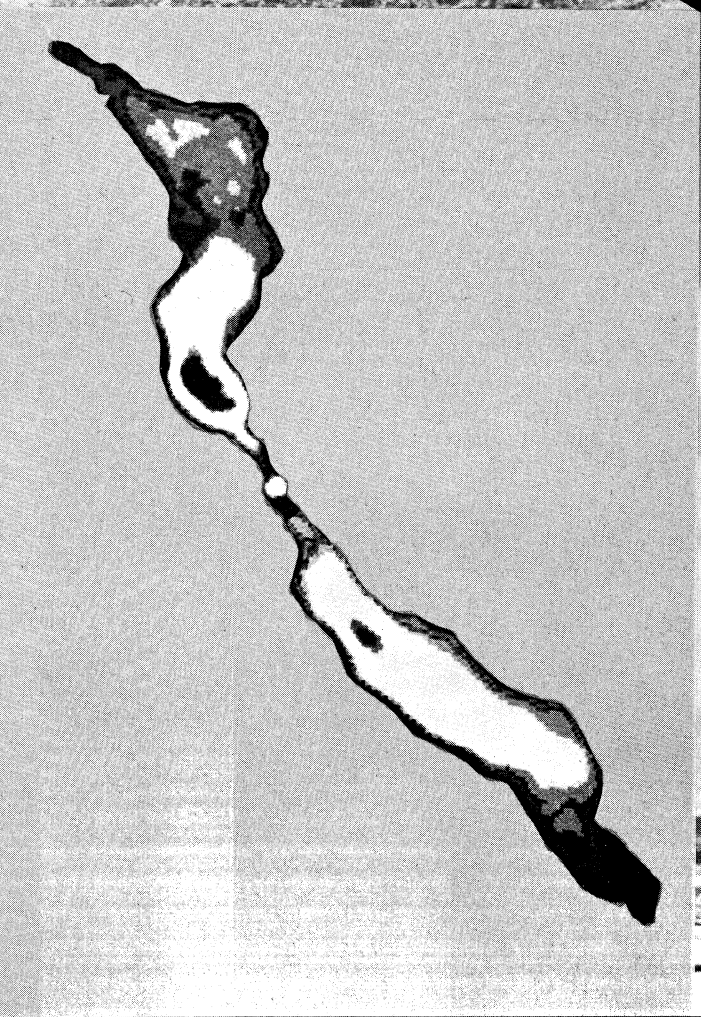
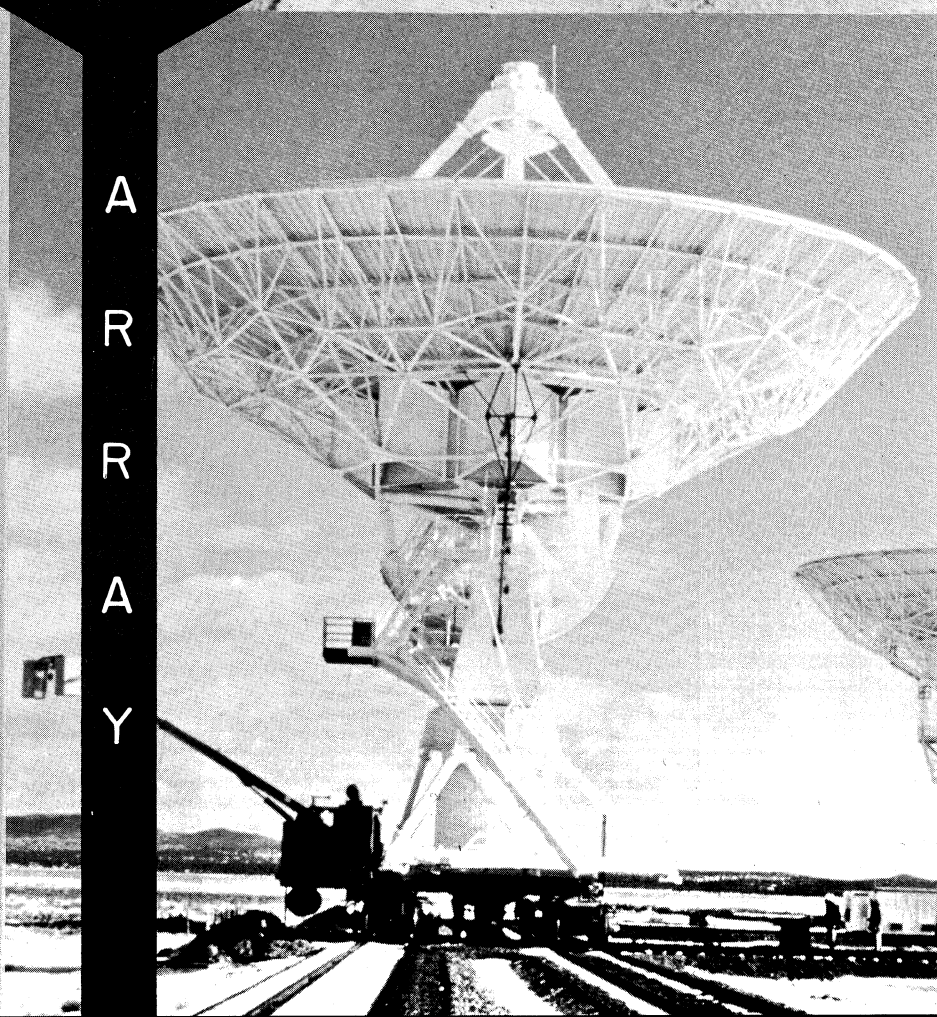
the OBSERVER

VERY LARGE ARRAY





THE COVER

The three photographs that compose our cover are identified below:

1. (Top, center) An aerial view of the "C" Array, Summer 1980.
2. (Lower, right) Antenna #2 on Hein's Trein, January 1976.
3. (Lower, left) Radio source 3C120 at λ20 cm done at the VLA by Alan Bridle, Ed Fomalont and Wil Bruegel in September 1979.

* * * * * *

SHIVA

Standing silently in the empty space in front of the control building, is "Shiva" the VLA's symbolic, 12-foot high, burnished, stainless steel sculpture.

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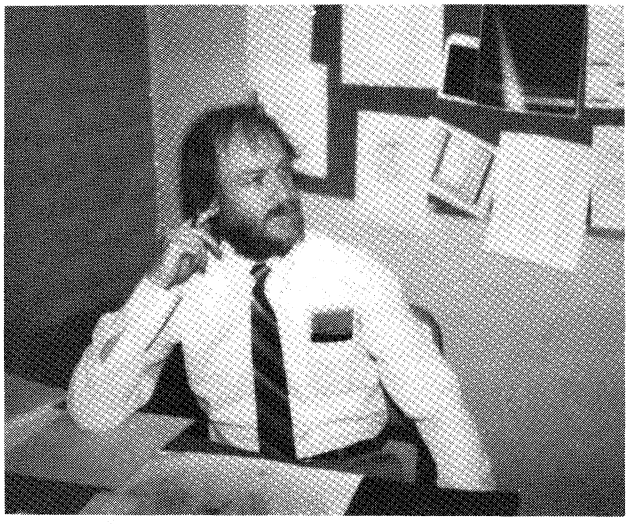
Dave Weber

The Observer staff would like to express its appreciation for the work that went into accumulating the articles and information that comprise this issue. The VLA is a very busy place these days. Thank you, VLA.

A special thanks to all the people who helped with *The Observer*.



DR. RON EKERS

VLA Director

The VLA is fortunate to have Dr. Ron Ekers as its new director. Since his arrival in September 1980 he has plunged into the administative, scientific, computer and personnel aspects of his job with enthusiasm and common sense.

Jay and Ron Ekers have been married for 17 years and have two sons, Brook, 14 and Dane, 11. Jay has a degree in chemistry and has worked in astronomy and related topics over the years while raising a family. The Ekers appear to be adjusting well to Socorro which, in many respects, is very different from Groningen, Netherlands in its lifestyle.

In the mid 1960's Ron was involved in the early stages of aperture synthesis in Australia. Compared with the VLA these early interferometers were 'barbaric'. There were just two antennas, one of which had to be moved on a rail. Telescope operators were unknown. Computers consisted of gears and pulleys and string attached to small motors. And when something went wrong at 3:00 a.m., a trip fifty feet up to the focus of a telescope to kick an intermittant klystron and mutter obsenities, were all part of the game.

After receiving a Ph.D. from the Australian National University in 1967, Ron came to Cal Tech in Pasadena, California. There he continued his work on the mapping of extragalactic sources and was among the first to observe nearby elliptical and spiral galaxies. He made some significant observations of pulsars soon after their discovery. Ron's versatility and breadth of interests were already apparent.

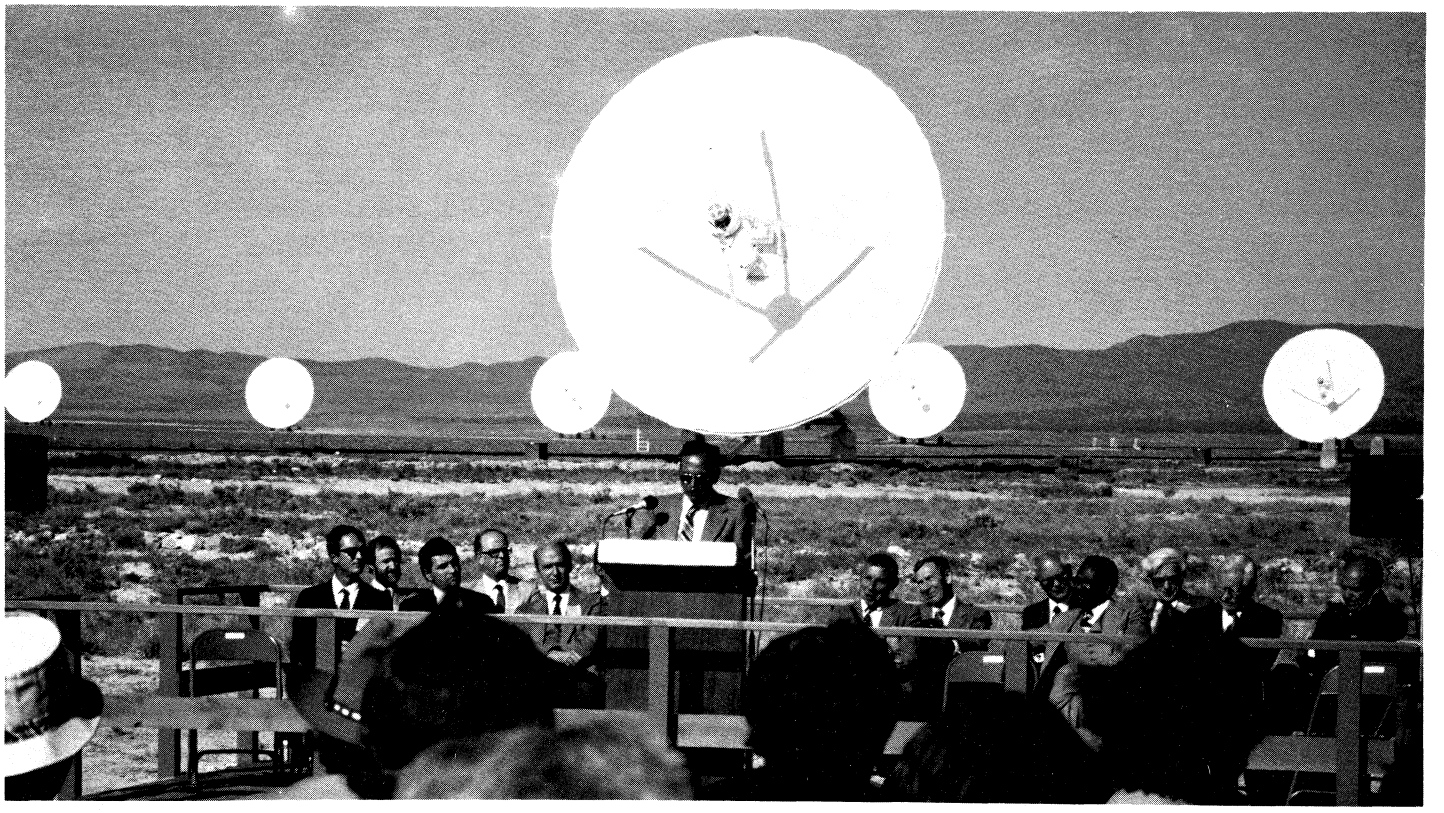
In 1971, Ron took a position at the University of Groningen, Netherlands where he remained until recently lured to the VLA. Besides continuing his research interests, Ron, with others, developed one of the earliest image processing systems. He has also participated on visiting and advisory committees of most of the major radio instruments. Since 1973 he has been a member of several NRAO and VLA committees so he is already very familiar with the problems the VLA will face in the coming years. Undaunted by them, he came to the VLA anyway.

AS THE OLD YEAR ENDS,
LET ME REMEMBER...

Let me remember, as the old year ends,
That there has been no year without some new
And unexpected happiness that transcends
The years; let me recall how friendships grew
Through days that I believed so desolate,
That nothing beautiful could ever grow
In them: and let me not forget how great
Successes came, when hope had seemed to go.

Oh, let me not forget, beginning now
A year that seems to promise little good,
How even the darkest years contained somehow
More lovely days than I believed they could,
For so I am assured I shall not miss
Some bright transcendent happiness in this.

--Jane Merchant



From left to right: Carl Heiles, Ron Ekers, Senator H. Schmitt (NM), Robert Hughes, Don Langenberg, Frank Press, Morton S. Roberts, David S. Heeschen, Frank Johnson, John Slaughter, Don Cooke, Gerald F. Tape, John H. Lancaster

VLA DEDICATED - OCTOBER 10, 1980

Jack Lancaster

When should AUI/NSF dedicate one of the world's most sophisticated scientific instruments which did its first significant scientific work in mid 1977, but was not scheduled for final completion until 1981?

The answer to this question was October 10, 1980 when the VLA was dedicated by Dr. Frank Press, Science Advisor to the President, before some 600 staff members and invited guests. This date seemed close enough to completion; the New Mexico weather should be at its best; it was not the "dark of the moon", important to optical astronomers; it coincided with the AUI Board of Trustees Meeting; and Congress should be in recess, freeing up Washington visitors.

Work began in December 1979 with the establishment of an Ad-Hoc Committee consisting of Lancaster, Wade, Bignell, Napier, Wells, Temple and Swann. Later this committee was expanded to include all 130 members of the VLA Staff. During the spring the date was approved; the dedication speaker invited; guest lists prepared by the National Science Foundation, Associated Universities, Inc. and NRAO; the program debated and firmed up; all possible motel rooms in Socorro tied up,

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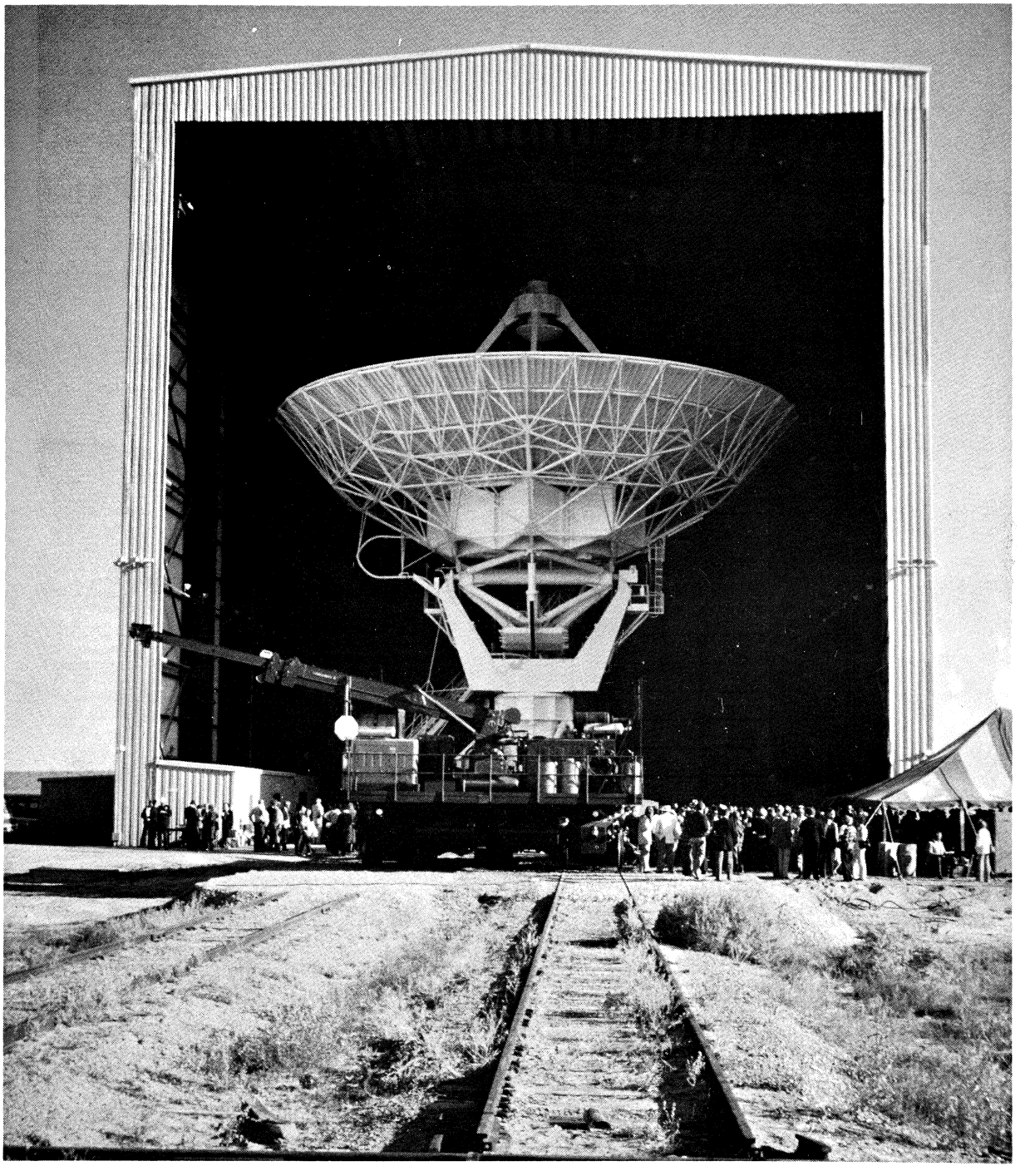

The Assembly Building, an antenna and an antenna transporter dwarf the many VLA Dedication visitors at lunch time.

plus 150 rooms in Albuquerque; buses reserved and arrangements made with New Mexico Institute of Mining and Technology to cater the event plus furnishing extensive logistic support. Formal invitations were sent out and then the fun began of getting everyone transported, housed, fed and seated on time.

Dedication day was clear and bright, if somewhat windy. Events started at 11:30 a.m. with registration and a light Mexican lunch, followed by scientific orientation talks, scientific and equipment displays in all buildings, and a movie. At 3:00 p.m. the dedication ceremony was held, followed by a reception and an old-fashioned western barbeque. The evening was topped off by a western dance.

During the day Barry Clark set up the array in snapshot mode which permitted real-time maps of different radio sources to be produced each twelve minutes. The array followed the Third Cambridge Catalogue, producing souvenir polaroid prints for the guests.

Seated on the platform were Frank Press, Science Advisor to the President; Bruce King, Governor, State of New Mexico; Pete Domenici and Harrison Schmitt, Senators from New Mexico; Manuel Lujan, Congressman from New Mexico; Lewis M. Branscomb, Chairman, National Science Board; John B. Slaughter, Director Designate, NSF; Donald N. Langenberg, Deputy Director, NSF; Francis S. Johnson, Assistant Director, AAEO, NSF; W. Donald Cooke, Chairman of the Board, AUI; Gerald F. Tape, President, AUI; Robert Hughes, President-Designate, AUI; Morton S. Roberts, Director, NRAO; David S. Heeschen, Senior Scientist, NRAO; Carl B. Heiles, Professor, University of California, Berkeley; Ronald D. Ekers, Site Director, VLA, NRAO and John H. Lancaster, VLA Construction Manager, NRAO.

