

The Minimum Separation Problem for an Offset Slant Axis Antenna

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May 19, 1994

In the most compact array configuration the mmA antennas are required to be placed as close together as possible. Lamb studied this problem in detail^[1]. However, his study concerns with only antennas with a conventional Cassegrain mounting. The finding in his memo is that a closest spacing of 1.25 D may be achieved, where D is the aperture of the antenna. For an offset slant axis design, the antenna structure is different. The problem therefore needs studying again.

The most conservative way to determine the minimum separation is to place antennas so that they would not touch each other under any circumstances. This minimum spacing between antennas corresponds to the dimension of the maximum antenna sweeping volume. For a Cassegrain antenna, the sweeping volume is determined by the distance between the elevation axis and the edge of the dish or the top of the secondary mirror assembly. In Fig. 1a, a typical value for the distance of an 8 m antenna is about 5.3 m, that is about 0.66 D. The sweeping volume is then 10.6 m or 1.33 D. In Fig. 1b, the sweeping volume of an offset slant axis antenna is determined by the distance between its azimuth axis and the outmost edge of the secondary mirror supporting structure. The distance is 5.45 m. The sweeping volume is then 10.9 m, which is 1.36 D. This figure is slightly larger than that for a Cassegrain mounting design. To reduce the sweeping volume of an offset slant axis antenna, it is necessary to move the secondary supporting trusses closer to the secondary mirror or to move the azimuth axis closer to its secondary mirror structure. These modifications may not be possible without reducing the stiffness or increasing the weight of the structure.

However, when the array antennas are installed on site, the antenna's outmost edges can be protected reliably by electronic or mechanical sensor system to avoid any possible damage or antenna interference (note, software protection is also reliable in avoiding collision or interference. Many telescopes have developed programs for avoiding the dish from pointing directly to the sun). In this way, both Cassegrain antennas or offset antennas can be placed more closely than the above mentioned distances. The distance between two nearby antennas for both Cassegrain or offset mountings can be as small as 9.6 m, which is 1.2 D as shown in Fig. 1. In fact, antennas with such spacing distance only interfere in a very rare case.

Reference

- [1] J. Lamb, Minimum spacing constraints for MMA antennas, mmA memo #64.

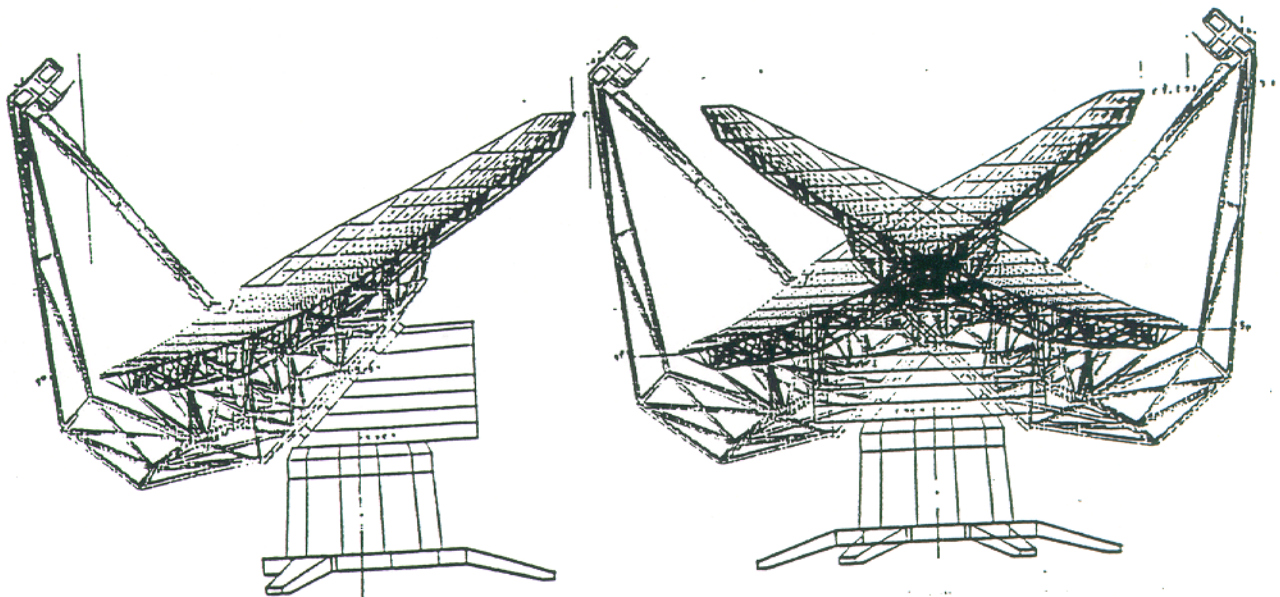
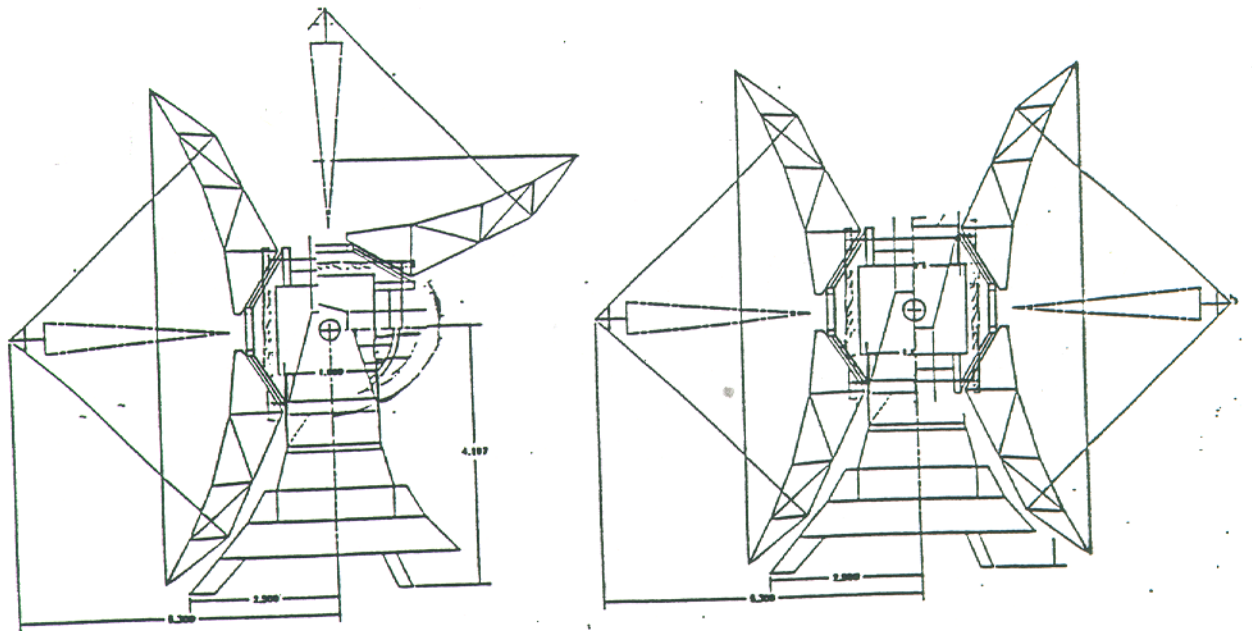


Figure 1 (a) The separation between two Cassegrain antennas;
 (b) The separation between two offset antennas.