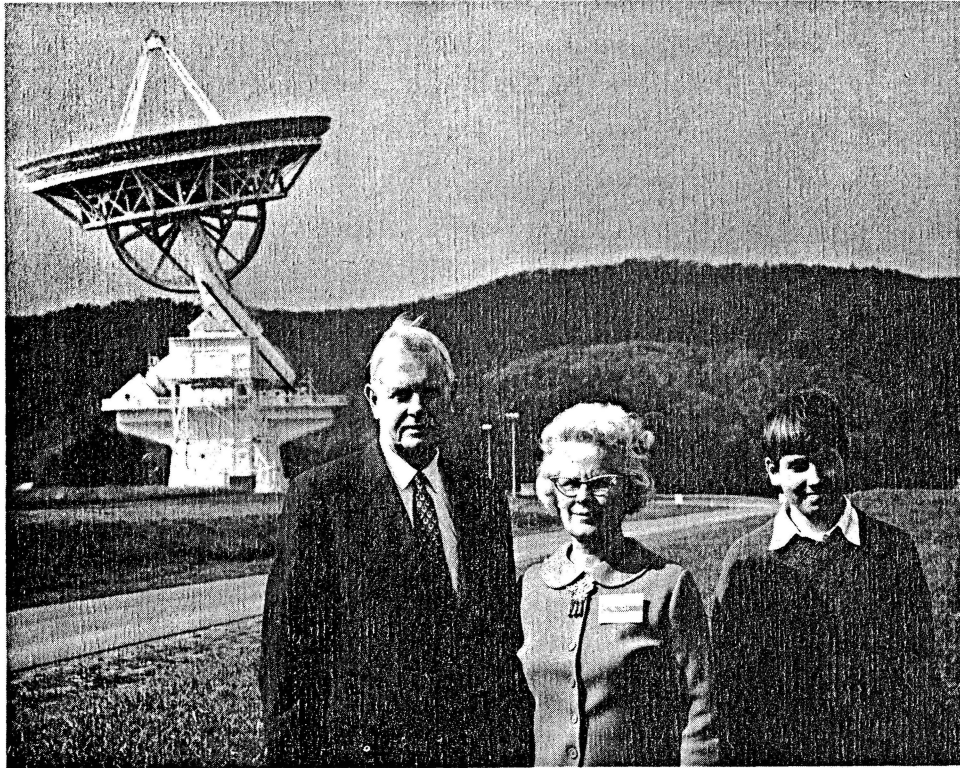


The OBSERVER

Vol. 9, No. 2

November 1969

Page 1



Dr. Gerald Tape, AUI President, Mrs. Tape and son visit Green Bank for Trustees' Meeting. (See page 8.)



Welcome back to Green Bank: Mort, Elizabeth and Joey Roberts!
(See story on page 2.)

**MORTON S. ROBERTS
APPOINTED ASSISTANT DIRECTOR
FOR GREEN BANK OPERATIONS**

On September 15, Dr. Heeschen appointed Mort Roberts Assistant Director for Green Bank Operations, replacing John Findlay who returns as Assistant Director to Charlottesville. Even during the two weeks before Mort's appointment became effective, he began to immerse himself into Green Bank activities, asking questions, listening to people, and informing himself about all facets of the operation. During the week of October 6, he and his wife Joey, their daughter Elizabeth and dachshund Ninny moved to Green Bank into the house occupied last summer by Sandy Weinreb and his family.

Mort is no stranger to Green Bank. He joined our staff in Green Bank from Harvard in 1964 and moved to Charlottesville when the NRAO headquarters moved in 1966. He has observed many times on the 140-ft and 300-ft telescopes and, according to scuttlebutt, we may even see him running a program on the interferometer soon. Mort's main scientific interests lie in the area of galactic structure. He has been particularly active during the last seven or eight years trying to find how much neutral atomic hydrogen gas is in other galaxies, how that gas moves inside each galaxy, and trying to piece together data that could tell us how Milky Way systems are formed and how they evolve. Knowing Mort, we are all sure that his interests in these problems will not waver as he undertakes his new duties.

Before his five-year association with Harvard, Mort Roberts spent his academic career on the West Coast. He got his bachelor's degree from Pomona College in 1948, his M. S. from CalTech in 1950, and his Ph. D. from Berkeley in 1958. During his career he has been a college teacher, a professional physicist, a pure researcher, and now he is turning his attention to administration. All of us at the NRAO are looking forward to working with Mort in his new capacity and we wish him the very best as he launches into this new and challenging facet of his career. (W. E. H.)

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Jorg Pfleiderer
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Jon Spargo
Mary Ann Starr
C. M. Wade
Beverly Weatherholt
Dorman Williams
Tom Williams



*Holiday
Greetings*



The Observer is a bimonthly publication of the National Radio Astronomy Observatory.

FROM THE DIRECTOR'S OFFICE

One of the greatest contributions that the Observer can make to all of us at the NRAO is to inform. No matter what we do at the Observatory, our jobs are made more interesting when we can learn what the other fellow is doing and how it all fits into the big picture. In this column I shall comment on various plans we have and things that are happening, their status at the moment and our hopes for the future. Obviously, not all of them can be covered at one time, nor can all the details be given for want of space, but any of us in the Director's Office would be happy to talk about them at greater length, anytime. Let's cover a few now.

First, as of October 12, Congress still has not yet approved the final budget for the NSF this year, so we cannot say anything new about the 300-ft resurfacing or its new control building or the plans for further development at Green Bank mentioned by Dave Heeschen in the last Observer. This delay is not unusual. It happens nearly every year. Our money for operations continues during this time so it is "business as usual" except that we are not allowed to begin any major construction. Recently, you may recall, President Nixon asked for a 75% reduction in government construction. This may affect our plans for the 300-ft control building but it probably will not affect the telescope resurfacing which we hope can be accomplished during next summer.

October was an exciting month at the 140-ft telescope. There were two transcontinental or intercontinental very long baseline (VLB) interferometer experiments on the telescope during the month. In a VLB experiment two telescopes look at the same radio source at the same time and record the receiver output at each location on magnetic tape. Very highly accurate clocks must be located at each telescope at each end of the experiment, otherwise the interference "fringes" caused by the two signals beating against each other cannot be identified. When the telescopes are located far apart, the beam in the sky (actually a series of "fan" beams located very close to one another) is very narrow and permits

part of the fine-scale structure of the radio source to be studied. This desire to see how small the smallest sources really are is the motivating force behind the VLB experiments where observers try to choose pairs of antennas with as much distance between them as possible.

One of the VLB teams is headed by Irwin Shapiro from MIT. Many telescopes were trained on the radio sources 3C 273 and 3C 279 (Nos. 273 and 279 in the third Cambridge, England, catalogue of sources published in 1959) as the sun moved in front of them on October 8. Einstein's Theory of Relativity predicts that the apparent position of these sources will change ever so slightly as they near the edge of the sun because the gravitational field of the sun can bend the radio wave as it passes by on the way to the earth. Shapiro's team hopes to check Einstein's theory and, at the same time, they will be able to measure the distance between the telescopes that participate in the experiment to an accuracy of a few inches. There are many telescopes participating in this experiment: our 140-ft, CalTech's 90-ft, and Lincoln Lab's 120-ft (Haystack) telescopes. The other CalTech 90-ft and 130-ft telescopes are also in the net as well as one at the Jet Propulsion Laboratory. The experiment was run here last year too, but this time the number of participants as well as the number of telescopes has mushroomed.

The other VLB experiment involves Ken Kellermann, Barry Clark, and John Payne from the NRAO, Marshall Cohen from CalTech, and David Jauncey from Cornell who, with a group of astronomers from the Soviet Union including L. Mayveyenko and I. Moisseev, are running a VLB experiment between the 140-ft telescope and a 72-ft Russian telescope located in the Crimea within a stone's throw of the Black Sea. We expect Dr. Matveyenko and his colleague, Dr. N. Kardashev, to visit us during the experiment; Ken, Barry, and John are in the Crimea and Marshall and Dave will be in Green Bank. If this experiment is successful, it will have been made

Continued, next page --

with the longest baseline (in wavelengths) yet run and will offer the highest resolution ever run on the set of 30 sources they will observe. As you can imagine, there are many complications in an experiment like this one — visas to be got, permission to send equipment to Russia, delays in communicating between the two telescopes, and a host of smaller problems, none of which turned out to be insurmountable. Aside from the obvious scientific merit of the experiment, the friendly spirit of cooperation that is now in evidence between the two groups represents a new and significant milestone in East-West relations.

The Electronics Division is working on a new set of VLB terminals and a computer processor that will be available by mid-1970. When ready, they will significantly enhance the rate at which data can be taken and will allow the observers to make many more observations during a VLB run than they can do at present. Although there has been a lot of activity on the astronomical applications of VLB techniques, many more things can be accomplished in other fields of science, too. These include measurements of intercontinental distances with an accuracy better than a few inches that will permit scientists to study earth tides and continental drift, studies of irregularities in the earth's rotation, changes in the earth's rotation axis, further checks on relativity theory, and the determination of highly accurate positions of both radio sources and the radio telescopes that observe them. In order to foster further interest in these other scientific applications of the VLB technique, John Findlay is organizing a Symposium on Very Long Baseline Interferometry to be sponsored by URSI and the NRAO that will be held in Charlottesville on April 13-15, 1970. A "Call for Papers" was sent out on October 1.

We wish to welcome Ned Conklin to the Tucson staff. He will be NRAO's Scientist in Residence at the 36-ft telescope and will be responsible for the activities in Tucson. Starting in September, the 36-ft went back into operation after a 2-month summer maintenance period. Outside visitors and staff are now routinely scheduled for observations and we will begin to get our feet wet by doing spectral line observations in November.

Next time I would like to discuss the Dicke Committee Report and the steps we are taking to insure that NRAO will remain at the forefront of radio astronomy in the future. If space will allow I shall also touch on one of our prime budget items — OOE (Other Observing Equipment) — the plans we have in the areas of new receivers and instrumentation for the telescopes. Next to the people at NRAO, OOE is the lifeblood of the Observatory.

William E. Howard III


LETTER TO THE EDITOR

Once again we are reading words of wisdom and bits of news from the resurrected Observer. Hopefully, it won't be buried again. Let us all do our part with articles and letters to the editor.

