

EVLA MEMO 51

THE PROPOSED NEW MEXICO ARRAY CONFIGURATION

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ABSTRACT

The configuration for the New Mexico Array portion of the EVLA Completion Phase proposal is presented. The configuration provides good UV coverage and uses sites that are, in most cases, close to fiber optics and power. All of the sites are expected to have low levels of RFI. There are 9 new sites; it is assumed that the Los Alamos VLBA antenna will have to be moved. This memo is an update EVLA MEMO 35. The basic configuration has not changed a lot, but the specific choice of location has been, in many cases, affected by the results of site visits, discussions with the BLM and Forest Service, ongoing UV studies and information from the communications companies who own the fiber.

A table of the miles of fiber required is included along with updated UV coverage plots.

1. Introduction

EVLA Memo 35 (Walker 2002) described the methods being used to derive a configuration for the New Mexico Array (NMA) and presented a possible configuration. Since that time, little has changed in the methods so they will not be discussed further. However there have been some changes in the favored configuration, many as the result of site visits. A major perturbation to the array study is the result of strong indications from the Los Alamos National Laboratory that they will require that the VLBA antenna on their property be moved. That, combined with an inability to identify an affordable means of obtaining the required fiber access to the Los Alamos area, has led to consideration of configurations without the Los Alamos site. If it turns out that the Los Alamos site is retained, the most southern site (NM 113 below) would not be used and it may prove desirable from a UV coverage point of view to alter the location of one other antenna. There are several possibilities for the single antenna alteration.

All of the sites below have now been visited by some combination of Craig Walker, Frazer Owen, and Cam Wade — mostly Owen and Walker. Most of the sites are near fiber that we believe can be leased at reasonable rates. Most also have 3 phase power nearby, a concern that may be as significant as fiber. None of the sites appear to be in environmentally sensitive areas. The configuration appears to be a very good one from the standpoint of RFI. All sites are far from civilization and sheltered by hills or mountains. However RFI testing is still needed. As might be expected, there have been compromises to the UV coverage to meet some of the other siting constraints, but those compromises are considered to be minor.

As far as we know, the configuration proposed here is viable, could be built and would perform well. It is meant to be the configuration used in the EVLA Completion Phase proposal.

Below is the list of sites with some description. After each station name the elevation, latitude, longitude, and catalog name are given in parentheses. The catalog name is the name in the station catalog used by SCHED in the configuration search and is the name that appears on the UV plots. The coordinates, in most cases, are from GPS readings taken while standing on a likely looking spot. But the process of acquiring access to the sites has not begun so the exact locations are still unknown. We have communicated with BLM and Forest Service personel about the general nature of the project and about regions of interest, but not about exact locations. The process of environmental assessment and public involvement has not begun. Each site location can be adjusted by several miles and not damage the UV coverage.

2. The Sites

1. Pie Town (2365m 34:18:04 108:07:09 VLBA_PT): This existing VLBA antenna is already connected to Western New Mexico Telephone Co-op (WNMTC) fiber for observations with the VLA. It will need to be upgraded to EVLA electronics standards. It is on BLM land just east of the small community of Pie Town very near where US 60 crosses the continental divide.
2. Dusty (2100m 33:40:57 107:36:25.8 NMA_DUST): This site is a bit north of the micro community of Dusty, south of the VLA. The coordinates above are on the edge of the Cibola National Forest. Road distance from the VLA control center is roughly 32 miles. There is no known fiber nearby and it is a significant distance to three phase power. The simplest option may well be to install both along the road from the VLA. Dusty is in the WNMTC service area so it is likely that they will install the fiber. The UV coverage constrains the site to be within about 5 miles of the above location to the west, north, and east and about 1.5 miles to the south. The tight southern constraint is to avoid opening a significant gap to the VLA. A site closer to the road than the above coordinates might be preferred logistically if it can be obtained. Such a site would probably be on BLM or private land.
3. Rincon (2153m 33:55:41 108:17:31 NMA_RINC): This site is on BLM land near where Rincon Canyon meets Patterson Canyon close New Mexico Highway 12, just off the edge of the Plains of San Agustin. Note that you will need a very good map to find Rincon Canyon. The site is about half a mile north of NM12, just west of the hills west of the small community of Old Horse Springs. A WNMTC fiber runs along NM12 so it is very close. Power may be a big problem. There are high tension lines a few miles west but they probably cannot be accessed. In fact, they should be checked for RFI effects. Otherwise the nearest three phase power seems to be near Datil or Aragon. This area may be on the boundary between power companies. The UV coverage constrains to site to be within about 5 miles of the above position.
4. Spurgeon Mesa (1622m 33:28:37.7 108:55:48 NMA_SPUR): This site is on Gila National Forest land along US 180 between Glenwood and Reserve. The WNMTC fiber runs along US 180

as does 3 phase power, so utilities are close. There are high tension lines nearby so the RFI should be checked.

