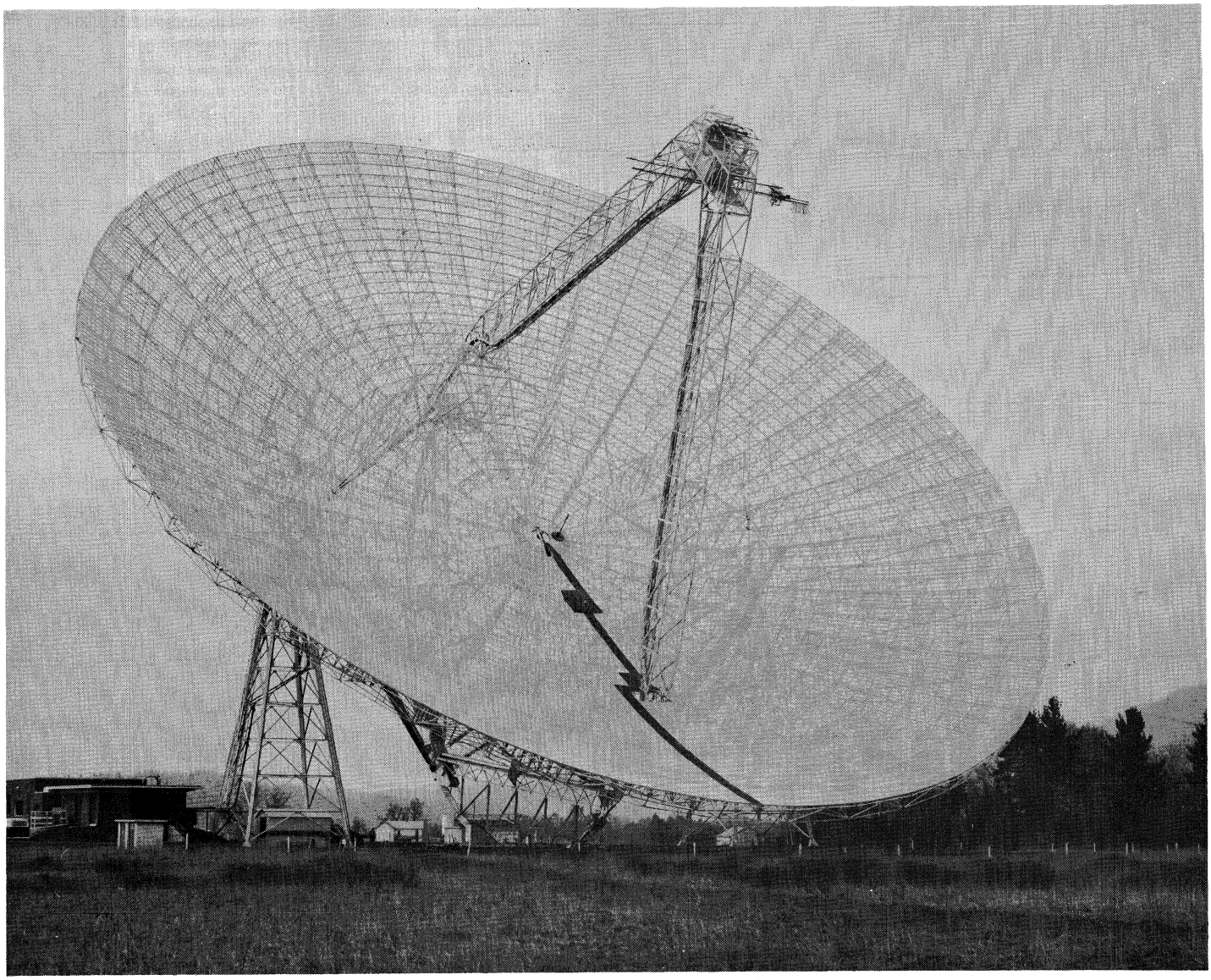
The OBSERVER

Vol. 13, No. 6 December 1972 Page 1



THE 300-FT IS 10 YEARS OLD

Stories on pages 3 and

NRAORA REPORT

Richard Fleming

Coming to the end of an active year, your Recreation Association finds that many activities were planned and enjoyed by the members. There were seven parties or dances held, two concerts presented, four athletic activities sponsored, two activity groups sponsored, and a large exciting summer picnic. Events scheduled during December include: a Children's Christmas Party on Sunday, December 17; a Teen Christmas Ball on Saturday night, December 23; and a New Year's Party on Saturday night, December 30.

Only those who have been members of the Board of Directors can completely appreciate how much work goes into planning and carrying out a schedule such as this. Much thanks must be given to the members of the Board for the hard work and time given by them during the past year.

During the year the Rifle and Pistol Club, Archery Club, and the Craft Studio were moved from the Arbogast House to the Hannah House located at the Recreation Area.

Annual election results have been tabulated. Ronald Monk and Leroy Webb were elected as new members and Richard Fleming, Jane Chestnut, and Pearl Clarkson were re-elected as members. The new members will assist the board during December and then they will take their places on the board in January.

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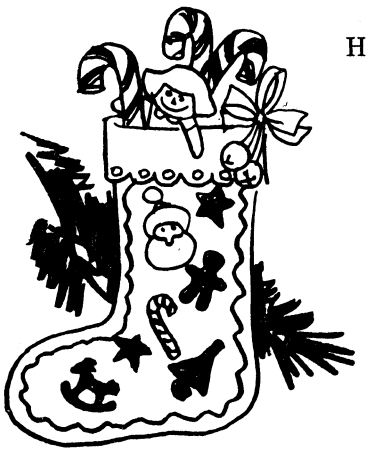
MERRY
CHRISTMAS

AND

HAPPY
NEW
YEAR



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

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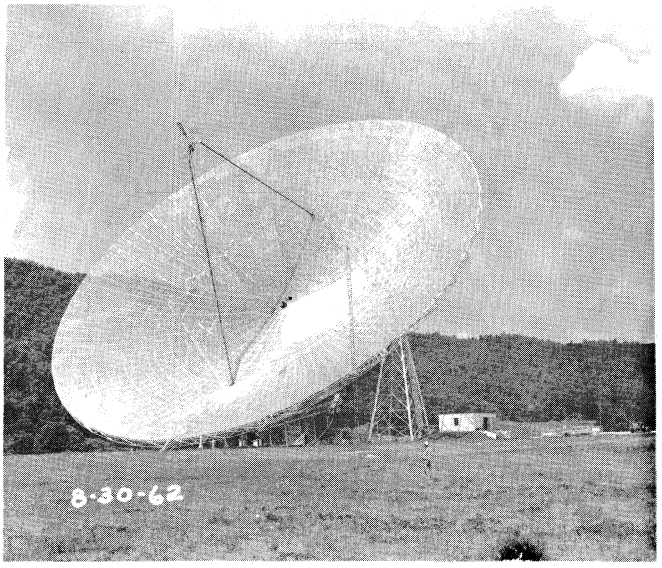
THE 300-FOOT TELESCOPE IS TEN YEARS OLD

J. W. Findlay

On the morning of Thursday, September 20, 1962, I was standing in the sunshine near the recently completed 300-ft telescope. Fred Crews had almost finished the installation of the first receivers and the cabling to the control building, and Frank Drake was ready to make the first tests of the telescope. For some reason Fred walked into the control building and moved the telescope in declination, and as he came out I called to him, "Fred, it's all yours." In this highly informal way the 300-ft passed from the construction phase to the telescope operation's division and its scientific life started. I left that afternoon



The 300-ft telescope as it looked on August 30, 1962. The surface had just been completed.

to attend the Trustee's meeting in New York and Frank Drake called me on the morning of September 21 to say that he had used the telescope the night before, that he had measured the aperture efficiency at 1400 MHz and that it was about 40 percent.

The story of the building of the telescope was written up in Sky and Telescope, Vol. 25, pages 68 to 75, 1963, shortly after the American Astronomical Society had met at White Sulphur Springs and Green Bank. In this article I want to write about the telescope in its first ten years of observing. But it is worthwhile perhaps reproducing the chart of the progress of building the telescope which appeared in that Sky and Telescope article.

Chart Progress on the 300-Ft Radio Telescope

1960	November	Design work started
1961	April 27	Ground-breaking ceremony
	April 28	Steel fabrication and erection contract signed with Bristol Steel and Iron Works, Inc., Bristol, Va.
	May 20	Foundation contract signed. B. F. Parrott and Co., Roanoke, Va.
	August 14	Main telescope foundation completed; steel erection started
	September 29	Drive foundation completed
	December 12	Steel erection completed
1962	January-March	Measurements made of steel support structure for dish surface
	April 10	Drive system installed
	May 4	Drive tested
	May 14	Setting of paraboloid surface started
	August 30	Surface of paraboloid completed
	September 20	First receivers and feeds installed
	September 21	Telescope started testing observations
	October 1	Instrument operational with continuum receivers for 750 and 1400 MHz

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Thus from the time we started design to the time we started observing was slightly less than 23 months, and the telescope in its original form cost about $850,000.

In the following ten years, since 1962, the telescope has done a very large amount of science. These observations have been intermingled with a continual program of improving the telescope's performance. These improvements were not foreseen in detail when the telescope was built but we did realize when we were designing and building it that it would be capable of becoming a better instrument if we desired to make it so. In its initial form we hurried it to completion because at that time we only had at the Observatory the first 85-ft telescope and we could see that the completion of the 140-ft was still several years away. Thus, we might regard the original 300-ft as a stop-gap instrument. It was intended to work at 21 cm and longer wavelengths and so, for example, we put onto it a very cheap but adequate reflector surface. The initial cost of this was about $125,000 or somewhat less that $2 per square foot. Later, as I shall say, we have resurfaced the telescope and much improved its performance, but at a cost of more than half a million dollars. Similarly the initial feed support, which will be well remembered by those who had to climb it, was quite a minimal structure. The main telescope structure itself had no excessive steel and the first control building was small and simple; so was the positioning system by which the telescope was moved in declination.

Nevertheless, because the early scientific programs which were chosen fitted the telescope so well, there was an immediate start on some excellent scientific work. I cannot in this article list all those who observed, but in the first block perhaps one should mention the group from the Department of Terrestrial Magnetism which included Bernie Burke and Merle Tuve and which made observations of neutral hydrogen in the nearby galaxies M31 and M33. To do this they brought one of the earliest multifilter hydrogen-line receivers which they themselves had built. It had 90 channels and contained a large number of mechanical devices to help it work. They even at this early stage installed an elementary traveling feed to increase the integration times. Several survey programs began at this time. Bertil Höglund, who was visiting then from Sweden, started his 1400 MHz sky survey. Ivan Pauliny-Toth, with several other staff members from Green Bank, observed all the radio sources in the 3C radio catalog. This program at that time was important because there were many of the 3C sources whose positions were quite uncertain because of the fact that they were "lobe shifted", meaning that there was uncertainty as to which interferometer lobe they were in.

Dave Heeschen and Cam Wade made a quite detailed survey of many normal galaxies and Dave Hogg observed a number of supernova remnants. It is interesting to see the speed at which the first publications appeared as a result of these programs. Both Ivan Pauliny-Toth and Dave Hogg reported the first results of their observing programs at the American Astronomical Society meeting just after Christmas, in 1962, and their summaries are published in Vol. 68 of the Astronomical Journal. Another long program at this time was that of the NRL group on the polarization of radio sources and another start was Mort Roberts beginning his observations of hydrogen in other galaxies in about mid-summer of 1963.