A highlight of the ceremony was the presentation by Dr. Langenberg of the National Science Foundation Distinguished Public Service Award gold medal to David Heeschen for his many years of service to the VLA Program during its conception, design and construction. A similar medal was presented to Gerald Tape for his fifteen years of service as President of AUI.

During the ceremony the twenty-seven antennas were bunched in the "C" configuration, pointing to the southwest over the audience. As Dr. Press dedicated the instrument to the extension of human knowledge across billions of light years of distance and time, the antennas were directed to a source to the south. Due to the orientation of the three arms and the positioning of the limit stops, all the antennas seemed to start off in different directions or reverse their azimuth rotation after a short time. However, in a few minutes all was normal and the VLA was back at work.

* * * * * *

THE VLA OPEN HOUSE ... via AMATEUR RADIO

Paul Harden KA5CNE

Saturday morning, October 25, 1980, was a little bit colder than expected. After scraping the frost off the windshield, I drove with a slight shiver to the Socorro VLA office. There to meet me were Larry Beno, WA6GFE, Chuck Broadwell, W5UXH, Daryl Grant, W7LHO, Jim Oty, WB5GWH, and Al Miller, KA5FCT. In spite of our asynchronous shivering, we managed to load assorted transceivers, antennas, coax and the like into the van, followed by a quick brew of coffee, then off to the VLA site. We had all decided to leave early to give us ample time to get two amateur radio stations on the air before the open house was to begin around 11:00 a.m.

Arriving at the VLA site (circa 8:30 a.m.) we found the temperature to be in the low 20's. The first task was to carry several lengths of steel pipe from the warehouse to use for antenna supports. Even with gloves we nearly suffered frostbite from carrying those pipes! The old drafting trailer was chosen to be the location (QTH) of the stations. As the clock approached 10:00 a.m. (1600 UTC) we were ready to make our first contact (QSO). After a few final touches, Larry Beno, WA6GFE, sat down in front of the

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15-meter station and called CQ on 21.390 MHz:

"CQ CQ CQ, this is WB5GWH, Whiskey Bravo five Golf Whiskey Hotel in New Mexico, special event station at the VLA Observatory, the world's most powerful radio telescope calling CQ and listening."

"WB5GWH, here is WA4HNL, Whiskey Alpha four Hotel Nancy Lima in Dunwoody, Georgia. The name is Joel and you're running a 5 by 9 signal here today. So what type of special event station are you running there again old man? WB5GWH, WA4HNL, over."

"Fine business Joel... the name here is Larry and thanks for the nice signal report. You're also about 5 by 9. This is a special event station at the world's most powerful radio telescope, the Very Large Array, commemorating the dedication of the instrument. And by the way Joel, you're our first special event contact, over."

"Very fine Larry...I have read about your installation there. How many antennas do you guys have built now? Over."

"All 27 antennas are now built and operational, Joel. We are currently using the A array, where the antennas are the farthest apart. There are nine antennas on each arm of a huge wye, with each arm about 12 miles long. Each antenna weighs about 216 tons and has an 83-foot dish. WA4HNL, WB5GWH."

"Sounds like an interesting project Larry. Good luck with your work there and your special event station..."

And so the majority of contacts went, with a large number of hams being quite familiar with the VLA to our surprise. The VLA was described in various details, depending on the questions asked, and it seemed that everybody had at least something to ask about the observatory. Many hams "listened in" so that when they finally got a chance to "work" the VLA station, they had time to work up some mighty interesting questions, often requiring a rather detailed answer. But with many of today's hams involved in satellite, VHF, millimeter-wave and moon-bounce techniques, most are very fluent in discussing the VLA feed-horns, parametric amplifiers, phase stability and interferometer principles.

Three stations were activated. The first was a ten watt 2-meter (145 MHz) rig, used strictly for local work. About two dozen hams were in the general populace that showed up, many who had similar 2-meter equipment in their cars.

The second station was Al Miller's Kenwood TS-120, operated on single side band phone at about 80 watts output. This station remained on 15-meter all day using a 40-15 meter half-wave dipole. It was powered exclusively from a Sears die-hard car battery from 10:07 a.m. until the last contact at 7:32 p.m.

The third station was Paul Harden's TenTec Triton IV (540), running about 100 watts output into a trap-vertical antenna resonant on the 40, 20, 15, and 10 meter amateur bands. The vertical antenna was mounted atop a 20-foot section of 2½ inch steel pipe, giving a total height of about 55 feet. The 10-meter band (28 MHz) was used primarily using both single side band and morse code. Chuck Broadwell's home-brew CW keyboard was used. This looks like a computer terminal keyboard and spits out perfectly spaced morse code characters.

Since all of the VLA hams are engineers or technicians, we were primarily responsible to serve as tour guides during the open-house. The stations were thus manned throughout the day as we became available for short periods of time and of course the time spent on the air before and after the open-house.

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We managed to contact hams in 38 of the 50 states, 4 Canadian provinces, 1 in Uruguay and 1 maritime mobile station in the Pacific. Because of the 21- and 28- MHz frequencies utilized, communications within about 600 miles was not possible due to the minimum "skip" characteristics of those frequencies. Hence, our neighboring states could not be contacted. Also, 28-MHz propagation died promptly at 6:00 p.m., local sunset.

This VLA special event station had been tentatively planned for some time. As a result, several foreign observatories were contacted prior to the operation to set-up schedules to contact them. Unfortunately, the October 25th weekend also turned out to be the annual CQWW (World Wide) contest. This is an international contest in which the goal is to contact as many hams in as many different foreign countries world wide as possible during this 48-hour period. Needless to say, hardly a spare kilohertz of spectrum could be found! If any of the hams at the foreign observatories tried to work us, their signals (or ours) didn't penetrate the congestion, or they were leaped on by the contestors for a contact from a "new country". Station CX7AAR(non-observatory) in Uruguay was the only significant distant (DX) station contacted outside of the U.S. or Canada. This inability to work into the normally available foreign countries was the only disappointing aspect of our operation. Even Peter Napier's father in New Zealand, ZL1BI, was to contact us. That would have been fun.

At 7:32 p.m., Jim Oty made the last contact with station WD9EQU in Connersville, Indiana, about an hour after the VLA was again restored to an isolated observatory after some 2,000 persons visited the facility. The stations were dismantled, the antennas brought down and the log-book signed out with nearly 200 contacts established. A good number of our open-house visitors stopped by the stations and found this unique method of sharing the open-house with others to be truly interesting. After all, this was our purpose, to share the VLA "over the air" via amateur radio.

The VLA hams wish we could call this type of operation "original", but the truth of the matter is it is far from it. In fact, at the time of this writing, another special event station is on the air from the Jet Propulsion Laboratory (JPL) broadcasting pictures taken by Voyager II of Saturn. This station, W6VIO (Voyager In Outerspace) is providing verbal descriptions of their findings in addition to broadcasting the actual Voyager images of Saturn via slow-scan TV and regular TV inside the amateur radio frequencies allocated for TV transmissions. Such an operation does much for the public image of such organizations; hopefully, the VLA hams presented an equally impressive image of the work being done by the NRAO.

Several interesting aspects of the operation resulted. First, Eva Rigby, one of the VLA secretaries, answered long distance telephone calls from all over the United States and one from Mexico inquiring as to what frequencies we were operating on, etc. Because we did not expect this reaction from hams, poor Eva was totally unprepared for these type of calls. But like any good secretary, she managed to track us down, transferring the calls to the drafting trailer. Daryl and Paul were both found answering the phone "VLA ham shack"! Contacts were established with the majority of those calling.

The second interesting aspect was the comments and reactions experienced from the hams we worked. Hams often like to brag about their equipment and antenna systems. On one occasion, I was carefully explaining the VLA antenna array to one gentleman. Afterwards, he returned stating, "Now wait a minute Paul. Am I really to believe that you're using an antenna 26 miles across and weighing 216 tons? You wanna run that by me again?" If Dr. Ekers had not been standing next to me at that particular moment, I may have been tempted to convince him of the dimensions of "my antenna"!

A more visible result of our operation

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was receiving the QSL cards from nearly 200 hams. QSL cards are normally like a postcard containing the ham's call letters and pertinent information to confirm a specific two-way contact. Within days after our operation, the QSL cards began to arrive, most accompanied with self-addressed, stamped envelopes to cover postage, a custom hams exercise when QSL'ing a special event station. The VLA consequently, is obligated to return a QSL card to confirm the special event contact. These special event QSL cards are somewhat of a collector's item since they are issued only once for some special commemoration. The VLA QSL card is a folding card with a brief technical description of the array. It was designed by the VLA hams and printed locally.

The QSL cards received from the stations we contacted were displayed in the VLA Control Building Lobby which fascinated many. Most of the cards contain comments in appreciation for taking the time to explain the VLA to them over the air, which we replied, "we did it with pride and pleasure".

73,
The VLA hams

Operators during the VLA special event station were:

WB5GWH*	Jim Oty	KA5FCT	Al Miller
KA5CNE*	Paul Harden	WA6GFE	Larry Beno
W7LHO	Daryl Grant	W5UXH	Chuck Broadwell

(*Indicates call letter used for the stations.)

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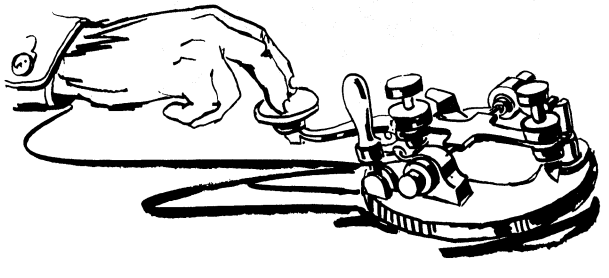

SPECTRAL LINE OBSERVATIONS WITH THE VLA

Pat Palmer

What kind of institution is this where grown men sit around connecting dots on a page at 4:00 a.m.? Certainly one that should be investigated. (But, you may never be the same again.)

At first view the VLA looks like a wonderful device for molecular line observers: 27 antennas! One could search for 27 different molecules simultaneously! I spent the first half of 1980 at the VLA and had the opportunity to make a closer inspection. It turns out that the antennas are all connected together in some diabolical way and that proposals to use them separately are treated, at best, rudely. But if one can survive the indignities and tolerate strange terms like phase jump, L6, and ANTSOL, he will find that there is some sense to it after all: the 27 antennas of the array form a very powerful telescope.

As you may have gathered, I, like many other molecular line observers who have primarily used the 140-foot and 36-foot telescopes, had not previously learned much about interferometry. During the past year when they added the spectral line capability to the VLA, it became time to learn.

The primary reason for our interest in the use of the VLA is that we can obtain higher angular resolution than with a single dish. For many problems, this higher resolution is absolutely critical. For example, recently I used the VLA to observe a 19-cm wavelength emission line of formamide (formamide(NH_2CHO) is a sort of heavy, foul-smelling liquid at room temperature on earth). This line had been first observed by Carl Gottlieb, Lee Rickard, and me with the 140-foot telescope in 1971. We proposed an explanation for this and similar emission lines seen at cm-wavelengths against continuum sources. In our model, the emitting gas cloud must lie exactly along the line of sight to the continuum radio source. However, with a telescope beamwidth of 19 arcminutes we could not make a precise enough determination of the position of the cloud to check the theory. Also, to check and

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further develop the theory, one would like to compare measurements of this 19-cm line with those of the many other molecular lines near 3-mm wavelength made with the 36-foot telescope.

However, at this wavelength, the 36-foot telescope has a beamwidth of about 1 arcminute. Direct comparison of our original measurements with 36-foot measurements might be totally misleading: the different lines might come from separate clouds several arcminutes apart and we would not be able to tell the difference. In August, using the VLA, I was able to measure the 19-cm NH_2CHO line with an effective beamwidth of about 1/2 arcminute. The cloud does lie along the line of sight to the Sgr B2 radio source, and I can now make use of the mm-wavelength line data in my analysis.

What is it like observing at the VLA? First, one must make up the actual observing program; that is, the detailed schedule of when to look at the source, when to look at the calibration, when to change frequency, etc. Care is needed to make an efficient schedule but once this has been done and the observing program has been typed in at a terminal and stored on disk (frequent invocation of higher powers seem to aid me), the observer need only sit around and wait for his program to begin. The actual observing is mostly boring because it marches along under computer control. An entire antenna may develop a problem, drop out of the array for a while to be repaired, and then start up again almost without the astronomer noticing! The observer can monitor the data to some degree, but otherwise, he doesn't have much to do but wander around and look at things.

By the end of the observing period, the astronomer has invested perhaps one day of work: 1/2 day planning and typing in the observing program and 12 hours observing. With this effort, he has obtained a vast amount of absolutely unique data. To this point, it seems like an unbelievably easy way to do significant research. But, from here on the astronomer must earn his keep. The current

Pat Palmer, his VLA spectral line studies completed, gets back down to earth.

spectral line data reduction system is an interim one and its basic plan is to make the spectral line data look like continuum data and process it as such. (Hence, most of the following description applies to continuum data reduction also.)

First, the vast amount of data that has been collected must be edited and calibrated. How easy this is depends on many factors. For some programs it can be done in 6 hours or so, but for others it can easily take several days. Since the computing resources required are fairly large, it is most efficient to work outside of normal working hours when the load on the computer is lightest. This usually means working nights and sleeping days. Thus, visiting observers often appear as pale, mysterious hermits who straggle in in the late afternoon, grab some coffee, and set out to find a terminal to sit hunched over until the next morning when they will collapse again. When the calibration is finished, the map-making begins.

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Finally, one can see the data in a clearly understandable form, and often in a few more nights he can hope to be finished.

The final products are maps of intensity as a function of position in the sky. Since the line observer needs to determine the intensity as a function of position in the sky, and as a function of frequency, he has added a third dimension. The only practical way to do this now is to make a map at each frequency of interest. In the "worst case" with the VLA, one would observe some line using 256 frequency channels, and in principle have to make 256 maps to get all of the available information on the angular distribution of line emission as a function of frequency. Even though the programs are exellently designed, such a task would require that the observer spend a horrendous amount of time sitting in front of a terminal processing data (and a large amount of time bookkeeping). In addition, it requires computer time. Last spring, Stan Hansen and Ken Johnston are reputed to have made 800 maps in a study of OH maser emission from W49 and Orion A, driving themselves -- and others trying to use the computer -- nearly mad. Actually, things are usually nowhere near this bad and often the observer need analyze only a few groups of channels across the line. In my experiments, I usually had perhaps 6 or 8 channels to analyze. Because of the newness of the spectral line system, unexpected problems in handling the data arise much more frequently than they do with the continuum system. However, Eric Russell and Gareth Hunt have always responded quickly with solutions to the problems. In fact, such problems are now becoming relatively rare. In addition, although this is only an interim system, Eric and Gareth have continued to make improvements that greatly streamline its use. As an example of how things can work with a knowledgeable observer, Arnold Rots, in October, had his data edited, calibrated and color photos of the maps finished within two days of the observations. With the interim system (and our own lack of experience) VLA spectral line studies can be exhausting, and at times maddening, but of the many observers I have seen here, none doubt that it is worth the effort.

By now a number of spectral line programs have been carried out, and interesting scientific results have been obtained. In a program with Demetrium Matsakis, Ake Hjmarson, Al Cheung, and Charles Townes, I have been studying NH_3 lines in several sources. Not surprisingly, these are sources studied long and hard by line observers using the other NRAO telescopes: Orion, DR21, and Sgr B2. Again, the vastly improved angular resolution is the critical factor. Earlier single dish studies of NH_3 in Orion had revealed a number of peculiarities in the KL-region. These lines are highly excited, apparently corresponding to a high temperature for the molecular gas, and have large line widths, corresponding to very rapid gas motions. The best angular resolution with a single dish is obtained at Bonn with the 100-meter dish which for NH_3 studies has a beamwidth of only 40". One feels very good about the Bonn radio data until he looks at a recent infrared map of the region. This map (with $\sim$ 2" resolution) reveals 9 infrared peaks in a region only $\sim$ 20" in diameter, and the obvious question is: how does the NH_3 emission fit in? Last March we observed the (4,3) line of NH_3 in Orion with a beamwidth of a few arc seconds. We find that the (4,3) line primarily comes from two sources about 5" apart, and that these sources are along the side of one of the infrared peaks called IRs4. Currently we are weighing two quite different explanations: these sources may be protostellar condensations or they may just be clumps of gas that are excited by radiation and material flow from IRs2, one of the nearby infrared sources. We are currently analyzing both models.

And, finally as we near the end of this article, I must admit that I have not been involved in all, or even most (though, hopefully some) of the interesting spectral line programs carried

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out so far at the VLA. I cannot review them all, of course, but I will describe a somewhat arbitrary selection.

In July, Arnold Rots, Hélène Dickel, Rick Forster, and Miller Goss observed the H_2CO maser in NGC7538. This line was first noticed about 5 years ago in observations at Bonn with a 2.3 arcminute beam. An emission line was seen and it was only the second source in the sky to show the 6-cm H_2CO line in emission. The possibility that it was a maser was considered and found unlikely. Then, last year the above group observed at Westerbork and found that the line source was $< 4.0"$ in diameter implying that it is a maser. The VLA observations with higher resolution and sensitivity showed that the source contained two components with diameters $\leq 0.1"$ and separated by a few arc seconds, and that each is somewhat circularly polarized! Thus, the source is decidedly a H_2CO maser and displays many of the properties of OH and H_2O masers. That this source is fairly unique was demonstrated a month later when Ken Johnston, John Beiging, and I beat our heads against the wall studying Orion, the only other known 6-cm H_2CO emission line source. Even with all of Ken's tricks for spectral line interferometry, we found no maser.

In October, John Beiging, Tom Wilson, and Tom Pauls observed the (3,3) NH_3 line in Orion. (This line differs from the (4,3) line that we observed because it arises from a metastable state and hence can be excited in lower density regions.) They obtained a beautiful map (with much better signal-to-noise than we had). They found that the (3,3) arises from two small components, and at first glance, the (4,3) and (3,3) maps look very similar, except theirs is nicer. Detailed comparisons will be made.

Some fascinating observations of OH masers associated with evolved stars were made by Boudewijn Baud, Anders Winnberg, and Henry Matthews. Similar stars have been the subject of VLBI studies, and many very small emission sources scattered around the stars were found. After the VLBI studies, one might ask: why use the lower resolution of the VLA? The results for the first star completely analyzed give an answer: emission features with sizes $\sim$ 3" - 5" were found to be centered on the star. Thus the "hot spots" found in VLBI work are only part of the story. The OH in the entire circumstellar envelope has a population inversion and is masing. Thus, one need not consider such as extreme models as would be required to produce many little, separate masers as suggested by the "hot spots". Rather, the entire envelope has a population inversion, and the "hot spots" probably do not differ qualitatively from the rest of the envelope, but only quantitatively.

In summary, with only the interim spectral line system, many important scientific results have been obtained. Perhaps more importantly, the experience gained in working with this system has helped us understand more clearly what is needed in the "final system". In any case, the VLA is quickly taking its place as radio astronomy's most powerful spectral line instrument.

* * * * * *

"Roughing It? In Datil"

Alison Patrick

For a girl who grew up on the edge of a large city, coming to the "wilds of New Mexico" was more than an adventure, it was the beginning of the fulfillment of a dream. I had always had a horse or two, a couple of calves and assorted other animals of one kind or another but in a suburban area you can always run down to the corner shopping center when you run out of something.