5. West US60 (2200m 34:15:50 108:47:00 NMA_W60): This site is on BLM land between Quemado and Red Hill, north of US 60. We have not yet identified a specific site, but there seem to be plenty of opportunities in the area. There is 3 phase power at US 60, and fiber at Quemado. The BLM indicated that WNMTC might be interested in putting fiber in the area. It should be possible to use BLM land. The preferred area for UV coverage is roughly from half way between Quemado and Red Hill to about Red Hill. We need a better name once we identify a specific site.
6. Mangas Valley (1600m 32:43:34 108:26:52 NMA_MANG) This site is on National Forest land near the Tyrone mine south of Mangas Springs, fairly close to Silver City. It is on Forest Road 851 just as it enters the Gila National Forest (Big Burro Mountains) in Mangas Valley. There is three phase power in Mangas Valley and WNMTC fiber along FR851 (going to Redrock and Lordsburg). Environmental problems should be minimal because it is close to, and dominated by, a huge Tyrone Mine tailings pile.
7. Cuchillo (1500m 33:14:00 107:23:00 NMA_CUCH): This site is on BLM land near Cuchillo, which is west of Truth or Consequences. Three phase power is on NM52. Fiber is also there and probably belongs to Valor, but they don't seem to know it! The above coordinates are a mile or so west of the community on BLM land, but anywhere in the general vicinity would do. Going east to Engle improves the UV coverage some at the cost of RFI. Going west to Winston might be better for RFI and might help if we need to connect through Dusty. The RFI concerns are Truth or Consequences and a nearby aircraft navigation beacon.
8. Torrance (1930m 34:19:45.7 105:30:48.0 NMA_TORR): This site is on state land near the micro-community of Torrance between Duran and Corona, southwest of Vaughn. There is 3 phase power nearby and fiber at the railroad less than 2 miles away. The fiber is labeled for Level 3, but we have reason to believe that Eastern New Mexico Telephone Company (ENMTC) has fiber here and we only saw the one. The land is slightly rolling, and by using a low spot, such as at the above coordinates, it should be possible to hide from the Sandia Peak transmitters. Better RFI protection might be obtained by getting behind some hills in the vicinity, but access might be problematic.
9. Elk (1700m 32:53:35.3 105:09:21.9 NMA_ELK): This site is on BLM land about 14 miles east of Elk, on County Road 33 just north of US82. Fiber is available along the highway. Three phase power is about 6 miles away. The site is a bit farther east then optimal, but it seems to be a good site while others to the west may be difficult. Going west to the general area of Sunspot, Apache Point, or Cloudcroft is a bit better for UV coverage but fiber access may be a problem. The fiber route back to the VLA is the longest and would involve Penasco Valley Telephone Co-op, Tularosa Basin Telephone Company, ENMTC, and WNMTC
10. NM 113 (1450m 32:03:55.8 108:33:32.5 NMA_N113): This site is on land along NM 113 north of NM 9 in southern New Mexico. Depending on exact location, BLM or private land may be used. From a UV coverage point of view, sites further east, up to well beyond Columbus, could be somewhat better. But there is a Customs Service aerostat radar south of Deming

and up to 10000 ft above the ground. The suggested site is about as far as possible from that radar and, with a little care, the radar can be hidden by some hills. Fiber and power are in the immediate vicinity, as is a railroad. The fiber belongs to Valley Telephone Co-op. Alternatives near the company town of Playas and also west of Hachita are possible. This is the site that will not be built if Los Alamos is retained.

