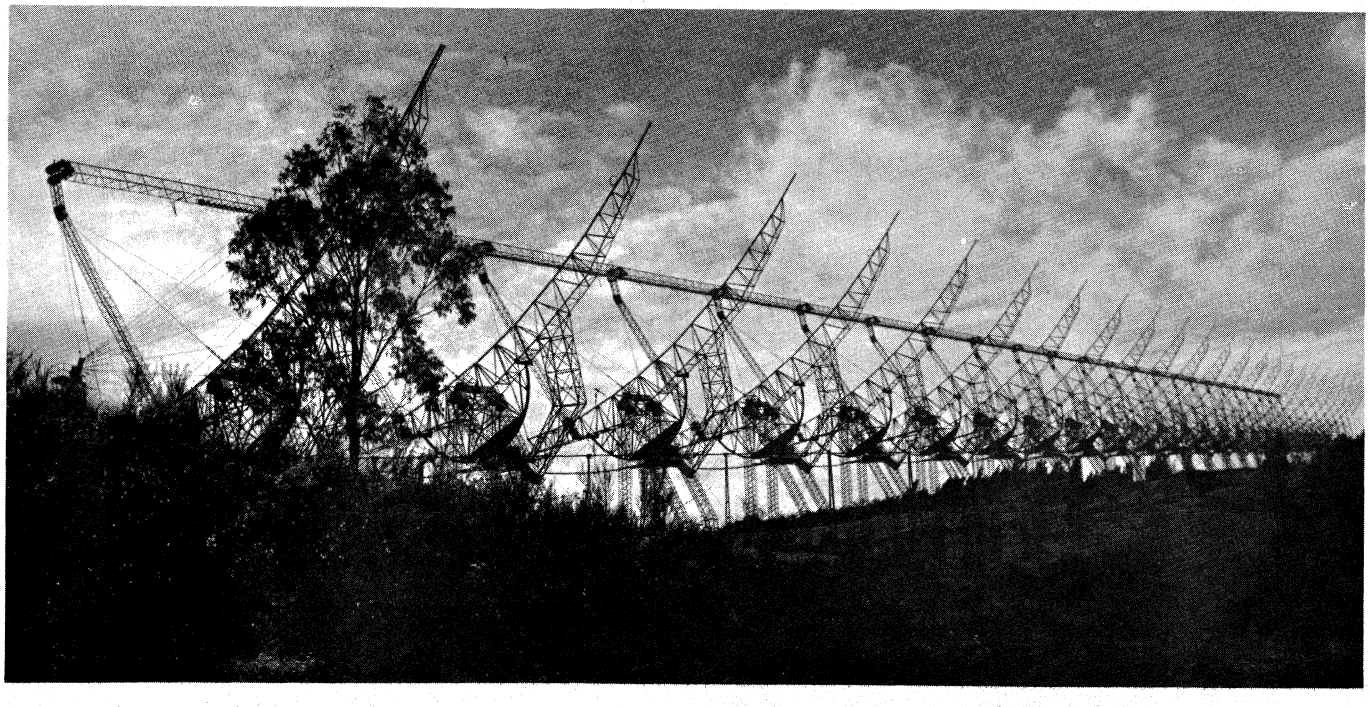
THE OBSERVER

OCT.'75



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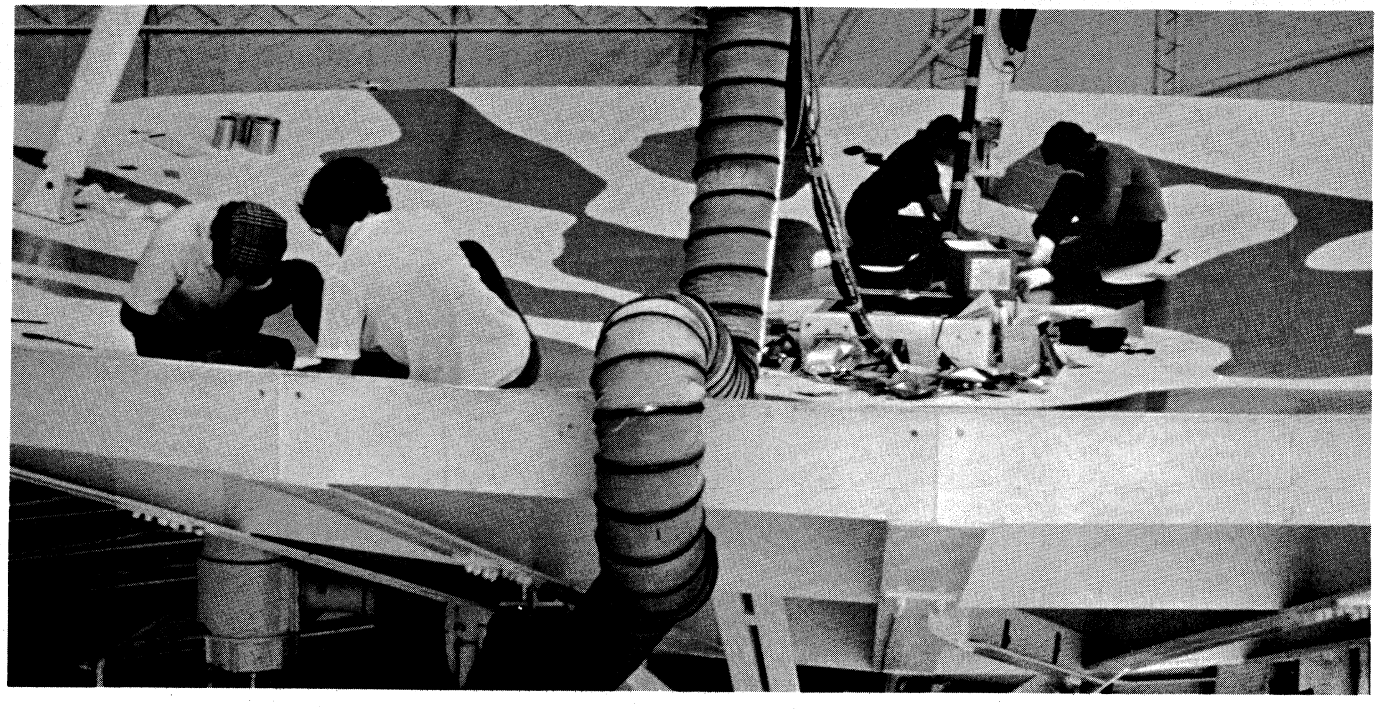

