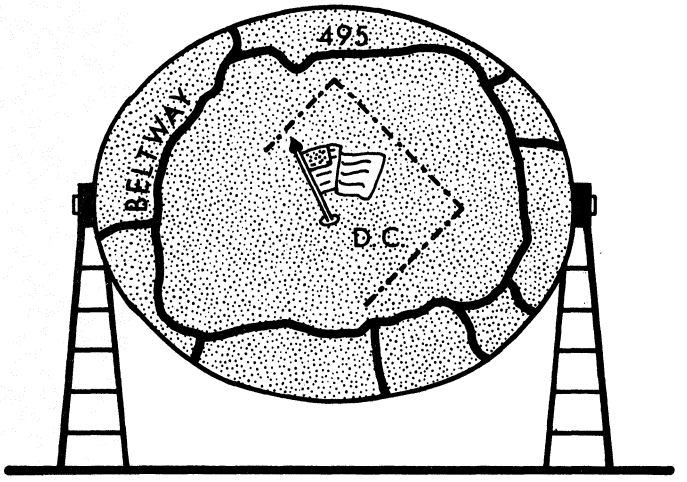
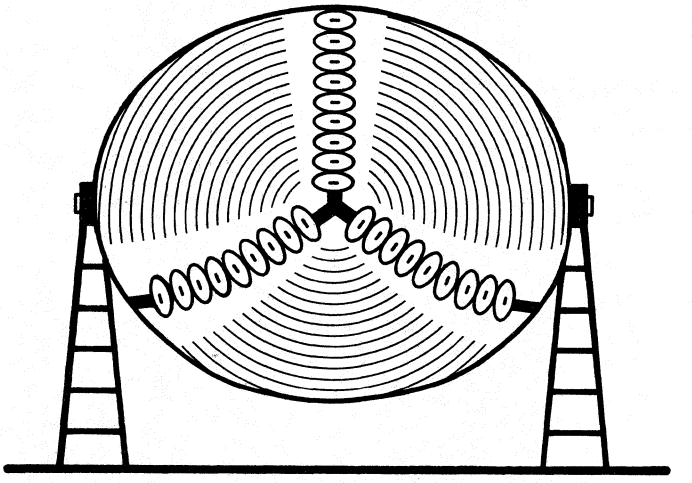
The OBSERVER

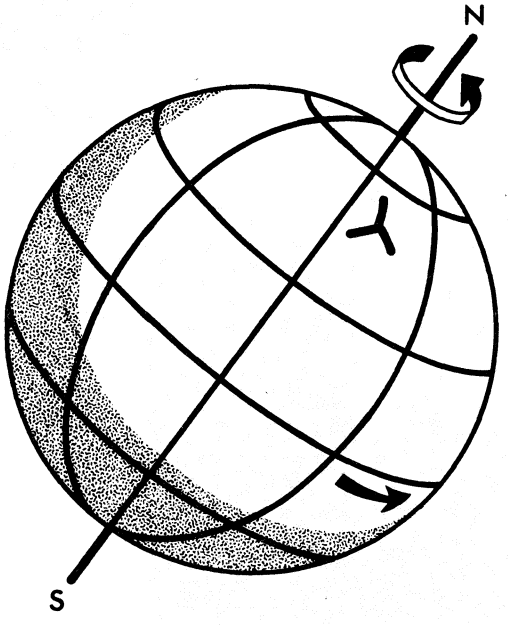
Vol. 13. No. 2 April 1972 Page 1

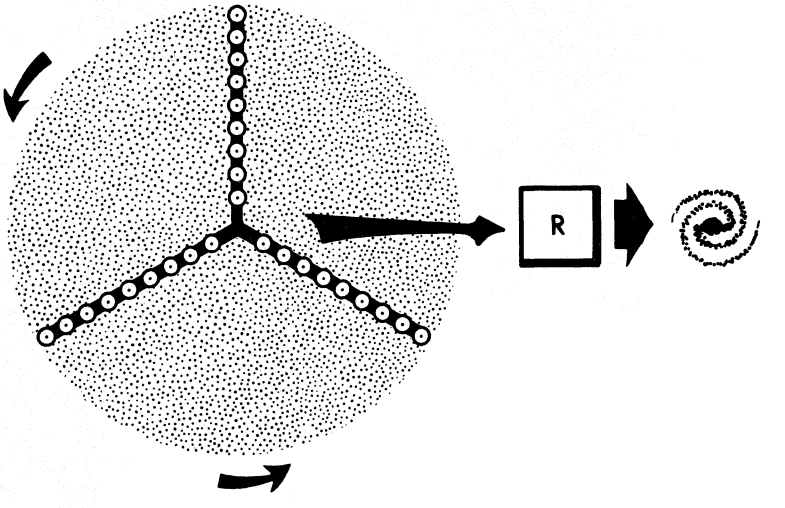
THE VERY LARGE ARRAY (VLA)

NATIONAL RADIO ASTRONOMY OBSERVATORY - VERY LARGE ARRAY









HOW THE VLA WORKS - PAGE 2

THE VLA - PAGE 5

HOW THE VLA WORKS

First Picture — The Vugraph shows how large a conventional radio telescope would have to be in order to achieve the resolving power and sensitivity of the VLA. The large telescope can be broken down into many smaller antennas.

Second Picture — Ideally, the whole telescope area should be "filled" with smaller antennas. However, the Wye-shaped distribution of antennas can simulate the

Third Picture — large telescope by making use of the earth's rotation. The Wye system is then rotated relative to the object which is being ob-

Fourth Picture — served, and in 8-12 hours time of "exposure" the large telescope will be synthesized and a picture of the radio source may be obtained.

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A special thanks to all of those who helped assemble the OBSERVER.

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The OBSERVER is a bimonthly publication of the National Radio Astronomy Observatory, P. O. Box 2, Green Bank, West Virginia 24944.

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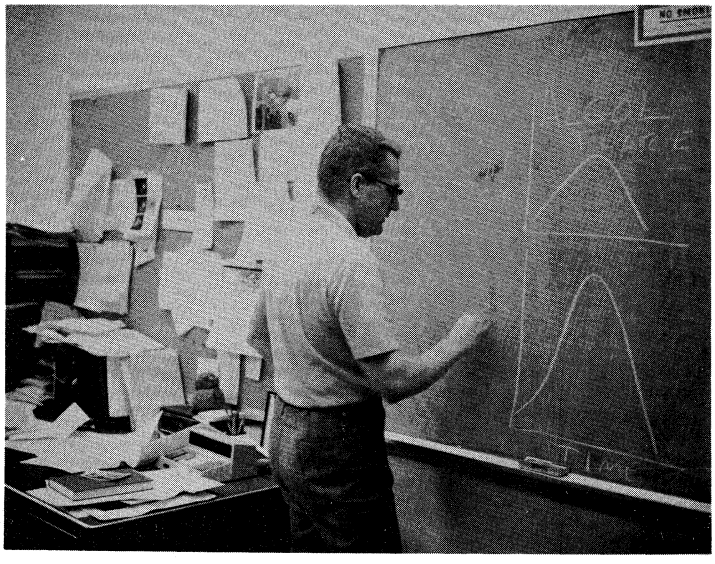
RADIO BINARY STARS

R. M. Hjellming

The NRAO interferometer continues to be the foremost detector of radio stars in the world. In June 1971 an OBSERVER article reported on the early successes of the interferometer in the radio star business. At that time the scorecard listed: (1) three novae or exploding stars; (2) one x-ray star, called Scorpius X-2, which is a very variable radio star and the strongest source of x-rays in the sky - surrounded by a double radio source; and (3) a radio source "at" the position of Antares, a red supergiant in Scorpius, which is one of the brightest stars in the sky.

Data taken with the interferometer in May - June 1971 provided two new and important results. It was the Antares radio source which provided the most important clue which led to other radio stars and the title of this article: Radio Binary Stars. Up until June 1971, Campbell Wade and I believed the Antares radio source was produced in the gigantic atmosphere of the red supergiant. We paid little attention to the faint blue companion star 3.2 arcseconds away from the red star and paired with it in a so-called binary system where two stars move around each other like the earth moves around the Sun. The extreme weakness of the Antares radio source made it impossible to find the position to better than 5 arcseconds, therefore both Antares A (the red star) and Antares B (the faint blue star) were possible sources. On June 1, 1971 a radio flare at 8085 MHz was detected, and the position of the source could be determined to one arcsecond. Surprise! Antares B was the radio source. This was unexpected because that star is small and quite normal; the main unusual thing about it was its proximity to the red supergiant which continuously spews matter into space. The other eventually important result from the May run was that, of the two new x-ray stars detected during that time as radio sources, Cygnus X-1 and GX17+2, the former was later found to be associated with a binary star.

