

SSC OPERATIONS PROJECTION
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The construction costs for establishing the Superconducting Super Collider (SSC) have been developed in the Conceptual Design Report (SSC-SR-2020) of March 1986. The related auxiliary costs for accelerator research and development activities and associated accelerator equipment that are required during the construction period have been estimated in SSC Technical Note SSC-N-175.

This note provides an estimate for operating the SSC laboratory and accelerator facilities after construction completion. Manpower requirements are developed for the various technical operations and laboratory support functions. The manpower estimates, associated materials and support, and utility services are the major cost elements in the operations area. Projections are also provided for the categories of equipment, accelerator improvements, general plant project improvements, and general plant equipment which are normally required in the support of a major High Energy Physics accelerator laboratory.

Background

The construction plan and schedule described in the SSC Conceptual Design Report is assumed. The construction program starts at the beginning of FY88 and is completed in mid-FY94 for a duration of 6.5 years.

The construction plan provides for a sequential turn-on of the four injection accelerators (Linac, LEB, MEB, and HEB) prior to beam acceleration and storage in the collider ring. Following appropriate acceptance tests for each of the above accelerator systems, it is assumed that construction is complete and that each accelerator will enter into a pre-operational phase prior to total project completion. The expected start of the pre-operations phase for each injection accelerator is as follows:

Linac	FY91	(4th Q)
LEB	FY92	(3rd Q)
MEB	FY93	(2nd Q)
HEB	FY93	(4th Q)

Major parts of the collider are expected also to become operational sequentially in a manner similar to that of the train of injection accelerators. Each of eight sectors of the collider is comprised of 1,130 superconducting primary dipoles and quadrupoles -- nearly twice the number of magnets as in the HEB. The installation program for magnets and other technical components will start in a sequential manner for each sector. When installation is complete, the superconducting magnet systems will be cooled to liquid helium temperature and acceptance tests will be conducted. When the sector successfully meets specifications for operations, the system will remain at liquid helium temperature in readiness for initial beam tests. The initial beam tests will consist of directing low intensity beams through certain completed sectors of the collider prior to completion of all sectors.

The acceptance test completion of each sector of the collider will initiate its pre-operational phase. The projected schedule is summarized below for each of the eight arc sectors and the east and west cluster regions.

Sector SH	FY92	(2nd Q)
Sector NA	FY92	(3rd Q)
Sector SG	FY93	(1st Q)
Sector SE	FY93	(2nd Q)
Sector NB	FY93	(3rd Q)
Sector SF	FY93	(4th Q)
Sector NC	FY94	(1st Q)
Sector ND	FY94	(2nd Q)
West Cluster WC	FY93	(1st Q)
East Cluster EC	FY94	(1st Q)

The manpower required to support the pre-operational activities is detailed in Table 1. The corresponding costs for each category are provided in Table 2. The salary rates for each category are the same as these developed for the Conceptual Design Report. The rates are representative of a national average in FY86 dollars. Using the manpower costs from Table 2, the total pre-operations costs are summarized in Table 3. The power costs are taken from Table 8.5-5 of the Conceptual Design Report.

Table 1

STAFFING DISTRIBUTION FOR PRE-OPERATIONS (FTE)