We certainly want to be informed, and the inspiring article in the August issue, "From the Director's Office", is a movement in the right direction.

We all need to know what is expected of us and how we can prosper from things to come. Most of us at the Observatory take pride in our work and hope it adds to the improvement of operations.

When we each see our efforts and skills acknowledged and appreciated, our self-respect and cooperation with others will grow.


Omar Bowyer

(Thanks, Mr. Bowyer, for our first "letter". We hope others will follow. An invitation is hereby extended to all our readers to submit appropriate and proper articles and letters. —Editorial Staff.)

THE THREE-ELEMENT
INTERFEROMETER

D. E. Hogg

Interferometers, which are radio telescopes in which the collecting area has been divided into several separate parts, have long been used in radio astronomy for those observations requiring the highest angular resolution. For example, they have been used to measure the position of radio sources with great accuracy, and to determine if there are "hot spots", or regions of high radio emission, within radio sources. More recently, using the technique of synthesis devised by M. Ryle in England, interferometers have been able to make maps of radio sources which show in detail the regions from which the strong radio signals come. Such maps are a major first step in our understanding of radio sources. The three-element interferometer in Green Bank is now being used for synthesis, and has already produced maps for about twenty objects.

Ryle's technique is fairly easy to understand in a general way, although the actual system has required much work not only by the Interferometer Group and by the telescope operators, but also with the computer in Charlottesville. Imagine that we have two 85-foot telescopes that we want to use to get the same information about a radio source as we would get with a dish of diameter 2700 m (1.7 miles), corresponding to the largest available separation of 85-1 and 85-2. We can think of the 85-foot antennas as being equivalent to two surface panels of the large dish. Thus, when we make an observation of a radio source with the antennas at some separation (see the accompanying drawing on page 6) we get the same information about the source as we would from the two surface panels all having the same relative orientation and separation.

If we move 85-2 to another location, and make a second observation, then we get information about the source that would be equivalent to that given by another pair of surface panels (BB in the drawing). We would continue this process, moving 85-2 and making another measurement, until we had covered the entire area of the big dish. Then we would take all of the observations



of the source which have been saved up, and, using a Fourier transform, make a map of the source.

This procedure will work, but it takes many years to complete the observations for just one source. Happily, there is a much faster way of doing it. If we track a source for several hours, then a single pair of antennas occupies more than one pair of positions; they actually sweep out a long track, shown as the shaded regions in the drawing.

The increase in speed which the tracking gives makes the synthesis technique practical. With the Green Bank interferometer, using three telescopes, we can get enough data to make a picture of the source in just nine different antenna moves, assuming the source is tracked for the full twelve hours at each configuration.

The interferometer electronics was designed and built by the Interferometer Group, under the leadership of W. Tyler, A. Robichaud, and J. Coe. The signals which are received at each of the three antennas are brought by cable to the interferometer control building where they are multiplied together and processed through a first stage of reduction by the DDP-116 on-line computer. It is of critical importance to measure the relative times of arrival of the signals at each telescope. To do this, an accurate timing mark — the local oscillator signal — is sent by cable to the telescopes. The necessary accuracy is obtained by an ingenious phase-locking system designed by K. Wesseling.

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OLD FRIENDS - NEW FACES

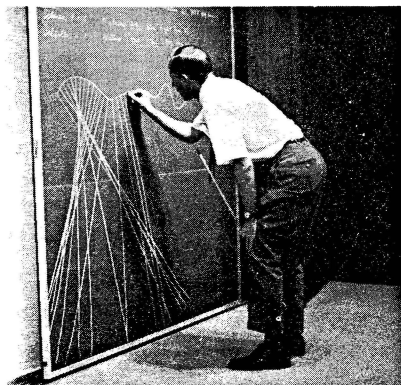
Frances Copper

The Users' Committee will meet in Charlottesville on November 6 and 7. Committee members who have indicated they will come to Charlottesville include:

B. F. Burke, MIT
W. A. Dent, U. Mass.
J. R. Dickel, U. Illinois
J. N. Douglas, U. Texas
W. C. Erickson Univ. of
F. Kerr) Maryland
E. B. Fomalont, CalTech
S. J. Goldstein, U. Va.
D. L. Jauncey, Cornell
H. C. Ko, Ohio State
A. E. Lilley, Harvard
C. H. Mayer, U.S. NRL
T. K. Menon, U. Hawaii
K. Riegel, UCLA
A. R. Thompson, Stanford
J. W. Warwick, U. Colo.
D. R. W. Williams, Berkeley.

Committee members who have not yet replied to our invitation include:

A. H. Barrett) MIT
S. H. Zisk)
C. Heiles, Berkeley
A. G. Smith, U. Fla.
G. Westerhout, U. Md.
P. Palmer, U. Chicago.



TRUSTEES' MEETING

The Trustees of Associated Universities, Inc. held their annual Green Bank meeting on October 16 and 17. A dinner for the trustees and their wives was held in the cafeteria on the evening of the 16th. The cafeteria staff, under the direction of Bill McLaughlin, did their usual excellent job in serving a fine meal. Only the physical size of the dining area restricted the number of diners who could attend — a problem not faced in the July 1968 picnic for the trustees. Special compliments are due the Garden Club for the strikingly attractive flower arrangements which they prepared for the lounge and cafeteria.

Trustees in attendance were:

Dr. Bart J. Bok (U. Arizona)
Dr. Richard H. Chamberlain (U. Penn.)
Dr. Carl C. Chambers (U. Penn.)
Dr. Joseph C. Elgin (Princeton U.)
Dr. Herbert Friedman (NRL)
Dr. Thomas Gold (Cornell)
Dr. Louis H. Hempelmann (U. Rochester)
Dr. Vernon W. Hughes (Yale U.)
Dr. Allyn W. Kimball (Johns Hopkins U.)
Dr. Franklin A. Long (Cornell)
Dr. Francis E. Low (MIT)
Dr. I. I. Rabi (Columbia U.)
Dr. William H. Sweet (Mass. Gen. Hosp.)
Mr. LaRoy B. Thompson (U. Rochester)
Dr. Milton G. White (Princeton U.)
Mr. L. Gard Wiggins (Harvard U.)

Officers in attendance:

Dr. Gerald F. Tape, President
Mr. Lewis R. Burchill, Controller
Mr. Charles F. Dunbar, Secretary

Others:

From BNL: Dr. Maurice Goldhaber,
Dr. Victor P. Bond, Dr. Rodney L. Cool, and
Dr. Leland J. Haworth. From NRAO: Dr. David Heeschen,
Dr. Morton Roberts, Dr. Hein Hvatum
Dr. John Findlay, Mr. T.R. Riffe and Dr. W. E. Howard.

Scientific presentations were given on Friday morning by:

Dr. C. M. Wade, Dr. D. E. Hogg, and
Dr. R. M. Hjellming.

TRAVELLING FEED SYSTEM

Troy Henderson and Ken Cottrell

The recent addition of a travelling feed system has moved the 300-foot a little further up the versatility scale. It could even be said that the 300-foot is now encroaching on the celestial territory of its more fully steerable neighbors, the 140-foot and the interferometer.

During the telescope's early days, the Naval Research Laboratory first applied the travelling feed idea to the 300-foot. Their feed assembly was constructed so that radio sources could be tracked in right ascension, thus increasing the possible observing time on any particular source. Incorporating this innovation, the 300-foot became more than just a meridian transit instrument. NRL's idea did not immediately show practical application; however, following the discovery of pulsars the idea gained convincing appeal.

In mid-1968 a visiting research group from one of the great Massachusetts universities made the proposal for a second travelling feed system. The specific application of this new system would be in pulsar research. A joint arrangement for design and construction was worked out between NRAO and the Massachusetts group, and actual fabrication began at the NRAO shops on November 1, 1968.

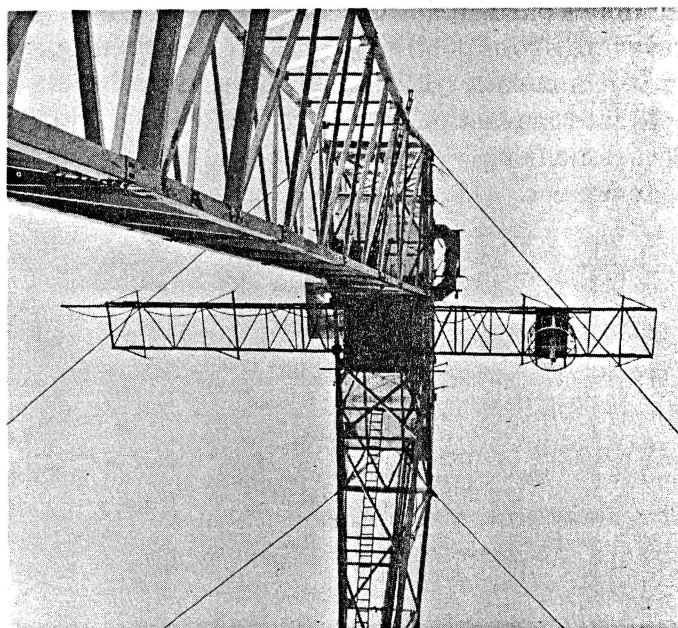
The feed assembly consists of a set of rails and a feed carriage which is driven along the rails at various rates. The rails are 51 feet long allowing for 46 feet of carriage travel between limits. The carriage is fastened on the rails by a stepping motor, gear assembly, sprocket gear and sprocket chain. The drive system is so arranged that one motor revolution equals about one inch of travel along the rails. The stepping motor is a pulse driven motor that will respond to pulses from 1 to 500 per second. Thus the rate of travel can be varied just by varying the number of pulses sent to the motor.

Operational control for the travelling feed is provided from the control console located in the control room. Scan mode is used for observational tracking and requires precise pulses to the

motor. The scan pulses are derived from a Beckmen counter on which the timing rate of the pulses is set by a six-digit thumbwheel selector. The counter has been modified to give pulses occurring from 100,000 times/second to one pulse each 1.99999 seconds. Slew mode is used to get to position as quickly as possible and is provided by a multivibrator that is variable from about 100 to 500 pulses/second.

