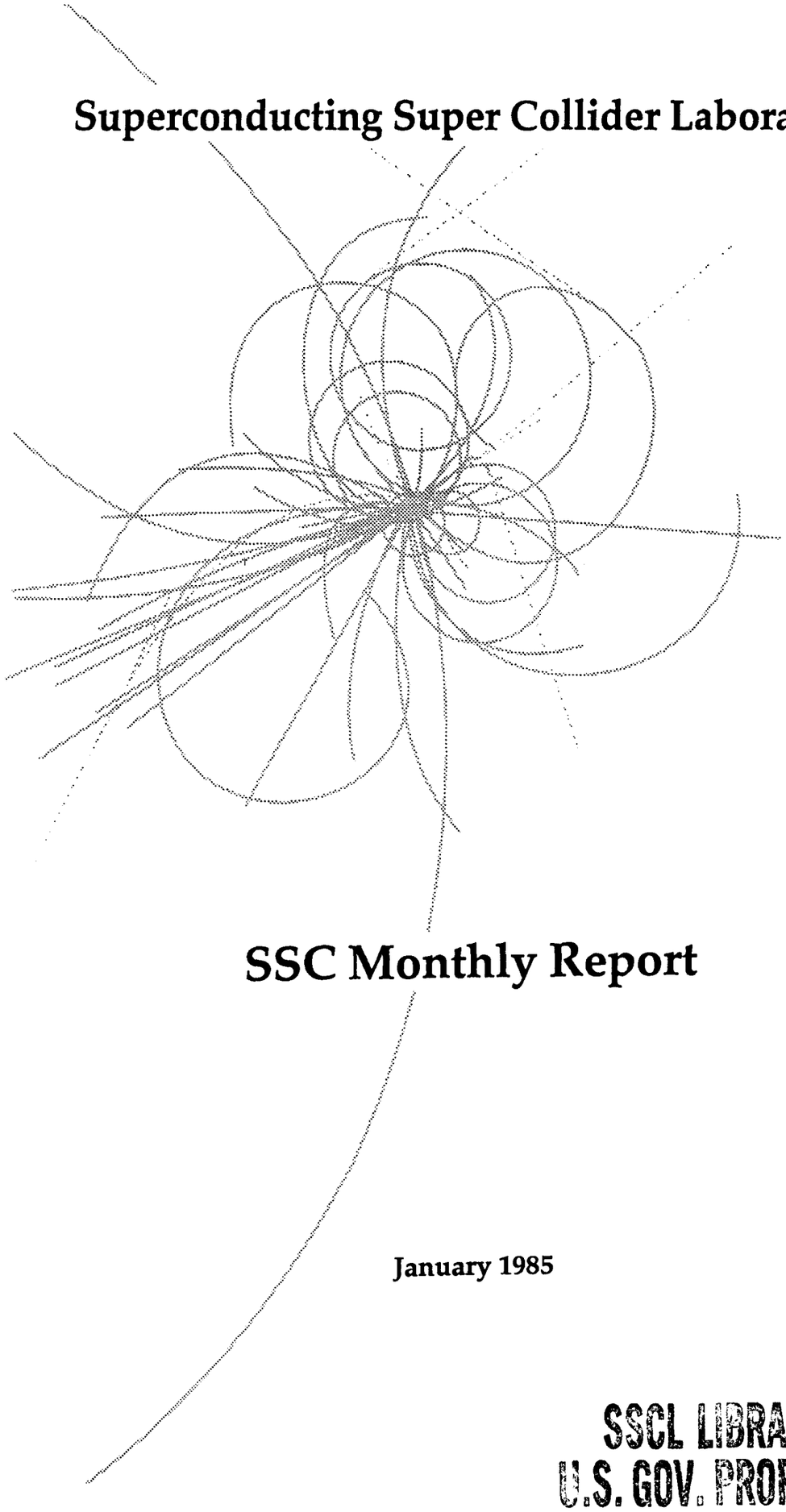
SSC-10

Superconducting Super Collider Laboratory

SSC-10



SSC Monthly Report

January 1985

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SSC MONTHLY REPORT

JANUARY 1985

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CONTENTS

	Page
A. Project Summary	1
B. Project Report	4
1.0 Central Design Group	4
2.0 Brookhaven National Laboratory	9
3.0 Fermi National Accelerator Laboratory Program	17
4.0 Lawrence Berkeley Laboratory Program	20
5.0 Texas Accelerator Program	24
C. Project Cost Data	25