These observations of Roberts' were made with the multifilter line system, but by early Spring of 1964 Art Shalloway had completed and tested our first 100-channel autocorrelation receiver and this meant that Gart Westerhout from the University of Maryland could begin his project of mapping the neutral hydrogen in our galaxy to the ten arc minute resolution available with the 300-ft telescope. This program, as we all at NRAO know so well, went on for several years and appeared finally as a large block of hydrogen-line maps in a first edition in 1966 and in a final second edition in June of 1969. This Maryland-Green Bank 21 cm line survey of the galaxy probably represents the greatest single piece of work done with the telescope. The scope of the program was very large and the care spent in achieving uniformity and completeness through the whole task of observing and of data reduction must certainly place it in this position.

By the early part of 1965, the telescope had lived through three quite severe winters and the structure began to show some problems. Failures or cracks occurred in some of the connections of the steel members in the reflec-

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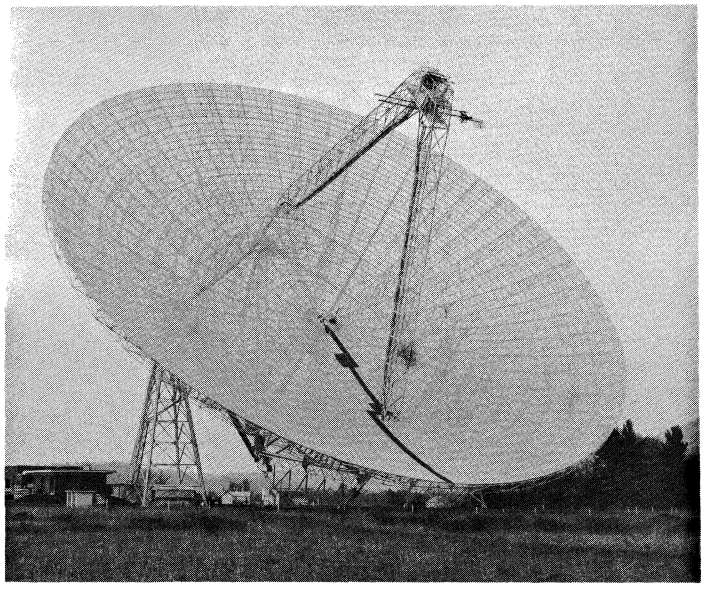
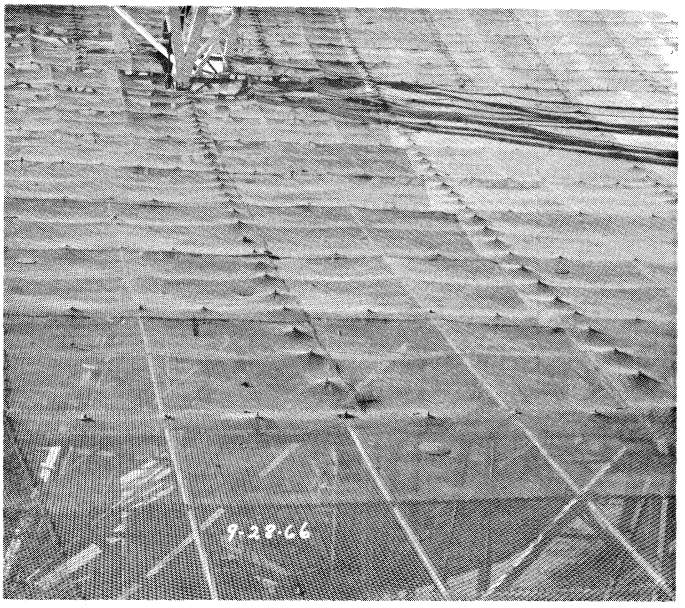
tor structure. The problem areas were those where some very light steel members were close to the heavy supporting members of the dish itself. These problems were studied by our own engineering division under Bill Horne and also by the Rohr Corporation, and a plan was developed for strengthening the reflector structure and making changes to the feed support of the telescope. The original feed support, although satisfactory, would only carry light loads and by this time it appeared desirable that standard front end boxes should be usable on the 300-ft and also that a reasonable sized observing room to carry the electronics should be available just behind the focal point. Therefore in the summer of 1966 a quite extensive program of strengthening and modifying the telescope was undertaken by the Rohr Corporation. New feed support legs



Two new feed support legs were part of the structural improvements in 1966.

and the new focal point observing room were added and the cables which in the original telescope ran from the concrete counterweight to a point close to the elevation bearings were replaced by the present rigid steel members. This latter change is interesting since the original first telescope design would have placed rigid steel members in these positions but since the members technically had only to carry tension loads, we modified this design before building the telescope and used three inch bridge strand cables instead of the steel members. This was an example of a change in design meant to improve economy but which did in fact introduce other problems into the behavior of the whole structure.

When the strengthening program was complete there were two main results, one good and one not so good. The telescope was much stronger and the deflection pattern of the structure had been improved. However, the extensive work on the telescope had resulted in considerable damage to the original telescope surface, and although in fact many of the surface sheets were removed during the winter of 1966 and rolled by a road roller in order to re-flatten them, and then replaced on the telescope, it was not possible to bring the telescope performance back to the level at which it had originally started.



By September 1966 the original surface of the 300-ft was in bad shape.

It was at about this time that the notorious jet engine was used on more than one occasion to blow snow out of the surface of the 300-ft telescope. I recall this activity as an example of how somewhat light-hearted remarks are sometimes made and then turned into not very sensible actions. The problem of snow loading of the 300-ft has always been a quite serious one. In the design stage I was asked several times what snowload the telescope would stand (it is in fact about 10 pounds per square foot)

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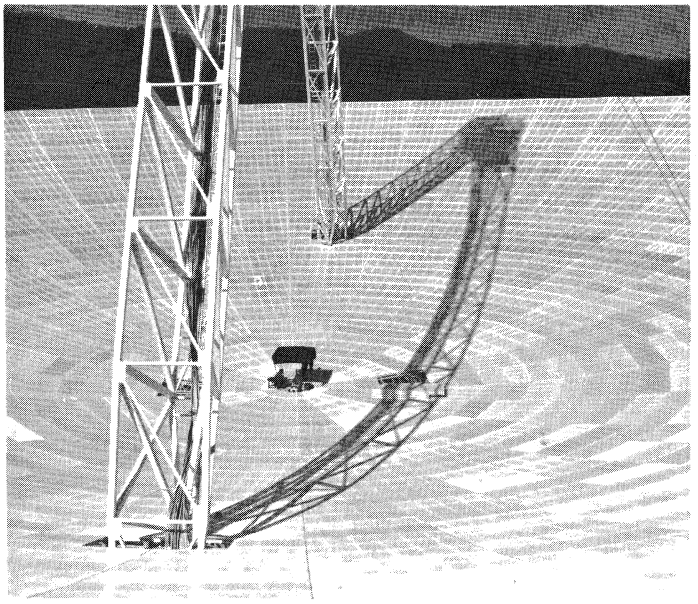
and what would be done if more snow than this occurred and the telescope was in danger of collapse. I looked at several ways of removing snow; one of which was to send an electric current up one tower, through the structure and down the other tower in order to warm all the steel and melt off the snow. This required about a gillion amperes and was obviously unacceptable. I therefore turned off many of the questions by saying that the best source of a large amount of heat in the right place would be to blow the exhaust of a jet engine at the telescope. This would both blow the snow away and melt it at the same time. This idea was taken up by people who can now remain nameless and a suitable surplus jet engine was procured, mounted on a trailer, tested many times to the acute discomfort of everyone around Green Bank and finally used on two or three occasions to blow snow out of the telescope. It did in fact work but the trouble and inconvenience far outweighed the advantage.

Let us turn back to the scientific work which continued despite the interruptions due to the structural improvements. Many programs were carried out and at this time it is hard to single out any particular one. Perhaps the work on pulsars is the one which deserves mention. As soon as the discovery of pulsars was announced in February 1968, a number of visiting astronomers started using the telescope to make pulsar observations. Staelin and Reifenstein discovered the now famous pulsar in the Crab Nebula in observations made between the 17th and 21st of October 1968. They realized that this was possibly an important discovery and it has since turned out to have been the discovery of one of the most interesting of all pulsars. This interest lies partly in the fact that the pulsar period is short like the Vela pulsar and thus it is assumed that the Crab pulsar is a fairly new object. Secondly, it is the only pulsar which has been identified optically and which shows optical pulsations. It lies close to the middle of the Crab Nebula, which is of course a supernova remnant and it is a classic case of the way in which a neutron star can be left behind when a supernova occurs. An indication of the rapidity of discoveries at that time in the pulsar game is given by the fact that Staelin and Reifenstein made their announcement in IAU Circular No. 2110 and only a few days later the Arecibo group had enough further information about this pulsar to publish in IAU Circular No. 2113. The Arecibo group, among others, have continued to study this pulsar in great detail because it has continued to show a very interesting behavior in the way its period occasionally changes as time goes on.

The pressure for observing time on the 300-ft continued to remain high despite the fact that its aperture efficiency at 1400 MHz had now been reduced to a figure only somewhat greater than 30 percent; thus it seemed wise to plan further improvements to the telescope in order to improve its performance at 21 cm and also if possible to give it useful performance at shorter wavelengths. The engineering division had analyzed the telescope structure and had predicted that if there were a good reflector surface the telescope would perform usefully at 11 cm and could even be expected to have a useful efficiency over a limited range of elevation angles at wavelengths as short as 6 cm. Therefore, plans were made and funds requested for the resurfacing of the telescope to achieve this performance. The new surface, which is of course the one now existing on the telescope, is a properly designed set of lightweight reflector panels mounted on adjustable studs. It is in fact a good conventional radio telescope surface.



In 1970 the 300-ft was given a new surface made up of adjustable panels covered with 3/8" aluminum mesh.

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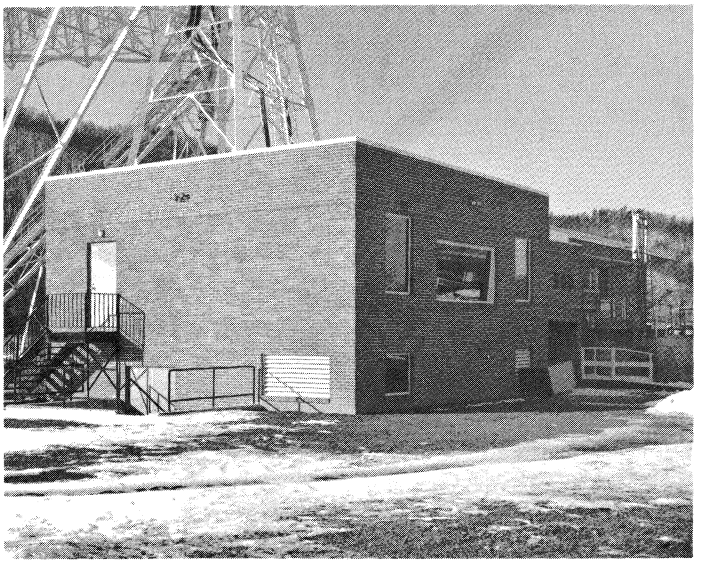
The final fabrication of this new surface was done by Radiation Systems, Inc. of McLean, Va. and the surface was installed under the same contract by the Micro-T Construction Company. This work was carried out between July and early December 1970 and the telescope restarted observations in December 1970. Figure 1 (page 8) shows the performance of the 300-ft with its new surface and these curves show that the predictions of its potential performance have in fact been borne out in practice.

During the time that this resurfacing program was being worked two other changes were made to the telescope; one was that an entirely new variable speed drive system was added and the second was that the final version of the traveling feed which increased observing time, permitted polarization measurements and also gave focus adjustments, was installed. This traveling feed was working by April 1971. Soon after, that is by November 1971, the new control building for the telescope had been completed and the move into it was made in mid-November. This new control building is an extra room of an area of about 1000 sq. ft. which is an addition to the old control room which is now mainly used for office space. The new control building is shielded by steel mesh to give protection from interference from many of the instruments within the control building.



