

NATIONAL RADIO ASTRONOMY OBSERVATORY
Charlottesville, Virginia
VERY LARGE ARRAY PROJECT

VLA ELECTRONICS DIVISION MEMO #123

DESIGN SPECIFICATIONS FOR FEED AND RACK SUPPORT STRUCTURE FOR VLA ANTENNA

Peter J. Napier

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1.0 FEED LOCATION

Each feed for the VLA antennas has a mounting flange at or near its aperture with an interface surface on the lower side of the flange. The nominal phase center of all feeds is located at the point where the feed axis intersects this mounting interface surface. The nominal phase center of all feeds must lie on a circle (the Feed Circle) with radius 38.4 in. around the main reflector axis at a height of 66.0" above the main reflector vertex, as shown in Figure 1. The axis of each feed is inclined at an angle of 8.23° to the axis of the main reflector. The axis of the feed must be in the plane containing the axis of the main reflector. The axis of each feed passes through the vertex plane on a circle with radius 47.95" around the main reflector axis.

The locations of the feed mounting flanges around the 38.4" radius circle are shown in Figure 2. Note that, to allow correct alignment of the dual frequency dichroic reflector system, the adjacent sides of the C and Ku Band flanges must be parallel and perpendicular to the line AC.

2.0 FEED SUPPORT

The feeds should be supported by tower structures that sit on the octagonal plate which forms the ceiling to the vertex room. The support for this octagonal plate has already been designed by Ray Werner in his memo of February 22, 1974. A single tower structure should support the C, K and Ku band feeds; transition sections at the

top of this tower will support each feed at its correct angle. A separate tower will support the L Band feed. Figure 3 shows the clear areas which must be left in the plate structure in the vertex plane to allow the feed outputs to protrude down into the vertex room. Note that clear areas should be provided for a future feed and on the axis; these areas will have a weather-proof cap over them when not in use.

The feed support plate and the feed support towers should be weather-proof. Weather seals will be needed at the interface between the towers and the plate and at the interface between the towers and the feeds. Ray Werner has designed the weather seal between the plate and the vertex room in his memo of February 22, 1974.

Figure 4 shows the C- K- Ku- Support Tower. Four tapped holes must be provided on the vertex plate beside the C- K- Ku Support Tower as shown as mounting points for the feed-window blower-deicer. On the downside wall of the C- K- Ku-support tower, two $1.285 \pm .03$ diameter holes must be provided as shown to provide feed-throughs for the cables for the dichroic reflector mount mechanisms. A similar hole must be provided on the up-side wall of the support tower at the bottom of near the blower-deicer mounting pad for the blower-deicer cable - the exact location of this hole is not important.

The feed support towers should locate the feeds within the tolerances listed below:

Feed Location Tolerance: The center of the mounting interface of the K Band feed should be located on the feed circle with a repeatable error (setting error, gravity deformation) of less than 0.4 inches and a non-repeatable error (vibration, wind loading) of less than 0.07 inches. These tolerances insure repeatable and non-repeatable pointing errors of less than $1/4$ and $1/20$ beamwidth respectively. The tolerances for the other frequencies are proportionately greater, except that the 32.457" separation between the Ku and C Band feeds must be maintained to within 0.5".

Feed Tilt Tolerance: The feed axis should not deviate from an angle of 8.23° to the main reflector axis by more than 40 arc min. at any time. The feed support interface should allow local adjustment of $\pm 1/2^\circ$ for feed alignment.

Feed Output Lateral Movement: The feed output, assumed to be 70 inches below the mounting flange, must not move more than 0.1" as the telescope tilts from zenith to horizon. This tolerance should be held for all frequencies.

3.0 EQUIPMENT DIMENSIONS

L-Band Feed

The maximum allowable dimensions for the L Band feed are defined in VLA Feed Specification A13660N1. The L Band Support Tower should be designed assuming these maximum dimensions and for the flange interface defined in VLA Drawing G13660P. The weight of the feed should be taken as 1500 lb. with the center of gravity located 40" below the mounting flange.

C-Band Feed

The overall dimensions for the C-Band Feed are shown in VLA Drawing D13670P1 and the mounting flange interface is defined in VLA Drawing C13670M5. The weight of the feed plus the ellipsoidal reflector and its support mechanism mounted on the feed should be taken as 140 lbs. with the center of gravity located 20" below the mounting flange.