SSC MONTHLY REPORT
JANUARY 1985

A. PROJECT SUMMARY

1. Highlights of the January activities include the following:

- o A workshop on NbTi superconductor, co-hosted by LBL and U. of Wisc., was held at LBL January, 16&17.

- o A Workshop on SSC Comissioning and Operations, hosted by the CDG Accelerator Division, was held at UC Berkeley, January 14-18.

- o Specific work on site criteria for the SSC was initiated with the CER Corporation and their subcontractor, Parsons Brinckerhoff. Work centers on the Site Parameters Document to be used by DOE with their request for site proposals.

- o The report of the review panel on Tunneling Technology was transmitted to DOE.

- o Fabrication and asssembly of the first one meter 4.0 cm bore, 6.5 T magnet with collared coil was completed at LBL.

- o The first SSC Program Quarterly Review was conducted by DOE on January 29, 1985.

2. Laboratory Programs

Activities at BNL centered on implementing plans for the Design D magnet. Major magnet components in production for 4.5 meter model magnets include yoke and collar dies and laminations. Model magnet tooling in assembly stage includes a coil winding mandrel and a curing fixture. Development has been started on a new collar press using incremental pressing. Substantial progress has been made in trim coil development, both on the LBL style and Multiwire trim coils. Field measuring coils for testing 4.5 meter long magnets are in various stages of design or construction and progress continues on the prototype "mole".

At FNAL a program has been developed for designing and building components for the Design D magnet. Cryostat and suspension concepts were studied and considerable progress was made in preparing draft cryostat criteria for Design D. The six meter magnetic, and the twelve meter heat leak models are nearing completion. The one meter model program is continuing with emphasis on refinements to the dry winding techniques.

At LBL fabrication and assembly were completed on the first Design D-one-meter model magnet using a collared coil. A final room temperature coil preload of approximately 12,000 PSI was achieved. The magnet is equipped with remote reading collar positon indicators and data on collar deflection vs. magnet current will be obtained during testing. Fabrication is proceeding on the

second collared coil magnet, with the Nitronic 40 stainless steel collars completed and coil winding about to begin. A series of runs were made on the experimental cabler varying cabling parameters such as wire twist and tension and the quality of cable produced was evaluated. Differing mandrel shapes were also tried and the results of these tests were provided to the manufacturer in preparation for the February cabling run.

A report covering modifications to the POISSON program has been completed. The outer boundary condition has been extended to include the effects of externally applied fields generated by the earth or adjacent magnets. A preliminary design of elliptical outer boundary iron for the SSC Design D dipole has been completed. Work continues on the design of improved coil ends.

At TAC design modifications have been made to the super-ferric magnet. A pole face correction winding has been added to correct the decapole component of the magnetic field. A magnetic shunt along the face of the coil has been added to help make the magnetic field more uniform and to reduce the peak magnetic field seen by the conductor. The coil package has been reshaped in a wedge to ease assembly.

B. PROJECT REPORT

1.0 Central Design Group

1.1 and 1.2 Administration, Project Planning and Management

The first DOE Quarterly Review of the SSC Program was held at the Design Center on January, 29. Representatives from CH, DHEP, and SAN attended. The SSC program of the CDG was presented together with the R&D efforts at BNL, FNAL, LBL, and TAC.

The SSC Management and Program Plans have been updated and revised to reflect current plans and budget projections. Work has continued on an SSC Brochure which will describe the SSC project and goals in a manner appropriate for the general public. The second edition of the SSC Newsletter was produced. The newsletter is geared to provide current information to the HEP community.