A system to indicate carriage position utilizes a 0-50 variable voltage power supply, a digital voltmeter, and a 1000 ohm, 10 turn potentiometer. The potentiometer is coupled to the drive motor through a gear reducer. Electrically, the potentiometer is a voltage divider whose voltage is indicated on the digital voltmeter. The position indicating system can be calibrated to read either inches along the track or in minutes of time, a more convenient indication for observational purposes.

The completed travelling feed system was installed on the telescope for initial testing on June 27, 1969.



Travelling Feed During Pulsar Observations

Continued, next page --

An interesting and important point in the operation of the travelling feed is the difference between telescope beam on the sky and the rail position of the carriage. Whatever the carriage does on the rails is a mirror image of what the beam does on the sky. When the carriage is actually west, the beam on the sky is east; therefore, west is east and east is west.

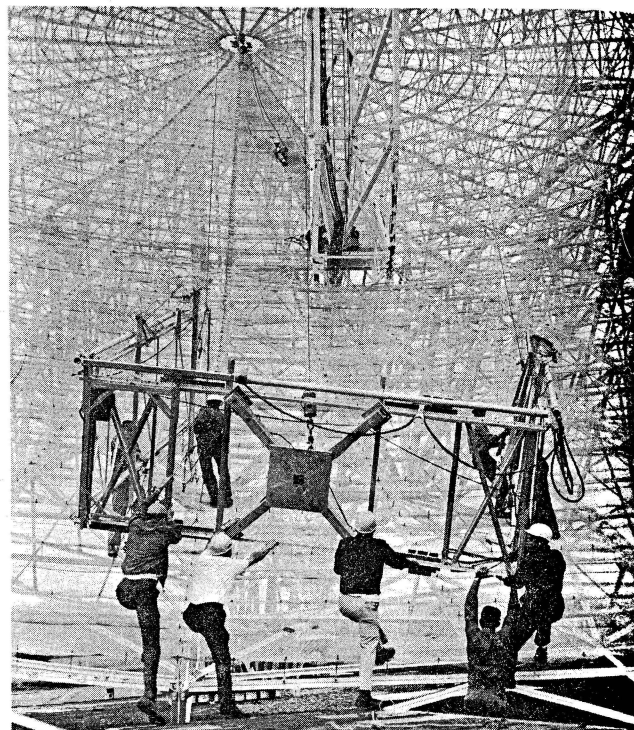
Three observational experiments have thus far been conducted with the new travelling feed system at various frequencies between 112 MHz and 377 MHz. Two of these experiments were run on pulsars and the third in molecular astronomy, involving the search for a new molecule called "Ketene". All indications are that the system is performing within expected accuracies. The travelling feed assembly was designed for observations at frequencies below 400 MHz. At these frequencies, it increases the on-source tracking time for the telescope from approximately 15 minutes (mean average) to a mean average of over two hours.

Space will not allow for a full and proper documentation of the contributions which each individual participant has made in this project. However, from preliminary design to final testing it has been a truly cooperative effort — a brilliant transaction of creative talent and skill in workmanship — a characteristic NRAO achievement. (See photo at right.)

CATASTROPHE! During a recent wind and electrical storm French Beverage was really a loser. Not only was the chimney at his home knocked down, but he lost the better part of his roof. The lightning knocked out receptacles and burned up appliances. His loss was covered partially by insurance.

Luckily, neither French nor family was hurt.

Miniskirts are now available in all thighses.



Installing the Travelling Feed Assembly after Modifications during August-September 1969

Beaty Sheets reports that two former NRAO scientific staff members visited Green Bank recently to do some observing on the telescopes — Dr. May Kassim and Dr. Hugh Johnson.

Dr. Kassim is presently with the State University at Albany in the department of Astronomy and Space Science. May says, "Teaching and research (with pleasant visits to Green Bank included) are balanced in not a very smooth fashion as yet."

Dr. Johnson is presently with Lockheed Missiles and Space Co., Palo Alto, California (since 1963). He continues, of course, in astronomy, especially the optical aspects of cosmic X-ray sources.

Those jet planes are opening up a whole new world for us. Breakfast in New York, lunch in San Francisco — and baggage in Hong Kong.

SAFETY PROGRAM AT NRAO

Tom Williams

Prior to September, 1967, relatively little emphasis has been put on a Safety Program. This consisted principally of a first-aid room, the formal reporting of accidents, and the availability of a set of "Telescope Safety Regulations" and "Instructions for the Safe Handling of Helium." At about that time two or three plans for a formal program were prepared and reviewed, culminating in the designation of a Safety Committee and the establishment of a formal program in June, 1968.

The following were designated as the Safety Committee: J. W. Findlay, S. Weinreb, J. F. Crews, T. Williams, O. Bowyer, and W. Oref. In October of 1968 a 10-page brochure titled "Safety at Green Bank" was issued, covering the organization, various responsibilities, and an initial group of "Rules for Safe Working," and incorporated the following introductory statement by Dr. Findlay:

"The need for safe working practices is already well-known throughout NRAO. It is a part of the duties of every employee to make sure that our work is as safe as possible..."

The Committee has since attempted to carry out the program under this outline and has heavily stressed the theme that frequent and repeated safety messages will secure the results desired—fewer and less severe accidents. Monthly meetings and site inspections have been established. Very favorable policies have been set up relative to equipment and tools, including personal equipment such as safety shoes and glasses. Poster displays, changed monthly, are distributed throughout the site. Literature is distributed monthly to supervisory level people and all employees receive a safety-oriented publication monthly in their pay envelopes. We have become

a member of the National Safety Council with its attendant benefits from publications and records, information, etc.

From January, 1967, through September, 1969, there have been 54 accidents reported. The most common infractions are (1) failure to wear hard hats or glasses under circumstances where they should be worn, (2) disregard for safety features on tools and equipment, and (3) failure to take a proper position when lifting an object of some weight. However, on the positive side, the greatest benefits have been the revelation and elimination of unsafe practices which heretofore have gone unnoticed or uncorrected, i. e., elimination of electrical hazards on tools and equipment, replacement of metal ladders by wooden ladders for servicing electrical equipment, provision of numerous fire extinguishers, etc.

The following persons presently serve on the Safety Committee: M. Roberts, F. Crews, O. Bowyer, J. Dolan, W. Oref and myself. Two others serve on the monthly inspection team — L. Webb and E. Gardner. At the time the following photograph was taken, Carl Wooddell was serving on the team.



OUR SAFETY COMMITTEE (l. to r. — Jim Dolan, Wally Oref, Tom Williams, Carl Wooddell, and Leroy Webb)

Continued, next page --

It is the goal of the program to emphasize that it will be successful only in proportion to the extent to which full employee cooperation is achieved. Safety suggestion boxes for all employee participation have been located throughout the site and an annual prize has been established for the best safety suggestion turned in.

Your participation is urged through safe practice observance, suggestions, and contacts with your Division Head, or directly with the Safety Committee, on any matter pertaining to safety.

* * * *

Miniskirted girls are handling the flag duties on many road construction projects in the Dakotas, Wyoming and British Columbia, according to word from the National Safety Council.

This came about because motorists just weren't paying sufficient attention to the regular flagmen.

The girls were outfitted with miniskirts, reflective hats and jackets, and sent out with their flags, and this was the end to the problem, the Council reports. The motorists not only paid extra attention to the girls, as expected, but heeded their signals.

* * * *

CONGRATULATIONS,
SAFETY COMMITTEE!

The Observer staff would like to congratulate the members of the Safety Committee. The number of accidents has decreased and we feel sure that this is due in part to the measures taken by the Committee.

We would also like to point out that only a couple of people have made suggestions. Turn in your safety suggestion and be eligible for the annual prize!

* * * *

FEDERAL TELECOMMUNICATIONS SYSTEM

Beverly Weatherholt

As of September 1, 1969, Green Bank is now equipped with five FTS lines connecting us directly with Charleston, West Virginia. These lines are to be used for OBSERVATORY OFFICIAL BUSINESS ONLY. All personal and after hours calls will still be placed through Lewisburg.

At first the lines did not function correctly and everyone was ready to go back to the old system. But with improvements made by the telephone company and more understanding on our part, the System seems to be working out alright.

FTS allows us to call Government agencies located in nearly 500 cities and communities that are connected directly to the network. Those that we are most familiar with are the National Science Foundation, BNL, MIT, University of Chicago and Goddard Space Flight Center.

NRAO-CV will eventually be on the network, but the lines have not been installed yet.

Although there is not an initial charge for each call made on FTS, it is not a free service. The charges we pay depend on the number of calls we make; as the number of calls increase, the charges increase.

* * * *

Shortly after one fellow had had a telephone installed, a neighbor dropped in and found him immersed in the business of filling out a form from a mail-order catalog. The telephone was ringing persistently, but its possessor took no heed whatever.

"Willy," the caller ventured, "ain't that your number?"

"Yeah, 'tis."

"Wal, aintcha goin' to answer it, for gossakes?"

"Zeb," said the other, looking up, "I'm busy and I had that durn thing installed for my convenience."

* * * *

FACTS FROM FISCAL*

"Timely Tip — Are You Up to Date on Your Withholding Exemptions?"

John Hawkins

Every payday the payroll section uses the information from your Withholding Exemption Certificate (W-4) to determine how much income tax to deduct from your pay. Therefore, it is important that this certificate be accurate and up to date at all times.

If the information on your present certificate is correct, let it stand. If, however, the information is not correct, get a new certificate, fill it out, and return it to the payroll section.

Usually, your exemptions change when you get married or divorced, when a dependent is born or dies, or when you begin or stop supporting a dependent.

Be careful to avoid claiming any exemption that the law does not allow. Any taxpayer who knowingly claims a false exemption is subject to prosecution.

If you expect to owe more income tax for the year than will be withheld, you may increase this withholding by reducing the number of exemptions claimed, or by authorizing the payroll section to withhold an additional amount each pay period. This is especially important if both you and your wife are employed, or have substantial non-wage income.

Forms W-4 and further information may be obtained from the Fiscal Division.

IS YOUR ADDRESS CORRECT ON OUR RECORDS? If not, please advise the payroll section of any correction required.

Congratulations, Harry Fox, on your first year of employment with NRAO on October 7!

* Information supplied and researched by the NRAO Fiscal Division.

