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NATIONAL RADIO ASTRONOMY OBSERVATORY
Charlottesville, Virginia

February 6, 1967

Dr. Randall M. Robertson
Associate Director for Research
National Science Foundation
Washington, D.C.

Subject: Site Selection for the VLA

Dear Dr. Robertson:

The VLA Design Group has selected the Plains of San Augustin, approximately 50 miles west of Socorro, New Mexico, as the best site for the proposed Very Large Array, and we propose that site-acquisition activities be instituted at the earliest possible date. This site is designated Y-15 in NRAO reports and proposals.

This decision has been made after approximately two and one-half years of study by the NRAO and their contractors, during which 29 sites were given consideration. These sites are described in VLA report No. 3, "Possible Sites for the VLA", by C.M. Wade, May, 1966. This report also describes the criteria for site evaluation, and these are discussed again in Chapter 8 of the VLA Proposal.

After a preliminary reconnaissance period, during which the list of sites was reduced to three, Limbaugh Engineers, Inc. of Albuquerque, New Mexico, were retained to make detailed engineering, economic, and cultural studies of these three. A preliminary report by Limbaugh, dated 1 August 1966, served as the basis for eliminating one site, Y-27 near Marfa, Texas. This site has a history of catastrophic weather

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phenomena, has a very complicated land-ownership pattern, and is extremely remote from cultural amenities. The remaining two sites, Y-15 near Socorro, New Mexico and Y-23 near Sells (Kitt Peak), Arizona, were studied in detail by Limbaugh. This study included the preliminary design of the buildings, utilities, access roads, and railroad tracks for the array, so that detailed comparison of costs could be made for the two sites.

The results of the Limbaugh study are given in their report dated November, 1966, and are summarized in Chapter 12 of the VLA Proposal. The two sites are compared below on the basis of the principal site criteria:

<u>Criterion</u>	<u>Arizona Y-23</u>	<u>New Mexico Y-15</u>
Cost to develop	\$13.3 million	\$10.8 million
Nearest city	Tucson - 50 miles	Socorro - 50 miles
Land ownership	Papago Indians	U.S. Government and New Mexico Government
Altitude	2,600 feet	7,000 feet
Latitude	32° 05'	34° 04'

The New Mexico site is superior with respect to land ownership, altitude and developmental costs. The Arizona site leads with respect to latitude and access to amenities. It is impossible to evaluate quantitatively the relative importance of such factors as proximity of amenities (schools, hospitals, housing, etc.) and latitude. These criteria must be judged subjectively, in the light of past experience in the siting of radio telescopes.

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There is no question that Tucson offers far more attractive facilities than does Socorro. The presence of the University of Arizona and the Kitt Peak National Observatory has been cited as a strong argument in favor of the Arizona site. Presumably it would be easier to attract competent scientists to employment at the VLA if it were associated with the astronomical complex of Tucson. In fact, however, it is not visualized that many, if any, astronomers will be in residence at the site. The requirement is rather for a small number of highly-skilled electronic engineers and a larger number of electronic technicians. These people, while they will insist upon comfortable housing and adequate schools, will not consider proximity to other astronomers a prime advantage. It is believed that Socorro, with its small technical college, offers adequate facilities for the staff envisioned for the VLA. The 50-mile road between Socorro and site Y-15 is an excellent, high-speed highway maintained to Federal standards. The highway distance from Y-15 to Albuquerque is about 125 miles, a 2-1/2 hour drive. The airline distance is 90 miles, and the flying time by light plane is 35 minutes. The weather is usually excellent for flying by visual flight rules.

The fact that the New Mexico site is at a much higher altitude than the Arizona site is the most important single consideration in the comparison. It has been shown in VLA report No. 4, by Baars and Lites (1966) and in the VLA Proposal (pages 5-7 to 5-10) that a high-altitude site promises better VLA performance than a lower site, other things being equal. The high-resolution performance of the VLA is expected ultimately to depend upon the stability of the atmosphere, which, in turn, depends upon the water vapor content. It is shown in the VLA

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Proposal (Chapter 5) that high altitude sites have much lower total atmospheric water vapor content than low-altitude sites. This fact may also compensate for the higher geographic latitude of the New Mexico site: the higher altitude is likely to permit operation at larger zenith angles than would be possible at the Arizona site. In any event, it will be possible to observe the galactic center from either site, which is the principal reason for preferring a low latitude.

We believe that the land acquisition problem would be easier for the New Mexico site. This is not a deciding factor in itself, however. Radio-frequency interference from local sources would also probably be less troublesome at the New Mexico site, though we believe that either site would be acceptable from this point of view.

Thus, the decision must be made by deciding which is more important, the accessibility of the Tucson metropolitan area to the Arizona site, or the higher altitude and lower developmental costs of the New Mexico site. We have decided in favor of the higher altitude, recognizing this as the one factor at issue which bears directly on the ultimate performance of the instrument. All other features of the New Mexico site are either favorable or acceptable.

The exact location and complete description of the San Augustin site is given in VLA report No. 3, by Wade, and in the Limbaugh report dated November, 1966. All reports cited in this letter are in your files.

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When and if a decision is made to acquire this site, it will presumably be appropriate for VLA Project personnel to consult with the Corps of Engineers or with such other government agency as might be charged with the responsibility for the acquisition. We await your decision in this regard.

Sincerely yours,

David S. Heeschen
Director

G. W. Swenson, Jr.
Chairman, VLA Design Group