THE OBSERVER

DEC. '75

THE MISSING MASS ---------

STORY ON PAGE 3

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NOTE: <u>CHANGE IN PUBLISHING DATES OF THE *OBSERVER*.</u> Beginning with the March 1976 issue, the *OBSERVER* will be published quarterly.

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We welcome two new members to the *OBSERVER*'s Editorial Board: Bill Brundage, Electronics and Wendell Monk, Central Shops.

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A special thanks to all the people who contributed articles and who helped with the assembly and distribution of the *OBSERVER*.

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THE MISSING MASS

H. J. Rood*

Galaxies are found in groups containing about five bright members or in larger aggregates up to rich clusters containing hundreds or even thousands of member galaxies. The mass of a group or cluster is one of its fundamental physical properties, but efforts to derive it have so far led to inconsistent results.

To find the mass of a group, we can first estimate the mass of each of its galaxies and then add them up to obtain the so-called "conventional mass" of the group. Or we can assume that, like our solar system, each group of galaxies is held together by its own gravity so that Newton's laws of motion and gravity can be applied to the observed separations and motions of group members to obtain a quantity called the "virial mass" of the group. Here we are using the same principles as were used to derive the mass of the sun from the orbital velocity of the earth. If our data and assumptions are okay, then we expect that the virial mass should equal the conventional mass. The "mass ratio" (virial mass divided by conventional mass) should be equal to 1.

As early as 1933, however, the Caltech astronomer Fritz Zwicky examined the great coma cluster of galaxies with over 1,000 members. He found that its mass ratio is about 100. This could mean that only 1 percent of the virial mass is accounted for in the form of its galaxies - 99 percent is missing! Other studies soon indicated that many other groups and clusters have similar mass ratios. Over the years, changes in the estimate of the rate of expansion of the universe, and improved data on galaxies have reduced the mass ratios to about 10 for rich clusters, and typically about 30 for small groups. We want to know why all these numbers disagree.

Are we witnessing an effect of uncertain data? This is at least partially the case. It is difficult to distinguish on the sky between a member of a group and a chance galaxy seen in front of or behind a real group. A superimposed galaxy can be recognized if its motion differs greatly from that of group members. Even when obvious superimposed galaxies are filtered out, however, many groups still have large mass ratios. But the motions used to derive the virial mass in the past have usually come from optical techniques, and have large uncertainties. Typical errors of about 60 kilometers per second are not much smaller than the actual motions of galaxies relative to one another in a typical group. To eliminate this uncertainty, John Dickel and I are using the 300-foot telescope to derive new motions of group galaxies from 21-cm neutral hydrogen line observations which have uncertainties of only 10 kilometers per second.

The 21-cm data can also be used to estimate conventional masses of galaxies if we assume that the inner parts of a galaxy rotate like a solid body and the outer parts rotate similar to the way the planets revolve around our sun. To date, we have analyzed data for 6 groups. We find that three have mass ratios of about unity. The other three, however, have mass ratios of 30 or more. These large values may be explained in one or more of the following ways:

1. The groups are exploding either violently or gently with the general expansion of the universe. For this case, the virial "mass" of a group has no relation to its actual mass.

2. The groups are actually held together so that the large mass ratios indicate that a group contains large amounts of mass in addition to the conventional masses of its galaxies. This missing mass could be in either of two forms. (a) It could lie in the space between galaxies. Suggested forms have included neutral, ionized, and molecular hydrogen, stars fainter than the sun, black holes, neutrinos, golf balls,... (b) It could lie within the galaxies themselves; that is, the conventional mass estimates are wrong. Recent 21-cm line work by Mort Roberts, Arnold Rots, Penn Central Shostak and others suggests that the conventional masses do not take account of appreciable amounts of matters which appear to be present in large halos or coronas surrounding the inner disks of spiral galaxies.

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3. The laws of physics as we presently know them may not be applicable to groups and clusters. Clearly, this is a hypothesis of last resort.

The above three possible explanations, however, should be given little attention at this point in time. The observational data must first be made more complete and less ambiguous, and 21-cm line astronomy is uniquely suited for this task.

*Visiting radio astronomer - University of Illinois.

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HOW TO GET TAPES FROM SWEDEN

Dave Shaffer

Several years ago, Ken Kellermann and Barry Clark described their adventures connected with doing VLB experiments to Russia. Bureaucracy reigned everywhere. But it couldn't happen at home, right? Wrong!

Late in 1972, as an attempt at a thésis, I did some 6 cm VLB between California and Sweden. We sent magnetic tapes from Caltech to Onsala with no problems. SAS even had a special rate. After the experiment, we sent them off, in my name, to NRAO, Charlottesville. I put a note on them to hold the tapes in Washington, and I would pick them up.

I got to Charlottesville some days later and called SAS in New York. Yes, the tapes had arrived, but SAS doesn't fly to Washington, so they'd given the tapes to Delta to take to D.C. So, naively (I should have called Delta) I set out from CV for Dulles Airport. I arrived at Delta about noon, gave the clerk my waybill number and said, "Where are my tapes?". A quick riffle through his file and he says, "We don't have them." Panic. "You must. SAS said so." Another look. No papers. So he calls Joe on the phone. Joe is at their big computer. He asks Joe to find out where the tapes are. An hour later, Joe hasn't called back. Sitting for an hour in an airport freight office ranks with watching the Calcomp draw HI contour maps for excitement.

After some additional agitation on my part, the clerk calls Joe back, and tells him I'm waiting. Oh, Joe thought it was a routine trace. A few minutes later, Joe calls and says, "We gave them to United." What! "Well, we sent a customs form to Pat Armstrong and 'he' told us to send the tapes to Richmond, the nearest port of entry." A collect call to Pat confirmed that. So I went next door to United and said, "Where are my tapes? Here's the waybill." Another paper shuffle, "We don't have them." "Delta said you did." "What's the transfer manifest number?" "What?" Without a transfer manifest number, United couldn't track down the shipment. Back to Delta, more paper shuffling, finally a transfer manifest. Back to United, "Oh, yes. Those tapes were sent to Richmond."

It's now 2:30 PM, but the trail was getting hot. Into the car, and off for Richmond. It's further than I thought and I finally arrive at the airport about 4:30 and find United. "Where are my tapes?" (Sound familiar?) Success: "Over there." Oops, they're in a chicken wire cage, courtesy of US Customs. "Where's the Customs man?", is my next question. "He's gone home for the day!" But a grad student is resourceful. I quickly phone the Customs Bureau downtown. Yes, they could send an agent out, but it's a special trip and would cost $30. I don't have $30 on me. Reluctantly, I head back to CV, after ascertaining that Customs will be at the airport from 1:30 to 4:00 PM the next day.

Day #2. Off to Richmond, arriving about 1:20. At least the tapes are still in their chicken wire cage. Here's the Customs man. "Those are my tapes. Can I get them?" "Where's your form 3311?" "What!?" (We'd gotten tapes from Australia in California without any paperwork.) "We sent a form 3311 in the notice to NRAO." OK, try another tack: "Don't you have some form 3311's with you?" "You can get them back in town. If I carried all the different forms, I'd need a truck." After some argument, he agreed to look in his briefcase and closet. No form 3311's. Off I go downtown. Find the Federal building and a parking

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place. Find the Customs Office. "Do you have form 3311's?" "Yes, how many do you want? They come in tablets of 100 for 75¢." "I don't need a hundred, I just need two." After more discussion, they relented, gave me two and even let me use a piece of carbon paper!

Back to the airport, find the Customs man, give him his precious forms in duplicate. I expected to at least have to open the cartons. Nope, he was happy now. "Take them," he said. Success! Back to NRAO with my tapes.

A story like this should have a happy ending, but it doesn't: the tape recorder in Sweden malfunctioned and the tapes were no good.

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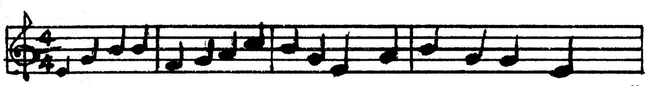
HELLO, OPERATOR

Janet Warner



"Hello, operator, information, put Jesus on the line!"

Considering the unusual requests of the Green Bank telephone operator (yours truly), in "Almost Heaven, West Virginia" and at an Observatory where we are always in contact with heavenly bodies, the above request is not completely out of the question! We will try to put anybody you want "on the line", but Jesus has a toll free number and you can ring it yourself!

By now you should be beginning to get the message.

The new FTS conversion will be taking place December 1, 1975. Of course, I will assist you on all calls, but there are a few things we can do to make all types of calls easier.

