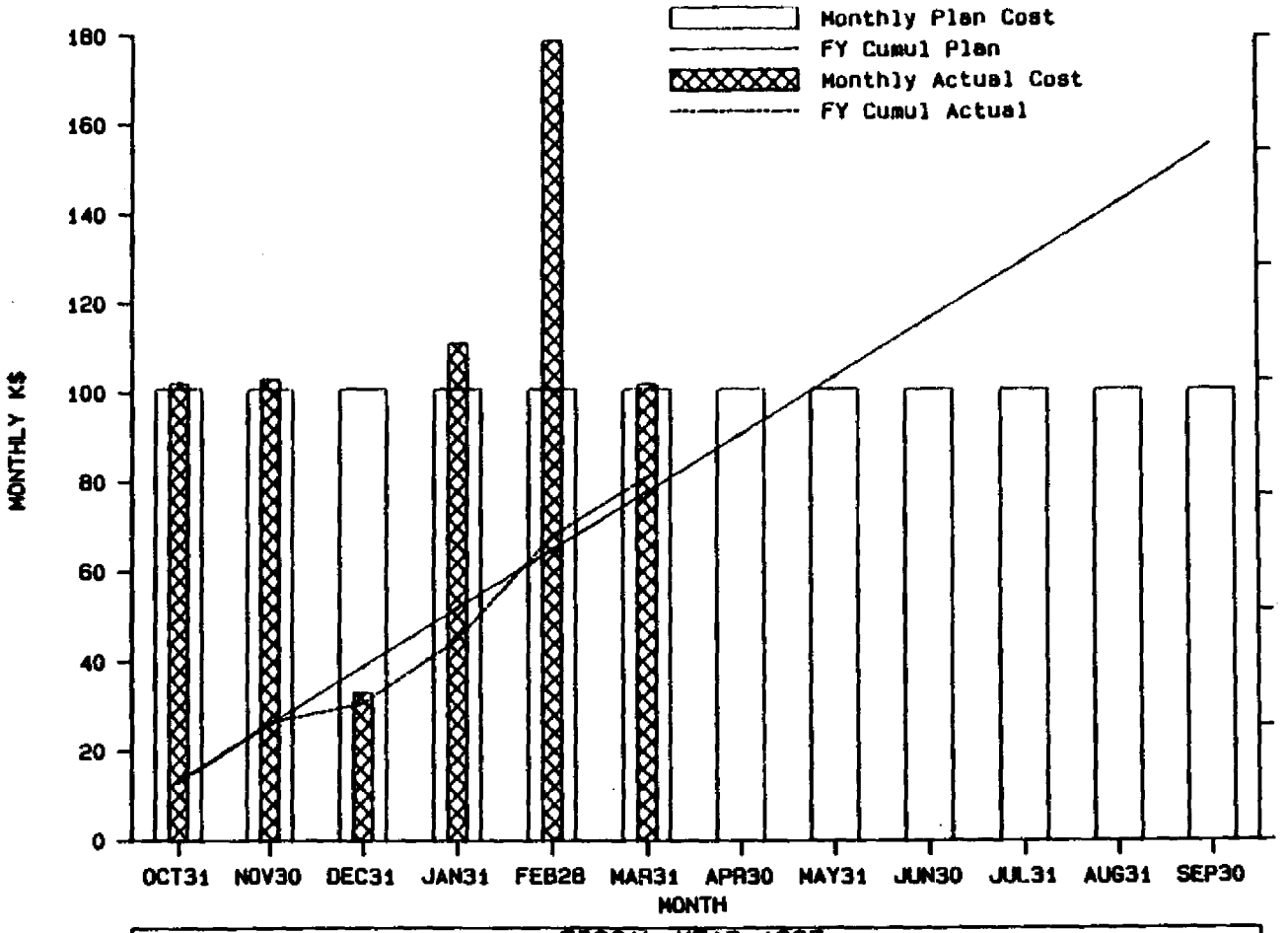
24-APR-85

Figure 8



	FISCAL YEAR 1985											
	OCT31	NOV30	DEC31	JAN31	FEB28	MAR31	APR30	MAY31	JUN30	JUL31	AUG31	SEP30
Monthly Plan	101	101	101	101	101	101	101	101	101	101	101	101
FY Cumul Plan	101	202	303	403	504	605	706	807	908	1008	1109	1210
Monthly Actual	102	103	33	111	179	102						
FY Cumul Actual	102	205	238	349	528	630						