Living in Datil is like moving to the edge of the universe, and I don't regret it one minute. No more smog, no more cars and trucks going by at all hours, no more horrible headlines in the morning

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papers. As a matter of fact, we don't even get a paper! There isn't one in Datil. With 100 people, give or take a handful, there doesn't seem to be too much happening that isn't all over town by word of mouth in 15 minutes anyway. The crime rate must be in the minus figures too, nothing ever happens! Very few people even bother to lock their doors.

Most of the people who live here heat with wood and quite a few use wood cookstoves during the winter. When the temperature drops to 20 below, or lower, a wood cookstove can sure work wonders in heating the kitchen and there is no way to describe the difference in a batch of bisquits or warm loaves of bread cooked in a wood stove. It almost makes one regret the coming of summer. Wood is plentiful in Datil, most of the surrounding area is National Forest with piñon pine and cedar thick and ready for the taking. No permits are needed for cutting wood for home use.

Datil is tucked in the foothills at about 7,900 feet, 68 miles west of Socorro. The air is crisp, clear, cool in summer and sometimes downright cold in the winter. Snow usually starts around the first of October with an inch or two now and then, usually melting in a day or two when the sun can get to it. Then, around the first of the year until April or May, 6 to 8 inches at a time and not always melting. Since my children were born and raised in Phoenix, this white stuff is looked forward to with a mixture of excitement and dread. Snow ice cream is a real treat and sliding down the hills on plastic bags and inner tubes is great fun but Mom sure gets cranky when it gets tracked in or the front porch doesn't get swept off!

Right now, we live in a trailer that our wood stove keeps warm and cozy enough but eventually we will build our own log home, complete with wind and solar power and maybe, just maybe we can become self-sufficient enough to tell the electric company to go raise someone elses bill. Where we are now and looking ahead there is no one anywhere I would ever trade places with.

* * * * * *

BIRDS OF THE VLA SITE

Dick Thompson

The best known birds of the VLA site are the Great Horned Owls that make their home in the antenna assembly building. Most of the time they spend their days roosting on the high beams near the roof of the 105-foot high building. One or more of them have usually been present since the winter of 1975. Pat Chavez, who was a member of the E-Systems' construction team in the early years of the project, recalls that one year several eggs were laid on the bare beams and fell to the floor. Fortunately, the building had always been designated a hard-hat area! The next year the E-Systems people thoughtfully placed a large, open box about 30 feet up on the southwest wall of the building and the owls successfully nested in it. Every year since then, a pair of Great Horned Owls have continued to use the box, usually raising two young birds.

In woodland areas Great Horned Owls usually lay their eggs in the abandoned nest of some large bird such as a Red-tailed Hawk. Their lack of skill in nest building evidently accounts for the egg problems that occurred before the box was provided.

Great Horned Owls are the largest and most widely distributed of North American owls. They prey upon animals as large as cottontail rabbits and skunks, but much of their food usually consists of smaller rodents. In the New Mexico area certain small rodents and their parasites are carriers of plague, and the owls and other birds of prey make a contribution to the control of this population.

Barn Owls have occasionally been

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found roosting amongst the backup structure of antennas parked in the stow position. These owls are markedly smaller than the Great Horned, and are largely white in color with buffish-orange back and wings. I particularly remember one which emerged in alarm from an antenna that Bill Horne and his crew had just picked up with the transporter and started to move away. That was in the early days of the construction when antennas were often parked out on the array arms for several weeks before being outfitted. I have not seen a Barn Owl at the site for over a year.

Of the diurnal birds of prey of the San Augustine Plains, Golden Eagles are the largest and most impressive. They can occasionally be seen perched on the power poles along old U.S. 60. Many of them are young birds with white markings on the wings and tail, and lack the golden tinge on the head and neck.

Only once have I seen a Bald Eagle at the site. On that occasion it flew over while I was walking back to the control building after lunch, and by the time I had borrowed the binoculars from the observing room it was out of sight. Several Bald Eagles usually spend the winter at the Bosque del Apache National Wildlife Refuge about 60 miles to the east. They are attracted by the flocks of waterfowl there, and their prey includes birds wounded by hunters. They spend a lot of time sitting in the big, old cottonwood trees by the marshes and leave to the Golden Eagles the more arduous hunting on the open plains.

Hawks and Eagles of the Plains of San Augustine are most numerous in winter after they have left their nesting areas in the mountains or in the plains to the north. Ferruginous Hawks are the largest and most numerous of the hawks. They are generally white with occasional flecks of brown on the breast and underparts and medium to dark brown on the back and wings. These features show up clearly when they are perched on power poles or fences. Most of the birds that one sees are young ones. Fully adult birds have rust-colored markings on the wings and thighs from which they get their name. Rough-legged Hawks and Marsh Hawks are also to be seen, but less commonly than the Ferruginous. The only Sharp-shinned Hawk that I have seen at the site was in November 1976, when Ramon Molina, of the VLA antenna division, caught one that had flown inside one of the workshop buildings.

Two species of falcons, birds of prey with slim, pointed wings and rapid flight, frequent the VLA site. These are the small, colorful Kestrels, also known as Sparrow Hawks, and the graceful Prairie Falcons. In their size, shape, and speed of flight, Prairie Falcons closely resemble the rare and endangered Peregrine Falcon. However, instead of being largely dark brown or gray like the latter, Prairie Falcons are a desert-sand color, in perfect coordination with the landscape of the plains.

During the recent VLA dedication ceremony, while the audience listened with rapt attention to the words of Gerry Tape, one of these beautiful birds came speeding from the direction of the north arm of the array, circled up above the control building and disappeared over our heads towards the west. Even without binoculars one could see the small black patches at the base of the wings which are a distinguishing mark of the bird. For me, the Prairie Falcon contributed the high point of the ceremony that day.

One of the smaller birds that nest and raise their young at the VLA site, is the Loggerhead Shrike which has some of the characteristics of a bird of prey. A pair of Loggerhead Shrikes have raised their young at the site for several summers, and the empty nest in the piñon by the flagpole belongs to them. A shrike is a little smaller than a robin and mostly gray with black and white markings on the wings, tail and face. Shrikes prey upon insects and also small birds and animals, and have the habit of impaling them upon sharp thorns, for reasons that no one really understands. For some

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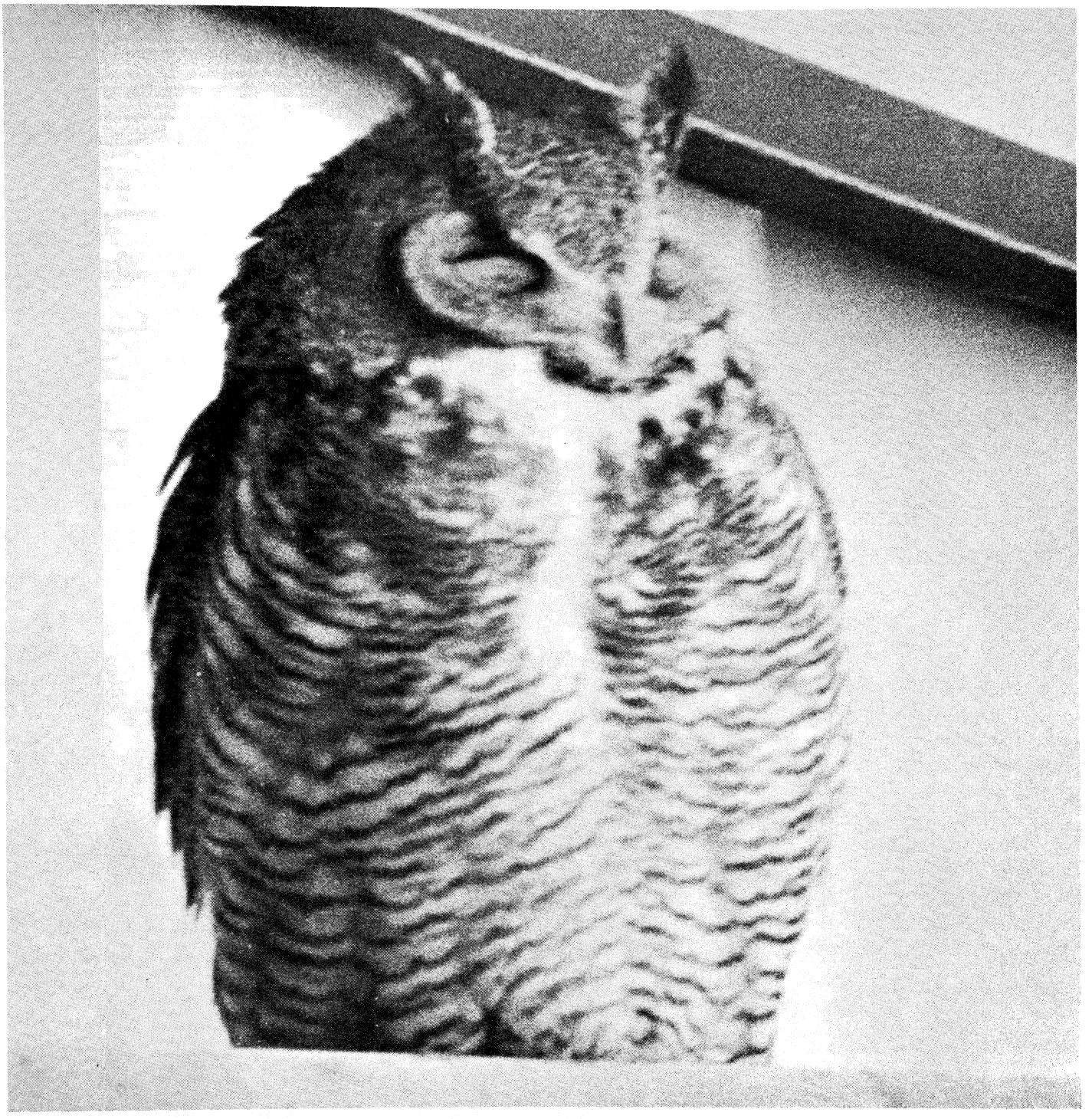


Great Horned Owl in the Antenna Assembly Building. Photographed by Daryl L. Grant, December 1980.

months in 1977, the pointed leaves on the large yuccas in front of the control building and cafeteria were adorned with the remains of several horned toads, small lizards and sundry unfortunate creatures.

Occasionally a shrike will take relatively large prey. One December morning in 1976, I heard the sound of a bird flying into my office window. Looking out I saw a shrike flying off, and thought it had suffered the collision, until I noticed that it was carrying in its claws a junco, a bird only slightly smaller than the shrike itself. I have no idea whether the shrike had been chasing the junco or whether it just took advantage of a chance accident.

Other small birds that nest at the VLA site include Say's Phoebe, a species of flycatcher with a brownish-orange breast. In July or August of most years, a pair of these birds can be seen feeding their young near the back of the control building, their nest being tucked away in some corner beneath the visitor's gallery. Rock Wrens frequent the piles of railroad ties and probably find places to nest among them. Some of the other small birds appear only on migration, and are evidently attracted by the shelter of the buildings and pine trees. Unfortunately, a few of them end their journey forever by flying into the large areas of glass around the main entrance door of the control building. The most noticeable of these small migrating birds are warblers of various species including Wilson's and the Yellow-rumped Warblers and the Yellowthroat. Any bird seen in spring or fall, smaller than a sparrow and largely yellowish or olive green, is likely to be one of this group.

In the open plains, the commonest small birds are the Horned Larks, which like the owls, derive their name from having small tufts of feathers on each side of the head. The larks are especially numerous in the winter time and rise in flocks from the road sides as one drives by. In the cold weather they are joined by numbers of Chestnut-collared Longspurs, small sparrow-like birds which nest in the open country of more northerly states. It is rather difficult to sort out the different species in the winter flocks since they are usually either hidden among the grass or flying rapidly away. The best tactic is to sit by some open water, such as the VLA sewage lagoon, and watch as the flocks alight to drink.

To the hard-core birder, the sewage lagoon is undoubtedly the most interesting feature of the site. Open water on the arid plains is a great attraction to migrating birds, particularly to shorebirds, a group that includes ome of the longer legged birds that frequent marshes and shallow water. Those that I have seen at the lagoon include four species of sandpiper: the Spotted, Western, Least and Baird's. Other shorebirds that have visited there are the Greater and Lesser Yellowlegs, Marbled Godwit, American Avocet, Long-billed Dowitcher, Wilson's Phalarope and Common Snipe. Small flocks of ducks including Bufflehead, Green-winged and Cinnamon Teal, Pintail, Shoveller, etc., can sometimes be found on the lagoon. A White-faced Ibis, Horned Grebe and a pair of Short-eared Owls have also been seen there.

One shorebird species, the Mountain Plover, is not attracted by water but is found on the open plains. Mountain Plover are known to have nested on the Plains of San Augustine in the first half of this century but at present they seem to appear only during the spring migration. They are certainly one of the birds that could easily be overlooked, and credit for noticing them at the VLA site goes to Dave Heeschen who identified them when taking a walk down the west arm one evening in March, 1978.

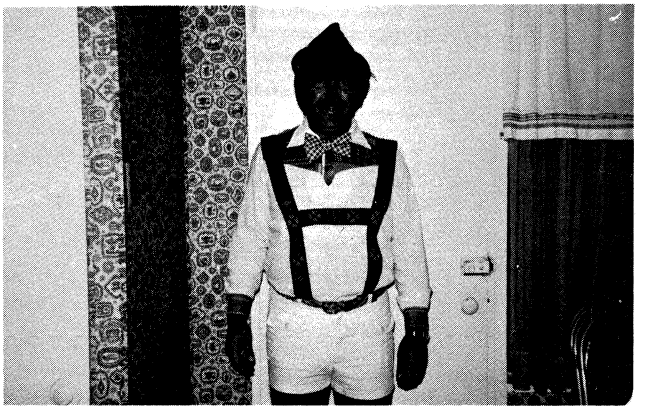
The birds mentioned above are only some of the more interesting ones to be seen at the VLA site. Other species that I have not yet seen here are to be expected so, hopefully, there are some new ones yet to be found.

* * * * * *

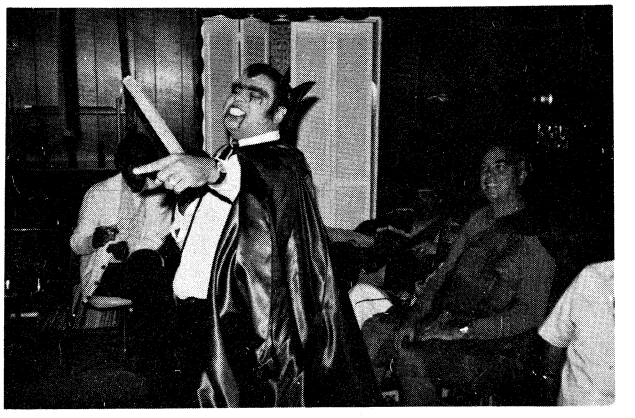
GOBLINS AND WEIRDOS

Rick Hagen

It's not all work and no play at the VLA. At our pot luck dinner and Halloween Party last year, some of the guests came dressed in the best Halloween costumes we've ever seen. A sample of a few of the costumes are pictured here.



It looks like more than Rick (Pinnochio) Hagen's nose is growing -- might be caused by too much Cerveza.



Dracula (played by Andy Sanchez) with James Cole the Jolly Green Giant looking on.

Jack and Phyliss Lancaster in attire typical for Socorro on Saturday nights.

Jo Egler clowning around with Jon Spargo, Bill Delguidice and Bill Randolph.

Shirley "you jest" Melton

Ina Cole with her "medicine" cabinet.

HIKING ON SOCORRO'S SKYLINE

Peter Napier

When I used to hike in Virginia and West Virginia I always had problems with trees. After staggering exhausted to the top of a mountian, instead of being rewarded with a glorious panoramic view, all I would usually see was trees! The opportunity to move west with the VLA in 1975 presented me with a solution to the problem. Probably most of the United States thinks of New Mexico as a desert state. In fact, it is much more correct to think of New Mexico as a mountain state. Less than one-third of the state lies below 5,000 feet above sea level, and there are at least fifty-five separately named mountain ranges. Almost none of them are covered with trees on top!

There are several interesting mountain hiking areas within sight of Socorro. Here is a brief guide to some of them.

Twenty five miles to the north of Socorro is the high, rugged mountain, Ladron Peak (9,176 feet). Ladron is the Spanish word for robber and the mountain used to be a meeting place for Navajo and Apache horse thieves. Ladron is most easily climbed from the road that runs from Magdalena, through the ghost town of Riley, to the town of Bernardo on I-25. When you are due west of Ladron Peak on this road, a prominent white dirt road can be seen over on the lower slopes of the mountain and you should make your way over to this on the numerous four wheel drive roads. From the end of the road Ladron can be climbed in two to three hours up steep rock slides. There is no trail but there is a marvelous view from the top up and down the Rio Grande and if you are lucky you may stumble across the silver treasure which was supposed to have been hidden on the mountain in Spanish times.

If you are driving to Ladron from Magdalena, an interesting side trip is a visit to the Riley Cave. This is quite a large cave with several different rooms and crystal deposits. Be careful though, when Dave Weber and I first visited this cave we were amazed by the quantities of what we thought were rabbit droppings that we saw as we squeezed into all the nooks and crannies. A local expert later assured me that these were in fact rattlesnake droppings! The entrance to the cave is about 100 yards along a trail on the west side of the road exactly 3.1 miles from the Rio Salado crossing.

A much easier climb than Ladron is Polvadera Mountain (7,292 feet). Take the Polvadera exit off I-25 eight miles north of Socorro and drive north on the frontage road to the road that leads up the mountain to the Ma Bell microwave station. Its best to ask permission at the ranch with the horse stables situated at the road junction. From the microwave towers follow the ranch road up to the head of the valley and then across country to the top of the mountain. The most remarkable thing about Polvadera Mountain is the masses of prickly-pear cactus that grow on its slopes. For anyone who likes to make jelly from the fruit of the prickly-pear, this is the place to come in the late fall.

The steep pyramid shaped mountain a few miles northwest of Socorro is Strawberry Peak (7,012 feet), so named, alas, not because there are strawberries growing on top but because from some angles it looks like one. Strawberry is a worthwhile short day trip because it looks right over onto Socorro and the Rio Grande and because it is steep enough at the top that you feel you have really climbed something when you get there. The mountain can be climbed from the west or east sides. From the west side, ask permission at the Water Canyon Lodge and then take the ranch road by the large black water tank, just west of the Water Canyon turnoff. Drive through the stockyards and then follow the dirt road (barely negotiable for a VW bug) to the abandoned ranch at the foot of Strawberry. On the way in, you pass the old stagecoach station/jail which used to service the Magdalena to Socorro stagecoach

run. Strawberry can be climbed in about two hours via its south ridge, or, if you are feeling a little more adventurous, by picking a route up through the cliffs on the southwest side. On the way down visit the old stone corral and well in Nogal Canyon between Strawberry and Socorro Mountains. From the east side it takes about five hours to climb to the top from the end of Newbury Road in Socorro, following up the arroyo which runs down from Nogal Canyon.

The town of Socorro sits at the foot of Socorro Peak (7,243 feet). This is an exceptionally rugged mountain covered with cliffs of volcanic rock and old silver mines. Twelve miles beneath Socorro Peak is a large body of magma which gives rise to 2 or 3 micro-earthquakes (less than 3.0 on the Richter Scale) a day and maintains a constant temperature of 96° F at the ends of the mines 400 feet below the surface. Socorro Peak (or M Mountain as it is known locally) lies within a Federal Military Reservation which is used by the TERA (Terminal Effects Research and Analysis) research group of the New Mexico Institute of Mining and Technology to carry out ballistics research. A special permit from TERA is needed for each person wanting to hike on Socorro Peak, but the permit is readily given after a visit to the TERA office on campus. The most interesting route up Socorro Peak is to follow the road from the security gate at the Socorro Golf Course until it turns toward the armament facilities in Blue Canyon. At this point hike across country and up the prominent canyon which descends the face of the mountain directly facing Socorro, just south of the peak with the M on it. This route consists mainly of steep rock slides with an occasional scramble around a dry waterfall. You will know that you are on the correct route if you keep finding golf balls because this is the route of the annual Elfego de Baca Shoot in which golfers tee off of the top of M Mountain and attempt a hole in one on the golf course 2,700 feet below. Easier routes up the mountain are provided by following the road further up into Blue Canyon or by taking one of the less steep ridges above the old silver mines. The summit, which can be reached in three or four hours, provides a glorious panorama of Socorro and the Rio Grande Valley on one side and the Magdalena Range on the other.