Ku-Band Feed

The overall dimensions for the Ku Band Feed are shown in VLA Drawing G13690P1 and the mounting flange interface is defined in VLA Drawing C13680M2. The weight of the feed plus the dichroic plate and its support mechanism mounted on the feed should be taken as 100 lbs. with a center of gravity 12" below the mounting flange.

K-Band Feed

The overall dimensions of the K-Band Feed are shown in VLA Drawing G13690P1 and the mounting flange interface is defined in VLA Drawing D13690M7. The weight of the feed should be taken as 50 lbs. with a center of gravity 30" below the mounting flange.

Future Feed

The weight of the possible future feed should be taken as 500 lbs. with a center of gravity 30" above the main reflector vertex.

Deicing Equipment

The feed blower-deicer equipment should be taken as a load of 100 lbs. on the vertex plate in the position shown in Figure 4 and an additional load of 50 lbs. with a center of gravity at the location at the mounting flanges of the C- K- Ku feeds.

4.0 RACK MOUNTING

As well as supporting the feeds above the main reflector vertex, the vertex plate must support four racks which will hang beneath it in the vertex room. The rack locations and dimensions are shown in Figure 5. Note that the location of Rack B has changed from the position given it in S. Weinreb's memo of 11 December 1973. This will require a change in the location of the secondary floor support holes defined in that memo; E-Systems must be notified of this. Six inch by six inch mounting pads for the racks must be provided on the underside of the vertex plate in the locations shown in Figure 5. The exact size and location of the bolt holes on these pads is not yet defined. Weights of the racks are as follows:

Rack A - IO/IF Rack: Weight 400 lbs. with a center of gravity 56" below the rack support pads.

Rack B - Front-End Rack: Weight 700 lbs. with a center of gravity 46" below the rack support pads.

Racks C and D - Future Racks: Weight 600 lbs each with centers of gravity 56" below the rack support pads.

Assuming that the racks are perfectly rigid structures and that the secondary support points on the floor are completely soft (they provide no support at all) the rack mounting pads should be designed with sufficient strength to meet the following tolerances as the telescope tilts from zenith to horizon:

Rack Lateral Movement: The top of the rack (assumed to be 16" below the rack mounting pads) must not move more than 0.05". The bottom of the rack (91.44" below the rack mounting pads) must not move more than 0.05".

Rack Axis Alignment: The rack axis must remain parallel to the axis of the main reflector to within 1 degree.

