NATIONAL RADIO ASTRONOMY OBSERVATORY

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May 15, 1985

Dr. Ludwig Oster
Division of Astronomical Sciences
National Science Foundation
1800 G Street, N.W.
Washington, D.C. 20550

re: VLBA Environmental Impact

Dear Dr. Oster:

Enclosed for your use is a Report on the Anticipated Environmental Impact of the Very Long Baseline Array Radio Telescope.

Ludwig, as you will see, this is a generic statement which I have written in a general tone to cover the entire VLBA program and all sites including the Array Operations Center. This was necessary, since we do not have site-specific information for many of the sites yet. It is my intent to supply you with a statement for each particular station site as the exact locations and additional information become available (I am working on the Pie Town site now). These forthcoming site-specific statements will be in the form of appendices to this general statement, if that is acceptable to you.

Please accept my apology for having delayed this long in sending this statement to you. I was holding it in the hope of finishing the Pie Town section so they could be sent together. I have been unable to achieve that; however, Pie Town will follow soon.

Best regards,

Bill

William H. Porter
VLBA Business Manager

cc: Director's Office
J. Marymor
B. Peery
C. Wade

Pie Town
Los Alamos

A REPORT ON THE ANTICIPATED ENVIRONMENTAL IMPACT OF THE VERY LONG BASELINE ARRAY RADIO TELESCOPE

1.0 PROJECT DESCRIPTION

1.1 General Project Description

The Very Long Baseline Array (VLBA) is a radio telescope which will be built by Associated Universities, Inc., a non-profit educational and research corporation that operates the National Radio Astronomy Observatory under contract with the National Science Foundation. The VLBA will consist of ten (10) individual antenna elements and an Array Operations Center (AOC) at fixed sites throughout the United States and Puerto Rico. The eleven sites chosen for location of the antennas and AOC are in the following general geographic areas:

- Pie Town, New Mexico
- Kitt Peak, Arizona
- Los Alamos, New Mexico
- Fort Davis, Texas
- Oroville, Washington
- Puerto Rico
- North Liberty, Iowa
- Owens Valley, California
- Mauna Kea, Hawaii
- Westford, Massachusetts

- Socorro, New Mexico (AOC)

The Array will operate as a single instrument, with each antenna directly controlled from the AOC via dedicated telephone lines. Signals received from space will be recorded on magnetic tape at each individual site. The tapes will be shipped to the central data processing facility in the AOC to be simultaneously replayed and correlated with each other to form images of celestial radio sources.

The Array will be operated under a preplanned program under the control of a central computer, which will simultaneously monitor the performance of the antennas and receivers as well as the meteorological conditions at each site. An Array Control Operator will be present at all times at the AOC to intervene when necessary and to carry out various household tasks.

Normally each antenna element will run entirely under control from the AOC. A few technician/operators will be available at each site, however, for inspection, routine maintenance, and the simpler unscheduled repairs of malfunctioning equipment. The local staff will also be responsible for updating operating systems at the local control computer, for changing and

shipping the data tapes to the AOC, for security and precautionary oversight, for emergency intervention and routine startup and shutdown procedures.

1.2 Typical Antenna Station Description

Each antenna station will cover approximately one and a half acres of land and will include an antenna, a site control building with loading dock, a small building to house a standby diesel power generator and other equipment, a parking area, utilities and sanitary facilities, and an access road. The station site will be enclosed with a security fence.

1.2.1 Antenna. The antenna will be a wheel and track, elevation over azimuth configuration with a 25-meter (82 foot) diameter solid surface reflector. When the antenna is aimed at the horizon, the top edge of the antenna dish will be at its maximum height of approximately 100 feet above the ground. The antenna foundation will be a 50 foot diameter cast-in-place concrete ring. Four concrete "spokes" spaced at 90 degrees will connect the outer foundation ring to a pintle bearing support foundation at the center, or hub.

