U.S. ATLAS E.T.C.
Cost Book

Funding Source: All **Funding Type:** All

Institutions: All

WBS Number: **Description:**

Institution : **Contact:**

COST SUMMARY: (Project)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	Cost	Schedule	Design	Technical	Cost	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 1.1.1.5 **Description:** Module Assembly/Test

Institution : **Contact:** Maurice Garcia-Sciveres

This covers the assembly and test of modules. The basic components of the modules(sensors, electronics, hybrids and cables) are described in other WBS elements. We include here electronics wafer thinning and dicing, die sort, module mechanical assembly, module testing. Attachment of modules to disk sectors and testing after this attachment.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
1104	488	44	1592	187	601	28	288	17.8	7.3

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	1980	2952	0	0	8513	2485	180	5405	601.127
MFG MC	0	0	0	0	0	441	0	0	4245	0	0	1164	127.115
MFG B/I	0	0	0	0	1540	6030	0	0	0	0	0	0	293.041
EDIA P	0	1760	0	1760	0	0	0	0	0	0	0	440	187.002
EDIA B/I	0	40	3520	1760	0	0	0	0	0	0	0	0	461.950
	0	1800	3520	3520	3520	9423	0	0	12758	2485	180	7009	1670.235

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	230	9	0	23	0	0.0	288.018
MFG MC	43	0	0	0	0	0.0	47.525
EDIA P	25	0	0	0	0	0.0	27.825
	298	9	0	23	0	0.0	363.368

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	4	393	792	559	286	0	2034

WBS Number: 1.1.1.5.1 **Description:** Design/Engineering

Institution : **Contact:** Maurice Garcia-Sciveres

This covers the engineering design manpower needed for module prototypes, to establish production procedures, for oversight of industrial fabrication and in-house assembly and for the design of test procedures and equipment.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
191	67	35	259	180	0	11	0	2.0	3.0

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
EDIA P	0	1760	0	1760	0	0	0	0	0	0	0	0	180.353
EDIA B/I	0	40	3520	1760	0	0	0	0	0	0	0	0	461.950
	0	1800	3520	3520	0	0	0	0	0	0	0	0	642.303

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
EDIA P	10	0	0	0	0	0.0	11.130
	10	0	0	0	0	0.0	11.130

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	4	196	439	14	0	0	653

WBS Number: 1.1.1.5.1.1 **Description:** Prototype Design

Institution : LBNL/UC- Senior **Contact:** Maurice Garcia-Sciveres

This is the engineering time needed for the design of prototypes for module assembly.

Basis of Estimate: Physicist estimate

Details of Estimate: Engineering design is supported by base program

COST SUMMARY: (Project)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
	0	0	0	0	0	0	0	0	0.0	1.5

MANPOWER SUMMARY:	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
EDIA B/I	0	0	2640	0	0	0	0	0	0	0	0	0	277.358
	0	0	2640	0	0	0	0	0	0	0	0	0	277.358

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	Cost	Schedule	Design	Technical	Cost	Schedule	Cont %
	4	4	8	8	2	1	1	28

PROFILE SUMMARY:	FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
	0	0	0	0	0	92	185	0	0	0	277

WBS Number: 1.1.1.5.1.2 **Description:** Production Design

Institution : LBNL/UC- Senior **Contact:** Maurice Garcia-Sciveres

Production design for module assembly. This includes all mechanical aspects but not electrical testing.

Basis of Estimate: Physicist estimate

Details of Estimate: Engineering and designer time is supported by base program at LBNL.

COST SUMMARY: (Project)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
	0	0	0	0	0	0	0	0	0.0	1.0

MANPOWER SUMMARY:	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
EDIA B/I	0	0	880	880	0	0	0	0	0	0	0	0	136.421
	0	0	880	880	0	0	0	0	0	0	0	0	136.421

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	Cost	Schedule	Design	Technical	Cost	Schedule	Cont %
	4	4	8	8	2	1	1	28

PROFILE SUMMARY:	FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
	0	0	0	0	0	0	136	0	0	0	136

WBS Number: 1.1.1.5.1.3 **Description:** Testing Design

Institution : LBNL/UC-Junior **Contact:** Maurice Garcia-Sciveres

Engineering design for testing.