300-FOOT TELESCOPE

Troy Henderson

During August and September the 300-foot received a partial face lifting. Most of the back-up structure and anything on the ground under the telescope received a coat of white paint. Rainy weather, paint supply, and scheduling prevented completion of the painting this Fall. Hopefully, the facial will be completed next year along with other beautification that is planned for the 300-foot.

Observing-wise, for this period the programs have for the most part used the 1400 MHz, 4-feed system. The 1400 MHz observations were an intense source survey, a search for H₂ in high-velocity regions, and mapping the Rossetta Nebula. Two periods of pulsar observations were conducted using the new travelling feed assembly with a 100-200 MHz cavity feed.

At the conclusion of the pulsar search on August 15, the travelling feed assembly was removed from the telescope and taken to Central Shops. Modifications were made to the cable hanging system and to the drive assembly by Dorman Williams, Basil Gum, Bedford Taylor, and others. A new barn door hanger was placed along the north side of the track. In addition to moving the cables from south to north side, the new hanger was made so that the entire cable assembly hangs vertical for all telescope positions. A larger sprocket chain and drive sprocket were added to the drive system. After a few test runs, the new and improved travelling feed system was re-installed on the telescope on September 18. No problems were encountered with the system during the second pulsar program or during the new molecule search program that used the travelling feed with a 375 MHz, 50-channel receiver system.

The difference between gossip and news is whether you hear it or tell it.

140-FOOT TELESCOPE

Bill Hunter

The "Crazy Season" is upon us here at the 140-ft and elsewhere in the Pocahontas County region. Crisp, cool October mornings once again bring out the primitive soul of man. There's a certain spring in his step and a gleam in the eye as he views the beautiful, gold and crimson hills surrounding him. Guns are oiled, cleaned, polished and checked. Ammunition is acquired by the gross for practice rounds to sharpen the old reflex. Scouting expeditions up "Turkey Hollow" and down "Squirrel Ridge" are frequent. Thousands of turkey feathers are daily swept from the office, kitchen and control room, and rumors are flying thick and fast of this flock and that flock, twenty-two in this bunch, fifty in that, and tracks by the thousands. If a guy doesn't get one this year, he's just plumb unlucky. Oh, well, there's always next year. Here's wishing thee and me the best of luck, and even if we don't get the elusive bird, I know we all will emerge with a little better disposition and a feeling of contentment.

Well, so much for dreaming — back to business. There are numerous areas at the 140-ft that constitute hazardous conditions due to the nature of the drives, braking and control circuitry. High pressure lines run through various routes and high voltages are present at many points. Sometimes oil leaks occur and footing may become slippery. Maintenance or repair work may be in progress. There are signs posted at these areas and it is mandatory they be obeyed. These signs are put there for your protection. We are proud of our instrument and do not discourage properly conducted tours. No one, not even our 140-ft personnel, should leave the first or second floor lobby without first obtaining consent from the operator on duty in the control room. Also, report to him when you are clear of the area. When going to or from deck, use elevator unless some authorized person familiar with dangerous areas accompanies you. These rules also apply to the service tower. The operator must be notified before anyone is permitted on the service

tower. We have experienced very few cases where these rules were not observed, but occasionally people do go wondering up and down the passageways, probably not aware of potential dangers. New people quite frequently are uninformed and don't know the procedure here; we hope this serves as a reminder to them as well as some of us not so new.

Just a word of commendation to those involved in our recent power outage at the 140-ft. At 0930 we were interrupted by the whine and boom of failing motors, dimming lights and chattering relays. Dave Williams arose three feet from the console chair, quickly flipped the Bat Handle (Emergency Stop) and precharge switch. Howard covered twenty stairs in three large strides and de-energized all breakers to the control circuits. The silence was eerie. The electricians were promptly on the scene and the trouble diagnosed as one of three 4160 volt feeders ruptured between the 140-ft and the substation. Mr. Williams, Mr. Elliott, and others from several divisions began to function smoothly and soon trucks, winches, generators, rope, people, new cables (excellent foresight that this item was available), and all necessary paraphernalia were on hand to do the job. Arrangements were made to supply the clock room and Residence Hall with emergency power. The main site power was cut off. During continuing downpour (it always rains during these occasions) the old cables were removed and new ones pulled in. Main site and 300-ft power was restored at about 2200 hours. Hot coffee was provided by Chester Cassell and John Matheny, a very welcome addition. The men were sent home at 2300 for a quick snooze and back on the job at 0600. The 140-ft was again humming by 1040 and all relaxed. At 1120 the 208 volt transformer belched forth smoke and flame and practically the whole scene re-enacted. Two emergency transformers were acquired from somewhere and jury rigged as a replacement. By removing countless light bulbs and equipment from the line to reduce the load, we are at present limping along in partial blackout. (Bring your own flashlight.)

The Telescope Operations Division wishes to thank all those assisting in restoring "The Queen" to service.

SIGHTING-IN DAY

The Green Bank Rifle and Pistol Club will hold a sighting-in day for all hunters of the area on November 1. The club range will be open from 11 a. m. to 4 p. m. Members of the club will be on hand all day to help hunters properly sight-in their rifles and pattern their shotguns.

The club is offering this opportunity as a public service to hunters in this area as part of a nation-wide program conducted by the National Rifle Association. Hundreds of NRA affiliated clubs throughout the country are taking part in this program.

A correctly sighted-in rifle and shotgun is an important step to safe and accurate shooting and increases the percentage of clean kills, says Jim Dolan, President of the Green Bank Rifle and Pistol Club. Familiarization firing and knowledge of the point of impact of the gun being used adds enjoyment and safety to the fine sport of hunting.

Detailed information on sighting-in techniques and firing points for zeroing in will be available at the range. Hunters are requested to have all firearms unloaded and actions open when entering the range area. Targets will be furnished.

* * * *

NRAORA

Beverly Weatherholt

New Rule — Persons between 18 and 21 years are allowed to attend adult activities if they are accompanied by one of their parents or legal guardian. That parent or guardian will then be responsible for that person and his or her date.

Magazines — It was suggested that the NRAORA subscribe to magazines and provide books for people staying in the Residence Hall. The Board feels that it is the Observatory's responsibility to provide reading material for guests at the Residence Hall.

Continued --

Blinders — Jim Dolan suggested that the NRAORA buy a canvas to stretch between the swimming pool and tennis courts. The Board feels that a canvas would be too expensive and suggests that J. D. buy himself a pair of blinders so "activities" at the pool will not interfere with his tennis playing.

Golf Course — The golf course is ready for use now and three sets (two right-handed and one left-handed) have been purchased for use. The same rules apply to the golf course and clubs as do to other recreation facilities and equipment. The clubs will be stored in the little building at the pool where the ice maker is and the key may be obtained from the Guard.

Halloween Dance — November 1 has been set for the annual Halloween Dance. Spooks and goblins will gather "in costume" in the basement of the Lab and dance to the music of "Bucky Clark and the Bad Habits," a local group. Prizes will be given for the Best Couple, the Best Dressed, and the Ugliest.

Christmas — Plans are now underway for the usual Christmas activities. Be sure to return to Bev the sheet containing the names and ages of your children so all can share in the activities.

* * * *

XEROX USERS, PLEASE NOTE

When removing staples from paper, throw them in the waste paper basket and do not leave them on the Xerox machine. If they are left on the machine, they often drop down on the drum and scar it. The drum has to be replaced (and they are expensive).

* * * *

Coming upon a football which had been left in the barnyard, the old rooster promptly called the hens around him. "Now, ladies," he said diplomatically, "I don't want to appear ungrateful, or raise any unnecessary fuss, but I do want you to see what's being done in other yards."

INTERFEROMETER NEWS NOTES

Jon Spargo

No doubt many have heard about the 42-ft telescope and its many trials and tribulations, so you can imagine the amazement of all concerned when the 42-ft in its debut as a remote control telescope turned in a nearly flawless performance. It all came about as a result of the installation of digital encoders with readouts in the control center here in Green Bank. For a week operators, your reporter included, ran the 42-ft (located about 22 miles away in Huntersville) from here in Green Bank. After a couple of minor problems with the readouts and the microwave link, things settled down to something of a routine. We even managed some useful observations. Many sighs of relief were heard by those who used to have to make the long trip south to Huntersville.

Still another item of interest. Did you know electricity was heavy? Well, it is! If you don't believe it, come to the control center. There you will see our main power transformer resting on a newly poured concrete platform. The old one cracked and was giving away. Why? Speculation is that because of the heavy load on electrical lines and the transformer; the old pad just couldn't hack the program any longer. One side benefit is that many of us have learned what all those breaker panels hanging on basement walls are for. Anyone for unregulated power?

From our "quote of the month" department comes this definition by Ambrose Bierce — "TELESCOPE: A device having a relation to the eye similar to that of the telephone to the ear, enabling distant objects to plague us with a multitude of needless details. Luckily it is unprovided with a bell summoning us to the sacrifice." Our feeling is that Mr. Bierce should have lived long enough to contemplate the Interferometer and the DDP-116.

That's about all for now. See you next scan.

* * * *

It is said that a woman never loses an argument. The worst she can do is fail to make her position clear.

* * * *

ELECTRONICS — GB

Ray Hallman

People are very busy in GB Electronics. In fact, it's hard for a contributor to get these busy people to stop long enough to talk about themselves.

In the Back-End Lab, work is in progress on the new autocorrelator, model III. Lewis Beale, Carl Wooddell, and Steve Mayor of "back-end" suggest that it be mentioned that the first re-issue of the Observer was very good. Accordingly, the first issue was very good.

Action continues swiftly in the Bill Vrable Laboratory. The distance measuring instrument designed by John Payne is nearing completion and it is impressive in appearance. Bill was very happy around World Series time after finding himself twenty-five dollars richer. He says that if it's in the Jansky Lab, he will find it.

The Interferometer Group is expanding the interferometer since Jesse Davis has left to return to school. A newly constructed paramp control unit is on the bench undergoing final test.

On the Digital scene, the 50-channel synchronous scanning system is ready for Kitt Peak. The system is capable of recording the gathered data on computer compatible magnetic tape and paper. The paper printout allows on-the-spot checkout of the system.