3. Fiber Miles

A new estimate has been made of the miles of fiber that must be leased to send the signals from the above sites to the VLA. This was done with the help of the New Mexico Road and Recreation Atlas (Benchmark Maps), the Recreational Map of New Mexico (GTR Mapping), the MapQuest web site, and the VLBI scheduling program SCHED (which calculates baseline lengths). The values are good to about 5%. The various sources don't always agree on the mileages and, in some cases, we don't know exactly where the fiber goes. Details for the estimate are shown in the Table 1. Included are an estimate of the total miles for each segment, for each site, and for the array. Also the number of miles of potentially shared fiber are shown as is the number of miles of new fiber that will need to be installed (the "last mile") to reach the existing phone company fibers.

The current concept for shared fiber allows the signals from up to 3 sites to be transmitted on the same fiber. With this configuration, there are 4 different fibers arriving at the VLA. One only carries Dusty. The one that goes through Socorro carries Cuchillo, Torrance, and Elk. There are two arriving from the direction of Datil. One has Rincon, Pie Town, and West US60. The second has Spurgeon, Mangas, and NM113. For each site in the table, the second mileage column shows the number of miles of fiber required that are not shared with a site closer to the VLA.

4. UV Coverage

The UV coverage for the proposed array is shown in Figures 1 and 2. Figure 1 shows the coverage when the VLA is included. The VLA here is represented by 12 antennas, 4 on each arm. Figure 2 shows the NMA as a stand alone array. Note that much of the time when the NMA is used by itself, not all of the antennas will be there because at least 2 will be needed by the VLBA. It turns out that the 7 antenna subset of the NMA, not including Torrance, Elk, and NM113 has good UV coverage, with or without the VLA, for baselines to about 180 km. The remaining 3 antennas make a reasonable set to use with the VLBA, giving the VLBA somewhat better short baseline coverage than it now has. I will predict that this often will be how the antennas are divided between the arrays.

The telephone company fiber belongs to Western New Mexico Telephone Co-Op, unless otherwise noted in footnotes.

Table 1. Fiber miles

Station	Segment	Miles	Added Miles ^a	Sites on Fiber	New Miles ^b
1: Pie Town	VLA — B45/NM12 junction	37	37	3	—
	B45/NM12 junction — Pie Town	28	28	2	—
	VLA — Pie Town TOTAL	65 ^c	65		—
2: Dusty	VLA — Dusty TOTAL	32	32	1	32
3: Rincon	VLA — B45/NM12 junction	37	—	—	—
	B45/NM12 junction — Rincon	11	11	1	1
	VLA — Rincon TOTAL	48	11		1
4: Spurgeon	VLA — Rincon	48	48	3	—
	Rincon — Spurgeon	64 ^{d,e}	64	3	1
	VLA — Spurgeon TOTAL	112	112		1
5: West US60	VLA — Pie Town	65	—	—	—
	Pie Town — Quemado	23 ^d	23	1	—
	Quemado — West US60 site	19 ^{d,e}	19	1	19
	VLA — West US60 TOTAL	107	42		19
6: Mangas	VLA — Spurgeon	112	—	—	—
	Spurgeon — Mangas site	59	59	2	1
	VLA — Mangas TOTAL	171	59		1
7: Cuchillo	VLA — San Antonio	62	62	3	—
	San Antonio — Cuchillo site	63 ^{d,f}	63	1	2
	VLA — Cuchillo TOTAL	125	125		2
8: Torrance	VLA — San Antonio	62	—	—	—
	San Antonio — 8 mi S of Corona	80 ^g	80	2	—
	8mi S of Corona — Torrance site	15	15	1	2
	VLA — Torrance TOTAL	157	95		2

Table 1—Continued

Station	Segment	Miles	Added Miles ^a	Sites on Fiber	New Miles ^b
9: Elk	VLA — 8 mi S of Corona	142	—	—	—
	8 mi S of Corona — Cloudcroft ^{d,h}	111	111	1	—
	Cloudcroft — Elk site ^{d,i}	45	45	1	1
	VLA - Elk TOTAL	398	156		1
10: NM113	VLA — Mangas site	171	—	—	—
	Mangas site — Lordsburg	45	45	1	—
	Lordsburg — NM113 site	27	27	1	1
	VLA — NM113 site TOTAL	243	72		1
TOTAL		1458	769		60

^aThese are miles of fiber not shared with a site closer to the VLA

^bThis is the additional distance beyond the pre-existing fibers — the “last mile”.

^cThe VLA — Pie Town fiber is known to be 65mi long — it is in current use for Pie Town link astronomy. We don’t know exactly where the Pie Town spur joins the main fiber along NM12, but if we assume it is at the B45/NM12 junction, the map measured distance is correct. We have looked in that area and near New Horse Springs for the fiber but have not seen it. Until we have better information, we will assume the fibers meet at that junction.