The new addition to the 300-ft control building was completed in December 1971.

The new temperature control system was included and this for the first time has given the telescope a good environment for both the telescope operators and the electronics.

The control center inside the new addition to the control building.

Since the restart of operations on the telescope in its present form, it is interesting to see that some of the 1962-type of science is being repeated. Sky surveys were started by the same Ivan Pauliny-Toth, Mike Davis, and Ken Kellermann at both 11 cm and 6 cm wavelength. Many continuum and line observations are now made on the telescope, there is still a block of regular observers of various characteristics of pulsars, and even the VLB observers are able to use it at the lower frequencies. One might now describe the telescope as a fully automated transit telescope which has also limited hour angle tracking. It is capable of use to wavelengths as short as 6 cm and it should continue to be for sometime a major astronomical instrument. Figure 2 (page 8) may be of interest in showing the usage of the telescope through 9 years of its effective life.

It is not fair to select any one group of all the parts of the Observatory who have contributed to the success of the first ten years of observations with this instrument. However, perhaps if I were forced to do so I

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would pick the telescope operators under the leadership of Bob Viers who has for many years had the 300-ft as his own telescope. We all wish it many further good years of good science.

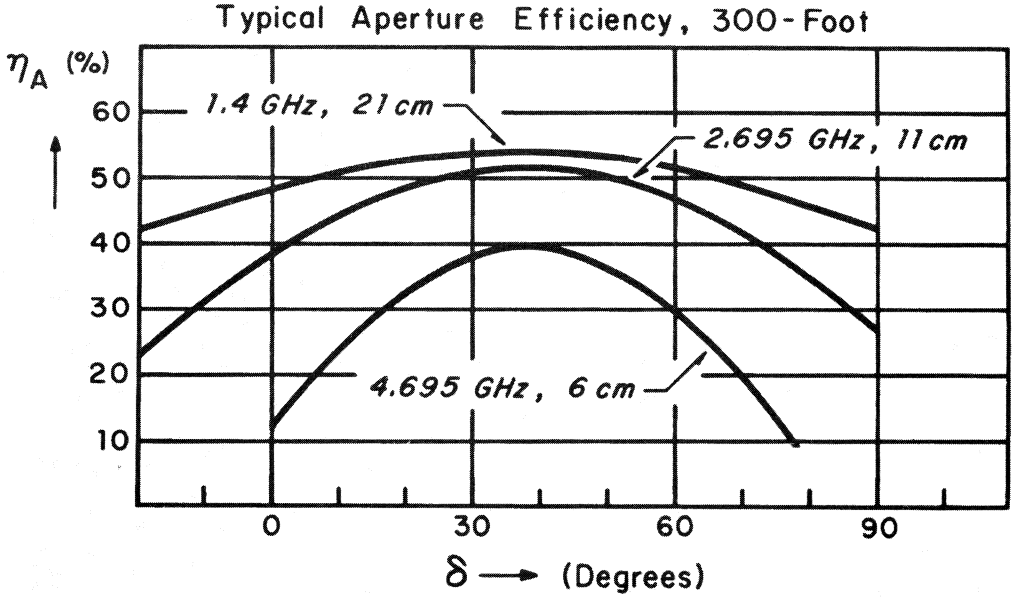

Figure 1

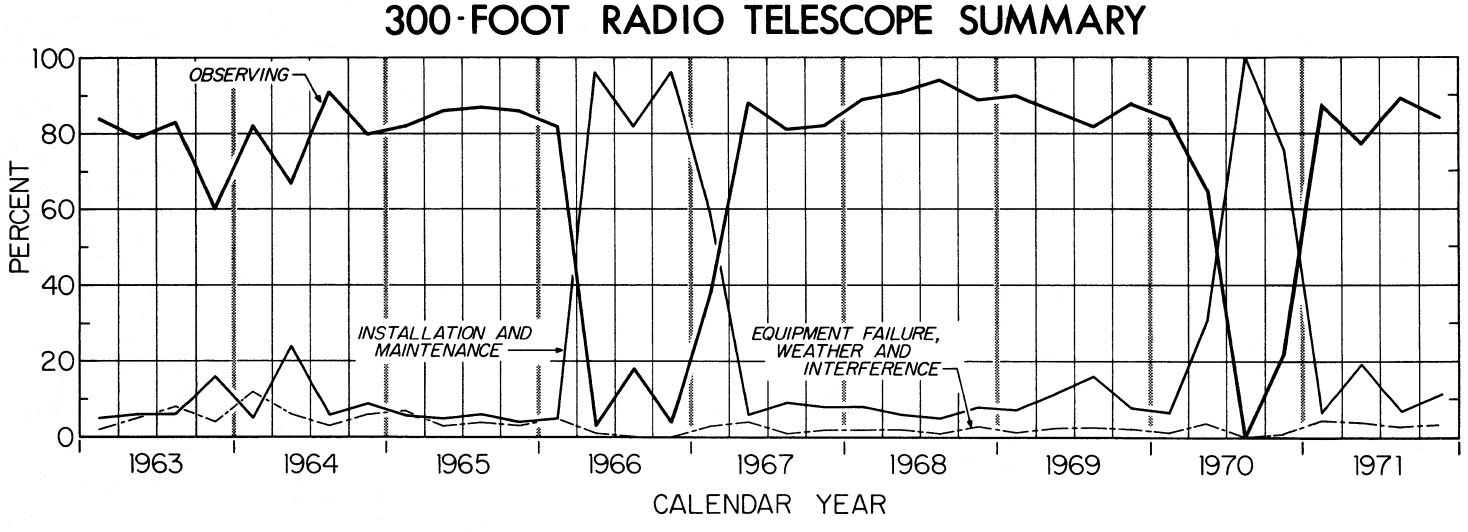

Figure 2 - This summary for each quarter of the calendar year shows the percentage of time the telescope was scheduled for observing, for routine maintenance and installation of new experiments, and the percentage of time lost due to equipment failure, bad weather, and radio interference. The time spent on structural improvements in 1966 and re-surfacing in 1970 are clearly shown.

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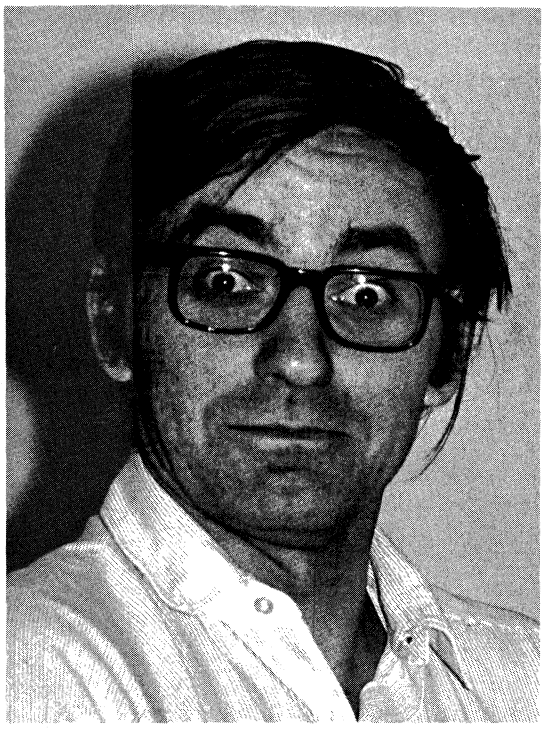
A PARTY IN CHARLOTTESVILLE????

Bruce Balick



It was a good party.

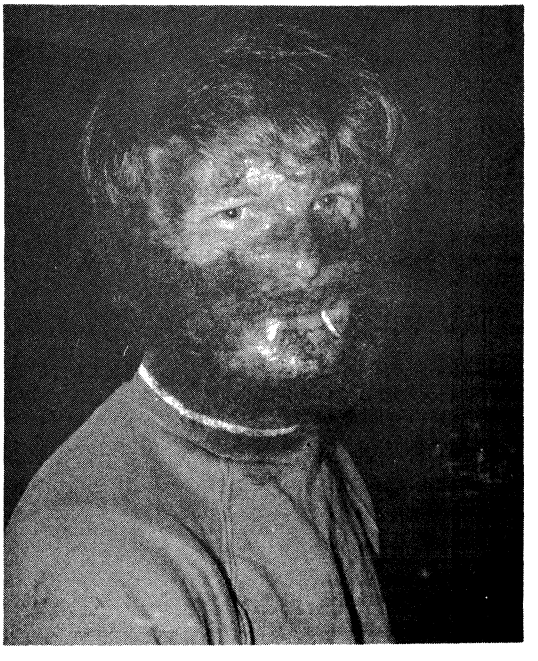
You could tell it was good. Nobody talked shop. Three unexpected trips for more beer. My wife told me she danced with three men--two of them scientists! And Art Shalloway got hit hard right in the nose (more about that later). They had to throw us out of the place. Not a bad party at all.

Let's get the details over with that they expect you to talk about in the OBSERVER. The party was held October 28 at the Four Seasons Tennis Club just north of Charlottesville. The dance committee consisted of Brilliant Bruce Balick, Vivacious Elaine Litman, and Diabolical Deminted Seth Shostak who all contributed essential ingenious inventiveness (P.S. check the author's name). Actually, many people deserve credit and thanks for the preparations. Donna Beemer helped with just about everything. Jeanne Ray, Peter Napier, Carl Bignell, Bob Haas, Bill Meredith, and others gave up a lot of time also.

Now let's get down to the interesting part.

First of all, the food and drink. Shown below are some of NRAO's hungriest. Elaine Litman really spread a feast for this party.

Cold cuts, hot and cold hors d'oeuvres, spreads, fruits and nuts were abundant (especially the fruits and nuts who did the eating). The punch was designed to put hair on your chest. Apparently Charlie Pace missed his mouth and got punch on his face.



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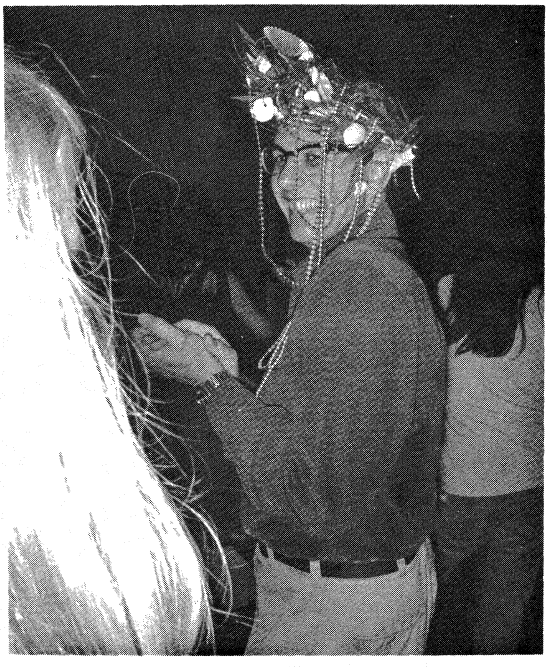
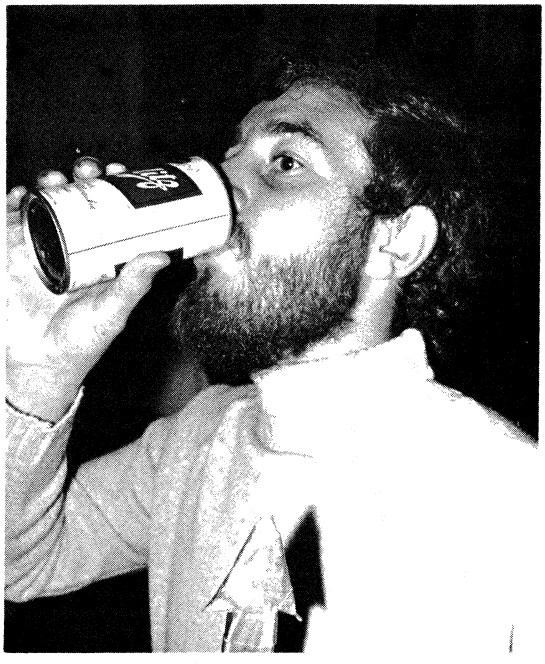
It's funny how differently people act outside the office. I mean that seriously. Take the administrators for example. Have you ever seen Bill Howard looking like this?

