36 antennas

1-12-00

BAUDRY SHOULD DO THIS ?

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MMA Cost Estimation Data Input Table

WBS Number	8.1.1	*e.g., 1.1.4.45*
Title	Refine digitizer design	*e.g., Project Management and Tracking*
Estimator	Webber	*Name*
Basis of Estimate	EN	**EN** *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors

Technical	10	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Cost	6	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Schedule	8	*(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical	2	*(2 or 4 are valid)*
Cost	1	*(1 or 2 are valid)*
Calculated Contingency:	34%	*(See defintions)*

Task Description *(Text for the WBS dictionary)*: The digitizer (sampler) design will be refined in preparation for production.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.	3							0.3
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.	6							0.5
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.1.1
Title Refine digitizer design

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Lab supplies	each	5	1							5

Total (1999 $K): 5

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

BAUDRY ? K1.8

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MMA Cost Estimation Data Input Table

WBS Number 8.1.3 *e.g., 1.1.4.45*

Title Digitizer contract materials *e.g., Project Management and Tracking*

Estimator Webber *Name*

Basis of Estimate EN **EN** *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors

Technical	10	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Cost	6	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Schedule	8	*(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical	2	*(2 or 4 are valid)*
Cost	1	*(1 or 2 are valid)*
Calculated Contingency:	34%	*(See defintions)*

Task Description *(Text for the WBS dictionary)*: The parts and materials required to assemble 320 digitizers will be procured.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.		3						0.3
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.		3						0.3
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.1.3

Title Digitizer contract materials

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Custom digitizer chips	each	0.4		320						128
Circuit boards & components	each	1		320						320
Chassis	each	0.5		320						160
Cables & connectors	each	0.5		320						160
Misc. parts	each	0.5		320						160
									Total (1999 $K):	928

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
									Total (1999 $K):	

BOUDRT ?
X1.8

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MMA Cost Estimation Data Input Table

WBS Number	8.1.4	*e.g., 1.1.4.45*
Title	Assembly of digitizers	*e.g., Project Management and Tracking*
Estimator	Webber	*Name*
Basis of Estimate	EN	**EN** *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors

Technical	6	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Cost	6	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Schedule	8	*(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical	2	*(2 or 4 are valid)*
Cost	1	*(1 or 2 are valid)*
Calculated Contingency:	26%	*(See defintions)*

Task Description (*Text for the WBS dictionary*): The required 320 digitizers will be assembled.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.		1						0.1
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.		23						1.9
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.1.4
Title Assembly of digitizers

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

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MMA Cost Estimation Data Input Table

WBS Number	8.1.5	*e.g., 1.1.4.45*
Title	Digitizer validation and delivery	*e.g., Project Management and Tracking*
Estimator	Webber	*Name*
Basis of Estimate	EN	**EN** -*Engineering/Bottom Up/ Parametric;* **VQ** - *Vendor Quote;* **PO** - *Place Order; or* **AC** - *Actual Cost*

Assigned Risk factors

Technical	6	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Cost	6	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Schedule	8	*(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical	2	*(2 or 4 are valid)*
Cost	1	*(1 or 2 are valid)*
Calculated Contingency:	26%	*(See defintions)*

Task Description (*Text for the WBS dictionary*): The 320 assembled digitzers will be tested and delivered.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.		1	4					0.4
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.		1	3					0.3
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.1.5
Title Digitizer validation and delivery

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Lab supplies	each	5		1	1					10

Total (1999 $K): 10

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

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MMA Cost Estimation Data Input Table

WBS Number 8.2.1 *e.g., 1.1.4.45*

Title Prototype FIR filter testing on interferometer *e.g., Project Management and Tracking*

Estimator Webber *Name*

Basis of Estimate EN **EN** *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors

Technical	10	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Cost	10	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Schedule	8	*(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical	2	*(2 or 4 are valid)*
Cost	1	*(1 or 2 are valid)*
Calculated Contingency:	38%	*(See defintions)*

Task Description *(Text for the WBS dictionary)*: The digital FIR filter will be tested with the test interferometer.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.	4							0.3
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.	2							0.2
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.	2							0.2
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.2.1

Title Prototype FIR filter testing on interferometer

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

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MMA Cost Estimation Data Input Table

WBS Number 8.2.2 *e.g., 1.1.4.45*

Title Design & test FIR filter refinement *e.g., Project Management and Tracking*

Estimator Webber *Name*

Basis of Estimate EN **EN** *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors

Technical	10	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Cost	10	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Schedule	8	*(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical	2	*(2 or 4 are valid)*
Cost	1	*(1 or 2 are valid)*
Calculated Contingency:	38%	*(See defintions)*

Task Description *(Text for the WBS dictionary)*: The final refinements to the design of the FIR filter will be determined and any final changes made.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.	1							0.1
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.	1							0.1
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.	3							0.3
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.	3							0.3
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.2.2