^dDistance derived with the help of a road mileage from MapQuest.

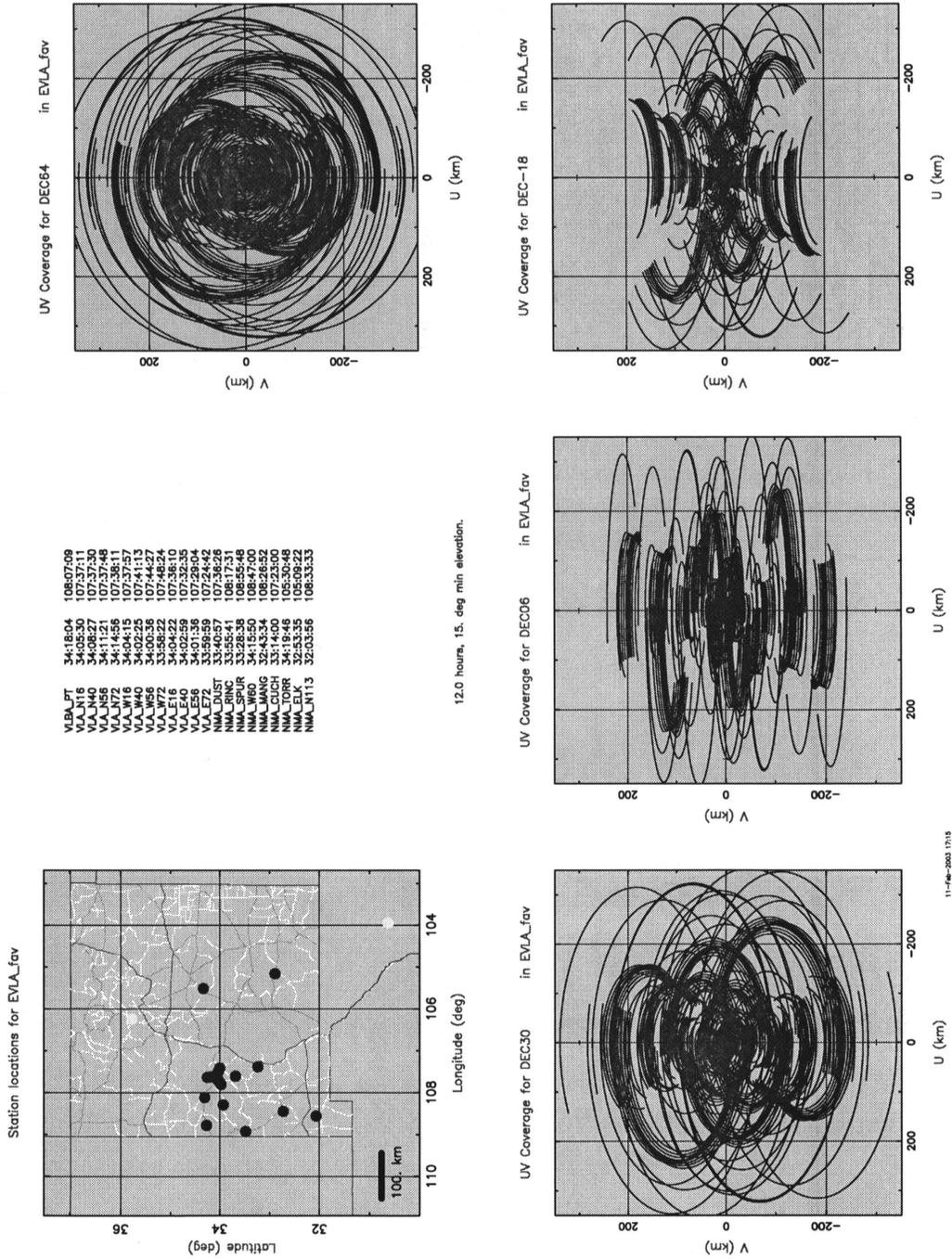
^eBased on SCHED baseline length to a town of known location.

^fRoad miles. The fiber in the area may belong to Valor Telephone Company. We don’t know the fiber connection path yet. An alternative is to run about 46 miles of new fiber to the Dusty site and share from there.

