INTERFACE REQUIREMENTS

Spartan IR Camera for the SOAR Telescope

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30 September 2001	Original.
10 October 2001	Added feedback from S Heathcote.
13 April 2002	Changed telescope prescription.

This note addresses physical, electrical, thermal, and optical interface requirements of the Spartan IR Camera. The data interface will be in a separate note.

1 Physical

The camera mounts on the Instrument Support Box (ISB) at a bent port where the angle between the mounting surface and the gussets is greater than 45° (the top or bottom locations in Figure 1).

The bolt pattern of the mounting surface is defined by Figure 2, which is taken from the document "Specification SOAR Nasmyth Instrument Support Cages, April 12, 2001." The camera uses only the holes on a 600-mm square and the two alignment holes on a 362.0-mm radius.

Holes for the alignment pins will be drilled in the instrument at the telescope. The observatory will provide a way to transfer the positions of the holes from the ISB to the instrument.

The instrument may take a space of up to a 700-mm square (centered on the bolt pattern) on the mounting surface.

The instrument envelope is defined in Figure 2. Within the instrument envelope, access to at least three bolts to the Nasmyth bearing plate is allowed. These bolts are on a ϕ56-in circle.

1.1 Estimated mass and center of mass

The instrument mass is approximately 330 kg, and the center of mass is approximately (110 mm, 0 mm, 580 mm). The directions are these: x is in the plane of the Nasmyth bearing, y is parallel to the beam from the telescope mirror M3, and z is perpendicular to instrument mounting surface. The center of the coordinate system is the beam center on the instrument mounting surface.

1.2 Handling fixture

The instrument will be moved with an overhead crane. Lifting lugs (on the top in Figure 2) enable the instrument to be lowered onto the ISB.

2 Electrical

AC power, 110V 50–60Hz, of the amount 250W is needed.

3 Thermal

Less than 20W of heat and about 16W of cold will be vented to the air.

The computer and the motor controller will be mounted in a cooled box on the Instrument Support Cage (ISC). The cooled box is supplied by the SOAR project. The length of cables from the center of the instrument to the cooled box will be at least 5 m. The computer and motor controller occupy about 18 inches of height on a 19-in rack. The heating is about 250W.

4 Optical

The telescope prescription has two mirrors with power. The primary mirror has a radius of curvature of –13502.80 mm and a conic constant of –1.003141. The secondary mirror has a radius of curvature of –2032.71 mm and a conic constant of –1.5203. It is 5835.8021 mm from the primary.[1] The diameter of the mirror is greater than 4250 mm and less than 4300 mm. The focal length of the telescope is 68.1 m, and the focal ratio of the beam at the Nasmyth port is between f/16.03 and f/15.84.

[1] Mac MacFarlane, 4/11/02, Memo OS-02-007, "Changes to SOAR Prescription," B F Goodrich.

The focal surface of the instrument is 150±3 mm from the mounting surface of the ISB. A goal is to reduce the tolerance to ±1 mm. During operation, the telescope and tip-tilt guider can accommodate this shift in the location of focus.

The diameter of the field is 8 arcmin.

To preserve the diffraction spike in the H and K bands, the surface errors of the dichroic mirror in the ISB must meet this requirement: The RMS error over the size of the beam of a point source is less than $\lambda/24$ at 633nm.

The Seidel aberration coefficients of the telescope are 0.00000 mm of spherical aberration, 0.00002 mm of coma, 0.00065 mm of astigmatism, 0.00522 mm of field curvature, and –0.00008 mm of distortion for a marginal ray and where applicable for the edge of an ϕ8-arcmin field. The primary aberration is curvature: the focal surface is concave toward the primary mirror with a 962-mm radius of curvature, and the focus at the edge of the field is 3.27 mm ($(4\,astig + 2\,curv)\,f^2$) closer to the primary than that of the center. Astigmatism translates to a difference between the sagittal and tangential focus of 0.65 mm ($2\,astig\,f^2$) at the edge of the field.

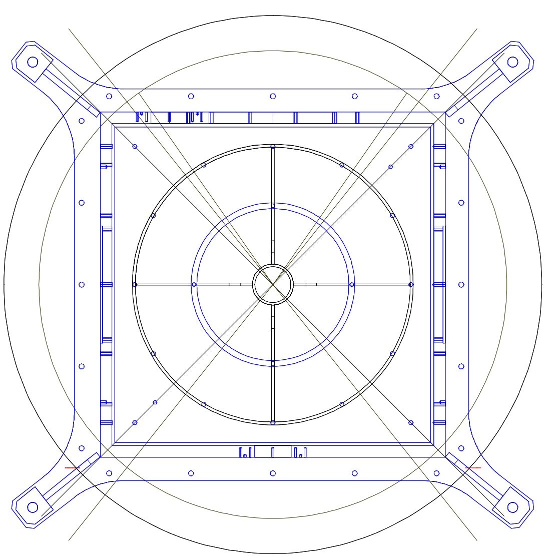

Figure 1 Instrument support box (from the file "17554 ISC Cage.dwg," dated 6/1/01 from Vertex RSI of Richardson TX). The light beam, heading toward the reader, is steered up, down, left or right to a "bent" port. The camera must mount at either the top or bottom ports, where the gussets allow a wider space.

