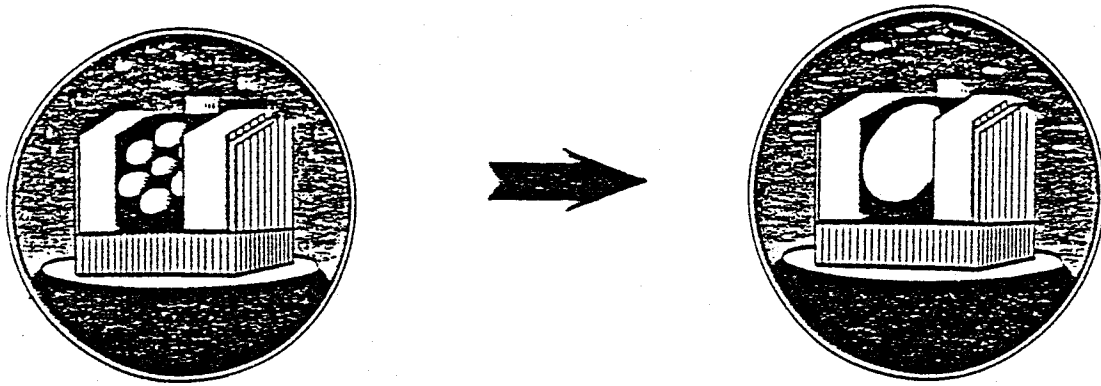


6.5 METER TELESCOPE



MMT Conversion Technical Memorandum #96-1

A Hardpoint Length Calculator for the MMT Conversion

S. C. West

March 1996

A Hardpoint Length Calculator for the MMT Conversion

S. C. West

1.0 Overview

This memo provides positioning information for the 6.5-m primary mirror hardpoint system. In addition to providing the stiffness of the support system, the hardpoints allow one to precisely position the primary mirror relative to its cell. A matrix that describes the changes in lengths of each hardpoint actuator as a function of mirror motion about the vertex is developed.

In the mechanical journals, the process of calculating the lengths of adjustable struts as a function of output plane (mirror) position in a parallel manipulator is termed the inverse kinematic solution. This is our task. For those interested, a literature summary of these mechanisms is cited [1-6], and much effort has been spent determining generalized analytic solutions for the direct kinematic problem of determining the position and orientation of the output plane given arbitrary lengths of the strut actuators (a much harder problem).

2.0 Geometry

The 6.5-m primary mirror hardpoint system can be described as two planes (the cell backplate and the mirror backplate) whose orientation with respect to each other is controlled with 6 adjustable struts (hardpoints) containing flexures near each attachment. The hardpoints are grouped into 3 pairs with a near-common connection at the cell backplate and separate connections onto the mirror backplate. Such a configuration is commonly called a 3-6 Stewart platform parallel manipulator (*i.e.*, the struts are connected at 3 locations on the fixed plane and 6 locations on the output plane). The exact geometry for the MMT 6.5-m mirror cell is shown in *Figure 1 on page 2*. The coordinates of the attachment points (as of 2-21-96) are:

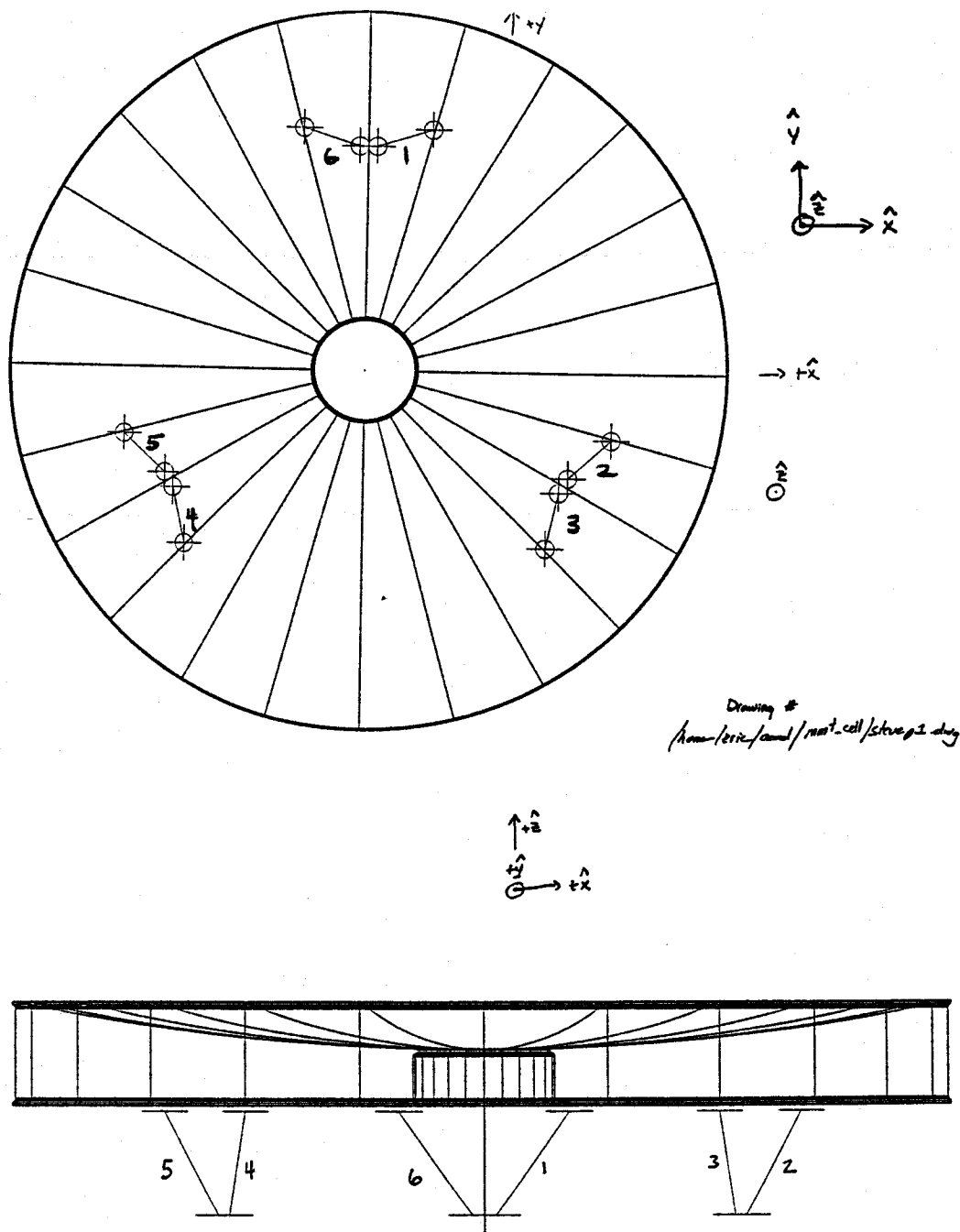


FIGURE 1. Top and side wireframe views of the MMT hardpoint attachments. The official numbering scheme is shown in both views. The upper hardpoint attachment plane (through the E6 wedge faces) is separated from the lower attachment plane by 715.12 mm. Drawings by Eric Anderson.