(1) The Tucson and New Mexico offices have direct FTS lines. You could reach your party more quickly by making these calls yourself.

(2) All toll free numbers (800 numbers) should be placed by you.

(3) Place your own personal telephone calls and report them to me afterwards. Remember, too, honesty pays!

To be a telephone operator, patience is of essence -- not only on my part (I always try to keep cool), but yours as well. I realize that every second you are waiting seems like an hour, but you can be assured that I'm trying to complete your call as quickly as possible. However, there are busy numbers, equipment failure, and wrong numbers to be considered. Above all, when an emergency call is received, top priority is given to this, and it often requires several minutes of my time to obtain the information so that the NRAO squads can respond. You must remember you are one among hundreds requesting a service.

But there is a humorous side to this also, and I would like to share this story with you.

One day a lady called in and asked for Mr. Howard. I asked, "Which Mr. Howard, William E. or Richard?" She replied, "Oh you know, the one in charge of the cafeteria -- Jennifer's father!"

(This is only one of many incidents, but this definitely is a favorite!)

I enjoy my work and aim to please. Just dial 0, and remember

"Central's never busy, always on the line;
You can hear from heaven, almost anytime.
'Tis the royal service, free to one and all;
When you get in trouble,
give this line a call!"

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CREF VALUES

1975

January	$30.67	February	$32.80
March	33.77	April	36.12
May	38.07	June	39.88
July	36.81	August	35.86
September	34.31	October	35.89

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MAKING VISIBLE "THE INVISIBLE UNIVERSE"

Seth Shostak

Grab the average guy in the street and ask him what he knows about radio astronomy. Chances are, he'll tell you something about the daily horoscopes he hears on his transistor AM-FM. In fact, of course, radio astronomy is the scientific study of our universe using radio antennas instead of the more conventional mirror and lens telescopes with which we're all familiar. Because radio waves usually have an easier time penetrating the dust and gas clogging the space between stars, we can often "see" further into the cosmos by studying these radio emissions than we can using ordinary light. Radio astronomy is one of the newest sciences and yet it has already taught us an enormous amount about the types of objects populating space and the early history of the universe.

To introduce this exciting new science to the general public, the National Radio Astronomy Observatory (NRAO) recently decided to commission the production of a short public-relations film. As a staff member of the Observatory, and past producer of numerous sophomoric student films, I could hardly allow this production to be contracted out without first making my own bid. I and two fellow astronomers, Robert O'Connell and Dick Sramek, submitted a proposed film treatment and tentative budget to the Observatory. They liked the idea of an in-house production, not to mention our bare-bones budget. All systems were go, and we were in the movie biz.

The principal viewers of our film -- the target audience -- were to be the twenty-five thousand or so tourists who annually visit the Observatory's telescope site in Green Bank, West Virginia. The tours, which start with the movie and end with a narrated bus trip to the telescope, are free. Although not widely publicized, the Observatory tour has become the second-most popular tourist attraction in West Virginia. (In all fairness, however, it should be pointed out that the Observatory is but five miles from the state's number-one attraction: the Cass Scenic Railroad.)

The tour is aimed at satisfying the visitors' curiosity about the huge metal antennas which sprout mushroom-like from a West Virginia valley. Beyond that, however, is the much broader aim of promoting an area of pure, basic research. Astronomy is not pursued for the usual kinds of reasons: for profit, for social welfare, for defense, etc. Instead, it is motivated by man's sheer curiosity about his world. To know where the universe came from and where it's going. Knowledge for its own sake. Our film was intended to stimulate the tourists' interest in a subject with no obvious applications or payoffs. And to convince him that this interest is worth the tax money he pays to support it!

The audience presented its own set of problems. Road-weary, and with restless kids in tow, our viewers would be shunted into a small auditorium to see a film for which they might or might not have any interest. Their knowledge of astronomy could safely be assumed to be nil.

I have made a big point of describing the purpose and target audience of our movie. It seems extremely important to define these variables before writing the script for a sponsored film. A movie may be a cinematic showpiece, a surefire winner in competition - and yet utterly fail to get its message across. We're all aware of entertaining TV commercials for products we can't remember.

How were we going to "sell" astronomy? Exploring conventional approaches, we briefly considered having the Rockettes prance before the camera, holding placards which spell "NRAO" and singing "2000 Lightyears from Home". Or Raquel Welch in a filmy negligee: "Hi. I'd love to tell you about pulsars." Shunting these interesting, but implausible, schemes aside, we opted for a "gee whiz" approach. We would illustrate those astronomical subjects which generate the most public interest: pulsars, quasars, life in space, etc. These are subjects everyone's heard about, but few understand. Additionally we would simply explain how a radio telescope works and why it's different from an ordinary telescope. In general, however, we wanted to avoid the didactic approach taken by so many science films. Our primary purpose was to *interest* our audience in radio astronomy, not to instruct them. And at all costs we would avoid scenes of real scientists seated at

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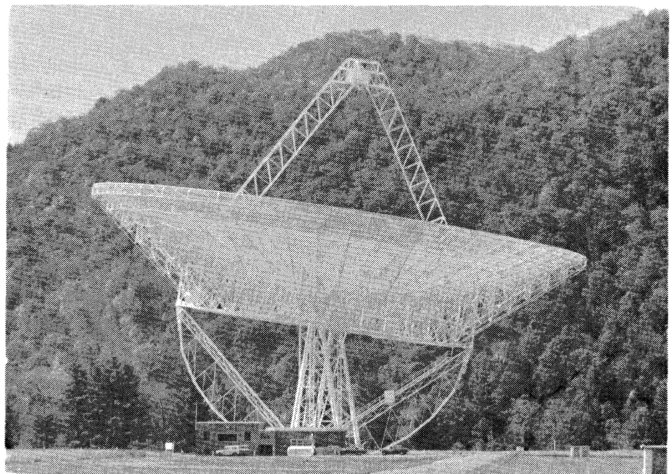
paper-strewn desks, gestering awkwardly while explaining their latest research! We'd viewed plenty of such scenes in other films, and they made Sominex seem like twenty cups of coffee.

The scripting began. Taking our cue from TV melodramas, we decided to open our film with a bang: a 1930's-style mad scientist using contemporary high-voltage electronics to establish contact with the cosmos. We had in mind a scene from Universal's "INVISIBLE RAY" featuring Boris Karloff. Besides being a grabber, this opening would allow us to dramatically compare the classical movie view of science with today's modern observatory. The shift from grainy black and white to color would further emphasize the contrast, as we brought our audience quickly forward in time. With a few aerial shots to bridge the gap, we would then deposit the viewer in that verdant West Virginia valley where the telescopes grow. Using animation and time-lapse photography, we next demonstrate how these huge metal ears are tuned to faint signals from space. Then, holding "hardware" shots to a minimum, we begin our outerspace odyssey, proceeding first to the sun, then past the planets to a pulsar. In each case we dramatically show the nature of our subject - gigantic flares on the surface of the sun and stroboscopic flashes from the tiny pulsar. Thence through the dust and gas of the Milky Way, passing an alien, life-supporting planet, and then to the realm of the galaxies. We see a galaxy explode, sending huge clouds of radioemitting gas hurtling into space. Ultimately we rush past whirling galaxies to the edge of the universe - the distant habitat of the quasars. At ever increasing speed we plunge toward one of these mysterious objects, beacons at the limits of creation, and the screen is overwhelmed with light and shaken with sound. A resounding climax, which leaves our audience with sweat pouring down their cheeks and lumps in their throats.

Well, scripting a trip to the edge of the universe is one thing, staging it in front of the camera is something else. Especially given our limited resources. Let me reiterate that radio telescopes don't "see" in the conventional sense, so there's no chance of live outerspace photography. Our studios consisted of my boudoir and an empty room in the Observatory's lab building. No special effects equipment of any kind. We anticipated contracting out some animation, but with a total budget of $11,000, we weren't in a position to afford much artwork. Finally, thanks to Stanley Kubrick, we knew the public wasn't going to be satisfied with cheapie-looking space photography. Against these handicaps must be balanced the considerable advantages of having the full cooperation of Observatory personnel, and very flexible deadlines.

We started with the simple stuff, footage of the Observatory, inside and out. For a while we had use of a loader Arri S, which we used in conjunction with my trusty non-reflex Bolex. Registration tests failed to reveal any difference in footage from the two cameras, and about 90% of the final film was made up of Bolex material. We shot Eastman ECO (7252) exclusively, relying on a few rented quartz lights to punch up the interiors. Great use was made of a red gel to add a "scientific" look to much of the laboratory footage. The telescopes themselves presented a problem: painted white to prevent heating



Painted white to prevent overheating by the sun, the 300-foot tended to burn out when the scene was exposed normally. This problem was solved by underexposing by one stop.