Title Design & test FIR filter refinement

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Parts	each	5	1							5

Total (1999 $K): 5

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

X1.8

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MMA Cost Estimation Data Input Table

WBS Number 8.2.4 *e.g., 1.1.4.45*
Title FIR filter chip & board fabrication *e.g., Project Management and Tracking*
Estimator Webber *Name*
Basis of Estimate EN **EN** *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors
Technical 10 *(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Cost 10 *(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Schedule 8 *(2, 4 or 8; see definition)*

Multipliers for Contingency
Technical 2 *(2 or 4 are valid)*
Cost 1 *(1 or 2 are valid)*
Calculated Contingency: 38% *(See defintions)*

Task Description *(Text for the WBS dictionary)*: A custom FIR filter chip will be manufactured. The printed circuit boards needed for filter implementation will be fabricated.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.	1							0.1
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.	1							0.1
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.2.4
Title FIR filter chip & board fabrication

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
FIR filter chips	each	0.15	560	2000						384
Circuit boards & parts	each	0.5	100	220						160
Chassis	each	0.5	100	240						170
Cables & connectors	each	0.25	100	240						85
Misc. parts	each	0.25	100	240						85

Total (1999 $K): 884

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

884 X 1.8 = 1.59 MEG

MY EST = 1.78 MEG WITH ASS'Y

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X1.8

MMA Cost Estimation Data Input Table

WBS Number	8.2.5	*e.g., 1.1.4.45*
Title	FIR filter board assembly	*e.g., Project Management and Tracking*
Estimator	Webber	*Name*
Basis of Estimate	EN	**EN** *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors

Technical	10	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Cost	10	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Schedule	8	*(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical	2	*(2 or 4 are valid)*
Cost	1	*(1 or 2 are valid)*
Calculated Contingency:	38%	*(See defintions)*

Task Description *(Text for the WBS dictionary)*: The FIR filter boards will be assembled.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.		1	1					0.2
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.		6	6					1.0
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.2.5
Title FIR filter board assembly

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Lab supplies	each	5		1	1					10

Total (1999 $K): 10

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

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X1.8

MMA Cost Estimation Data Input Table

WBS Number 8.2.6 *e.g., 1.1.4.45*

Title FIR filter board validation and delivery *e.g., Project Management and Tracking*

Estimator Webber *Name*

Basis of Estimate EN **EN** *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors

Technical	10	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Cost	10	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Schedule	8	*(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical	2	*(2 or 4 are valid)*
Cost	1	*(1 or 2 are valid)*
Calculated Contingency:	38%	*(See defintions)*

Task Description *(Text for the WBS dictionary)*: The FIR filter boards will be tested and delivered.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.		2	2					0.3
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.		2	2					0.3
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.2.6

Title FIR filter board validation and delivery

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

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MMA Cost Estimation Data Input Table

WBS Number 8.3.1 *e.g., 1.1.4.45*

Title Correlator boards *e.g., Project Management and Tracking*

Estimator Webber *Name*

Basis of Estimate EN **EN** *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors

Technical	4	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Cost	4	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Schedule	8	*(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical	2	*(2 or 4 are valid)*
Cost	1	*(1 or 2 are valid)*
Calculated Contingency:	20%	*(See defintions)*

Task Description (*Text for the WBS dictionary*)

The final versions of the control, memory, correlator, and accumulator board prototypes will be assembled and tested. Any needed design modifications will be made and tested. The production versions will be released.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.	12							1.0
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.	30							2.5
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.	8							0.7
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.3.1

Title Correlator boards

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Circuit boards & parts	each	2	8							16
Lab supplies	each	5	1							5
Software maintenance	each	10	1							10

Total (1999 $K): 31

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

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MMA Cost Estimation Data Input Table

WBS Number	8.4	*e.g., 1.1.4.45*
Title	Correlator Chip	*e.g., Project Management and Tracking*
Estimator	Webber	*Name*
Basis of Estimate	EN	**EN** *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors

Technical	6	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Cost	6	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Schedule	8	*(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical	2	*(2 or 4 are valid)*
Cost	1	*(1 or 2 are valid)*
Calculated Contingency:	26%	*(See defintions)*

Task Description (*Text for the WBS dictionary*)

The prototype correlator chips will be fabricated according to the design carried through the layout phase during design and development. The first wafer runs will be packaged and tested. Any design modifications needed in order to meet the specifications will be performed, and a new wafer run will be ordered if it is required. The new design will be verified and a production run for the prototype correlator will be procured.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.	6	12						1.5
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.	4	4						0.7
			Ops.								
		Chile	Constr.								
			Ops.								

TOO HIGH ?