	SSC CONSTRUCTION							OPERATIONS				
	FY88.	FY89.	FY90.	FY91.	FY92.	FY93.	FY94.	FY95.	FY96.	FY97.	FY98.	FY99.
LABORATORY PERSONNEL:
DIRECTORS OFFICE & PROJ SUP	0.	0.	0.	8.	18.	30.	161	0.	0.	0.	0.	0.
DIVISION OFFICE	.	.	.	2.	4.	8.	41	.	.	.	.	.
PLANNING & BUDGET	.	.	.	5.	10.	15.	81	.	.	.	.	.
REPORTING	.	.	.	1.	2.	3.	21	.	.	.	.	.
Q/A
SAFETY	2.	4.	21	.	.	.	.	.
ACCELERATOR OPER. DIVISION	0.	0.	0.	62.	211.	373.	1931	0.	0.	0.	0.	0.
DIVISION OFFICE	.	.	.	2.	4.	6.	51	.	.	.	.	.
INJECTOR	.	.	.	20.	70.	135.	651	.	.	.	.	.
COLLIDER	.	.	.	30.	105.	190.	901	.	.	.	.	.
MAGNETS	10.	10.	121	.	.	.	.	.
ACCELERATOR SYSTEMS	.	.	.	5.	12.	20.	121	.	.	.	.	.
ACCELERATOR PHYSICS	.	.	.	5.	10.	12.	91	.	.	.	.	.
CONVENTIONAL SYS. DIVISION	0.	0.	0.	11.	58.	102.	601	0.	0.	0.	0.	0.
DIVISION OFFICE	.	.	.	1.	4.	6.	31	.	.	.	.	.
CONSTRUCTION
PLANT ENGINEERING	.	.	.	1.	4.	6.	31	.	.	.	.	.
BLDGs & GROUNDS
SECURITY	.	.	.	2.	10.	20.	121	.	.	.	.	.
FIRE PROTECTION	.	.	.	2.	10.	20.	121	.	.	.	.	.
CUSTODIAL	.	.	.	5.	30.	50.	301	.	.	.	.	.
TECHNICAL SUPPORT DIV	0.	0.	0.	7.	38.	62.	331	0.	0.	0.	0.	0.
DIVISION OFFICE	.	.	.	1.	4.	6.	41	.	.	.	.	.
ENGINEERING SERVICES	.	.	.	1.	4.	6.	41	.	.	.	.	.
TECHNICIANS
SHOPS:
COMPUTER	.	.	.	1.	4.	6.	31	.	.	.	.	.
E/M SHOPS	.	.	.	2.	8.	12.	61	.	.	.	.	.
CRAFT SHOPS
E/M EQUIP	.	.	.	2.	8.	12.	61	.	.	.	.	.
WAREHOUSE	5.	10.	51	.	.	.	.	.
TRANSPORTATION	5.	10.	51	.	.	.	.	.
ADMINISTRATION DIVISION	0.	0.	0.	8.	55.	94.	511	0.	0.	0.	0.	0.
DIVISION OFFICE	.	.	.	1.	4.	6.	31	.	.	.	.	.
PROCUREMENTS/CONTRACTS	.	.	.	1.	10.	16.	81	.	.	.	.	.
PAYROLL/ACCOUNTING	.	.	.	2.	10.	16.	81	.	.	.	.	.
PERSONNEL	.	.	.	3.	8.	12.	71	.	.	.	.	.
STAFF SERVICES:
VISITORS/PR	6.	10.	61	.	.	.	.	.
TRAVEL/TRANSP	4.	10.	61	.	.	.	.	.
COMMUNICATIONS	2.	4.	21	.	.	.	.	.
CONTRACT SERVICE	2.	4.	21	.	.	.	.	.
ENV. HEALTH	.	.	.	1.	4.	6.	31	.	.	.	.	.
TECHNICAL INFORMATION	5.	10.	61	.	.	.	.	.
PHYSICS SUPPORT DIVISION	0.	0.	0.	0.	0.	0.	01	0.	0.	0.	0.	0.
DIVISION OFFICE
PHYSICS
TECHNICAL SUPPORT
COMPUTATIONS, DATA ANAL
GRAND TOTAL	0.	0.	0.	96.	380.	661.	3531	0.	0.	0.	0.	0.

Table 2

COST DISTRIBUTION FOR PRE-OPERATIONS STAFF (FY86K\$)