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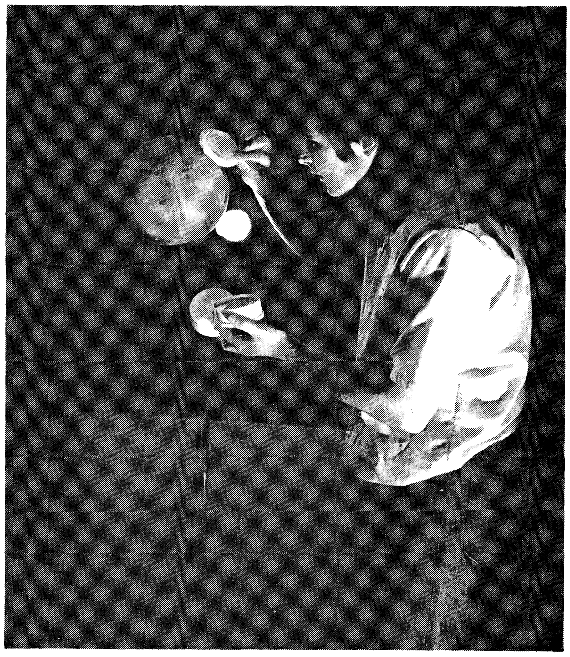
by the sun, they tended to burn out if we exposed normally for the surrounding foliage. We ended up underexposing the foliage by one stop. The other problem with the telescopes was their unpredictable positions, dictated by the requirements of research and not by photographic esthetics. Patience is a wonderful virtue.

We intended to introduce the Observatory with some aerial footage. After rejecting the usual aerial camera services as beyond our budget, I finally found a Tastee-Freeze owner in Elkins, W. Va. who had a small helicopter. Taking the door off the passenger side, he flew me around the site for $60 an hour. The gyroscopic mount consisted of my two hands, but with a 10mm lens and slight overcranking, the footage was more than tolerable.

With the live-action scenes out of the way, we faced up to the difficult two-thirds of our film: the wall-to-wall special effects. The sun and pulsar sequences included animation, so we carefully storyboarded these scenes for drawing and photography by Pilgrim Film Services of Hyattsville, Md. Whenever possible we used actual astronomical photographs for backgrounds to minimize the change in "look" when cutting from models to animation, etc. We also had Pilgrim make up about 100 feet of zooming white stars on a black background. This was done by multiple printing of camera zooms into a star field. The zooming stars were later printed on top of slow dolly shots into color astronomical photos of gas clouds and galaxies, giving a very real impression of moving through space. A good set of zooming stars is a requirement for any serious space cinematographer.

Our most ambitious model shot was of an alien planet slowly orbiting in space, ultimately occulting its own sun. The planet itself was a small beach-ball from the neighborhood supermarket, immediately dubbed planet "Voit". We had just given Voit a coat of orange paint and black surface markings when a couple of neighborhood kids stole it off the patio where it was drying. With cries of "planet thieves" we chased the kids around the block, finally recovering our lost world. Voit was hung from the bedroom ceiling by black threads and driven by a small DC motor. We had



Putting a little pancake makeup on planet Voit to minimize the glare of its shiny continents.

covered up the window behind it with black posterboard which we peppered with small holes. The indirect sunlight coming through the holes made a very effective star field. By overexposing two stops above normal sunlight, the stars burned in nicely. For the alien sun, we encased a small bulb in a blackened beer can, adjusting a spotlight to provide additional illumination on the near side of the beach ball. Voit performed like a real star...er, planet...and with a little dramatic music the scene became a definite goosebumper.

Many other special effects were accomplished by optical printing. In one comic relief sequence, we have three telescopes slewing back and forth in synchronism with Offenback's "Can-Can". Carefully planned repeated printing of about twenty frames of original were required. Black and white footage of solar flares was beefed up by printing through yellow filters onto color stock. An exploding galaxy was made up of four scenes printed together: To begin with, we photographed a background plate of our doomed galaxy. Pre-explosion flickering in the nucleus was simulated by hand-scratching the flickers onto a length of black leader.

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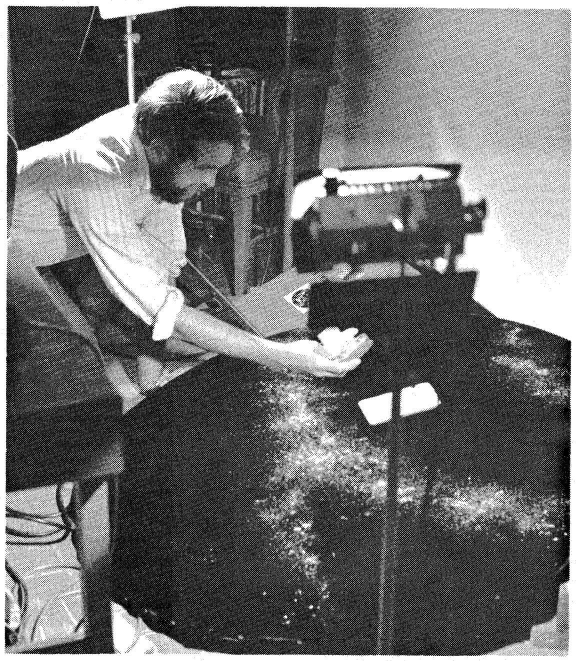
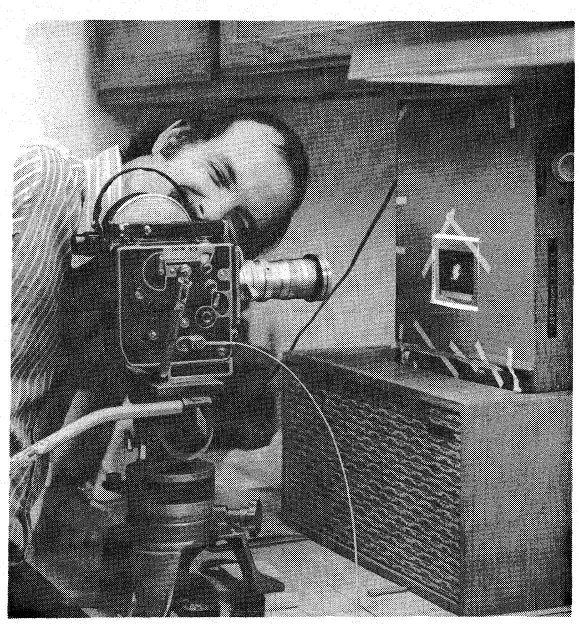
This film was then projected onto a makeshift rear projection screen where it was photographed by the camera, thereby both increasing the flicker frequency and reducing the image size on the film. A rheostat-controlled small bulb in a dark room simulated the explosive flash. We put a piece of window screening over the lens to produce diffraction spikes. Finally, some tedious animation of two teardrop-shaped pieces of cardboard yielded the expanding gas clouds expelled by any self-respecting galaxy explosion. The effect of all four sequences printed together is, well, shattering.

The most ambitious sequence of the film is the grand finale: the fabulous rocket trip through whirling galaxies into the heart of a distant quasar. Stock footage was definitely a no-go. This cosmic first was to be documented in my bedroom. As before, we decided to build up the sequence in pieces, putting them together later on the optical printer. The quasar was shot first. Using transparent paints, we colored about 50 feet of clear leader, "programming" the art work to slowly change color and flicker frequency. This quasar film was then threaded into our projector, and the camera aimed directly at the lens thereof. A rented 12-120mm Angenieux allowed the camera to slowly zoom in on our brilliant subject. Window screening was again employed to add diffraction spikes. However, even a 10:1 zoom was not enough to produce a screenfilling quasar, so an additional 4:1 zoom was added during optical printing, yielding a total change in image size of 40:1.



Dick Sramek, a member of the production team, puts the final touches on a galaxy created from flour and salt and mounted on a rotatable "sky" made up of a four-foot-diameter plywood disk covered with black velveteen.



Co-producer Bob O'Connell checks the Bolex before zooming in on a slide of the Crab Nebula.