CDG Staff members visited several industrial firms during the month to obtain advice on techniques and methods used by industry for planning, analysis, and production. Firms visited included AT&T, GM, and the Cross Co. CDG staff members also attended meetings of the CH A/E Selection Committee established to select the A/E firm(s) for conceptual design work on SSC conventional facilities.

1.3 Accelerator Research and Development

1.3.2 Accelerator Theory and Computation. The CDG/LBL accelerator physics activities involved the setting up of test lattices, the determination of magnet errors for aperture evaluation purposes, and tracking program developments. Six test lattices, each containing two families of sextupoles, have been created and stored in the data base on an LBL VAX.

The Magnet Error Group of the Aperture Task Force continued to evaluate the magnet multipole errors for each magnet style. Results of this effort will be input to the magnet evaluation process. Intensive effort was focused on improving the tracking programs, PATRICIA, MARYLIE, and DIMAT for SSC purposes. A limited amount of tracking computations were made using PATRICIA and DIMAT. The effort will increase substantially next month.

Impedance calculations have begun for vacuum enclosure components and a program to evaluate beam instability thresholds using the calculated impedance is being activated.

1.3.3 Accelerator Systems. The Task Force on Commissioning and Operations of the SSC held a Workshop at U.C. Berkeley, on January 14-18. Preliminary results of the Workshop indicate that there are enough experts on accelerator/storage ring operation to carry out the tasks required of the Task Force. No obvious preference toward a particular magnet type with regard to commissioning and operations has, as yet, been uncovered; however, further details are being pursued. Meetings of the task Force are scheduled for February 26-27, March 26-27, and in April to complete the report.

The photon induced gas desorption experiment is scheduled to start in March at the VUV ring of the National Synchrotron Light Source (BNL). Design work for the beam line and beam line components is complete and fabrication has started. Preliminary design of the cryostat is complete and final design work has started. The safety review by the NSLS staff is completed and the experimental setup for Phase I (warm tube) is approved. Two mass spectrometers are on order with delivery scheduled for February.

1.3.4 Magnet Program. A reference design activity has been commissioned by the CDG Magnet Division in order to provide needed data for a magnet selection. Both high and low field magnet options will be defined in enough detail to make cost comparisons. The first goal is to

provide a technical description of both a 3T and a 6T accelerator by April 1. The CDG, with assistance from industrial organizations will make magnet cost estimates by June 1. Ron Yourd and Clyde Taylor will organize and coordinate this activity with the design work being done by the Laboratory magnet R&D groups.

1.4 Conventional Systems

The Conventional Systems Division of the CDG performed considerable planning activities aimed at achieving the major goals of the next two years. This involved tasks associated with siting studies, site criteria and reporting. Preparations have also begun for the conceptual design of the conventional facilities for the SSC.

In order to to proceed with the request for site proposals, specific work on the Site Parameters Document was initiated by personnel from the CER Corp. and their subcontractor Parsons Brinckerhoff. The accelerator systems to be used in the study will be derived from the Reference Designs Study with physical criteria provided by CER/PB. Editorial work and report production is centered in the CDG at LBL.

The selection of an A/E firm(s) for conceptual design work for conventional facilities is underway at the Chicago Operations Office of the DOE. The selection panel considered thirteen responses to

to the Commerece Business Daily announcement and requested four firms to make oral presentations in early February.

2.0 Brookhaven National Laboratory Program

2.1 General. Analytical studies continued on the initial 3.2 cm aperture coil design, particularly in the presence of a large sextupole harmonic, -77×10^{-4}, with an outer to inner coil ratio of 1.35. Lead and power supply limitations restrict testing to equal currents in the apertures of the 2-in-1 magnets while it is desirable to test with unequal currents to assess cross talk between apertures. If the magnetic center is not accurately known the large sextupole term will generate a large pseudo quadrupole term, which would mask any quadrupole term due to unequal currents in the two apertures. A simple design modifaction, removing two turns from the inner coil layer, resulted in a sextupole term of 14×10^{-4}. The transfer function dropped by 4.6%, resulting in a loss of about 2.3% in the central field. The sensitivity of the (4.0 cm I.D. with 1.5 cm collars) coil design to centering errors in the iron yoke was computed as a quadrupole term of 1.95×10^{-4} per 5 mil horizontal displacement and a skew quadrupole term of 1.86×10^{-4} per 5 mil vertical displacement. Approximate coil and iron configurations for coil inner diameters of 3 and 5 cm were estimated by linear scaling of the new configuration, to be used in cost estimates for different apertures.