	SSC CONSTRUCTION						58034	OPERATIONS					01
	FY88.	FY89.	FY90.	FY91.	FY92.	FY93.		FY94	FY95.	FY96.	FY97.	FY98.		FY99
BASE F86LABORATORY PERSONNEL:													
K\$/YR													
DIRECTORS OFFICE & PROJ SUP	0.	0.	0.	451.	996.	1693.	890	0.	0.	0.	0.	0	
76 DIVISION OFFICE	0.	0.	0.	152.	304.	608.	304	0.	0.	0.	0.	0	
53 PLANNING & BUDGET	0.	0.	0.	265.	530.	795.	424	0.	0.	0.	0.	0	
34 REPORTING	0.	0.	0.	34.	68.	102.	68	0.	0.	0.	0.	0	
47 Q/A	0.	0.	0.	0.	0.	0.	0	0.	0.	0.	0.	0	
47 SAFETY	0.	0.	0.	0.	94.	188.	94	0.	0.	0.	0.	0	
ACCELERATOR OPER. DIVISION	0.	0.	0.	2624.	8728.	15298.	8017	0.	0.	0.	0.	0	
67 DIVISON OFFICE	0.	0.	0.	134.	268.	402.	335	0.	0.	0.	0.	0	
40 INJECTOR	0.	0.	0.	800.	2800.	5400.	2600	0.	0.	0.	0.	0	
40 COLLIDER	0.	0.	0.	1200.	4200.	7600.	3600	0.	0.	0.	0.	0	
40 MAGNETS	0.	0.	0.	0.	400.	400.	480	0.	0.	0.	0.	0	
40 ACCELERATOR SYSTEMS	0.	0.	0.	200.	480.	800.	480	0.	0.	0.	0.	0	
58 ACCELERATOR PHYSICS	0.	0.	0.	290.	580.	696.	522	0.	0.	0.	0.	0	
CONVENTIONAL SYS. DIVISION	0.	0.	0.	349.	1728.	3002.	1728	0.	0.	0.	0.	0	
67 DIVISION OFFICE	0.	0.	0.	67.	268.	402.	201	0.	0.	0.	0.	0	
67 CONSTRUCTION	0.	0.	0.	0.	0.	0.	0	0.	0.	0.	0.	0	
55 PLANT ENGINEERING	0.	0.	0.	55.	220.	330.	165	0.	0.	0.	0.	0	
25 BLDGS & GROUNDS	0.	0.	0.	0.	0.	0.	0	0.	0.	0.	0.	0	
29 SECURITY	0.	0.	0.	58.	290.	580.	348	0.	0.	0.	0.	0	
32 FIRE PROTECTION	0.	0.	0.	64.	320.	640.	384	0.	0.	0.	0.	0	
21 CUSTODIAL	0.	0.	0.	105.	630.	1050.	630	0.	0.	0.	0.	0	
TECHNICAL SUPPORT DIV	0.	0.	0.	291.	1434.	2286.	1259	0.	0.	0.	0.	0	
63 DIVISION OFFICE	0.	0.	0.	63.	252.	378.	252	0.	0.	0.	0.	0	
53 ENGINEERING SERVICES	0.	0.	0.	53.	212.	318.	212	0.	0.	0.	0.	0	
28 TECHNICIANS	0.	0.	0.	0.	0.	0.	0	0.	0.	0.	0.	0	
SHOPS:	0.	0.	0.	0.	0.	0.	0	0.	0.	0.	0.	0	
35 COMPUTER	0.	0.	0.	35.	140.	210.	105	0.	0.	0.	0.	0	
35 E/M SHOPS	0.	0.	0.	70.	280.	420.	210	0.	0.	0.	0.	0	
35 CRAFT SHOPS	0.	0.	0.	0.	0.	0.	0	0.	0.	0.	0.	0	
35 E/M EQUIP	0.	0.	0.	70.	280.	420.	210	0.	0.	0.	0.	0	
27 WAREHOUSE	0.	0.	0.	0.	135.	270.	135	0.	0.	0.	0.	0	
27 TRANSPORTATION	0.	0.	0.	0.	135.	270.	135	0.	0.	0.	0.	0	
ADMINISTRATION DIVISION	0.	0.	0.	295.	1936.	3264.	1765	0.	0.	0.	0.	0	
60 DIVISION OFFICE	0.	0.	0.	60.	240.	360.	180	0.	0.	0.	0.	0	
34 PROCUREMENTS/CONTRACTS	0.	0.	0.	34.	340.	544.	272	0.	0.	0.	0.	0	
31 PAYROLL/ACCOUNTING	0.	0.	0.	62.	310.	496.	248	0.	0.	0.	0.	0	
34 PERSONNEL	0.	0.	0.	102.	272.	408.	238	0.	0.	0.	0.	0	
STAFF SERVICES:	0.	0.	0.	0.	0.	0.	0	0.	0.	0.	0.	0	
37 VISITORS/PR	0.	0.	0.	0.	222.	370.	222	0.	0.	0.	0.	0	
28 TRAVEL/TRANSP	0.	0.	0.	0.	112.	280.	168	0.	0.	0.	0.	0	
29 COMMUNICATIONS	0.	0.	0.	0.	58.	116.	58	0.	0.	0.	0.	0	
32 CONTRACT SERVICE	0.	0.	0.	0.	64.	128.	64	0.	0.	0.	0.	0	
37 ENV. HEALTH	0.	0.	0.	37.	148.	222.	111	0.	0.	0.	0.	0	
34 TECHNICAL INFORMATION	0.	0.	0.	0.	170.	340.	204	0.	0.	0.	0.	0	
PHYSICS SUPPORT DIVISION	0.	0.	0.	0.	0.	0.	0	0.	0.	0.	0.	0	
67 DIVISION OFFICE	0.	0.	0.	0.	0.	0.	0	0.	0.	0.	0.	0	
58 PHYSICS	0.	0.	0.	0.	0.	0.	0	0.	0.	0.	0.	0	
48 TECHNICAL SUPPORT	0.	0.	0.	0.	0.	0.	0	0.	0.	0.	0.	0	
35 COMPUTATIONS, DATA ANAL	0.	0.	0.	0.	0.	0.	0	0.	0.	0.	0.	0	
GRAND TOTAL	0.	0.	0.	4010.	14822.	25543.	13659	0.	0.	0.	0.	0	