The whirling galaxies posed a difficult problem. Actual telescope photos of galaxies are unsuitable for a number of reasons, not the least being that they are unavoidably cluttered with the foreground stars of our own galaxy. Artworked galaxies would likely be unrealistic and would certainly be expensive. A solution was found, however, and I urge all star-trekkers to take note: We first constructed a rotatable "sky" made up of a four-foot diameter plywood disk covered with black velveteen. A bolt through the center of the disk allowed it to turn. The galaxies were fashioned on this sky, and a

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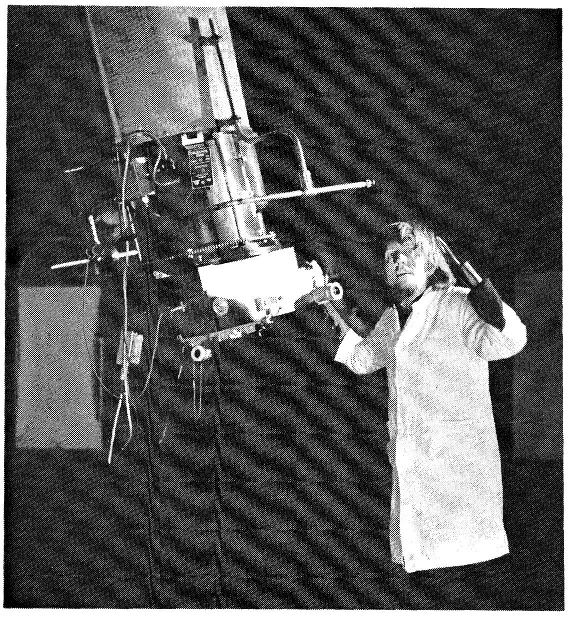
frame at a time the lens was zoomed as the disk was turned. Colored gels in the camera gave appropriate tints to our cosmic creations. The galaxies themselves? Common ingredients found in every kitchen: salt and flour. A handful of salt was used to outline the galaxies, and flour makes grand interstellar gas and dust. Even the least artistically inclined (a category which includes the author) are capable of making expertfooling galaxies with the ol' southern recipe given here.

As we finished the outer space footage, it came time to deal with the problem of our 1930's intro. We photographed our own "mad scientist" sequence using the venerable McCormick Observatory in Charlottesville, Va. as a set. Our scientist, ably played by Bob Haas, is in fact an electronic engineer, and he brought his own spark equipment for appropriate visual effects. Using a 45° angled piece of glass in front of the camera to partially reflect some artwork, we were able to simulate a beam of light suddenly descending on Bob - an "invisible ray". We resurrected some vintage Double-X negative to



The obligatory mad scientist, looking madder than most, was portrayed with chilling authenticity by Bob Haas. The sequence opens the film with a flashback to 1930's-style science-fiction.

use as camera stock, and had this printed several times to increase grain and contrast. Lots of kickerlight heightened the 1930's effect, as did the use of a circular wipe during the scene transition. The final version was skipprinted to add a little extra speed to the action. This sequence makes a strong bid for the audience's attention at the head end of our film.

After a month of editing, we made a pilgrimage to Capitol Film Labs in Washington, D. C., to lay in the sound. Jack Flynn's commanding voice gave our narration authenticity. We pored through Capitol's music library to find the material for our completely scored, orchestrally full music track. Dramatic compositions, with touches of the mysterious, were generally first choices. Our effects were brought along from home on quarter-inch tape, thence transferred to 16mm mag. We recorded our own effects, using everything from laboratory oscillators to ham-radio equipment. The final mix of five different tracks was artfully accomplished by Capitol's Hal Magruder.

The film has been a success, not only with the tourists at Green Bank, but with the general astronomical community. Several dozen universities have obtained prints for showing to beginning astronomy classes. In October 1974, "THE INVISIBLE UNIVERSE" won a second place in the CINDY competition. In May 1975, the International Education and Television Film Festival held in Rome, Italy awarded "THE INVISIBLE UNIVERSE" second place. To commemorate the award, NRAO received an engraved cup and a beautiful scroll. Perhaps a few of the many thousands who see this picture will be sufficiently interested by its subject to pursue the pleasures and problems of astronomical research. To us, that would be a gratifying reward.

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A man's contentment lies
in enthusiastic appreciation
for the things he has.
A man's misery lies
in excessive desire
for the things he has not.

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THE HUMAN BACK - A BAD DESIGN?

Sebastian von Hoerner

An amazingly large fraction of all people have been painfully troubled by their back, in one way or the other. It seems that back trouble is one of the most common ailments. Usually, it occurs as a muscular spasm (cramp), or as a slipped or ruptured disc. Since the other moving parts of our skeleton seem to function in a much better way, what, then, is wrong with our spine? As with many other problems, the solution was suggested at a Green Bank coffee break, when my colleague Ivan Pauliny-Toth remarked that it is only two million years ago that we first tried to walk erect on two legs, which is too short a time for having our bodies successfully adapted to this new posture. While recovering from a recent back surgery, I felt a strong urge to study this problem in some more detail, and now I would like to tell some of the results.

Time scales of evolution. Our Earth is 5 billion years old, just as our Sun and its other planets are. We do not know when the first life developed, but the first petrified traces of it are over three billion years old. A spinal chord was first developed by some primitive little fish about 450 million years ago, and 350 million years ago some more sophisticated fish crawled ashore, developed lungs and turned into reptiles. From those, the mammals developed 150 million years ago, and some of them climbed as apes into the trees, about 40 million years ago.

Quite recently, only two million years ago, some apes jumped down again, they shed their fur and filed their tails away, making a living as hunters in the open prairies. Using their hands for tools and weapons, they walked on two legs and have been having back trouble since then.

Evolutionary changes take a long time for getting successful. The horse, for example, took 40 million years to perfect its one-toed hoof. Two million years is just too short to expect much structural improvement. Our spine indeed is essentially the same as that of our four-legged ancestors (the apes did not need much change since climbing gives not more spinal stresses than four-legged walking). If our evolution would go on in the normal way, without doctors and hospitals, all those with back trouble would be eaten by the wolves, only improved variations would survive and reproduce. We would probably develop a shorter and wider rump, and the bony backward extensions of our spine would grow longer, comparable to the ribs, allowing stronger back muscles and, most important, at a larger distance from the spine. Actually, however, our evolution has been stopped, once and forever, by the invention of medicine. It is too late now, and we must learn how to live with our spine as it is.

Two legs versus four. Since our spine was designed for four-legged animals but is now being used by two-legged humans, what actually is the difference, how much more stress does the spine suffer? First, we must consider the weight distribution. Calling W the total weight of an animal or a human, we roughly estimate: rump=0.50 W, legs=0.25 W, arms=0.15 W, head=0.10 W. Next, Figure 1a shows the original design, an animal on all fours; and Figure 1b gives a simplified model, a slender supported truss with central load. This load is P = 1/2 rump, the other half being supported directly by the legs, or P = 0.25 W. According to the equation given in Figure 1b, an important factor is the slenderness ration, L/H. Taking human dimensions, we use L = 20 inch and H = 7.5 inch. The force F, in compression along the spine and in tension along the abdominal muscles, then is F = (1/4) (20/7.5) 0.25 W, or F = 0.17 W.

If we now sit or stand, the load to be carried by the spine is P = 1/2 W in the average. But the compression F is somewhat larger (say, 20%) because the surrounding muscles must be in tension, like guy wires, for maintaining an upright balance. Thus, F = 0.6 W. As compared to the walking animal (F = 0.17 W), the compression along the spine is 3.5 times larger when we sit up or stand erect on two legs. Which shows that we must watch our posture, avoiding stoop as well as swayback, even if we do not carry any load (and the more so if we do). Just the weight of our own body is already a heavy load; the engineers, by the way, would call it the "dead load" which does not sound nice when applied to ourselves.

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The largest stress occurs when we bend forward and lift something heavy. But again, just our own weight is enough to do harm, and many back aches and even damaged discs occur when we simply bend forward, tying our shoe laces for example. Figure 2a shows such a case, with the cantilevering truss of Figure 2b as a simplified model. The end load is now P = head + arms + 1/2 rump = 0.50 W, two times larger than that of the walking animal. The equation of Figure 2b shows that, everything else being equal, the cantilever yields four times more force than the supported truss. And the slenderness, L/H, is now much larger since H is now only the small distance between back muscles and spine. Using H = 3 inch, we find F = (20/3) 0.5 W, or F = 3.33 W. This force is 20 times larger than that of the animal walking on all fours. Any design, overstressed by a factor 20, is bound to give severe trouble.

How large a load must we carry, well balanced on our shoulders, in order to have the same compression (F = 3.33 W) along our spine? Half of our weight is carried anyway, and the compression is again 20% larger than the total load because of the guy wire tension needed for balance. Omitting the details, we find P = 1.50 W. Thus, bending over as in Figure 2a gives the same compression along the spine as carrying on your shoulders a person 1 1/2 your own weight. Which just means: never bend over like this! If you pick up something from the floor, no matter how little weight it has, then squat or kneel, and bend as little as possible; or brace your left arm against your left knee, avoiding an unsupported cantilever.