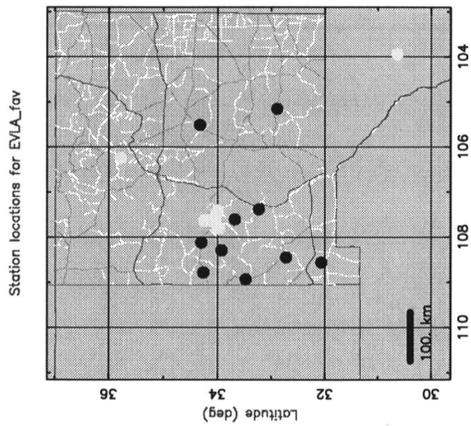
^gMap estimate without knowing exact route (somewhere near Claunch). This segment is on Eastern New Mexico Telephone Co-Op fiber.

^hThis segment is on Tularosa Basin Telephone Company.

ⁱThis segment is on Penasco Valley Telephone Co-Op fiber.

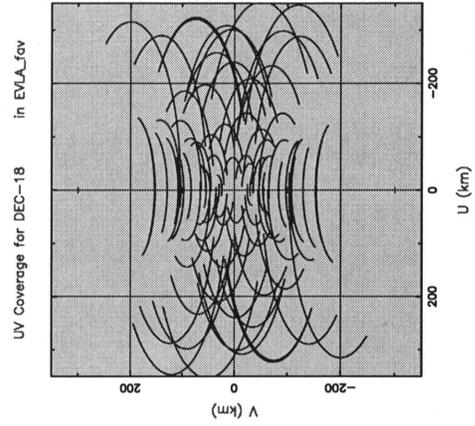
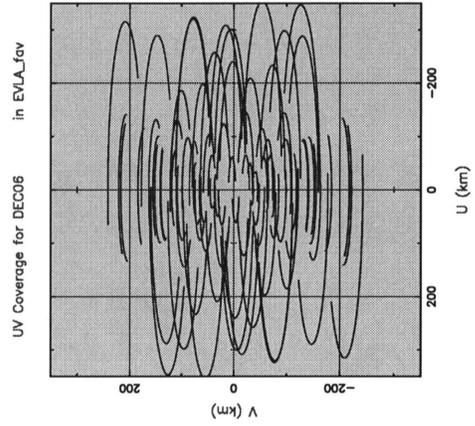
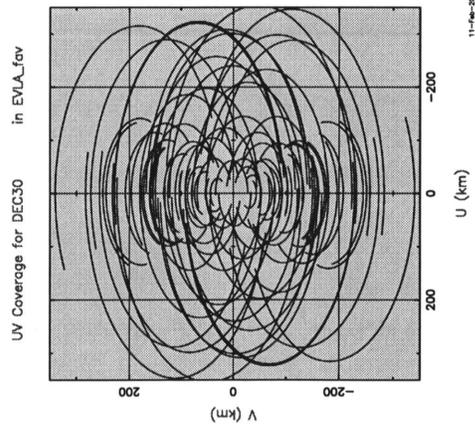
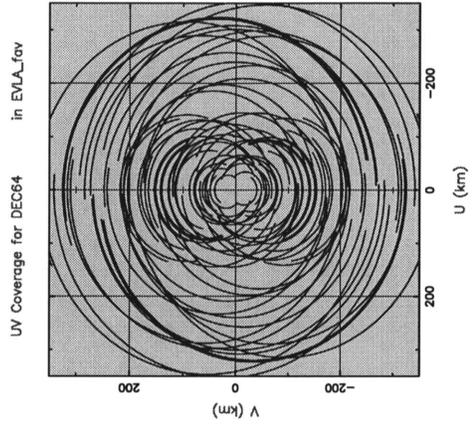


1.— The UV coverage of the NMA plus VLA on a scale of 350 km.



VLBA_PT	34:18:04	108:07:09
NMA_DUST	33:40:57	107:36:26
NMA_RINC	33:55:41	108:17:31
NMA_SPUR	33:28:38	108:55:48
NMA_W60	34:15:50	108:47:00
NMA_WANG	32:43:34	108:26:52
NMA_CUCH	33:14:00	107:23:00
NMA_TORR	34:19:46	105:30:48
NMA_ELK	32:53:35	105:09:22
NMA_N113	32:03:56	108:33:33

12.0 hours, 15. deg min elevation.



2.— The UV coverage of the NMA alone on a scale of 350 km.