Table 3

PRE-OPERATIONS COST SUMMARY (M\$)

	FY <u>91</u>	<u>92</u>	<u>93</u>	<u>94*</u>
Manpower	4.0	14.8	25.5	13.6
M+S**	2.0	7.4	12.7	6.8
Power	<u>-</u>	<u>3.4</u>	<u>11.0</u>	<u>11.4</u>
Total	6.0	25.6	49.2	31.8

* First half of FY94

** Materials and services @ 50%

Operations

The end of the construction period (mid-FY84) marks the beginning of the SSC Operations phase. A smooth transition is desired between the pre-operations activities described in the previous section and the start of full SSC operations. In order to project the costs in both areas, a functional model for the staff activities has been assumed based on the experience at existing accelerator laboratories. The staff categories listed in Tables 1 and 2 are typical of these laboratory functions although the exact arrangement and nomenclature will vary depending on the actual laboratory organization structure.

The projected staffing for the operations phase is detailed in Table 4. The same functional categories are used as those of Table 1. The corresponding direct costs are provided in Table 5 in FY86 dollars.

Electric power represents the second largest operational cost factor. The scenario for turn-on of the four injection accelerators and the various sectors of the main ring cryogenic systems was outlined in the previous section. This turn-on schedule with a realistic allowance for a build-up of operational efficiency leads to the power estimates summarized in Table 6. The resulting costs are based on the assumption of power costs at \$50 per Megawatt hour.

A summary of the total costs for operation of the SSC accelerator system is provided in Table 7. While this summary includes general manpower support for operations of the experimental areas, it does not include the computer and data analysis systems associated with detector operations or direct costs related to construction and/or modifications of major detector systems. These are addressed in the next section.

Table 4
STAFFING DISTRIBUTION FOR OPERATIONS (FTE)