1.2.2 Site Control Building. The site control building will be a single story masonry building on grade approximately 50 ft by 25 ft with security-type windows and doors, a small loading dock, and an access ramp. The building will house equipment and facilities for controlling and monitoring the antenna operation, other electronic equipment, radiometers, a recording system, magnetic tape storage space, a hydrogen maser clock system, mechanical equipment (building environmental system and electrical power system), sanitary facilities, spare parts and components storage area, and a space for repairing facilities. Only minor repairs and preventative maintenance will be performed at the site.

1.2.3 Utilities. The site will require water, sewer, telephone and electric service. All utilities will be buried. If commercial water and sewer service are available and cost efficient, they will be used. Otherwise, a well and septic system (or alternative waste disposal system) will be installed on the site. At the high mountain sites, potable water may be trucked in and stored on-site. Telephone and electric services will be commercially provided. It is estimated that three telephone lines of digital transmission grade will be required at each site. The estimated electric power demand is 100 to 125 kVA for a typical site. A standby diesel power generator estimated at 75 kVA will provide emergency power during commercial outages.

1.2.4 Equipment Storage. Each site will have an equipment storage building approximately 10 ft by 20 ft to house the standby power generator and required maintenance equipment.

1.2.5 Access Road and Parking. Each site will have a 20 ft wide access road to the nearest maintained highway, and parking within the security fence for 4 to 5 vehicles. The road and parking area will be thoroughly compacted gravel with a light asphaltic sealer applied. The access road will be laid at or near grade as much as possible to minimize land disturbance, cut and fill and drainage problems.

1.3 Array Operations Center Description

The AOC will be a two-story building approximately 200 ft by 50 ft built on the campus of the New Mexico Institute of Mining and Technology (New Mexico Tech) in Socorro, New Mexico. The AOC will have offices, laboratories, work areas, computer space, control rooms and shops to provide housing and facilities for the operation, monitoring and maintenance of the ten remote antennas which make up the VLBA. The AOC also will be the central point of shipping and receiving of parts and data tapes, as well as the central data reduction facility for the array.

2.0 ANTICIPATED ENVIRONMENTAL IMPACT

The following paragraphs address the anticipated environmental impacts of the VLBA. Each subheading contains remarks directed toward the impact of the antenna stations and, where appropriate, the AOC.

It is anticipated that the Very Long Baseline Array radio telescope, consisting of ten antenna stations and the Array Operations Center, will have NO SIGNIFICANT ADVERSE ENVIRONMENTAL IMPACT considered either as eleven separate and distinct units or as a collective whole.

2.1 Archeological. Prior to any disturbance of a site, an archeological survey will be performed by an archeologist certified in the state where the proposed site is located. No known archeological sites are anticipated for use as VLBA antenna sites; however, in the event the archeological survey produces evidence of archeological interest, development of the site will be altered in accordance with a plan agreed to at the time with the landowner and responsible regulatory agencies.

2.2 Historical. The same general comments apply to sites of historical interest as apply to sites of archeological

interest. It is highly unlikely that any VLBA site will be of historical interest.

2.3 Socioeconomic. The **antenna stations** will require a few technicians to be on site part- or full-time for various routine maintenance activities, housekeeping and security. Otherwise, the antennas are designed to be operated by computer from the AOC in Socorro, New Mexico. Therefore, it is anticipated that the stations will have no significant impact on the socioeconomic structure of the areas in which they are located.

The operation of the **AOC** will require approximately 80 full time personnel. A number of these personnel may be either new hires or transfers from other distant divisions within NRAO who will move into the Socorro area; however, some will also be NRAO transferred employees already living in the Socorro area. The relative mix of these numbers is not currently known. In any event, it can be said that the development of the AOC in Socorro will produce an influx of something fewer than 80 families into the area. This is judged to not represent a major impact on the socioeconomic structure of the Socorro area.

