

The O B S E R V E R



Story on next page.

CHILDREN'S CHRISTMAS PARTY

Richard Fleming

"Where did all those kids come from?", asked the adults and "Where did all those adults come from?", asked the kids. There were plenty of both at NRAORA's annual Children's Christmas Party held in the gaily decorated auditorium on December 19. Santa Claus played to an almost packed house. Spirited kids were everywhere and, we must admit, they behaved very well much to the relief of parents, Santa's helpers, and Santa.

The Rec board put on a good party. It was well planned and it was obvious a lot of effort went into it. The Christmas tree was an exceptional tree, beautifully decorated, and the whole auditorium was spruced up with Christmas finery.

The party started off with cartoons and included one with a Christmas theme. Shortly after the last cartoon, Santa dropped by with a bag of gifts and he and his helpers distributed some really nice presents. Next came snack time. NRAORA provided about a dozen different kinds of cookies for the kids to choose from. I think every kid sampled one of each variety. Cookies were washed down with orange drink and the snack was topped off with a cup of ice cream. On their way out the door, each child was handed a box of mixed Christmas candy and this ended a fine afternoon.

Congratulations to the NRAORA Board of Directors who produced an excellent party for the children!

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

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RAINY DAY FUN
or
HOW TO MAKE YOUR VERY OWN IOPENER

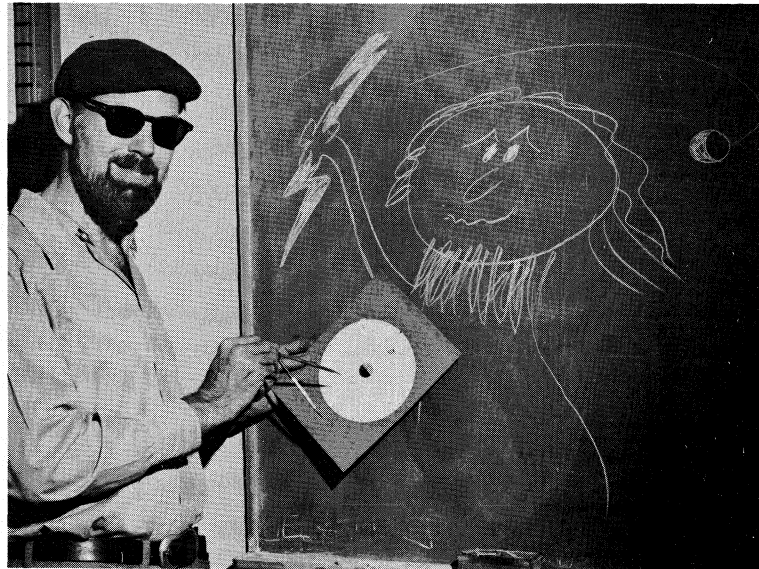
John Rather

It is a good thing to pause, sometimes, to consider how many unsolved problems confront us virtually within our own backyards. While it is fashionable to ponder the complexities of Quasars and Pulsars and other "far out" matters, it is possible to detect radio emissions resulting from some very complex and poorly understood processes with a good short-wave receiver in our own homes. These enigmatic processes, usually lumped together under the name PLASMA RADIATION are emitted along with THERMAL and SYNCHROTRON RADIATION from the planet Jupiter. The latter two processes are much more widely discussed among radio astronomers than plasma radiation, probably because they are much easier to understand! Thermal radiation is just what it implies, the "heat" emitted by any warm source. Synchrotron radiation results when fast electrons pass through a magnetic field. But plasma radiation arises from very esoteric interactions of charged particles with each other and sometimes also with magnetic fields. The two strongest sources of radio emission in the solar system result from plasma instabilities on the sun and in the ionosphere of Jupiter. It may turn out that such processes will also help explain some things that we don't understand about pulsars and quasars. But the purpose of this paper is to tell a few of the facts about the Jupiter puzzle.

Since Jupiter is 5.2 times farther from the sun than the earth, it receives much less solar energy than we do, both in the form of radiation and in particle flux from the solar wind. Considering this, we might expect Jupiter to be a rather dull subject for radio studies. The temperature of the cloud tops, which define the "surface" which we can see when we look at Jupiter, is about 150° K, or -164° F. This "warmth" is so frugal that we can measure it only with very sophisticated equipment. Hence, these THERMAL RADIO EMISSIONS are of interest primarily to people such as those who have 140-foot or 36-foot dishes for short wavelength work.

The second type of radiation, the Jovian SYNCHROTRON RADIATION from magnetically trapped particles originates from Van Allen belts simi-

lar to those surrounding the earth. In 1959, Frank Drake and Hein Hvatum measured an equivalent temperature of $70,000^{\circ}$ K at 400 MHz and correctly inferred that the radiation was originating from Van Allen belts. What is surprising is that there are so many trapped particles and that the magnetic field confining them is so strong. Detailed radio studies indicate that the Jovian magnetic field strength is 10 to 100 times greater than that of the earth and that there are about 100,000 times as many trapped energetic particles. In the past 12 years there have been no proven short or long term variations of the synchrotron emissions (other than a $\pm 10^{\circ}$ polarization change due to rotation of the planet) despite great variation of the average flux of energetic particles from the sun during the 11 year solar cycle. The sun is still generally regarded as the source of the Jovian particles although this has not been proven.



John Rather

The third class of radio emission, the PLASMA RADIATION, was first recognized as coming from Jupiter by Burke and Franklin in 1955. It peaks in the "shortwave" band between 20 and 40 MHz and is so strong (approximately 1,000,000 flux units) that it was doubtless recorded by Jansky during his lengthy surveys in the 1930's. The most extensive records which now exist have been accumulated at Boulder, Colorado, by J. W.

--continued next page--

Warwick and his co-workers. The real surprise came from Australia in 1964 when E. K. Biggs was able to deduce that the occurrence of the bursts is strongly correlated with the position of the large inner satellite, Io, as observed from the earth. Io is about the same size as our own moon and, by chance, at about the same distance from Jupiter that our moon is from us. In subsequent work George Dulk elucidated many observational details, showing how the frequency and intensity of the emissions depend on the longitude of both the earth and Io in the longitude frame which is fixed to the Jovian magnetic field. Since we know that the earth is not directly influencing the emissions, we must conclude that they are highly directional. In other words, the earth must be "on the beam" in order for us to receive a signal.

It is now reasonably certain that Io, orbiting well within the Jovian magnetosphere, is setting up a disturbance which propagates a quarter of a million miles down to the Jovian ionosphere and triggers the emissions at very well defined angles to the magnetic field of the planet. The strong elliptical polarization which is observed suggests that the source mechanism involves some sort of plasma instability in a very small region of the ionosphere. Nevertheless, there remains the vexing problem of how Io, which is moving very slowly with respect to the plasma attached to the magnetic field in its vicinity, can transmit appreciable energy down to the ionosphere. It is almost as if a breeze lightly ruffling the leaves of a tree could cause violent twitching of a root! Although this may smack of the impossible, several interesting theories have been proposed to account for it. One of the most intriguing ideas has been proposed by Goldreich and Lydon-Bell, but it is too complicated to discuss here.