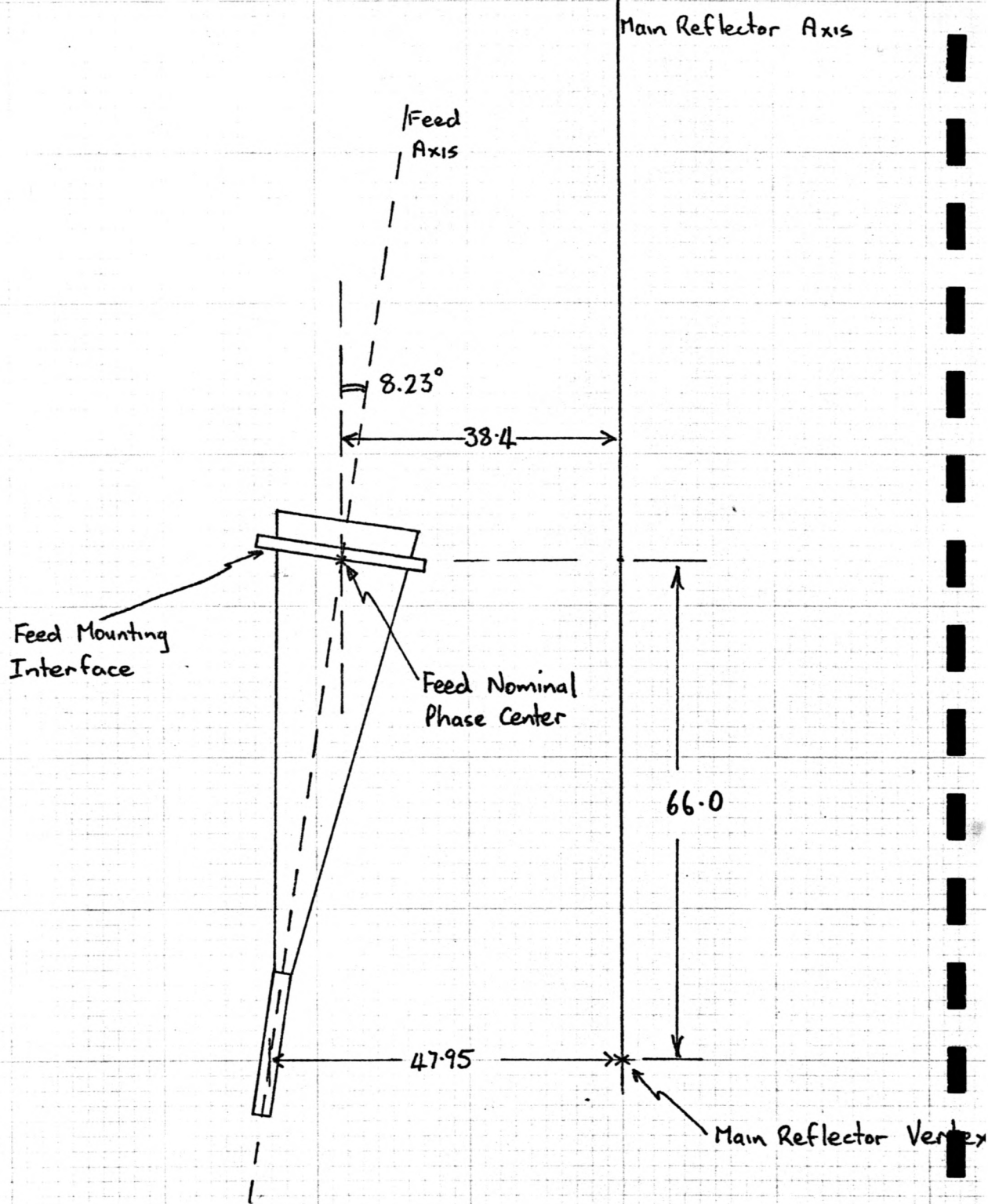


Figure 1. Feed Phase Center Location.