The prime attraction for Socorro hikers who want to hike close to home is

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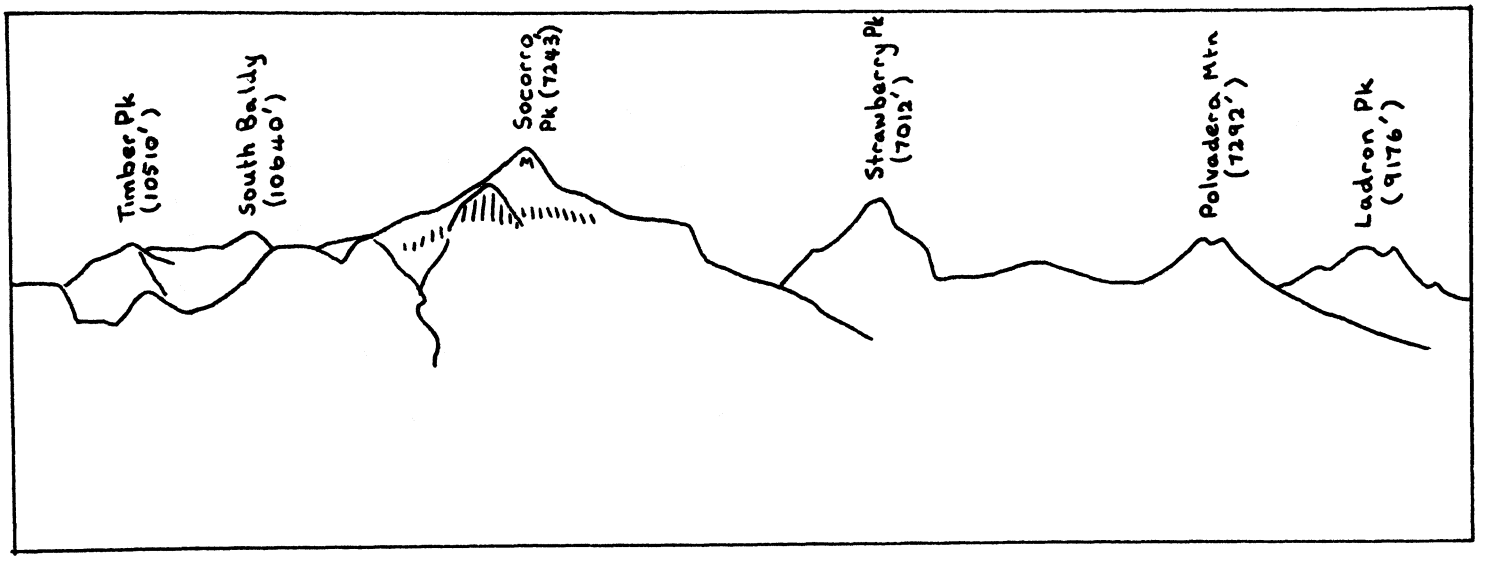

The Western Skyline of Socorro

the Magdalena Range portion of the Cibola National Forest which reaches its high point of 10,640 feet above sea level at South Baldy Peak. I can drive my VW bug to within about 200 feet of the top of South Baldy in about 50 minutes from my home in Socorro, depending on the condition (which can at times be very bad) of the road from Water Canyon up the mountain. From the end of the road there is a beautiful four mile trail over South Baldy and along the crest of the range to North Baldy (9,858 feet). This trail is at an elevation of over 10,000 feet for most of its length and passes through alpine meadows and ponderosa pine forest. For those hardy souls who prefer to hike rather than drive, South Baldy can be climbed in about four hours using forest trail number 11 which starts from the sharp bend in the road about 2½ miles above the Water Canyon Campground. If you like snowshoeing or plodding through deep snow, this is an excellent mid-winter's day trip. A less strenuous, high elevation day trip is a climb of Timber Peak via forest trail number 70 which runs along a narrow, exposed, grassy ridge from a point approximately 2 miles below the end of the Langmuir Lab road. There are many other trails originating in the Water Canyon area. A full day trip can be made passing from Water Canyon to South Canyon on trail 15 and returning to Water Canyon on trails 12 and 13. On this trip, in South Canyon, I saw the only black bears that I have seen in the Magdalena Mountains.

The hikes I have described here are all day hikes. If you would like to try something a little longer or more challenging Socorro is within four hours driving time of the mountains in the Blue Range Primitive Area, the Black Range Primitive Area, the Gila Wilderness, the White Mountain Wilderness, the Wheeler Peak Wilderness, the Manzano Wilderness, the Sandia Wilderness, the Pecos Wilderness and the San Pedro Parks Wilderness. An excellent reference for the trips in these areas is the book, Guide to the New Mexico Mountains by H. E. Ungnade, Published by UNM Press, 1973.

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A LETTER FROM THE WHITE HOUSE SEPTEMBER 29, 1980

Perhaps more than any other science, astronomy epitomizes man's quest to understand the nature of the universe -- its origin, its composition, its destiny. The dedication of the Very Large Array marks another step forward into a new era of astronomy.

This magnificent radio telescope -- the world's largest -- is our most recent and powerful instrument in this quest. Its unique design and construction will allow radio astronomers to search out and examine the most distant celestial objects, to study the formation and distribution of matter deep in space and to solve many fundamental mysteries of physics, chemistry and the cosmos.

Great credit is due to the organizations and individuals whose ideas and efforts have made the VLA possible: the National Science Foundation, the National Radio Astronomy Observatory, Associated Universities, Inc. and those members of the astronomy community who conceived and nurtured this new national facility.

The scientific research that will be made possible by the VLA is of the highest order. It is an endeavor worthy of a great nation. I know that Americans everywhere join me in congratulating all those associated with the VLA and in wishing them every future success.

Signed,
Jimmy Carter

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U. S. ARMY FORTS AND INDIAN BATTLES NEAR SOCORRO

Dave Weber

During the middle to late 1800's there were many U. S. Army posts, forts and camps in New Mexico which were the logistic bases for the army campaign against the Apaches, Navajo and Comanche Indians. Several of these army bases and Indian/army battle sites are near Socorro and would make interesting day trips (if you can find them).

Following the Mexican War, army detachments were garrisoned in many towns and villages to protect the civilian population. Local villages which had detachments were: Socorro, Luis Lopez and Valverde. In 1851, Col. Edwin Vose Sumner assumed command of the army troops in the New Mexico Territory and was ordered to establish permanent posts for more effective action against the Indians. Had Sumner had a choice he probably wouldn't have built any forts. It was fairly well known that Sumner did not have a high regard for the New Mexico Territory and felt that the United States should force Mexico to take it back. Barring that wistful suggestion, he felt that the natives should be armed and allowed to fend for themselves.

The Mescalero and Mimbreno (also called Gila or Warm Spring) Apache bands were the most troublesome in the area. These two tribes spent a good deal of time terrorizing the people. The forts that Sumner was to establish would be instrumental in the Army's campaigns against these Indians.

After the Civil War broke out the New Mexico Army activities were shifted from Indian campaigns toward repelling the Confederate invasion. Noting this absence of army pressure on them, the Apaches and Navajos felt that they had driven the U. S. Army from the field and increased their activities. When the California Volunteers arrived in New Mexico in 1862, they resumed the Indian campaign under the direction of General Carleton who had previously served with the Dragoons in New Mexico. Conditions were pretty bad in New Mexico at this time.

Carleton's California Volunteers and the New Mexico Volunteers rounded up about 9000 Apache and Navajo Indians which were placed in a new reservation, Bosque Redondo, on the Pecos River. He founded Fort Sumner to oversee these Indians. After a few years it became apparent that there were too many Indians for the resources of the country so the Navajos were permitted to return to their home country and the Mescaleros were given a reservation in the Sacramento Mountains.

The Mimbreno Apaches were eventually (in 1869) given a reservation at Ojo Caliente on the southwest side of the San Mateo Mountains. Victorio and Loco were the leaders of this band which became fairly well behaved when they received a food subsidy. Unfortunately for them Geronimo and his followers took up residence there and the events following his capture turned Victorio and his band onto the warpath for a long Indian war. The San Carlos Indian agent, John Clum, was ordered by the Indian Bureau to capture Geronimo, if possible, and to move Victorio and his band to San Carlos in Arizona.

Victorio and his followers broke San Carlos and returned to Ojo Caliente, later they were moved to Fort Tularosa (now known as Aragon), back to Ojo Caliente and finally to the Mescalero agency where he might have stayed if it hadn't been for a misunderstanding that led him to fear for his life and run into the mountains. He rode with some Southern Apaches, Chiricahua (Cheer-a-kaw-a) and Mescalero raiders from Mexico, the Davis Mountains, and the Mescalero Reservation and perhaps some Comanches.

In his four campaigns, Victorio ranged from Mexico to the Black Range, San Andreas and the San Mateos, with U. S. Cavalry troops constantly in pursuit. He was finally killed in Mexico by General Terrazas.

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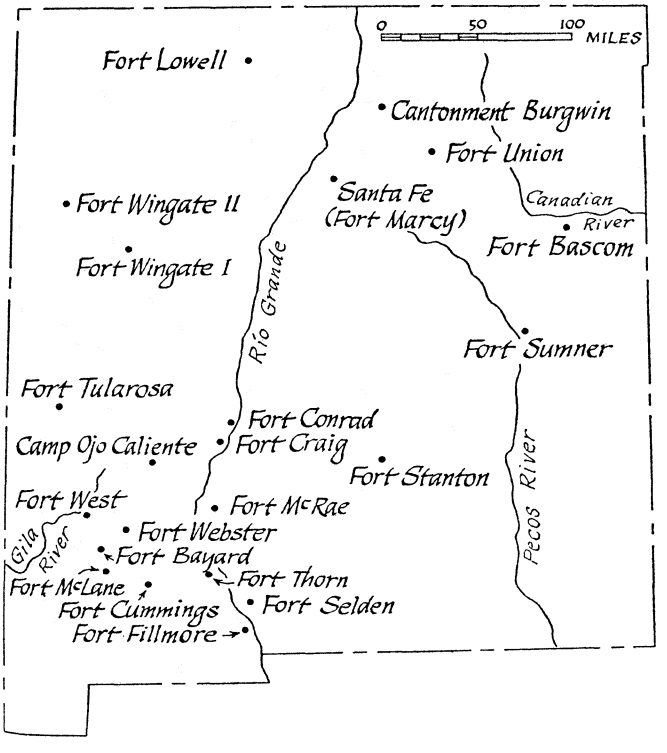
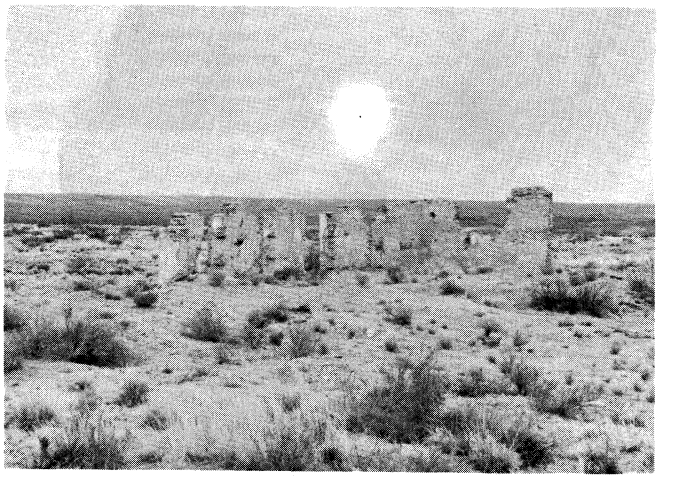
After Victorio's death, Nana (about 80 years old) lead a raid out of Mexico and there was a fight with the cavalry in Monica Canyon in the San Mateos and another battle west of Sabinal.

During the Geronimo campaigns, troops were stationed near Datil. In October, 1885, the army established a post called Datil/Horse Springs near the ground now occupied by the Datil Springs Camp Grounds of the Bureau of Land Management. The post was closed in September, 1886.

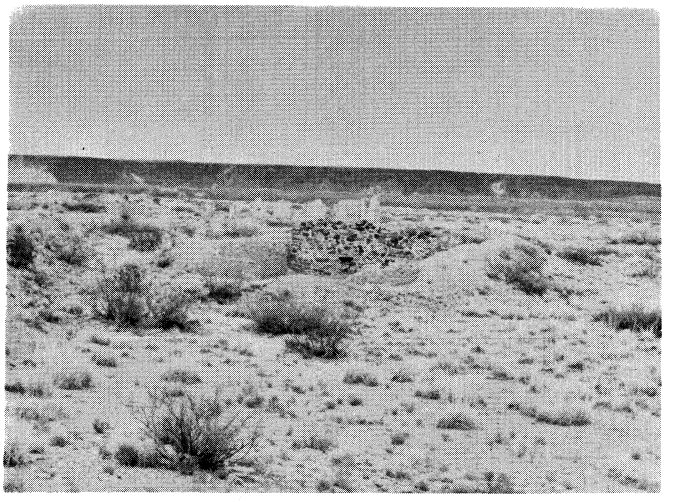
That the Government had built many forts in this area is clearly shown on the map below. A brief description of some of these forts follows. More information about the forts of New Mexico can be found in Forts of the West by Robert W. Frazer.

Conrad: Located on the right side of the Rio Grande, twenty-four miles south of Socorro, was established on September 8, 1851, and was abandoned on March 31, 1854.





Fort Craig officer's quarters.



Earthworks and walls of Ft. Craig. Black Mesa is visible in the background. Val Verde battle site is on the left.

Craig: Located on the tableland to the right of the Rio Grande about four miles below the present town of San Marcial, was established on April 1, 1854, and was abandoned in 1885. An interesting outpost of Ft. Craig was a sawmill which was set up in Mill Canyon on the west side of the Magdalena Mountains at about 8,000 feet

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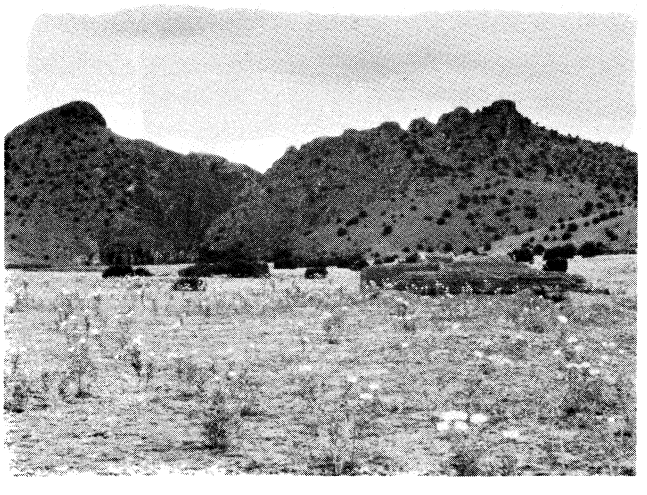
elevation. Troops cut lumber for Ft. Craig and other posts and did a little prospecting on the side. This site is easily accessible and one may still find artifacts there such as buttons, buckles, and shoulder scales (an anachromistic form of armour worn by the cavalry in the 1850's).

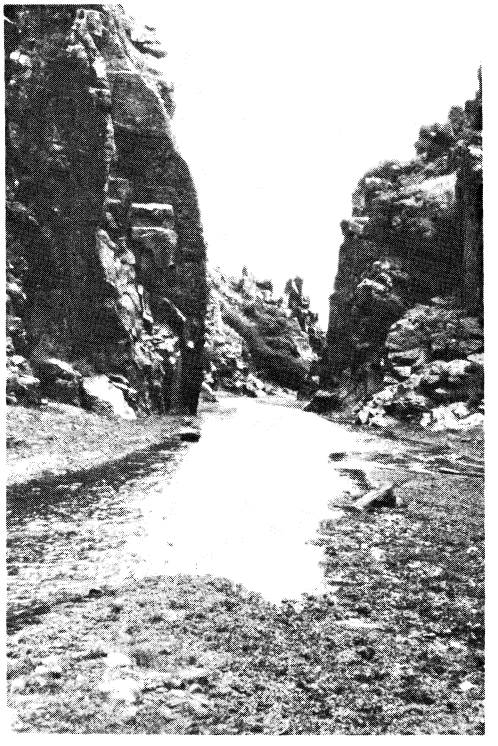
Fillmore: Established on September 23, 1851, and situated about six miles south of Mesilla on the left bank of the Rio Grande. Troops were withdrawn from this fort on October 10, 1862.

McRae: Located near Ojo del Muerto, about five miles west of the Jornada del Muerto and three miles east of the Rio Grande. It was established on April 3, 1863, and abandoned on October 30, 1876.

Ojo Caliente: Near the foothills of the San Mateo Mountains on the right bank of the Alamosa River some eighteen miles north of the present town of Winston. (It was a camp and never officially designated a fort.) Ojo Caliente was established in 1859 and abandoned during the Civil War. Ojo Caliente is an interesting area a few miles south of Dusty. The adobe agency building's walls are still standing and the many springs (some of them hot) make it a pleasant area.



Ojo Caliente, Cuchillo Negra Mountains and springs are in the background.



Ojo Caliente springs.

Selden: Located at the southern end of the Jornada del Muerto, about one and one-half miles east of the Rio Grande, some twelve miles above the town of Doña Ana. It was established on May 8, 1865 and permanently abandoned in April 1889.

Stanton: Originally located on the Rio Bonito approximately two miles south of its later site. It was established on May 4, 1855 and abandoned as a military post August 17, 1896 and transferred to the Interior Department.

Thorn: Established December 24, 1853 on the right bank of the Rio Grande at Santa Barbara, now Hatch. It was not used after July 5, 1862.

Tularosa: Located in the present Catron County. Original site was on the left bank of Tularosa Creek, about 15 miles north of the town of Reserve. Established on April 30, 1872 and moved 18 miles east of the original site to Horse Creek. On November 26, 1874, the fort was abandoned.

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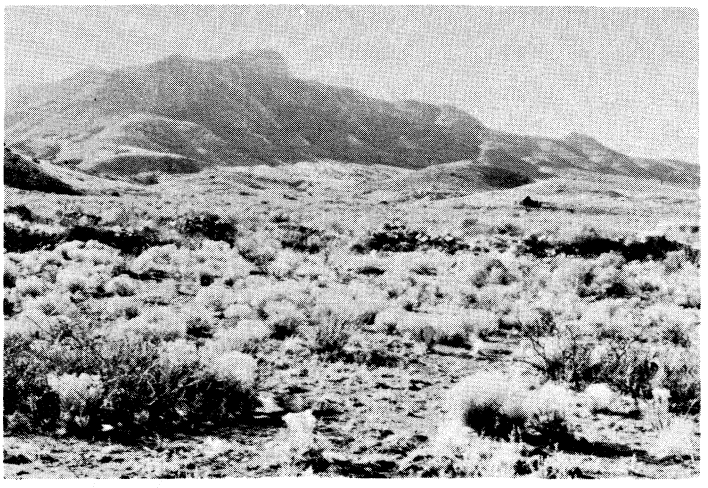
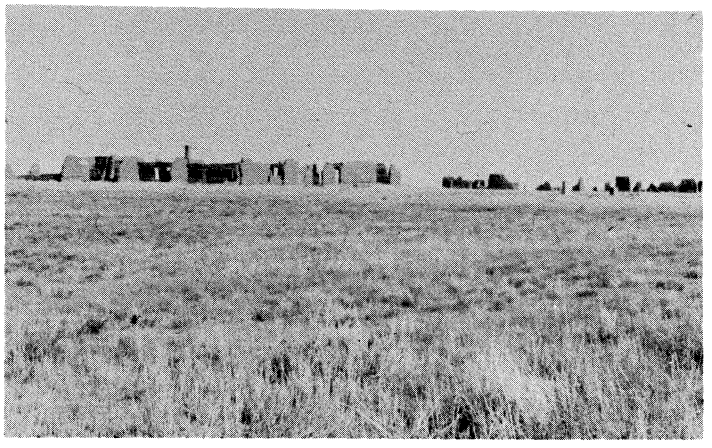


Cook's Peak, Cook's Range, Fort Cummings is in the canyon over the hill.