In summary, our back was a good design for our four-legged ancestors, but we use it now for a purpose it was not designed for. As compared to walking on all fours, going erect gives 3 1/2 times more compression along the spine, and bending forward even 20 times more. We should think about our posture and actions, we must use our head to help our spine. The human head, after all, is supposed to be a thing of daily use and not an ornament.

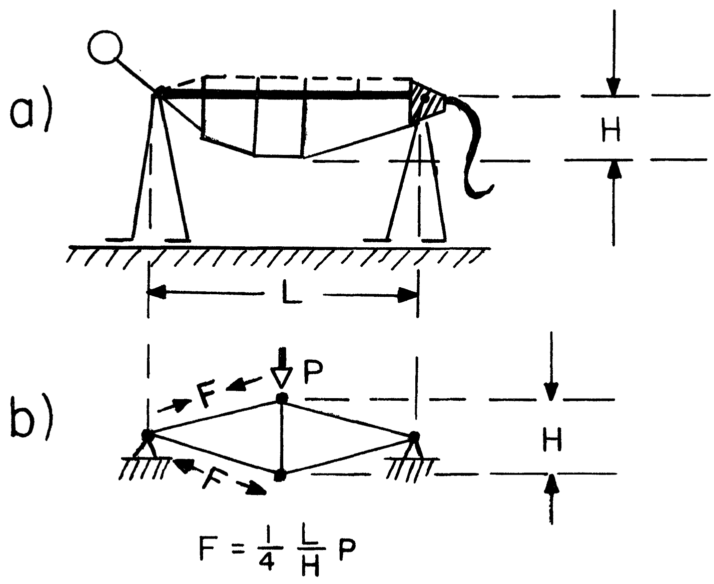

Fig. 1. a) Four-legged animal.
b) Slender truss, with central load P, supported at both ends.

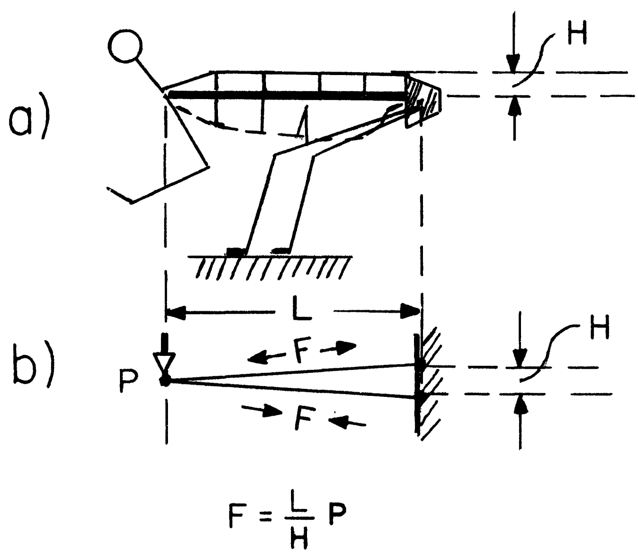

Fig. 2. a) Human, bending forward.
b) Cantilever, with end load P, fixed at one end.

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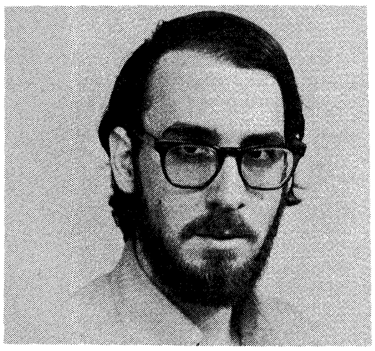
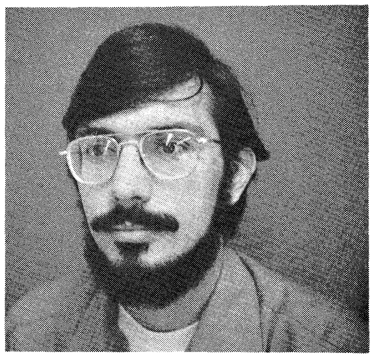
NEW EMPLOYEES

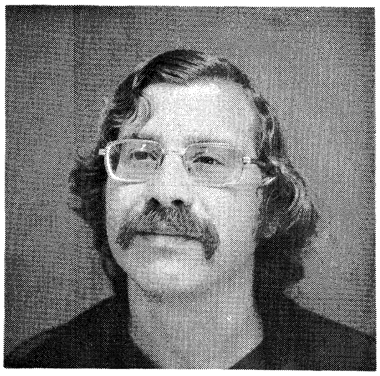


Lee J. Rickard
Research Associate
Basic Research - CV

Catherine F. Johnson
Secretary
Business Office - CV

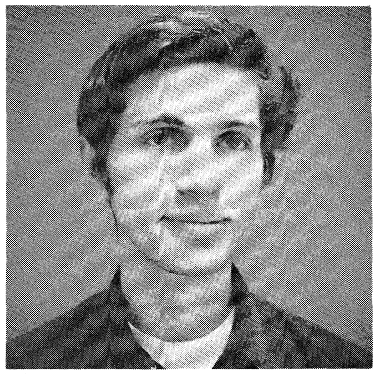


Russell A. Hulse
Research Associate
Basic Research - CV



Jesse K. Hill
Research Associate
Basic Research - CV

Reginald D. Atkins
Technician
Electronics - GB



David M. Rosenbush
Scientific Associate
VLA - CV

David L. Vandevender
Helper
Plant Maintenance - GB

Photo Not Available

Joe S. Ortiz
Maint. Trainee
VLA - NM

Photo Not Available

Ernest M. Caloccia
Electronics Engineer
VLA - NM

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Photo Not
Available

Judith B. Martin
Secretary
VLA - NM

Rehires

Shirley M. Carpenter	Fiscal Division - GB
Victoria L. Taylor	Administrative Services - GB

Terminations

Michael T. Benson	VLA - CV
Jean M. Bulabois	VLA - CV
Benjamin B. Campbell	Plant Maintenance - GB
Sharon E. Compton	Administrative Services - GB
John G. Lyon	Basic Research - CV
Jerzy Machalski	Basic Research - CV
C. Read Predmore	VLA - NM
Kristine B. Rye	Computer Division - CV
Geronimo C. Valencia	Administrative Services - GB

Return From Leave Of Absence

June E. Thomas	VLA - CV

OBSERVER'S COMMENT SHEET

These comments apply to the observing program: L45 (i.e., F26, B175, etc.)	Telescope: (Check one) 140-foot [ ] 300-foot [X] Interferometer [ ] Receiver: 21-cm cooled (ν or λ)	Date of Run: Mo. Oct Yr. 75 Signed: ____ Your home office telephone no. A/C 304 456 2318

In an attempt to assess whether observers on NRAO telescopes are experiencing any problems or difficulties connected with their visits to the site, the Observatory is encouraging each observing team to complete this form and turn it in to the site director's office. You may wish to comment on our policies or procedures, and it will be especially valuable for us in our continuing concern for how we are handling the observing programs. The site director will send copies of this report to the Director's office and to any other individual(s) whom you may name, below. We will do our best to improve the operation, based on your suggestions.

Degree of success of observing run: 20%. Too many undetectable sources. Can't NRAO provide better objects to look at than this? Considerable solar interference. Who scheduled the sun to come up right in the middle of the day?

Remarks concerning equipment: Too complicated. It took over two hours to figure where to plug in the headphones. Surely NRAO can come up with a better data recording scheme. This reading magnetic tapes with iron filings is ridiculous. Who ever heard of guiding a telescope with computer cards? There isn't even an offset guider at the focus.

Remarks concerning services: One of us didn't get any travel money and even had to provide his own place to stay.

Doesn't anybody ever calibrate this instrument? What we need is a good friend of the telescope, not the clod thats in that position now.

The tea and crumpets were over 15 minutes late one night. Besides, the crab apple jam is terrible.

Observer: Please send this sheet to the site director who will then distribute it to the Director's office and to any other individuals whom you may name below.

- [ ] Electronics Division
- [ ] Computer Division
- [X] Telescope Operations
- [ ] Admin. Arrangements

Others: (by name) ____

PROGRESS REPORT ON THE VLA ANTENNA AND TRANSPORTER

Bill Horne

The late fall of 1975 has produced visible evidence on the Plains of San Augustin, New Mexico of the planning and labors of a great number of AUI employees. On September 22 AUI accepted from E-Systems Antenna No. 1, and on November 13, 1975 AUI accepted from E-Systems Antenna No. 2. These are the first of a planned 28 antennas which will comprise the most visible portions of the hardware for the VLA project. AUI also accepted on September 22 the first VLA transport vehicle. These pieces of equipment represent partial fruition of efforts starting in the early 1960's with planning, and in the middle 1960's with conceptual design efforts which have continued to the present and undoubtedly will continue for some time in development of the VLA. It is not the purpose of this article to prepare a history of the VLA but only to summarize recent events leading to the above delivery.