A new 13 cm receiver system is being built in the Front-End Lab. It is portable and requires only three external connections, namely, the oscillator, intermediate frequency output, and single power supply. Work is progressing on the radar portion of the distance measuring instrument and is nearing completion.

George Behrens of the Front-End Lab Annex reports that a new 6 cm front-end box is going up on the 140-ft telescope. The paramp is cooled to a low, low -423 °F. The noise temperature is only 60°, allowing for very quiet and sensitive operation in the 5 GHz range.

That's it for Electronics-Jansky Lab. Here's wishing you a most enjoyable holiday season.

* * * *

PLANT MAINTENANCE

Helen Carpenter

This issue Plant Maintenance Division will feature its Automotive Shop consisting of Gail Geiger, Cliff Barkley, Odell Johnston, and Paul Devlin, supervisor. It is the job of this group to service and maintain approximately 50 licensed vehicles and 40 other units such as generators, mowers, etc. To decrease interference for the telescopes, the maintenance and site vehicles are being converted to diesel. The Auto Shop has removed gasoline engines from approximately 20 vehicles during the last 18 months and replaced each with a diesel engine; this, in addition to the regular service and repair work, has kept our gang "on the ball". It still allows Odell time to do a little turkey hunting, "truck style"; right, Odell? *



(l. to r.): Paul Devlin, Clifford Barkley, Odell Johnston, and Gail Geiger.

Plans are underway to move the Shinaberry House and the Nut Bin from their present location to Observatory property between the church and high school.

We extend a welcome to Merle Kerr who has joined our division as a truck driver, having transferred from Central Shops.

Roy Pennington and Bill Lovelace, guards, attended a First Aid School in Morgantown on September 23 and 24 at the University Hospital.

We have another fire truck being readied "for the road". (See photo.)

We welcome Pat Hall back to work after his recent illness. Presently on our sick list is Jesse Tacy at the Greenbrier Valley Hospital in Ronceverte.

* * * *

CENTRAL MACHINE SHOPS

Sheet Metal Shop

Dorman Williams

We are glad to hear that the travelling feed is working fine!

If you saw a thing that looked like the moon module satelliting around the shop, it was only a stool for George Behrens. He is using it to service front-end boxes on the 140-ft. How did it work, George?

We have been making a lot of parts for the Interferometer Group. At the present time we are finishing up the third front-end box for them.

No news from George and his 36-footer even though we are building three front-end boxes for the 36-ft. (No news is good news!)

Winston Cottrell has left NRAO. We wish him the best of luck. Boyd Wright will be transferred into the Sheet Metal Shop. Welcome back, "Coonie"!

* * * *

The average male completely dominates his woman. That's until he's about six months old.

* * * *

Would you believe? — Odell was testing one of the vans on a dirt road when a couple of turkeys whooshed in on him. Some people have all the luck.

A TALE OF THE SEA

C. M. Wade

Shortly after noon on Friday, September 26, the sleek sailing vessel Eris was blown out of Deltaville, Virginia on a voyage of exploration. The purpose of the journey was to discover how gin tastes at as many Chesapeake Bay anchorages as possible. Captail Heeschen was in command, ably assisted by two first mates, Von Hoerner and Wade. The crew consisted of an undetermined number of gremlins.

Since the success of any voyage of this nature depends on thorough training, Eris spent most of Friday afternoon in intensive practice in riding at anchor. The drill went satisfactorily.

Shortly before sunset, we got under way, sailing down the Bay by moonlight. Most of the night was spent in dodging big ships that seemed to come from nowhere, although we had a pretty clear idea of where they should go. By breakfast time, we had made good nearly 40 miles, arriving at the Chesapeake Bay Bridge-Tunnel. From here, Eris headed out of the Bay into the open Atlantic. It was slow going until early afternoon because of a weak wind and an unfavorable tide. Then the wind picked up, and we rounded Chesapeake Light, 12 miles offshore, at 5:30 p. m. on Saturday.

Having seen for ourselves that there is water in the ocean, we headed back to the Bay, arriving at the Bridge-Tunnel by 9:45 p. m. The night was spent sailing back up the Bay. We were off Tangier Island at dawn, and at noon Sunday, Eris tied up at a marina in Crisfield, Maryland (on the Eastern Shore). This completed the first leg of the trip. We covered about 130 nautical miles in about 40 hours of unrelenting seamanship.

The rest of Sunday, and all of Monday, was spent in recuperating from the rigors of the voyage. We sailed from Crisfield on Tuesday morning, the 30th of September. After crossing Chesapeake Bay, we sailed up into the Potomac River and anchored about sunset in a very pretty inlet near Wynne, Maryland. Here we carefully wrung out the last bottle of gin and shifted to wine.

Wednesday was devoted to exploring various picturesque inlets along the Potomac. Eris anchored for the night in the Coan River, near

Lewisetta, Virginia. We used up the last of the wine; and now the only alcohol left on board was in the stove, and we knew that our survival depended on getting back to Deltaville the next day.

Eris got under way early Thursday morning with 40 miles to go to get back to Deltaville. Up to this point the weather had been fine, but now it turned sour. We had to beat into strong headwind with frequent heavy rain, all the way. Soaking wet we arrived at Deltaville about 1:00 a. m. Friday. Thus ended another classic voyage.

* * * *

LIBRARY

May Daw

Those of us who heard Professor Fred Hoyle when he gave the Fourth Annual Jansky Lecture recently may be interested in reading a few of his books. The CV library has six of them, including the ever-popular science fiction story The Black Cloud. Anyone who has not read it will have hard time imagining the series of events which gives radio astronomers control of the world! The other titles we have on hand are Frontiers of Astronomy (1955), The Nature of the Universe (1960), Astronomy (1962), Of Men and Galaxies (1964), and Galaxies, Nuclei, and Quasars (1965). Professor Hoyle is Plumian Professor of Astronomy and Director of the Institute of Theoretical Astronomy, Cambridge, England.

A long line is forming in Green Bank, composed of people waiting to read the GB library's copy of The Peter Principle (which I mentioned in this column last time). They will continue to wait until whoever took the book home without checking it out realizes the situation. . . .

Both libraries have received a set of 12 color photos of the Apollo mission and lunar landing. The NASA pictures highlight the flight from blast off to lunar footsteps. Many individuals have asked me about ordering personal sets, so I thought I would mention here that they are called "NASA Picture Set No. 4" and are sold by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Order must be paid in advance, at \$1.75 for each set.

* * * *

WEDDING BELLS

Carpenter-Gordon

The Dunmore Methodist Church was the setting for the wedding of Jane Carpenter and Ronald Gordon which took place October 25th.

Jane is secretary to Wally Oref and Ronald is a new employee in the Central Machine Shops.

Their honeymoon was spent at the Pocono's in Pennsylvania and touring Maryland and Virginia.

As part of the prenuptial activities, Jane was honored by a miscellaneous shower given by some of her friends at the Observatory. Seventy-five guests attended and really showered her with lovely and useful gifts.

Mullenax-Carter

Plans are in the making for the December 6 wedding of Janice Mullenax to Richard Carter of Norristown, Pennsylvania. Janice is employed in the Scientific Services Division and Richard is a block operator for the Penn Central Railroad in Philadelphia.

Janice plans to terminate employment at the Observatory and she and Richard will establish their new residence in Norristown.

BEST WISHES,
Jane and Ronald — Janice and Richard!

THANK YOU

My sincere thanks to all NRAO employees for their expressions of sympathy and assistance during my recent bereavement.

John W. Hawkins

JOHN PAYNE IN RUSSIA

As you know, John Payne is now in Russia with the VLB group. If you would like to know what he thinks about the Russian way of life, read the following excerpts from his letter to Mike and Rosemary Balister.

"...Matveyenko met me at the airport. There were surprisingly few formalities. They didn't even open my case and it seemed to be the same for everybody. He took me to my hotel which, although it has a few peculiarities, is not so different from an American one. I have my own room with bath and shower and although the plumbing is a bit crude and the toilet paper more like sandpaper, it's really not bad at all. The problem is that to eat you just have to speak Russian. The restaurant is cafeteria style but you have to pay before you get the food, so, of course, you have to tell the woman what you want in advance. This is very difficult.

"About Moscow, I really am very surprised. I had visions of a dreary city with huge women digging the roads and everyone looking dead miserable—it just isn't like that at all. It certainly is the cleanest city I've ever been in; all the people are very well dressed—lots of miniskirts—and they are obviously pretty well off. The stores have a really wide range of goods and although some things seem expensive the main prices are quite a bit lower than in the States. I have been into a couple of restaurants and they were like something out of another age. Very large rooms, complete with gold leaf and chandeliers. They always seem to have a band with dancing. The food is just fabulous—for about \$2 you get a magnificent meal with wine. I have got to know a few people and have found out the salaries for various jobs and when you figure out the prices of things, the standard of living comes out to be quite high. The Metro is better than the London tube I think although it is not so big. The standard fare is 5 cents and you can go as far as you like. Once again it is spotlessly clean. There are cars everywhere and although they seem o.k. mechanically the styling is late 1940's by American standards. Hardly anyone owns a car; most of them are taxis which are very cheap. There are a

LETTERS TO THE PUBLIC EDUCATION OFFICE

FIRE EXTINGUISHERS FOR SALE

(How would you like to answer the following letter received by Wally Oref?)

"Greenbank Radio Telescope Greenbank, W. Va.

"Dear Sirs:

"A few days ago I read an article in Science World Magazine on radio telescopes-dish type. I got to thinking-if two little Italian boys can make a radio telescope, I can too. I know It's pretty big project, but if you can send me some information on how to go about building one on a smaller scale-for instance an 8-foot dish with a diagram of the radio equipment needed-I can convert an old tranceiver into equipment I need. There is a large strip job not far away-with a steamshovel on it which is no good-with permission I could get parts from it. If you could send me some information on how I could use old car parts to rotate, raise or lower a radio dish-it would be more convenient if I could move and adjust it-by using steering wheels. I am only 12, but I'll do it. A high school graduate and another boy my age are going to help, so it may work out. I've got enough to build- all I need is information."

"Sincerely, _____."

("They said it couldn't be done, but he with a grin replied...")

"Mr. Smith," said the science professor, "would you care to tell the class what happens when a body is immersed in water?"