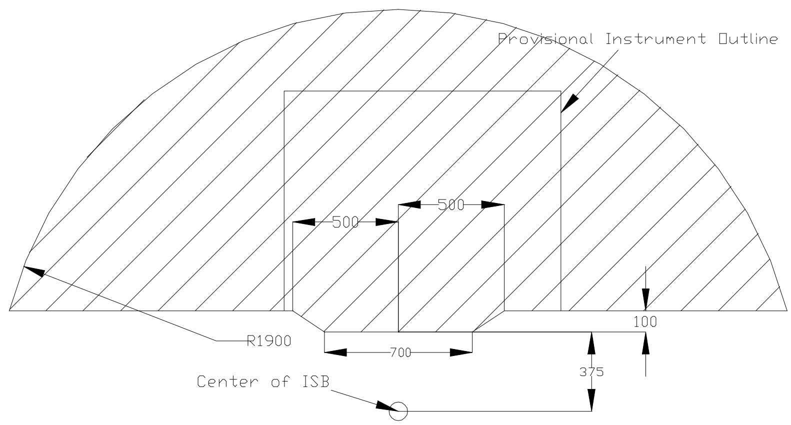

Figure 2 Instrument envelope (hatched) and the provisional instrument outline. The rotation axis of the Nasmyth bearing is perpendicular to the paper. In the direction perpendicular to the drawing, the instrument envelope is 740mm thick and centered on the center of the bolt pattern; it is 700mm thick at the mounting plate.

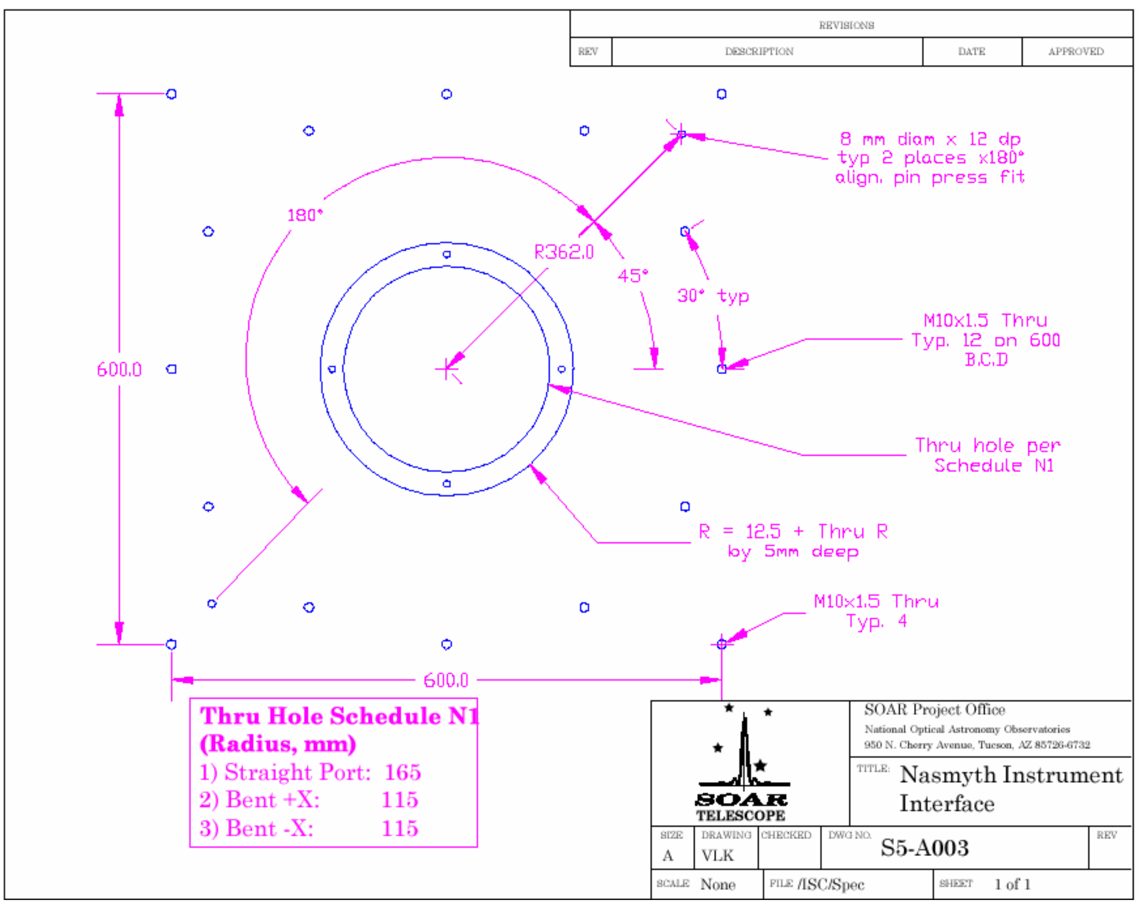

Figure 3 Nasmyth instrument interface, which is taken from the document "Specification SOAR Nasmyth Instrument Support Cages, April 12, 2001." (The through hole schedule N1 has been modified to be 135 mm for the bent ports.)