Since attempts to visualize the various relationships among the observational parameters tend to promote vertigo, I have devised a simple device which aids contemplation of Dulk's data. For obvious reasons it has been named the "Iopener". By cutting out the attached sheets on the last two pages of the OBSERVER, and following the simple instructions, you too can become party to the mysteries of Jove. Simply cut out the small disk which shows Io and has windows (cut out) at the two optimum positions where the earth must be with respect to Io in order for us to

receive signals. Put a tack through the center of this "Io disk" and tack it up to the polar graph, preferably with a back-up piece of cardboard. The polar graph shows the angular departure of Io and the earth from the longitude of the magnetic pole in Jupiter's northern geographic hemisphere. This pole is tipped about 10° from Jupiter's north pole toward longitude $\lambda_{JRR} = 200^\circ$ just as the earth's magnetic north pole is tipped about 17° toward longitude 93° in northern Canada. Rotating the upper disk with respect to the lower one gives a frequency and intensity plot of the decameter radiation. It can easily be seen that the signals are strongest when Io is passing from about 70° before the longitude of the north magnetic pole to 70° after it. If Jupiter and the satellite are positioned so that the earth lies in one of the two cut-out windows, the radiation occurs as shown. If the earth lies very far outside of the windows the radiation is either much weaker or rarely observable at all.

If you wish to convert your Iopener into a deluxe model, you may cut out a disk one inch in diameter to represent Jupiter and stick it to the head of the tack. Half of the disk may be colored like a pink, yellow and orange target to simulate a polar view of Jupiter's cloud bands, while the other half may be colored black to indicate the dark side. The whole apparatus may then be suspended inside a bird cage to simulate the magnetic field, or to get down to the nitty-gritty, depending upon your point of view. If you can devise further improvements in your Iopener, particularly brightly colored improvements, and if you want to improve your rapport with the Tucson office, you may mail the finished product to me. I will guarantee that it will be prominently displayed for an indefinite period.

CASS RAILROAD ATTENDANCE RECORD

Total visitation to the Cass Scenic Railroad increased 12% over 1970. Records show that 80,545 rode the train in 1971.

ENGINEERING

New - 45-ft. Portable Antenna

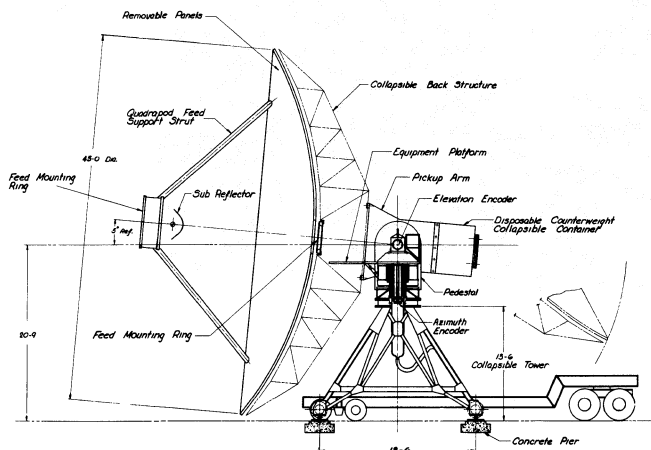
After months of planning, design concept, etc., a contract has been "let" to Electronic Space Systems Corp. for the design, fabrication, and delivery of a 45-ft. portable antenna for further research and replacement of the existing 42-ft. portable antenna of which design parameters are such that the overall use is limited.

The new 45-ft. portable antenna will be an elevation over azimuth-turret mounted type which may be used as a Cassegrain or prime focus system at maximum limits.

The prime focus system will be such that the existing Interferometer feed systems can be used on the 45-ft. antenna.

The Cassegrain system is only in preliminary design stages but provisions will be incorporated in the structural design of the antenna to be interchangeable with the prime focus system.

The antenna design is such that it may be moved, fully assembled, for short distances on a standard trailer. For long distance moves, (such as Bever Lick or Spencer Ridge sites) the antenna will be dismantled, placed on two trailers and reassembled again at the site. A small portable crane will be used for dismantling, loading, and assembling.



NRAO Concept - 45-ft. Portable Antenna.

The support tower for which the elevation over azimuth pedestal is fixed will be a four legged structure with indexing base plates fixed to the bottom of the four legs. These plates will facilitate indexing at other stations when short distance moves are required.

The antenna is scheduled to be delivered in July 1972.

NRAORA NEWS

Richard Fleming

With the old year behind and the new ahead, we, as members of the Recreation Association, can look back at a very eventful year. Much was accomplished and many activities were sponsored by your Rec Association and I would like to recap a few of these. By bringing the activity list published in the last OBSERVER up to date we find 19 activities sponsored during the year. This is quite a list and much thanks goes out to the members of the Board of Directors who worked so willingly on the various activities. These people gave their time and energy to plan and organize 5 major parties, summer picnic and work with or participate in a number of activities.

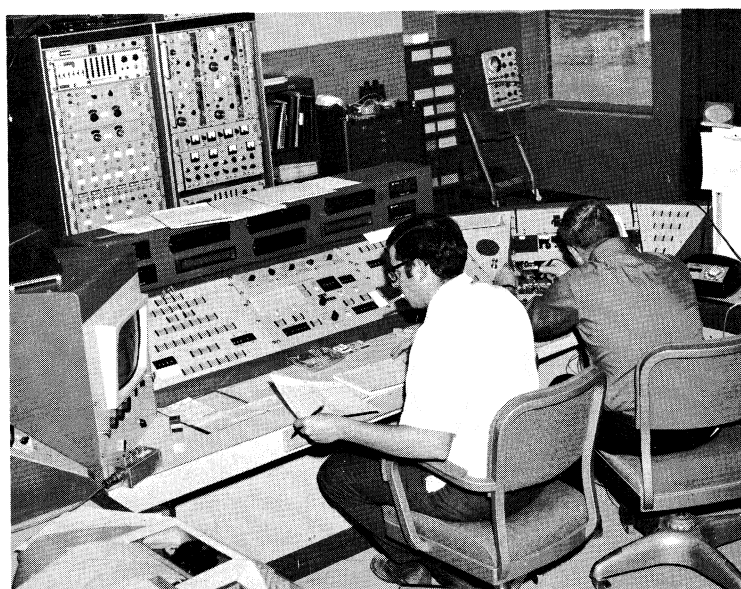
Elections were held in November and six new board members were elected. The new members are Bill Brundage, Ken Cottrell, Carl Davis, Dave Williams, Bob Vance, and Harry Wooddell. These new members, along with 5 from the previous board plan to have an equally eventful year ahead (January - December 1972).

The Board of Directors is the governing body of the Association and encourages, promotes, budgets and carries on recreational activities to be participated in by employees. It is therefore important that we have your support and comments at any time. The Board meets the second Tuesday of each month and any employee that has a matter to bring up may be present at such time. Meeting notices are posted on the bulletin boards along with any activities planned.

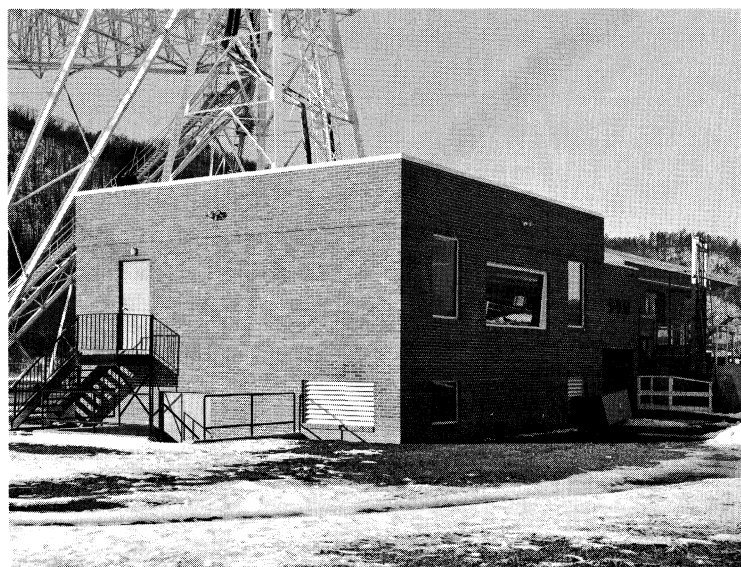
300-FOOT CONTROL CENTER

Jon Spargo

A picture of the 300-foot has recently adorned the prestigious pages of "Time" magazine. It is too bad "Time" couldn't have carried a picture of the new control center - a picture, maybe, from among the excellent ones accompanying this article. The center



is in full operation now and has evoked unanimous satisfaction among those who had waited so long for its realization.