Knowing about Antares B, one of the obvious guesses was that binary star systems with gas streams moving between the stars might be good candidates for radio sources. In October 1971, the first binary observed was Algol, a system where two stars revolve around each other once each 1.86 days, with the fainter star periodically getting in front of the other and blocking out part of its light. It was a radio star, and a very variable one at that. A week later, the interferometer detected another famous binary star, Beta Lyrae, long known for the peculiar gas motions between and around the two stars.



Bob Hjellming discussing Algol.

During January and February 1972 the interferometer has been waging a major campaign against the binary radio stars with two objectives: (1) monitor Algol and Beta Lyrae to learn as much as possible about how they behave; and (2) search for other radio stars, because Algol-type and Beta Lyrae-type binaries are very common. The results have been surprising in every way. First of all, Algol seems to have gone in a fit of periodic flaring - frequently reaching levels 15 times stronger than any observed during Oct. - Nov. 1971. The flares seemed to occur at a rate of at least one or two a day - with almost every type of behavior. The other surprising result was that a search of a few dozen binaries, many even closer than Algol,

--continued, next page--

revealed no new radio stars.

What does it all mean? The most obvious guess is that since Algol did behave very differently this year compared to last, the frequent and intensive radio flaring may be a short lived level of activity in a binary radio star. The failure to detect others, so far, argues that most of the time such active flaring does not occur.

The strengths reached by Algol are almost a hundred times the weakest levels detectable with the NRAO interferometer. This means that, unless nature is very perverse, something of the order of at least a hundred radio binary stars similar to it should eventually be detectable with the interferometer - if we can ever figure out when they are likely to be turned on rather than turned off.

At the present time there are clearly four radio binary stars: Algol, Beta Lyrae, Antares B, and HDE226868, the blue star later found to be a binary star coincident in position with the Cygnus X-1 radio source. As was just mentioned, we now know enough to believe there should be many more.

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AUXILIARY ELECTRICAL POWER

Buck Peery

A little, white, metal building with a large smoke stack, located under the hill below the 140-foot, houses 1200 horses of power which drives an auxiliary generator. The generator will provide electric power during periods when commercial power is not available. This horsepower is developed by an airplane type jet engine.

The jet engine is the same engine used in jet aircraft eight to ten years ago and weighs approximately 400 pounds. The gas generator and air compressor, the section in which the fuel burns, runs at a speed of 22,000 rpm. Hot gases exhausted from this section are used to drive a gas turbine at a speed of 19,000 rpm. Gases entering the turbine are at temperatures of 1000 to 1200 degrees Fahrenheit. The turbine is directly connected to a gear system which drives the electric generator at 1200 rpm. The high speed of the gas generator and the high velocity of the gases through the turbine and exhaust system causes the installation to emit a very high-pitched screeching noise. Standard fuel is JP-1 jet fuel; however, in an emergency kerosene or diesel fuel can be used. The engine uses fuel at the rate of 90 gallons per hour when fully loaded.

The generator generates electric power at 4200 volts and 60 hertz, the same voltage and frequency as that distributed on the site when commercial electricity is the source of supply. The capacity of the generator is 800 kw. When the system was installed this was approximately twice our demand from the commercial power source. Today our demand frequently exceeds the capacity of the generator.

Control of the auxiliary generator is completely automatic. A monitoring system continuously checks the voltage on the incoming commercial power lines. If the incoming line voltage drops to 0 and remains at 0 for 70 seconds, the control system goes into action. The control system first opens the switch in the incoming commercial power lines and then starts the jet engine. After the engine is up to speed and is stabilized, the control system closes a switch in the lines from the generator allowing the generator to feed power to the site electrical system. It usually takes 30 to 40 seconds for the jet engine to start, to come up to speed, and to stabilize. This means 100 to 110 seconds elaspse from the time the lights go out (indicating a loss of commercial power) till the lights come on again (indicating the auxiliary generator is supplying power).

The power companies' record for providing commercial power to the site has been very good. Commercial power has been off for 70 seconds or longer only three or four times since the installation of the auxiliary generator. Even with this record, it is still very essential that we have an auxiliary generator to provide power when we have a commercial power failure to insure the safety of personnel and to protect valuable equipment.

Each Friday around 1300 hours our electrical department runs the jet engine for approximately thirty minutes to check out the controls and operation. During these tests, the generator can not be connected to our site's electrical system.

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THE VLA

D. S. Heeschen

As everyone knows, after 5 years of trying on our part. the VLA has been submitted to Congress as part of the President's budget for 1973. Hearings by both the House Authorization Committee and the House Appropriations Committee have already been held, and the VLA was well received. It remains now for Congress to vote on the budget and, we hope, authorize the VLA and appropriate $3 million for it in 1973. This may not occur for many months and until it does we cannot be sure that the VLA is finally on the way.

In the meantime, however, since it does look very hopeful, things are beginning to happen. The NSF has announced selection of the San Augustin Plains, New Mexico as the site of instrument, and at NRAO we are beginning to organize our design and construction program. Various people in the engineering, electronics, and business divisions are already heavily involved, as are several members of the scientific staff. As the work on the VLA progresses, more of the present NRAO staff will join the project staff. Hein Hvatum is in overall charge of this work for NRAO.

If the VLA is approved by Congress, I believe it will be a great thing for radio astronomy and for the NRAO. It will be a tremendously powerful instrument which will greatly increase the scope and depth of possible radio astronomy investigations. Building it will be a very big job, and it presents us all with a real challenge. The projected time for completion is almost ten years, with partial operation starting however as early as 1976. To meet this schedule, and at the same time continue to fulfil our existing obligations to the ongoing research at Green Bank and Kitt Peak, will require the co-operation and hard work of just about everyone at NRAO. During the design and construction stage of the VLA the NRAO staff will grow slowly. Initially these new people will be in various sites - Green Bank, Charlottesville, and soon a few in New Mexico. When the VLA is in full operation, in 1981 or 82, we anticipate that there will be an operating staff for it of 60 to 70 people, at the Plains of San Augustin. In addition there will of course be others concerned with the VLA at Green Bank and Charlottesville.

We do not intend to slowdown or otherwise curtail activities at Green Bank or Kitt Peak because of the VLA. On the contrary, I expect activity will continue to increase. The Green Bank and Kitt Peak telescopes and facilities are still the best in the world and will remain so for quite some time. They represent a resource of great importance to radio astronomers everywhere, and we must continue to operate them and improve on them. The proposed budget for 1973 includes about $7.2 million and for 1974 somewhat more, exclusive of VLA money. These funds are primarily for operation of the Green Bank and Kitt Peak telescopes, and they represent significant increases over previous years. So if anyone was packing up to go job hunting - unpack. Work at Green Bank and Kitt Peak should continue strongly for the forseeable future.

The VLA was conceived, though not quite in its present form, in 1961. Its design has evolved considerably since then and in fact some features of it are still developing. I find it exciting and challenging that after all these years it may now come into being. And I find it even more exciting to contemplate the science it will be possible to do with it, beginning already in 1976. The next ten years at NRAO--Green Bank, Kitt Peak, Charlottesville, and Plains of San Augustin--are going to be busy and challenging ones. I hope that everyone at NRAO will share in the excitement and challenge.

