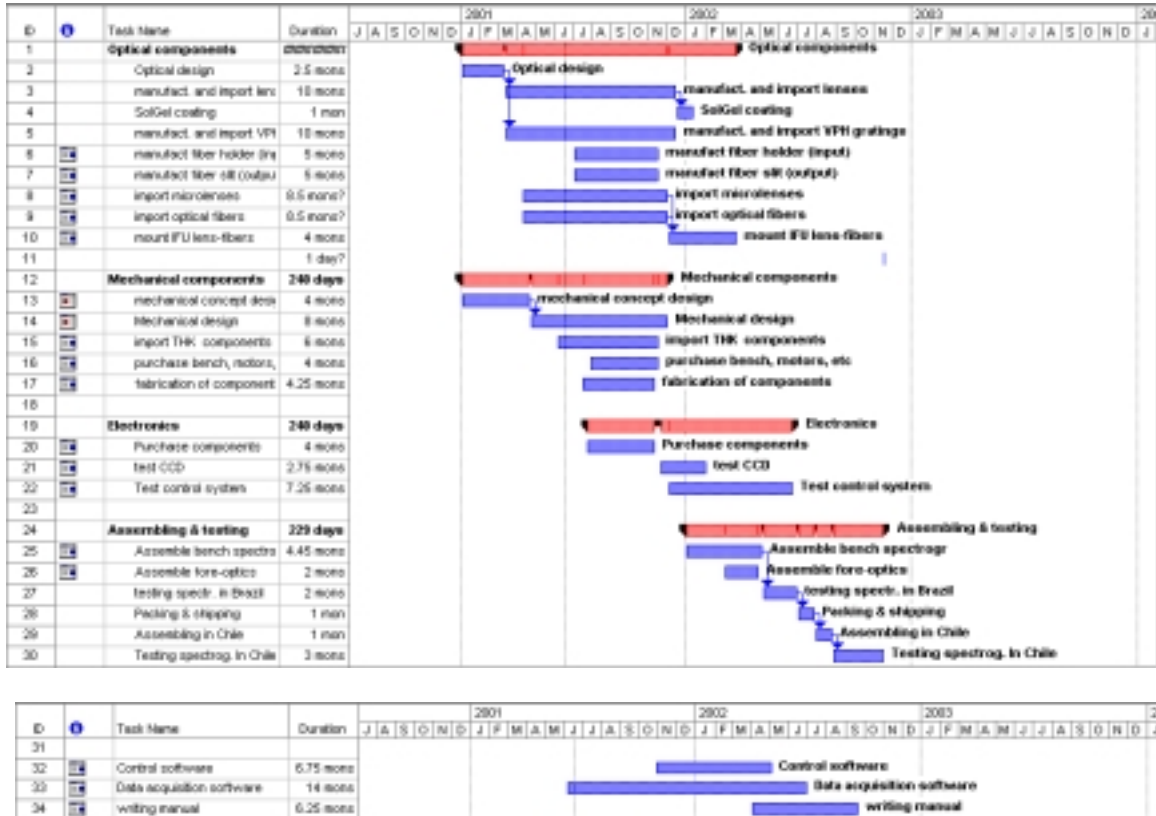


## 4- The Work Breakdown Structure and costs

### 4.1 WBS



### 4.2 COSTS

The total cost including contingency and overhead, and including the prototype, was estimated as 1.5 million dollars. Now that the prototype is ready, the remaining costs for the main SOAR spectrograph is 1.4 million dollars, including contingency.

We propose to use in-house staff for scientific and system design, as far as possible, and use external engineering help when necessary. The salaries are lower than US standards, and we can only roughly estimate them in dollars, due to fluctuations in the change rate. The overhead was considered to be 48% for all charges except equipment, in order to be consistent with other SOAR proposals. The overhead takes into account expenses covered by the institutions involved in the project (LNA, IAG) that are not displayed explicitly in the cost breakdown, like administration, installations, communications, etc.

Funds for this project have been approved by the São Paulo State Research Agency - FAPESP; they do not include the overhead and contingency costs, nor the management

costs stated in WBS, nor the salaries of engineers with permanent positions at IAG and LNA, but they include external services costs, like optical design, etc. We present here the sum of the contributions from FAPESP, IAG and LNA.

*Mechanical, optics, electronics* :. The manpower required for design, assembling, etc. is estimated based on the experience on development of astronomical instruments at LNA. The costs of optical components, mechanical and control components are based on catalogs and current experience; the costs of optical components will depend on the final design.

