



## Relay Mirror Specifications & Requirements

M.A. SHURE (CHARA), S.T. RIDGWAY (NOAO/KPNO & CHARA)  
AND T.A. TEN BRUMMELAAR (CHARA)

### 1. INTRODUCTION AND GENERAL INFORMATION

This document describes specifications for the manufacture of relay mirrors for the telescopes of the CHARA Array. These mirrors are referred to as “M6” in the telescope mechanical drawings. The information and specifications provided herein are intended to enable prospective suppliers (hereafter called “vendors”) of polished mirrors to respond to a Request for Quotation. It is expected that these specifications will become part of any contract for mirror blank purchase that may result from this RFQ process.

### 2. REQUIRED OPTICS

Optical components are required to meet the specifications given in this document, which describe:

- *Seven (7) flat mirrors, cut to size, with test documentation.*

The acceptance testing of the first mirror must be completed prior to GSU accepting delivery of the additional four mirrors. Quoted prices will be f.o.b. delivery point, including shipment costs to the CHARA Array site in California, and the mirrors must be packed in containers suitable for protecting them from damage during shipment.

CHARA will supply circular mirror quality Corning ULE blanks with dimensions of 8.00 (+0.04/-0.02) inches (203.2 mm) in diameter and 1.26 (+0.04/-0.02) inches (32.0 mm) thickness. Supplied substrates will have been ground with #80 grit or finer, and beveled approximately 0.03 inch at 45°. Blank thickness will be satisfactory as supplied, and up to 0.5 mm additional surface thickness may optionally be removed.

Table 1 sets out the mechanical characteristics of the mirrors. In addition, each mirror will have a unique four character *identification code* (to be specified by CHARA) inscribed on the back and a *fiducial mark* scribed on the side.

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<sup>1</sup>Center for High Angular Resolution Astronomy, Georgia State University, Atlanta GA 30303-3083  
TEL: (404) 651-2932, FAX: (404) 651-1389, FTP: ftp.chara.gsu.edu, WWW: http://www.chara.gsu.edu.  
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**TABLE 1.** Mechanical Characteristics

Total quantity	7
Diameter	$203.2 \pm 0.25$ mm
Center hole diameter	$2 \pm 0.25$ mm
Focal length	$\infty$ (i.e. flat)
Thickness	$32.0 \pm 0.25$ mm
Edge bevels	$1 \pm 0.5$ mm
Coefficient of thermal expansion	$\leq 1.5 \times 10^{-7} \text{ }^\circ\text{C}^{-1}$ ( $-10^\circ$ to $25^\circ\text{C}$ )
Stress condition	$\leq 15$ nm/cm

**TABLE 2.** Surface Specifications

Surface figure (RMS @ 633 nm)	$0.014 \times \lambda$ ( $0.028 \times \lambda$ wavefront)
Surface figure (P-V @ 633 nm)	$0.10 \times \lambda$ ( $0.20 \times \lambda$ wavefront)
Surface roughness	$\leq 5$ Å
Surface quality	60–20 scratch & dig
Coating	None
Clear aperture annulus	181 mm outer diameter 10 mm inner diameter

### 3. MIRROR SURFACE SPECIFICATIONS

The dimensions of the relay flat are shown in Figure 1. The CHARA Array telescope primary and secondary mirrors are confocal parabolas. They serve as beam reducers, converting the collimated input light in a 1-meter beam into a 5-inch diameter collimated beam. The mirror described in this report will be used to relay this 5-inch beam. The polished mirror surface shall be optically flat and will conform to the requirements set out in Table 2. The RMS optical specifications will be satisfied over the clear aperture of the mirrors (an annulus which excludes a small circular area around the 2-mm center through-hole). Note the cylindrical counterbore (76.30-mm diameter) on the back side of the mirror to be added by the vendor.

Optical surface testing for acceptance purposes shall be performed with interferometric testing equipment, or equipment with similar performance approved by CHARA, capable of resolving errors at least 50% smaller than the surface deviation specification given above, and capable of resolving the surface to spatial scales of 2-mm. The mirrors are to be tested with an interferometer having a minimum aperture of 6-inches. Each mirror will be delivered with: 1) a digital wavefront map (as an ASCII file on a 3.5-inch HD floppy disk), including documented orientation with respect to the optic, and 2) documentation of surface roughness tests. The tertiary will be mounted to a cylinder fitting into the counterbore in the back of the mirror (see Figure 1). At the fabricator’s discretion, the mounting fixtures can be provided for installation prior to final figuring.