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CREF UNIT VALUES

1971

January	$41.37	July	$41.24
February	41.57	August	44.01
March	43.14	September	43.85
April	45.23	October	41.84
May	43.81	November	42.38
June	43.58	December	46.21

1972

January	$48.27	February	$50.49

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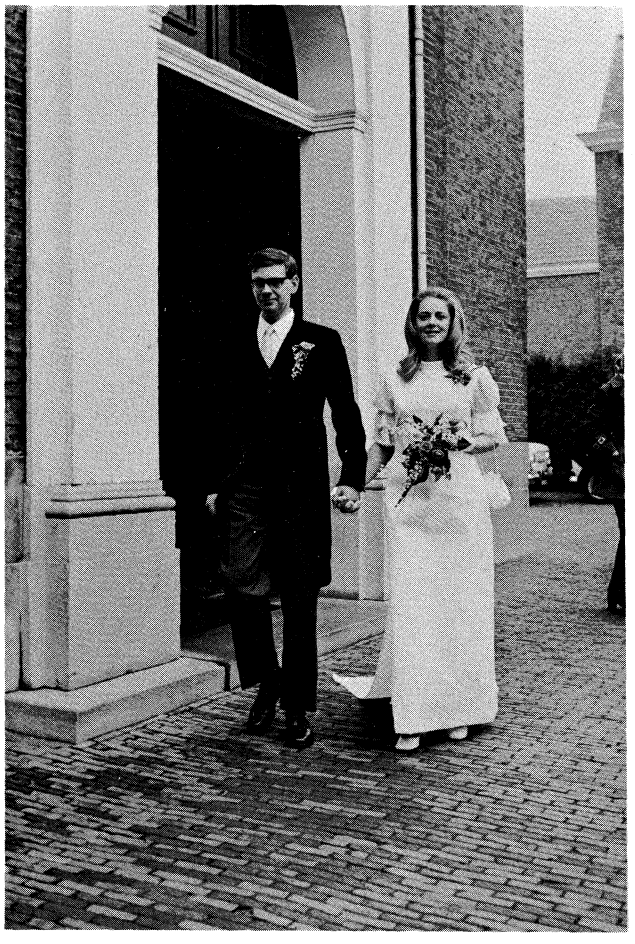
WEDDING IN HOLLAND

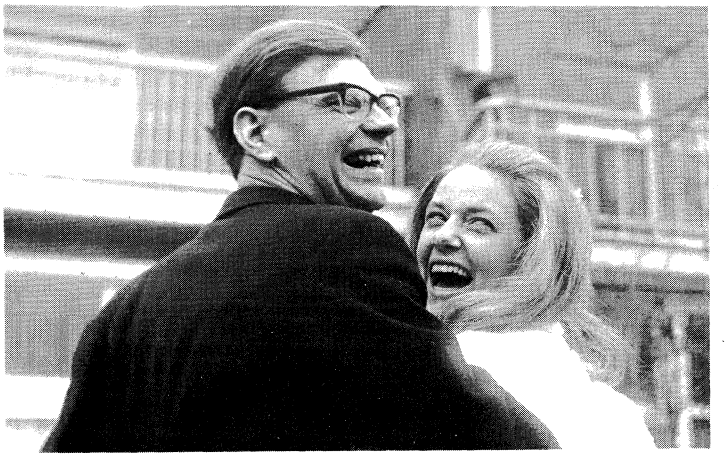
Remember Karel Wesseling? He was employed at NRAO from 1966 to 1968 as an electronics engineer assigned to the interferometer group. After he returned to Holland, he worked in the medical electronics profession. Perhaps through this association he met the lovely girl he married on December 18, 1971. Those at NRAO who received invitations were sorry they couldn't go to Holland for the wedding. Karel sent us some lovely photos and we're reprinting them here plus the comments which were written on the back of the pictures.

"Coming out of the 16th century church: Begynhof in Breda, after the ceremony. The girl in the white dress is mine! I'm hers too."



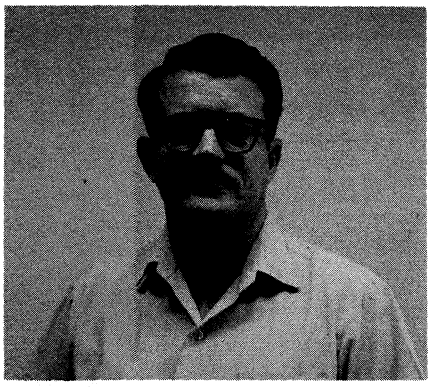
"Re-entering her parents' house in Breda. Her father is a physician who lives in a big house, where we had the reception."

"In the garden, after the church ceremony, but before the reception."

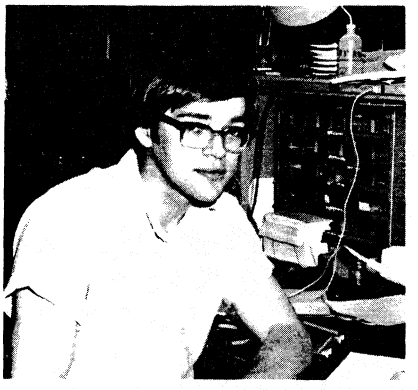


BEST WISHES, KAREL AND HANNY!

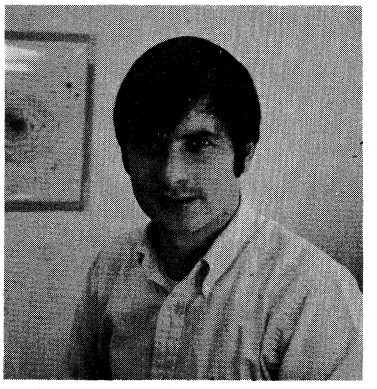
NEW EMPLOYEES



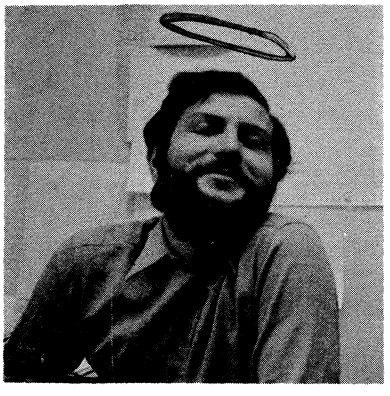
Franklin C. Willoughby
Intermediate Technician
Electronics Division - CV



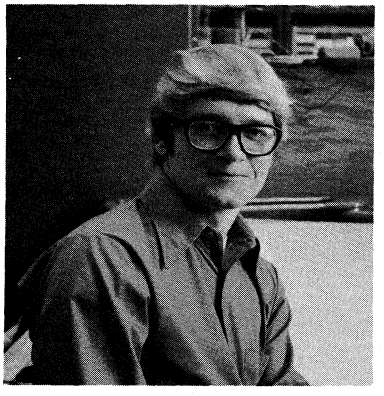
Randall C. Shears
Jr. Electronic Technician
Electronics Division - GB



G. Seth Shostak
Research Associate
Basic Research - CV

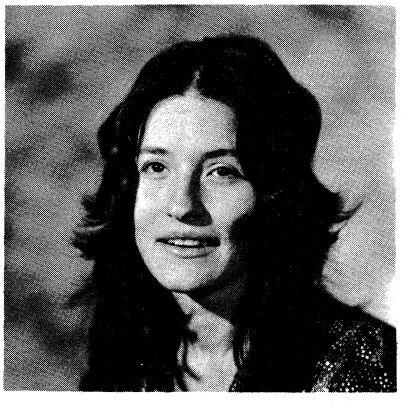


Riccardo Giovanelli
Jr. Research Associate
Scientific Services - CV



Gary L. Wesner
Draftsman
Electronics Division - CV

Paul J. Mellick
Scient. Prog. Analyst II
Computer Division - CV



Maria C. Gobin
Secretary
Tucson

Patricia W. Quinn
Receptionist/Tel. Oper.
Bus. Mgr. Division - CV

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Terminations

John W. Hawkins.....Administrative Services
Ray Robertson.....Administrative Services
John F. C. Wardle.....Basic Research
Collins E. Yang.....Engineering Division
Claude N. Williams.....Co-op
C. Keith Sword.....Co-op

Transfers
(From Adm. Services to Plant Maint.)

Delbert Cassell
Harlan G. Tallman
Ether J. Tyson
James L. Pennington
Roy D. Pennington

Leave of Absence

Jo Anne Byram.....Business Management Division

Rehires

Joseph P. Greenberg.....Co-op

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A SECRETARY DEFINED

Now, to get all the definitions out of the way, the National Secretaries Association (International) says a secretary "shall be defined as an executive assistant who possesses a mastery of skills, who demonstrates the ability to assume responsibility without direct supervision, who exercises initiative and judgment, and who makes decisions within the scope of assigned authority."