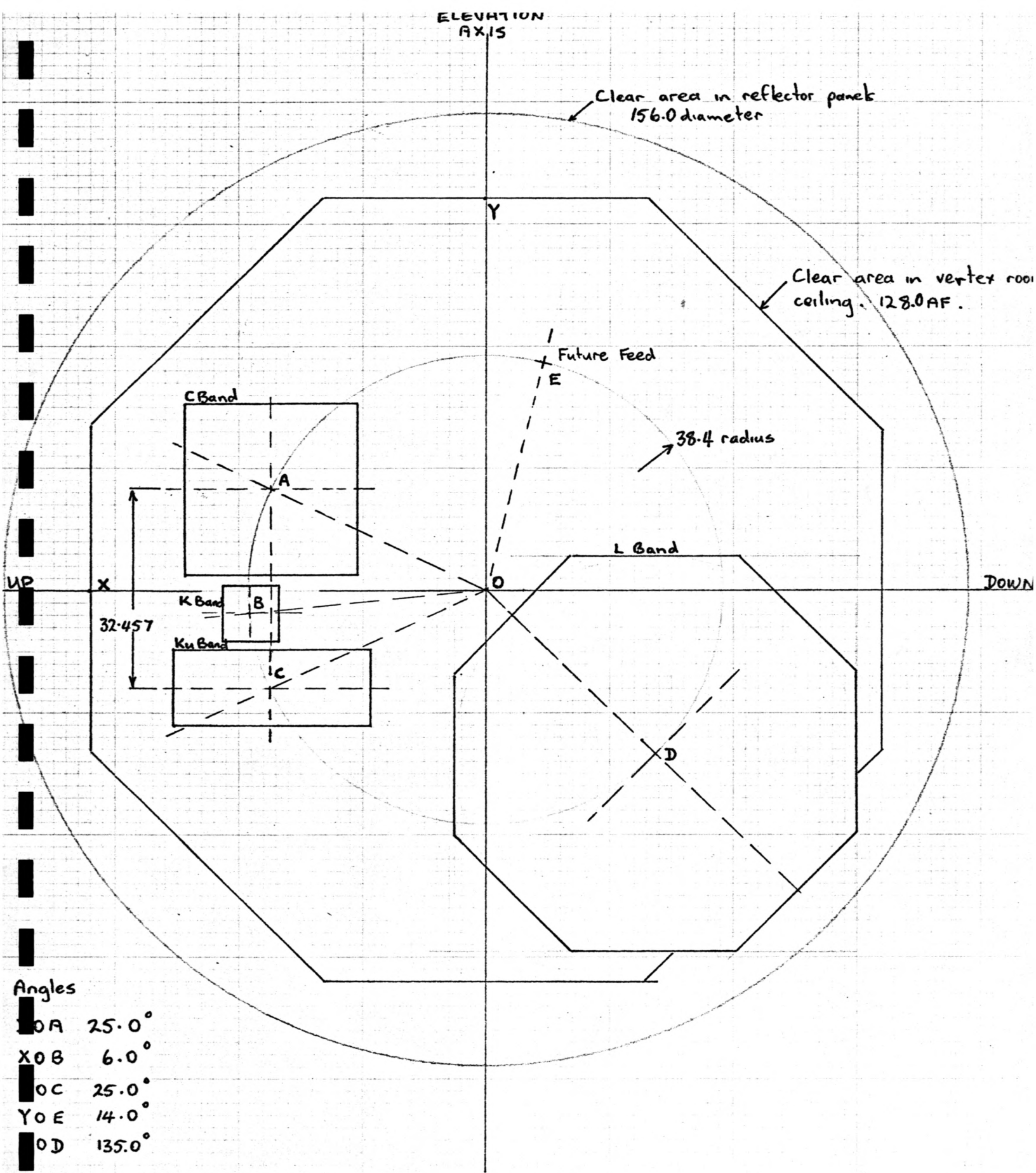


Figure 2. Layout of feed mounting flanges around feed circle.