WBS Number 8.4
Title Correlator Chip

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Chip mask set	each	25	1	1						50
Correlator chips	each	0.25	1000	14000						3,750

Total (1999 $K): 3,800

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Chip circuit design	each	50	1	1						100
Chip layout	each	50	1	1						100

Total (1999 $K): 200

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MMA Cost Estimation Data Input Table

WBS Number 8.5 — *e.g., 1.1.4.45*

Title Correlator Racks — *e.g., Project Management and Tracking*

Estimator Webber — *Name*

Basis of Estimate EN — **EN** - *Engineering/Bottom Up/ Parametric;* **VQ** - *Vendor Quote;* **PO** - *Place Order; or* **AC** - *Actual Cost*

Assigned Risk factors

Technical 4 *(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*

Cost 4 *(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*

Schedule 8 *(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical 2 *(2 or 4 are valid)*

Cost 1 *(1 or 2 are valid)*

Calculated Contingency: 20% *(See defintions)*

Task Description (*Text for the WBS dictionary*): The prototype correlator racks will be designed, assembled, and tested.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.	3	0						0.3
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.	6	0						0.5
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.5

Title Correlator Racks

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Racks & bins	each	10	1							10
Control computer	each	10	1							10
Power supplies	each	3	1							3
Cables & connectors	each	4	1							4
Fabricated parts	each	3	1							3
Misc. parts	each	1	1							1

Total (1999 $K): 31

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

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MMA Cost Estimation Data Input Table

WBS Number 8.6 — *e.g., 1.1.4.45*

Title Correlator software — *e.g., Project Management and Tracking*

Estimator Webber — *Name*

Basis of Estimate EN — **EN** *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors

Technical 4 *(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*

Cost 4 *(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*

Schedule 8 *(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical 2 *(2 or 4 are valid)*

Cost 1 *(1 or 2 are valid)*

Calculated Contingency: 20% *(See defintions)*

Task Description (*Text for the WBS dictionary*): The software for the correlator will be written and tested. In addition, test software to aid the engineers in system integration will be written and tested.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.	12	12	12					3.0
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.6

Title Correlator software

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Computers	each	3		1						3
Software maintenance	each	2	1	1	1					6

Total (1999 $K): 9

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

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MMA Cost Estimation Data Input Table

WBS Number 8.7 *e.g., 1.1.4.45*

Title Prototype Correlator Production *e.g., Project Management and Tracking*

Estimator Webber *Name*

Basis of Estimate EN **EN** *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors

Technical	8	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Cost	4	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Schedule	8	*(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical	2	*(2 or 4 are valid)*
Cost	1	*(1 or 2 are valid)*

Calculated Contingency: 28% *(See defintions)*

Task Description *(Text for the WBS dictionary)*: The parts for the prototype correlator capable of handling one baseline with 16 GHz bandwidth will be ordered. The prototype correlator will be assembled, tested, and delivered to the test interferometer site.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.		24	18					3.5
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.		32	18					4.2
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.7

Title Prototype Correlator Production

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Circuit boards & parts	each	2		32	32					128
Racks, bins, power supplies	each	5		2	2					20
Cables & connectors	each	10		1	1					20
Misc. parts	each	10		1	1					20
Software maintenance	each	10		1	1					20

Total (1999 $K): 208

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

X 1.8

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MMA Cost Estimation Data Input Table

WBS Number 8.8.1 *e.g., 1.1.4.45*

Title First 1/4 Correlator *e.g., Project Management and Tracking*

Estimator Webber *Name*

Basis of Estimate EN *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors

Technical	8	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Cost	4	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Schedule	8	*(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical	2	*(2 or 4 are valid)*
Cost	1	*(1 or 2 are valid)*

Calculated Contingency: 28% *(See defintions)*

Task Description *(Text for the WBS dictionary)*: The final configuration for the correlator will be determined. The parts, including correlator chips, will be ordered for the first 1/4 of the correlator (enough to handle the first 1/2 of the antennas). This first 1/4 of the correlator will be assembled, tested, and delivered to the site in Chile.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.			18	18				3.0
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.			18	18				3.0
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.8.1

Title First 1/4 Correlator

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Racks & power supplies	each	67			1					67
PC boards & components	each	197			1					197
Bins, cables, connectors	each	46			1					46
Fabricated parts	each	26			1					26
Misc. parts	each	53			1					53
Software maintenance	each	10				1				10

Total (1999 $K): 399

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

X 1.8

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MMA Cost Estimation Data Input Table

WBS Number 8.8.2 *e.g., 1.1.4.45*

Title Second 1/4 Correlator *e.g., Project Management and Tracking*

Estimator Webber *Name*

Basis of Estimate EN **EN** *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors

Technical 8 *(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*

Cost 4 *(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*

Schedule 8 *(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical 2 *(2 or 4 are valid)*