"Sure," said Mr. Smith. "The telephone rings."

Through the suggestion of the Safety Committee the NRAO fire department will make available to all employees AT WHOLESALE COST fire extinguishers for home and car use.

The CO2's are recommended for home use. Prices are f.o.b. Green Bank.

- 5 lb. CO2 (List \$42) \$30.00
20 or more 28.00
5 lb. Dry Chemical 1A Rating ABC Fires 18.20
20 or more 17.00
5 lb. Regular (List \$24) \$16.80
20 or more 15.00
2 3/4 lb. Regular (List \$14)
1 to 12 \$ 8.50
13 to 24 8.25
25 to 50 8.00
2 1/4 lb. 1A Rating ABC Fires (List \$16)
Based on a gross \$ 7.75

If you are interested in purchasing any of these, contact Paul Devlin, GB ext. 284.

By the way, it's "cash on the barrel head" at time of order placement.

FREE ADVERTISEMENT
We again invite you to place your advertisements in The Observer. Also, we will accept announcements from local, civic groups. Next due date is December 12, 1969.

STRANGE HOBBIES OF NRAO PEOPLE

"Unsafe at Any Speed"

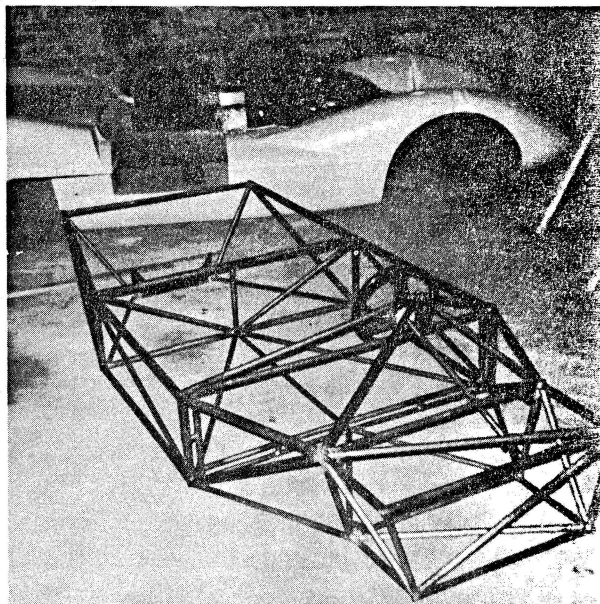
Shelton Reid and Neil Albaugh have combined forces to build a machine that is 34 inches high, 60 inches wide, weighs 940 pounds, and will be powered by 200 horses.

A '66 Corvair engine supplies the go power through a late model VW transaxle. The chassis is of thin-wall, mild steel, round tubing, mostly 16 and 18 gauge. A body of glass fiber, built by John Sabel of Rockville, Maryland covers the 75 pound space-frame chassis.

When questioned as to who built the chassis, they gave a smug smile and replied, "We did. It took a while to learn to weld this thin-wall tubing well enough. We wasted a lot of time trying to arc weld it, but finally gave up and used gas welding." "If we ever build another chassis, it will be of square tubing instead of round," they added.

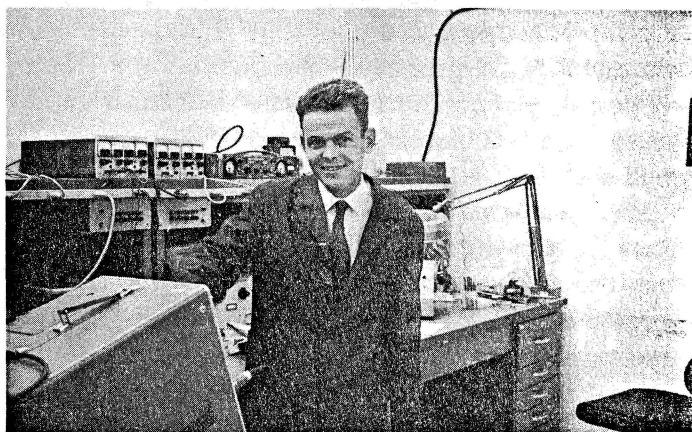
The two most frequent questions asked are: When will it be finished? and What are you going to do with it? To these questions they replied as follows: "We hope to have the thing running by late next summer, but it probably won't ever be actually 'finished'. We may use it to go through SCCA drivers' school; and if we're lucky, run it in competition if the rule change we're hoping for takes place. Under present rules, it would run in A Sports/Racing — a tough class, competing against 427 Chevies and Fords. If the rule change doesn't occur, we'll try to license it for the street, but even that is doubtful since DMV takes a dim view of cars with plexiglass windscreens, headlights 18" off the ground, no padded dash, windshield wipers, etc. It seems that it would be considered 'unsafe' even though it will accelerate, corner, and brake at about 1.2 G. If you said: How can you exceed 1 G?, go stand in the cloak-room. To tell the truth, we really don't know what we will do with it. But then there is always the salt flats at Bonneville. If we could squeeze about 220 BHP out of this Corvair engine, we should be able to do about 160 MPH with proper gearing. Maybe, 170."

The sound you just heard was Ralph Nader going into the cardiac arrest!



WELCOME, JORG PFLEIDERER

Jorg Pfleiderer is on leave from Bonn University (Institute for Astrophysics and Space Research). He spent the last academic year at J.I.L.A., Boulder, Colorado reducing ultraviolet observations of the Milky Way. During his one-year stay at NRAO he intends to survey elliptical galaxies for radio emission.



36-FOOT TELESCOPE

George Grove

The fiasco of the month of September was the attempted observation of the solar eclipse on THURSDAY, the eleventh. The summer rain had tapered off to a hang-over of clouds; the power line seemed to have been cured; our encoder parts had come through from Wayne-George; and we had our mag tape problems investigated by Bill McAdams of 3C.

We spend SUNDAY and MONDAY of that week trying to dazzle our visiting astronomers with some fast footwork on servo-system problems, dome door-roller failures, and checkout of our two receivers on the bench. TUESDAY and WEDNESDAY we managed a few mapping scans of the sun at 9 mm and checked out the 3 mm on the telescope WEDNESDAY, PM. THURSDAY morning the receiver was as dead as a cold pizza, so Don and Bill went through a fast box drill to put the 9 mm on, tightening the last screws as the eclipse started. We fired up the receiver and, almost immediately, it became ill — the mixer currents and total power gyrating around furiously, while the visiting astronomers Buhl, Zirin, Simon, and Tlamicha calmly discussed whether to go ahead or not and the operators wolfed down the last of the Excedrin. It was decided that we march on, so we floundered through the rest of the eclipse with nothing more than a few computer regurgitations to brighten this scene. After the eclipse, we regrouped and tried both receivers out on the bench; and, of course, they both worked beautifully. Don went into a telescope cable checkout routine and found two of the high-priced connectors on our telescope jumper cables had imbibed about a cup of water each. This brought back memories of the good old days at Green Bank when we used to mummify each connector with many layers of black Scotch tape.

The eclipse crowd was followed by two University of Maryland people, Kundu and Liu, who also worked on the sun at 9 mm and 3 mm, until the end of September when Hobbs, Caulk and Maran took over.

Dewey Ross came through Tucson late in September, looking over the local job situation. Johann Schraml left at this same time on his way back to Germany. Ned Conklin came in October to be our NRAO Resident Scientist. Jerry Middleton also has moved out to be Resident Programmer and, as of this writing, is suffering through the house-buying procedures.

The water vapor project was dried up in September, and all three of the machines were sent out to carry on at other installations.

G²

John Payne in Russia (continued from page 19) --

surprising number of American cars driving around. I don't know where from but its probably the Embassy.

"It's really quite funny. They have provided us with a car and driver to take us wherever we want to go. They keep giving us theatre tickets, etc... There are lots of theatres and cinemas. Something that surprised me was that they show American movies. Oh, yes, the smaller cafes have music all the time—mostly 'The Beatles'! Seems like the John Birch Society is a bit out of date!

"I'm glad Bill (Vrable) packed tools and things. They are very slow and incompetent at doing things. Just taking nails and screws out of a packing case seems to be a major engineering feat. It's probably because, as kids, they don't fool around with cars and motor bikes and their education seems to be very academic. Everyone knows about the moon landing. It was on TV and we have been making life-long friends by distributing pictures of the landing as these don't seem to be generally available."

Terminations: A. J. Burford, W. Cottrell, R. D. Davies, Mary Davis, M. Felli, G. F. Macdonald, R. E. Powell, A. Rahim, R. S. Rubin, J. Schraml and R. P. Swann.

EUROPE ON \$5.00 A DAY

or

"How to Survive on the Continent Without
a Weekly Check from NRAO"

Susan Brown

After a wonderful summer in Europe, I naturally arrived back at work last month enthused and excited about the prospects of once again ruthlessly releasing tapes, typing memos, etc. However, I found out upon arriving that one of my first duties was to write an account of my trip for the newly resurrected Observer. At first I felt something like a third grader on the first day of school writing an essay on "How I Spent My Summer". Then I decided that it would be far more beneficial to list a few helpful hints to other \$5.00 a day NRAO travelers (that is the present per diem, isn't it?) who are making plans to go to Europe in the near future.

First of all, for those of you who aren't familiar with Arthur Frommer's book, Europe on \$5.00 a Day, it is the Bible of the American budgeteer on the continent. And for those who really want to save money, you can even save the \$2.50 that the book costs by simply going to Europe and following everyone else around who has the book tucked under his arm — they're everywhere!

Modes of Transportation — There are, of course, many different ways of getting around in Europe -- hitch-hiking, rented cars, bicycles, airplanes, etc. We're convinced, however, that the most economical way is a wonderful invention known as the Eurailpass which you buy in the States before you leave. This pass entitles you to two months of unlimited first class travel by train anywhere on the continent. It wasn't, however, quite as comprehensive as we had been informed by a local travel agency (I wouldn't want to be so pointed as to mention any names) who told us in no uncertain terms that our Eurailpasses would cover all cross-channel travel. When we told the British Rail Agent what we had been told "back home", he suggested in his proper King's English that perhaps our travel

agency should send someone over sometime to see what things were like on that side of the ocean.