On October 18, 1973 a contract was let to E-Systems of Dallas, Texas for the design, manufacture, erection and testing of the 28 antennas. In January of 1974 a contract was arrived at with E-Systems for the final design, fabrication and assembly of the transporters. The design of these two elements of the VLA was carried out in the period from placing the contracts until July of 1974, at which time design reviews and final design corrections were made. Procurement of certain long lead items for the antenna, consisting of motors, gear reducers, the elevation gear segments, surface panels, and the azimuth bearing gear, were initiated prior to final design approval in order to secure their delivery in time for incorporation into the antenna as assembly progressed. It may be hard to imagine but for gear reducers of the type required for this antenna the manufacturers will quote a 52 week delivery time and will not guarantee that delivery. The azimuth bearing-gear combination requires even more time in that the forgings must be ordered by the bearing manufacturer from a very limited number of forging suppliers (who are running at full capacity and aren't looking for business). The forgings for this part of the antenna were ordered on March 28, 1974 and the bearing was not ready for inspection at the manufacturer's plant until May 12, 1975. These two items are just an example of the trials and tribulations which occur when one tries to plan and assemble an antenna.

A very important feature of the antenna assembly planning was the Antenna Assembly Building (locally known as the "San Augustin Hilton") which has become a distinctive feature of the VLA site. This building in which the assembly of the antennas is carried out is 135 feet long, 96 feet wide and 104 feet high at the center. Parallel assembly of the reflector and the pedestal for the antenna are carried out in the building. The building contains a 5-ton bridge crane which spans the width of the building and can travel the full length of the building, and two fixed hoists in the top of the building of 35-ton capacity each. Assembly procedure consists of assembly of the reflector on tooling in the rear portion of the building while assembly of the pedestal, yoke arms and elevation wheel are carried out in the forward portion of the building on foundations. The pedestal is then picked up by the transport vehicle while the reflector is hoisted to the roof of the assembly building. The transporter moves the pedestal underneath the reflector and the reflector is then lowered and attached to the pedestal after which the antenna is returned to its foundations for installation of feed legs and drives. This assembly building will be used, after construction is complete, as the antenna service and maintenance building.

The assembly building construction was started in October of 1974 and substantially completed in March of 1975. During this time fabrication of the antenna structure was underway at Hobbs, New Mexico with trial assembly of the four major components of the structure for Antenna No. 1 being completed in March of 1975. Disassembly and shipping of the components to the VLA site was accomplished in April with field assembly of the antenna initiated April 29, 1975. Assembly of the transport vehicle was started on the site in March of 1975. As can be seen from the assembly plan, this vehicle was a critical

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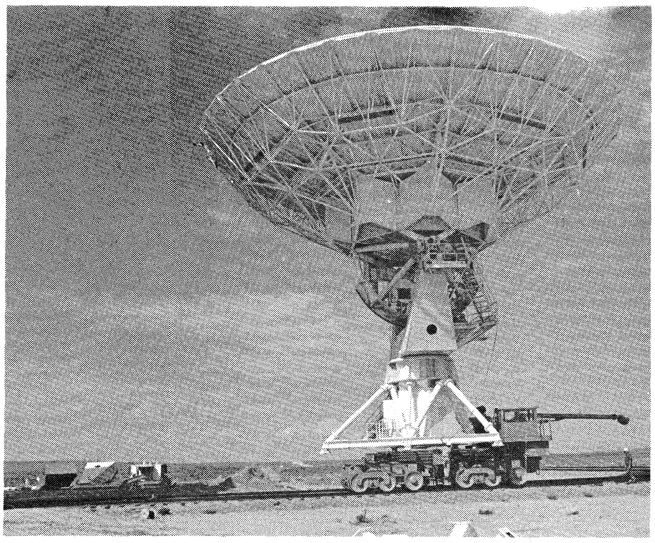
item in the completion of the antenna. On June 28 the subreflector was successfully attached to the pedestal base and on July 18 the completed antenna was moved from the assembly building to the master foundation adjacent to the assembly building where final axis alignment, surface panel alignment, gear and drive alignment and servo installation was accomplished. The antenna and transporter were accepted by AUI on September 22, 1975 and then moved by AUI to a maintenance foundation for installation of cryogenics, cabling and electronic equipment.

On October 24, 1975 the first signals were received by Antenna No. 1, and radiometric testing began. A photograph of the first move of the antenna from the assembly building to the master foundation (July 18) is shown below from which some idea of the size of the equipment and the assembly building plus the expanse of the Plains of San Augustin can be gained.

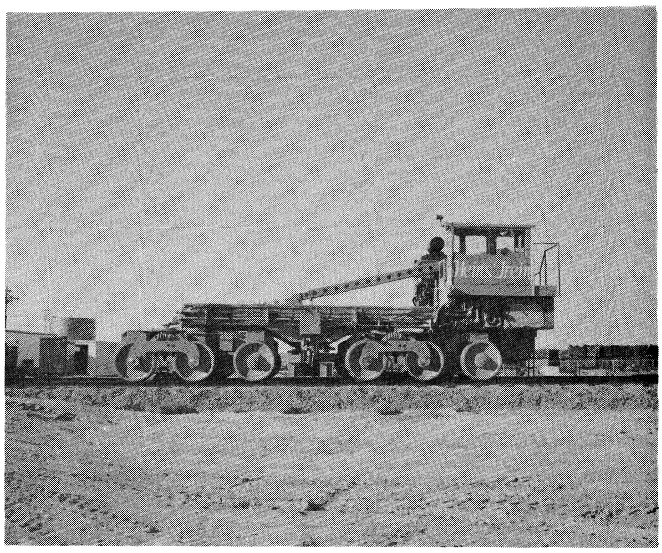


VLA Antenna No. 1, part of assembly building, and the Plains of San Augustin.

Assembly of Antenna No. 2 proceeded quite smoothly and on November 13, 1975 AUI became the proud owner of the second of the anticipated 28 antennas. This antenna is presently being outfitted with AUI electronics and is anticipated to be in operation by the end of the year.

On the following page is a table showing the mechanical parameters of the antenna, which shows a comparison between the contract design parameters and the achieved results. The sophistication of this antenna compared with the existing 85-foot Blaw-Knox antennas can be realized by many NRAO employees who can remember the panel manufacturing RMS of the B-K antennas as 0.125 inch compared with the VLA RMS of 0.015 inch and the panel installation RMS of .018 inch for the VLA antenna compared with the 0.125 inch initially used for the B-K antennas.

A photograph of the transporter is shown below which gives some idea of the complexity of this vehicle. Imagine a vehicle which will pick up a 200-ton antenna from a foundation, move out a railroad spur to the main track, turn itself 90 degrees and travel down the main track to another spur, turn 90 degrees again and travel on the spur to place the antenna on a concrete foundation for operation. Since the prime access to the



VLA antenna transporter. Note the nickname on the cab.

antenna locations is by rail, this vehicle is also the service vehicle for the antennas and contains a crane and work platform which can service all areas of the antenna. The operation and performance of this vehicle has brought forth much interest and concern but,

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MECHANICAL PARAMETERS FOR ANTENNAS NO. 1 AND NO. 2

VLA PROJECT

	Design Specification	Measured Antenna 1	Measured Antenna 2
Panel Manufacture (rms)	0.015 in. (0.38 mm)	0.011-0.015 in. (0.28-0.38 mm)	0.011-0.015 in. (0.28-0.38 mm)
Panel Setting At 50° (rms)	0.018 in. (0.46 mm)	0.014 in. (0.37 mm)	0.0095 in. (0.24 mm)
Azimuth Center To Foundation Center	0.05 in. (12.7 mm)	0.08 in. (2.0 mm)	0.06 in. (1.5 mm)
Azimuth Lean	18 arc sec	12.5 arc sec	12 arc sec
Elevation Orthogonality	18 arc sec	11.0 arc sec	12.5 arc sec
Elevation Offset	0.1 in. (2.5 mm)	0.06 in. (1.5 mm)	0.03 in. (0.8 mm)
Collimation Orthogonality	18 arc sec	3 arc sec	3 arc sec
Collimation Offset	0.25 in. (6.4 mm)	0.03 in. (0.8 mm)	0.05 in. (1.3 mm)
Alignment Focal Mount To Collimation Axis	18 arc sec	5 arc sec	2 arc sec
Servo Error	3.24 arc sec (18 mph wind)	3 arc sec (25 mph wind)	Not Measured
Resonant Frequencies			
Rocking	2.07 Hz	2.20 Hz	2.20 Hz
Torsional	2.15 Hz	2.14 Hz	2.10 Hz
Slew Rates			
Elevation	20°/min	20°/min	20°/min
Azimuth	40°/min	40°/min	40°/min

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subject to the usual trials and tribulations of such a complicated piece of machinery powered by hydraulic systems and controlled by temperamental pneumatic and electronic apparatus, the performance has generated a confidence that the system works.