The movement of equipment and cabling from the old to the new building was accomplished smoothly and on schedule. It was a convincing demonstration of thorough planning effectively executed.

The new center provides a giant leap forward in efficiency. The additional space makes it possible to have one receiving system standing by, connected and ready. System changeover time is thus greatly reduced.

Look out, little green men! You is about to be unraveled.

1971 TOUR SEASON

Wally Oref

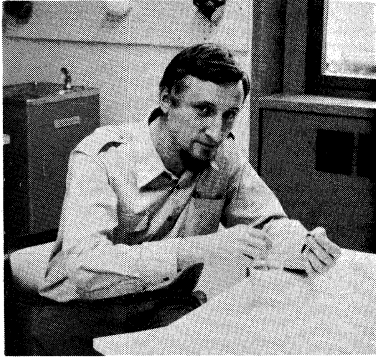
This is a sort of an end-of-the-year report on our 1971 tourist season. More people toured the Observatory this year than ever before. When tours ended on October 31, 1971, 27,171 people had taken the regular summer tour. This is an increase of 6,371 over the same time period in 1970. In addition, another 1,101 visited as members of special groups who came when regular tours were not offered.

Again this year the largest percentage of visitors came from West Virginia followed by Virginia, Ohio, Maryland, Pennsylvania, in that order.

August was the top tour month - 9,955 registered in that month. The most popular tour day was Sunday and the least popular was Monday. Most visitors took the 9:30 AM tour. The second most popular tour time was at 4:30 PM. The largest one week's registration (8/9 - 8/15) was 2,731; the largest one day's registration was 626 on August 15.

Our questionnaires cleared up one popular myth. For years it was popularly thought that most visitors came to tour the NRAO after learning about it at the Cass Railroad. Not so. According to the questionnaires that visitors filled out for us, 3 out of 4 learned about NRAO tours from some source other than the Cass Railroad.

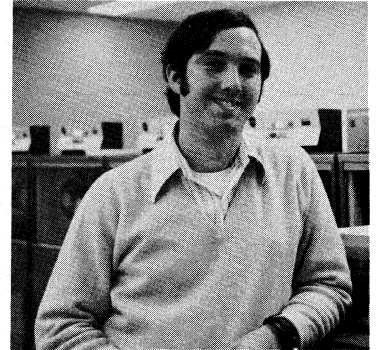
NEW EMPLOYEES



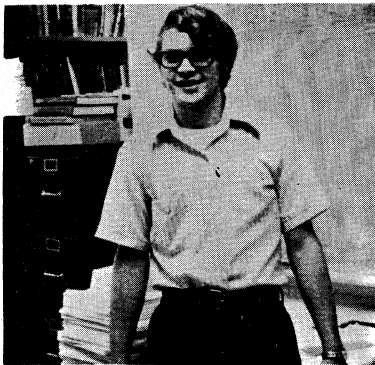
Peter Brosche
Visiting Assistant Scientist
Basic Research-CV



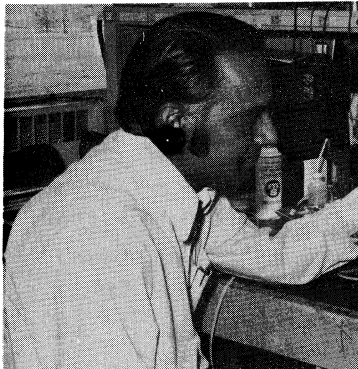
M. Kathryn Campbell
Graphic Arts Trainee
Scientific Services-CV



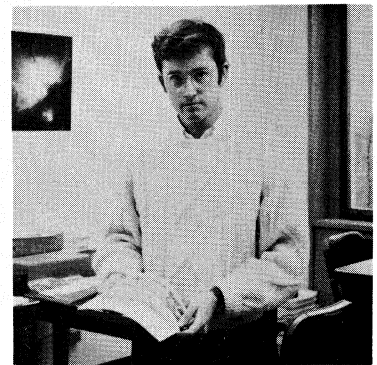
Ellis C. DeMasters
Computer Operator
Computer Division-CV



Edward B. Davis, Jr. (Ted)
Co-op Student
Scientific Service-CV



Nidumolu V. G. Sarma
Visiting Electronic Engineer
Electronics Division-GB



Richard H. Gammon
Research Associate
Basic Research-CV

Elizabeth D. Rather

Scientific Programmer Analyst

Tucson

Terminations

C. Shelton Reid
Jochen Edrich
Janice S. Marks
James C. Jafolla
Lois J. Gross
Joseph Greenberg
David M. Berg

Retirees

Verna A. Tracy
Administrative Services-GB

Thomas Williams
Plant Maintenance Division-GB

Edward S. Wilson
Fiscal Division-GB

Co-op Students

Claude N. Williams, Jr.-GB

Stephen J. Hirsch-CV

Sol Lawand-CV

C. Keith Sword-CV

Transfer

Donald L. Nelson - From Electronics
Division to Telescope Operations

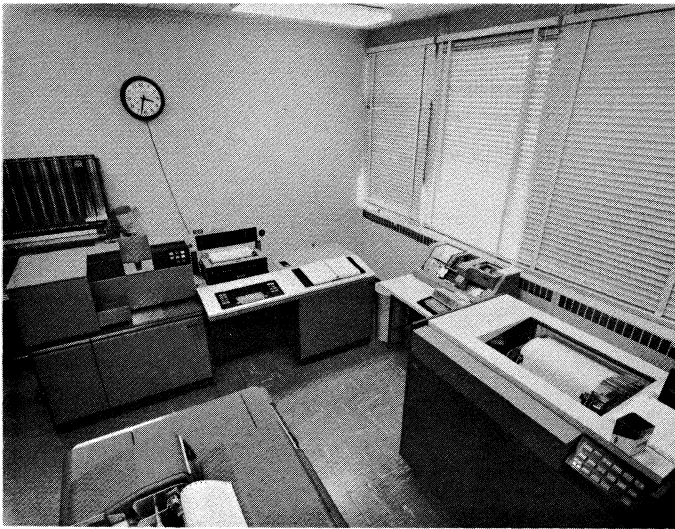
Deaths

We regret to report the deaths of two former em-
ployees, Franklin J. Callender and Forrest H. Ervin.

NEW COMPUTER

Don Hovatter

An IBM 1130 computer has recently been delivered to Green Bank. When the installation and debugging procedure are completed, the 1130 will replace the 407 punch card system now in use, and will be located where the 407 is now.



The computer will be for multi-use. It will be utilized for accounting, personnel, and inventory works and, since the 1130 will accept Fortran, it will also be used by the Scientific and possibly the Engineering Divisions.