2.2 Model Magnets. A mechanical model for the mechanism by which damage to the inner Niobium Tin coils has occured during fabrication was developed and verified. Modification to the pole piece extension and reduction in the curing pressure, coupled with

previous modifications, should allow fabrication of acceptable coils.

Electrical leads have been reworked in order to permit bias test powering of a 2-in-1 magnet to study field perturbation questions. Winding of modified inner coils will begin in February.

Progress was made on components of the 4.0 cm aperture x 4.5 meter long magnets, primarily in the following areas:

- Yoke and collar lamination dies and laminations are progressing with first inspection expected in late February for the yoke and shortly thereafter for the collars.

- Nitronic 40 stainless steel collar material sheets have been received and samples are being tested for magnetic permeability.

- A mockup of the coil-end-transition region to assure insulation holdoff and creep path has been completed and is available for inspection.

- Magnet strain gauge transducers, yoke and helium vessel parts have been released to Central Shops and outside vendors for fabrication.

- The first hand-wound trim coil was tested to 150 A at 5T and 4.5 K using 0.021 inch diameter superconductor sup-

plied by LBL. This provides experience in manufacturing trim coils of the LBL-type, pending more extensive development of the Multiwire process.

- The vendor for the Multiwire contract has successfully transferred 0.008 in diameter wire onto its substrate, and modifications to handle 0.010 to 0.012 in diameter wire is nearly complete.

- Model collars and a six inch coil test section, supplied by LBL, were successfully squeezed to the design prestress on the inner and outer coils, and the four keys were inserted. Approximately 50% of the prestress was lost upon removal of the press load, due to the excessive clearance between the assembly rods and the corresponding holes in the collar packs. The laminations were electrical discharge machined and the location and size of the holes had larger tolerance than collars to be manufactured with dies. Rods, undersized by 10 mils, were used to accomplish assembly with the resulting loss of prestress. The holes are being drilled and reamed so oversize rods can be incorporated to rectify this problem.

2.3 Tooling and Facilities

Coil fabrication tooling R&D consisted of the following:

- Pole piece extensions and mandrels for the 3.2 cm aperture coils were modified to minimize relative movement.

- All purchase orders related to coil tooling for the 4 cm aperture x 4.5m long magnets have been released.

- Pertinent areas of the full length (16.6 m) coil winder were redesigned to accommodate a straight-ended coil and the design is 75% complete.

- Assembly of the 4 cm aperture inner and outer mandrels is continuing, and assembly of the inner and outer form blocks has begun.

- Drawings have been released to Central Shops for coil stand assembly and coil transport equipment required for magnet assembly.

Coil and yoke assembly tooling progressed in the following areas:

- The module bonding fixture has been redesigned for the 1-in-1 configuration and released to the shops.

- A scheme for collaring coils was finalized and detailing of the assembly table and associated tooling commenced.

- Fixtures to assemble individual collar packs are being detailed.

- A new collar press concept, using existing CBA strong backs coupled with incremental pressing, is now under development and will permit manufacturing tooling in a time consistent with the current schedule.

- A weld test fixture has been designed and engineered in order to explore stresses in the helium vessel shell during and after welding.

Progress in bore tube and trim coil tooling was made in the following areas:

- Copper plating of the inner surface of the bore tube to facilitate heat transfer of the synchrotron radiation and impedance effects.

- Coatings on the outer surface of bore tubes to ensure trim coil and insulation adherence.

- A bore tube measuring laser.

- Wrapping tooling for Kapton and Kevlar for trim coils.

Magnet test facilities progress includes:

- Drawings released to the shops for the manufacture of tubes for the vertical tangential measuring coils for 4 cm aperture magnets.