With the completion of Antennas 1 and 2, it might appear that a brief respite would be in order but such is not the case. Antenna fabricators are hard at work and trial assembly of Antenna 3 is virtually complete at the fabricators. Antenna 4 is fabricated and ready for trial assembly while Antennas 5 through 10 are in various stages of fabrication. Fabricators for various mechanical components are working diligently with one supplier (the elevation gear segments), having delivered to E-Systems in Dallas, Texas gear segments for all eight of the next antennas. Meanwhile back at the ranch, the electronics groups are procuring and preparing systems for Antennas 3 through 10, with expected delivery of Antenna 3 being the latter part of April 1976. The site construction is proceeding with trackage and foundation work in progress which will complete approximately eight miles of additional trackage and 43 additional antenna foundations by mid-1976. The control building is rushing toward a February completion date, and all site personnel are eagerly awaiting the completion early in 1976 of the cafeteria building. The wives in particular are quite interested in this building as the packing of sack lunches has become a chore rather than an experience.

A recitation of this sort would not be complete without some comment on the personnel problems involved. The original Green Bank employees of NRAO will recall the early days of Green Bank with road and building problems. Add to that a location fifty miles from the nearest sizable town and with no buildings or houses on the site, and one can appreciate the efforts of the first site crew. A moderately comfortable site had been established by the arrival in late spring of the bulk of the VLA project staff but there were still remaining some interesting transportation problems. These were solved by the addition of a small school bus initially and later a rental diesel bus followed by the arrival in the fall of an NRAO bus. The use of the bus system while having many advantages has seen several demonstrations of fancy footwork in order not to be stranded in the wilds of the Plains of San Augustin. The various small problems of supply, availability and manpower which arise during the early days of a project of this scope have been solved by the close cooperation of the various groups and the project looks forward to successful prosecution of its assignment.

*****

NEW AUI TRUSTEES

Dixie Lee Ray, former chairman of the AEC, Donald Langenberg, Director of the Laboratory for Structural Matter of the University of Pennsylvania, and John De Wire, Associate Director for the Laboratory of Nuclear Studies at Cornell were elected new trustees to the Board of Associated Universities, Inc. at their annual meeting in Green Bank this October.

Dr. Lee will fill the unexpired term of William D. McElroy who resigned. Drs. Langenberg and De Wire were elected for a three year term.

Dr. Charles K. Bockelman, Deputy Provost for the Sciences at Yale University was elected Chairman of the Board.

*****

Quote: "Harvard is said to owe its Observatory to that heavenly apparition, the spectacular comet of March 1843, which led a number of wealthy Bostonians to raise money for a telescope worthy of the College with a view to quelling fears that the world was coming to an end."

Bessie Z. Jones, "Diary of the two Bonds: 1846-1849; first directors of the Harvard College Observatory." Harvard Library Bulletin, XV, 368, 1967.

*****

THE ULTIMATE IN GAS SAVING

Arnold Rots

To the intelligent reader (and that's what we all are, aren't we?) Dave Shaffer's proposal for a gas-saving contest in the *OBSERVER*'s last issue must have sounded like oil companies pleading to remove price controls in order to keep the price of gas low: it smells like rotten fish. I won't deny that his contest can be a lot of fun, but somehow I have the feeling that a straight conversion of miles into gallons of gasoline is too simplistic. For instance, going straight up the mountains will certainly save miles but requires rather special gear which, I am afraid, is not exactly serving any fuel economy goal. Not to mention all the extra miles and gasoline involved in first finding the shortest way. Or, as a piece of more realistic criticism: getting on and off I-64 might cost more fuel than staying on it and driving an extra few tenths of a mile.

Instead I would like to propose a truly fuel saving contest. It requires two supervisors, one at Green Bank and one in Charlottesville. Somebody leaving from Green Bank goes to the local supervisor and tells him he is going to make it to Charlottesville on, let's say, 3.62 gallons of gas. The supervisor secures that there is exactly that amount in the tank and seals it. The rules are that the vehicle and the persons in it have to make it on their own, without breaking the seal or other foul tricks; that is, pushing by these persons is allowed (that is part of the fun, of course), but any physical contact with another vehicle is not. The Charlottesville supervisor then checks the seal upon arrival and countersigns a certificate issued by the supervisor at the other end.

Special provisions would have to be made, of course, for the shuttle. One driver might decide to start with a minimal amount of gas, knowing that it would be the other driver who would have to push that huge chunk of heavy metal for the last twenty miles or so.

Also, people like Butler Burton should be prevented from dominating the contest, and the owners of big frigates should not be discouraged in trying to save gasoline. Although the latter category might try to operate on, say, four of their twelve cylinders, a more realistic approach would be to introduce multiple record lists. I propose three lists: an absolute one (who gets whatever car he - or she - drives from one place to the other on the least amount of gas); the amount of gas spent per pound of human weight; and the amount of gas spent per person in the car. The second one has built into it - as the bright reader immediately recognized, of course - a healthy urge for overweight people to try to loose some extra pounds. The third one is to discourage people to stuff their cars with small children just for the sake of setting a new record. One might also have noticed already that the last two record lists are quite capable of reviving the issue of car-pooling on the Green Bank-Charlottesville trips.

Finally, I would like to point out that it is only fair to have separate record lists for Green Bank-Charlottesville and for Charlottesville-Green Bank. Everybody who has some understanding of gravitational potential energy (or who has just common sense) must appreciate this point. The kinetic energy one can gain from the altitude difference is roughly 3000 joules per pound. As a quick cafeteria-calculation showed, one can equalize the amounts of gas for both trips (when carrying a modest 3000 pounds) by 'neatly' converting one's car into a Christmas tree with some 850 watts worth of fancy equipment on the Green Bank-Charlottesville trip.

*****

PEARL S. BUCK BIRTHPLACE OPEN THIS WINTER

The Pearl S. Buck Birthplace Museum will remain open this winter. The public is welcome to take the museum's guided tour. As usual, trained guides in colorful dresses of the 1890's escort visitors through the historic house where the famous Nobel Prize winning author was born on June 26, 1892.

Although the museum had been closed last winter for reasons of economy, the institu-

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tion's directors decided at a recent board meeting to try out the new idea of keeping the museum open for the winter in preparation for the Bicentennial celebration. According to Mrs. Georgy Hoylman of Gassaway, Foundation President, the new schedule will provide Bicentennial travelers the opportunity of visiting this historic shrine in the peace and quiet of the off-season in contrast with the crowded conditions expected during the spring and summer of 1976. Of those forthcoming seasons, it is predicted that more Americans than ever before will see historic sites in commemoration of the Nation's 200th birthday, making long waiting lines inevitable.

At the Birthplace Museum, plans are also being made for the annual St. Nicholas Day celebration between December 4th and 7th. Since Miss Buck's maternal ancestors came from Holland, St. Nicholas Day was always a time of great joy and festivity. To recapture the social and religious flavor of the occasion, the house will be decorated in the old-fashioned way and, like last year, visitors can Christmas shop in the fine gift shop at the museum after their tours.

Open all year, visitors may tour the museum Monday through Saturday 9 AM - 5 PM and on Sundays 1-5 PM. The house is located just north of Hillsboro which is between Lewisburg and Elkins on U. S. Highway #219. Special admission rates for groups are available upon request. For a free brochure describing the historic facility, write or call: David H. Corcoran, Executive Director, Pearl S. Buck Birthplace Foundation, P. O. Box 126, Hillsboro, West Virginia 24946. Phone 304-653-4430.

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SOCIAL SECURITY TAXABLE EARNINGS BASE TO INCREASE JANUARY 1, 1976

Monroe E. Petty

Employees earning more than $14,100 will be subject to increased Social Security taxes in 1976. The Department of Health, Education and Welfare recently announced that the maximum taxable earnings base for Social Security purposes will be increased from the present $14,100 to $15,300. For persons earning $15,300 or more, this will mean an increase of $70.20 per year.