Debugging is expected to continue through the month of January. After that time a schedule will be established for future use of the computer.

You cannot bring prosperity by discouraging thrift.

--Abraham Lincoln

LIBRARY BURIED BY REPRINTS

Virginia Van Brunt

Hope you had a fine holiday and your new year is off to a good start. We thought you might be interested in an insiders look at the distribution of reprints of NRAO-published scientific papers....just what did we do in 1971, besides get buried?

The library maintains a mailing list of about 600 individuals and institutions, both domestic and foreign, including such countries as Argentina, Australia, Czechoslovakia, Finland, Mexico, Sweden, and the USSR, among others.

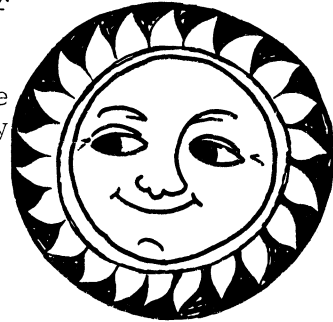
Papers are included in our reprint series which were written and published by the NRAO Scientific Staff or were written by visitors using the NRAO telescopes.

We have two series for our reprints: Series A - which includes reprints of articles published in large journals (such as Astronomy and Astrophysics); and Series B - which includes reprints from smaller journals (such as Astrophysical Journal). The distinction between the

two series is size. Since 1957 we have distributed 213 reprints in Series A and 270 in Series B, for a total of 483 papers.

Berdeen O'Brien in Green Bank is responsible for distribution of the reprints. About every 6 weeks she mails a batch of reprints to individuals and institutions on our mailing list. In 1971 she mailed out 37,000 copies of 135 reprints!!!

Because of this quantity we have discontinued individually numbering reprints, although we still assign a number for storage purposes. We have an Author Index to the Reprint Series, so it is possible to find all papers authored or co-authored by an individual.



NRAORA BASKETBALL

Dave Williams

NRAORA basketball season is well underway with eight games played to date. One of these games was against Wayne McClure's (Halley Electronics salesman) church league team from Beckley. The NRAORA superstars dropped this game by the score of 74 - 68. We plan a return engagement sometime later in the season and maybe the outcome will be different then.

We have adopted a couple of rules from the American Basketball Association this season. One is the use of the red, white and blue basketball. It doesn't help our play any, but it sure looks good. The other rule is the three point goal. A line has been painted on the floor 23 feet from the basket. Any baskets made from behind this line counts three

points. As you can see from the scores that accompany this article, there have not been many 3-point goals, but hopefully there will be more in the future.

The accompanying scores are pretty much self-explanatory. You can see that Russ Poling is well out in front in both total points and average. It is also quite evident by looking at the personal foul column who is the roughest and dirtiest player by a good margin. Of course, this was expected and does not come as any surprise!

All games are played on Wednesday nights at the Green Bank school gym with game time at 7:00 PM. Anybody is welcome to come and watch at no charge. You will not necessarily see a great showmanship of basketball skill, but you will find the game very lively and entertaining. The next game will be January 26, 1972 and every Wednesday thereafter until the end of March.

Player	Games	2-Point Goal	3-Point Goal	Fouls	Total Points	Average	Personal Fouls
R. Poling	6	59	0	23	141	23.5	10
D. Williams	6	45	0	10	100	16.7	14
R. Monk	6	38	0	22	98	16.3	12
L. Howell	4	22	0	9	53	13.2	10
E. Fomalont	2	10	0	3	23	11.5	4
W. Monk	5	22	0	12	56	11.2	6
J. Spargo	2	9	0	0	18	9.0	7
R. Gordon	1	4	0	1	9	9.0	5
W. Vrable	5	16	0	10	42	8.4	6
W. Brundage	3	9	0	2	20	6.7	11
J. Shears	6	12	4	3	39	6.5	7
W. Shuman	6	15	3	2	39	6.5	11
C. Williams	1	3	0	0	6	6.0	1
C. Davis	6	10	1	6	29	4.8	21
R. Ervine	3	3	0	1	7	2.3	7
J. Coe	4	2	1	1	8	2.0	7
W. Radcliff	5	3	0	0	6	1.2	6

ANTENNA TEST RANGE

George Behrens

The picture below (Fig. 1) shows the new Antenna Test Range which has been constructed behind the Jansky Lab. It will be used to test feed antennas used on NRAO radio telescopes. The measurements thus obtained will, hopefully, aid in the development of new feeds which will contribute to increased radio telescope sensitivity.

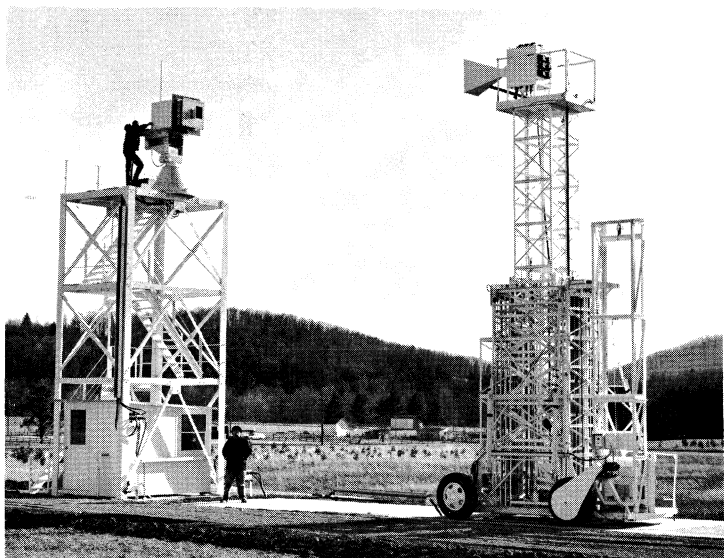


Fig. 1 Antenna Test Range.

The feed is an antenna located at the focal point above the telescopes reflector. The feed's function is to capture the radio energy reflected to it by the reflector and funnel or "feed" it to the receiver for amplification. How well the feed performs this task affects the sensitivity of the radio telescope. By testing a feed on an antenna test range and measuring its radiation pattern one can predict how well it will perform its signal capturing job at the telescope.

The radiation pattern of an antenna is measured by transmitting a radio signal towards the antenna and measuring the amount of signal received by the antenna as it is rotated in a horizontal plane. Recording the received signal level vs. the antenna's angular position on a chart recorder produces the radiation pattern. In Fig. 2 is shown a typical feed antenna and its radiation pattern.

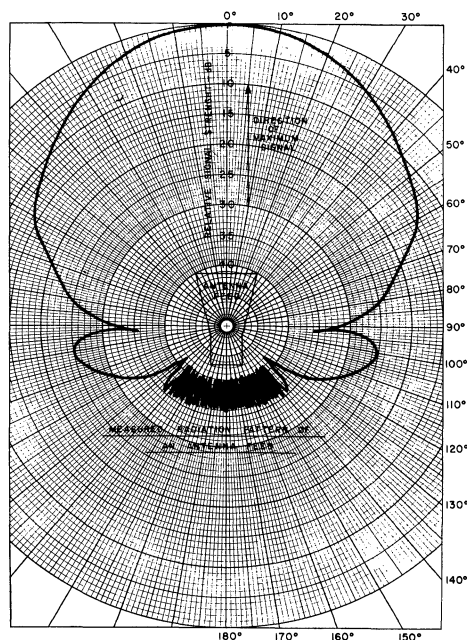


Fig. 2 Feed Antenna & Radiation Pattern.