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PUZZLE

Here's a puzzle for you.

O T T F F S S E N T is something you normally use every day. Don't concentrate too hard. It might even help if you count to yourself.

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TUCSON TOPICS

Bob Hogarth

We keep growing all the time here in the Wild, Wild West. Our most recent addition is our secretary, Maria Christina Gobin. Chris comes to us all the way from Buenos Aires, Argentina and Bolivar, Venezuela. She went to Robert Morris College in Pittsburgh, then came to Tucson, where her husband, Chuck, is completing his Master's in Modern European History at the University of Arizona.

A few of the Eastern folks decided to try our sunny winter climate for a while. Bill Del Giudice, Jim Dolan, Tony Hamed, Wally Oref, and Dave Williams were out recently, and Drs. Heeschen, Hvatum, and Wade were out in February for the AUI Trustees Meeting. We felt we had to reciprocate, so we sent Gene Wetmore back East to see how the other half lives. He hopes the typical Tucson weather he took with him was appreciated.

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THE OBSERVER

Did you notice that there wasn't a March issue of the OBSERVER? For the first time in a long time we skipped an issue. Here is why we did it. We got behind in printing the January issue by more than three weeks because of printing work that was required to get out the fourth volume of the VLA report. This, in turn, put a squeeze on the March issue. We just didn't have the heart to put the bug on people to write articles again when the last issue was barely off the press. Anyhow, news and happenings just don't happen that fast at NRAO. Also, some Observatory people had suggested that we could get better coverage of Observatory events and ease the strain around major holidays if we skipped a month and published on the even months. We gave this idea some thought and decided that it wasn't a bad idea. So when time caught up with us on the March issue, we decided this was a good time to switch to the even months. From now on, starting with the April issue, the OBSERVER will be published bimonthly on the even months.

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NOISE

Jim Dolan

Probably everyone is aware that one of the main reasons that Green Bank was selected as the location of the National Radio Astronomy Observatory was because of the low radio noise level in the valley. The reason for the low noise level was low population density, low traffic levels, and the natural shield provided by the beautiful Allegheny Mountain ridges surrounding the valley. Perhaps I should explain that the "noise" to which I refer is not audible (the kind you hear with your ear) but radio frequency noise that interferes with communications and low level receiving systems. You have seen some effects of interference on your own television receiver. Since radio quiet was a main factor in selecting Green Bank, it follows that we have a vested interest in keeping the area as free as possible from interfering signals. Everyone knows by now that our visible environment is under increasing pressure from pollution of one type or another. The radio spectrum, though not so visible, is also becoming more polluted with undesirable signals. Even our relatively secluded valley, in spite of our efforts is becoming noiser as time goes by.

If we allow noise levels to rise uncontrolled we will eventually reach a point where radio astronomy observations will be almost impossible. The NRAO has put forth considerable effort in systems to control both intentional and unintentional radio noise in the area. Possibly the most visible effort is the white van (commonly referred to as the milk wagon or "Good Humor" truck) that may be seen throughout the area from time to time. This van houses most of the necessary equipment to locate interference sources in the area. Such things as television preamplifiers, like those most people use in the area, have given us some real headaches. One model in particular has a tendency to be unstable at certain temperatures, usually in the dead of winter, and causes considerable interference. (That company must have a darn good salesman because there seems to be lots of these things around.) People are generally glad to find out that the trouble they are experiencing with their television set is really the fault of the not so expensive preamp.

There are many other sources contributing to the general increase of noise in our area. Automobile ignition noise is a particularly bad offender as traffic density increases in our locality. Also, modern technology is continually providing consumers with more electrical and electronic devices, most of which are capable of generating radio interference. Such things as thermostats, electric motors, fluorescent lights, garage door openers, CB transceivers, and practically any device that uses electric power is a potential source of trouble. A new device that causes particular concern is the microwave oven. The reason this device demands special attention is because it generates large amounts of radio energy on or near frequencies that are used for radio astronomy. Add to this the possibility of spurious signals (signals other than those desired) and the reason for concern is obvious. A unit of this type could cause interference to the NRAO from as far away as 10 or 15 miles, even if it was operating properly. If the unit should be faulty, this distance could be greater. (Also, the microwave energy from a faulty unit can be dangerous).

The source of much interference at the VHF frequencies (about the same frequencies as used for television broadcast) is the 60 cycle power distribution system. Normally we try to locate the source of the trouble and request maintenance help from the Monongahela Power Company. It may be my imagination, but it seems that most of this trouble occurs during the coldest weather and usually at night. At least I can't remember too many troubles on a warm, spring afternoon when an excuse to get out of the lab would be welcome.

Ironic as it may be, we also cause trouble for ourselves. It is not unheard of for one telescope system to cause interference to another. Computers, relays, faulty heaters, and local oscillators can cause interference not only to adjacent systems but also to the system of which they are an integral part. So we must also clean our own house. As it is with other forms of pollution, radio interference is everybody's job.

Although any of the aforementioned devices can cause radio astronomers to come unhinged, many of the same sources can cause

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TV viewers or FM buffs to likewise lose their cool. So if your TV or FM is doing strange things, it could be that you are a victim of this different kind of pollution. In case this happens and you are anywhere near the Observatory and it is a nice, warm, spring afternoon, just call the author. In case this happens in the middle of the night or the weather is cold and windy, call the author's helper.

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NRAORA REPORT

Richard Fleming

With the conclusion of the New Year's Dance last year we began a new year's activities, looking forward to a big and eventful year to come. On February 9th your recreation association sponsored a jazz concert. This program was presented with financial assistance from the West Virginia Arts and Humanities Council. The Jazz Trio from West Virginia University, under the leadership of Dr. James Miltenberger on piano and Mr. Robert Hamrick on bass guitar and Mr. James Jackson on drums, presented an excellent two hour concert which was very much enjoyed by all. Over 100 people attended and enjoyed jazz versions of songs from musical groups like The Beatles, Burt Bacharach, "Jesus Christ, Super Star", and from composers like Bach and Hyden. They presented jazz stylings of music from early Renaissance to the most recent rock times. There were demonstrations of different styles of music (classical, jazz, African) utilizing a variety of improvisational approaches. The trio has performed throughout West Virginia and was featured on a half-hour TV program.

We are planning to have one or two more concerts during the year and will be announcing these as plans materialize.

Plans are in the making for the summer picnic and it promises to be the best ever with some new happenings all should enjoy. There hasn't been a picnic like this one before, so plan to come.

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SASSAFRAS TEA-A SPRING TONIC

Weepy Meringue

Eat right, exercise, get plenty of rest, and drink Sassafras tea for your health and enjoyment. How to make Sassafras tea the right way (the Appalachian Mountain way) is what this article is about.

Right off the bat I'm going to assume you know where you can dig some Sassafras roots. You'll have to dig it yourself or get some from someone who does. This tea is made from the whole roots and I don't believe it can be store bought. The only thing I've seen for sale in stores is the root bark. Here's the recipe:

Place 6-10 cups of fresh, cold water in a 4-quart enamel pan. Add 6-8 pieces of Sassafras roots (about as thick as your little finger) and bring water to a boil. Lower heat and simmer for 15-20 minutes until tea takes on a reddish color. Remove pan from heat and DRAIN OFF THE LIQUID but keep the roots. The first brewed tea from fresh roots is strong and tastes woody. Discarding the first batch is the secret to making good tea. Again add 6-10 cups of fresh, cold water to the pan and roots. Bring to a boil and then simmer for another 15-20 minutes or until tea takes on a pleasing reddish color. It is now ready to serve. After several cups of tea are removed, add the same amount of fresh, cold water, heat, and simmer. This process can be repeated several more times if you want more tea. Save the roots. Don't throw them away. Sassafras roots give up their flavor slowly and can be used several times. Dry the roots and store in a dry place.

Sassafras root tea also makes an exceptionally good iced tea. Make the tea the same way but use more roots and boil for 5 or 10 minutes longer. You want a strong tea for iced tea. This tea will be darker in color. Fill tall glasses with ice and pour the hot, Sassafras tea over the ice. Add sugar to taste. Ummmmmmmm.....it's good!