2.4 Land Use. The **antenna station** sites will be approximately one and a half acres in size, and are generally located in undeveloped, even desolate, areas. Where possible, the sites are placed on land already owned by the federal government, and in several cases are near existing telescope installations. Therefore, the antenna sites are not expected to significantly impact land use in the chosen areas. The development process will comply with all zoning regulations of the site areas.

The **AOC** will be constructed on land already planned for development by the owner, New Mexico Tech (i.e., State of New Mexico), and therefore will not impact land use or zoning in the area.

2.5 Land Disturbance. A desirable site characteristic is the ability to use the naturally occuring land formations for both hiding the antenna from view and shielding it from radio interference. Consequently, one aim in the site planning process is to use the natural shape of the sites rather than engage in a lot of earthmoving and cut and fill. Therefore, land disturbance of the **antenna station** sites will be minimized. The acre and a half will be cleared and grubbed, and there will be some grading to shape and prepare each site for construction. At the proper time in the construction process, the site will be regraded and landscaped.

2.6 Landscaping. The nature of VLBA operations will require a low maintenance landscaping plan for the **antenna stations.** Any plantings will be natural to the area, and will require little maintenance. Grass and weeds will be controlled with the use of black plastic and mulch where appropriate. There will also be a 35 foot wide gravelled strip encircling the

antenna base for maintenance vehicle access and fire protection for the antenna. In addition, there will be a gravel access road and parking area.

The **AOC** will be landscaped suitably for the campus of New Mexico Tech.

2.7 Wildlife. Construction of the VLBA **antenna stations** and **AOC** is not expected to have any significant adverse impact on either plant or animal wildlife in the areas. The sites are so small (approximately 1.5 acres) and will generate so little operational activity (post-construction) that their development will have little impact on any type of wildlife in the area.

The sites chosen are not currently known to be the habitat of any threatened or endangered species, either plant or animal. In the event that any of the sites are later discovered to be the sole habitat of a threatened or endangered plant or animal species, the site will be relocated.

2.8 Water Supply. The **antenna stations** are expected to use a maximum of 100 gallons per day of potable water during construction, and a maximum of 1500 gallons per month during operation. The stations will be supplied with treated water (such as from a municipal or private system) or will have a well on site. At the high mountain sites, such as Kitt Peak and Mauna Kea, water may be hauled by truck to a storage tank on the site. In any case, the low water usage will not represent a significant impact on either the treated water supply or ground water supply in the areas.

Potable water for the **AOC** will be supplied through the Town of Socorro municipal system. At maximum future operation, the AOC maximum water usage is expected not to exceed 15,000 gallons per day.

2.9 Wastewater Disposal. Wastewater requiring disposal at the **antenna stations** generally should approximately equal the amount of potable water supplied (i.e., a maximum of 1500 gallons per month). The stations will be connected to a public wastewater disposal and treatment system or will have a properly designed and constructed septic system on site. The engineer performing the site design is also investigating the possible advantages of installing an alternative waste disposal system at the stations, such as electric toilets; however, the study is still underway and no recommendations have been received. In any event, wastewater disposal at the stations should represent no significant impact to either municipal systems or the environment.

Wastewater from the **AOC** will be disposed of in the Town of Socorro municipal system, and is not expected to represent a significant impact on the Town's system.

2.10 Solid Waste Disposal. The solid waste generated at the **antenna stations** will be minimal, and will consist mainly of

paper. Any solid waste will be collected in trash bags and brought out in the operator's vehicle to be disposed of in a proper receptacle or dumpster.

Solid waste generated at the **AOC** will be properly disposed of via the same disposal system used by New Mexico Tech.

No significant adverse impact is anticipated from solid waste disposal practices.

2.11 Utilities. Other utilities required at the **antenna stations** and the **AOC** include electric and telephone service. These services will be obtained from commercial companies in the areas, and will be brought into the station from a point no less than 1000 feet away. No adverse environmental impact is expected from the construction or operation of these services; however, the utility companies will be responsible for supplying the service to the site, and therefore, will be responsible for the environmental impact of these services.