Cost 1 *(1 or 2 are valid)*

Calculated Contingency: 28% *(See defintions)*

Task Description (*Text for the WBS dictionary*) The parts, including correlator chips, will be ordered for the second 1/4 of the correlator. This second 1/4 of the correlator will be assembled, tested, and delivered to the site in Chile.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.				18	18			3.0
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.				18	18			3.0
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.8.2

Title Second 1/4 Correlator

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Racks & power supplies	each	67			1					67
PC boards & components	each	197			1					197
Bins, cables, connectors	each	46			1					46
Fabricated parts	each	26			1					26
Misc. parts	each	53			1					53
Software maintenance	each	10					1			10
Computers	each	3					7			21

Total (1999 $K): 420

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

X1.8

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MMA Cost Estimation Data Input Table

WBS Number	8.8.3	*e.g., 1.1.4.45*
Title	Third 1/4 Correlator	*e.g., Project Management and Tracking*
Estimator	Webber	*Name*
Basis of Estimate	EN	**EN** *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors

Technical	8	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Cost	4	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Schedule	8	*(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical	2	*(2 or 4 are valid)*
Cost	1	*(1 or 2 are valid)*
Calculated Contingency:	28%	*(See defintions)*

Task Description (*Text for the WBS dictionary*): The parts, including correlator chips, will be ordered for the third 1/4 of the correlator. This third 1/4 of the correlator will be assembled, tested, and delivered to the site in Chile.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.					18			**1.5**
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.					18			**1.5**
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.8.3
Title Third 1/4 Correlator

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Racks & power supplies	each	67				1				**67**
PC boards & components	each	197				1				**197**
Bins, cables, connectors	each	46				1				**46**
Fabricated parts	each	26				1				**26**
Misc. parts	each	53				1				**53**
Software maintenance	each	10						1		**10**

Total (1999 $K): 399

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

X1.8

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MMA Cost Estimation Data Input Table

WBS Number 8.8.4 — *e.g., 1.1.4.45*

Title Fourth 1/4 Correlator — *e.g., Project Management and Tracking*

Estimator Webber — *Name*

Basis of Estimate EN — **EN** -*Engineering/Bottom Up/ Parametric;* **VQ** - *Vendor Quote;* **PO** - *Place Order; or* **AC** - *Actual Cost*

Assigned Risk factors

Technical 8 *(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*

Cost 4 *(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*

Schedule 8 *(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical 2 *(2 or 4 are valid)*

Cost 1 *(1 or 2 are valid)*

Calculated Contingency: 28% *(See defintions)*

Task Description (*Text for the WBS dictionary*)

The parts, including correlator chips, will be ordered for the fourth 1/4 of the correlator. This last 1/4 of the correlator will be assembled, tested, and delivered to the site in Chile.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.						36		3.0
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.						36		3.0
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.8.4

Title Fourth 1/4 Correlator

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Racks & power supplies	each	67					1			67
PC boards & components	each	197					1			197
Bins, cables, connectors	each	46					1			46
Fabricated parts	each	26					1			26
Misc. parts	each	53					1			53

Total (1999 $K): 389

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):

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MMA Cost Estimation Data Input Table

WBS Number	8.9	*e.g., 1.1.4.45*
Title	Correlator test equipment	*e.g., Project Management and Tracking*
Estimator	Webber	*Name*
Basis of Estimate	VQ	**EN** *-Engineering/Bottom Up/ Parametric;* **VQ** *- Vendor Quote;* **PO** *- Place Order; or* **AC** *- Actual Cost*

Assigned Risk factors

Technical	1	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Cost	1	*(1, 2, 3, 4, 6, 8, 10, or 15; see definition)*
Schedule	2	*(2, 4 or 8; see definition)*

Multipliers for Contingency

Technical	2	*(2 or 4 are valid)*
Cost	1	*(1 or 2 are valid)*
Calculated Contingency:	5%	*(See defintions)*

Task Description (*Text for the WBS dictionary*): Standard test equipment to be dedicated to the correlator production task will be procured.

Labor

Position Type	Effort in	Location	Constr. or Ops.	2001	2002	2003	2004	2005	2006	2007	Totals (person y)
Scientist	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Programmer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Engineer	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								
Technician	months	US	Constr.								
			Ops.								
		Chile	Constr.								
			Ops.								

WBS Number 8.9
Title Correlator test equipment

Materials

Material Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)
Digital oscilloscopes HP54616B	each	6.7	3							20
Logic analyzers HP1660ES	each	20	2							40
Carts	each	0.25	6							2
Multimeters	each	0.2	6							1
Pulse generators HP8110A	each	6	1							6

Total (1999 $K): 69

Contracts

Contract Description	Unit of Measure	1999 Unit Cost ($K)	2001 Quantity	2002 Quantity	2003 Quantity	2004 Quantity	2005 Quantity	2006 Quantity	2007 Quantity	Totals (1999 $K)

Total (1999 $K):