This change applies to all wages paid to employees on or after January 1, 1976. The present tax rate of 5.85% will remain unchanged. The table below summarizes the maximum Social Security taxes for 1975 and 1976:

	Tax Rate	Taxable Earnings	Maximum* Tax
1975	5.85%	$14,100	$824.85
1976	5.85%	$15,300	$895.05

*Paid by both employee and employer.

*****

A.U.I. RETIREMENT PLAN TO CHANGE IN 1976

Monroe E. Petty

Effective January 1, 1976, the A.U.I. Retirement Plan will be changed to permit participation by younger employees and certain part-time employees.

Beginning next year, a regular fulltime employee may elect to join the retirement plan if he is at least 25 years of age and has three years of Observatory service.

Part-time employees may elect to join the plan if they are at least 25 years of age and have worked at least 1000 hours per year for three consecutive years.

Participation will be mandatory for all regular employees who are scheduled to work 1,000 hours or more per year, are age 30 or over, and have three months of Observatory service.

Participating employees are required to contribute 5% of their salary which is in excess of the Social Security Maximum Taxable Earnings Base. (Presently the Social Security base is $14,100, however, beginning in 1976 it will be increased to $15,300.) The Observatory contributes an amount equal to 10% of each participant's entire base salary. For participating part-time employees, the retirement contributions will be prorated, based on

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each participant's official work schedule.

In addition to the above changes, the rules for plan participants who are terminating their employment will also be changed. At present, a terminating employee who has participated in the retirement plan less than five years may request that his portion of the retirement accumulation be refunded to him in a single sum. In such cases the Observatory's portion of the accumulation is returned to the Observatory.

Beginning next year, the five-year provision will be eliminated. Instead, an employee may request a refund if the total contributions by both the employee and the Observatory are less than $2,000. In such cases the entire accumulation resulting from both the employee's and the Observatory's contributions will be paid to the employee in a single sum.

In those cases where the combined total of contributions exceeds $2,000, or where the employee does not request a refund, the retirement accumulation will remain on deposit with TIAA-CREF. At any later date, the terminated employee may begin drawing on annuity income from TIAA-CREF. Of if the terminated employee dies before starting his annuity income, the total proceeds in his retirement fund will be paid to his beneficiary.

All employees who will become eligible for participation in the retirement plan as a result of these changes will be contacted individually by the Personnel Office prior to January 1, 1976. Employees who have any questions regarding these changes should call M. E. Petty, Personnel Manager, CV-234.

*****

NRAO EMERGENCY ORGANIZATION GREEN BANK SITE

George Patton

The *RED EMERGENCY PHONE* rings, the PBX operator answers, and an excited caller requests an ambulance (or fire engine) to be dispatched to Wally Oref's house. The caller hangs up before any more information can be obtained. In this example, there is no particular problem since everyone knows where Wally lives - hidden behind the observatory away from the rest of the human race. But stop and think...does everyone know where you live and the fastest route from the site to your home?

The lack of information transferred in a request for assistance is a problem common to all emergency organizations and often results in delays and confusion in equipment dispatching. As most everyone knows, the most important time elapse in a medical emergency or fire is the time between the call for assistance and the time of arrival at the scene. This time could be the difference between life and death or saving a building from complete destruction by fire.

The Green Bank NRAO Emergency Organization has an advantage over most other emergency organizations in the sense that its primary responsibility is to the site and then to employees off site. This greatly reduces the number of people served and aids in establishing a file containing directions to the residences, special medical problems, and any other information which may be of use. The following questionnaire is to be used by employees in the Green Bank area to supply information to NRAOEO. This information will be kept confidential and will be available only to the emergency organization.

Please return the completed questionnaire (following page) to either George Patton or Bill del Giudice in the lab building.

*****

1976 HOLIDAY CALENDAR

January 1	New Year's Day
January 2	Holiday*
February 16	For Washington's Birthday
April 16	Holiday*
May 31	For Memorial Day
July 5	For Independence Day
September 6	Labor Day
October 25	For Veterans' Day
November 25	Thanksgiving Day
November 26	Holiday
December 23	½ Holiday
December 24	For Christmas Day (Saturday)

*Additional Holiday

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MEDICAL AND FIRE INFORMATION FACT SHEET

Employee Name ______________________________ Telephone ____________

Address ____

Directions From Observatory To Residence ______________________________

____

____

____

Number Of People Living In Household ______________________________

Medical Information On Persons Who May Need Special Care. Examples: Sensitive To Bee Stings, Epileptic, Diabetic, Etc.

Name ______________________ Condition ______________

People Who May Need Assistance In Evacuation In Case Of Fire. Examples: Young Children, Invalid, Etc.

Name ______________________ Location ______________

Name ______________________ Location ______________

Special Fire Hazards Such As Bottled Gas, Liquid Fuel Tanks, Large Stock Of Amonium Nitrate Fertilizer Or Other Explosives, Etc.

Description ________________ Location ______________

Description ________________ Location ______________

Nearby Source Of Water Such As Stock Pond (200 Gallons Or More), Stream, Etc. (Draw Map If Necessary)

Source ______________________ Location ______________

Use Additional Sheet For Any Other Information You May Want To Supply.

This Information Is Confidential And Is Provided For Use By The Observatory Emergency Organization To Assist In Rendering Aid In Time Of Need.

WHAT KIND OF CHRISTMAS?

Kitty Valtonen

Since word had gotten around, it was too late to pretend that it didn't exist. Everyone must have seen it sitting there, battered and impressively swathed in postage stamps. and addresses repeated on every side. It would have to be shared to the last crumb, for the X-ray eyes of every West Indian had penetrated the paper layers and sized up that promising cake within.

At Christmas, Black Cake is a tradition in many of the West Indian islands. It is made of succulent fruits soaked in local rum for up to 12 months, spices, a dark syrup of burnt sugar, and miscellaneous ingredients. The cake needs long, slow baking. Its taste defies all description. Many cakes are baked in October to catch the early parcel post overseas and as sure as I am a Trinidadian, Christmas became more real with each Black Cake to arrive in that windy place in Scotland. At home it was always a part of the endless visits paid to relatives and friends. People have their own recipes, and each cake is an individual product. You would sit sampling someone's own cake, sipping a cold drink and not really paying attention to the Christmas carols piped over from the neighbor's radio. At 84^{o} everyone's windows are, of necessity, wide open to trap passing breezes. If the heat is too oppressive, there is always the possibility of sea-bathing.

But, thrown together with an assorted bunch of West Indians abroad, we concentrated on the hunks of Black Cake carefully doled out. We were all agreed that Black Cake is for the common enjoyment. The degree of agreement depended upon whether or not it was your cake that was disappearing.

Most of us had stayed back to help the Scottish Post Office cope with the annual flood of mail - for an hourly wage, of course. It was one of the very few possibilities for earning some extra money at that time of the year in Aberdeen. The trials and adventures of mail delivery included hostile dogs, bitterly cold winds, 6:00 a.m. clocking-in time, and four-storied tenements built before elevators came in vogue. Apart from this, Christmas meant doing for ourselves in the hostel, which surprisingly, took on a very homey air since 95 percent of the inmates had vanished. The diet was curry, curry, and more curry because there were curry addicts from far-off places, and curry was such a good antidote for term-time fare.

There was some snow that year, and we gleefully trampled through winding streets of it to reach that oasis of warm rooms - the Students' Union catering to every taste and need, with snack bars ranging from the really groovy to the survival-fare type, hot baths and hair dryers for a small fee, acquaintances who could always be located in the far corner of the coffee bar, and a notable door porter named Jack, known as Union Jack. The dining room laid on a full Christmas dinner with all the trimmings for the price of haggis and mealie. The offer was available as long as supplies lasted, so if you were keen on turkey and Christmas pudding, you could have a ball through New Year - for the price of haggis and mealie.

Hogmanay, or Scottish New Year, is when the unitiated realize that this is what the Scots had been waiting for all December. It's a wild, wholehearted ushering in of the New Year. Sleep is strictly for the faint-hearted and the deaf. The night is charged with undiluted hilarity, high spirits of both kinds, and everywhere it's open house! Everyone is out "first-footing", or being "first-footed". Tradition holds that Good Luck enters the house if you bring a lump of tar as you set foot inside. Should a black-haired person be the first to cross the threshold after the stroke of twelve, it's a very lucky omen. Spirits are soaring and the spree continues. Once Hogmanay had started, it lasted a full week for some folk, but by then we were, alas, already back on "tatties and neaps".

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