To minimize the accuracy destroying effects of radio reflections from the ground, nearby buildings and trees, the transmitting antenna and antenna under test are supported well above the ground on individual towers as shown in Fig. 1. Atop the Test Tower (tower in background) the box-like enclosure (the Receiver Package) rests upon a rotating platform called the Turn-Table. The antenna to be tested (Test Antenna) is bolted to the side of the Receiver Package and cabled to the receiver inside. This receiver is used to measure the level of the signal picked up by the Test Antenna.

Several feet from the Test Tower is the Source Tower which supports the transmitting equipment (tower in foreground, Fig. 1). At the top of the Source Tower is another box-like structure called the Source Enclosure which houses low power transmitting equipment covering a range of frequencies from 0.1-40 GHz. The transmitting antenna is mounted on the outside wall of the Source Enclosure and cabled to the transmitting equipment within. The transmitting antenna beams radio energy at the test antenna as the latter rotates with the Receiver Package on top of the spinning Turn Table.

The separation distance between the transmitting antenna and the test antenna is important. For a given size test antenna

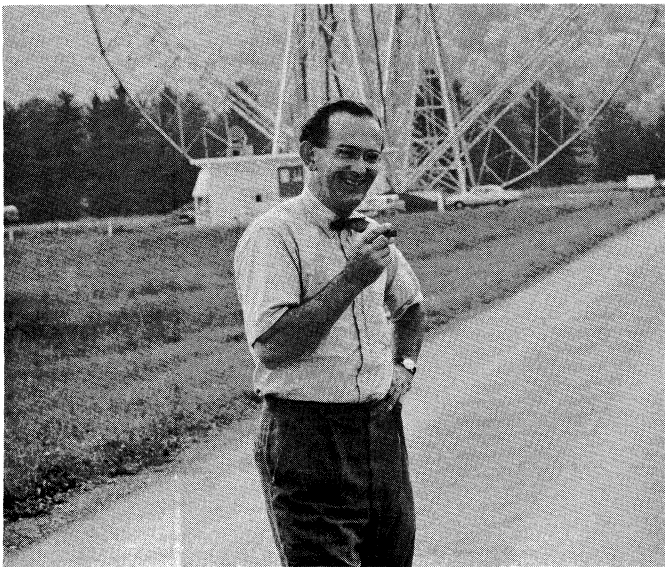
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and frequency, the separation must be more than a certain value to get accurate radiation patterns. For this reason the Source Tower is movable so that the minimum separation can be used for each antenna being tested thus minimizing the amount of transmitted power required. It is important to keep the transmitted power level low so it will not cause interference at the telescope.

In the Receiver House, at the base of the Test Tower, are various remote controls which operate the Turn-Table, the receiver, and transmitting equipment. Also located here is the chart recorder which receives two quantities of information: (1) the amount of signal received by the test antenna as measured by the receiver and (2) the angular position of the test antenna as measured by an angular measuring device on the Turn-Table. As the Turn-Table rotates, the Chart Recorder converts these two quantities into the radiation pattern.

NEW TRUSTEE APPOINTED

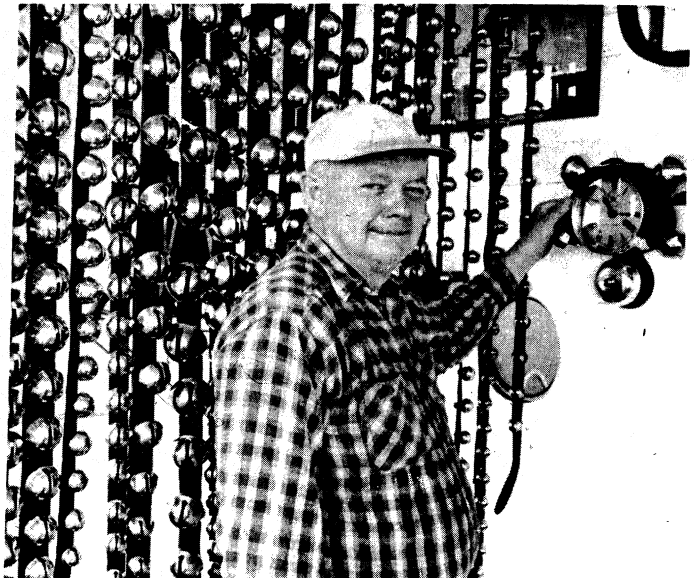
Dr. Gart Westerhout, Director of Astronomy at the University of Maryland, has been appointed to the AUI Board of Trustees as a Trustee-at-large.



Gart Westerhout

THE BELL COLLECTOR

You "old timers" knew "Spencer" Greenwood, as the shy, unassuming superintendent of the 140-ft. project. But how many of you knew that "Spence" was an avid collector of bells. Bells, that's right. All kinds of bells. We recently saw an article about the bell collector of Newcomb, Maryland. It was an article about Spencer Greenwood's bell collection. In his life time, he has collected almost a thousand bells of all sizes, shapes, weights. His most prized possessions are 664 sleigh bells, ranging from No. 1 size to No. 16. "Spence" polished and repaired every bell and renewed the 26 original leathers on which they're attached. Anyone interested in bells can see pictures of some of "Spence's" bells in the newspaper article that Harry Wooddell has. "We think we heard some of "Spence's" bells on New Year's Eve."



Spencer Greenwood - the bell collector.

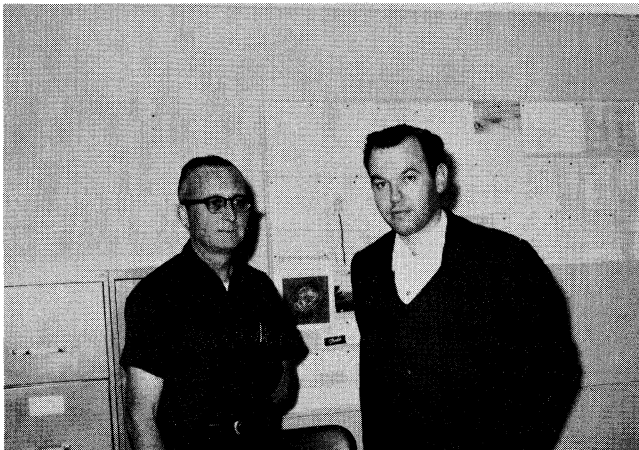
1971 SAFETY AWARD

Duane Sizemore was selected by the safety committee as the recipient of the \$25.00 award for the best safety suggestion for 1971. Duane's winning suggestion was that a tag out procedure for faulty equipment be instituted, thereby reducing the potential hazard to employees and the possibility of equipment damage.

LONG TIME NO SEE, SEÑOR FILLOY

Ten years ago, two bright-eyed fledgling electronics engineers arrived in White Sulphur Springs on their way to the NRAO for a one year internship. Both were from Buenos Aires, Argentina and neither could speak English. They had only recently graduated from La Plata University and had come to NRAO to study radio receiver electronics in particular and observatory management in general. They were the front men for what is now known as the Instituto Argentino de Radioastronomia in Buenos Aires. Last month one of those two engineers paid us a visit.

On November 17, Emilio Filloy came to the Observatory for a three day visit. NRAO is one of a half-dozen radio astronomy observatories he will visit in the USA and Europe to bring himself up to date on electronics and interferometry. Although he was busier than a one armed paper hanger while here, many of us who knew him from 1961 had a chance to chat with him about the past and the present. It still is a revelation to hear him talk about his one year visit in Green Bank as seen through the eyes of a Latin American bachelor (he is now married).