*Support equipment and supplies*: although some laboratory equipment is available at the LNA, additional equipment is needed to test efficiently the transmission characteristics of lenses, coatings, fibers and epoxy, from UV to NIR, and for fiber polishing and alignment of optics.

*Management, Reporting and documenting*: the effort involved in these items is similar to that of other SOAR instrument proposals.

*Travel*: the IFU spectrograph will be built at the LNA (Itajubá) and São Paulo University; in close contact with CTIO. Travels between São Paulo to Itajubá will take place about twice a month, with 2 days stays. Other displacements in Brazil include Rio-São Paulo and Florianópolis- São Paulo.

## WBS for the SOAR IFU

1 Mechanical									
	Unit cost	M&S total	Contingency			Overhead			
			%	cost	Total cost	factor	M&S	M&S+cont.	
Mech. design 6 m.mo.	5000	30,000.00	10	3000	33,000.00	0.48	14,400.00	15,840.00	
Thermal design 1 m.mo.	5000	5,000.00	10	500	5,500.00	0.48	2,400.00	2,640.00	
Mech. shop 6 m.mo.	3000	18,000.00	15	2700	20,700.00	0.48	8,640.00	9,936.00	
Assembling 4 m.mo.	5000	20,000.00	15	3000	23,000.00	0.48	9,600.00	11,040.00	
Optical bench	10000	10,000.00	25	2500	12,500.00				
Enclosure & suspension	3000	3,000.00	25	750	3,750.00				
Computer controlled mechanisms		50,000.00	25	12500	62,500.00				
Static supports		5,000.00	25	1250	6,250.00				
field rotator		10,000.00	25	2500	12,500.00				
misc metal, screws etc		5,000.00	25	1250	6,250.00				
<b>Total mechanical</b>		156,000.00			185,950.00		35,040.00	39,456.00	

2 Optics									
	Unit cost	M&S total	Contingency			Overhead			
			%	cost	Total cost	factor	M&S	M&S+cont.	
Optical design 3 m.mo.	5000	15,000.00	10	1500	16,500.00	0.48	7200	7920	

Installation	2 m.mo.	5000	10,000.00	15	1500	11,500.00	0.48	4800	5520
IFU assembling	6 m.mo	3000	18,000.00	15	2700	20,700.00	0.48	8640	9936
Camera & collimator lenses			40,000.00	15	6000	46,000.00	0		
Lenslet array		23000.00	23,000.00	15	3000	26,000.00	0		
Gratings	6 VPH	4000	24,000.00	20	4200	28,200.00	0		
fore optics	3 sets of lens		8,000.00	10	800	8,800.00	0		
Optical fibers	11 km		20,000.00	15	3000	23,000.00	0		
Jackets			1,000.00	15	150	1,150.00	0		
Coatings			5,000.00	15	750	5,750.00	0		
Cements & epoxy			2,000.00	15	300	2,300.00	0		
Spectral filters	3	5000	15,000.00	15	2700	17,700.00	0		
ADC			20,000.00	15	3000	23,000.00	0		
<b>Total optics</b>			201,000.00			230,600.00		20640	23376

### 3 Electronics

	Unit cost	M&S total	Contingency			Overhead		
			%	cost	Total cost	factor	M&S	M&S+cont.
CCD detector & control		220,000.00	15	33000	253,000.00	0	0	0
Encoders		8,000.00	10	800	8,800.00	0	0	0
Motors		5,000.00	10	500	5,500.00	0	0	0
misc connectors, wiring		5,000.00	15	750	5,750.00	0	0	0
Thermal control system		5,000.00	15	750	5,750.00	0	0	0
Mounting & testing	6 mo	5000	10	3000	33,000.00	0.48	14400	15840

### 4 Software & Computers

	Unit cost	M&S total	Contingency			Overhead			
			%	cost	Total cost	factor	M&S	M&S+cont.	
Develop. data acqu	3 mo.	5000	15,000.00	25	3750	18,750.00	0.48	7200	9000
Develop mech. Control	3 mo.	5000	15,000.00	25	3750	18,750.00	0.48	7200	9000
Dev. data red., calibr.	8 mo.	5000	40,000.00	25	10000	50,000.00	0.48	19200	24000
PXI computer+chassi			12,000.00	10	1200	13,200.00	0	0	0
Workstation			15,000.00	10	1500	16,500.00	0	0	0
<b>Total software</b>			97,000.00			117,200.00		33600	42000