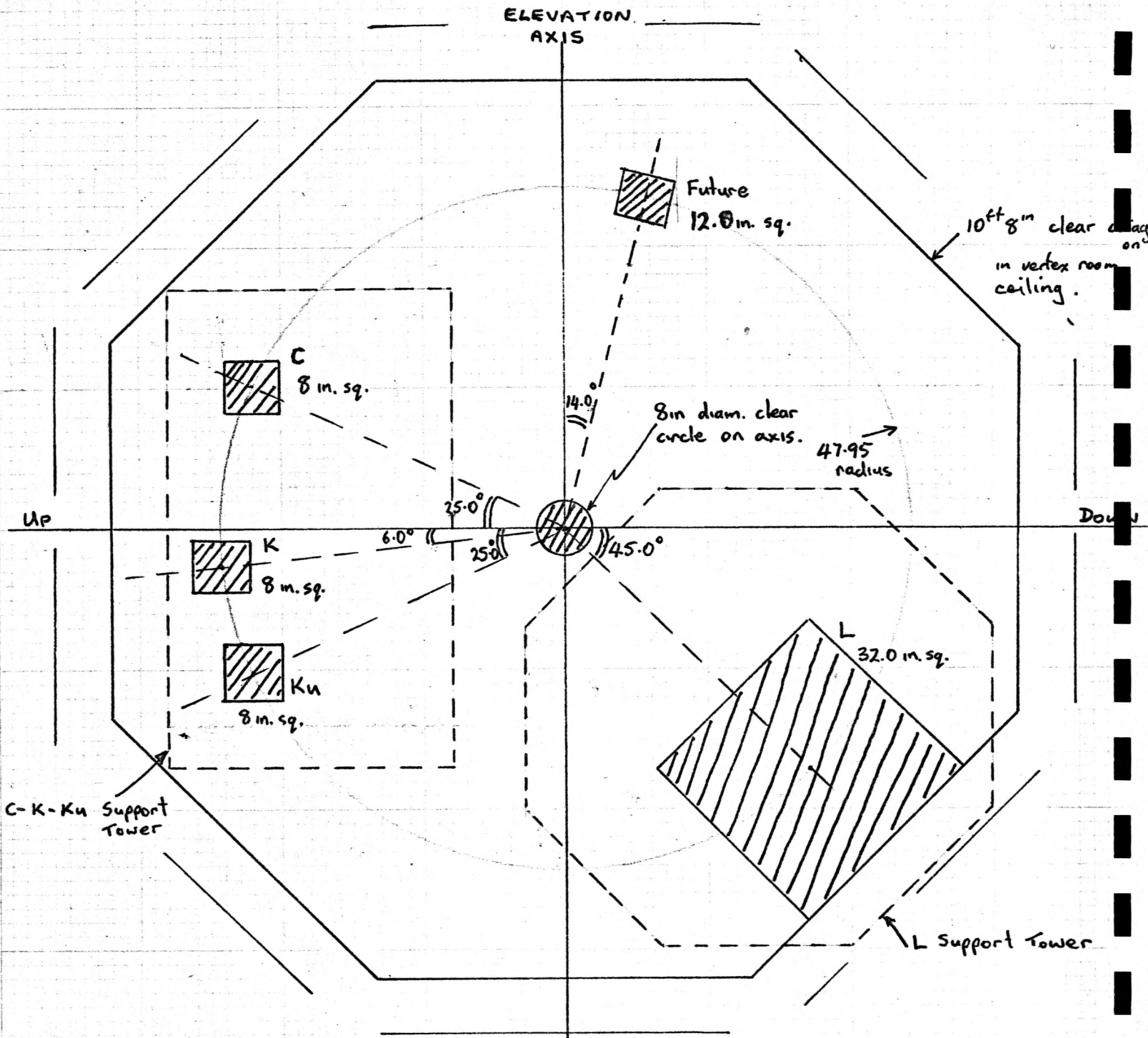


Figure 3. Clear areas needed in feed support plate.