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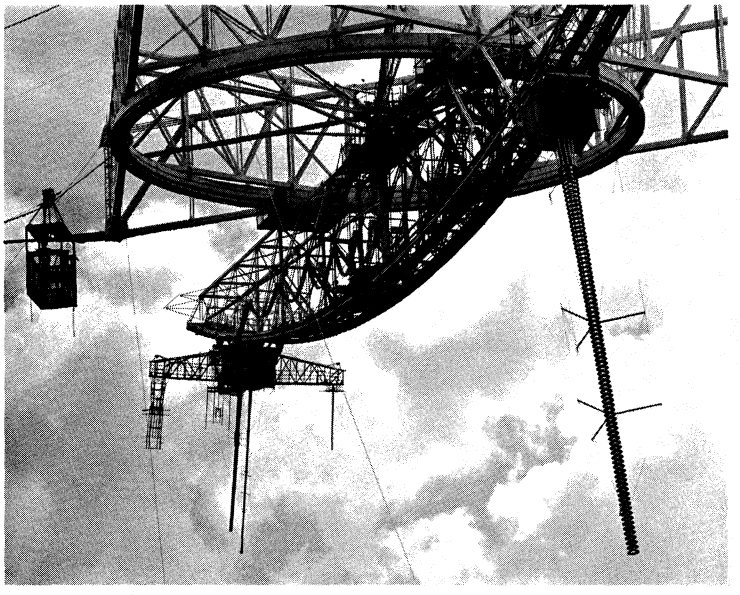
THE NATIONAL ASTRONOMY AND IONOSPHERE CENTER

Yervant Terzian

I. The Caribbean Jewel

The National Astronomy and Ionosphere Center (NAIC, Arecibo Observatory) has only one radio telescope--the 1000-foot in diameter spherical antenna. This antenna is the largest filled aperture radio telescope in the world and presently operates in the frequency range 30 to 840 MHz. The fixed reflector surface is made of half-inch square wire mesh suspended over the ground from cables that maintain its spherical surface. Movable line feeds up to 96 feet long hang 435 feet above the reflector from a stationary triangular platform suspended from three tall towers on the surrounding hills. As many as 16 feeds at different



A view of the Arecibo telescope suspended platform. The newly installed 96-foot line feed at 430 MHz is shown on the right.

frequencies have been installed on the movable platform. Observations can be performed simultaneously with all these feeds--providing the capability of a multi-antenna system. The declination range of the 1000-foot telescope (with an extendible boom on the platform) is from -05°54' to +42°36'. Although radio observations at any frequency in the range mentioned above are possible, NAIC maintains permanently several systems which are constantly in operation. The approximate parameters of these systems are summarized in the table below:

Frequency (MHz)	Half Power Beamwidth (arc minutes)	Sensitivity (°K ant. temp./flux unit)
74	75	5
111	51	5
196	33	3
318	17	8
430	10	14
606	10	4

Radar observations of the earth's ionosphere, moon, and planets are also possible at NAIC. The observatory operates two transmitters; one at 430 MHz and another at 40 MHz (to be changed to 50 MHz in 1972). All the radar experiments and some radio experiments sample data at an extremely fast rate. This makes it necessary to often use the NAIC CDC3300 digital computer on line with the telescope.

II. The Long Needle Feeds-and Efficient Science

In January 1972, a new 96-foot long line feed at 430 MHz (with circular polarization) was installed on the Arecibo telescope. This system has a sensitivity of ~ 14.5°K/flux unit; a half power beamwidth of ~ 9.6 arc minutes; and sidelobes less than three percent of the main beam. Wherever one looks with this system there is a radio source. The aperture efficiency of the antenna with this feed is 53 percent.

Another important addition will soon be a multibeam system of ten overlapping beams at 606 MHz. The ten low noise receivers and the ten line feeds have been completed and the system should be operational by the summer of 1972. This system will be capable of mapping more than a degree in declination simultaneously.

A 100-channel autocorrelator receiver is now functioning at Arecibo, and detection of several hydrogen recombination lines have already been made at frequencies of 318, 430, and 606 MHz.

--continued, next page--

III. The Glorious Future

The 1000-foot antenna surface is now being upgraded by LTV Electrosystems, Inc. The upgrading of the surface of the telescope will be completed in 1974. Observatory operations will continue almost as normal during the upgrading. The new telescope surface will permit observations in the frequency range 30 to 7200 MHz. The present wire mesh will be replaced by 37000 adjustable aluminum perforated panels, three by seven feet in size each.

The upgraded system will enable astronomers to make observations at 21 cm (neutral hydrogen), 18 cm (OH molecules), and at wavelengths as short as 4.2 cm. The half power beamwidth at 21 cm will be $\sim$ 3 arc minutes, and at 4.2 cm $\sim$ 36 arc seconds (if 1000-feet are illuminated by the line feeds).

A new transmitter at a wavelength of 12.5 cm is also being constructed for radar studies of the solar system.

IV. National Operations

The NAIC is a National Center similar to the National Radio Astronomy Observatory and Kitt Peak. It is operated by Cornell University and is supported by the National Science Foundation. Scientists interested in performing experiments at Arecibo should send their proposals to the NAIC Director.

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READY FOR SPRING???

Virginia Van Brunt

You probably think all of NRAO's most successful farmers are in Green Bank. Maybe they are, but every year about planting time, one hears bits and snatches of conversations in CV which indicate there may be a few citified farmers too. Their plots may not be as great, but I suspect their enthusiasm is equal to the more experienced West Virginia natives.

And for gardeners everywhere, one of our more prolific publishers. the US Government, has a few publications which you may want to consider if you are thinking about a new approach to your planting methods or pest control:

APHIDS ON LEAFY VEGETABLES - HOW TO CONTROL THEM 16 pp. 15 cents

GROWING CAULIFLOWER AND BROCCOLI 12 pp. 15 cents

CONTROLLING TOMATO DISEASES 12 pp. 10 cents

MULCHES FOR YOUR GARDEN 8 pp. 10 cents

HOW MUCH FERTILIZER SHALL I USE? A GARDENER'S GUIDE FOR CONVERTING TONS OR POUNDS PER ACRE INTO PINTS, CUPS, TABLESPOONS, OR TEASPOONS PER ROW OR PLANT 6 pp. 5 cents

As always, prepayment is required when ordering from the government. If you are interested in these or others, the library can provide you with a more complete list or ordering information.

What else is new? Green Bank has received several new books recently in electronics and some rather different fields--would you believe Army Ants? Oceanography? Resources and Man?

Perhaps this is the time to mention again that we do issue a NEW BOOKS LIST monthly. If you are interested in receiving a personal copy, call and tell me. Otherwise, the latest list is available on the bulletin board in both libraries. Since new books are slow to be catalogued, the NEW BOOK LIST is a convenient way to keep up with new titles received before they are in the card catalogue.

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You cannot help the wage earner by pulling down the wage payer.

--Abraham Lincoln

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TRAVELS WITH CHARLIE--PART II

Barry Clark

Synopsis: I take a 150 pound clock named Charlie with me to Moscow for a VLB experiment. On the way, we visited Holland and Germany. After various adventures with customs officials, I at last get permission to take Charlie from Amsterdam to Moscow.

I was getting rather impatient about getting to Moscow by this time, and had gone ahead and made reservations for the next morning, despite the fact that I couldn't get a direct flight, as I had had before, but had to go via Copenhagen. So Saturday morning I showed up at the airport at eight, presented my multi-initialed and rubberstamped piece of paper, and was permitted to check Charlie, as baggage, on the Copenhagen flight, rather to the relief of the local customs boys, I think.

In Copenhagen, I spent my stopover admiring the scenery--that is, the baggage department scenery, as they unloaded Charlie's box from KLM, changed him from one cart to another, and drove him out to Aeroflot. Then off we went to Moscow, not over an hour late.

So there I was, in the Moscow airport, carrying a 150 pound clock, with no one to meet me (because my telegram would not be delivered for two more days), and with the clock battery pack using its last few minutes of capacity. After some time, I managed at last to attract the attention of an English-speaking tourist aide. "Could I plug the clock in and let it charge its batteries?"

"It would be better to do it at your hotel. In any event, it is not possible to do it without clearing customs."

"Could I call my friends by telephone to help me get my clock through customs?"