	SSC CONSTRUCTION						OPERATIONS					
	FY88.	FY89.	FY90.	FY91.	FY92.	FY93.	FY94|	FY95.	FY96.	FY97.	FY98.	FY99|
LABORATORY PERSONNEL:
DIRECTORS OFFICE & PROJ SUP	22|	49.	57.	64.	66.	66|
DIVISION OFFICE	5|	11.	15.	18.	18.	18|
PLANNING & BUDGET	10|	22.	24.	26.	28.	28|
REPORTING	3|	6.	8.	10.	10.	10|
Q/A	2|	5.	5.	5.	5.	5|
SAFETY	2|	5.	5.	5.	5.	5|
ACCELERATOR OPER. DIVISION	180|	429.	482.	525.	543.	563|
DIVISION OFFICE	6|	14.	16.	17.	18.	18|
INJECTOR	60|	140.	150.	160.	165.	170|
COLLIDER	80|	180.	220.	250.	260.	275|
MAGNETS	12|	35.	35.	35.	35.	35|
ACCELERATOR SYSTEMS	12|	35.	35.	35.	35.	35|
ACCELERATOR PHYSICS	10|	25.	26.	28.	30.	30|
CONVENTIONAL SYS. DIVISION	113|	271.	306.	343.	350.	355|
DIVISION OFFICE	3|	6.	6.	8.	10.	10|
CONSTRUCTION
PLANT ENGINEERING	10|	25.	30.	35.	40.	45|
BLDGs & GROUNDS	30|	90.	100.	110.	110.	110|
SECURITY	15|	30.	35.	40.	40.	40|
FIRE PROTECTION	15|	30.	35.	40.	40.	40|
CUSTODIAL	40|	90.	100.	110.	110.	110|
TECHNICAL SUPPORT DIV	178|	403.	505.	575.	625.	650|
DIVISION OFFICE	4|	8.	10.	12.	12.	12|
ENGINEERING SERVICES	30|	70.	85.	95.	110.	110|
TECHNICIANS	40|	90.	100.	110.	110.	110|
SHOPS:
COMPUTER	15|	35.	45.	50.	53.	55|
E/M SHOPS	25|	55.	75.	85.	100.	110|
CRAFT SHOPS	25|	55.	75.	85.	100.	110|
E/M EQUIP	9|	20.	25.	28.	30.	33|
WAREHOUSE	15|	35.	45.	55.	55.	55|
TRANSPORTATION	15|	35.	45.	55.	55.	55|
ADMINISTRATION DIVISION	74|	152.	181.	212.	225.	230|
DIVISION OFFICE	2|	4.	4.	4.	4.	4|
PROCUREMENTS/CONTRACTS	10|	21.	25.	30.	30.	30|
PAYROLL/ACCOUNTING	12|	25.	30.	35.	35.	35|
PERSONNEL	10|	22.	25.	28.	30.	30|
STAFF SERVICES:
VISITORS/PR	6|	12.	15.	18.	20.	22|
TRAVEL/TRANSP	10|	20.	25.	30.	33.	34|
COMMUNICATIONS	4|	8.	9.	10.	10.	10|
CONTRACT SERVICE	4|	8.	9.	10.	10.	10|
ENV. HEALTH	6|	12.	14.	17.	18.	20|
TECHNICAL INFORMATION	10|	20.	25.	30.	35.	35|
PHYSICS SUPPORT DIVISION	114|	255.	290.	330.	370.	400|
DIVISION OFFICE	4|	10.	10.	10.	10.	10|
PHYSICS	30|	80.	100.	110.	120.	130|
TECHNICAL SUPPORT	50|	90.	100.	110.	120.	130|
COMPUTATIONS, DATA ANAL	30|	75.	80.	100.	120.	130|
GRAND TOTAL	0.	0.	0.	0.	0.	0.	681|	1559.	1821.	2049.	2179.	2264|

Table 5

COST DISTRIBUTION FOR OPERATIONS STAFF (FY86 K\$)