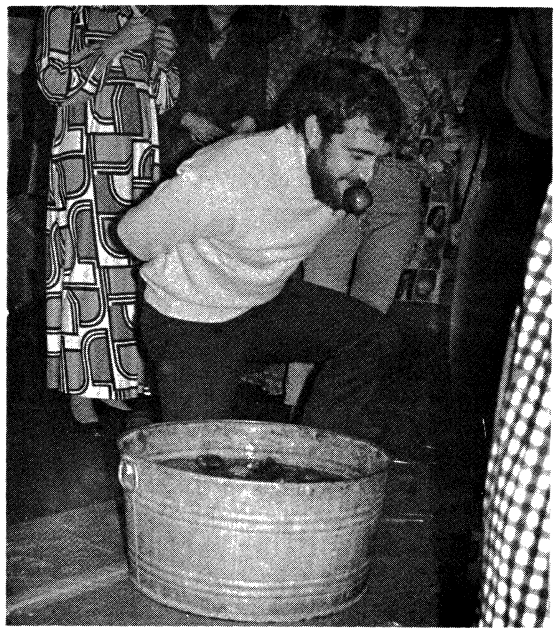


And then the secretaries! You know the dude on the TV ads for Winchester cigars? He could learn a thing or two from Donna Beemer.

As for the scientific staff, engineers, and computer staff--most were hiding behind cans of beer.



Now for the activities. The evening started with apple bobbing. Shown below is one of the successful few. Peter Napier apparently found one of the apples Seth



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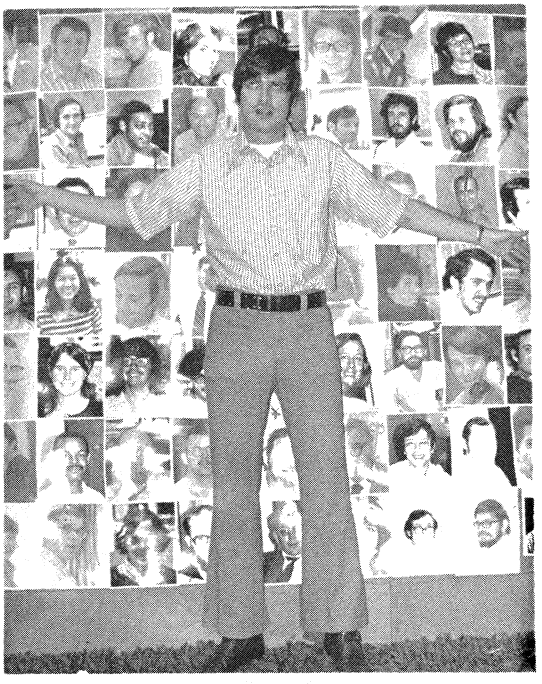
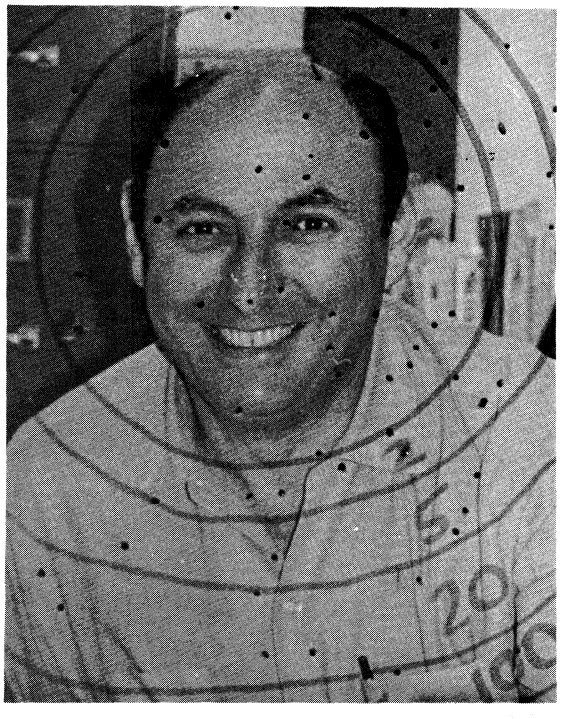
hadn't covered with shortening. Incidentally, no one admitted biting into one of the red onions disguised in the tub.

The biggest hit of the evening was the dart board. Pictures of nearly everyone in CV were enlarged to 8" x 10" and mounted on a large board. Several darts were provided, and the thuds of darts on target and shouts of devilish joy could be heard all evening. You could learn a lot about your popularity or who your friends are (or were) by watching carefully.

Needless to say, the administrators were by far the most popular targets. Wally Oref won't let me show the results. (He's afraid the funds for the OBSERVER will be cut.) The winner of the non-administrators is shown below.





It's Art Shalloway, and the punch in the nose is obvious.

One poor chap was pinned to the board by mad Englishmen. The apple on Seth's head is probably the result of someone with a William Tell hangup.

Later in the evening an appearance was made by the Great Pumpkin (alias Bob Brown). The sincere believers came in from the Pumpkin Patch to receive their gifts which ranged from toy airplanes which fly (George Conant) or crash (Tom Cram) to the books The Sensuous Dirty Old Man (Bill Meredith) and The Art of Erotic Massage (can't tell you who got this one) and a bag of corks (also anonymous). Below you'll see the Great Pumpkin awarding the prize for the best looking witch (Jeanne--can I tell them who won this?).

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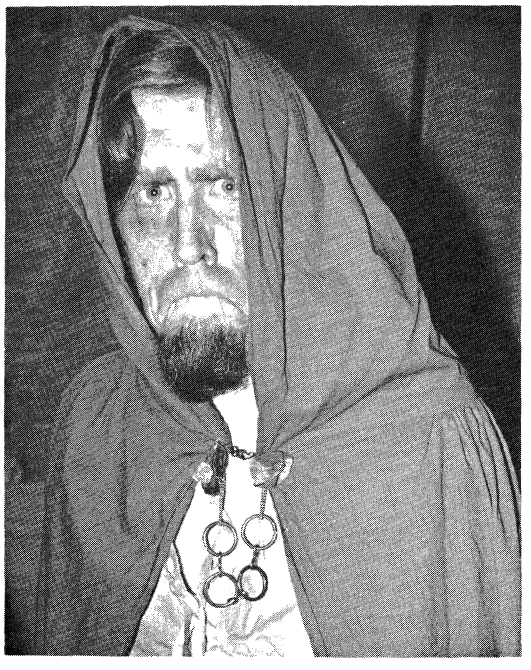
Incidentally, this wasn't a costume party.

There are always a few who costume up even though they weren't supposed to. So we had a contest. The finalists are shown below (Bill made it because he was without white shirt and tie).

Bob Haas, the winner, consented to a portrait.



Tony Kerr, his office-mate, made some wise-crack concerning how Bob usually looks. We need not repeat it here.

So went the party. Somehow the room we rented still stands. Oh yes, the clean-up. Most of it was done at 1 a.m. (they tell me) by people whose state of sobriety was questionable at best. One hung-over jerk forgot to reset his watch to standard time the next morning and came an hour before anyone else to finish up. Me.

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TRUSTEES' ANNUAL MEETING

R. Jeffries

The Board of Trustees of Associated Universities, Inc., held their annual meeting in Green Bank on October 19 and 20, 1972.

The meetings included the Board of Trustees' session Thursday morning and their combined meeting with the Visiting Committee Chairmen in the afternoon. The NRAO scientific staff gave two presentations Friday morning prior to the annual meeting which concluded the series of meetings.

There are twenty-five members of the AUI Board of Trustees representing many of the major universities and leading basic research facilities in the U. S. They govern the overall activities of Associated Universities in the same manner as a board of directors leads a major corporation.

Visiting committee chairmen represent the applied science, biology, chemistry, medical, and physics departments of a similar array of major universities and research facilities. They act as "watch-dogs" on our research activities and advisors in their appropriate fields to the Board of Trustees.

On Thursday evening a reception and dinner was held in the cafeteria for all of the visitors and members of the NRAO staff.

The writer takes this opportunity to thank all those employees who contributed in making the 1972 Annual Trustees' Meeting a successful undertaking.

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ON FITNESS AND FATNESS

R. M. Hjellming

Having been asked to write an article on the theory and practice of losing weight, I believe it is most important to discuss the relation between physical fitness and weight problems. In theory, exercise is not fundamentally necessary to lose weight, but in fact, for most people, a coordinated diet and exercise program is by far the easiest and most reliable way to take off excess weight (fat). However, the needed exercise is specifically what is called "aerobic" (oxygen-using) exercise. There are very good reasons for believing that the problems of fitness and fatness are closely related.

Anyone who reads the available books on losing weight soon discovers some discouraging facts. Most people who try dieting do not succeed in losing weight, and those who do seldom succeed in keeping it off permanently. Even the medical experts on obesity, who report a phenomenal 50% success rate for initial treatment, find that a year or so after patients have been "cured", most of them return to their old habits and their old weights. Why is weight loss so hard to accomplish, particularly in the long run? Most of the books on the subject agree that the basic problem is that people are very stubborn about clinging to old habits. Even if people are forced into doing something they don't really want to do, they may do it for a while, but eventually they rebel, or think that they can stop after attaining their goal, and return to old habits. The first rule for weight loss is that you must really want to do it for your own good reasons. The second rule is that you must consciously set out to drop a large number of old habits and replace them with some new ones. The third and most important rule is that you must realize that you can never, never return to your old habits. Unless you plan to permanently change various eating and exercise habits, you will never be successful and it is better not to try. What habits must be changed? Obviously, you must eat less and, less obviously, you must maintain some minimum level of physical exercise. I will now try to explain why.

A number of books on weight problems alude vaguely to the idea that regular "exercise" sometimes "helps". However, the key problem is "how much" and "what kind". Largely by accident, a specialist in exercise physiology named Kenneth H. Cooper, M.D. stumbled upon a set of circumstances whereby most of the people undertaking diets were successful, permanently. Cooper's original objective was: (1) to measure physical fitness in an objective manner, (2) determine the best ways to bring people to an adequate level of physical fitness, and (3) determine what level of exercise was necessary to maintain this proper level of fitness. As a side effect, he found that <u>almost everyone who embarked upon a plan to attain a minimum level of physical fitness was able, as a side effect, to achieve permanent weight loss simply by adding on a moderate diet to their physical fitness program</u>.

How and why? Cooper found that the key to physical fitness was a person's capability to attain and maintain a relatively high rate of oxygen consumption under conditions of physical exertion. Expressed in terms of the number of milliliters of oxygen processed per minute per kilogram of body weight (ml/min/kg), a person in poor condition could process only 25 ml/min/kg or less, while a person in excellent condition could process 50 ml/min/kg or more. Why is this important? The reason is the well established fact that physical effort requires energy, but energy is obtained in a steady fashion only by oxidation of food stuffs. Because the energy yield from food combustion in the muscles is 5 calories per ml. of oxygen consumed, your oxygen consumption rate limits the muscular energy you can produce. Cooper was able to show that exercises demanding high levels of oxygen consumption are necessary to improve and maintain a high level of oxygen consumption capability. He devised many exercise programs whereby an average person could double his oxygen consumption capacity (aerobic capacity) in a slow, safe, and systematic fashion.