### C 5 Installation and Commissioning

	Unit cost	M&S total	Contingency			Overhead			
			%	Cost	Total cost	factor	M&S	M&S+cont.	
Shipping		3,500.00	23	805	4,305.00	0.48	1680	2066.4	
Installation		8,000.00	13	1040	9,040.00	0.48	3840	4339.2	
Commissioning	8 m.mo	5000	40,000.00	20	8000	48,000.00	0.48	19200	23040
Support after install	4 m.mo	5000	20,000.00	20	4000	24,000.00	0.48	9600	11520
Subsistance at obs.	12 mo	1000	12,000.00	10	1200	13,200.00	0.48	5760	6336
<b>Total installation</b>			83,500.00			98,545.00		40,080.00	47,301.60

### C 6 Support Equipment & Supplies

	Unit cost	M&S total	Contingency			Overhead		
			%	cost	Total cost	factor	M&S	M&S+cont.

Zemax license	2900	2,900.00	0	0	2,900.00	0.48	1,392.00	1,392.00
LabView license	2550	2,550.00	0	0	2,550.00	0.48	1,224.00	1,224.00
AutoCad license	3000	3,000.00	0	0	3,000.00	0.48	1,440.00	1,440.00
Lab Spectrometer	3000	3,000.00	25	750	3,750.00	0	0.00	0.00
Lab camera	1800	1,800.00	25	450	2,250.00	0	0.00	0.00
Fiber polisher	2000	2,000.00	25	500	2,500.00	0	0.00	0.00
Light sources and detectors	4000	4,000.00	25	1000	5,000.00	0	0.00	0.00
Alignment facility	6000	6,000.00	25	1500	7,500.00	0	0.00	0.00
Laptop computer	3000	3,000.00	25	750	3,750.00	0	0.00	0.00
Misc tools & supplies	5000	5,000.00	25	1250	6,250.00	0	0.00	0.00
<b>Total support</b>		33,250.00			39,450.00		4,056.00	4,056.00

<b>C 7 Travel</b>								
	Unit cost	M&S total	Contingency			Overhead		
			%	cost	Total cost	factor	M&S	M&S+cont.
Sao Paulo-Itajuba & vice-versa 200		4,000.00	25	1,000.00	5,000.00	0.48	1,920.00	2,400.00
Other displacements in Brazil 300		2,400.00	25	600.00	3,000.00	0.48	1,152.00	1,440.00
Sao_Paulo_CT IO	800	2,400.00	25	600.00	3,000.00	0.48	1,152.00	1,440.00
Brasil-USA and vice-versa	2000	16,000.00	25	4,000.00	20,000.00	0.48	7,680.00	9,600.00
<b>Total travel</b>		24,800.00			31,000.00		11,904.00	14,880.00

<b>8 Management, Reporting &amp; Documenting</b>								
	Unit cost	M&S total	Contingency			Overhead		
			%	cost	Total cost	factor	M&S	M&S+cont.
P.I.s 12 m.mo.	6,000	72,000	10	7,200.00	79,200.00	0.63	45,144.00	49,658.40
Secretary 9 m.mo	2,000	18,000	10	1,800.00	19,800.00	0.48	8,640.00	9,504.00
Design review 2 m.mo	5,000	10,000	10	1,000.00	11,000.00	0.48	4,800.00	5,280.00
Documenting 4 m.mo	3,000	12,000	10	1,200.00	13,200.00	0.48	5,760.00	6,336.00
<b>Total management</b>		112,000			123,200.00		64,344.00	70,778.40

<b>Budget summary by WBS item</b>				
	M&S	M&S+cont	overhead	overh.+cont
1 Total prototype	90,800.00	99,880.00	30,960.00	34,056.00
2 Total mechanical	156,000.00	185,950.00	35,040.00	39,456.00
3 Total optics	201,000.00	230,600.00	20,640.00	23,376.00
4 Total electronics	273,000.00	311,800.00	14,400.00	15,840.00
5 Total software	97,000.00	117,200.00	33,600.00	42,000.00
6 Total installation	83,500.00	98,545.00	40,080.00	47,301.60
7 Total support	33,250.00	39,450.00	4,056.00	4,056.00
8 Total travel	24,800.00	31,000.00	11,904.00	14,880.00
9 Total management	112,000.00	123,200.00	64,344.00	70,778.40
<b>GRAND TOTAL</b>	<b>1,071,350.00</b>	<b>1,237,625.00</b>	<b>255,024.00</b>	<b>291,744.00</b>

**M&S+cont+overhead= 1,493,099.00**