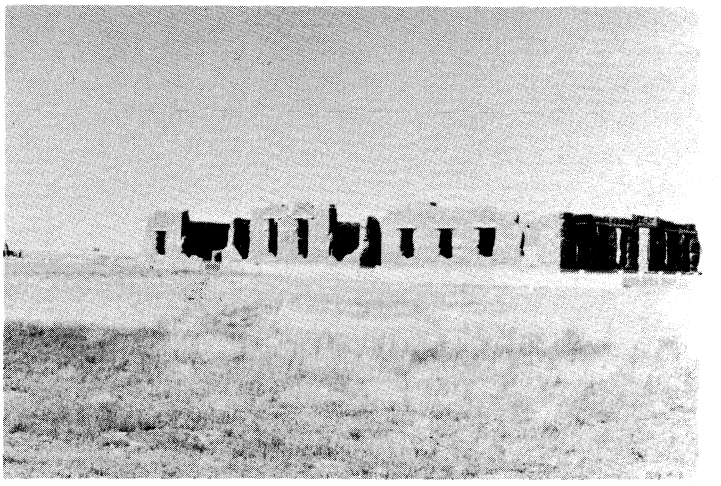
Cummings: Established October 2, 1863 at Cook's Springs in the Cook's Range, 53 miles west of the Rio Grande, on the Mesilla-Tucson road. Finally abandoned October 3, 1886.

Union: Established July 26, 1851, was originally located about 24 miles northeast of Las Vegas, New Mexico on the Mountain Branch of the Santa Fe Trail on the west side of the valley of Wolf Creek. It was later moved about a mile from the first site and east of Wolf Creek to the valley floor. The second



Fort Union barracks walls.

Fort Union officer's quarters.



Fort Union, Hospital.

fort's construction began in August, 1861. It was an earthwork structure in the form of an eight-pointed star. It deteriorated quickly and in 1863 the third and final site of Fort Union was started. Construction was completed in 1866. For many years it served as a general depot of supplies for New Mexico. When railroads moved into the area, its importance diminished. The arsenal was discontinued in 1882 and abandoned in 1891. It is now a national monument.

References:

Turmoil in New Mexico, 1846-1868, Keleher

The Conquest of Apacheria, Dan L. Thrapp

Frontier Army Sketches, James W. Steele (was commandant of Fort Cummings in 1867)

Forts of the West, Robert W. Frazer

Historical Survey of the Socorro District, Alvin Sanders

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Fort Union National Monument, National Park Service Historical Handbook No. 35, Robert M. Utley

Victorio and Mimbreno Apaches, Dan L. Thrapp

New Mexico Military Institutions, Lee Meyers

Garrisons of the Regular U. S. Army, New Mexico 1846-1889, S. C. Agnew

The Buffalo Soldiers, William H. Leckie

Frontier Regulars, The United States Army and the Indian, 1866-1891, Robert M. Utley

* * * * * *

STRANGE HAPPENINGS ON THE VILLAGE GREEN

Chris Salter

Pictured are Gareth Hunt (at the wicket) Wes Young, Norman Morrow.

The Winning Team
Front row: Peter Napier, Chris Salter, Dave Gibson, Gareth Hunt. Back row: Carl Bignell, Bill Randolph, Rosalie Ewald, Tim Cornwell, Eva Jean Rigby, Brook Ekers, Eric Russell, Claire Rigby, (the children are Celeste and John Bignell).

Passers by could be forgiven for imagining that mystical rites were being performed on the playing fields of New Mexico Institute of Mining and Technology on Saturday, November 8th. The fact of the matter is that the slow parambulations and weird cavortings of fourteen white clad figures did not mark a frightening outbreak of alien worship but the progress of the first Socorro/VLA cricket match.

The match turned out to be a truly international event with players representing the U.S.A., Jamaica, India, England, Holland, New Zealand, Canada (and even Texas!). The teams possessed a strong family element with the VLA being captained by Gareth Hunt, and Socorro by Adrian Hunt, while Eva Rigby and her daughter Claire added elegance to the VLA side. With Rosalie Ewald playing for the VLA team and Kathy Garrett for Socorro, the appearance of four lady cricketers, was greatly appreciated and it may well be significant that three of these were on the winning side.

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The VLA won the toss and elected to bat first. The observatory team and its supporters were filled with elation when Peter Napier struck the opening ball to the boundary for four runs but this joy turned all too soon to grief when Errol Watson's next delivery removed Peter's off-stump. The VLA innings proceeded by fits and starts and was given respectability only by the fine knocks of Dave Gibson (42 runs) and Gareth Hunt. Gareth finished at 43 not out having dominated a last wicket stand of 47 runs. The Socorro bowling hero was Ashok Singh who took 3 wickets for a mere 11 runs. As the last wicket fell, the scorer scrutinized his records and gravely announced that the VLA had accumulated a total of 109 runs.

"Would this be enough?" was the question running through everyone's thoughts as the two teams partook of a light (and mostly liquid) lunch. For a long time it appeared it would not and the Socorro team began their innings by showing a greater consistency in their batting than the somewhat erratic performance of the astronomical hopefuls. A fine stand for the sixth wicket by Ashok Singh and Kathy Garrett took the score up to 74 but alas for the town's side Kathy's dismissal marked the beginning of the end. Despite a spirited flourish of 31 runs by Ashok Singh the tail end of the inning collapsed leaving Socorro with a total of 91 and the VLA as victors by 18 runs. Peter Napier topped the VLA bowling with figures of 3 wickets for 7 runs.

The VLA captain led his side in three rousing cheers for the losers and then winning or losing seemed to matter less as both teams settled down to the after-match celebrations. One might well wonder whether this occasion will represent a unique experience in Socorro history? It appears not. Immediately after the game the home side issued a new challenge to the VLA for the beginning of next year's cricket season, adding only the three provisions that next time Socorro shall have first claim to the anomolously-situated Dave Gibson, that umpire Joel Siegel learns the rules of the game in the intervening period and that the scorer takes a pledge of sobriety for the duration of the play.

Final Scores

VLA	109 all out	
	Dave Gibson	42
	Gareth Hunt	43 not out
	Ashok Singh	3 for 11
Socorro	91 all out	
	Ashok Singh	31
	Peter Napier	3 for 7

Sides

VLA Peter Napier, Bill Randolph, Tim Cornwell, Carl Bignell, Dave Gibson, Rosalie Ewald, Brook Ekers, Eva Rigby, Gareth Hunt (Captain), Erik Russell, Claire Rigby, Chris Salter.

Socorro Errol Watson, Steve Toma, Manual Murtado, Wes Young, Norman Murrow, Kathy Garrett, Ashok Singh, Gopal Krishna, Adrian Hunt (Captain), Boshan Gupta, Joel Siegel, Wim Brouw (on loan).

* * * * * *

SOME NOTES ON CRICKET

John Findlay

The account of the Socorro/VLA cricket match may need a few words of explanation. Cricket is a difficult game to describe (and to play) so I will try to cover only the essentials.

A game is usually played between two teams, each of 11 players. The VLA/Socorro teams each had 12 players but this is acceptable. So also is a mix of males and females.

The game is played on a cricket field -- about the size of a baseball park, and the main action is on or near the cricket

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pitch -- which is in the middle of the field. The plan of the field shows the approximate positions of players and umpires during a game. Eleven players of one team are fielding. Two of the batting team are batting. The rest of the batting team are sitting in the shade doing nothing. In the diagram, U(1) and U(2) are umpires, WK is the wicket keeper and B(1), B(2) are the two batsmen. (I have shown 12 fielders -- in setting a field you cannot fill all these positions).

An innings starts with the bowler bowling (over-arm, stiff arm) 6 balls from wicket(2) toward B(1). B(1) can score runs by hitting the ball anywhere and exchanging positions with B(2) before the ball is returned to either wicket. B(1) is out if: (a) the ball knocks his wicket down, (b) his hit is caught on the fly by any fielder, (c) he is LBW (ball hits his leg and is thus prevented from hitting the wicket). B(1) or B(2) are out if they do not finish their run before the wicket is broken (Batsmen is run-out).

After 6 balls have been bowled all the fielders change roughly into mirror image positions and a new bowler bowls an over from wicket(1) towards wicket(2).

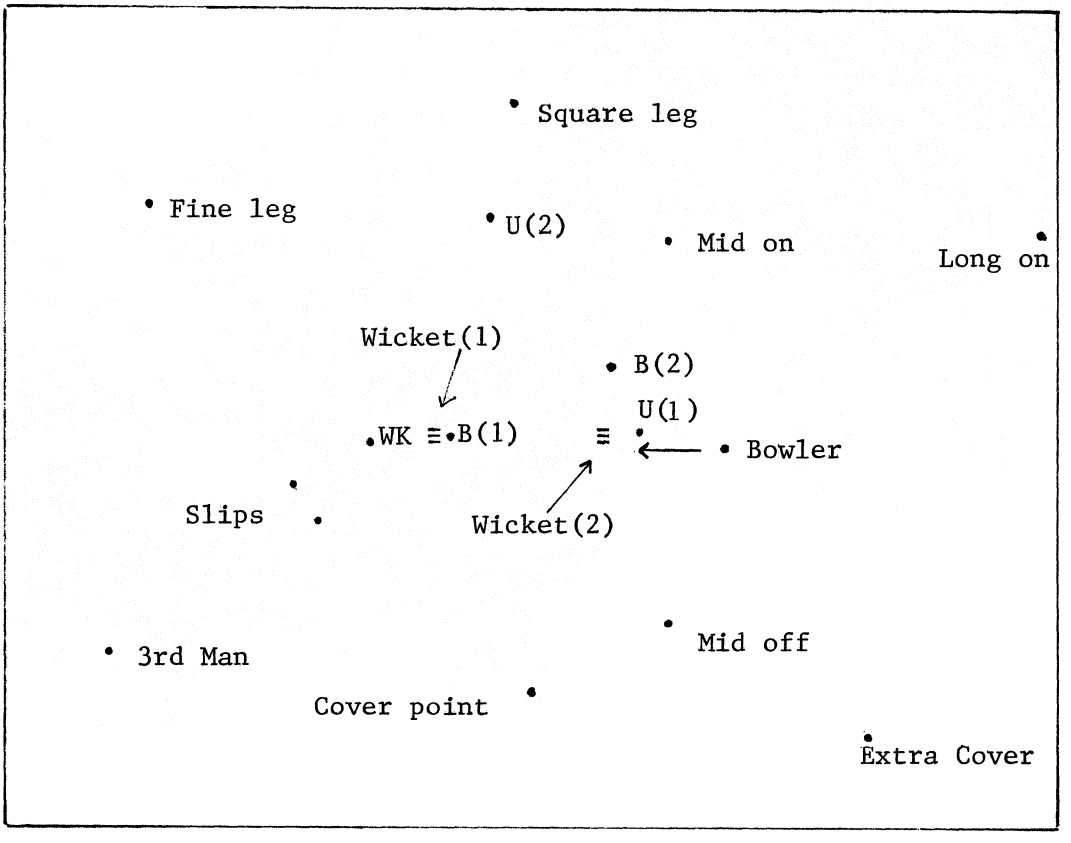
The innings ends when 10 of the eleven batsmen are out. A hit on the ground over the boundary gets 4 runs -- a "home-run" gets 6 runs.

I have not described the following terms: getting stumped, a sticky wicket, a no-ball, a full-toss, an off-stump, a leg-stump, the crease, a maiden over, an innings declared, silly point, making a duck and a few more.

The wickets are three wooden stumps with two bails resting on top of the stumps. The pitch is 22 yards long.

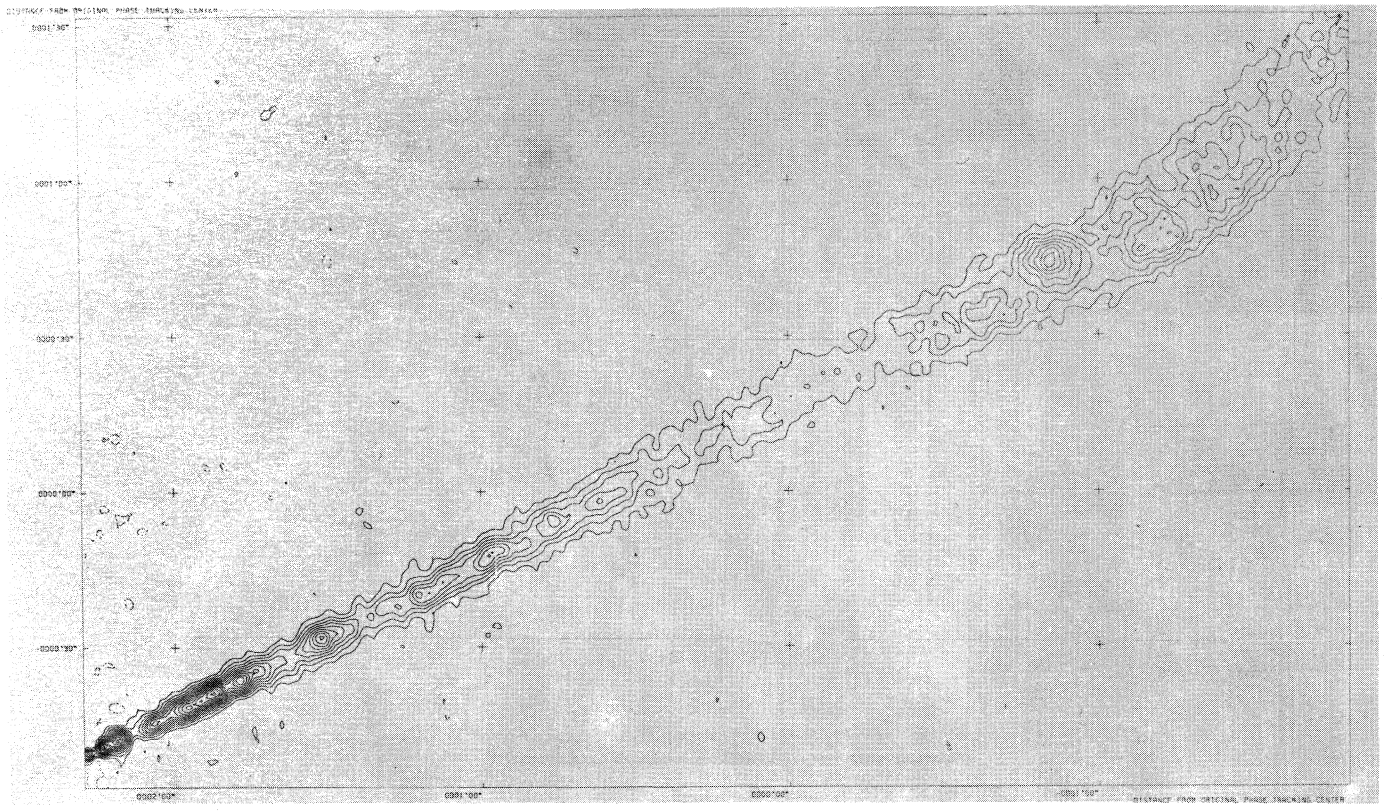
A CRICKET FIELD

(Not exactly to scale)



RADIO GALAXY NGC 6251

Rick Perley



This is a map of the brightness of the jet radio galaxy NGC 6251. The contours follow lines of equal radio brightness in the same way as a topographic map delineates the heights of landforms.

When observed through an optical telescope the galaxy NGC 6251 is a rather ordinary looking 14th magnitude elliptical galaxy (a small oblong blur 63,000 times dimmer than the dimmest stars we see by naked eye). This image is typical of millions of other galaxies.

In contrast to this, observations of NGC 6251 with a radio telescope show that this galaxy is quite different than other galaxies. Rather than confining the radio emission to the region from which the optical emission eminated, this unusual galaxy emits radio waves from a very long ray or "jet" stretching over 36,000 light years from the center of the galaxy. (One light year is 6 trillion miles). The jet leads to more extensive regions of diffuse radio emission (see Figure 1 on page 29) located more than a million light years from the optical galaxy.

We believe that the jet is transferring energy and material to the large diffuse lobes located at the end of the jet. Analysis of the data indicates that the material in the jet (which radiates at radio frequencies enabling us to observe the jet) is moving at a speed of about 1000 kilometers per second (over 2 million miles per hour). The size of the radio source, combined with our estimates of the speed show that this process has been going on for over 100

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Figure 1. A picture showing the intensity of 20 cm wavelength radio emission from NGC 6251. The galaxy is located about 300 million light years from the earth.
Observers: R. Perley and A. Willis

million years.

It is hypothesized that the nucleus of the galaxy is responsible for the extended radio structure. "Inflating" such a volume with the material necessary to produce the observed radio emission requires a very large amount of energy. The total energy contained in the entire radio source is 10^{57} ergs (1 followed by 57 zeros). By contrast a 2000 pound automobile traveling at 55 mph has an energy of 2×10^{11} ergs. If supplied continuously over the lifetime of the source, the power expended by the nucleus would be over 10^{34} watts, which is equivalent to the power radiated by 100 million Suns.

* * * * * *

SCIENTIFIC POSTERS

A series of fourteen posters was created for the dedication of the VLA in October. Some of the most recent observations and science to come out of NRAO's newest instrument are covered on these posters. The subject matter includes the Sun, Jupiter, Planetary Nebulae (remains of a dying star), supernova (a star undergoing a catastrophic explosion), head-tail galaxies, radio jets, gravitational lenses, radio spectroscopy, astrometry and archaeology.

All posters, except the one on archaeology, were designed and made by the VLA staff within about a 3 to 4 week period prior to October 10. Some of the contributors include:

J. Basart
Patrick Beckett (archaeology poster)
C. Bignell
J. Brannan
T. Cote
J. Dreher
R. Ekers
P. Harden
R. Hjellming
J. Lancaster
R. Perley
P. Riehle
A. Rots
D. Sramek
D. Thompson
C. Wade

Each poster consists of pictures, drawings and text mounted on a 32" x 40" extra-stiff bristol board. For the dedication and the open house two weeks later, the posters were mounted on easels and set up for display in the cafeteria. They are presently being mounted in frames and will be put on permanent display in the old drafting trailer. This trailer will be converted to a display area as part of a self-guided tour to be set up early in 1981. We have included photographs of four of the posters, Jupiter, Planetary Nebula, The Double Quasar, and A Supernova in the Spiral Galaxy M100 on the next four pages. Other posters in the series include:

The Universe
Radio Galaxies
Astrometry
Neutral Hydrogen in the Galaxy NGC 784
The Solar System
Radio Galaxy NGC 6251
3C 388
SS433 - A Star with Dynamic Radio Jets
VLA Archaeology
The Sun

--continued, next page--

THE DOUBLE QUASAR

LAST YEAR, WHILE STUDYING THE OPTICAL SPECTRA OF QUASARS, DENNIS WALSH, ROBERT CARSWELL, AND RAY WEYMANN DISCOVERED THAT TWO QUASARS, WHICH WERE SEPARATED BY ONLY 6 ARC SECONDS ON THE SKY, HAD NEARLY IDENTICAL SPECTRA. THE EQUAL REDSHIFTS OF THE SPECTRA INDICATED THAT THE TWO QUASARS WERE AT THE SAME DISTANCE FROM EARTH AND THIS, COUPLED WITH THE SMALL ANGULAR SEPARATION, MEANT THEY WERE SPATIALLY MUCH CLOSER TOGETHER THAN ANY OTHER KNOWN PAIR OF QUASARS. WHAT'S MORE, THE DETAILS OF THE TWO SPECTRA ALSO MATCHED, IMPLYING THAT THE TWO QUASARS HAD TO HAVE A REMARKABLE PHYSICAL SIMILARITY. RATHER THAN ASSUMING THEY WERE A UNIQUE PAIR OF TWINNED QUASARS, THE OBSERVERS SUGGESTED THEY MIGHT BE TWO IMAGES OF ONE QUASAR FORMED BY AN INTERVENING GRAVITATIONAL LENS.