What does this have to do with weight loss? The answer is that improved oxygen consumption occurs because of an improved cardio-vascular system capable of aiding more efficient metabolization of food-stuffs and excess fat. Dieting without aerobic exercise does nothing to improve your capacity

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to handle normal food intake; therefore, any return to old eating habits will result in a return to old weights. Both losing weight and maintaining a stable proper weight are matters of energy balance. If the energy produced by food combustion equals the food energy intake, then your weight is stable. If you take in more food energy than you burn, then it is stored as fat which increases body weight. Weight-loss is achieved by making food energy output, because then stored fat is metabolized to supply the needed extra energy. If you consume less food energy than your body uses, it takes the energy from stored fat and you will lose weight. There are only two reasons for failure: either you are cheating and eating more than you should or your metabolism is so inefficient at burning both food energy and energy stored as fat that little seems to be accomplished. Aerobic exercise itself uses up relatively few calories; however, it tunes up your capacity to metabolize food and fat by improving the key to the process--improved oxygen consumption.

How does one improve one's aerobic capacity? How can you measure aerobic capacity? What exercises are aerobic and how much is necessary? I will try to answer these questions, following the studies by Cooper, in a forthcoming article.

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GREEN BANK EARLY EDUCATION

Dorsalene Henderson

The second year for Green Bank Early Education is well underway. We are, presently, thirty-three people; ages 3 to 6 1/2. Our teacher is Dorsalene Henderson and our 'nother teacher is Jo Ann Gardner (aide).

We have been very busy learning our colors, tying our shoes, cutting jack-o-lanterns, brush painting, finger painting, counting--- we do so many things!

Some of our people come Monday and Tuesday, all day. We ride the bus. A different group comes on Thursday and Friday. On Wednesday the teachers either come see us at home or Mommy and Daddy come to school to visit the teacher. We even have breakfast and lunch at school. Sometimes we get a bit tired and then we have a nap on our cots.

We wish you could come by and see all of our beautiful work. The teacher has it put up all over the building. She says we are excellent, we're happy!

****

FOR SALE

Two snow tires mounted on wheels to fit up to 1966 Volkswagon; used one season. Also one deep well jet Myers water pump with 42 gallon tank.

Maxine Foe---Ext. 252 or 456-4172.

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WEST VIRGINIA'S HIGHEST MOUNTAINS

Craig Moore

In the eastern part of the state, particularly along the Allegheny Front, are numerous high knobs and ridges reaching well over 4000 feet in elevation. In other states it is a popular sport to visit each mountain top on a list of high spots. Colorado has its list of peaks over 14,000 feet and New York has its 46 Adirondack peaks over 4000 feet. The Adirondack Mountain Club, who pioneered the high peak list idea through its ADL 46'ers group, offers a patch and certificate to all who climb the 46 peaks by foot. Most of these peaks are officially trailless, but the sport has become so popular in recent years that the more likely routes now have obvious trails beaten by thousands of lug-soled hiking boots.

Pouring over topographic maps of West Virginia's highlands, I wondered how many high spots our state has. Arbitrarily I decided to list all mountain tops 4500 feet or higher which are separated by at least 500 feet of elevation loss or 5 air miles distance. The following is a list of 25 such spots arranged in elevation rank according to the most recent U. S. Geological Survey maps. Anyone who has information to share about these 25 highest mountains, or would like to collaborate on trips to climb them is encouraged to contact the author.

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WEST VIRGINIA'S HIGHEST MOUNTAINS*

	Mountain	Elev.	County	District	Map Reference
1	Spruce Knob (#1)	4860	Pendleton	Circleville	Spruce Knob NE 7 1/2'
2	Bald Knob	4842	Pocahontas	Green Bank	Cass 15'
3	Thorny Flat	4839	Pocahontas	Edray	Cass 15'
4	Unnamed knob on Back Allegheny Mtn.	4790	Pocahontas	Green Bank	Cass 15'
5	Thunder Knob	4777	Randolph	Dry Fork	Laneville 7 1/2'
6	Unnamed knob on Cheat Mtn.	4775	Pocahontas	Green Bank	Cass 15'
7	Spruce Knob (#2)	4710	Pocahontas	Edray	Mingo 15'
8	Beech Flat Knob	4700+	Randolph	Mingo	Cass 15'
9	Big Spruce Knob	4695	Pocahontas	Edray	Mingo 15'
10	Pharis Knob	4674	Randolph	Dry Fork	Spruce Knob NW 7 1/2'
11	Unnamed knob on Back Allegheny Mtn.	4646	Pocahontas	Green Bank	Durbin 15'
12	Black Mtn.	4625	Pocahontas	Little Levels	Marlinton 15'
13	Snyder Knob	4612	Randolph	Mingo	Durbin 15'
14	Elleber Knob	4595	Pocahontas	Green Bank	Hightown 7 1/2'
15	Watering Pond Knob	4593	Pocahontas	Green Bank	Hightown 7 1/2'
16	Unnamed knob on Spruce Mtn.	4585	Pendleton	Union	Onego SW 7 1/2'
17	Kile Knob	4566	Pendleton	Franklin	Circleville SW 7 1/2'
18	Gay Knob	4545	Pocahontas	Edray/Huntersville	Mingo 15'
19	Sharp Knob	4535	Pocahontas	Edray	Mingo 15'
20	Kennison Mtn.	4524	Pocahontas	Little Levels	Lobelia 15'
21	Sugar Creek Mtn.	4521	Pocahontas	Edray/Little Levels	Webster Springs SE 7 1/2'
22	Briery Knob	4518	Pocahontas	Little Levels	Lobelia 15'
23	Ward Knob	4507	Randolph	Mingo	Durbin 15'
24	Snowy Mtn.	4500+	Pendleton	Circleville	Snowy Mtn. 7 1/2'
25	Unnamed knob on Back Allegheny Mtn.	4500+	Randolph	Huttonsville	Durbin 15'

*Only those mountains separated by 500 feet elevation loss or 5 air miles distance are considered.

A REPORT ON THE FOUR DAY WORKSHOP ON THE THEORY OF EXTENDED EXTRA-GALACTIC RADIO SOURCES

Dave De Young

On October 9-12 of this year, Green Bank was inundated with an unusual assortment of people. This group behaved in a manner quite different from the usual Observatory visitors. They gathered together every morning, sometimes outside, shivering in the cold, and did nothing but talk at, and sometimes with, each other. Not once did they venture near a telescope, except for an occasional individual who could be seen wandering somewhat aimlessly about, staring up at the dishes.

This strange conglomerate of individuals was none other than a group of theorists, a type of astronomer whose existence had been rumored in Green Bank but who never before had been seen there in quite such numbers. The occasion which produced this unusual event was a four day workshop on the theory of extended extragalactic radio sources, and it was felt that Green Bank would be an ideal location for such a conference, not only because there the theorists could see where the data that they occasionally examine originates, but also because they could interact with observers. In addition, the fall colors in Green Bank are particularly striking at this time of year.

The topics discussed during the four days included most of the theoretical problems concerning these extragalactic objects which remain unsolved. Extended extragalactic radio sources are the largest known example of "astrophysical violence" seen in the sky. These objects are usually observed as two radio emitting blobs situated on either side of a galaxy or quasi-stellar object. The radio emitting regions are typically two or three times the size of an entire galaxy, and often emit radio radiation at a rate 10 to 100 times that of the light emitted from all the stars in a typical galaxy. This radiation arises from the motion of very energetic charged particles moving in a magnetic field. How these objects were ejected from the parent galaxy or quasi-stellar object, why they appear in the characteristic double form, and whether or not there is any material present in the emitting regions other than energetic particles and magnetic field are among the as yet unanswered questions confronting the theorists. The Green Bank workshop gathered together observers and theorists who have spent a great deal of time worrying about just these problems. Particular attention was paid to the problems of how the radio sources are ejected from the parent object. Some theories favor the occurence of a sudden catastrophic explosion in the center of the galaxy or quasi-stellar object, which ejects large amounts of gas (up to ten million times the amount of matter in the sun), energetic particles and magnetic fields. This material moves outward at speeds of 1 percent that of light to form the radio source. Another approach advocates the continuous emanation of intense very low frequency ($\sim$10 H_Z) radiation from the nucleus which then accelerates charged particles located outside the galaxy, causing them to emit radiofrequency radiation. It appears that within the next few years enough data will be available to allow one to choose between these two models.

General mechanisms by which charged particles can be accelerated were also discussed, and one conclusion which emerged from the conference was that the energetic particles which emit the radio radiation must somehow be replaced or rejuvenated during the lifetime of the radio source. This reacceleration occurs naturally in the model employing low frequency radiation, whereas the sudden outburst models must use some additional acceleration mechanism which is active after the radio source has been formed. The use of turbulence in the gas contained in the source or the presence of small, rotating pulsar-like objects within the source were two of the possible acceleration mechanisms discussed.

The presence or absence of significant amounts of gaseous material between galaxies was also a question which gave rise to lively debate. Most of the theoretical models for extended sources assume the existence of such a gas, for it is needed to restrict the size of the radio sources as they move through intergalactic space after being ejected. This confinement of the sources is required by observational evidence, and it could result from gravitational forces arising from many massive (and as yet unseen) objects within the source as well as from an intergalactic gas. Such a gas has not yet been directly observed, and the resulting uncertainty provides room for the endless debates upon which

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theorists thrive.

Although it cannot be said that any of the outstanding problems were "solved" during the four days, it was clear that all of the participants had gained new insight and understanding with regard to the various physical processes that must be incorporated into any successful theoretical model of these interesting astronomical objects.

Theorists need to interact with other theorists just as necessarily as observers must have telescopes. The kind of informal, relaxed atmosphere which prevailed at the Green Bank workshop is that which is most conducive to the generation of new and fruitful concepts.

The success of the workshop would have been impossible without the assistance and advice of many persons at NRAO. In particular, Phyllis Jackson and Donna Beemer in Charlottesville spent many hours helping with the organizational details, sending out various letters, and solving all manner of last-minute crises. Beaty Sheets and Jane Gordon provided great assistance with the organization in Green Bank, both before and during the conference. Jesse McLaughlin produced an excellent banquet, as usual, and Dave Gibson made essential contributions to solving transportation problems, and most importantly, documenting the conference. Special thanks must go to Ross Jeffries for co-ordinating and supervising all of the numerous details during the conference, and to Dave Hogg for generous and essential assistance in planning the entire meeting.

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THE BLACK HOLE

Buck Peery

Cool, crisp, autumn breezes in Deer Creek Valley have blown away the blue smoke in the parking lot at the Lab and helped disperse the pile of white sand south of the Lab but they have not condensed the fog generated by a recent article* written by a raving reporter for the OBSERVER. The white sand pile and the Black Hole in the west end of the Lab are mortarly related.

The Black Hole is not the result of the collapse of a concentrated energy source, even though considerable energy was used in concrete saws, burning tourches, sledge hammers, and manpower in its development. It is not a new source of water, a landfill for disposal of blown fuses from the Lab, a place for Engineers to calibrate plumb-bobs, or a place for crack(ed) Geologists to study the fissures and bonding power in man made building rocks.

It is a silo for a VTOP (vertical take off platform), a vertical transporter, -- an elevator. Its important dimensions are very appealing to those with sharp critical eyes, -- 7'-0" B - breadth, 4'-8" W - width, and 22'-8" H - height, and a 3000 pound weight capacity.