"It would be better to do it at your hotel. In any event, it is not possible to do it before clearing customs." With a final "Nothing can be done", she vanished into thin air and left me to face customs.

So there stood Charlie and I, neither of us with more than a minimal grasp of the language, and one of us capable of doing nothing more than ticking. Furthermore, Charlie's battery voltages were getting disastrously low, and he would shortly stop, and all the high quality time with which we had filled him through so much tribulation at Bonn would quickly leak away. So, with some trepidation I got in line for a custom's inspector who had been pointed out to me as speaking a little English. As I hefted Charlie onto his counter what to my delighted eye should appear but Matveyenko and Kogan from the Space Research Institute, and Marshall Cohen and his daughter from Caltech, who were arriving for the same experiment! With Kogan to translate, Charlie and I quickly cleared customs (the inspector seemed more interested in my large collection of paperback books and in the Dutch and German coins I had picked up for my kids than in Charlie). Safely clear of officialdom, we went outside and sat down on the sidewalk. (Kogan produced the Russian proverb equivalent to "It never rains but it pours", with the operative noun changed to Americans; he had come to meet me twice already, unsuccessfully.)

At this point Charlie's remaining life was measured in seconds. His batteries had decreased from 27 volts to below 24, the limit of the meter. His power supply had fallen out of regulation, and the stream of electrons was starting to congeal in his arteries. But, miracles abound! The Russians had brought with them a battery of their own, because Marshal Cohen was carrying a crystal oscillator which he was keeping warm (he hadn't had it filled up with time because it is so much leakier than Charlie).

I didn't dare disconnect the main batteries and plug in the Russian 24 volts directly, because I was afraid that the fifteen minute reserve battery was too low to carry the clock even for a few seconds. So we took half the Russian battery, and connected it to the inverter, which takes 12 volts DC and makes 60 Hz AC 120 volts. which the power supply converts back to 24 volts DC. Comparing in my mind the size of their battery with Charlie's own, I concluded that it was good for about an hour; which, coincidently, is the time it takes to drive from the airport to the hotel.

The next problem was that Charlie would not fit inside the car's trunk, and it is apparently illegal to drive in the Soviet Union with the trunk ajar but tied down.

--continued, next page--

(Charlie had fit nicely in the trunk of a rented Opel in Holland and Germany, but in other areas the Volga is a larger auto.) Finally, Matvenyenko vanished into the hinterlands, and returned in a surprisingly short time with a taxi. Charlie and his keepers (Kogan and I) were banished to the taxi, while the others rode off in the Institute car. Charlie rode inside the car, and I held my arms around him to keep him from scratching the dashboard (most Russian drivers take a fierce pride in their cars) or disconnecting his wires.

The next problem, at the hotel, was to get Charlie up to our room. The Academy of Sciences Hotel in Moscow has two small elevators. (I could write a separate treatise on "Soviet Elevators I Have Known" with an appendix dealing with stairs.) It was clear that, at most, Charlie and two people could fit in an elevator. Further, it was a rather busy time for the elevators, and they were carrying five or six people at a whack, and still there was a queue. Now the Soviet ethos on queue waiting is a sophisticated and developed one, with subtlies far beyond my primitive sociological insight, but it soon became clear that, as far as the queue was concerned, Charlie was an unperson, and that we who chose to associate ourselves with him could darn well wait until after the queue had dissipated. But after a while, us pushy Americans managed to commandeer an elevator and hijack it to the third floor. We hustled Charlie into the room, exchanged his European type line cord plug for a Soviet type, and plugged him in at last to the good old wall socket.

Sunday was spent in shameless weekend tourism. Monday, among other things, I went out to the airport to see if the other VLB gear had safely arrived (it had) and whether it would fit in the cargo airplane the Institute had chartered to fly it to the Crimea (it would, though there was some confusion about some crates, whose weight in pounds was written on them, but was marked kilograms).

When we got back to the Academy Hotel at dinner time, after about nine hours absence, we found Charlie unplugged. The hotel maids, deciding that a ticking box with glowing lights and American labels must be up to no good, had unplugged him for the safety of Hotel and guests. Fortunately, such a weighty decision apparently involved a large discussion to decide the question. This conference, what with scheduling problems and the like, did not reach its decision until 3:00 PM, and Charlie had been on batteries for only 3 hours, and was not discommoded at all.

The next morning Charlie and I went out to the airport to emplane for the Crimea. Since he was a bit heavier than the usual suitcase, we carried him up the stairs ourselves (instead of letting the Intourist lady do it, as foreigners usually do) and plunked him in the plane's luggage compartment. Three hours later we were in sunny Simferopol in the middle of the Crimea, and I was again met by Kogan and a car hired by the observatory. This time, by removing the lining, we managed to get Charlie in the trunk with the lid closed. Charlie indicated that he had about three hours of battery life left, and it is about a three hour drive from the Simferopol airport to the observatory. Therefore, it seemed a good idea to connect the inverter which would let Charlie run from the car battery, though not charge his own batteries. Kogan and the driver concluded that making this connection was not a suitable activity for an airport parking lot, so we drove out and parked by the roadside a few miles toward the city of Simferopol. A crowd of small boys materialized from nowhere to watch the operation. They were, however, more interested in the car than the wiring. The car was a new model Volga, which looks like a 1963 Pontiac, and is still rather a rarity. (The old model Volga looks like a 1953 Pontiac, and I never ride in one without a pang of nostalgia for a car of that vintage which was one of the cherished possessions I brought into my marriage which my wife regarded as totally disreputable and undesirable, along with the suit I graduated from high school in.) One boy asked the driver how much the car cost, and he replied, "Fifty kopecks."

Mike Balister said the clock could be run this way from twelve volts, though the batteries could not be charged. However, the electromotive force of the lead sulphate reaction appears to exhibit a preference for political or economic idealogies, and it ended up with the car battery supplying about a fourth of the power, and Charlie's internal batteries the rest. Figuring that we were at least preventing disaster, we went on out to

--continued, next page--

the observatory without incident, with only a brief stop at Yalta to ask Charlie if he was going to make it OK.

The next day the rest of the VLB equipment arrived. There was also supposed to be a crane, which would lift the heavy tape unit up into the antenna. But late in the afternoon Ivan Moiseyev came up to me and informed me that "The crane will not." So he rounded up all of the observatory's male employees and they picked up the 650 pound box and lifted it ten feet into the antenna base.

We then fetched Charlie from his nest in the lab building, and carried him over to join his friends. I began to hook things up to check for the dislocations of travel. As I worked hooking things up, I kept getting these annoying tingles as I touched our equipment. Muttering things about "ground loops" and "induction", I asked for a ground wire to get rid of the problem. I was handed one, but when I approached our equipment with it, I was rewarded with a shower of sparks and a firm "thunk" as the breaker tripped. It seems that somewhere in his power supply, or as Mike Balister later theorized, in his power cord, Charlie's case had become connected to one side of the power line, and both sides of a Soviet 220 volt line are at 125 volts above ground. So long as Charlie was in his wooden crate, he didn't bother anybody, but when we connected him to the rest of the equipment, he was well on the way to booby-trapping half the receiver when we caught him. We very quickly converted him to 110 volt operation, where one line is indeed neutral.

This has been the story of how Charlie and I carried the time from Ghent to Aix, and it was apparently as hard on Charlie's nerves as on mine, and on those of the many people who helped me along the way. On his return from the Soviet Union, Charlie had to be remanded immediately to the intensive care unit of the local rubidium clock hospital.

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You cannot strengthen the weak by weakening the strong.

--Abraham Lincoln

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LETTER TO THE OBSERVATORY

National Radio Astronomy Observatory
Green Bank
West Virginia

Dear Sirs

Once before I sent a letter on contacting people in outer space and sugested the morning star the original wormwood. It is realized that this is the same as every body elseses guess. But let me explain where this theorie comes from. It is recorded in the peabody pappers Harvard University that there is a sertain tablet namily "Tiponi" this tablet is still in curculation today its markings are said to be sacred never the less. These markings have been decyphered and the cypherings followed and the most exterordinary outcome was determined. The cypherings cover aloted tasks, and on one such task mission it was discovered that under mount Zion there lies a giant solar sell. This ancient divice was constructed many years ago under instructions that it was to put back in the sun when this planets occupants were peacefull enough to except visitors from outer space. As an ameture Archeologist I was one of the people who whent along on the question a seing if the ancient instructions that go with the legend around Tiponi, were corect. Having had two looks at Mount Zion we are able to say that there is a secoret chamber under this mountain. We have taken a look at the enterence, and are satisfied it still exists same as it was put there those many years ago. Now if by any chance you are interested in this Solar Sell, tread lightly its garded well. We could still be coaxed to follow the rest of the instructions Tiponi give us and retreave the Solar Sell. Are you interested? Last time I was there I was picked up as a tramp and imprisiond. I was only having a good look at the writings on the wall.