THE POSSIBILITY OF A GRAVITATIONAL LENS ARISES NATURALLY FROM EINSTEIN'S THEORY OF GENERAL RELATIVITY. THIS THEORY PREDICTS THAT A RAY OF LIGHT PASSING NEAR A MASS WILL BE BENT BY THE GRAVITY OF THAT MASS, AS SHOWN ON DIAGRAM 1. FOR EXAMPLE, THE SUN'S GRAVITY, WHICH BENDS THE EARTH'S PATH INTO A CIRCULAR ORBIT, SHOULD ALSO BE ABLE TO BEND THE PATH OF LIGHT RAYS PASSING NEAR IT (BUT TO A MUCH, MUCH LESSER EXTENT). THIS BENDING, WHICH SHOULD CAUSE A MINUTE CHANGE IN THE APPARENT POSITION OF A STAR WHEN THE LINE OF SIGHT TO THE STAR PASSES VERY CLOSE TO THE SUN, WAS ACTUALLY OBSERVED DURING THE ECLIPSE OF 1919, PROVIDING EINSTEIN'S THEN NEW THEORY WITH ITS FIRST TRIUMPH.

IN THE CASE OF THE DOUBLE QUASAR, A LENS COULD BE FORMED BY THE GRAVITY OF A MASSIVE GALAXY LYING BETWEEN US AND THE EXTREMELY DISTANT QUASAR. IF THE GALAXY WERE NOT TOO FAR AWAY, IT MIGHT BE FAINTLY VISIBLE. WITH THIS POSSIBILITY IN MIND, PETER YOUNG, JAMES GUNN, JEROME KRISTIAN, JOHN OKE, AND JAMES WESTPHAL USED THE 200 INCH TELESCOPE ON MT. PALOMAR TO OBTAIN VERY SENSITIVE OPTICAL IMAGES OF THE AREA CONTAINING THE QUASARS. THEY FOUND THE GALAXY AND THUS PROVIDED STRONG EVIDENCE THAT THE DOUBLE QUASAR WAS, INDEED, THE RESULT OF A GRAVITATIONAL LENS. THE GALAXY WAS THE BRIGHTEST OF A RICH CLUSTER OF GALAXIES LOCATED ABOUT HALF-WAY BETWEEN US AND THE QUASAR.

AT THE SAME TIME, PENNY GREENFIELD, REINARD BURKE, AND DAVE ROBERTS WERE USING THE VLA TO OBTAIN HIGH RESOLUTION RADIO IMAGES OF THE QUASARS. THEY SAW NOT ONLY THE COMPACT OPTICAL COMPONENTS BUT ALSO A GOOD DEAL OF COMPLEX, EXTENDED RADIO EMISSION. SUCH EXTENDED, OPTICALLY-INVISIBLE RADIO EMISSION AROUND QUASARS IS COMMON, BUT THIS EMISSION WAS A PROBLEM FOR THE LENS THEORY BECAUSE IT SEEMED THAT IT SHOULD SHOW UP IN BOTH IMAGES BUT WAS, IN FACT, ONLY SEEN AROUND THE NORTHERN ONE. HOWEVER, ALL WAS NOT LOST. THE PALOMAR STUDY GROUP SHOWED THAT, DEPENDING ON THE DETAILS OF THE DISTRIBUTION OF MASS IN THE GALAXY AND THE CLUSTER CONTAINING IT, RATHER COMPLEX IMAGES COULD BE FORMED. DIAGRAM 2. SHOWS HOW EXTENDED STRUCTURE ON THE SIDE OF THE QUASAR FURTHEST FROM THE GALAXY CAN BE SEEN AS ONLY ONE IMAGE WHILE THE QUASAR ITSELF IS SEEN AS TWO IMAGES.

FOR NOW, THE GRAVITATIONAL LENS THEORY OF THE DOUBLE QUASAR SEEMS ABLE TO EXPLAIN ALL THE OBSERVATIONS. WORK CONTINUES HERE AT THE VLA AND ELSEWHERE TO OBTAIN FURTHER DETAILS WHICH MAY PROVIDE MORE STRINGENT TESTS. OF PARTICULAR IMPORTANCE MAY BE MEASUREMENTS OF VARIATIONS OF EACH COMPONENT WITH TIME. SINCE THE LIGHT MAKING UP ONE IMAGE MUST TRAVEL FURTHER TO REACH US THAN THAT MAKING UP THE OTHER IMAGE, VARIATIONS IN THE QUASAR'S LUMINOSITY WILL SHOW UP IN ONE COMPONENT BEFORE THE OTHER. IF A SUFFICIENTLY GOOD MODEL OF THE GEOMETRY OF THE DOUBLE QUASAR CAN BE DETERMINED, THESE TIME DELAYS COULD ALLOW THE FIRST DIRECT LARGE-SCALE MEASUREMENT OF THE EXPANSION RATE OF THE UNIVERSE.

GLOSSARY

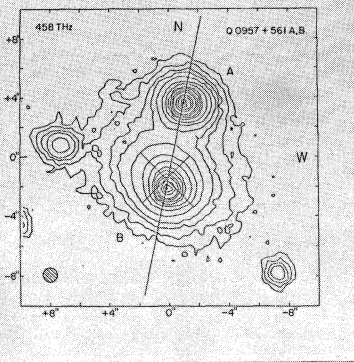
SPECTRUM: AN OPTICAL SPECTRUM OF AN ASTRONOMICAL OBJECT IS A MEASURE OF THE INTENSITY OF LIGHT AT EACH WAVELENGTH (COLOR) EMITTED BY THE OBJECT. EACH KIND OF ATOM TENDS TO EMIT LIGHT AT A UNIQUE SET OF WAVELENGTHS. BY EXAMINING ITS SPECTRUM, WE CAN LEARN SOMETHING ABOUT WHAT KINDS OF ATOMS ARE PRESENT IN AN OBJECT.

REDSHIFT: IF A LIGHT-EMITTING OBJECT IS MOVING AWAY FROM US AT A HIGH SPEED, THE CHARACTERISTIC WAVELENGTHS OF THE ATOMS IN ITS SPECTRUM WILL APPEAR TO OCCUR AT WAVELENGTHS LONGER (REDDER) THAN THOSE AT WHICH THEY ARE NORMALLY OBSERVED. THIS SHIFT IN WAVELENGTH IS CALLED THE "REDSHIFT" OF THE OBJECT.

HUBBLE'S LAW: IN THE MID-1920'S, EDWIN HUBBLE AND M.L. HUMASON STUDIED RELATIVELY NEARBY GALAXIES TO DETERMINE THEIR DISTANCES. IT WAS ALREADY KNOWN THAT THE SPECTRA OF THESE GALAXIES WERE GENERALLY REDSHIFTED AND HENCE THAT THEY WERE MOVING AWAY FROM OUR GALAXY. THEY DISCOVERED THAT THE MORE DISTANT A GALAXY, THE LARGER WAS ITS REDSHIFT. THIS RELATIONSHIP IS KNOWN AS "HUBBLE'S LAW". IT IS A CONSEQUENCE OF THE EXPANSION OF THE WHOLE UNIVERSE FROM THE PRIMORDIAL "BIG BANG".

QUASAR: A QUASAR USUALLY LOOKS LIKE A STAR BUT WITH A VERY UNUSUAL SPECTRUM. IT WAS NOT UNTIL 1963 THAT MARTEN SCHMIDT REALIZED THAT THEIR ODD SPECTRA WERE ACTUALLY NORMAL SPECTRA REDSHIFTED SO FAR AS TO BE ALMOST UNRECOGNIZABLE. FROM HUBBLE'S LAW, THESE ENORMOUS REDSHIFTS MEANT THAT QUASARS HAD TO BE TREMENDOUSLY DISTANT, FAR MORE DISTANT THAN THE FAINTEST OBSERVABLE GALAXIES. TO BE SEEN AT ALL, THEY MUST BE AMAZINGLY LUMINOUS. AFTER NEARLY TWENTY YEARS OF WORK, WE STILL ARE UNCERTAIN AS TO WHAT QUASARS REALLY ARE.

A 5-GHz, VLA RADIO "PHOTOGRAPH" OF THE DOUBLE QUASAR MADE BY P. GREENFIELD (MIT), R. BURKE (MIT) AND D. ROBERTS (BRANDEIS). THE COLORS REPRESENT THE INTENSITY OF RADIO EMISSION: RED IS BRIGHT, BLUE IS DIM. THE RESOLUTION IS 0.4 ARC SECONDS. THE TWO COMPACT BRIGHT SPOTS IN THE CENTER ARE THE QUASAR IMAGES. THE ARCS ON EITHER SIDE OF THE UPPER IMAGE ARE THE EXTENDED RADIO EMISSION. THE SMALLER SPOT CLOSE TO THE LOWER QUASAR IMAGE COINCIDES WITH THE VISIBLE GALAXY. THIS QUASAR IS ABOUT 14 BILLION LIGHT YEARS DISTANT. THE PICTURE SHOWS AN AREA HALF A MILLION LIGHT YEARS ACROSS.



A CONTOUR PLOT OF THE OPTICAL EMISSION OF THE DOUBLE QUASAR MADE WITH THE 200 INCH MT. PALOMAR TELESCOPE BY P. YOUNG, J. GUNN, J. KRISTIAN, J. OKE AND J. WESTPHAL (CALTECH). EACH CONTOUR REPRESENTS A CHANGE OF ABOUT 0.5 MAGNITUDE (50%) IN THE OPTICAL BRIGHTNESS, THUS THE HIGHEST CONTOUR, ON THE NORTH IMAGE, REPRESENTS A BRIGHTNESS ROUGHLY 600 TIMES THAT OF THE OUTER, LOWEST CONTOUR. THE SCALE IS CLOSE TO THAT OF THE RADIO IMAGE ABOVE BUT THE RESOLUTION IS LESS, 1.0 ARC SECOND.

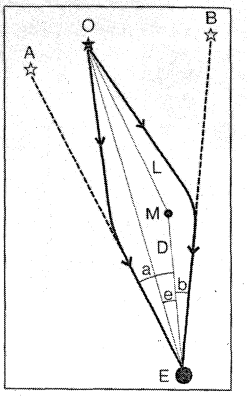


DIAGRAM 1. THE EXISTENCE OF TWO LIGHT RAY PATHS FROM OBJECT O TO EARTH E, ONE ON EITHER SIDE OF MASS M, CAUSES AN EARTH OBSERVER TO SEE TWO IMAGES A AND B OF THE OBJECT.

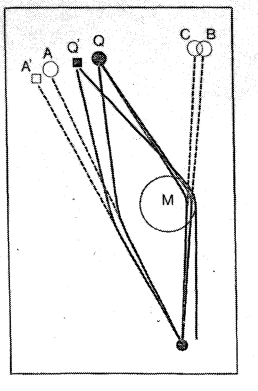
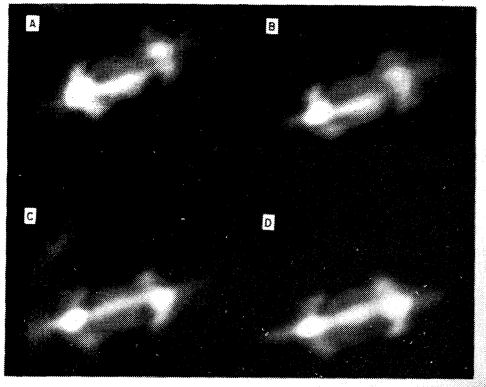


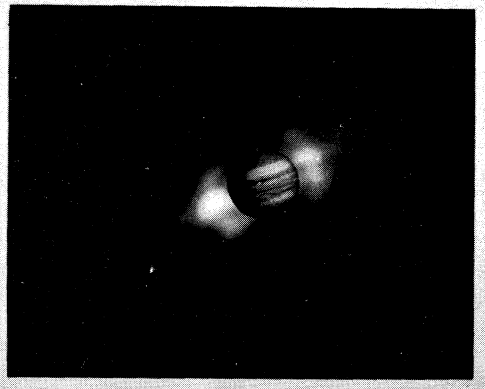
DIAGRAM 2. MODEL FOR THE FOCUSING OF THE DOUBLE QUASAR. Q REPRESENTS THE ACTUAL QUASAR. IMAGE A IS SEEN AT THE EARTH AS ONE COMPONENT, AND IMAGES B AND C ARE SEEN UNRESOLVED AS THE OTHER. Q' REPRESENTS THE EXTENDED RADIO FEATURE SEEN FROM EARTH AS IMAGE A' ONLY.

JUPITER



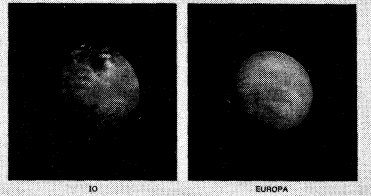
THESE MAPS WERE MADE WITH 20 CM WAVELENGTH VLA DATA. EACH FRAME MAPS JUPITER'S RADIATION FROM A DIFFERENT VIEW OF THE RADIATION BELTS. FRAMES (B), (C), AND (D) ARE THE IMAGES RECORDED AFTER 12^{s}, 119^{s}, AND 115^{s}, RESPECTIVELY OF THE PLANETS ROTATION COMPARED TO FRAME (A). THE ROTATION PERIOD IS 9 HOURS AND 51 MINUTES. THE OBSERVATIONS WERE TAKEN WHEN JUPITER WAS ABOUT 530,000,000 MILES FROM EARTH. THE ANGULAR SEPARATION OF THE TWO BRIGHT PEAKS IN FRAMES (C) AND (D) IS APPROXIMATELY 49 ARC SECONDS.

OBSERVERS: J. ROBERTS, G. BERG, AND R.C. BIGNELL



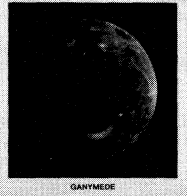
A VOYAGER I OPTICAL PICTURE OF JUPITER IS SUPERIMPOSED ON TOP OF THE VLA OBSERVATIONS AT 20 CM. BOTH IMAGES ARE ON THE SAME SCALE. THE DIAMETER OF THE PLANET IS ABOUT 88,730 MILES (OR ABOUT 142,796 KM) AND THE OVERALL SIZE OF THE RADIO EMISSION IS APPROXIMATELY 266,190 MILES OR SLIGHTLY GREATER THAN THE DISTANCE BETWEEN THE EARTH AND THE MOON.

THESE ARE THE SAME VLA OBSERVATIONS DISPLAYED IN THE FIRST PICTURE WITH THE INTENSITY OF THE RADIO EMISSION COLOR ENCODED. THE SCALE IS RED THROUGH BLUE FOR THE MOST INTENSE THROUGH LEAST INTENSE PARTS.

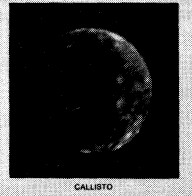


IO

EUROPA



GANYMEDE



CALLISTO

THESE SATELLITES OF JUPITER, AS PHOTOGRAPHED BY VOYAGER I, ARE VERY DIFFERENT WORLDS. IO IS THE MOST SPECTACULAR WITH ITS BRILLIANT SHADES OF RED, ORANGE, YELLOW, AND WHITE, AND ITS VOLCANIC ACTIVITY. EUROPA IS RELATIVELY FEATURELESS. IT HAS MANY UNEXPLAINED THIN DARK LINES CRISSCROSSING THE SURFACE, BUT ONLY A FEW SMALL IMPACT CRATERS AND NO GIANT BASINS. GANYMEDE HAS A VARIETY OF SURFACE FEATURES, RANGING FROM WATER-ICE AND CRATERS TO LONG PARALLEL GROUPS OF MOUNTAIN RIDGES AND VALLEYS. LASTLY, CALLISTO IS THE LEAST GEOLOGICALLY ACTIVE OF THESE FOUR GALILEAN SATELLITES. IT IS SO THOROUGHLY COVERED WITH CRATERS THAT ANY NEW METORITIC IMPACTS WOULD OBLITERATE OLD CRATERS AS NEW CRATERS WERE FORMED. THE LOW DENSITY OF CALLISTO INDICATES THAT ICE OR WATER MAY BE A SIGNIFICANT COMPONENT OF ITS INTERIOR.

JUPITER, LOCATED AT A DISTANCE OF ABOUT 486,000,000 MILES FROM THE SUN, IS THE LARGEST PLANET IN THE SOLAR SYSTEM. IT HAS THE UNIQUE PROPERTY OF BEING THE STRONGEST RADIO-EMITTING PLANET. THE RADIO EMISSION OF JUPITER ARISES FROM A REGION ABOUT THREE TIMES LARGER THAN THE VISIBLE PLANET.

THE PRESENT VLA OBSERVATIONS AT 20 CM WAVELENGTH HAVE THE GREATEST RESOLUTION OF ANY RADIO OBSERVATIONS TO DATE. MOST OF THE 20 CM RADIO EMISSION, WHICH EMANATES FROM THE REGION EXTERNAL TO AND SURROUNDING THE PLANET PROPER, IS PRODUCED BY A MECHANISM KNOWN AS SYNCHROTRON RADIATION. THE PARTICLES RESPONSIBLE FOR THIS EMISSION ARE ELECTRONS TRAVELING CLOSE TO THE SPEED OF LIGHT IN A MAGNETIC FIELD. THE GEOMETRY OF THIS FIELD APPROXIMATES A DIPOLE (LIKE A BAR MAGNET) WHICH CONFINES THE ELECTRONS. THE EARTH HAS A SIMILARLY SHAPED MAGNETIC FIELD CONTAINING TRAPPED PARTICLES HIGH ABOVE THE ATMOSPHERE. THIS REGION IS OFTEN REFERRED TO AS THE VAN ALLEN RADIATION BELT.

THE DIPOLE-SHAPED MAGNETIC FIELD OF JUPITER IS NOT ALIGNED WITH THE AXIS OF ROTATION (AGAIN LIKE THE EARTH'S FIELD). THUS, AS JUPITER ROTATES, THE MAGNETIC FIELD REGION APPEARS TO WOBBLE SIMILAR TO AN OFF-BALANCED TOP. BECAUSE JUPITER ROTATES RAPIDLY, VLA DATA MUST BE DIVIDED INTO GROUPS WITH EACH GROUP CONTAINING DATA OF ONE PARTICULAR "SIDE" OF THE PLANET. A MAP IS MADE FROM EACH GROUP OF DATA AS SHOWN IN THE TOP LEFT PICTURE.

IN ADDITION TO THE RADIATION FROM THE FAST MOVING ELECTRONS SURROUNDING THE PLANET, THERE IS ALSO THERMAL RADIO EMISSION FROM THE PLANET ITSELF. THIS RADIATION IS PRODUCED BY THE RANDOMLY MOVING MOLICULES IN THE GASES OF THE PLANET. THIS EMISSION CONTRIBUTES 15 PERCENT OF THE TOTAL EMISSION AT 20 CM.