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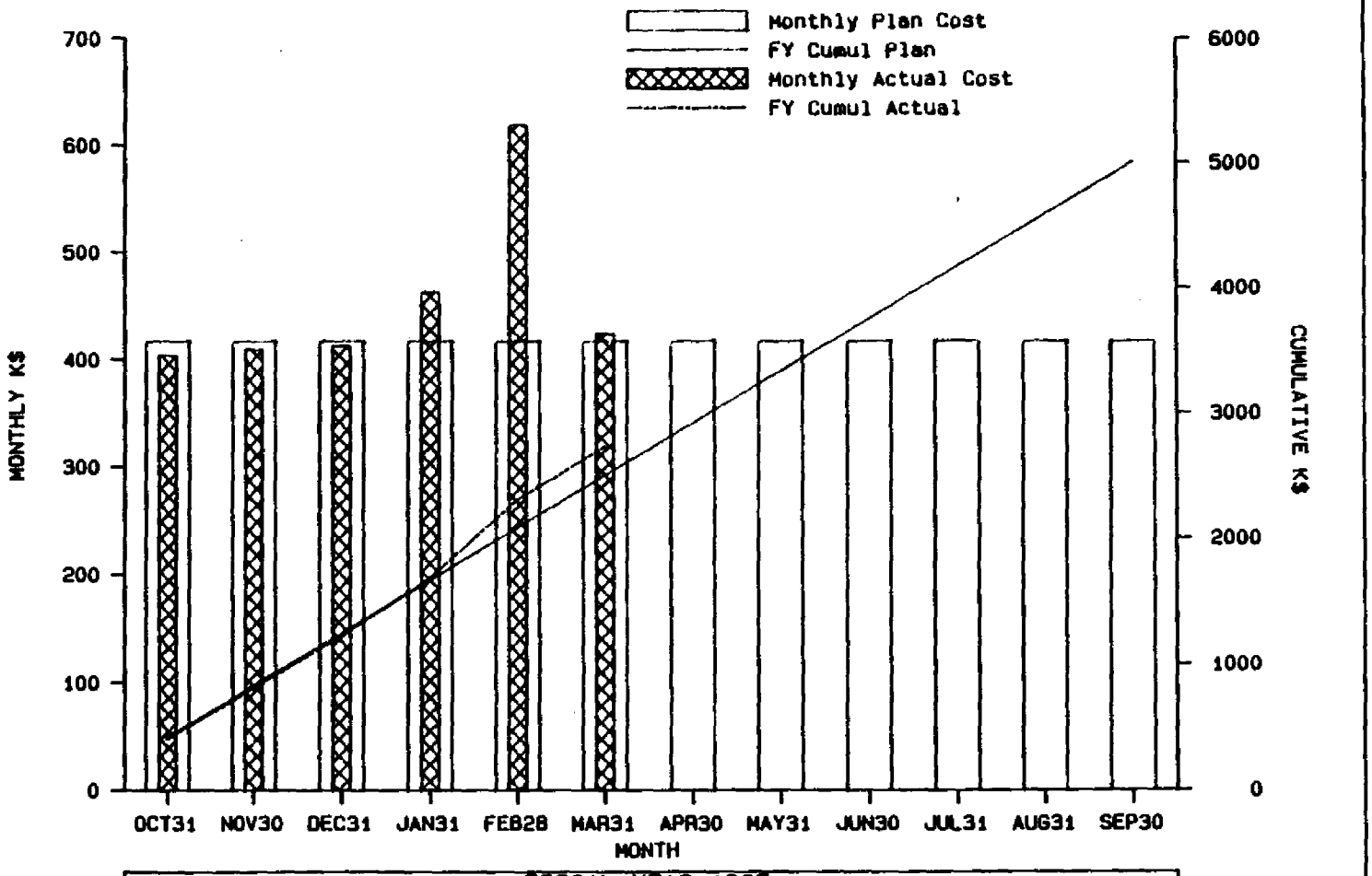
(JSZ)
4:30 pm
24-APR-85

Figure 9



	FISCAL YEAR 1985											
	OCT31	NOV30	DEC31	JAN31	FEB28	MAR31	APR30	MAY31	JUN30	JUL31	AUG31	SEP30
Monthly Plan	417	417	417	417	417	417	417	417	417	417	417	417
FY Cumul Plan	417	833	1250	1667	2083	2500	2917	3333	3750	4167	4583	5000
Monthly Actual	403	409	412	462	618	423						
FY Cumul Actual	403	812	1224	1686	2304	2727						

SSC
(JSZ)
4:28 pm
24-APR-85

Figure 10