Basis of Estimate: Physicist estimate

COST SUMMARY: (Project)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
	191	67	35	259	180	0	11	0	2.0	0.5

MANPOWER SUMMARY:	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
EDIA P	0	1760	0	1760	0	0	0	0	0	0	0	0	180.353
EDIA B/I	0	40	0	880	0	0	0	0	0	0	0	0	48.171
	0	1800	0	2640	0	0	0	0	0	0	0	0	228.524

MATERIAL SUMMARY:	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
EDIA P	10	0	0	0	0	0.0	11.130
	10	0	0	0	0	0.0	11.130

PROFILE SUMMARY:	FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
	0	0	0	0	4	104	118	14	0	0	240

WBS Number: 1.1.1.5.1.3.1 **Description:** Mechanical Prototypes

Institution : LBNL/UC- Senior **Contact:** Maurice Garcia-Sciveres

Engineering time will be needed to develop test procedures for the mechanical prototypes and to design fixtures and probe cards.

Basis of Estimate: Physicist estimate

Details of Estimate: Supported by base program

COST SUMMARY: (Project)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.5

MANPOWER SUMMARY:	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
EDIA B/I	0	40	0	880	0	0	0	0	0	0	0	0	48.172
	0	40	0	880	0	0	0	0	0	0	0	0	48.171

CONTINGENCY FACTORS:	*Risk*				*Weight*			Cont %
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	
	4	4	8	8	2	1	1	28

PROFILE SUMMARY:	FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
	0	0	0	0	4	22	22	0	0	0	48

WBS Number: 1.1.1.5.1.3.2 **Description:** Functional Prototypes

Institution : LBNL/UC-Junior **Contact:** Maurice Garcia-Sciveres

An engineer will be needed to design test cards and related fixtures for functional module prototypes including burn in.

Basis of Estimate: Physicist estimate

Details of Estimate: We estimate 0.5 FTE in FY01 and 0.25FTE in FY02 electrical engineer for dedicated module burn-in and test system. An additional 0.5FTE of designer time for probe cards, test cards - design, debugging and use.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
191	67	35	259	180	0	11	0	2.0	0.0

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
EDIA P	0	1760	0	1760	0	0	0	0	0	0	0	0	180.353
	0	1760	0	1760	0	0	0	0	0	0	0	0	180.353

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
EDIA P	10	0	0	0	0	0.0	11.130
	10	0	0	0	0	0.0	11.130

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
4	4	8	15	2	1	1	35

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	82	96	14	0	0	191

WBS Number: 1.1.1.5.2 **Description:** Development and Prototypes

Institution : **Contact:** Maurice Garcia-Sciveres

This covers prototype developments for all aspects of module assembly and test.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
280	74	26	354	0	209	17	54	3.2	2.6

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	1100	1188	0	0	0	2124	180	1056	208.907
MFG B/I	0	0	0	0	0	4620	0	0	0	0	0	0	145.645
	0	0	0	0	1100	5808	0	0	0	2124	180	1056	354.552

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	40	9	0	0	0	0.0	53.988
EDIA P	15	0	0	0	0	0.0	16.695
	55	9	0	0	0	0.0	70.683

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	174	191	60	0	0	425

WBS Number: 1.1.1.5.2.1 **Description:** X-ray Inspection

Institution : LBNL/UC-Junior **Contact:** Maurice Garcia-Sciveres

X-ray inspection of modules and assemblies

Basis of Estimate: Parametric estimate

Details of Estimate: Costs are based on $200 per hour contract with X-Tek for use of their X-ray inspection machine. We assume 25 hrs per year for FY01, FY02 and FY03.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
17	1	7	18	0	0	17	0	0.0	0.0

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
EDIA P	15	0	0	0	0	0.0	16.695
	15	0	0	0	0	0.0	16.695

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	**C o s t**	**Schedule**	**Des i gn**	**Technical**	**C o s t**	**Schedule**	**Cont %**
1	1	4	0	2	1	1	7

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	6	6	6	0	0	17

WBS Number: 1.1.1.5.2.2 **Description:** Wafer Thinning

Institution : LBNL/UC- Senior **Contact:** Maurice Garcia-Sciveres

Thinning of prototype IC and dummy wafers

Basis of Estimate: Parametric estimate

Details of Estimate: Costs are based on minimum lot charge($120) from Okamoto. We assume 3 lots in each of FY01, 02 and 03.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
1	0	16	1	0	0	0	1	0.0	0.0

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	1	0	0	0	0	0.0	1.202
	1	0	0	0	0	0.0	1.202

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	**Cost**	**Schedule**	**Design**	**Technical**	**Cost**	**Schedule**	**Cont %**
1	10	4	0	2	1	1	16

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	0	0	0	0	0	1

WBS Number: 1.1.1.5.2.3 **Description:** Wafer Dicing and Die Sort

Institution : LBNL/UC- Senior **Contact:** Maurice Garcia-Sciveres

Dicing of prototype IC and dummy wafers

Basis of Estimate: Parametric estimate

Details of Estimate: Dicing costs are based on minimum lot charge of $100 and 5 lots per year.