	SSC CONSTRUCTION						OPERATIONS					
	FY88.	FY89.	FY90.	FY91.	FY92.	FY93.	FY94.	FY95.	FY96.	FY97.	FY98.	FY99.
BASE F86 LABORATORY PERSONNEL: K\$/YR												
DIRECTORS OFFICE & PROJ SUP							1200|	2676.	3154.	3556.	3662.	3662|
76 DIVISION OFFICE							380|	836.	1140.	1368.	1368.	1368|
53 PLANNING & BUDGET							530|	1166.	1272.	1378.	1484.	1484|
34 REPORTING							102|	204.	272.	340.	340.	340|
47 O/A							94|	235.	235.	235.	235.	235|
47 SAFETY							94|	235.	235.	235.	235.	235|
ACCELERATOR OPER. DIVISION							7542|	17988.	20180.	21963.	22746.	23546|
67 DIVISION OFFICE							402|	938.	1072.	1139.	1206.	1206|
40 INJECTOR							2400|	5600.	6000.	6400.	6600.	6800|
40 COLLIDER							3200|	7200.	8800.	10000.	10400.	11000|
40 MAGNETS							480|	1400.	1400.	1400.	1400.	1400|
40 ACCELERATOR SYSTEMS							480|	1400.	1400.	1400.	1400.	1400|
58 ACCELERATOR PHYSICS							580|	1450.	1508.	1624.	1740.	1740|
CONVENTIONAL SYS. DIVISION							3256|	7747.	8787.	9961.	10370.	10645|
67 DIVISION OFFICE							201|	402.	402.	536.	670.	670|
67 CONSTRUCTION							0|	0.	0.	0.	0.	0|
55 PLANT ENGINEERING							550|	1375.	1650.	1925.	2200.	2475|
25 BLDGS & GROUNDS							750|	2250.	2500.	2750.	2750.	2750|
29 SECURITY							435|	870.	1015.	1160.	1160.	1160|
32 FIRE PROTECTION							480|	960.	1120.	1280.	1280.	1280|
21 CUSTODIAL							840|	1890.	2100.	2310.	2310.	2310|
TECHNICAL SUPPORT DIV							6362|	14399.	18065.	20521.	22541.	23416|
63 DIVISION OFFICE							252|	504.	630.	756.	756.	756|
53 ENGINEERING SERVICES							1590|	3710.	4505.	5035.	5830.	5830|
28 TECHNICIANS							1120|	2520.	2800.	3080.	3080.	3080|
SHOPS:							0|	0.	0.	0.	0.	0|
35 COMPUTER							525|	1225.	1575.	1750.	1855.	1925|
35 E/H SHOPS							875|	1925.	2625.	2975.	3500.	3850|
35 CRAFT SHOPS							875|	1925.	2625.	2975.	3500.	3850|
35 E/H EQUIP							315|	700.	875.	980.	1050.	1155|
27 WAREHOUSE							405|	945.	1215.	1485.	1485.	1485|
27 TRANSPORTATION							405|	945.	1215.	1485.	1485.	1485|
ADMINISTRATION DIVISION							2480|	5093.	6042.	7062.	7495.	7671|
60 DIVISION OFFICE							120|	240.	240.	240.	240.	240|
34 PROCUREMENTS/CONTRACTS							340|	714.	850.	1020.	1020.	1020|
31 PAYROLL/ACCOUNTING							372|	775.	930.	1085.	1085.	1085|
34 PERSONNEL							340|	748.	850.	952.	1020.	1020|
STAFF SERVICES:							0|	0.	0.	0.	0.	0|
37 VISITORS/PR							222|	444.	555.	666.	740.	814|
28 TRAVEL/TRANSP							280|	560.	700.	840.	924.	952|
29 COMMUNICATIONS							116|	232.	261.	290.	290.	290|
32 CONTRACT SERVICE							128|	256.	288.	320.	320.	320|
37 ENV. HEALTH							222|	444.	518.	629.	666.	740|
34 TECHNICAL INFORMATION							340|	680.	850.	1020.	1190.	1190|
PHYSICS SUPPORT DIVISION							5458|	12255.	14070.	15830.	17590.	19000|
67 DIVISION OFFICE							268|	670.	670.	670.	670.	670|
58 PHYSICS							1740|	4640.	5800.	6380.	6960.	7540|
48 TECHNICAL SUPPORT							2400|	4320.	4800.	5280.	5760.	6240|
35 COMPUTATIONS, DATA ANAL							1050|	2625.	2800.	3500.	4200.	4550|
GRAND TOTAL							26298|	60158.	70298.	78893.	84404.	87940|

Table 6

SSC-Projected Average Power Utilization (Megawatts) and Costs (M\$)

	FY 91	92	93	94	95	96	97	98	99	(Max)
Linac	0.1	0.3	0.8	0.8	0.9	1.0	1.0	1.0	1.0	(1.2)
LEB	-	0.3	0.8	0.8	0.9	1.0	1.1	1.1	1.1	(1.4)
MEB	-	0.2	5.0	6.0	7.0	8.0	8.0	8.0	8.0	(10.0)
HEB	-	-	2.0	6.0	10.0	14.0	16.0	16.0	16.0	(18.0)
Test Beams	-	-	0.8	1.2	1.4	1.6	1.6	1.6	1.6	(2.0)
Collider	4.0	11.0	20.0	40.0	50.0	60.0	65.0	70.0	72.0	(80.0)
Lab Facilities	4.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	(6.0)
TOTAL POWER (MW)	8.1	15.8	34.4	59.8	75.2	90.6	97.7	102.7	104.7	(118.6)
TOTAL COST (M\$)*	3.4	6.6	14.0	25.0	32.0	38.0	41.0	43.0	44.0	(50.0)
Construction	3.4	3.2	3.0	2.0	-	-	-	-	-	-
Pre-Op	-	3.4	11.0	11.4	-	-	-	-	-	-
Operations	-	-	-	11.6	32.0	38.0	41.0	43.0	44.0	(50.0)