Speed is not one of the VTOP's outstanding characteristics. It will be propelled hydraulically at the rate of 50 feet per minute and the acceleration and deacceleration will cause less than 1/10 G pull. Such speed will be a great help to the weary and heavy-laden, (the freight handlers), but to those moving their own weight and a few papers it will be much healthier and faster to use the stairs.

Equipment to operate the VTOP will consist of an oil pump located in a small room in the basement and a 24'-0" long cylinder installed vertically below the silo floor.

The silo was constructed by Jerry Rexrode of Staunton, Virginia. Jerry and his men did an excellent job. The inconvenience caused by dust and noise generated by the construction was offset by the entertainment provided by the men as they worked in the very confined space.

The VTOP is being installed by Old Dominion Elevator Company of Salem, Virginia. If all goes well, Santa can come into the Lab by the way of the VTOP instead of the chimney.

*Obvious reference to article, "The Sand Pile" (see August issue).

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Common sense is in spite of, not the result of, education.

--Victor Hugo

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SUPER SOCKO STELLARAMA

Louella Parsuns

Lights! Camera! Dullsville. Yes, all Tinsel-Town is a-ga-ga as the big cameras roll into the obscure town of Green Bank, West Virginia filming the latest in a series of incredibly tedious space epics. Entitled "The Invisible Universe," this celluloid masterpiece-in-the-making is intended to replace the current Observatory flick which is shown to over twenty thousand tourists each summer. The film has been commissioned by the NRAO, and is to be made on a budget somewhat less than that of the love scene in "A Day in the Life of Ivan Denisovitch". To get the real skinny on this cinematic landmark, I paid a visit to the plush Charlottesville office of producer-director G. S. "Big Daddy" Shostak. As I whipped out my notepad, G. S. offered me a Dutch Masters and settled back in his luxurious naugahide swivel chair.

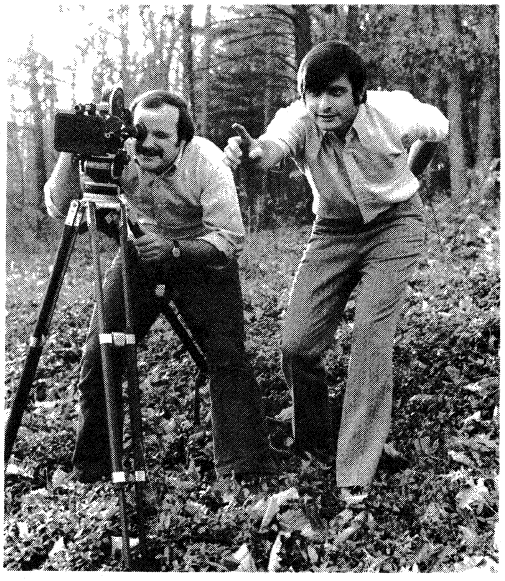

Fig. 1: While Bob O'Connell rolls the big eye, G. S. "Big Daddy" directs exciting dramatic, tension-ridden scene. There are fourteen barnyard animals in this picture. Can you find them all?

"Tell me, Dr. Shostak...."
"Please call me Big Daddy."
"What's the real skinny on this picture?"

"Well, Louella-baby, we wanted to produce a real filmic experience for these knowledge-hungry tourists; something that would bring goosebumps to their elbows. Lenny Nimoy tried it in 'Star Trek', Stanley almost did it in '2001', and Hayakawa came closest of all in 'Crater Creatures vs. Godzilla'. But this'll be the one that picks up where the others left off. We intend to spare no effort to make sure this is the biggest thing since chicken fat."

"What about your production crew?", I enquired as Big Daddy chewed on a No. 2 Eberhard-Faber.

"Only the best. Bob O'Connell, who took big kudos for his roll in 'The Annette Funicello Story', is co-producer, and Dick Sramek is key grip."

"Since you bring that up, I might remind you that some of your past productions have been labeled sophomoric drivel by the critics."

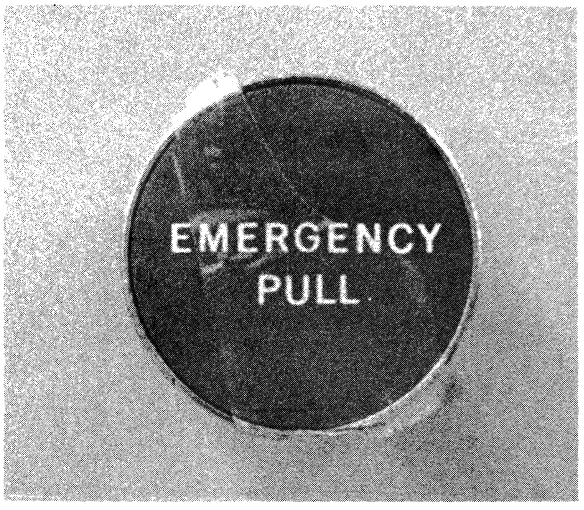

Fig. 2: Exciting, dramatic, tension-ridden scene being directed in Fig. 1.

"That's still better than freshman drivel. Besides, how can you expect those dumb critics to appreciate the subtle psychological nuances, the delicate handling of leitmotifs and the perfection of personality portrayal in something as epic as 'The Cephalopods that Masticated Milwaukee'?". Big Daddy was gesticulating wildly as his office mates left the room.

"How will the current film differ from its predecessor?"

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"Mainly in content. We decided the public was tired of seeing electronics and computers, so we wrote them out of the script. Same with telescopes and astronomers. Also cows and derricks. Frankly, about all that's left are close-ups of trees. We originally titled the film 'Sex for Six at Seven', but we figured NRAO couldn't afford to buy another tour bus."

"Has production of this film been very complicated?"

"Louellums, this whole shtick has been an Excedrin headache. Have you ever tried to cover a 140-ft dish with pancake makeup? Using a two-inch sponge?"

"Sounds tough. How 'bout the cast?"

"Truly stellar. You can tell they're movie stars by the film on their teeth."

The movie will be rated 'E' for egregious.

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PLANE KILLS DEER?

Sooner or later it had to happen and it finally did. An airplane killed a deer on the NRAO airstrip. Fault was not established and whether the deer ran into the plane or the other way around, no one will say. Whichever way it happened, one deer was killed and one airplane was damaged. No one on board the airplane was hurt but there must have been some anxious moments for pilot and passengers. The incident occured on October 18 at around 6:30 p.m. and involved an AUI twin engine plane and a deer from a herd grazing near the airstrip.

The deer were grazing at the edge of the woods about 200 feet from the runway at the time the AUI plane was approaching the west end of the landing strip. As the plane dropped down towards the edge of the runway, the pilot noted the deer scurrying off into the woods. He thought no more about the deer as he concentrated on his landing approach and touched the plane down. He was already part way down the runway before he saw the blur off to his left and in front of the plane and realized it was a deer. A collision was eminent. The pilot knew it was too late to avoid hitting the deer and keeping control of the airplane was uppermost in his mind as the left wing and the deer met. The deer was killed instantly. The impact ripped a hole in the leading and trailing edges of the wing, but the pilot was able to bring the plane under control and to a stop.

The game warden gave the deer to a local family. We don't know who was given the bill for the damage to the plane which was estimated at several thousands of dollars.

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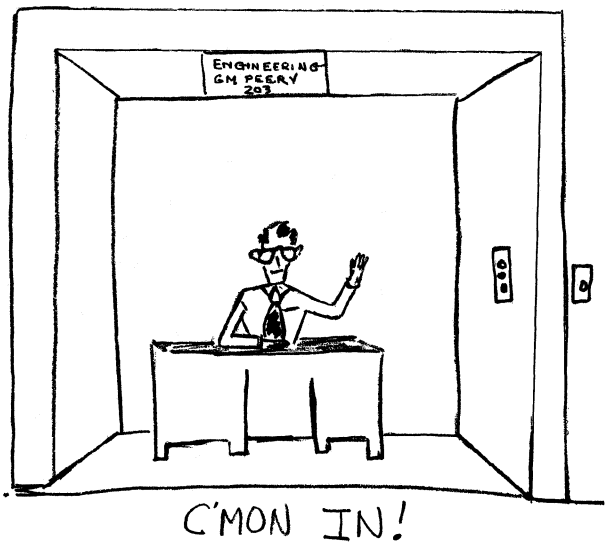
COMMENTS

At least two people on the second floor had the same idea about "The Black Hole". One put it into picture form and the other into words. They are presented below for your enjoyment.



"Buck Peery now has the largest office at Green Bank. It is only 5' x 7' but it is 25 feet high. Next thing you know Bill Brundage will want one just like it."

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Curiosity is one of the permanent and certain characteristics of a vigorous intellect.

--Sameul Johnson

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A 300-FT BIRTHDAY

B. Viers and J. Spargo
(and a cast of thousands)

On Sept. 21, 1972, the passing of the tenth birthday (operational) of the 300-ft radio telescope occurred with hardly an eye being batted. It was actually about a week later, when around coffee one morning, that the fact was brought to our attention by our ever alert supervisor. Since then we've spent many a coffee break wishing for a party as well as listening to, telling and re-telling many stories, anecdotes and outright lies concerning the history of our beloved big ear. The party has yet to materialize as we lack sufficient backing (How about it, Dr. Findlay?).

Anyway, those of you who have been around the "Stronomy Plant" long enough to collect your ten year pins, will undoubtedly have heard or told just about all the stories, etc., that have been discussed here of late over coffee. So then, our purpose here is not to embellish upon, or destroy these cherished memories but rather to add to the justly won fame of our ten year old, by relating some hitherto unknown facts or trivia (take your pick) in the hope that you too can share in some memorable coffee breaks discussing 300-ft lore. Speaking of ten year pins, we think a special ten year pin should be presented to the 300-ft for ten years of faithful service which we hope to document before this tale concludes. Perhaps this pin could be presented at our proposed party if we ever get one. Oh well! It's just a thought.

Now onward, or should we say backward, through history. All of the following incidents are true, only the order of occurrence has been changed due to some funny quirks of our memories.

How many times have you heard this question? What does George Grove really do around here? Well, at about 0100 hours on Sept. 21, 1962, the 300-ft control room was filled with the lyrics of the "Tide Commercial" and then an ominous voice saying "Eh John Hancock", as yes, you guessed it, none other than old lonesome George started positioning the telescope for its very first scan (observation, to you who are uninitiated). This scan started at 01^h07^m sidereal time or $01^h27^m42^s$ EST. The source was 3C47 and we were on our way. Since George, 32 additional operators have graced the console of the 300-ft. A list of their names appears at the conclusion of this article. See how many you can remember.

A short time later it was realized that it would be great if we could tip the telescope further south in declination than was possible at that time. The one big restriction stopping this was a planet named Earth. So, the Engineering Division got busy with transit and drawing board, with Plant Maintenance doing likewise with picks and shovels (and some heavy equipment). The result was that part of the planet was relocated to make a large pit at the south side of the telescope. This allowed the telescope to be tipped about 20° further south and increased its total range to about 105°. In 1971 a frequent user of the 300-ft, and a true believer in the principle of symmetry, requested that more of the planet be relocated in order that a pit could be provided on the north side enabling observations near the north star. This was duly accomplished and our total declination range extended to about 111°.