Die sort assumes method used for SVXIII for CDF. $400 for materials and 20 hours shop time.

Labor for die sort is student at 0.1 FTE

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
6	1	16	7	0	4	0	2	0.1	0.0

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	0	0	0	0	20	0	176	3.709
	0	0	0	0	0	0	0	0	0	20	0	176	3.709

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	2	0	0	0	0	0.0	2.115
	2	0	0	0	0	0.0	2.115

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	Cost	Schedule	Design	Technical	Cost	Schedule	Cont %
1	10	4	0	2	1	1	16

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	1	3	2	0	0	6

WBS Number: 1.1.1.5.2.4 **Description:** Module Assembly and Testing

Institution : LBNL/UC- Senior **Contact:** Maurice Garcia-Sciveres

Tooling, labor, supplies and equipment for assembly and testing of prototype dummy and real modules.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
196	55	28	251	0	150	0	46	2.4	2.1

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	1100	660	0	0	0	1464	80	880	149.748
MFG B/I	0	0	0	0	0	3740	0	0	0	0	0	0	117.903
	0	0	0	0	1100	4400	0	0	0	1464	80	880	267.651

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	37	5	0	0	0	0.0	46.226
	37	5	0	0	0	0.0	46.226

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	132	138	43	0	0	314

WBS Number: 1.1.1.5.2.4.1 **Description:** Tooling

Institution : LBNL/UC-Junior **Contact:** Maurice Garcia-Sciveres

Tooling for assembly of dummy and real prototype modules.

Basis of Estimate: Parametric estimate

Details of Estimate: Costs are based on parametric scaling from existing tooling assuming two more design cycles.

COST SUMMARY: (Project)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
	79	22	28	101	0	77	0	2	0.8	1.0

MANPOWER SUMMARY:	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	0	0	0	0	1464	0	0	76.771
MFG B/I	0	0	0	0	0	1760	0	0	0	0	0	0	55.484
	0	0	0	0	0	1760	0	0	0	1464	0	0	132.255

MATERIAL SUMMARY:	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	2	0	0	0	0	0.0	2.271
	2	0	0	0	0	0.0	2.271

CONTINGENCY FACTORS:	*Risk*				*Weight*			Cont %
	Technical	Cost	Schedule	Design	Technical	Cost	Schedule	
	3	4	4	8	4	1	1	28

PROFILE SUMMARY:	FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
	0	0	0	0	0	67	67	0	0	0	135

WBS Number: 1.1.1.5.2.4.2 **Description:** Assembly

Institution : LBNL/UC-Junior **Contact:** Maurice Garcia-Sciveres

Labor for assembly of dummy and real prototype modules.

Basis of Estimate: Physicist estimate

Details of Estimate: We assume 80 modules are assembled in this phase. Labor for mechanical assembly is supported by base program. Labor for wire bonding and related QC is project supported.

COST SUMMARY: (Project)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
	23	7	28	30	0	21	0	3	0.4	0.6

MANPOWER SUMMARY:	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	660	0	0	0	0	0	0	20.806
MFG B/I	0	0	0	0	0	1100	0	0	0	0	0	0	34.677
	0	0	0	0	0	1760	0	0	0	0	0	0	55.483

MATERIAL SUMMARY:	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	0	3	0	0	0	0.0	2.500
	0	3	0	0	0	0.0	2.500

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	3	4	4	8	4	1	1	28

PROFILE SUMMARY:	FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
	0	0	0	0	0	12	23	23	0	0	58

WBS Number: 1.1.1.5.2.4.3 **Description:** Testing

Institution : LBNL/UC-Junior **Contact:** Maurice Garcia-Sciveres

This includes mechanical and electrical testing of prototype modules

Basis of Estimate: Physicist estimate

Details of Estimate: Mechanical testing includes use of coordinate measurement machine time(project funded) at 2 hours per module. Mechanical technician time for other testing is supported by base program. Electrical testing assumes 0.25 FTE electrical technician from project funds. A prototype module burn-in system is assumed to be built during this phase. A rough estimate of this system is $20K, not including design. Test boards and special cables is estimated at 10K. Bare module probing is estimated at….

