



# CHARA TECHNICAL REPORT

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## Preliminary Unit Cost Estimate for the Mechanical Portion of the CHARA 1-m Telescopes

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### 1. INTRODUCTION

As an aid for your planning, a “rough” estimate of costs for fabricating the mechanical mount for the CHARA 1-m telescopes is provided below. The estimate is based on the telescope design illustrated in the drawings numbered CHARA 1E through 10E except for azimuth base which is in the process of modification to a configuration illustrated in a preliminary layout drawing numbered LDB895.

The accuracy of this estimate is felt to be approximately  $\pm 25\%$ . Individual item costs may have larger errors, but these will be averaged out in the total to the  $\pm 25\%$  figure.

Factors relevant to the estimate are:

1. All fabrication and finishing (i.e., painting) costs are computed @ \$40/hr rate which is appropriate for shops of modest size. To the extent possible, bids should be solicited from smaller shops to avoid large overhead costs.
2. Weldments requiring only a modest amount of machining were estimated on the basis of weight @ \$15/lb including material costs which should be conservative. These items proved to be the larger amounts in this estimate which justifies an effort during the detail drawing stage to simplify the fabrication requirements.
3. No allowance has been made for possible reductions in unit fabrication costs due to quantity purchases for 5 telescopes. However, some of the commercial part prices were based on purchase quantities for 5 telescopes.
4. The following cost items are not included:
  - Optics
  - Drive motor controllers
  - Position encoders
  - Control system development (software)
5. No “contingency” factor has been included.

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TABLE 1. Optics Support Structure (the "Tube" Assembly)

Item	Qty	Basis	Cost
OSS midframe & trusses	1	1124 lbs @ \$15/lb + 8 hrs finishing	\$17,180
Secondary frame	1	241 lbs est. wgt @ \$15/lb + 4 hrs finishing	3,760
Strut brackets	8	8 hrs/bracket fabrication time + \$75/bracket for materials	3,160
Struts	8	7 hrs/strut fabrication time + \$75/strut for materials	2,840
Secondary housing	1	41 hrs fabrication time + \$200 for materials	1,840
Secondary attach. plate & related hardware	1	35 hrs fabrication time + \$700 in materials	2,100
Secondary focus actuators	3	\$800 drive motor + \$620 mechanical reducer + \$1700 rollerscrew + \$500 fabrication & assembly cost	10,860
Metering rods & connector hardware	4	\$600 for invar rods + 56 hrs fabrication time + \$200 for materials	3,040
Primary cell (weldment)	1	425 lbs @ \$15/lb + 4 hrs finishing.	6,535
Whiffletree assembly	3	44 hrs/assy fabrication time + \$660 for materials	7,260
Primary lateral support assembly	1	56 hrs fabrication time + \$760 for materials	3,000
Primary lateral restraint & seismic clips	2	28 hrs fabrication time + \$100 for materials	1,220
Primary cover	1	\$3700 for commercial parts & materials + 24 hrs fabrication time	4,660
Tertiary support column & struts	1	20 lbs weldment @ \$15/lb + 40 hrs fabrication time + \$200 for materials	2,100
Tertiary mount	1	36 hrs fabrication time + \$300 for materials	1,740
Estimated Cost for the Optics Support Structure Assembly			\$71,295

*TELESCOPE COST ESTIMATES*

**TABLE 2.** Azimuth Mount Structures and Subassemblies

Item	Qty	Basis	Cost
Alt axis bearing (outboard)	1	\$250 outboard pillow block + 10 hrs fabrication time for axle assy + \$100 materials	\$750
Alt axis bearing (inboard)	1	\$1400 for bearings & seals + 48 hrs fabrication time for housing + \$850 for materials	4,170
Alt drive mount	1	82 hrs fabrication time + \$1,000 for materials	3,280
Alt drive motor & mechanical reducer	1	\$5,400 for motor, \$5,200 for reducer (Commercial items)	10,600
Alt drive journal	1	\$7500 for materials + 70 hrs fabrication time	10,300
Az yoke weldment	1	3150 lbs @ \$15/lb	47,250
Az "box" base	1	4,000 lbs @ \$15/lb	60,000
Az rotating tube	1	2,100 lbs @ \$15/lb	31,500
Az central bearing	1	\$2,800 for sph. roller brg. & seals + 48 hrs fabrication time for housing + \$850 for materials	5,570
Az support rollers	2	\$2,225 for roller materials + \$1,200 for commercial parts + 54 hrs fabrication time	5,585
Az cable wrap	1	\$2,000 for cable carriers + 26 hrs fabrication time + \$300 for materials	3,340
Az drive mount	1	82 hrs fabrication time + \$1,000 for materials	3,280
Az drive motor & mechanical reducer	1	\$5,400 for motor, \$5,200 for reducer (commercial items)	10,600
Az drive journal	1	\$7500 for materials + 70 hrs fabrication time	10,300
M4, M5, & M6 mirror mounts	1	\$2,000 for fabrication & materials w/o optics	6,000
Estimated Cost for Azimuth Mount Assembly			\$212,525

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**TABLE 3.** Summary of Estimated Costs for Fabrication

Item	Cost
Optics Tube Structure	\$71,295
Azimuth Mount Assembly	212,525
Subtotal	\$283,820
Assembly Costs @ 10%	28,400
Shipping Costs @ 5%	14,200
Estimated Total Costs	\$326,420