To those of you who think you've shortened your index finger by pushing buttons, we submit the following. The original telescope drive system was a 2-speed AC motor which drove the scope at either 10°/min. or 2.5°/min. Now try to imagine a rookie operator learning to position the scope to 10 seconds of arc by alternating between low speed and stop. We hear claims that the operators became adept at getting the position right on in only one, two, or three times. However, there are still some old timers around who appear to have shortened index fingers. After a few years of the above routine the Digital Lab blessed us with an automatic positioner. This handy gadget would position the scope to within one degree of a desired position which freed the operators to worry about other buttons that needed pushing, with the assurance that the telescope would be pointed to somewhere within the ball park when it stopped. Since then the auto-pos has been refined and a one minute of arc tolerance can now be achieved. In 1966 a variable speed drive was added and used in conjunction with the 2-speed drive. This allowed variable speeds between 0 and

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about 1°30'/min. It also made possible galactic scan programs. The operators were overjoyed with the ease of operation and Dr. Westerhout was downright ecstatic. Well, we really thought we had it made and then, wonder of wonders, the digital wizards came through again, and in the spring of 1968 a shiny new computer appeared. Not only would it position the scope exactly where we wanted it but it also collected all the data. Now, you might think that we really had it made. After all, in six years we had come from a purely manual operation to a fully automatic one. As luck would have it though, for every button we didn't have to push on account of automation, another button or switch or meter appeared that required our attention. In the end all that happened was that the work load was shifted a little.

Before the advent of the now-famous jet engine to remove snow from the surface of the telescope, the choice of snow removal fell to the backache brigade. This hearty corps, consisting of personnel from Telescope Operations and Plant Maintenance were called upon on two memorable occasions to remove, using brooms, an accumulation of one foot of snow from the telescope's surface. A quick calculation shows that 1.8 acres of snow one foot deep equals roughly 78,000 cubic feet of snow or about 38 railroad coal cars full.

Operators at the 300-ft can justifiably say that they worked their way up from the bottom, for the original control room was located in the basement of the building. A closed circuit television was used to observe the telescope attitude and weather (but mostly tourists). Later we moved upstairs where at least we had a small window or two to look out of if we wanted to climb over equipment to do so. Now of course we are in the plush surroundings of our new control room in the new addition to the control building. Here we can sit back and, as stated in an earlier OBSERVER article, gaze out of our picture window on "Almost Heaven, West Virginia", the view only occasionally marred by the goings on at the interferometer.

Well, when all is said and done, the real test of course is the production of scientific data. Here the 300-ft can more than hold its own. In its first ten years there were 210,213 observations logged (conservative estimate). This averages out to about one observation every 27 1/2 minutes. However, there have been some lengthly periods of down time for overhaul and modifications. They were as follows:

1. Replacing feed support legs and general beef-up of backup structure.....143 days
2. Rolling old surface.....102 days
3. Resurfacing.....203 days
4. Installation of Sterling Mount..... 10 days
5. Scheduled maintenance days.210 days
6. Holidays.....20 days

TOTAL 688 days
(or 1.8849315068 years)

After deducting the above, which doesn't include unscheduled down time due to equipment failure, we now average about one observation every 20 minutes, a remarkable record.

O.K., enough is enough, so we'll leave you to ponder our statistics. Perhaps in 1982 you'll permit us to add a few more tidbits for the record. Of course if you know some stories that we haven't heard, by all means join us for coffee. We'll be glad to listen.

300-ft Telescope Operators 1962-1972

George Grove
Robert Viers
Omar Bowyer
Fred Crews
Troy Henderson
Bill Hunter
Ralph Hawkins
Darrell Southern
Bob Vance
Richard Bird
Bill Terrell
Roy Walker
Richard Spurlock
Harold Crist
Dave VanHorn
Don Carderella
Leroy Webb
Shep Sutton
Ralph High
John Weaver
Spencer Everly
Ralph Graham
Roy Paitsel
George Liptak
Al Hogan
Ken Cottrell
Bob Nicols
T. J. Gladwell
Roy Sharp
Dave Williams
Jon Spargo
Paul Giguere
Jaab Baars

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A learned man is an idler who kills time by study. --George Bernard Shaw

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THE COST OF PERSONAL TRANSPORT

Mel Wright

I have owned four vehicles (forgetting the three bicycles, two baby carriages, and half-a-pair roller skates). The following table which I drew up out of interest summarizes the actual cost of each vehicle and tells its own story.

(cents per mile)

	Lambretta scooter	Triumph bike	Morris Minor	VW sedan
Depreciation	.5	0	.6	1.3
Maintenance	.5	1.1	.9	3.0
Tax	.13	.8	.5	0.5
Insurance	.12	.6	.4	1.0
Gas	1.0	1.5	2.1	1.2
Total	2.25	4.0	4.5	7.0
Annual Cost	$170	$110	$560	$950
Annual Mileage	7000	2600	12,000	13,000
Annual Income	$7000	$1000	$2000	10,000
Cost as % of Annual Income	17	11	28	9.5

The vehicles were owned as follows:

1961 Lambretta scooter: 6/1964 to 8/1967
1954 Triumph motorcycle: 6/1967 to 10/1968
1963 Morris Minor sedan: 11/1967 to 9/1970
(above while in England)
1968 VW sedan: 10/1970 to 9/1972
(while in Charlottesville)

To fill in some of the details: the scooter was the beginning of my nomadic life and took me as far afield as Turkey and Spain as well as numerous climbing trips to the English lake district some 300 miles from Cambridge. 7,000 miles per year is a lot of time to sit on a scooter. When first acquired, the scooter was capable of scaling the 1 in 3 (30% gradient) hills to be found in the lake district. The quoted steepest grade in 1st gear was 1 in 2.8. However, towards the end of its days my method of getting up these same hills was to procede throttle wide open and clutch engaged, alternately leaping off and running alongside, and then leaping on until the motor was about to stall. Excellent training for the crazy sport of hill running. On the continent of Europe I met many interesting people at the local weld shops in the backstreets of most countries. The scooter was good student transport.

The motorcycle, bought and sold for 30 pounds, was for fun. Most of the maintenance cost was replacing bits that fell off at high speed. Fortunately, I never fell off!

The Morris Minor was a saga---Greece, Spain, and North Africa. Forty miles per gallon, but note the high cost of gasoline in England; also taking one fourth of my income. Shifting to North America, gas becomes a minor item in comparison with the high depreciation and service costs. Seeing the final 7 cents per mile it is encouraging to me to learn that the average cost of the family car is closer to 12 cents in the United States and approximately 15 cents in England. But now think of $2,000.00 per car per year multiplied by about 100,000,000 cars in the United States. For $200 billion per year couldn't we do better than breathe each other's exhaust fumes? For example: Think of the free rapid transit you could build in one hundred major cities with one billion dollars per year and on the free use of public transport in rural areas with the other one hundred billion. Hmm!

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FOR SALE

AR Manual Stereo Turntable

with

Shure V-15 Type II Cartridge

Jerry Turner
Ext. 349

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Men love to wonder and that is the seed of our science.

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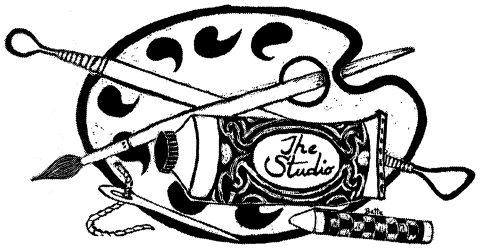
CRAFTERS MEET ON SUNDAYS

Bette delGiudice



The Studio (formerly Clay Daze) has moved to the Hannah House at the recreation area; sharing the building with the Rifle Club. We have the lower floor. In the past, we had to discontinue work in the cold weather. Now, with a comfortably heated building, running water, and lavatories, we can operate during all seasons.

For three years, we have potted, and glaze slapped quite contentedly with our guests, students, and visitors; but now with tremendously improved facilities, we will expand the variety of art and craft opportunities. Some of us plan clay sculpture, modge podge, candle making, tie dyeing, block printing, and batik.

The Studio is the place to do your untidy projects, with the opportunity to exchange ideas and techniques. Most Sunday evenings we have an "open workshop" from 6 to 9 o'clock. For information, or other arrangements, phone Bette delGiudice - 456-4742, or Perryn Fleming - 456-4783.

On Sunday, January 7, there will be an Open House with coffee served from 3 to 5 o'clock in the afternoon. Come join us, and make your plans.

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NOTE OF THANKS

Only two readers returned their comparison shoppers lists that were asked for in the August issue of the OBSERVER. Thanks Joan and Gerrit. You were the only two out of several hundred readers. But that's the way it goes.

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Tomorrow life is too late: live today.
--Martial

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TOURS-1972

The regular public tour season ended on October 29, 1972. During the season 22,000 people came to see the Observatory. They came from every state and twenty-six foreign countries. Forty-four percent came from West Virginia, thirteen percent from Ohio, ten percent from Virginia, nine percent from Maryland, and seven percent from Pennsylvania. The rest came from the other states and foreign countries.

In addition to the 22,000 regular tourists, 2,200 students came to visit the Observatory as special groups. They ranged from grade schoolers to college seniors. Most came from West Virginia schools but school groups also came from Ohio, Pennsylvania, Virginia, and Maryland.

This year's total is considerably less that last year's total of 27,170. Why the rather drastic drop? We really can't say for sure (we were not able to poll the people who did not come). However, if we had to give two reasons for the tourist decline, these would be the two: devastating flooding in the northeast USA in mid-June and an unusually rainy summer. Some tourist attraction operators we talked with gave a third reason. They said that they experienced a decline of tourists every election year.

August was our most popular tour month (7,948 people). Sunday was the most popular tour day and Friday was the least popular. Most people came for the 4:00 p.m. tour. The noon tour was the least popular but only slightly less than the 10:00 a.m. one.

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CV PAPER RECYCLING

Gerrit Verschuur reported to us that since the paper recycling program began in Charlottesville (some 25 months ago) they have turned in 53,600 pounds of paper and 19,700 pounds of white cards for which the scrap dealer paid just over $1,000.00. This 36 1/2 ton of paper represents the equivalent of 620 trees saved. It takes 17 trees to make a ton of paper.

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FIND THE JOURNALS

How well are you acquainted with the journals we receive in our library? In this maze of letters-reading up, down, forward, backward, and diagonally, you will find 44 titles. As you locate each title circle it. We've found one for you, the other 43 are up to you. Good luck!

A S T R O P H Y S I C A L L E T T E R S L M N Q R Z D A F P Y O U N S
S M D R S U P K L A U S T R A L I A N J O U R N A L O F P H Y S I C S
T A E L E C T R O N I C D E S I G N M O Z U P Q R X X Y D Z U S I D C
R G U R A I N O F U P Z M M E R S O N U E R O R G N O R H T M E S T I
O N P I I R I S H A S T R O N O M I C A L J O U R N A L A L N L O P F
N E Z S S C I E N T I F I C A M E R I C A N N A M E R Y I C L A N D I
O L Y N R T A T M O S P H E R I C S C I E N C E S Y D Y E G A L D Y C
M O N O H E D N M A L O S C I S Y H P N I S R E P A P T N E R R U C A
I P C A N D J L A M E R I C A N M A C H I N I S T M A P U R G P Y D P
C Q R E A T H E A S T R O N O M I C A L J O U R N A L P H Y S I C S E
A X C L O P H Y D I T S U R M A G E O P H Y S I C A L R E S E A R C H
L R Z B C D C S I R O R A D I O A S T R O N O M Y A B S T R A C T S T
S K Y A N D T E L E S C O P E R U S G N P I Z O M Y A Z D O T X Y M F
O B S E R V A T O R Y Y D N E W S C I E N T I S T A L B C D P U D D O
C Z A P H Y D A Y Q P Z A D O K L A D Y C A O P H Y S I C S T O D A Y
I L L C O N S T R U C T I O N M E T H O D S A N D E Q U I P M E N T T
E A S T R O N O M I C H E S K I I Z H U R N A L O U R K R I M O U P E
T A S J S M E T S Y S L O R T N O C D N A S T N E M U R T S N I W N I
Y M O P T I C A L S O C I E T Y O F A M E R I C A J N A N I G M E L C
O K Q P I Z M D L O U S S I C J E P T L E T T E R S W S M Y M I U P O
F Z S P A C E S C I E N C E R E V I E W S M E L L E R U R S M O W N S
A S T R O P H Y S I C A L J O U R N A L N O C R O U L U M O L O C P L
U A Z Q R P Z Y S I L C R A D I O S C I E N C E U P C R N M U N O W A
S C I S Y H P O R T S A D A I S Y R I P L F L I V R M O N D U B O Y C
T P L A N E T A R Y A N D S P A C E S C I E N C E G R R M P R D J A I
R M Z Y N A M O U V Y N A R E E L M P S I L M M T T O K U M D R S S M
A M E T A L F I N I S H I N G A M Y G O O L E F S A Y D C B A P T S O
L O Y F N E W I R E L E S S W O R L D C N E M A C J S B O E R U T A N
I A F Z I C A O P R A A Y L A Q S Y T N R O L L E T C I U M S R R A O
A S T R O N O M Y A N D A S T R O P H Y S I C S O N R O R L T C D I R
L U C O M J L X U R N Y U S P E K H I S E M I N D O T O A S L O I O T
M I C R O W A V E S S R N Z S R E T T E L S C I N O R T C E L E N E S
P R N D I I Y M R C A R E V I E W C I E R N U T A N U N M Y C A T N A
M Y A M C R O V A C E O T M I C R O W A V E J O U R N A L A S E D I T
E L E C T R O N I C S A S T R O N O M I S C H E N A C H R I C H T E N