- A room temperature, horizontal measuring coil for the 4cm aperture magnets is in the design stage and preliminary design has been completed for a Morgan coil to measure ramp rate effects.

- Tests are continuing on the fiber optic encoders and reversing drives for the mole prototype.

2.4 Tests and Measurements. No magnet tests were performed this month. The measuring coil and drive asssembly used to measure the TAC model magnets was shipped to Texas. The coil controller was completed and also shipped to Texas.

2.6 Superconductor Development. A total of 900 lbs. of high homogeneity NbTi wire was delivered by IGC, but due to scheduling problems at NEEW, the planned January production run of cable did not occur. The run, using approximately half the 900 lbs. of wire will take place in early February.

Research by the BNL Magnet Division, reported at the Superconductor Workshop, involved examination of NbTi wires from various sources, with current density ranging from 1300 to 2600 A/sq mm (5.0T, 4.2K) and filament diameters ranging from 0.6 to 23 microns, by scanning electron microscope. Filaments in high current density wires were shown to have clean, smooth surfaces and uniform cross section. In low current density wires, individual filaments show large variations in cross section and surface formation of numerous CuTi compound nodules and the superconducting to normal state resistance transition is relatively wide. These nodules were known to occur, but their effect on current density and superconducting to normal state resistance transition had not been previously demonstrated. The nodules also lead to large variations in filament diameter during draw-down and are believed to be due to excessively high temperature during wire processing.

Very promising wires have recently been produced in Europe and Japan demonstrating the production of small, uniform filaments combined with high current density. U.S. manufacturers are expected to duplicate or exceed this capability. Ongoing investigation points to the importance of controlling both compound formation and intrinsic current density.

2.7 Cryogenic Systems. Engineering studies have continued on the cryogenic/magnet interface for magnet Design D. Calculations have shown that, in addition to the 80K shield, a low temperature shield with mean temperature around 20K may be the most cost effective method when both capital and operating costs are considered.

3.0 Fermi National Accelerator Laboratory

3.2 Magnet Models. Model magnet RK1001, 7.6 cm aperture with Super Saver conductor, standard stainless steel collars, and solid insulation between the inner and outer coil layers, was completed and tested. No support rings were added to the outside of the collars. The conclusion of this test is that a high copper (1.8 to 1, Cu:SC) conductor cable with small filament size (9 micron) is very stable. In spite of the reduced helium irrigation and extreme distortion of the collars the magnet reached short sample (6200 amps).

3.2 Facility Development. Programming work is being completed on the fast data acquisition system being prepared for measurements on the 6 meter Design B Magnetic Model. This new system will also be useful in studies of quench propogation in one meter model dipole magnets. The room temperature magnetic measurement system is being proved by the comparison of warm to cold measurements on one meter models.

3.4 Superconductor Development. Assembly has begun on cable measuring devices which will allow the continious measurement and recording of cable thickness to a few tenths of a mil. The measurements will be used to select cable for winding such as to allow matching four coil sizes.

3.5 Cryostat Development. The design transition from the 5cm no-iron to the 4cm cold iron magnet has been completed. Sections are

being developed for the cryostat between suspension points. Currently two designs are being pursued for supports suitable for the 4cm design, a folded post and an elliptical arch. It is planned to have designs completed to a point where representative units can be fabricated within approximately one month.

An SSC Design D Cryostat Design Workshop, involving representatives from BNL, LBL, and FNAL, will be held at Fermilab on February 5-6. The Cryostat Design Criteria is scheduled for first release on February 15.

A group has been identified to study methods for automatic welding of cryostat bodies and interconnections. The objective of their work is to provide design criteria which will allow the use of such equipment.

The Magnetic Effects Model 10K and 80K lower shields have been assembled to the single phase assembly and suspension system and installed in the vacuum vessel. Work continued on test procedures, test support apparatus, schematics, and safety documentation.