Although we traveled by train most of the way through Holland, Germany, Denmark, Switzerland, Austria, Italy, and France, we also had the dubious pleasure of car travel with friends in England, Germany, Austria, and Italy. There's really no way to explain the European attitude toward "life on the Autobahn" until you've seen it in action. In Germany we were cruising along in our friend's new Mercedes at close to 90 m.p.h., and we were still getting passed by motorcycles!! And then in Austria we spent a week with the family with whom I had lived as an exchange student a few years ago who live in a beautiful little village surrounded by winding country roads. But then put my Austrian father, a very kind and gentle man who loves the peace and quiet of rural life, behind the wheel of his 3 year old Volkswagen on those beautiful little roads, and the result is truly unbelievable! This mild-mannered man becomes a maniac, racing around every curve at top speed while you hang on for dear life! Then in Italy our friends told us, "If you're going to have a wreck, you're going to have one regardless!" as we squeezed ourselves into a Fiat about the size of our largest suitcase and began five terror-packed hours of passing and being passed on the Autostrade with horns blaring and people shouting their displeasure at those few who had chosen not to enter into the excitement of this nerve-shattering national past-time. But in spite of all of this, we still weren't fully prepared for being pedestrians in Rome. In the beautiful Eternal City, which we truly loved, it's every man for himself when it comes to crossing the street. The basic idea is one enormous city-wide game of "chicken", and the natives have it down pat. They simply stroll out into six lanes of on-coming traffic and walk across as cars come to a screeching halt when they see that they mean business. We didn't really mind bluffing the Fiats (it was a toss-up as to who would have been hurt the most had the Fiat not stopped), but we did have some problems about the city buses. But after 8 weeks we

Continued, next page --

arrived back in Charlottesville unscathed, so I suppose it's all just a matter of what you're used to.

Luggage — No matter how little you decide to take, it'll still seem like too much by the time you've lugged it around with you for eight weeks on the continent. I'm sure we set an all-time low record for the total number of taxis in which we rode while in Europe — 4 in eight weeks! The rest of the time we made the sidewalks softer all the way from Copenhagen to Rome, from London to Vienna and feel deeply indebted to two sturdy pairs of Hushpuppies for seeing us through. I did find that carrying luggage was great practice for lifting tapes. They're just not as heavy as they were last May.

Places to Stay — By all means, stay with friends! We found that this cuts your living expenses down to about 15 cents per day and is much more enjoyable than staying in the local "Budget Inn". We had a grand visit with Robert and Gillian Wild in the beautiful Cotswold area of England but were sorry that we missed seeing little Michael David who arrived on the scene about a month after our visit. Gillian sent her best wishes to everyone at NRAO and was anxious to hear all of the latest Observatory news. So be kind to everyone — you might be in their country some day! This is not to say that the budget hotels and guesthouses are not without their own particular charm. We really think that someone should write a detailed book about these quaint places (I use the term loosely) entitled "Elevators I Have Known and Loved" or something like that since the one feature about almost all of these places which most impressed us was the unique sorts of elevators which we found in them. At one Pension in Geneva on the fourth floor of a bank building, the elevator had room enough for an absolute maximum of two people, and that was only if I balanced my pocketbook on my head or on George's shoulder. At another place in Nice, the elevator was an enormous, carpeted affair with padded seats and mirrors on all sides which took about 10 minutes to drift down from the fifth floor. But the interesting thing about this one, which had ample room for 10 people, was that it had a big sign on it which started: "No More

Than Three Persons Allowed on This Elevator At One Time!" — it makes you wonder!

Yes, it was a great trip and we'd do it all over again in a minute, but the next time it'll have to be "Europe on Five Diapers a Day"! (You never can tell what you might be bringing home with you!)

Our advice to all is do go! If we can do it, you can do it, believe me! Any if you'd like a sneak preview of all the beautiful, exciting, and interesting things that you just might see, Brown's Travel Advice, Inc., has a fantastic 3-hour travelogue in words and pictures planned with you in mind which can be arranged any evening at 818-A Cabell Avenue on amazingly short notice. And, of course, impromptu discussions are available at any time by simply dialing extension 258 in Charlottesville. So start saving your vacation days and your money — it's an experience you'll never forget!



Author Susan Brown
Computer Division Secretary

Two matronly ladies to travel agent: "We'd like to get completely away from civilization, near some nice shopping district."

<p>CONTENTIONS OF A 360 COMPUTER</p>
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What did I do to deserve a fate so horrible it almost defies description? The fact of the matter is I never had a chance. I am the manipulated, cursed at, overworked, underpaid, scapegoat tool of a bunch of half-crazed taskmasters. A hundred and sixty-eight hours a week these people do the most awful things to me. If I just up and die someday, stuffed to the registers with some ker's bad data, I would be a bit surprised.

Let me tell you about how these mad men systematically set about torturing me. First there's a group of sadists called users who think of insane things for me to do. They are divided into two groups: the casual users and the full-time users. The full-time users are the worst; they specialize in different types of torture. The newest of these are Elaine Litman and Shirley ang. Elaine specializes in making me draw. erry Middleton used to do that, but he went to Tucson to torture one of my cousins.) Shirley programs (invents horrors) for Dr. Stumpff (. 50).

Another specialized group of users are the systems programmers. As you can gather from their title, their job is to figure out how to let the most people get their jollies in the least time.

Fortunately, there are only two of them:

Braun (the master) and David Ehnebuske (the apprentice).

The other major group of people I have to deal with directly (there are hundreds of others who openly aid and abet these inhuman practices) are called operators. These operators' real job is to continually prod and poke me into action to make sure I never rest a moment.

For an example of how this organization works to persecute me, consider this: A while back Eddie Powell, who had done his share of the torture from 00:00 hours to 08:00 for a long time, decided not to do it any more. Wow! I thought, a rest every day for 8 hours! But no, ng came not one to replace Eddie, but four new task masters: Ann Jackson, Betsy Chen, l Beyers, and George Wren. Ann Jackson has

taken over for Eddie and the others beat me only part of the time. After that, No. 50 decided Wade Davis was so good at making me do other people's thing that now Wade is Chief Computer Operator (Head Task Master and Torture Artist).

Now, I ask you, is this fair? People as far away as Green Bank, West Virginia know what goes on here but nobody goes any thing. Won't you please help stop this heartless treatment? Remember, "Only you can content tortured wires!"

The 360
(Debugged by
David Ehnebuske)

<p>ELECTRONICS — CV</p>

Jack Cochran

Digital Lab — full of changes: Bob Swann has left the Observatory; Bernie Pasternak is now the new digital technician under Art Shalloway. Also, working on the drawing board, is a student from UVA, Steve Manzo. In spite of personnel changes a 23 K contract for getting printed circuit cards made for the new correlator has been let.

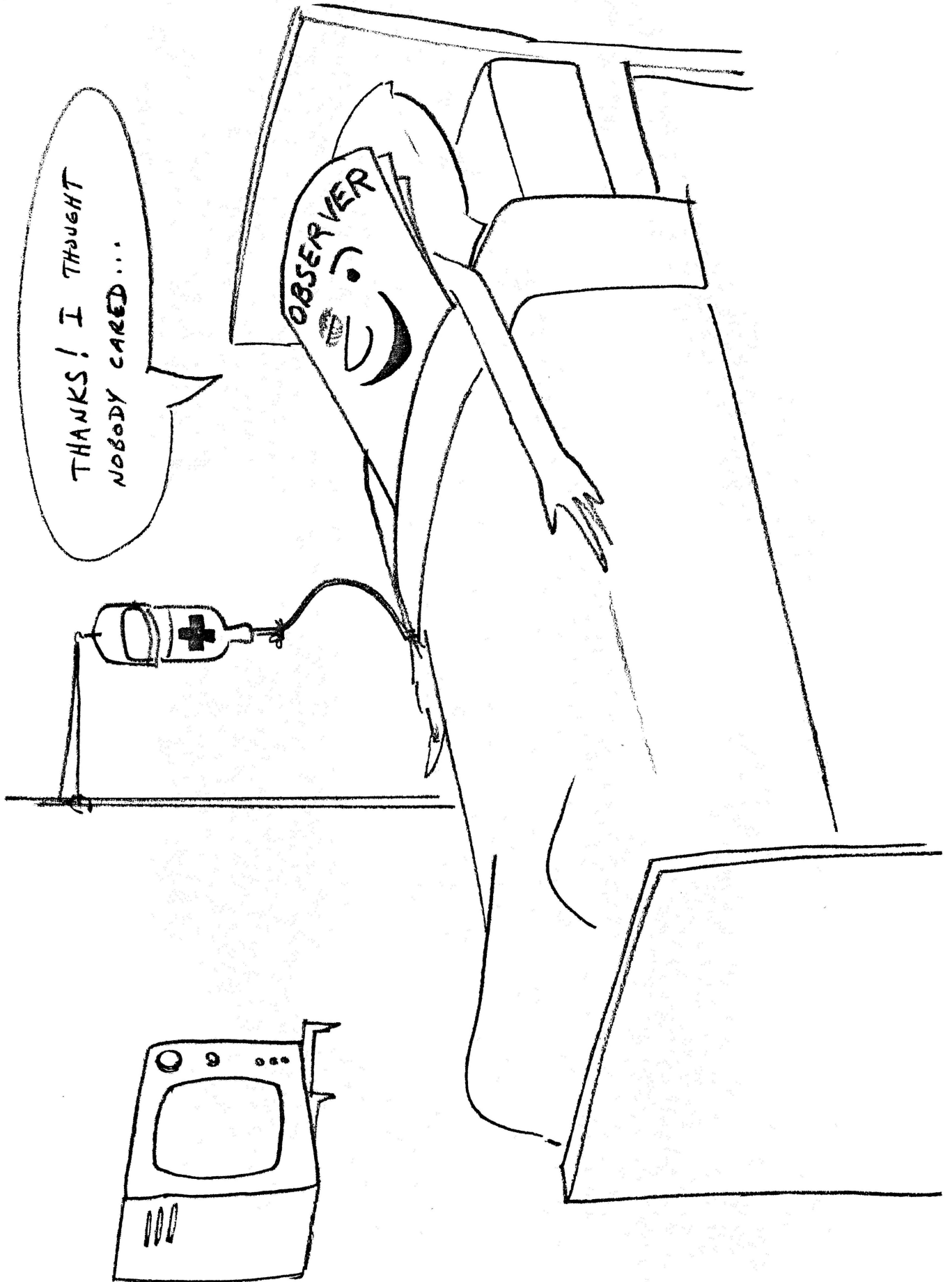
Low Noise Devices Lab — The 48 GHz par-amp to be built in this lab has now been assigned a project number. Three paramp systems are now in development — dual 1400 MHz (coolable), 22 to 24 GHz, and the 48 GHz.