* Assumes Power Cost @ \$50 per MWh

Table 7

TOTAL COSTS FOR SSC ACCELERATOR OPERATIONS (M\$)						
	FY <u>94*</u>	<u>95</u>	<u>96</u>	<u>97</u>	<u>98</u>	<u>99</u>
Staff	26.3	60.2	70.3	78.9	84.4	87.9
M&S**	13.1	30.1	35.1	39.4	42.2	43.9
Power	<u>11.6</u>	<u>32.0</u>	<u>38.0</u>	<u>41.0</u>	<u>43.0</u>	<u>44.0</u>
TOTAL	51.0	122.3	143.4	159.3	169.6	175.8

* Last half of FY94

** Materials and Services at 50%

It is of interest to compare the current projections with those of the SSC Task Force on Operations and Commissioning (SSC-SR-1005) July 1985. The Task Force projected operations costs for a period after construction in which reasonable operational efficiency had been achieved with "steady state" conditions. We will assume that this condition is similar to the projection of this report for FY99. The comparison is shown in Table 8. While the current model differs in detail from that of the Task Force, the manpower projections and associated costs are in good agreement. The primary difference lies in the higher percentage of M&S (Materials & Services) or "purchases" that are projected in the Task Force Report.

Table 8

COMPARISON WITH OPERATIONS AND COMMISSIONING TASK FORCE REPORT
(Circa FY99)

	<u>Task Force Report*</u>		<u>This Report</u>	
	<u>FTE</u>	<u>FY85 M\$</u>	<u>FTE**</u>	<u>FY86 M\$</u>
Injection Systems	300	12.4		
Collider	405	16.7		
Exp. Areas	300	11.0		
Acc. R&D	150	5.8		
Facilities R&D	150	5.8		
Central Shops	100	3.9		
Admin/Support	<u>750</u>	<u>29.9</u>	—	—
<u>Staff Sub-total</u>	2101	83.6	2264	87.9
M&S		70.0***		43.9
Power		<u>44.0</u>		<u>44.0</u>
TOTALS		197.6		175.8

* SSC-SR-1005

** See Table 4 for details

*** Noted as "purchases" in SSC-SR-1005

Other Laboratory Funding Categories

The categories of Equipment related to Acceleratory Systems, Accelerator Improvements, and General Purpose Plant are difficult to forecast 10 years in advance. The projections for the SSC are scaled from previous experience primarily by a comparison with SLAC and FNAL as shown in Table 9.

Table 9

SINGLE PURPOSE HEP LABORATORY COMPARISONS

(FY86M\$)

	<u>FNAL</u> <u>(FY76)</u>	<u>FNAL</u> <u>(FY86)</u>	<u>SLAC</u> <u>(FY86)</u>	<u>SSC</u> <u>(FY99)</u>
Operations	84	110	80	176
Equipment	19	18	6.5	25
AIP	5.7	5.5	2.5	10
GPP	5.7	3.0	1.6	5

SSC Detector Related Costs

The 1985 HEPAP summer study estimated an annual expenditure for SSC equipment (full detector complement) of \$130M during the peak of SSC construction. For the detectors, a 4 to 5 year fabrication period (and, hence, spending period at that level) was anticipated, yielding a total equipment cost of \$520-650M. A first estimate of the computer costs was made in 1985 at the Fermilab workshop on triggers, data acquisition and computing. This group provided a very preliminary cost estimate of \$45M for off-line computing equipment.

During the past year three advisory panels of experts from the world community of particle physicists were appointed to consider SSC detector requirements and to generate the required cost estimates:

- 1) The Detector Cost Model Advisory Panel (DCMAP) was convened to put forth a reasonable model of what an initial detector complement might look like. This panel, chaired by Professor George Trilling of the University of California, Berkeley, provided a report that was then used as input for the work of the other panels.
- 2) The Detector Cost Evaluation Panel (DCEP), chaired by Professor Roy Schwitters of Harvard University, was asked to estimate the costs for that complement of detectors. In its work the panel used the cost data base obtained from large detectors presently under construction (CDF, DO, L3, SLD) and made some assumptions about the future cost trends for electronics and data acquisition equipment.
- 3) The Off-Line Computer Advisory Panel (OCAP), chaired by Dr. Stewart Loken of Lawrence Berkeley Laboratory, was charged with estimating the cost of

the off-line computer facility at SSC. The data output of the detector complement generated by DCMAP was used to provide an estimate of the computing load at the SSC.