The Heat Leak Model end vessel assemblies were measured for heat leak to liquid helium and nitrogen. The measured and predicted total (conduction plus radiation) heat leak to 80K of 22W were in very good agreement. The measured total heat leak to 4.5K of 0.45W was significantly less than the predicted value of

1.05W. The analytical methods of calculation are under review. The aluminum mock thermal assembly in the center section of the model has been completed and is being instrumented. Work is continuing on the single phase containment vessel.

The measurement of a Magnetics Effects Model post support in the Suspension Heat Leak Dewar has been completed. The measurements have resulted in an excellent agreement between the predicted and measured values for heat leak (23mW). Follow-on measurements, which are in progress, include the upper heat intercept at temperatures other than 10K, for example 20, 30, and 40K. After completion of the upper intercept temperature variation run, a heat leak measurement will be made with the connection to the 10K shield removed. This will complete the planned testing of the Magnetic Effects Model post. The heat leak suspension dewar will be converted for the measurement of multilayer insulation systems and their application techniques.

4.0 Lawrence Berkeley Laboratory Program

4.1 General. LBL and the U. of Mich,.co-hosted a NbTi superconductor workshop at LBL. The workshop focus was on the needs of the SSC project. About 40 representatives from industry and government laboratories attended, and presentations were made by 20 attendees. Feedback from the participants has been positive and another workshop is being planned in the Madison, Wisconsin area for mid-July.

4.2 Magnet Models. Work continues on the 1-in-1 dipole magnets. The following tasks were completed on D12C1:

- 0 Fabrication of magnet yokes
- o Fabrication of collar position indicator parts
- o Assembly of coils on mandrel
- o Calibration test of coil load cell sub-assemblies
- o Installation of aluminum collars on coil assembly
- o Calibration test of collar position indicator assembly at 80K
- o Installation of coil voltage taps instrumentation and coil end insulators
- o Installation of coil/collar assembly into magnet yokes
- o Installation of collar position indicator of magnet yoke
- o Installation of magnet and instrumentation leads.

Problems had been anticipated in asssembling the collared coil, however, the assembly went reasonably well and no surprises were encountered. Once the final pole shim thicknesses were experimentally determined, the collaring operation was completed in less than two shifts. A loss of of about 25% in coil preload was experienced when the load was transferred to the collar pins and

keys from the press platen. A final room temperature coil preload of approximately 12,000 PSI was achieved. The mechanical assembly was completed January 31 and moved to the test area for installation in the cryostat. Magnet testing is scheduled to start in early February and be completed by the end of the month.

The following tasks were completed or started on D12C2:

- Completed fabrication of 1.5cm stainless steel collars
- Completed design of platen for collar installation press
- Completed design of coil end wedges
- Completed fabrication of mold for production of end wedges
- Started molding of coil end wedges
- Assembly of coil curing fixture 75% complete
- Mechanical measurement of 23 and 30 strand cable 80% complete

Inspection of the completed 1.5cm stainless steel (Nitronic 40) collars showed that they meet the specified tolerances. A series of mechanical tests, similar to those performed on the aluminum collars, will be conducted on these collars. The purpose of the tests is to confirm the predictions of the finite element analysis and to provide collared coil shape data for field quality predictions.

Initial measurements of both the 23 and 30 strand cable produced by NEEW in December, indicate they are acceptable for use in D12C2. Once these measurements are completed, final design of the coil packages can begin. Coil winding is expected to start in February . The coil curing fixture assembly is proceeding satisfactorily and should be completed when the first coil has been wound.

4.3 Calculations and Analysis .A report covering modifications to the POISSON program was completed. These modifications include incorporation of the condition on the outer elliptical boundary that correctly simulates an air region extending to infinity. The outer boundary region has been extended to include the effects of externally generated fields such as the earth's or adjacent magnets and the program can now handle hydrodynamic problems involving flow around a body with circulation. The editing of the output was changed in order to improve color mapping, and several bugs were removed. The possibility of increasing the speed of editing was investigated.

The investigation of the practicability of using R. Fernow's (BNL) magnet design program continued and it was found to be too large for the present HP-1000 system. However, the new HP-1000, scheduled for delivery in early March will have enough capacity. Several system-specific routines were found in the program, and these must be integrated into the program.