Clear areas marked

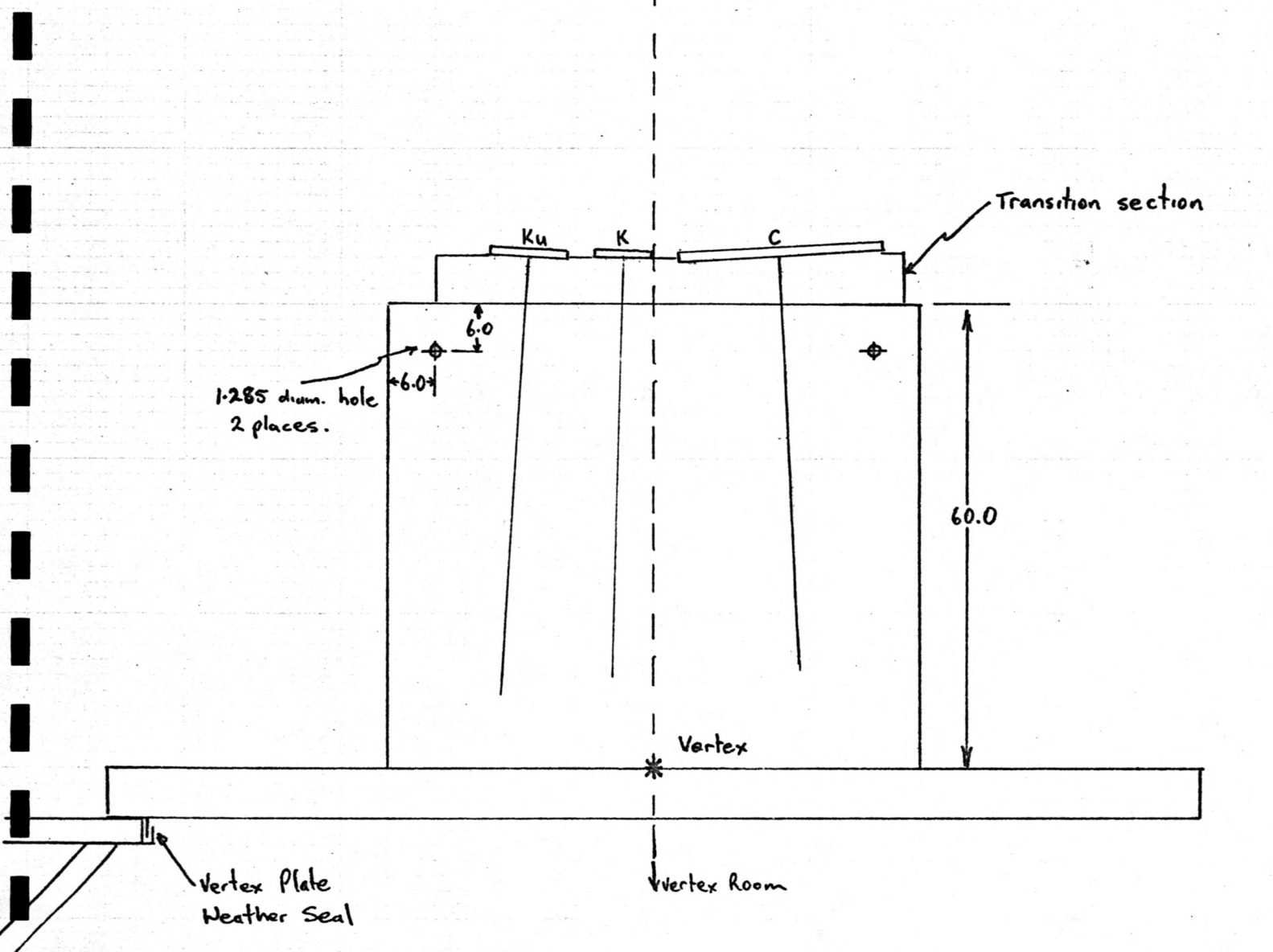
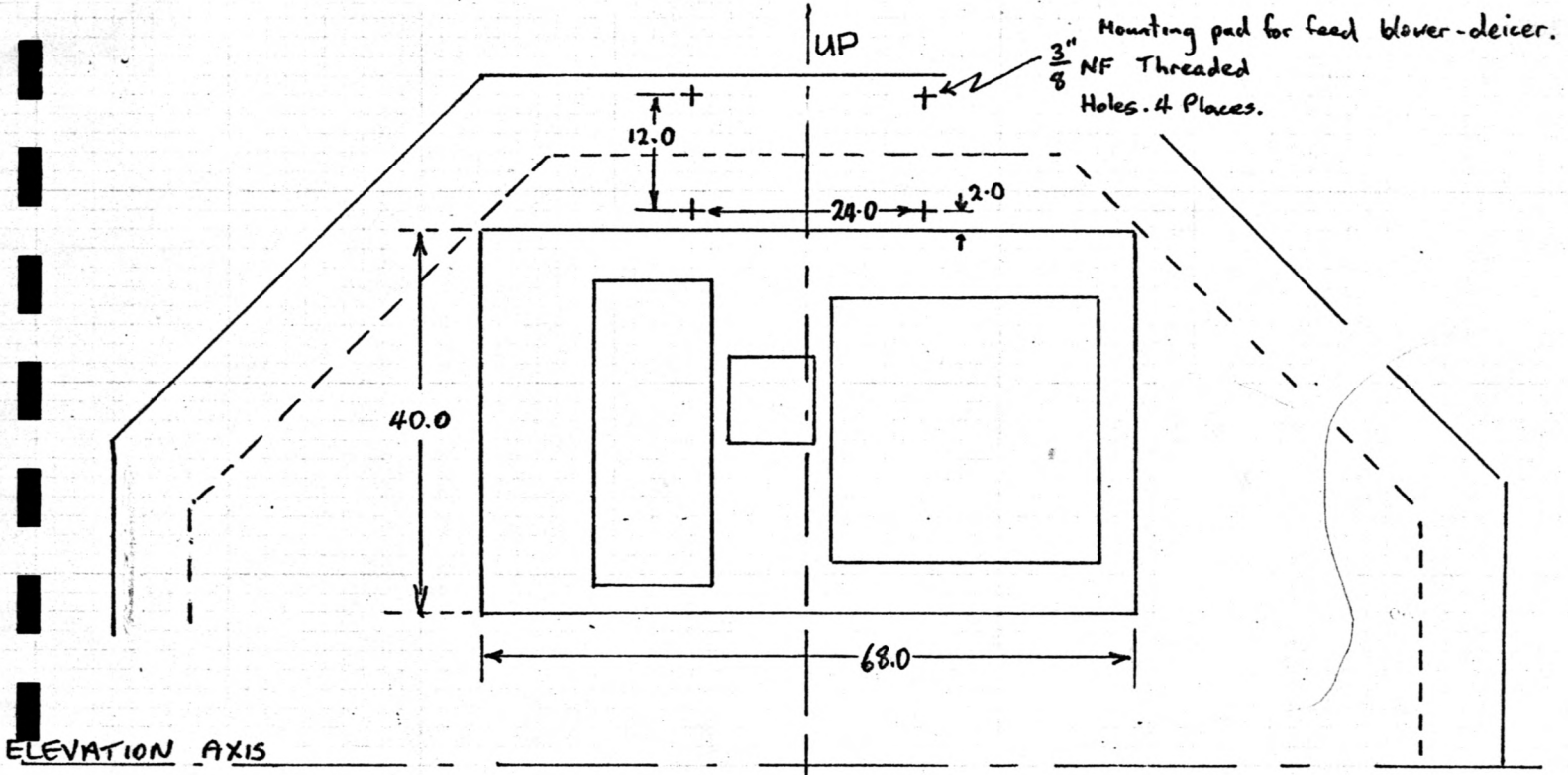