Food for thought

Sincerely
P H

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NRAO TEN-YEAR EMPLOYEES

Left to right: D. Hogg, L. McPherson, C. Barkley, R. Vance, J. Tacy, M. Wimer, I. Michael, C. Puffenbarger, W. Oref, M. Foe, A. Collins, M. White, H. Coleman, T. Carpenter, N. Horner, L. Sipe, H. Brown, J. Ralston, and H. Taylor. (Not present when picture was taken: S. Von Hoerner, J. Matheny, C. Dunkle, D. Ross (Tucson), C. Wooddell, and J. Oliver.)

Ten-year pins and certificates were awarded to twenty-five employees on January 11, 1972, at an evening dinner held in the Green Bank cafeteria. Pins and certificates were presented by David Heeschen, NRAO Director.

WEATHER IN GREEN BANK

John Weaver

On March 20, 1972 at 0722 EST, the sun in its apparent motion through the skies was over the earth's equator and prime meridian simultaneously. This marked the vernal equinox and sent the Northern Hemisphere winter season of 1971-72 into history.

This winter was marked by contrasts. By and large it must be considered a mild one; however, the lowest temperature recorded since local records have been kept, beginning with the 1967-68 season, occurred on 8 February 1972 when the mercury dipped to minus 20 degrees. On 29 February it rose to 67 degrees making the February temperature range 87 degrees.

The most severe Artic outbreak of the winter swept through the local area in mid-January dropping the daily mean temperature, i.e., the mean between the daily high and low, from 38 degrees on 13 January to minus 4 degrees on January 16. By January 19 the mean temperature had climbed back to 37 degrees. The daily highs during this period were 52 on January 13, 10 on January 16, and 58 on January 18 and 19. Lows were 25, minus 18, 12, and 20 degrees on the same days.

Statistics for the last five winters show that the earliest occurrence of zero or below temperature was on November 25, 1970 with minus 2 degrees. The latest was 26 February 1970 with minus 4. Lows for the same period were minus 18 on January 2, 1968, minus 5 on January 14, 1969, minus 12 on January 11, 1970, minus 10 on January 3, 1971, and minus 20 on 8 February 1972.

Now a word about temperature measurements. Large variations will be observed over an area such as Pocahontas County due to elevation differences. All other considerations being equal, adiabatic temperature change is approximately 6 degrees F per 1000 ft. change in elevation. Temperature measurements used here are taken at 2637 feet elevation, in ambient air, with a sensor calibrated to read exactly 32 degrees F when immersed in melting ice.

Standard National Weather Service criteria for measuring ambient air temperature specify that the sensor (thermometer) be shaded, in a ventilated area, five feet above the ground, preferably over a grassy surface, and at least forty feet from any building or structure. These criteria are met when measuring temperature at the interferometer.

The accompanying graphs (page 18) show the 24 hourly high, low and mean temperatures for December, January, and February for last winter.

Nothing was mentioned in this article concerning snow because precipitation amounts have not, in the past, been recorded. We now have installed at the interferometer a rain gauge, kindly furnished us by the National Weather Service, and beginning with March 1, rain and snow fall amounts will be recorded.

If anyone desires to question the qualifications of your reporter, remember, I knew a leader in the field when he was a nobody. Watch Channel 12, be diligent, thrifty, remember that lows rotate counter-clockwise, above all save up sixteen dollars and you too can become an associate member of the American Meterological Society.

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IN THE MAIL

Mr. Maurice Segall,
Senior Vice-President and General Manager
American Express Card Division
cordially invites

Mr. Radio Astronomy Obsr

to apply for the
American Express Money Card.

Will the real Mr. Radio Astronomy Obsr. come forward?

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Among those who recently received their 25-year pins at BNL was Max Small, former manager of the 140-foot project.

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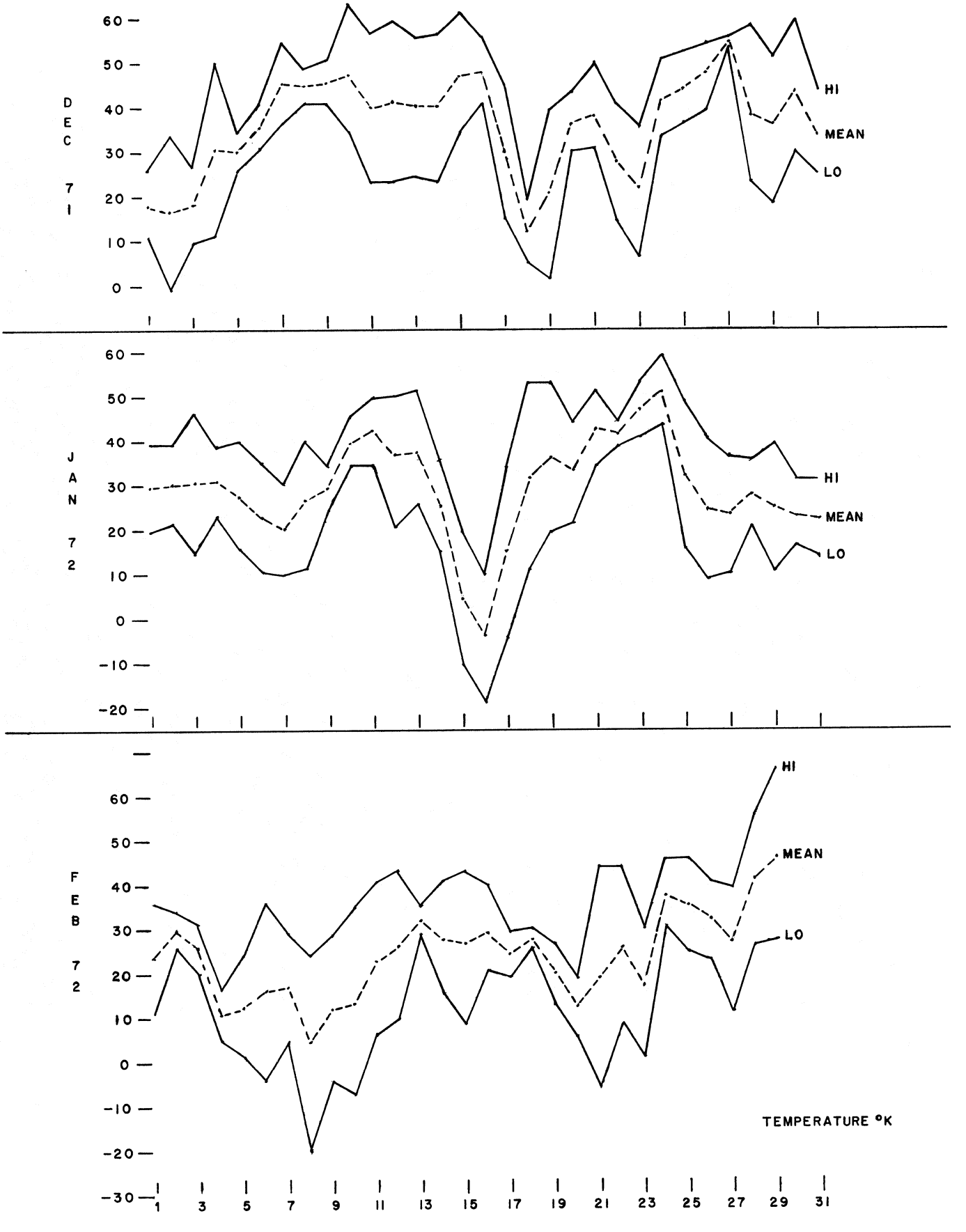
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GREEN BANK BOWLING[1]