Work continued on the design of the ends for Design D dipole coils. The goal is to design practical and economical coil ends that minimize aberrations in the integral field and give an acceptably low increase in field at the conductor compared to that far from the ends.

A preliminary investigation of the field quality of 2-in-1 dipole corrector coils was performed. Cooldown of a string of SSC dipoles, and its effect on the temperature gradient at the front end of the cooldown wave, was investigated.

4.6 Superconductor. A series of runs were performed on the LBL Experimental Cabler in preparation for the February cabling run at NEEW. Several mandrel designs were evaluated and the optimum design was given to NEEW for fabrication. The effect of strand twist on cable springback was investigated by varying the relationships between strand twist direction, additional twist provided by the planetary rotation system, and cable twist direction. The best cable was selected from the matrix of samples prepared. Unfortunately the cablers at NEEW do not currently have the capability to operate in this mode, so a mode that is available and produces acceptable cable was selected.

5.0 The Texas Accelerator Center Program

5.2 Short Magnets. The two original one meter magnets have been mounted together as a 2-in-1 magnet and another 2-in-1, one meter, magnet is being tested. It will take another month to obtain most of the desired results. As a result of previous tests and analysis, two changes have been made to the design. A pole face correction winding has been added to correct the decapole component of the magnetic field and a magnetic shunt has been added along the face of the coil to make the magnetic field more uniform and to reduce its field as seen by the conductor. A one meter magnet will be constructed with the new design modifications when materials arrive in early March.

The 25 foot magnet has been assembled several times. Many things were learned in these trial assemblies, some of which led to design modifications in the one meter model program. The 25 foot magnet helium container, with coils, etc., has been enclosed and welded together. The final assembly is straight, horizontally and vertically,to within an amplitude of 15 mils and a twist of less than one milliradian. Amplitudes of up to 40 mils had been expected.

5.3 Long Magnets. The modifications to the superferric design have been incorporated into the design in the agreement with General Dynamics, as the design is to be set by February 15, 1985. Drawings with the modifications have been sent to General Dynamics. It is anticipated that the modifications will make the assembly easier than the previous design.

C. PROGRAM COSTS

The January costs for the SSC program are provided in Tables C-1 through C-7 as follows:

Table	SSC Group
C-1	CDG
C-2	BNL
C-3	FNAL
C-4	LBL
C-5	TAC
C-6	SSC Program Summary
C-7	Related Program Summary

TABLE C-1

CENTRAL DESIGN GROUP

JANUARY 1985 COST REPORT (K$)

	Program Element	Labor	Mat'l & Services	G&A	Month Total	Year To Date	Annual Budget
1.1	Administration	20	114	66	200	452	1650
1.2	Program Planning & Management	7	0	4	11	40	450
1.3	Accelerator R & D	2	35	18	55	73	2150
1.4	Conventional Systems Develop.	2	0	1	3	3	1075
	CDG TOTAL COSTS	31	149	89	269	568	5325
	Estimated Commitments					164	

TABLE C-2

BROOKHAVEN NATIONAL LABORATORY

JANUARY 1985 COST REPORT (K$)

	Program Element	Labor	Mat'l & Services	G&A	Month Total	Year To Date	Annual Budget
2.1	General	21	26	22	69	239	800
2.2	Magnet Models	96	38	64	198	752	2200
2.3	Tooling	24	25	23	72	262	800
2.4	Magnet Measurement & Devel.	20	6	13	39	152	400
2.5	Power Supplies & Quench Prot.	18	1	9	28	104	280
2.6	Cryogenic Testing	27	7	14	48	186	500
	BNL SSC PROGRAM	206	103	145	454	1695	4980
2.7	Superconductor Development	28	19	22	69	272	899
2.8	Cryogenic Systems Development	37	9	19	65	251	771
	BNL ACCELERATOR RELATED PROG.	65	28	41	134	523	1670
	BNL TOTAL	271	131	186	586	2218	6650
	Additional Commitments					455	

TABLE C-3

FERMILAB

JANUARY 1985 COST REPORT (K$)