Figure 4 C-K-Ku Support Tower

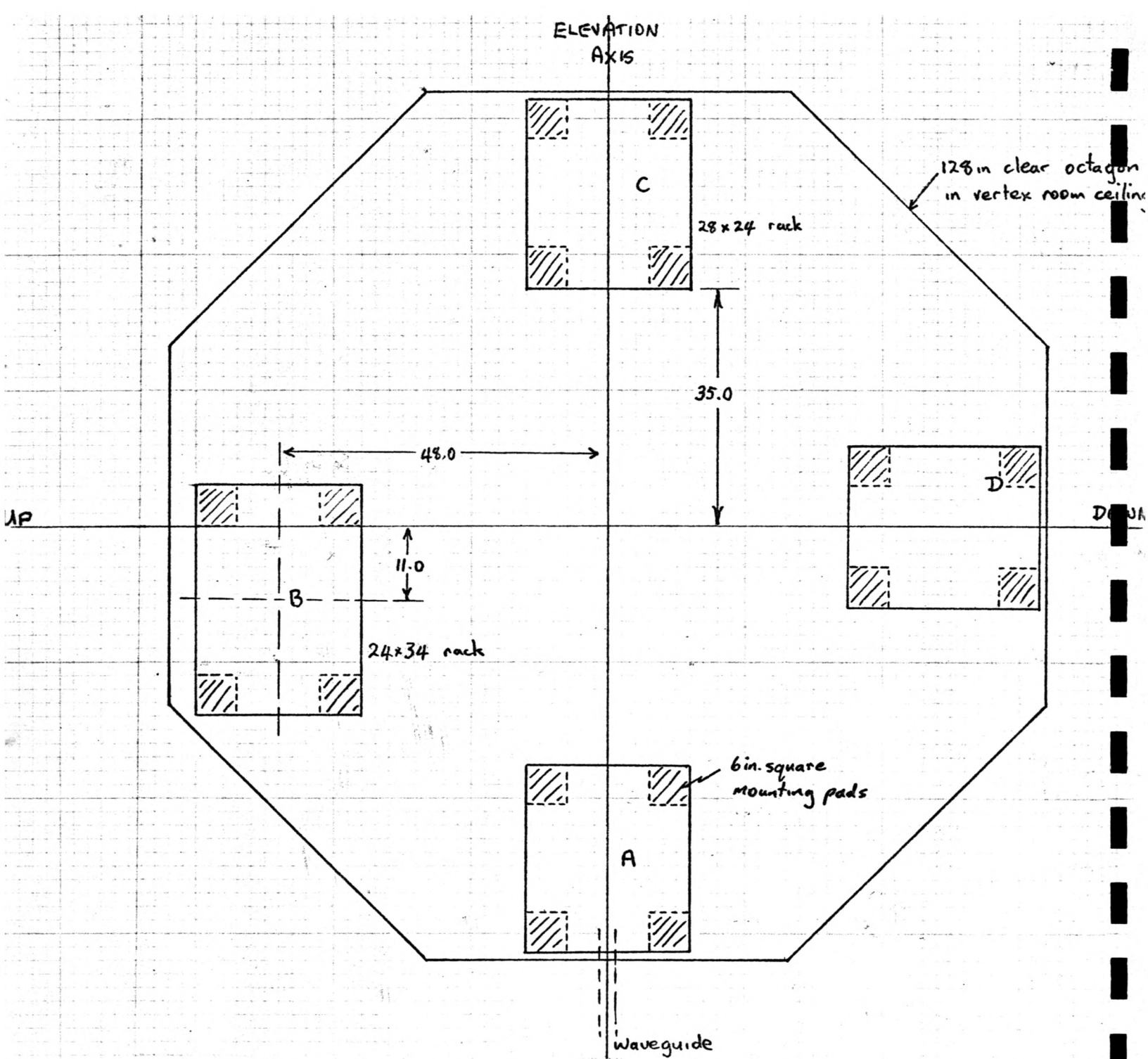


Figure 5. Rack Location on Vertex Plate (viewed from above vertex)
Rack Mounting Pads show *c*