Both Green Bank teams are well into the second half of league play. And both teams look like they will post better win/loss records for the second half than they did in the first half. There is even an air of optimism that one or both teams will finish in the top three spots. Here's the latest statistics:

TEAM	WON	LOST
First Half League Play		
Monday Night	33 1/2	38 1/2
Tuesday Night	30	42
Second Half League Play		
Monday Night	31	17
Tuesday Night	31	21

HIGH GAME AND HIGH SERIES (SCRATCH)
(Monday Night Team)

Name	High Game	High Series	Average
Howard Brown	201	539	150
Herb Hanes	184	460	137
Troy Henderson	137	388	129
Don Hovatter	218	548	160
Wendell Monk	220	627	171
Bill Radcliffe	204	522	149
Jon Spargo	210	585	171
Bob Vance	205	510	147
Ron Weimer	140	369	105

HIGH GAME AND HIGH SERIES (SCRATCH)
(Tuesday Night Team)

Name	High Game	High Series	Average
Leroy Webb	209	535	160
Russ Poling	217	533	154
Bill Vrable	219	548	151
Wally Oref	214	523	148
Dave Williams	174	478	143
Don Stone	189	492	143
Harold Crist	175	471	139
John Matheny	196	520	135

[1]Statistics by D. Stone and D. Hovatter

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NRAO BASKETBALL GAME

Green Bank NRAO traveled to Charlottesville NRAO on April 8 to play their annual inter-NRAO rivalry game. Green Bank was the winner, scoring 81 points against Charlottesville's 53. The three high scorers for Green Bank were Wendell Monk - 26, Ronnie Monk - 21, and Russ Poling - 18. High scorers for Charlottesville were T. Fredrick - 11, D. Pasternak with 10, and E. Allen - 10.

After the game the Charlottesville players hosted the Green Bank team to a party. From all reports the Green Bank boys really enjoyed the party and asked that the OBSERVER express their thanks to the Charlottesville team.

CV TEAM	GB TEAM
Charlie Smith	Carl Davis
Dave Gibson	Ron Monk
Tom Bania	Jon Spargo
Ernest Allen	Russ Poling
Dave Pasternak	Bob Ervine
Ted Fredrick	Bill Vrable
Sol Lawand	Wendell Monk
Tom Cram	
Ted Davis	
Haywood Smith	
Jim Huntley	
Jack Cochran	
Gary Pasternak	
Bob Eskanazy	

****

WANTED: BABY SITTING JOBS

Mary Jane Oref - Age 13
Experienced Baby Sitter
Call: 456-4647

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FOR SALE

Fishing Worms - Hybrid Red Wigglers
Call: Don Stone, Ext. 343 or 456-4746

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WORK WANTED

Lawn Mowing - Flower Bed Weeding - Garden Hoeing. Richard Oref - 456-4647

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A N N O U N C E M E N T

It is my pleasure to announce the following two winners of this year's AUI Trustee Scholarship:

Mr. Dennis Hunter

Mr. Hunter has been active in the following clubs at Green Bank and Pocahontas High Schools:

Future Teachers of America	Freshman and Sophomore
Future Farmers of America	Freshman, Sophomore and Junior
Varsity	Freshman, Sophomore, Junior and Senior
Honor Society	Junior and Senior
Drama Club	Senior
Newspaper	Senior
Student Council	Junior
President	Senior

Dennis is the son of Mr. and Mrs. Lloyd H. Hunter of Arbovale, West Virginia. Mr. Hunter is a Technical Specialist II in the Telescope Operations Division of the NRAO.

Miss Denise Meredith

Miss Meredith has been active in the following clubs at Lane High School, Charlottesville, Virginia:

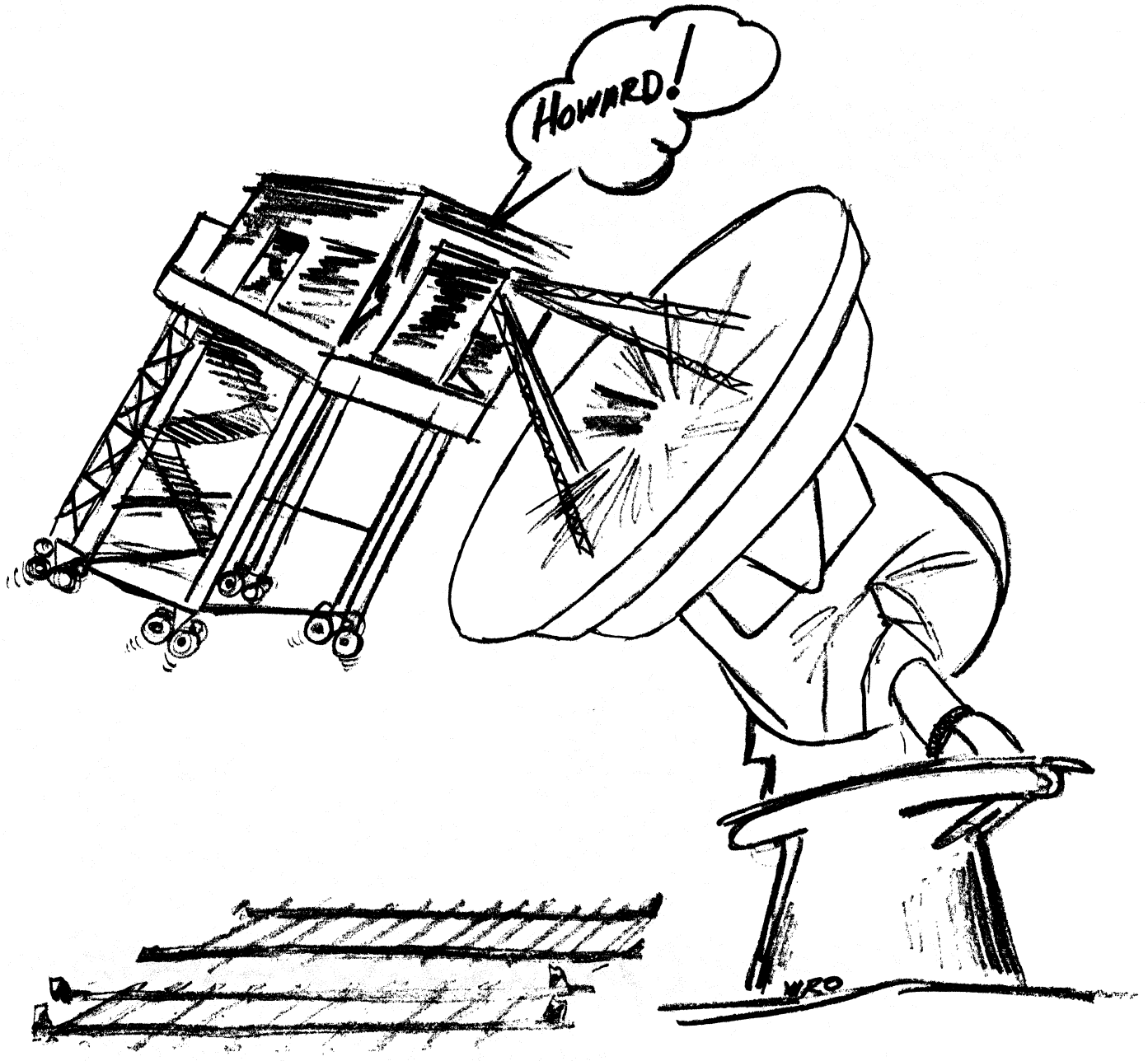
Players' Club	Senior
Student Cooperative Assoc.	Junior and Senior
Ecology Club	Senior
Spanish Club	Senior
Vice President	Senior
Honor Society	Senior
Musical Drama	Sophomore, Junior and Senior

Denise is the daughter of Mr. and Mrs. Bill L. Meridith of Charlottesville, Virginia. Mr. Meredith is a Scientific Associate I in the Basic Research Group of the NRAO.

Alternate winner selected by the Scholarship Committee is:

Miss Pamela Weaver, daughter of Mr. and Mrs. John D. Weaver of Arbovale, West Virginia. Mr. Weaver is a Technical Specialist II in the Telescope Operations Division of the NRAO.

Congratulations!


HOWARD!
WRO