Millimeter Lab — Neil and Bob are preparing the 9 mm receiver for installation on the telescope at Tucson at the end of the month.

Joe Burford has left the Observatory and formed his own company — A. J. Associates.

Dear Editor: Should a father of fifty get married again?

Dear Reader: No, that is enough children for any man.



A. U. I. RETIREMENT PLAN

ABOUT THE PLAN BENEFIT ILLUSTRATIONS

BACKGROUND. The AUI Retirement Plan is carried with Teachers Insurance and Annuity Association (TIAA) and College Retirement Equities Fund (CREF). TIAA was established in 1918 and chartered in the State of New York as a nonprofit life insurance and annuity company to provide insurance and retirement annuities for employees of educational and other nonprofit institutions.

CREF, which is a companion to TIAA, is a separate, nonprofit corporation established in 1952 to provide retirement benefits based on common stock investments. Today, over 250,000 persons, employed by more than 2,000 different institutions, participate in the TIAA-CREF Retirement Program.

Associated Universities, Incorporated adopted the TIAA Retirement Program for its employees in 1948. Four years later CREF was established and made available to all employees holding TIAA contracts.

PARTICIPATION. You begin to participate in the plan after three months of full time employment and attainment of age 30.

CONTRIBUTIONS. Your contributions and those made by the Laboratory are determined as a percentage of salary, and are sent to TIAA-CREF each month to be applied to your individually owned annuity contracts.

SALARY	YOU CONTRIBUTE	LABORATORY CONTRIBUTES	TOTAL CONTRIBUTIONS
On first \$7800 of salary	2½%	10%	12½%
On salary over \$7800	7½%	10%	17½%

IMMEDIATE FULL VESTING OF BENEFITS. You own all retirement benefits as you earn them. If you leave Brookhaven before retirement, you take your annuity with you, including all benefits purchased by Laboratory contributions. If you join another of the 2,000 institutions having TIAA-CREF retirement plans, contributions to your annuities will be made under the rates established by that institution. Otherwise, you may make payments to the annuities on your own, or you may leave them on the paid-up basis until you decide to begin receiving your annuity income. In order to keep the benefits intact for their intended purpose—a lifetime income—the annuities do not provide for loans or cash surrender (but see REPURCHASE, next).

REPURCHASE. Employees who terminate within five years from the date their TIAA-CREF annuities are issued may have their contracts "repurchased" if they are not transferring to another institution having a TIAA-CREF plan. Upon repurchase, TIAA-CREF pays to the employee a single amount equal to the portion of the accumulation arising from his own contributions, and the Laboratory recovers its proportion of the accumulation.

CREF PARTICIPATION. You may elect to have the total contributions applied to your TIAA annuity, or to have from 25% to 75% of the total contributions paid to CREF, which provides a variable annuity based

on common stock investments. During retirement the dollar amount of the CREF annuity income changes from year to year to reflect the market value and dividend income of the Fund's investments. The accompanying TIAA annuity provides a fixed income, except as increased by dividends.

The purpose of the balanced TIAA-CREF system is to provide a retirement income that can be more responsive to changes in the cost of living than a fixed-dollar annuity alone and less volatile than a common stock annuity alone.

DEATH BENEFIT PRIOR TO RETIREMENT. If you die before retirement, the full TIAA-CREF accumulation, including all Laboratory contributions and all investment earnings, is payable to your beneficiary. Your beneficiary may take either a lump sum settlement or elect any of several income options available from TIAA-CREF.

ANNUITY STARTING DATE. The normal retirement age at the Laboratory is 65. However, you may begin drawing your TIAA-CREF annuity income at any age if you leave the Laboratory before age 65.

DEATH BENEFIT AFTER RETIREMENT. Upon the death of an annuitant after he retires, the amount continued to his beneficiary depends on the income option chosen at the time he retired. All of the retirement income options but one, the Single Life Annuity, provide for continuation of an income to a beneficiary.

OPTIONS ON RETIREMENT. Just prior to your retirement date you will be asked to select one of the following seven annuity income options:

1. Single Life Annuity: Pays you (only) an income as long as you live. It provides a larger monthly income than the other options, since all payments cease with your death.
2. Ten Years Certain and Life: Pays a specified income as long as you live, with payments guaranteed to continue for the first ten years whether you live or die.
3. Twenty Years Certain and Life: Same as the preceding except that payments are guaranteed for twenty years instead of ten.
4. Full Benefit to Survivor: Pays you a lifetime income. However, if your wife lives longer than you, she continues to receive the same income for the rest of her life.
5. Half Benefit to Second Annuitant: A specified income continues as long as you live. If your wife survives you she receives one-half of this income for life.
6. Two-thirds Benefit to Survivor with Ten Year Guarantee: Pays a specified income so long as both husband and wife live. Upon the death of either spouse the payments are reduced by one-third and continue to the survivor for life.

NOTE: ON OPTIONS 4, 5, AND 6, PAYMENTS ARE GUARANTEED FOR TEN YEARS, EVEN IF BOTH HUSBAND AND WIFE DIE.

7. Installment Refund: Available in TIAA but not in CREF, this option pays you an income as long as you live. If you die before receiving total payments equal to the full accumulation you had before payments began, the income continues to your beneficiary until the sum of all payments equals that amount.

BASIS FOR ILLUSTRATION. The benefit illustrations in Tables I and II are based on the assumption that participation in the retirement plan starts at four different ages and retirement takes place at age 65. The following hypothetical salary progressions were used: Salary Scale A, \$6,000 to \$12,000; Salary Scale B, \$9,000 to \$18,000; and Salary Scale C, \$12,000 to \$30,000. These scales assume that the average salaries shown increase at the compound rate of about 2% to 2½% per year. In reality, many salaries of twenty year Laboratory employees have increased by a multiple of these factors.

ATTAINED AGE	SALARY SCALE A AVERAGE SALARY	SALARY SCALE B AVERAGE SALARY	SALARY SCALE C AVERAGE SALARY
30-34	\$ 6,250	\$ 9,400	\$12,700
35-39	7,000	10,400	14,550
40-44	7,650	11,450	16,700
45-49	8,400	12,650	19,100
50-54	9,300	14,000	21,800
55-59	10,250	15,400	25,000
60-64	11,500	17,000	28,600

Table I shows illustrative retirement incomes for a person entering the Laboratory plan at the ages shown and retiring at age 65. The assumptions used are shown at the bottom of the table.

IF ENTRY AGE IS	YEARLY SINGLE LIFE INCOME AT AGE 65 (MALE)			% FINAL AVERAGE SALARY
	TIAA INCOME	SOCIAL SECURITY PRIMARY AMOUNT	TOTAL INCOME	
SALARY SCALE A (\$6,000 TO \$12,000)				
30	\$8,541	\$2,000	\$10,541	90
35	6,842	2,000	8,842	75
40	5,354	2,000	7,354	63
50	2,877	2,000	4,877	42

SALARY SCALE B (\$9,000 TO \$18,000)				
30	\$14,067	\$2,000	\$16,067	91
35	11,348	2,000	13,348	76
40	8,898	2,000	10,898	62
50	4,725	2,000	6,725	38

SALARY SCALE C (\$12,000 TO \$30,000)				
30	\$22,485	\$2,000	\$24,485	81
35	18,507	2,000	20,507	68
40	14,797	2,000	16,797	56
50	8,159	2,000	10,159	34

ASSUMPTIONS.

1. That all contributions are made to TIAA rather than to TIAA and CREF. In effect, this assumes that CREF experience will parallel that of TIAA.
2. TIAA rate basis: current Minimum Rates plus dividends on the 1969 TIAA dividend scale (total 4¾%). TIAA dividends may be increased or decreased in the future and are therefore not guaranteed.
3. Single life benefits are shown for TIAA. If, for example, the Joint and ½ to Survivor option were chosen by a man and wife both aged 65, the TIAA incomes would be about 12% less than those shown.
4. The Social Security benefit for the employee only is shown. If he has a dependent wife who is also age 65, there would be an additional Social Security benefit of approximately \$1,000 or a total of \$3,000.

Other illustrative figures based on different salary and age assumptions may be calculated from the table at the back of the booklet "For your future security - Associated Universities, Inc., Retirement Income Plan."

Table II shows illustrative death benefits for a person entering the Laboratory plan at age 30. The assumptions used for Table I have also been used for this table.

IF DEATH OCCURS AT END OF	DEATH BENEFIT (SALARY SCALE A)	DEATH BENEFIT (SALARY SCALE B)	DEATH BENEFIT (SALARY SCALE C)
10 years	\$10,027	\$ 16,261	\$ 24,180
20 years	28,336	46,737	71,669
30 years	61,125	100,829	159,048
35 years	85,714	141,167	225,636

YEARS TO RECOVER THE ACCUMULATION: TIAA uses annuitant mortality tables as the principal basis for determining the amount of retirement income you will receive each year. These tables are based on experience showing that the average life expectancy of a male who reaches age 65 is slightly over 16 years. For a woman who reaches 65 it is approximately 21 years. This is the length of time TIAA expects to pay an income to each retiring individual. Of course, should you live longer you go right on receiving your annuity income because payments are guaranteed for life.

Simple arithmetic shows, however, that under the Single Life Annuity, the original accumulation is paid back in about 10 years. For example, the employee in Salary Scale A winds up with an accumulation (Death Benefit, Table II) of \$85,714 after 35 years participation. His Single Life Annuity income (age 30, Table I) is \$8,541 per year or about 1% of the accumulation.

The employee's share of the original accumulation is recovered in less than 5 years - At current contribution rates, an employee's contributions can account for a maximum of 43% of the total accumulation at 65. Thus the employee is assured of receiving his portion of the accumulation in the first 4.3 years of retirement - before reaching age 70.