	Program Element	Labor	Mat'l & Services	G&A	Month Total	Year To Date	Annual Budget
3.1	General	3.5	18.3	7.8	29.6	59.6	340
3.2	Magnet Models	75.9	230.6	110.3	416.8	1092.2	3225
3.3	Facility Development	9.6	14.8	8.8	33.2	75.1	340
	FNAL SSC PROGRAM	89.0	263.7	126.9	479.6	1226.9	3905
3.4	Superconductor Development	1.8	6.6	3.0	11.4	53.4	400
3.5	Cryostat Development	89.3	44.9	48.3	182.5	561.1	890
3.6	Accelerator Physics	30.2	(0.5)	8.6	38.3	214.0	830
	FNAL ACCELERATOR RELATED PROG	121.3	51.0	59.9	232.2	828.5	2120
	FNAL TOTAL	210.3	314.7	186.8	711.8	2055.4	6025
	Additional Commitments					548.0	

TABLE C-4

LAWRENCE BERKELEY LABORATORY

JANUARY 1985 COST REPORT (K$)

	Program Element	Labor	Mat'l & Services	G&A	Month Total	Year To Date	Annual Budget
4.1	General	4	3	3	11	49	115
4.2	Magnet Models	18	9	13	40	135	395
4.3	Analysis	7	0	4	11	46	125
4.4	Instrumentation/Measurements	7	0	4	11	49	155
	LBL SSC PROGRAM	16	12	24	73	279	790
4.5	Accelerator Theory	31	10	20	61	272	800
4.6	Superconductor Development	6	28	16	50	77	410
	LBL ACCELERATOR RELATED PROG.	37	38	36	111	349	1210
	LBL PROGRAM TOTAL	53	50	60	184	596	2000
	Additional Commitments					166	

TABLE C-5

TEXAS ACCELERATOR CENTER

JANUARY 1984 COST REPORT (K$)

Program Element	Labor	Mat'l & Services	G&A	Equip	Month Total	Year To Date	Annual Budget
5.1 General	0	27.7	16.4	0	44.1	161.7	825
5.2 Short Magnet Models	57.6	0	6.6	0	64.2	427.1	1150
5.3 Long Magnet Models	70.1	0	0	0	20.1	70.2	1660
5.4 Tooling	0	0	0	0	0	0	630
5.5 Theoretical Analysis	3.0	0	0	0	3.0	10.5	130
5.6 Facility Development	0	0	0	23.7	23.7	58.0	605
TAC SSC PROGRAM	80.7	27.7	23.0	23.7	155.1	727.5	5000

0438S

TABLE C-6

SSC PROGRAM SUMMARY

JANUARY 1985 COST REPORT (K$)

Program Element	Labor	Mat'l & Services	G&A	Equip	Month Total	Year To Date	Annual Budget
1. CDG PROGRAM	31	149	89	0	269	568	5325
2. BNL SSC PROGRAM	206	103	145	0	454	1695	4980
3. FNAL SSC PROGRAM	89	263.7	126.9	0	479.6	1226.9	3905
4. LBL SSC PROGRAM	16	12	24	0	52	279	790
5. TAC SSC PROGRAM	80.7	27.7	23.0	23.7	155.1	727.5	5000
TOTAL SSC PROGRAM	422.7	555.4	407.9	23.7	1409.7	4296.4	20000

0438S-6

TABLE C-7

ACCELERATOR RELATED R&D PROGRAM SUMMARY

JANUARY 1985 COST REPORT (K$)

Program Element	Labor	Mat'l & Services	G&A	Equip	Month Total	Year To Date	Annual Budget
1. CDG TOTAL	0	0	0	0	0	0	0
2. BNL PROGRAM	65	28	41	0	134	523	1670
3. FNAL PROGRAM	121.3	51.0	59.9	0	232.2	828.5	2120
4. LBL PROGRAM	37	38	36	0	111	349	1210
5. TAC PROGRAM	0	0	0	0	0	0	0
TOTAL ACCEL RELATED R&D PROGRAM	223.3	117.0	136.9	0	477.2	1700.5	5000

0438S-7