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
94	26	28	120	0	52	0	41	1.2	0.5

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	1100	0	0	0	0	0	80	880	52.171
MFG B/I	0	0	0	0	0	880	0	0	0	0	0	0	27.742
	0	0	0	0	1100	880	0	0	0	0	80	880	79.913

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	35	3	0	0	0	0.0	41.455
	35	3	0	0	0	0.0	41.455

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	Cost	Schedule	Design	Technical	Cost	Schedule	Cont %
3	4	4	8	4	1	1	28

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	53	48	21	0	0	121

WBS Number: 1.1.1.5.2.5 **Description:** Module Attachment

Institution : LBNL/UC-Junior **Contact:** Maurice Garcia-Sciveres

Tooling, labor, materials and supplies for attachment of prototype dummy and real modules to disk sectors.

COST SUMMARY: (Project)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
	60	17	28	77	0	55	0	4	0.7	0.5

MANPOWER SUMMARY:	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	528	0	0	0	640	100	0	55.450
MFG B/I	0	0	0	0	0	880	0	0	0	0	0	0	27.742
	0	0	0	0	0	1408	0	0	0	640	100	0	83.192

MATERIAL SUMMARY:	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	0	4	0	0	0	0.0	4.445
	0	4	0	0	0	0.0	4.445

PROFILE SUMMARY:	FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
	0	0	0	0	0	35	44	8	0	0	88

WBS Number: 1.1.1.5.2.5.1 **Description:** Tooling

Institution : LBNL/UC-Junior **Contact:** Maurice Garcia-Sciveres

Prototype tooling for attachment of modules to disk sectors.

Basis of Estimate: Parametric estimate

Details of Estimate: Based on existing tooling and assume two more complete design cycles

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
34	10	28	44	0	34	0	0	0.4	0.0

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	0	0	0	0	640	0	0	33.561
	0	0	0	0	0	0	0	0	0	640	0	0	33.561

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	0.0	0.445
	0	0	0	0	0	0.0	0.445

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	Cost	Schedule	Design	Technical	Cost	Schedule	Cont %
3	4	4	8	4	1	1	28

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	17	17	0	0	0	34

WBS Number: 1.1.1.5.2.5.2 **Description:** Assembly

Institution : LBNL/UC-Junior **Contact:** Maurice Garcia-Sciveres

Assembly/attachment of prototype modules to disk sectors.

Basis of Estimate: Physicist estimate

Details of Estimate: This is labor for assembly. It assumes 0.15 FTE per year to develop and use techniques.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
19	5	28	24	0	17	0	2	0.3	0.0

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	528	0	0	0	0	0	0	16.645
	0	0	0	0	0	528	0	0	0	0	0	0	16.645

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	0	2	0	0	0	0.0	2.000
	0	2	0	0	0	0.0	2.000

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	Cost	Schedule	Design	Technical	Cost	Schedule	Cont %
3	4	4	8	4	1	1	28

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	1	9	8	0	0	19

WBS Number: 1.1.1.5.2.5.3 **Description:** Testing

Institution : LBNL/UC-Junior **Contact:** Maurice Garcia-Sciveres

Testing of prototypes after attachment to disk sectors.

Basis of Estimate: Physicist estimate

Details of Estimate: This includes IR imaging for sector quality control. Cost of IR camera is covered under Testing in Mechanics. Labor for IR testing is provided by base program. This also includes labor for survey using optical CMM or other. Equipment for electrical testing is covered under module testing.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
7	2	28	9	0	5	0	2	0.1	0.5

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	0	0	0	0	0	100	0	5.244
MFG B/I	0	0	0	0	0	880	0	0	0	0	0	0	27.742
	0	0	0	0	0	880	0	0	0	0	100	0	32.986

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	0	2	0	0	0	0.0	2.000
	0	2	0	0	0	0.0	2.000

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	**C o s t**	**Schedule**	**Des i gn**	**Technical**	**C o s t**	**Schedule**	**Cont %**
3	4	4	8	4	1	1	28

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	17	17	0	0	0	35

WBS Number: 1.1.1.5.3 **Description:** Production

Institution : **Contact:** Maurice Garcia-Sciveres

Pixel module assembly, testing and attachment to disk sectors. See production model for assumptions. US is entirely responsible for bumped wafer thinning, dicing of these wafers, IC sort. US will assemble about one-quarter of modules and test them. US will attach all disk modules to sectors and test after attachment.