MYSTERIOUS RISTENPART CHARTS DISCOVERED IN ANTIQUE FILING CABINET IN GREEN BANK

Virginia Van Brunt

The Ristenpart Charts are not the only mystery worthy of comment in this column for the OBSERVER. The mysterious voice on the other end of the telephone in the Charlottesville library is that of Martha Sanders, who is replacing Virginia Van Brunt for the time being.

On our orientation tour to Green Bank, to introduce Martha to the wilds of West Virginia and the workings of NRAO, Berdeen O'Brien brought out an unusual pile of "things to look at". This time the pile was rolls of charts, yellowed with age, covered with a hefty layer of dust, and rolled up in brown paper.

Not wanting to sneeze my way through the rest of the afternoon, I procrastinated as usual, and asked Berdeen to put them on the shuttle so we could look at them in Charlottesville and decide what to do with them.

Having happily dispensed with "the charts", Martha and I continued our tour of Green Bank and the telescopes.

The following week, Tom Bania was looking through the charts and mumbled something about them being from Chile. All of a sudden both of us remembered a folder in the correspondence file, left from the days of May Daw, which was labeled "RISTENPART CHART MYSTERY". We quickly retrieved the file and reviewed the situation.

We had received letters in 1968 from several observatories, claiming that NRAO had the only copies of numbers 10 and 19 of the Ristenpart Chart series, and would we make copies of these charts available to interested observatories. Unfortunately no one was able to locate <u>any</u> set of the charts, much less locate the two elusive numbers, for which we were to have the only copies.

Happily the two missing numbers were in their appropriate places in the roll. But, had it never been decided to install an elevator in Green Bank, Buck Peery might never have insisted that Berdeen clean out that old filing cabinet, and what would the world of astronomy have done without having found the long forgotten Ristenpart charts?

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MEDICAL TRAINING

Richard Fleming

A medical training course is being conducted during the months of November, December, and January and is being attended by NRAO guards Jim Pennington, Roy Pennington, Ether Tyson, Delbert Cassell, Pete Tallman, Fire Chief Glen Grandon, ten members of the BFD Rescue Squad, and five members of the Marlinton Rescue Squad. This Emergency Medical Technician (E.M.T.) course consists of seventy hours of classroom work (two nights weekly for ten weeks), a four hour written exam, and a practical exam, all of which is followed by ten hours spent working in a large hospital emergency room (Morgantown).

The course is taught by Green Bank, Marlinton, and Elkins doctors and nurses with the aid of slide presentations and movies. Practical sessions are supplemented by use of a life size "doll" named Tammy.

The course is titled "Emergency Care and Transportation of the Sick and Injured" developed by the American Academy of Orthopedic Surgeons and is sponsored by the West Virginia State Department of Health. The course is devoted to instruction in actual care of patients with specific injuries or illness, at the scene of onset and during transportation to a medical facility. The instruction is intended to be detailed in presentation and comprehensive in scope, and upon successful completion the Emergency Medical Technician receives certification from the State Department of Health.

After completion of this course, training will continue by having at least two classroom sessions each quarter.

The Paramedic program is growing throughout the country and will be available in the future. We will be ready by keeping the training standards high since the present Emergency Medical Technician course is a prerequisite for the Paramedic program and continued training is planned.

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A wise man knows everything; a shrewd one, everybody. --Anonymous

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OZMA REVISITED

Pat Palmer and Ben Zuckerman

Hisss....Snap! Crackle! Pop!....Hiss.... Is this the way extraterrestrial beings will sound when (sceptics say "if") we learn of their existance? None of our friends in or out of astronomy seems too sure. Since Frank Drake had a 21 cm listen to Tau Ceti and Epsilon Eridani back in the dark ages of radio astronomy, there have been plenty of conferences, books, and talk about extraterrestrial beings--and even a few observations. However, about a year or so ago it occured to us that no one had seriously exploited the tremendous advances of radio astronomy during the 1960's. We now have a 400 channel correlator (Frank had a 1 channel scanning radiometer), a 300-foot telescope (Frank used 85-1), and two 50°K 21 cm paramps (Frank's amplifier was typically 500°K). All of these effectively allows us to take data 10,000,000 times faster than in the original Ozma experiment. In our opinion, if the original look was worthwhile back in the peaceful days of yesteryear, perhaps a factor of 10^7 could justify utilization of some valuable 300-foot telescope time in these days of bleeding ulcers and high blood pressure. Fortunately, the NRAO referees (or at least most of them) agreed with us and we were given a week on the 300-foot telescope to carry out our search. (It is interesting that when we discuss this project with people they are either for it or against it, with very few fence-sitters.)

What should we look at in our precious week, and how should we look at it? Frank Drake looked at two stars for a long time. Our feeling was that it was better to look at a lot of stars, even if only for a little time each. Basically we feel that if the LGM (little green men) on a planet circling Delta Agnew T had their transmitters off at 8 PM they were not likely to turn them on at 10 PM. Thus we decided to use the 300-foot telescope and look at a few hundred stars each for a few minutes a day rather than use the 140-foot telescope to track a smaller number for a long time each. Unfortunately, Sandy Weinreb and crew still don't have a front end-backend setup that allows us to cover the whole radio spectrum all at once. Thus we were forced to choose a specific observing frequency. Because of the great sensitivity of Skip Thacker's 21 cm paramps and because of certain common arguments (probably incorrect or irrelevant) that have been given by others in favor of interstellar communication at the 21 cm hydrogen line wavelength, we decided to have a go at this frequency. (B. Z., being anthropomorphic, prefers the 1 cm water wavelength.)

But how can we recognize our LGM? All of our friends who are much more sophisticated in such weighty matters as communication theory, planetary radar, pulsars, etc., realized that using an autocorrelation receiver and looking at the data in time intervals no shorter than 20 seconds is not the optimal way to proceed with the search. Even old-fashioned spectral line types like us (we can still remember the good old days when competing for 140-foot time with Peter Mezger and Ken Kellermann was our major worry) realized this was true. Unfortunately, to substantially improve our resolution in either frequency or time seemed to require a monetary and/or personnel expenditure from NRAO that we were not prepared to request. Thus we hope that the aforementioned factor of 10^7 improvement is sufficient to justify our pedestrian search.

Our 170 stars were chosen on very strict grounds which we will only briefly mention here. Essentially, we chose stars that appear to be similar to the sun and that are as close as possible. We used star catalogs that are supposed to be complete (down to a certain minimum brightness) out to 65-80 light years from the sun. For the first go around we eliminated all stars that were possible members of multiple systems, were variables or flare stars, had strong calcium emission lines (probably indicating that the star is relatively young), or had another peculiarity that might not fit in with any other preconceived notions we happened to hold. Of the 1000 odd stars in the catalogs we were hard pressed to find 200 that met all of our criteria and fell within the declination range (-19° to +90°) covered by the 300-foot telescope. In particular, both Tau Ceti and Epsilon Eridani fell by the wayside for one reason or another.

What bandwidth should we use on the

--continued, next page--

autocorrelator? We split it in half - 10 MHz attached to one front end to cover all bets and 625 KHz attached to the other. Since the party line on these matters is that to reach the greatest distance our LGM will transmit in the narrowest feasible wavelength band, one might wonder why we didn't choose a narrower window than 625 KHz (4 KHz resolution). The reason is that if the LGM don't constantly correct their transmission frequency for the doppler shift of the motion of their planet (or other orbit) as seen by us, the transmission frequency will appear to vary by as much as 625 KHz for planets that are circling their star in the "zone of life". (For example, because of the Earth's motion around the sun, to an LGM 21 cm frequencies transmitted here will appear to vary by ~300 KHz during the course of a year.) Also, since the radial velocities of our target stars are somewhat uncertain due to optical measurement errors, we couldn't have narrowed the bandwidth by much more than a factor of 10 even if we had wanted to.

At any rate we might hope to detect a civilization with about our level of technical competance (i.e., a 40 Megawatt transmitter on an 100 meter telescope beaming in our direction) beaming at us from any of our stars. We could not pick up "All in the Family" or any similar essentially isotropic transmission unless the power output was millions of times greater than terrestrial TV stations.

Our observing time was the second week of November, and after punching a zillion cards for the "computer controlled" 300-foot telescope, things ran very smoothly thanks to the operators at the telescope and a good system. We are now looking over the data. We want to assure our friends at the NRAO that in case we see anything we'll keep it quiet so that the military doesn't come in and shut the place down, thus putting you all out of work.

What are our chances of success? Well, Dr. Eugene Parker, the chairman of the department at one of our home insititutions and, thus, not someone to be trifled with, estimates our chances of success per star as approximately (length of a NSF Grant)/(age of a star). Certain of our colleagues are more optimistic.

What of the future? We were surprised to find that it is possible to have a brief look at all of the stars worth looking at within 25pc of the sun north of declination -19° in just 2 or 3 runs on the 300-foot telescope.

Thus we hope to exhaust the list within the next year or so. (Catalogs of more distant stars are less accurate and complete, so the value of looking at more distant stars diminishes rather rapidly.) Looking ahead 5 or 10 years (assuming that success has not been attained before then) a search covering much larger hunks of the radio frequency spectrum seems to be a possible step forward. Also, finer time and frequency resolutions should be achievable, primarily through the development of bigger, faster computers. To significantly increase the size of the antenna or the sensitivity of the amplifier seems unlikely except on a much longer time scale. Perhaps the development of smarter astronomers will help.

Perhaps we will inform the OBSERVER of the final results of this search in a future issue.

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FIREFIGHTING PRACTICE

Richard Fleming

You're right----the landscape does look a little different when coming onto the site. There is something different near the gate at the Works Area. Let's see...oh yes... there is still something new....or missing. You guessed it - the Arbogast house is gone.

During October, a weekend of firefighting practice for the NRAO Fire Department and BFD Fire Department included smoke-mask training and actual firefighting practice. Two houses, one (Beard, south) very dilapidated and the other (Arbogast) termite riddled and very unsafe, were set on fire and each department drove to the scene, set up equipment and made an attack on the fire. The two NRAO trucks and two BFD trucks worked together using different equipment, hook-ups, and firefighting techniques. Each man present was rotated to different jobs and received the kind of training that will be very important when responding to a real emergency.

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The pen is the tongue of the mind.--Cervantes

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