Emilio Filloy Visiting With Carl Wooddell

Emilio is with the Instituto Argentino de Radioastronomia in Buenos Aires, Argentina. He didn't tell us what his exact title is, but he said that his job at the Instituto is some-

thing like the job Hein Hvatum does for NRAO but on a much smaller scale. We took this to mean that he was in charge of technical matters for the Instituto.

If you have ever wondered who brought Pisano wine to NRAO, it was Emilio and Reuben. Whether they should be best remembered for this is open to speculation. For many years now, Pisano wine has been and still is the official wine sipped before, during, and after dinner at NRAO affairs. They also treated some of us to an Asada, a feast that features chunks of beef marinated in a very special Argentine sauce and cooked on an open fire. The cooked beef chunks are eaten with large pieces of home-made bread, a salad and, of course, wine.

They too, coined the term "sockshaker" and were forever trying to pull off the colombo muy grande (a very big blast).

It was nice to see Emilio and we hope he has a very successful tour. He left on a Saturday and the last thing he said was that he wished everybody well and goodbye.

NRAO HOLIDAYS 1972

February 21	For Washington's Birthday
May 29	For Memorial Day
July 3	*Holiday
July 4	Independence Day
September 4	Labor Day
October 23	Veterans' Day
November 23	Thanksgiving Day
November 24	*Holiday
December 22	Half Holiday
December 25	Christmas Day
December 26	*Holiday

* Additional Holiday

TRAVELS WITH CHARLIE

Barry Clark

John Steinbeck wrote a book called Travels with Charlie about a trip through the USA in a camper (in the days when this was unusual) with a large dog named Charlie. He claimed that having this non-hominoid companion enhanced his appreciation of the country by forcing him to make more varied contacts than if he had been traveling all by himself. For this purpose, however, I shall now proceed to demonstrate that a dog is less effective than a Rubidium vapor frequency standard (i.e., a clock). This is the story of how I carried the time to the Crimea for the May 1971 VLB experiment.

My friend, the clock, is a fairly modest suitcase, made by the Hewlett-Packard Company with wonders of quantum physics, micro-wave engineering, and digital logic packed tightly into its seven inch chassis, weighing something under forty pounds. Modest also is its demand for some thirty-five watts of continuous power. After all, you can light only a rather dim light bulb with this sort of power. Note, too, that nicad batteries have a very high energy storage capacity per pound of weight. So, though the pounds are beginning to mount up, you must realize that thirty pounds of batteries are indeed a minimum requirement for a ten hour portable power supply. Mike Balister's battery charger is not an excessive weight--it has a transformer in it, of course, but all the circuitry is fairly light transistors. And the fact that I felt it necessary to take a 60 cycle inverter to run the whole works from an auto battery was my own decision, of course. We perhaps could have made a lighter packing case for it, of sheet metal rather than wood, but we didn't realize how heavy the wood one was until it was made, and then it would have taken too long to make a metal one. So, despite the miracles of modern miniturization, I found myself with a seventy kilogram clock package. While I still outweighed it, not by that much. (A German acquaintance referred to it as "Ein drei-Man Uhr"--a three man watch.)

Anyway, the plan was to ship Charlie to Europe cold, warm him up there, fill him up with time, and cart him off to the VLB experiment before all the time could leak out. We planned to do it this way because the dir-

ect New York-Moscow flights take too long for Charlie's batteries to keep him warm, and we felt it would be easier to wake him up in Europe than to make the special arrangements for him to have something to eat on the airplane. So, since I would be in Europe anyway, I planned to visit two new instruments--the Westerbork Synthesis Radio Telescope in the Netherlands, and the 100 meter telescope near Bonn, Germany. Nobody in Holland seems to know what time it is (I had George Miley ask), so I planned to fill Charlie with time at Bonn, where I was told they knew the time from measuring the Norwegian Sea LORAN emissions.

So, one Friday I put Charlie on an airplane for New York, where he would wait for me to arrive the following Tuesday. And arrive I did. Asking at the National Airlines ticket counter where their airfreight depot was, I had the good fortune to encounter the nicest man in New York. He was a National Airlines passenger service aide, and he gathered up a company station wagon, drove me over to their airfreight warehouse (where we found Charlie with his "This Side Up" arrow pointing straight down), drove me and Charlie over to Pan-American airfreight, waited around while I handled Charlie's paper work, and drove me back to the passenger terminal, and refused a tip for all this.

From a sample of two, I make the following generalizations about trans-Atlantic flights leaving from Kennedy Airport: 1) They leave three hours late, 2) New York is overcast but Boston is clear, and 3) The movie projector breaks down half-way through the movie.

I was met at Schipol Airport near Amsterdam by George Miley (who had been waiting since the scheduled arrival time), and carried off to Leiden. I phoned Pan Am airfreight and found that (a) Charlie hadn't arrived yet, and (b) yes, they were open on Saturday mornings and I could pick up Charlie then. So I settled in for some sightseeing and talking at the observatories in Holland.

Then came Saturday morning, when I went out to Schipol to rent a car and pick up my clock. Disaster . . . While I had told the Pan-Am man in New York to have Charlie held at Schipol Airport, I didn't check to make sure he had written it on the papers. He

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had not. Pan Am, noting the University address I had given, had given Charlie to the usual customs agents for the University. And they said that the box had been shipped by train to Leiden. While trying to call somebody at the Leiden railroad station, I encountered Harry van der Laan, who promptly gave up his afternoon for the search. We eventually found the man in charge of freight at the railroad station, and he let us in to search the freight shed, but no Charlie. Impasse. Nothing could be done until Monday.

I had told Ivan Pauliny-Toth that I would drive in Saturday evening, so I got on the telephone to tell him I wouldn't be there. But nobody answered the phone at the Max Planck Institute. (And apparently not at the Sterrenwacht Te Leiden, either. Ivan was trying to call me.) So I then spent an interesting hour with the international information operator. Everybody I knew at Bonn either had no listed telephone number (Pauliny-Toth, Churchwell, Goss) or there were several listings with the same name (Mezger, Stumpff). I gave up.

Monday morning, the customs agents found Charlie, sitting in Schipol Airport. I drove over and picked him up. Dutch customs didn't trust me not to sell Charlie on the local rubidium clock black market, so they wrapped his box with string, sealed the string with lead seals, and told me not to open him except in front of a customs official. So I plunked him in the trunk of my rented Opel, and drove off to Bonn.

Tuesday morning, Ivan and I went to the customs office in Bonn, taking Heinz Wendker with us as an interpreter, to see if they would let us open up Charlie and fill him up with time. They said they didn't really approve of such activity, but we could if we posted a bond equal in value to the clock. When I said I didn't happen to have \$3000 in cash with me, they said we should see a bonding agent.

So we went to see a bonding agent. He said it was all very irregular, and that, though he was sure we were not smugglers, if we were, it was a most ingenious way to go about it. He would, however, bond us if we left a deposit of merely \$2500.

Back at the Max Planck Institute, Heinz looked for somebody who was familiar with customs procedures. We found such a man, and he was able to make an arrangement by which a customs agent would go with us that evening

to the telescope, watch us open the clock, and reseal it the following morning. It was now clear that I wasn't going to make it back to Amsterdam for my early morning flight to Moscow. So I called Schipol Airport, cancelled my reservation for Wednesday and made a new one for Friday. I also sent a telegram to Moscow, telling Leonid that I was not coming Wednesday. It got there Thursday.