COST SUMMARY: (Project)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
	633	347	55	980	7	392	0	234	12.6	1.7

MANPOWER SUMMARY:	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	880	1764	0	0	8513	361	0	4349	392.220
MFG MC	0	0	0	0	0	441	0	0	4245	0	0	1164	127.115
MFG B/I	0	0	0	0	1540	1410	0	0	0	0	0	0	147.396
EDIA P	0	0	0	0	0	0	0	0	0	0	0	440	6.649
	0	0	0	0	2420	3615	0	0	12758	361	0	5953	673.380

MATERIAL SUMMARY:	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	190	0	0	23	0	0.0	234.030
MFG MC	43	0	0	0	0	0.0	47.525
	232	0	0	23	0	0.0	281.555

PROFILE SUMMARY:	FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
	0	0	0	0	0	22	162	485	286	0	955

WBS Number: 1.1.1.5.3.1 **Description:** IC Wafer Thinning

Institution : LBNL/UC- Senior **Contact:** Maurice Garcia-Sciveres

Thinning of IC wafers after bump deposition.

Basis of Estimate: Vendor quotation

Details of Estimate: We assume that all IC wafers are to be thinned in US. Costs based on vendor price list from Okamoto. 500 6" wafers at $13 each(management contingency) and 162 8" wafers at $14 each. Contingency is taken to be 100% to account for possible need for minimum lot charges, which cannot be specified at this time.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
3	10	387	12	0	0	0	3	0.0	0.0

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	2	0	0	0	0	0.0	2.524
MFG MC	7	0	0	0	0	0.0	7.234
	9	0	0	0	0	0.0	9.758

Units	Unit Cost
1159	13

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	Cost	Schedule	Design	Technical	Cost	Schedule	Cont %
15	10	10	10	4	2	1	100

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	0	7	3	0	0	10

WBS Number: 1.1.1.5.3.2 **Description:** Dicing of IC Wafers

Institution : LBNL/UC- Senior **Contact:** Maurice Garcia-Sciveres

Dicing of thinned IC wafers.

Basis of Estimate: Vendor quotation

Details of Estimate: WE assume all FE IC wafers are diced in US. Costs are based on verbal estimate from Micro Dicing of $50 per wafer for 6" wafer and our extrapolation to $100 per wafer for 8" wafers. Contingency is fixed at 100% in case minimum lot charges are needed at some time.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
28	46	165	74	0	0	0	28	0.0	0.0

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	25	0	0	0	0	0.0	27.825
MFG MC	16	0	0	0	0	0.0	18.031
	41	0	0	0	0	0.0	45.856

Units	Unit Cost
1159	50

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	**C o s t**	**Schedule**	**Des i gn**	**Technical**	**C o s t**	**Schedule**	**Cont %**
15	10	10	10	4	2	1	100

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	0	28	18	0	0	46

WBS Number: 1.1.1.5.3.3 **Description:** IC Die Sort

Institution : LBNL/UC- Senior **Contact:** Maurice Garcia-Sciveres

We assume all FE die are sorted in US after dicing and packaged for shipment for bump bonding vendors.

Basis of Estimate: Parametric estimate

Details of Estimate: After dicing the die must be inspected, sorted and packaged in Gelpaks. We assume here that this will be done for all die at LBL.

Materials

We assume 4" Gelpaks can hold 48 good die and that 24,000 die are needed for baseline scope or about 500 Gelpaks at $17 each gives $8,500. Shipment is estimated at 25*$100=$2500.

Die sort is based on method used by CDF for SVXIII. We assume three special vacuum carriers at $400 each for materials, and 20 shop time each.

Probe cards are covered under 1.1.1.3.3.

Labor for die removal, loading die into carrier,reprobing and packaging is estimated to be 5 minutes per die or 2,000 hours for baseline scope.

Die must be marked. We assume laser marking and include cost of this in estimate at $10K for equipment.