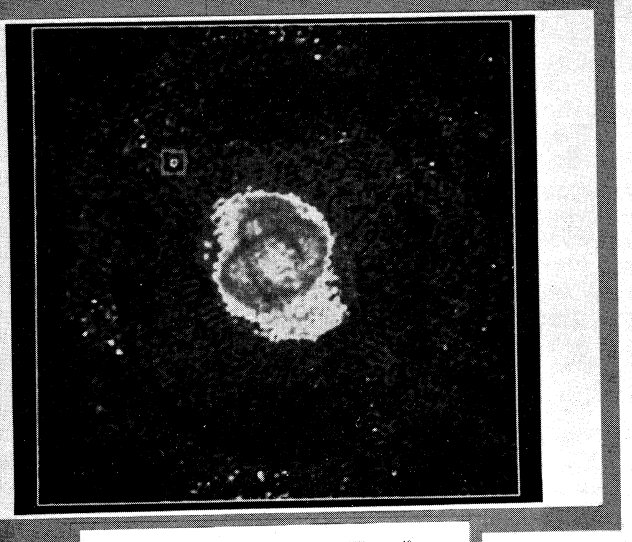
A THIRD TYPE OF RADIO EMISSION OCCURS IN RAPID BURSTS WHOSE DURATION CAN BE AS SHORT AS A MILLIONTH OF A SECOND. THE BURSTS ARE CAUSED BY JUPITER'S MAGNETIC FIELD INTERACTING WITH ITS SATELLITE IO AND THE PARTICLES LOCATED BETWEEN JUPITER AND IO. THE BURST RADIATION IS EMITTED AT RADIO FREQUENCIES BETWEEN 20 AND 80 MHZ WHICH IS TOO LOW TO BE OBSERVED WITH THE VLA.

THREE OF JUPITER'S MANY SATELLITES (OR MOONS) HAVE BEEN OBSERVED WITH THE VLA. THEY ARE IO, GANYMEDE AND CALLISTO, LOCATED APPROXIMATELY 262,000, 665,000 AND 1,168,000 MILES RESPECTIVELY FROM THE PLANET.

PLANETARY NEBULA NGC 6543

PHOTOGRAPH OF NGC 6543 TAKEN WITH THE 4-METER (150 INCH) TELESCOPE AT KITT PEAK, ARIZONA IN JULY 1978. THIS WAS TAKEN IN THE LIGHT OF HYDROGEN-ALPHA WHICH IS CAUSED BY THE ELECTRONS IN THE ATOMS OF HYDROGEN CHANGING ENERGIES.

OBSERVERS: B. BALICK, R. C. BIGNELL, L. E. GOAD AND R. M. HJELLMING.



THIS MAP OF NGC 6543 MADE IN DECEMBER 1978 USING 12 ANTENNAS OF THE VLA AT 6 CM WAVELENGTH. THE SIZE IS APPROXIMATELY 15 x 22 SECONDS OF ARC. THE SIZE OF THE VLA BEAM, 0.8 x 0.85 SECONDS OF ARC, IS SHOWN IN THE RED SQUARE.

OBSERVER: A.R. THOMPSON

PLANETARY NEBULAE ARE SHELLS OF GAS THAT SURROUND CERTAIN TYPES OF STARS. ULTRAVIOLET RADIATION FROM THE STARS MAINTAINS THE GAS IN AN IONIZED STATE; i.e. THE GAS IS HEATED SO INTENSELY THAT ELECTRONS BECOME DETACHED FROM THE ATOMS. AS A RESULT THE GAS RADIATES BOTH LIGHT AND RADIO WAVES. PART OF THE LIGHT EMITTED COMES FROM HYDROGEN, WHICH MAKES UP MORE THAN 90% OF THE GAS, BUT THE BRIGHTEST IMAGES OCCUR IN THE SPECTRAL LINES OF ELEMENTS SUCH AS OXYGEN WHICH RADIATE STRONGLY. THE RADIO EMISSION COMES MOSTLY FROM THE IONIZED HYDROGEN. IN BOTH THE RADIO AND OPTICAL CASES, THE STRONGEST RADIATION COMES FROM REGIONS WHERE THE GAS IS MOST DENSE. THUS, BOTH THE RADIO AND OPTICAL IMAGES INDICATE THE DISTRIBUTION OF THE GAS, AND ARE SIMILAR IN APPEARANCE.

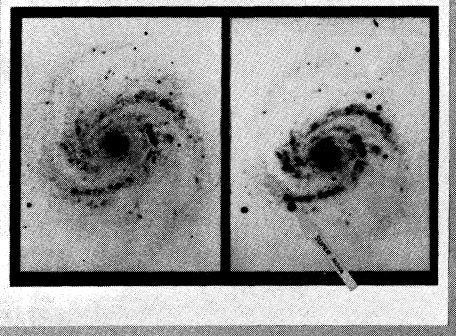
IT IS ESTIMATED THAT OUR GALAXY CONTAINS BETWEEN 20,000 AND 50,000 PLANETARY NEBULAE, OF WHICH OVER 1,000 HAVE BEEN CATALOGED. OVER 200 YEARS AGO, WHEN A FEW OF THESE NEBULAE WERE FIRST DISCOVERED, ASTRONOMERS REFERRED TO THEM AS "PLANETARY" BECAUSE, WHEN SEEN THROUGH THE SMALL TELESCOPES USED AT THAT TIME, THEY RESEMBLED THE DISKS OF PLANETS.

MODERN THEORY OF THE EVOLUTION OF STARS INDICATES THAT A PLANETARY NEBULA IS EJECTED AS THE STAR IN THE CENTER OF THE NEBULA PASSES BETWEEN TWO PERIODS OF ADVANCED AGE KNOWN AS THE RED GIANT AND WHITE-DWARF STAGES. THESE STAGES DO NOT OCCUR IN A NORMAL STAR UNTIL THE STAR HAS EXHAUSTED MOST OF THE HYDROGEN IN ITS INNER CORE. THE GASEOUS ENVELOPE ABOUT THE STAR CONTINUES TO EXPAND AFTER IT IS EJECTED, AND AFTER ABOUT 50,000 YEARS IT BECOMES TOO FAINT TO DETECT AND FADES INTO THE INTERSTELLAR GAS.

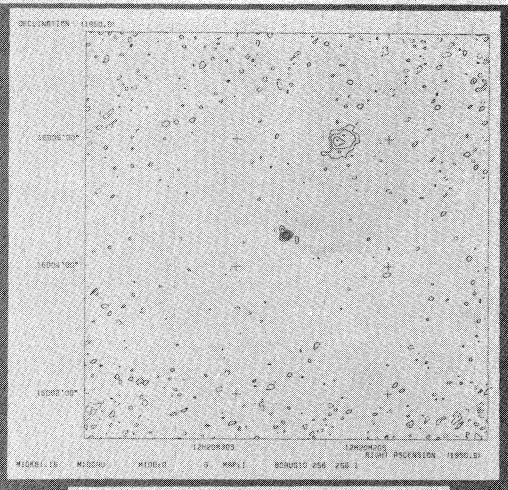
THE FORM OF THE GASEOUS SHELL VARIES CONSIDERABLY FROM ONE NEBULA TO ANOTHER, AND IN MANY OF THEM THE GAS APPEARS TO HAVE BEEN EMITTED IN SEVERAL SEPARATE BURSTS.

NGC 6543 IS ONE OF THE SMALLER AND BRIGHTER PLANETARY NEBULAE. ITS DISTANCE IS APPROXIMATELY FIVE THOUSAND LIGHT YEARS OR 1/6 OF THE DIAMETER OF OUR GALAXY, AND ITS DIAMETER IS 0.25 LIGHT YEARS. THE NAME OF THIS NEBULA COMES FROM ITS NUMBER (THE 6,543RD LISTING) IN THE NEW GENERAL CATALOG PUBLISHED BY DREYER IN 1888.

A SUPERNOVA IN THE SPIRAL GALAXY M100

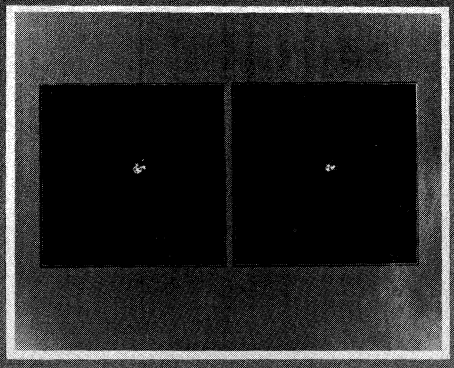


Optical photographs of M101, a spiral galaxy 50 million light years away. The picture on the left was taken in 1926, and the one on the right in 1979, shortly after the supernova was discovered.



A radio contour map at 5 cm of the region around M100 made sixteen months after the supernova explosion. By this time, the supernova brightness had increased to 7.5 mJy/beam. This low resolution map shows the extended emission associated with the nucleus, plus the supernova. The separation of the supernova from the nucleus is about twenty-five thousand light years.

Observers: R. Sramek, K. Weiler and J.M. van der Hulst



Radio maps of M100 at 6 cm wavelength. The map on the left was made eight days after the optical discovery. The supernova had not yet appeared as a radio source. On the right, a map made a year later shows the field dominated by a radio source, coincident with the supernova. Emission caused by cosmic rays near the nucleus of the galaxy is visible on both maps and has a brightness of about 0.5 mJy/beam, while the supernova is 5.4 mJy/beam.

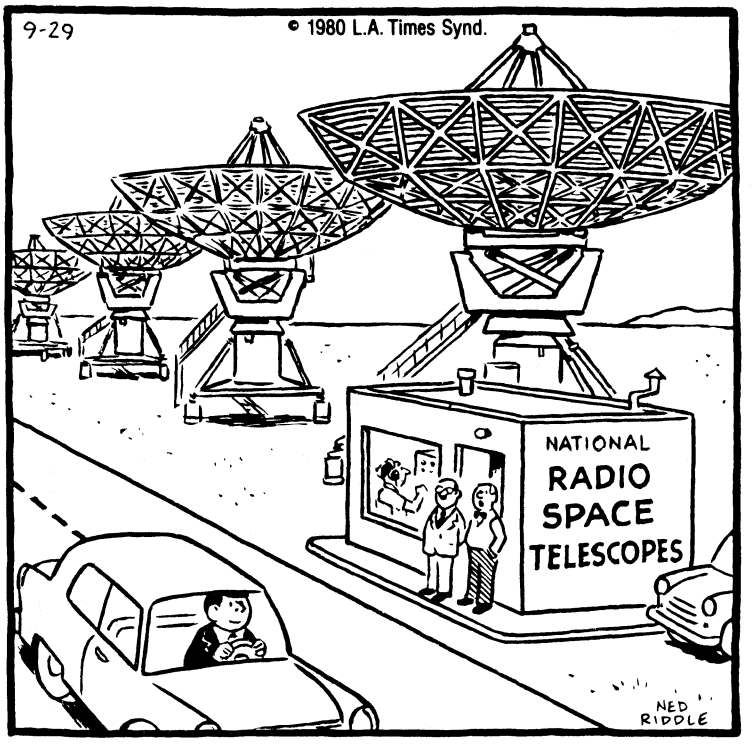
Observers: R. Sramek, K. Weiler and J.M. van der Hulst

A galaxy such as M100 contains roughly a hundred billion stars. About every 30 years, one of these stars explodes and suddenly flares with a brilliance which can equal that of the entire galaxy. This bright new object is called a supernova. The supernova remains very bright for a few days but then begins to fade. Within a couple of hundred days it has faded from sight. A few hundred years later the debris from this explosion will produce a strong radio emitting "supernova remnant" and the core of the exploded star will become a pulsar. However, during the time of the original explosion and for many years thereafter, the radio radiation is extremely weak. The weakness may be caused by the attenuation of radio waves passing through the dense shell of the supernova.

Earlier this year astronomers at the VLA succeeded in detecting the radio flash that followed a stellar explosion. The supernova event, called 1979c, was detected on an optical photograph of M100 on April 19, 1979. Eight days later a radio map made at the VLA showed only the nucleus of the galaxy and a few background sources. This was not unexpected since searches for early supernova radio emission were nearly always fruitless. However, when the same galaxy was mapped a year later, the field was dominated by a bright new radio source at precisely the position of the supernova. Subsequent observations made during the summer showed the radio intensity to be slowly rising. To improve our understanding of supernova evolution, further observations will be made to follow the development of the remnant.

The original detection of the supernova was made at 6 cm wavelength. Later maps were made at 20 cm, where the source was not detected, and at 2 cm wavelength, where it was barely detected. A spectrum for the source obtained in this way may help to explain the mechanism of the radio radiation.

MR. TWEEDY **by Ned Riddle**



"That guy has an unbelievably squeaky fan belt and passes here every day. He had us going for quite awhile."

MR. TWEEDY AND THE VLA

Pat Crane

On a recent trip to Charlottesville, I saw a copy of the "Mr. Tweedy" cartoon reproduced here, that someone had copied from the Washington Star and posted on the bulletin board. I immediately recognized the VLA antennas but was puzzled by the reference to a "squeaky fan belt". How appropriate for the upcoming VLA edition of The Observer, I thought, and wrote to the cartoonist, Ned Riddle and the L. A. Times Syndicate which distributes "Mr. Tweedy".

I soon heard from both; the Syndicate granted permission in exchange for a nominal fee and an acknowledgement. Mr. Riddle's letter acknowledged that his thought processes are weird (although no more so than those of most radio astronomers, I think). He had seen a photograph of the VLA in National Geographic, probably. Then, this summer the air conditioner belt on his daughter's car "made the most ungodly squeals". After they fixed the belt, they joked that maybe it had squealed at frequencies that only dogs could hear. And, remembering the picture of the VLA, Mr. Riddle thought it would be funny if the squealing belt might foul it up too.

We at NRAO are too familiar with the problems of man-made interference, in particular from the electrical systems (sparkplugs, generators, etc.) of cars. But, when presented in "Mr. Tweedy", the problem is much more humorous than when we find it at the telescope.

P.S.: The original cartoon is now hanging in my living room.

WHAT'S COOKING

BISCOCHITOS

Terry Romero

6 c. sifted flour
2 T. baking powder
1 tsp. salt
1 lb. lard or shortening
3/4 c. sugar
3 tsp. cinnamon
3/4 c. water
1 tsp. anise seed

Sift flour, measure and sift again with baking powder and salt. Set aside. Cream lard until fluffy. Add sugar, cinnamon and anise and continue beating until smooth. Alternately add flour mixture and water and work until smooth and evenly mixed. Cut dough into quarters. Lightly flour board and rolling pin. Roll out dough to 1/8 inch thickness, cut in two inch triangles with sharp knife and bake on ungreased baking sheet for 12 to 15 minutes at 400° until light brown. While cookies are still hot, dip lightly in a mixture of 2 T. of cinnamon and one cup of sugar.

* * * * * *

IMPOSSIBLE PIE

Sandy Treppa-Richards

1 stick butter or oleo (1/4 lb.)
2 c. sweet milk
1 c. sugar
4 eggs
2 tsp. vanilla
1/2 c. Bisquick
1/2 c. coconut or pecans

Put everything but coconut or pecans in a blender or mixer. Blend until well mixed, about 3 minutes. Pour into greased 10 inch pie pan. Sprinkle top with coconut or chopped pecans. Bake about 45 minutes in oven at 350°. Be sure to use 10 inch pie pan or two smaller pans or cut recipe in half.

* * * * * *

GREEN RICE

Rosalie Ewald

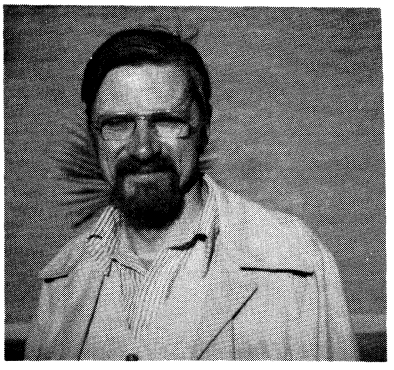
3 c. cooked rice
1 10 oz. package frozen spinach, boiled and well drained
1 1/4 c. evaporated milk
3 eggs
1/4 tsp. marjoram
1/8 tsp. pepper
1/2 tsp. salt
2 T. oil
1 c. shredded yellow cheese

Mix rice and spinach in casserole dish. Mix other ingredients, except cheese, in a small bowl. Add this mixture to rice and spinach. Sprinkle with shredded cheese. Bake covered at 350° for about one hour.

* * * * * *

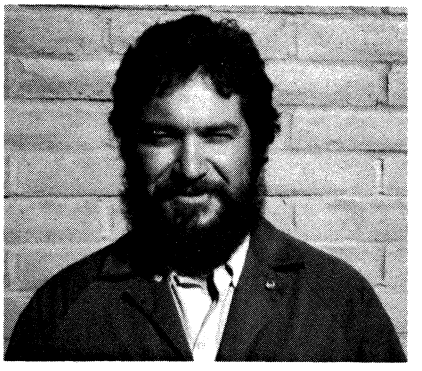
PERSONNEL UPDATE

New Employees



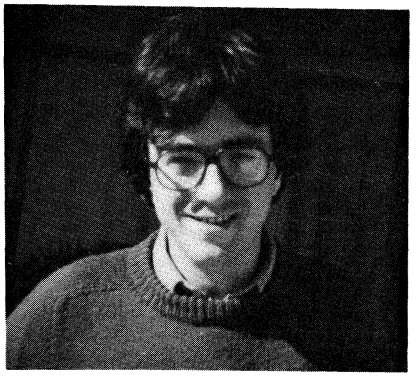
Alan Bridle
Visiting Scientist - VLA

Willem N. Brouw
Visiting Scientist - VLA

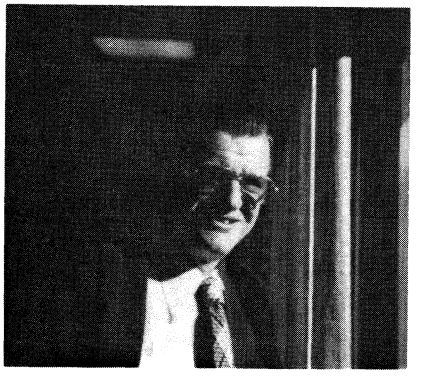


Charles R. Chavez
Building, Grounds,
Utility Worker - VLA

Kerry W. Clark
Technical Specialist - VLA

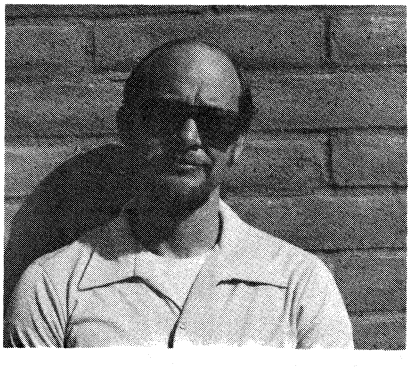


Timothy J. Cornwell
Research Associate - VLA

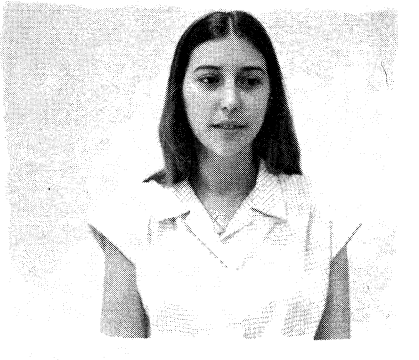


Robert T. Duquet
Scientific Prog. Analyst - VLA

David Emary
Technical Specialist - VLA



Jerald C. Gainer
Technical Specialist - VLA



Cynthia Henderson
Receptionist/Telephone Operator
Business Office - CV

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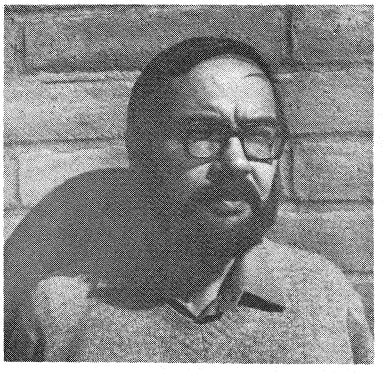
PERSONNEL UPDATE