Anyhow, that evening, we opened Charlie up, with the Customs Official there to certify that he wasn't full of marijuana or diamonds. We plugged him in, warmed him up, and filled him chock-full of high quality time. We sawed an air hole in his box, through which passed his power cord, and the following morning early, we took him to the Customs Office, had his symbolic string with lead seals wrapped around him again, and had his accompanying papers stamped and initialed.

That day I attended the dedication of the 100 meter radio telescope, whereat 600 people were treated to speeches, guided tours, and a lunch of pea soup, two beers, and one schnapps. But, that night, again disaster In carrying the clock from the telescope back to the Institute, the symbolic string had hung on the trunk latch and snapped. Recalling in vivid detail the history of German jurisprudence from Wallenstein to the Nuerenburg Trials, I went screaming for help to Heinz Wendker, who prevailed upon Herr Zann, who in turn was able to persuade his customs official friends to reinstall the string without jailing me in the process. This they did on my way back to Amsterdam Thursday morning. I got back to Schipol Airport at about 4:30 in the afternoon, just as the customs men were leaving. The man left on duty couldn't process Charlie's papers, but they did let me put him in bonded storage, plug him in, and cut the symbolic string to flip his battery charger to high.

I got back to the airport at 8:30 the next morning, figuring that was about right to unsnarl the paperwork to catch my 1 PM flight. The Customs Officials were there in force by that time. But, Disaster The German customs agent should not have stamped and initialed Charlie's papers, but should have kept them and issued a new set. The Dutch customs agents set to work to unscramble things. I told them that if they

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needed me, I would be in the waiting room next door, and got out my book for a little reading.

At 11 I went back to the Customs Office to see how things were coming on. Disaster . . . The lack of a document from Germany had been overcome, but meanwhile, they had found that Charlie was on the strategic materials list. They, as a signatory to the NATO could not let such an item go to Moscow. Meanwhile, they had forgotten I said I would wait next door in the waiting room, and had called all over Holland trying to find me. I produced a copy of the US export license, which said we could take Charlie to Russia (I had left another copy with the clock, but they didn't think to look there). They considered this item awhile. Then they decided it was not sufficient, since it was a xerox copy, with no rubber stamps (except a xeroxed one) or initials. They would call the US Embassy in the Hague to find out what they should do. They predicted that The Hague would call Kennedy Airport, where the export license original was. But anyway, the appropriate man to ask at the Embassy was out to lunch.

After waiting an hour and a half, The Hague called back, and the American at the Embassy chatted with me a while, learned that I did not profess to be an atomic spy, and told the Dutch Customs to go ahead and honor my xerox copy of the export license. The formalities completed, we walked out into the waiting room to the big window and watched my airplane take off.

Meanwhile, back at the airport, I made a new reservation, and sent a telegram to Moscow, telling my friends there that I would arrive on Saturday, not Friday (the telegram arrived Monday).

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NEW NSF HEAD

President Nixon has chosen Dr. H. Guyford Stever, President of the Carnegie - Mellon University in Pittsburgh, Pennsylvania, to become the next director of the National Science Foundation. He replaces Dr. William D. McElroy who is leaving NSF to return to the academic world.

GREEN BANK BOWLING¹

At the time this article was written, the Monday night team had bowled 64 games. Of these 64 games, they won 28 1/2 and lost 35 1/2 (1/2 game was a tie). This is better, they say, than they did for the same period last year. Wendell Monk with 220 has bowled the highest scratch game and the highest scratch series with 627. High games (scratch) and high series (scratch) scores for members of the Monday Night team follow:

Monday Night Team

<u>High Game</u> (Scratch)	<u>High Series</u> (Scratch)	<u>Name</u>
220	627	Wendell Monk
210	563	Jon Spargo
201	494	Howard Brown
200	513	Don Hovatter
187	477	Bob Vance
185	503	Bill Radcliff
184	460	Herb Hanes
140	369	Ron Weimer
137	388	Troy Henderson

The Tuesday night team has bowled 72 games so far. They have won 30 and lost 42 - about as well as they did for the first half last season. So far Russ Poling has the high game (scratch) with a 220 score. Russ also bowled the highest scratch series on the same night - 536. High games (scratch) and high series (scratch) scores for members of the Tuesday Night team are below:

Tuesday Night Team

<u>High Game</u> (Scratch)	<u>High Series</u> (Scratch)	<u>Name</u>
220	536	Russ Poling
204	525	Leroy Webb
202	476	Don Stone
197	474	Bill Vrable
191	446	Dave Williams
189	483	Wally Oref
183	468	Harold Crist
178	456	John Matheny

¹Statistics compiled by Don Stone.

TUCSON TOPICS

Bob Hogarth

We have a new employee at Field Station #2 - Bess Rather. She is employed part-time as a Scientific Programming Analyst II, working with Chuck Moore on the 116 and 316 computer programs. Bess is the Senior Systems Analyst for the Registrar's Office at the University of Arizona, here in Tucson. She has been with programming and data analysis at Berkeley and Oak Ridge, Tennessee for the past 9 years. Her husband, John, is developing the 1-Millimeter System here.

On December 8th the Old Pueblo experienced something rather unusual - a record shattering (or was that chattering?) 6.8 inches of white sunshine. It lasted most of the day in most places, and patches lasted as long as a week. We're back to normal now - temperatures in the 60s and 70s, down to the 30s at night.

And last, but far from least, Gene and Charlene Wetmore have a new addition to their family (or is that "deduction"?). Kari Michelle made her debut at 8:30 A. M. December 24th. She checked in at 5 pounds 11 1/2 ounces, and 19 inches. Mother and daughter are fine.

That's 30 from here for this year. The West bids the East a Happy New Year!

THE BIG MOVE

Jim Dolan

Around the Green Bank lab, and probably the Charlottesville lab, the game of musical chairs continues. The crew from the Works Area have put up and taken down enough partitions to qualify as experts in the field.

The latest move is as follows: Partitions were removed in the area adjacent to George Behrens' area in the back of the lab. The equipment maintenance group consisting of Carl Chestnut and Bill Radcliff and related equipment was moved up from the basement. The storage cabinets in room 128 were moved into the area vacated by Chestnut, et al. Jim Dolan moved from room 138 to 128, sharing it

with Lloyd Swartz. Nidumolu Sarma, who was a man without an office, moved into room 138. We finally got all the telephone numbers moved so all is well until the next move.



Electronics Lab before Dolan Era.

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NOTICE

Please return pop bottles that you have at home. Turkey is coming up short on empties and he would appreciate their return.

THE SAN JUAN MEETING
of the
AMERICAN ASTRONOMICAL SOCIETY

Dick Sramek

About 12 NRAO staff members journeyed to San Juan, Puerto Rico last December for the 136th meeting of the AAS. NRAO is usually well represented at astronomical meetings, and this one was no exception; to be sure, the climate of San Juan did not deter our fellows. Since at the time I did not try to play reporter and keep track of the doings of all our boys, I'll just describe the meeting as I saw it, and a few of the items that personally impressed me as a first time visitor to Puerto Rico.

My first impression was the incredible joy of leaving Virginia in winter and a 20° F temperature and arriving at San Juan where it is perpetually summer and 75° F. Naturally, within an hour of landing we had found the ocean and were racing for the water, swimming and thrashing about. Drs. Vershuur and Burton renewed their long standing contest of body surfing - that is, who could surf the farthest into shore on a given wave. I suspect some cheating since an occasional contestant made it above the water line on the beach.