Total equipment cost is 11,000+1200+10000=22200

Laobr is 60 hours shop time and 2,000 hours student time.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
58	23	40	81	0	33	0	25	1.2	0.0

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	0	0	0	0	60	0	2000	33.371
	0	0	0	0	0	0	0	0	0	60	0	2000	33.371

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	22	0	0	0	0	0.0	24.709
	22	0	0	0	0	0.0	24.709

CONTINGENCY FACTORS:

Risk				Weight			
Technical	Cost	Schedule	Design	Technical	Cost	Schedule	Cont %
3	6	8	8	4	2	1	40

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	0	54	4	0	0	58

WBS Number: 1.1.1.5.3.4 **Description:** Module Assembly

Institution : **Contact:** Maurice Garcia-Sciveres

Tooling, materials and labor for attachment of flex hybrids to bare modules and attachment of pigtails.

Details of Estimate: We assume the U.S. begins assembly 650(goals) -> 435(baseline scope modules).

Tooling costs are estimated from conceptual designs and some fabrication of prototype parts

Labor

The assembly steps are

Clean and inspect bare module
Probe bare module
Attach pigtail to flex hybrid
Clean and inspect flex hybrid and test
Apply glue
Assemble flex hybrid to bare module
Inspect
Cure

Wire bond from FE pads to flex using automated bonder
Inspect
Repair, if necessary

Storage

Database logging

Wire bonding will be done at LBL and Ohio State, in equal proportion

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
173	66	38	239	0	119	0	54	3.7	0.4

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	884	0	0	3233	301	0	0	118.933
MFG MC	0	0	0	0	0	441	0	0	1605	0	0	0	51.284
MFG B/I	0	0	0	0	0	750	0	0	0	0	0	0	37.473
	0	0	0	0	0	2075	0	0	4838	301	0	0	207.690

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	28	0	0	23	0	0.0	54.093
	28	0	0	23	0	0.0	54.093

PROFILE SUMMARY:	FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
	0	0	0	0	0	0	17	169	76	0	262

WBS Number: 1.1.1.5.3.4.1 **Description:** Tooling

Institution : LBNL/UC- Senior **Contact:** Maurice Garcia-Sciveres

Tooling costs for module assembly

Basis of Estimate: Engineering judgement

Details of Estimate: $1000 for materials and about 300 hours of shop time. This is final iteration of tools developed during prototype phase.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
17	8	46	25	0	16	0	1	0.2	0.0

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	0	0	0	0	301	0	0	15.784
	0	0	0	0	0	0	0	0	0	301	0	0	15.784

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	1	0	0	0	0	0.0	1.113
	1	0	0	0	0	0.0	1.113

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
6	6	8	8	4	1	1	46

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	0	17	0	0	0	17

WBS Number: 1.1.1.5.3.4.2 **Description:** Assembly - LBNL

Institution : LBNL/UC- Senior **Contact:** Maurice Garcia-Sciveres

This includes labor and materials and supplies costs for assembly at LBNL.

Basis of Estimate: Engineering judgement

Details of Estimate: We assume 1FTE for the full period(including 6 month training period before full production start) at LBL split between physical assembly and wire bonding. And 0.25 FTE of supervision from a senior technician supported by base program. Miscellaneous materials and supplies, maintenance of wire bonder, etc are estimated to be 1,500 per month.

COST SUMMARY: (Project)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
	82	30	37	112	0	52	0	30	2.0	0.4

MANPOWER SUMMARY:	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	0	0	0	2349	0	0	0	51.820
MFG MC	0	0	0	0	0	0	0	0	1164	0	0	0	25.678
MFG B/I	0	0	0	0	0	750	0	0	0	0	0	0	37.473
	0	0	0	0	0	750	0	0	3513	0	0	0	114.971

MATERIAL SUMMARY:	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	27	0	0	0	0	0.0	30.051
	27	0	0	0	0	0.0	30.051

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	4	4	8	8	2	1	1	28

PROFILE SUMMARY:	FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
	0	0	0	0	0	0	0	103	42	0	145

WBS Number: 1.1.1.5.3.4.3 **Description:** Assembly - Ohio State

Institution : Ohio State U. **Contact:** Maurice Garcia-Sciveres

Wire bonding and inspection at OSU and related assembly tasks.