New Employees (Continued)

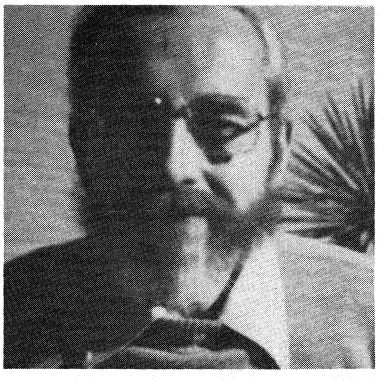
Shirley A. Melton
Accounting Clerk
Common Cost - VLA



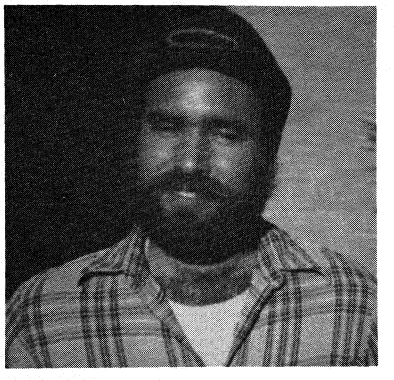
Zbigniew Nosal
Electronics Engineer
VLA Construction

Eva Jean Rigby
Secretary
VLA Site Management

Terry Romero
Secretary B - VLA

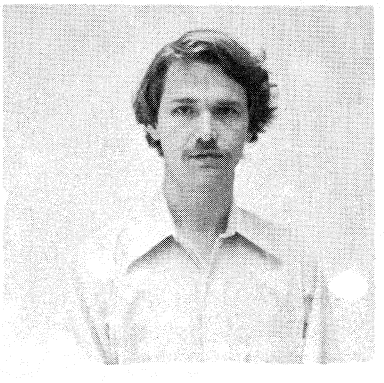


Christopher Salter
Scientific Programming Analyst
VLA Construction



Fred L. Sanchez
Staff Shop Technician
Antenna Maintenance - VLA

Betty F. Trujillo
Secretary A
Common Cost - VLA



Robert W. Vernon
Technical Trainee - I
Computer Division - CV

Esther Vigil
Secretary B - VLA

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PERSONNEL UPDATE

Other New Employees - Photos Not Available

Dick J. Barnes
Senior Buyer
Common Cost - VLA

Kevin Prendergast
Visiting Scientist
Basic Research - CV

Thomas H. Brasso
Senior Technician
Electronics Division - Tucson

Nathan M. Sharp
Technical Specialist III
Telescope Operations - GB

Terminations

Susan E. Delap
Robert F. Fromm
T. J. Jorgensen
Amelia R. Lopez
Janice Mole
Irene B. Morris
Nadine V. Owens
Kevin Prendergast
Michael T. Routt
Craig L. Sarazin
Ruth Saunders
Alice B. Shiflette
Ramesh P. Sinha

Change in Status

Robert L. Brown
from Assistant Director/GB Operations to Scientist

* * * * * *

NATIONAL RADIO ASTRONOMY OBSERVATORY HOLIDAY CALENDAR 1981

Thursday, January 1 - New Year's Day
Friday, January 2 - *Holiday
Monday, February 16 - Washington's Birthday
Friday, April 17 - *Good Friday
Monday, May 25 - Memorial Day
Friday, July 13 - Independence Day
Monday, September 7 - Labor Day
Wednesday, November 11 - Veteran's Day
Thursday, November 26 - Thanksgiving Day
Friday, November 27 - Holiday
Thursday, December 24 - Christmas Eve (½)
Friday, December 25 - Christmas Day

*Additional Holiday

INDIANS TO INTERFEROMETRY

A Brief and Necessarily Sketchy History of the Plains of San Agustín

Jonathan Spargo

Astronomers and their shiny new instruments are only the most recent culture to inhabit the Plains of San Agustín. Nearby there is direct evidence that at least six cultures preceded them, the oldest dating back to some 13,500 years ago. Early man certainly seems to have found the plains a good place to hunt and forage for his food.

The evidence for this is the basis for this little episode and is largely due to the efforts of Dr. Patrick H. Beckett of the Cultural Resources Management Division, Department of Sociology and Anthropology, New Mexico State University. His report, The Ake Site:

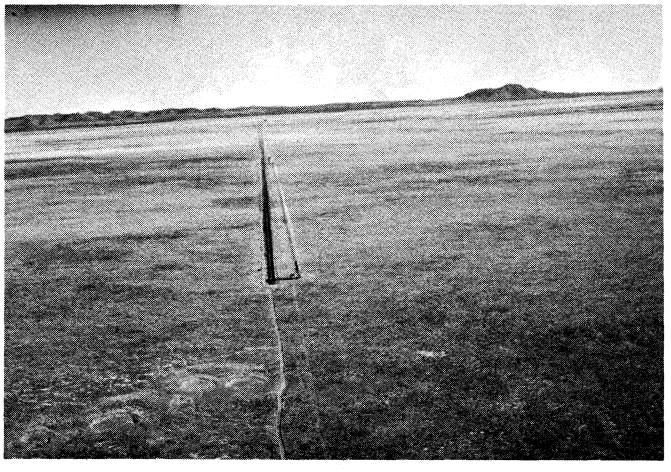

Figure 1. Looking down the west arm toward the center of the Wye, the Ake Site is physically located in the foreground directly on line with the railroad track and near the crater-like depressions. At the time of this photo in 1978 station AW8 was nearing completion with work on AW9 awaiting completion of the excavation of the Ake Site.

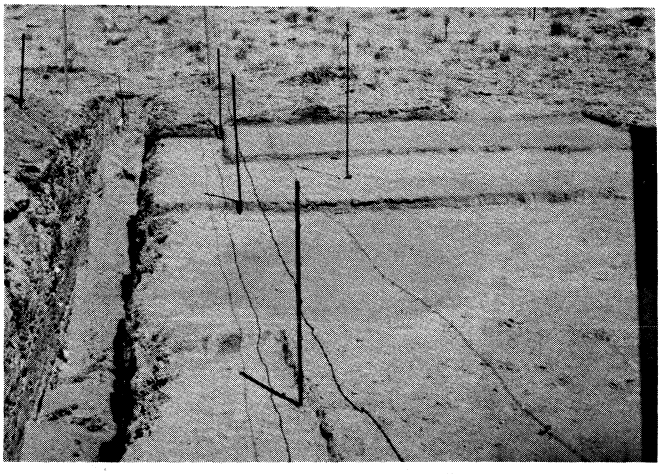

Figure 2: Fencing is not because of homesteaders vs. ranchers but necessary to protect excavations from curious cows and assorted VLA rubberneckers.

Collection and Excavation of LA 13423, Catron County, New Mexico, is the culmination of work begun by Pat and his archaeological team in February 1978. The Ake Site derives its name from the Ake ranch on which it is located. The excavation of the site was necessary because it is located directly in the path of the SW arm of the VLA wye, about midway between the last two stations on the arm.

The work was funded by NRAO/NSF because of Federal and State Antiquity laws which prohibit construction activities on such sites until they have been fully explored for their archaeological content. The site was found as a result of an archaeological survey done of the VLA Site in 1974. The site was submitted to the National Register on November 24, 1975 and has been placed on the State Register of Cultural Properties.

According to Pat, "The Ake Site is a large multi-component site located within the San Agustín Plains of west central New Mexico. Six distinct cultures are

--continued, next page--

represented in the immediate vicinity: 1) Folsom; 2) Chiricahua Cochise; 3) San Pedro Cochise; 4) Mogollon [pronounced Mo-gee-on]; 5) Spanish and 6) Anglo." A summary of human activity in the area can again be taken from Pat's report: "The earliest archaeological evidence in the Plains of San Agustín is found in the collections of local residents. Clovis points, in addition to later Folsom points, indicate an antiquity of at least 13,500 years for mankind in the area. No Clovis points or associated artifacts were recovered from the Ake Site. The Folsom component is the oldest culture at the site (10,000 years). The primary evidence of its presence are Folsom points, utilized flakes and the remains of bison tooth enamel which were found in direct association with each other.

"The next group of visitors to the site were hunters and gatherers of the Cochise Culture. The site appears to have been visited many times during the period, especially during the late summer or early fall" (a favorite time for astronomers and tourists also)

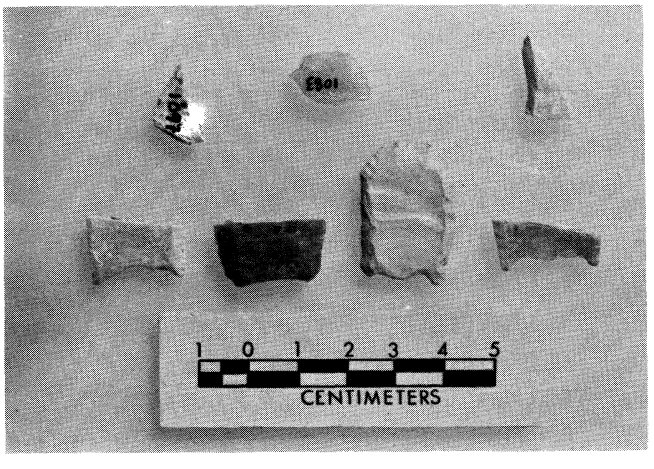

Figure 3: Folsom points, date back 10,000 years and are the oldes artifacts found at the Ake Site.

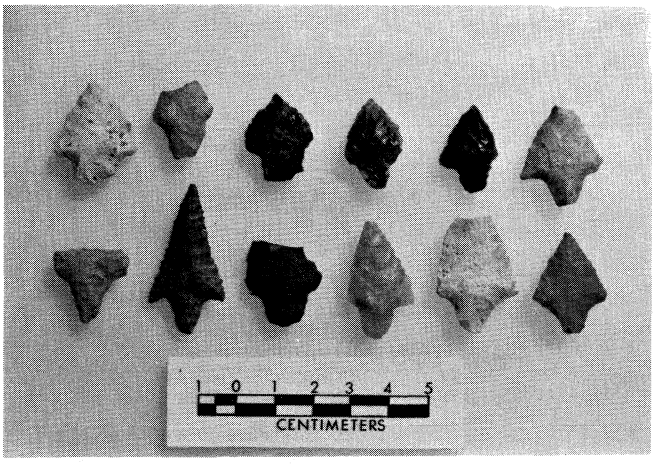

Figure 4: Archaic points date back 3,000 to 3,500 years ago.

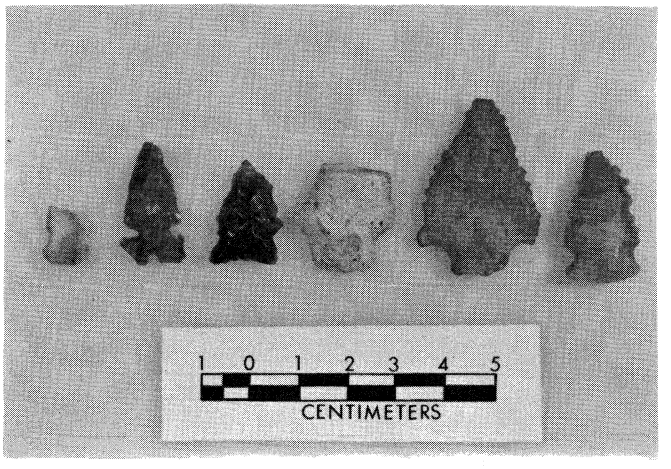

Figure 5: Formative and Late Archaic points.

"when water would have been present in the playa and wild foodstuffs would be mature.

"Sometime after the advent of the Christian Era, the site was again visited by members of the Mogollon Culture. The only remnants of their visit were a few

--continued, next page--

sherds of a pot (Alma Plain) found on top of a more recent dune surface. They may have been passing through or they may have been gathering wild foodstuffs, as their ancestors had done.

"Although the Apache were in the area in historic times, no evidence was recovered that would indicate that they stopped at the site. Thus, it is quite possible that the Ake Site had been abandoned for about 1,000 years, until the advent of cattle ranching and homesteading."

At this point I would like to add my two cents to Pat's narrative and comment on more recent human activity. The evidence for it is everywhere. One only needs to poke through local libraries, engage in conversations with a rancher or two or even talk to some VLA employees to complete the picture. As Pat mentioned the Apache were active in the region in more recent times and accounts of their activities (sometimes gruesome) are found in many books. One of the best is Black Range Tales by James A. McKenna (you may remember the movie "McKenna's Gold"). This book well documents the life of early prospectors who came to the area in search of precious metals and quick fortunes. One account tells of McKenna's attempt to find the "Lost Adams Diggings", a supposedly tremendous gold find where nuggets could be plucked from a stream. In his account he talks of traversing the Plains of San Agustín and mentions his efforts to steer clear of marauding bands of the dreaded Apaches.

The story of ranching in the area is equally colorful. A must for any newcomer is to read Agnes Morley Cleveland's account of her life as a young girl and woman growing up on a ranch in Datil in the late 1800's. No Life for a Lady is perhaps the most vivid account of ranching life, complete with thundering herds of antelope, hasty retreats to the settlement at Datil to avoid Indian raids and many other stories, both humorous and grim.

These and many other good books on the subject can be found in local libraries and bookstores. If, however, you wish to hear it first hand, all you need do is take a short walk to the VLA Front End Lab. There, for the price of a cup of coffee and a "Prince Albert roll your own", Leo Sánchez will tell you what it was really like to "cowboy" on the Plains. Where Leo now works as a technician on cryogenic front ends, he once slept in his bed roll on the annual cattle drives to Magdalena. Leo can spin many a colorful tale on such subjects as rattlesnakes, bears, cows, coyotes and the like. However, be sure to ask him to tell you the one about the Shetland Pony.

Having strayed somewhat from things archaeological I would like to return long enough to discuss some of the results of the excavation process. During the period of February-May 1978, we at the VLA Site were aware of the fact that the team was at work. It also turns out that during that time of the year we experience perhaps the worst weather we can have in the form of our annual spring windy season. From late March through most of April it is not uncommon to have many consecutive days of high winds with sustained velocities often over 30 mph. The spring of 1978 was no exception and so only a few hardy souls braved the elements from time to time to trek down the SW arm to view the excavations in progress.

The archaeologists were probably just as glad as they had their hands full with the wind as well. In retrospect, however, the winds did provide Pat with evidence for an exciting discovery. Aerial photographs dating as far back as 1930 clearly show dune movement on the plains. By Pat's account, "It became increasingly evident during the excavation that all of the aeolian dunes within the site area had been reworked in the past. This observation coupled with extreme high wind velocities experienced by the crew during excavations prompted the author to experiment with the ability of the wind and aeolian activity to move artifacts around within a known spatial area."

His experiment consisted of a trip to the nearby VLA railroad bed to collect some

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Figure 6: Archaeology in February is fun! Provided of course that you have a parka, wheelbarrow, shovel, shifting screen and a large T-bone steak waiting for you in Datil at the end of the day.

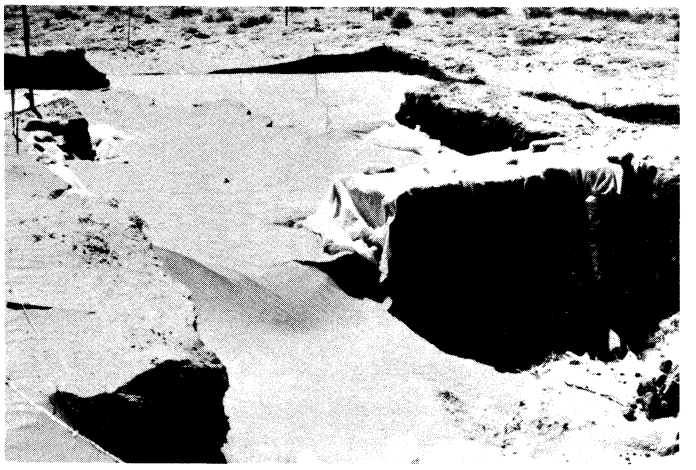

Figure 7: When you return the next morning, those legendary San Agustin winds have done it to you again and you start all over!

gravel. The rocks collected were of various sizes ranging from small pebbles about 1 cm in length, weighing about a gram, to larger stones 3 cm in length weighing up to 15 grams. The rocks are not unlike artifacts in that they are chipped and flaked during the crushing process. The rocks were numbered, painted and placed in small groups at various locations within the protected (fenced) site area. Their positions were monitored for 33 days during which some very windy conditions were encountered.

Some of the rocks didn't move at all because of their protected locations. Most of them did move, however. As expected the smaller rocks moved in a direction with the prevailing wind. Quite unexpected was the movement of some of the larger rocks backwards, or against the wind! In fact one rock moved backwards 2.6 meters! An explanation of this is fairly straightforward. The rock was heavy enough to prevent movement with the wind. This allowed the wind to erode or undercut the rock eventually causing it to tumble backwards against the wind.

In terms of impact on archaeological data this means that artifacts are subject to the same process and of course over much longer periods of time. The net result is a mixing of artifacts from different ages than were located initially in different soil strata. This puts great strain on identification techniques for artifacts, particularly in the Southwest where soil re-working mechanisms are very active.

Again I quote from Pat's report. "Nearest neighbor analysis has been widely utilized in order to interpret artifact clustering and activity areas (human) with some success. However, the natural processes actively at work on the Ake Site had destroyed some and changed other culturally deposited artifact clusters. The test trenches and excavations in Area 1 revealed that the deposits and strata had

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been reworked and that the lighter artifacts seemed to have floated over the heavier artifacts as a result of local aeolian activity and dune formation. This apparent sorting of materials by weight and size seemed to illustrate a somewhat measurable attribute of wind sorting."

I was first made aware of this experiment when Pat approached me about using VLA wind velocity and direction data to apply to his rock movement measurements. A few days worth of digging through old weather data plots produced enough data about direction and peak velocities to give a good indication of wind conditions during the experiment. It was a good fit and I was very pleased to be able to supply the data.

Pat is a very ebullient scientist and his enthusiasm is infectious which made my effort even more rewarding. Others were struck by it also as evidenced by the SRO crowd that packed the cafeteria conference room one noon hour to hear Pat talk about his findings at the Ake Site. For those of you interested in reading the full report, a copy of same is available for checkout from the VLA library.

As a parting shot I would like to make use of some research by Pat to settle once and for all the question: Is it spelled:

AGUSTÍN, AUGUSTINE, or AUGUSTIN?

You would be surprised how many times that question has been asked in the past 5 years! Apparently historical precedent favors San Agustín as the preferred spelling. This spelling is found in Darton's Geologic Map of New Mexico in 1928. It is preferred by the New Mexico Highway Department, the New Mexico Bureau of Mines and Mineral Resources and the United States Geological Survey. Bandelier in 1883 mentions the Plains of San Agustín as having no ruins. "San Augustine" and the shortened version "San Augustin" are of French origin and the old town of "Augustine" was evidently named using the French spelling. "Augustin" is still occasionally popular and sometimes appears on maps and articles this way.

Whatever you prefer, it is still where the VLA is and will likely remain for some time to come. Perhaps 13,500 years from now some archaeologist will identify the seventh culture to inhabit the plains as Interferometrist Scientificus Americanus and marvel at the artifacts of the ancient culture.

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ODE TO THE BLUEBIRD

Elaine McKee

I don't mind riding the bus each day,
Up or down, either way.
The folks are nice, they'll let you sleep,
Or you can talk, the visiting is cheap.

So I don't mind riding the bus each day;
Sleeping or talking all the way.
But if they're trying to give us frostbite;
Why don't they do the thing up right?

Break out the windows and leave 'em all night;
Or leave a little early, before sunlight.
And to freeze our feet, it would be nice
If they'd fill up the bus with lots of block ice.

I don't mind riding the bus per se,
Up or down either way,
It's lots of fun, there's lots of teasing,
But just here lately, the damn thing's freezing.