At last we were driven by the setting sun to the shelter of our hotel. Dr. Wright had arranged modest accommodations for us about a mile from the hotel where the meeting was held - at great savings in cost! All was very nice except there was no hot water before 8:00 AM when the manager arrived or after 10:00 PM when she turned off the heater for the night. Since we generally left about 8:00 AM and returned later in the night, showers became a problem. Also, there were no screens in the windows, but rather sheets of plastic with which to seal the windows. So the choice was either suffocating at night or suffering the mosquitos. (Harry, is a bottle of insect repellent an allowable rooming expense?)

The meeting was opened with a welcome by Dr. Frank Drake, now Director of the Arecibo Observatory in Puerto Rico. And the festivities began.

An AAS meeting consists of numerous sessions, many of which run simultaneously, so the meeting has some of the charm of a

three-ring circus. Each session is generally devoted to one specialized topic but if you happen to be both a nut on line-blanketed model stellar atmospheres and an extragalactic radio source freak, you'll find yourself dashing from room to room to hear some particular papers. In any one session, a dozen papers may be read, with ten minutes to each paper. The short time is necessitated by the large number of astronomers who want to tell their colleagues what they're up to. Nine minutes into each paper the session chairman rings a small bell to signal the speaker that he has one minute to go. Then the fun begins since, unless he is unusually well prepared, the speaker has only covered 1/2 to 2/3 of what he intended to say. The manner in which the astronomer responds to this crisis is fascinating. With some, the heart rate goes up, the word rate doubles, the information content quadruples, and they squeeze the remainder of the talk into one minute. Others just go to the last slide, drop the phrase "in conclusion", and terminate after a quick editing. A few brave souls simply plow on as if they never heard the bell. Since session chairmen are inevitably unimpeachable gentlemen and since there is no such thing as a hook at AAS meetings, about all the chairman can do is look uncomfortable and ring the bell a few more times with impatience. These guys aren't so bad if what they're saying is interesting.

Then comes a short question period. Most of the questions are honest attempts to clarify some problem, but a few are really harangues by someone pushing his own viewpoint. I've seen one question that took five minutes to expound and included a slide.

Between sessions there is a twenty minute break during which you get a chance to renew old acquaintances with people you spotted in the audience. "Hi Bob, how are things at Mosquito Flats Observatory?". Then you exchange the social gossip, and then down to astronomy. This is really worthwhile since you come away knowing a lot more about what people are doing at the moment. But I shall always remember the San Juan meeting as having the best coffee of any meeting I've been to; not thin and watery, but the real, rich black stuff.

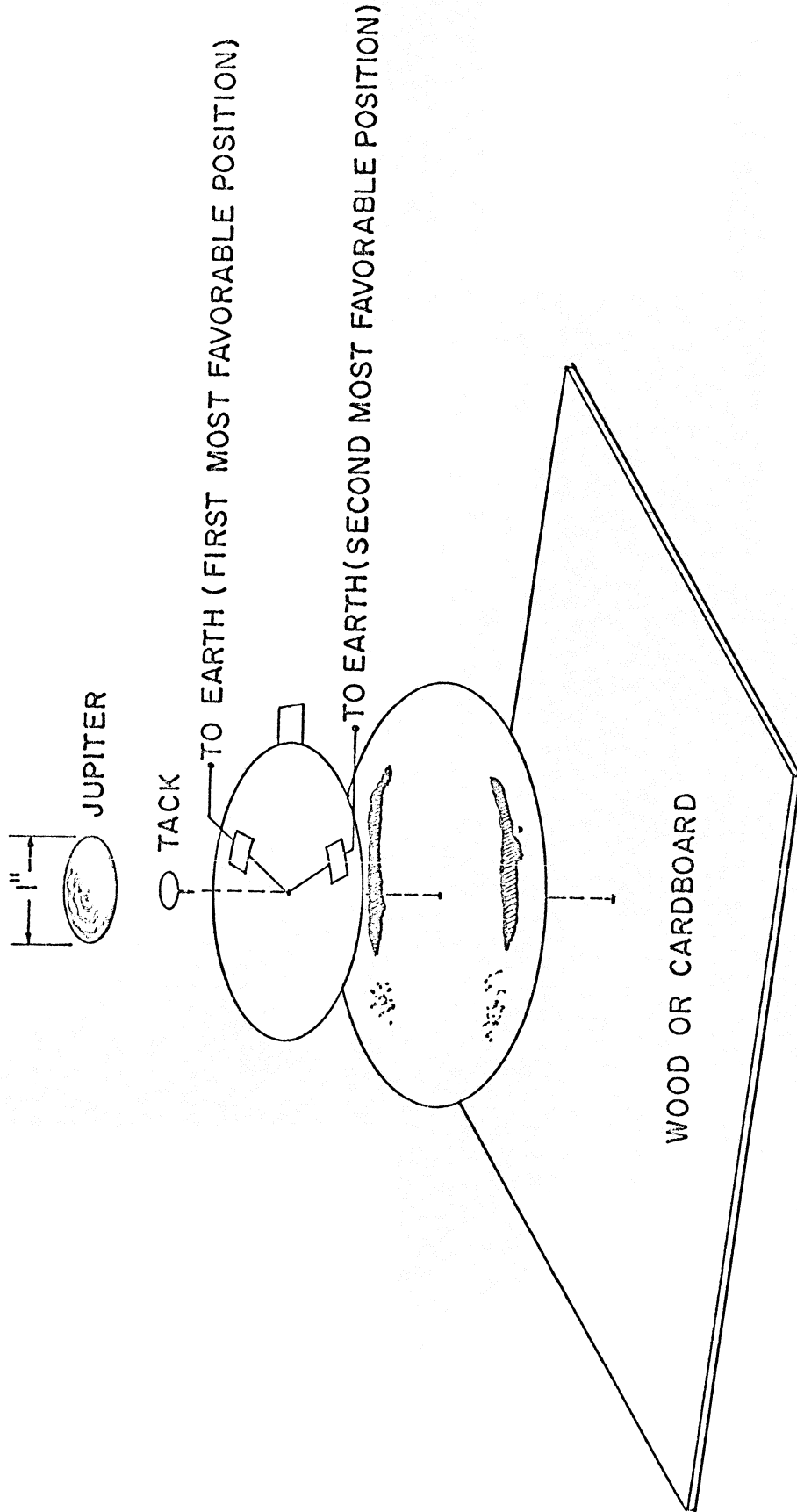
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Review papers were given before several sessions, including a presentation by Carl Sagan of the new photographs of Mars taken by the Mariner spacecraft. Especially impressive were the photographs of Phobos and Deimos, the moons of Mars, showing them to be irregularly shaped hunks of rocks with craters and even huge chips missing. Also, Ken Kellermann, under guise of the Helen B. Warner Lectures, gave a great talk on the key problems in extragalactic astronomy.

While in Puerto Rico, we got to visit the observatory outside Arecibo. The ride to the observatory took us through some of the back roads of Puerto Rico, which are small, winding, and without road signs. We found our way by asking directions every 1/4 mile. While pulling away from one group of school kids, they were laughing so hard I was sure they sent us down the wrong road. The 1000' dish at the observatory is really impressive. It is an open mesh antenna suspended in and completely filling a small valley. It's a beautiful place to work!

WANTED

"Brownie" Scouts need scrap felt material-- any color or size. If you have any to give away, call Mrs. Don Hovatter or Mrs. John Ralston, and it will be picked up.



HOW TO ASSEMBLE THE IOPENER