The DCEP arrived at a total cost for the initial complement of detectors that ranged between \$558M and \$865M. The cost range represents potential variations in the scope as well as uncertainties in the cost projections. There is also uncertainty as to the possibilities of foreign participation in the detector projects. In view of these possibilities, a cost of \$650M is projected at this time for the initial complement of detectors. The OCAP group has projected an estimate of \$71M for the data analysis systems costs with an annual support level of approximately 7M\$. The annual support cost is included under the Computations/Data Analysis category of the Operations Costs.

An estimate of the distributed costs for the above systems and their associated support is provided in Table 10.

Table 10

PHYSICS PROGRAM - DETECTOR RELATED COSTS

(FY86 M\$)

	FY 88	89	90	91	92	93	94	95	96	97	98	99
Detectors - Initial Compliment (650M\$)	10	40	100	140	140	130	90					
Detector Systems Support								5	10	15	15	15
(Detectors Sub-total)	10	40	140	140	140	130	90	5	10	15	15	15
Computer/Data Analysis System (70M\$)		2	8	15	20	15	10					
Data Analysis Support*			0.5	1	2	5	7	7	7	7	7	7
(Data Analysis Sub-total)	-	2	8.5	16	22	20	17	7	7	7	7	7

* This approximate level of support is provided under the SSC operations projections.

Summary

A summary of the overall SSC costs for accelerator operations beyond the construction period together with projections for detectors and related data analysis systems is provided in Table 11. The associated manpower levels in various areas are tabulated in Table 12.

Table 11

SSC CONSTRUCTION AND OPERATIONS SUMMARY

(FY86 M\$)

	<u>FY 88</u>	<u>89</u>	<u>90</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>	<u>95</u>	<u>96</u>	<u>97</u>	<u>98</u>	<u>99</u>
Construction (Costs)	75	297	628	791	675	493	51.3	-	-	-	-	-
R&D (Const. Related)	56	40	30	10	5	5	4	-	-	-	-	-
Pre-Operations	-	-	-	6	26	49	-	32	-	-	-	-
Operations	-	-	-	-	-	-	-	51	122	143	159	169
Accelerator Equip.	9	6	5	3	3	4	-	10	10	12	15	20
Accelerator Improve.	-	-	-	-	-	-	-	-	1	3	5	8
GPP/GPE	-	-	-	-	-	-	-	-	1	4	4	7
Detectors Systems	10	40	100	140	140	130	90	-	-	-	-	-
Detector Sys. Support	-	-	-	-	-	-	-	-	5	10	15	15
Data Analysis Syst.	-	2	8	15	20	15	10	-	-	-	-	-
TOTAL (OPERATIONS RELATED)*								93	139	172	198	218
												233

* Total excluding construction, detector and data analysis system costs

Table 12

SSC MANPOWER PROJECTIONS (FTE)

	<u>FY 88</u>	<u>89</u>	<u>90</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>	<u>95</u>	<u>96</u>	<u>97</u>	<u>98</u>	<u>99</u>
Construction:												
Management/Support	130	281	457	511	390	216	82	-	-	-	-	-
Tech-EDI	379	417	487	499	468	417	200	-	-	-	-	-
Tech-Construction	48	322	638	1447	1653	1412	135	-	-	-	-	-
Conv.-EDI	50	190	190	190	190	80	-	-	-	-	-	-
Conv.-Construction	-	<u>350</u>	<u>740</u>	<u>740</u>	<u>740</u>	<u>200</u>	-	-	-	-	-	-
SUBTOTAL	607	1560	2512	3387	3441	2325	417	-	-	-	-	-
Research & Dev.	674	464	312	133	66	56	47	-	-	-	-	-
Pre-Operations	-	-	-	96	380	661	353	-	-	-	-	-
Operations												
Accel. Equipment	30	30	25	15	15	20	50	50	60	75	100	125
Accel. Improvements	-	-	-	-	-	-	-	10	30	50	80	100
Visiting Scientists*	<u>30</u>	<u>50</u>	<u>100</u>	<u>200</u>	<u>300</u>	<u>350</u>	<u>400</u>	<u>450</u>	<u>500</u>	<u>500</u>	<u>500</u>	<u>500</u>
TOTALS	1341	2104	2949	3833	4202	3412	1948	2069	2410	2674	2859	2989

* Primarily Associated with Physics Research, Detectors, and Associated Data Analysis Systems