Basis of Estimate: Physicist estimate

Details of Estimate: See attached notes

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
74	28	38	102	0	51	0	23	1.5	0.0

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	884	0	0	884	0	0	0	51.329
MFG MC	0	0	0	0	0	441	0	0	441	0	0	0	25.606
	0	0	0	0	0	1325	0	0	1325	0	0	0	76.935

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	0	0	0	23	0	0.0	22.929
	0	0	0	23	0	0.0	22.929

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	Cost	Schedule	Design	Technical	Cost	Schedule	Cont %
4	4	8	8	2	1	1	28

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	0	0	66	34	0	100

WBS Number: 1.1.1.5.3.5 **Description:** Module Testing

Institution : **Contact:** Maurice Garcia-Sciveres

Electrical testing of bare and assembled modules. All U.S. bare module testing will be done at LBNL. Assembled module testing locations are TBD but are costed here at LBL rates. Assembled module testing is likely to be done at universities.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
245	155	63	400	0	152	0	93	6.5	0.4

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	0	0	0	5280	0	0	2349	151.978
MFG MC	0	0	0	0	0	0	0	0	2640	0	0	1164	75.831
MFG B/I	0	0	0	0	660	0	0	0	0	0	0	0	32.977
	0	0	0	0	660	0	0	0	7920	0	0	3513	260.786

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	84	0	0	0	0	0.0	93.492
MFG MC	20	0	0	0	0	0.0	22.260
	104	0	0	0	0	0.0	115.752

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	0	45	234	98	0	377

WBS Number: 1.1.1.5.3.5.1 **Description:** Bare Module Testing

Institution : LBNL/UC- Senior **Contact:** Maurice Garcia-Sciveres

A bare module is one after flip chip assembly and X-ray inspection but before attachment of the flex hybrid. We assume testing for one year with ramp up of 6 months.

Basis of Estimate: Physicist estimate

Details of Estimate: Costs of bare module assembly are for probe cards, tooling, probe stations maintenance and labor.

Materials costs

Probe cards 5,000
Tooling 2,000
Maintenance 2,000
Shipping/customs 10000

Labor

We assume 1FTE student equivalent for 1.5 years + senior technician(base program supported) + physicist supervision.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
57	33	59	90	0	35	0	21	2.0	0.4

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	0	0	0	0	0	0	2349	35.499
MFG MC	0	0	0	0	0	0	0	0	0	0	0	1164	17.591
MFG B/I	0	0	0	0	660	0	0	0	0	0	0	0	32.977
	0	0	0	0	660	0	0	0	0	0	0	3513	86.067

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	19	0	0	0	0	0.0	21.147
	19	0	0	0	0	0.0	21.147

CONTINGENCY FACTORS:

Risk: Technical	Risk: Cost	Risk: Schedule	Risk: Design	Weight: Technical	Weight: Cost	Weight: Schedule	Cont %
8	6	8	15	2	1	1	45

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	0	0	78	29	0	107

WBS Number: 1.1.1.5.3.5.2 **Description:** Assembled Module Testing

Institution : LBNL/UC-Junior **Contact:** Maurice Garcia-Sciveres

Modules after attachment of flex hybrids/pigtails and inspection are shipped to module testing sites for detailed testing and burn-in.

Basis of Estimate: Physicist estimate

Details of Estimate: Location of module testing is TBD. It is cost here at LBL rates. Assumption is 1.5 years duration. One module per day => 3 FTEs for goals or 2 FTEs for baseline scope. Equipment costs are taken to be 20K per site and 3 sites for goals, 2 for baseline. Shipment boxes and costs are taken to be 25K.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
189	121	64	310	0	116	0	72	4.5	0.0

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	0	0	0	5280	0	0	0	116.479
MFG MC	0	0	0	0	0	0	0	0	2640	0	0	0	58.240
	0	0	0	0	0	0	0	0	7920	0	0	0	174.719

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	65	0	0	0	0	0.0	72.345
MFG MC	20	0	0	0	0	0.0	22.260
	85	0	0	0	0	0.0	94.605

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	**Cost**	**Schedule**	**Design**	**Technical**	**Cost**	**Schedule**	**Cont %**
8	6	8	15	2	1	1	45

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	0	45	155	69	0	269

WBS Number: 1.1.1.5.3.6 **Description:** Module Attachment

Institution : LBNL/UC- Senior **Contact:** Maurice Garcia-Sciveres

Attachment of assembled modules to disk sectors. This includes thermal and mechanical testing but not electrical testing. All of this work will be done at LBNL

Basis of Estimate: Physicist estimate

Details of Estimate: Goals assume attachment of (2*9*6+4*8*6)*1.1=330 modules. We assume attachment and QA of 3 modules(one-half sector) per day or 880 hours.