2.12 Access Roads. Each **antenna station** will have a 20 foot wide access road to the nearest maintained highway. The access road will be compacted gravel with a light asphaltic sealer and will follow the existing natural terrain as much as possible. Cut and fill and general land disturbance will be minimized.

Access to the **AOC** will be on existing streets and roads in the Town of Socorro.

2.13 Stormwater Runoff. Drainage structures for handling stormwater runoff will be designed and constructed according to acceptable engineering practice. Due to the nature and small size of the development at the **antenna stations**, stormwater runoff volume will not be significantly increased over the pre-existing conditions. No significant adverse environmental impact is expected due to stormwater conditions.

The stormwater runoff from the **AOC** development will flow into the Town of Socorro stormwater system.

2.14 Erosion and Sediment Control. Proper vegetative and structural erosion and sediment control practices will be implemented during construction and operation of all VLBA sites. An erosion and sediment control plan acceptable to the responsible regulatory agency will be developed as part of the site engineering for each **antenna station** and the **AOC.** No significant adverse environmental impact is expected due to erosion and sedimentation.

2.15 Surrounding Water Quality. No significant adverse impact on the quality of ground or surface waters surrounding the **antenna stations** is anticipated for the following reasons:

- o The area of development is small (one and a half acres).
- o The type of development is passive. The development of the antenna stations will not generate much activity or

traffic which could lead to non-point source pollution.

- o No solid waste will be landfilled or otherwise disposed of on-site.
- o The volume of wastewater to be disposed of on-site will be small, varying between 0 gallons (for those stations utilizing a municipal system) and approximately 1500 gallons per month.
- o Weed and grass control will be by passive means as much as possible. If herbicides are used, they will be EPA approved, and will only be used in spot applications in an approved manner.

2.16 Air Quality. The operation of the **antenna stations** will not have any significant adverse impact on the air quality in the site areas. Generally, the only possible source of air pollutants from the antenna stations will be the standby diesel power generator, which will only be operated in the event of a commercial power outage or periodically for routine maintenance and operational checkup. Vehicular traffic to the stations will not exceed a few vehicles per day maximum which does not represent a significant increase in automobile emissions in any of the site areas.

The volume of traffic generated by the operation of the **AOC** is not expected to represent a significant increase in Socorro traffic, and therefore should not impact air quality in the area.

2.17 Noise. The **antenna stations** are virtually noiseless during operation, except when being repositioned rapidly, at which time the noise level would be considered moderate. Generally, the only other noticeable noise which may be produced during operation will be when the standby power generator is running. It should also be noted that the antenna stations will be located in very remote areas for the most part, so even the sound of the antenna moving or the generator running is not likely to disturb other human beings.

2.18 Sight. The antenna structure approaches a height of 100 feet in its maximum attitude and is painted white. It is, by its very nature, a highly visible object. However, again, it should be remembered that (1) the antenna stations are in remote areas away from most human development, (2) in some cases the antennas will be near similar existing structures, and (3) where possible, the natural terrain has been used to shield the antennas from both line of sight and radio interference. Also, while the antennas may be highly visible, they are not particularly offensive to most people's eyes.

Therefore, it can be said that the construction and operation of the VLBA antennas does not represent a significant source of sight pollution.

2.19 Safety. The operation of a VLBA **antenna station** does not present any particular type of safety threat to persons or

animals in the area. Even so, the entire acre and a half site at each antenna station will be enclosed in a security fence (eight feet high with barbed wire top strands) to prevent inadvertent or unauthorized entry to the site.

3.0 SUMMARY

The Very Long Baseline Array radio telescope, to be built by Associated Universities, Inc. under contract with the National Science Foundation, consisting of ten widely separated antenna stations and an Array Operations Center, is expected to represent NO SIGNIFICANT ADVERSE ENVIRONMENTAL IMPACT considered as either eleven separate and distinct units or as a collective whole.