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AST/RO Logistical Requirements

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The Antarctic Submillimeter Telescope and Remote Observatory project (AST/RO) is a 1.7 meter diameter submillimeter-wave telescope, scheduled for permanent installation at the South Pole in 1993. This memorandum describes the logistical requirements for that installation, while making the requirements as non-specific as possible, consistent with successful installation and operation of the telescope.

The telescope site should be fairly close to the center of the South Pole base to allow easy winter access. The telescope should be located so that the sky is unobstructed above 20 degrees from the horizon. The telescope should be as far as possible from radar and radio transmitters, consistent with its being accessible in winter.

The telescope is designed to be mounted on the roof of a laboratory. Only one existing structure at the South Pole is a possible site— the top of "Skylab" tower—but it has been shown to be insufficiently stable (Stark and Gress 1989). A new building must therefore be built. The roof must be capable of supporting the approximate 3000 lb weight of the telescope and variable 100 lb wind loads with less than 3 seconds of arc flexure. This means, essentially, that the support structure must have a steel frame anchored in the ice. The telescope is designed to be welded onto steel beams which box in a 48 inch by 52 inch open hatch in the laboratory roof. The steel beams boxing in this square should be 12 to 15 inch deep standard structural steel members (e.g. C15 x 33.9 for a 14 foot span), with the depth depending on the length spanned by the beam, in order to have less than 0.0003 inch flexure under variable 100 lb loads. The roof of the laboratory should be larger than an 8 foot radius circle from the central mounting point of the telescope, to permit working space around the telescope, especially when the Nasmythe focus is used. There should be a safety railing around the edge of the roof, and a ladder for access.

The roof of the building supporting AST/RO must be above the snow, but the building itself could be partially buried, or could be built on the surface and allowed to become partially buried with time. The operational lifetime of the telescope could be ten years or more, and this should be taken into account in the design.

It will be necessary to cover the antenna during snowstorms, to prevent snow accumulation. This will be done with a roll-away shed, approximately $9' \times 9' \times 9'$. When in a retracted position, this shed should not obstruct the sky above 20 degrees elevation angle. This shed could be a very light, tent-like structure or a wooden garage on rollers.

The laboratory space underneath the antenna holds the optics for the receiver. An adjacent laboratory area will hold two racks of electronics, including the AOS spectrometer, space for the computer terminal and printer, laboratory benchspace, storage for tools, and room for the receiver; all this will fit in a modest-sized room, approximately 150 square feet. The compressors for the refrigerators are about 100 cubic feet, but are very noisy and should be in separate soundproofed room or closet that has ducts and a blower to carry away the heat. We would like to be able to operate the telescope and receiver building at positive pressure, and use some of the waste heat from the compressors to warm the inside of the telescope. The compressor closet can be close to the receiver room and telescope. These facilities should be in place by February 1993, in preparation for the delivery of the telescope itself in November 1993. A Jamesway tent in place adjacent to the site in 1993 would fascilitate the handling of cargo during the installation of the telescope.

We estimate that 23 KW of electrical power will be needed, most of which is for the two cryogenic refrigerators (see Table 1). These refrigerators are designed for 220 V three-phase operation at 20 A per phase.

References

Stark, A. A., and Gress, J. 1989 in *Astrophysics in Antarctica* ed. D. Mullan, M. A. Pomerantz, and T. Stanev (American Institute of Physics: New York) p.p. 67-69.

Table 1. AST/RO Operational Power Requirements

Cryogenic Refrigerators	12000 W	continuous	220 V3-phase
Air Blowers	2000 W	continuous	220 V3-phase
Drive Motors	2000 W	intermittant	110 V
Computer	400 W	continuous	110 V
AOS	400 W	continuous	110 V
Receiver Electronic	1000 W	continuous	110 V
Vacuum Pumps	4000 W	intermittant	220 V3-phase
Room Lighting	600 W		
Total	22400 W	maximum	