Baseline scope is (2*9*6+2*8*6)*1.1= 224 modules or 600 hours.

Materials include clean room supplies and miscellaneous tools at $1000 per month. $4000 baseline, $2000 management contingency.

Adhesives are taken to be $1000 for both cases

Storage boxes for each sector at $20 each = $1200.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
51	19	38	70	0	44	0	7	0.5	0.4

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	0	880	0	0	0	0	0	0	43.969
MFG B/I	0	0	0	0	0	660	0	0	0	0	0	0	32.977
	0	0	0	0	0	1540	0	0	0	0	0	0	76.946

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	6	0	0	0	0	0.0	6.901
	6	0	0	0	0	0.0	6.901

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	Cost	Schedule	Design	Technical	Cost	Schedule	Cont %
4	6	8	8	4	1	1	38

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	22	11	12	39	0	84

WBS Number: 1.1.1.5.3.7 **Description:** Sector Electrical Testing

Institution : LBNL/UC- Senior **Contact:** Maurice Garcia-Sciveres

Electrical testing of sectors with modules attached.

Basis of Estimate: Physicist estimate

Details of Estimate: Electrical testing of completed sectors requires mechanical and electrical tooling, DAQ systems and labor. Temperature cycling will also be done

Tooling costs can only be crudely estimated at this time and we take 5,000.

We take 3000 for a refurbished environmental chamber.

Storage is taken to be $6000

DAQ systems are assumed to exist already at LBNL for this purpose for either IC testing or from ROD development.

Labor is taken to be one sector every two days(880 hours) + participation and supervision by postdocs and other physicists.

We do not separate here goals and baseline scope.

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
60	23	38	82	0	44	0	16	0.5	0.5

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
MFG P	0	0	0	0	880	0	0	0	0	0	0	0	43.969
MFG B/I	0	0	0	0	880	0	0	0	0	0	0	0	43.969
	0	0	0	0	1760	0	0	0	0	0	0	0	87.938

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	14	0	0	0	0	0.0	15.582
	14	0	0	0	0	0.0	15.582

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	Cost	Schedule	Design	Technical	Cost	Schedule	Cont %
4	6	8	8	4	1	1	38

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	0	0	34	70	0	104

WBS Number: 1.1.1.5.3.8 **Description:** Production database

Institution : LBNL/UC-Junior **Contact:** Maurice Garcia-Sciveres

Development and maintenance of module production database

Basis of Estimate: Physicist estimate

Details of Estimate: We assume development is done by physicists. But we include costs of computers for data entry and student labor for report generation and global QA. We include bar code equipment for sectors at 2K

COST SUMMARY: (Project)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs Project	FTEs Other
16	6	38	21	7	0	0	9	0.3	0.0

MANPOWER SUMMARY:

	S.W. Prof (hrs)	EE (hrs)	ME (hrs)	Design (hrs)	ET (hrs)	MT (hrs)	Admin. Super. (hrs)	Other Admin. (hrs)	Contract Labor (hrs)	Shops (hrs)	Tech. Serv. (hrs)	Student (hrs)	Total w/ overhead (k$)
EDIA P	0	0	0	0	0	0	0	0	0	0	0	440	6.649
	0	0	0	0	0	0	0	0	0	0	0	440	6.649

MATERIAL SUMMARY:

	Pur. Mat. (k$)	Stores (k$)	Travel (k$)	Low Level (k$)	R + D (k$)	High Level (k$)	Total w/ overhead (k$)
MFG P	8	0	0	0	0	0.0	8.904
	8	0	0	0	0	0.0	8.904

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	Cost	Schedule	Design	Technical	Cost	Schedule	Cont %
4	6	8	8	4	1	1	38

PROFILE SUMMARY:

FY 96 (k$)	FY 97 (k$)	FY 98 (k$)	FY 99 (k$)	FY 00 (k$)	FY 01 (k$)	FY 02 (k$)	FY 03 (k$)	FY 04 (k$)	FY 05 (k$)	Total (k$)
0	0	0	0	0	0	0	12	3	0	16