FOILING The 36 Ft., Page 6

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The Observer is a bimonthly publication of the National Radio Astronomy Observatory, P. O. Box 2, Green Bank, W. Va. 24944.

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A special thanks to the people who contributed articles and who helped with the assembly and distribution of The Observer.

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NOTE: One of the persons whose efforts helped make The Observer a success. Bev Workman - Assistant Editor and chief typist, resigned from NRAO at the end of August. Bev, we appreciated your efforts in behalf of The Observer and we wish you the best of luck.

RADIO ASTRONOMY IN INDIA

T. K. Menon

The major research installation in radio astronomy in India is located near the town of Ootacamund (Ooty) at an altitude of 2154 m in the picturesque Nilgri Hills of South India. It is called the Radio Astronomy Centre of the Tata Institute of Fundamental Research. The Institute has its headquarters at Bombay about 1300 km north of Ooty. The research interests of the members of the Institute cover most of the major areas of physics including cosmic rays, X-ray and infrared astronomy using balloons, radio astronomy and theoretical astrophysics. It has a total staff of nearly 2,000 including about 100 graduate students. The radio astronomy group has a research staff of sixteen including ten graduate students. The total supporting staff is about sixty.

The orgin of the radio astronomy group at the Tata Institute may be traced back to a meeting of a number of expatriate Indian radio astronomers in a smoke-filled dormitory room at Berkeley during the 1961 I.A.U. meeting there. It occurred to several of us at the meeting that, if all of the group could join together in one place, it could be a very strong group. It was clear early in the discussions that, in order to be scientifically competitive and financially realistic, such a project in India would have to exploit the low frequency part of the spectrum. Hence a tentative proposal was submitted in September 1961 to a number of organizations in India with little serious hope of any action. Hence we were very pleasantly surprised to get an immediate response from Prof. Homi Bhabha, a theoretical physicist who was the Director of the Tata Institute and also the chairman of the Atomic Energy Commission of India. At a meeting I had with him in Washington in November 1961, he agreed to our proposal in detail. Since in his organization his approval was equivalent to Government approval, it was only a matter of time before the group was officially launched.

The first person who returned to India was Govind Swarup from Stanford in 1963, followed soon after by M. N. Joshi who had worked with the Meudon group, N. V. G. Sarma who had worked at Leiden in the early days of the Benelux Cross, and a number of graduate students. The quality of the graduate students is very high since only about 10 out of 800 first class post-M.S. applicants per year are taken for the whole Institute. The selection procedure is very elaborate including three days of tests and interviews with about 150 applicants by junior and senior faculty members. M. R. Kundu, from Cornell joined the group in 1965. As in initial program to gain experience in working under Indian conditions and also to train the graduate students, it was decided to utilize the 36 six-foot dishes which had been part of the original Christianson Cross in Australia and had been gifted to India some years earlier. These dishes had been lying unopened in their original crates in the basement of one of the national laboratories in New Delhi. A 600 MHz array was set up in a suburb of Bombay, using the dishes for solar observations.

From the very beginning the construction of a large aperture low frequency instrument had been under discussion. After extensive discussions within the group and with astronomers all over the world, the concept of a low frequency equatorially mounted cylindrical paraboloid was accepted as the best means of utilizing the low geographic latitudes possible in India and also to exploit the technique of lunar occultations which had come into prominence at that time.

The final design chosen was a parabolic cylinder 529 m long and 30 m wide. The axis of rotation of the cylinder has been made parallel to that of the Earth by locating the cylinder in the north-south direction along a hill the slope of which is about 11° and is equal to the local latitude. Thus a radio source can be tracked in hour angle for 9½ hours per day by continuous mechanical rotation of the reflector. The beam is steered electrically in declination from $+36^{\circ}$ to -36° using phase shifters and delay parabolic frames each 30 m wide supported on 12 to 18 m high towers. The reflecting surface is formed by 1,100 stainless steel wires, each of 0.38 mm diameter. An overall r.m.s. surface accuracy of about 10 mm has been maintained. Old timers at NRAO may recall that a similar antenna system was under discussion at NRAO in 1960-61 for observations of flare stars and was

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to have been erected along a slope behind the Hannah House. The construction of the Ooty Telescope began in mid 1966 and the first observations were made in February 1970.

The frequency of operation at present is 326.5 MHz and it is proposed to add another frequency for operation at about 110 MHz. As is to be expected, the feed is a dipole array consisting of 968 half wave dipoles placed collinearly at spacings of 0.57 λ within a 90^{o} corner reflector. The dipoles are grouped into 22 modules of 44 dipoles each. One of the unusual features of the feed and receiver system is that the signals from the 22 modules are appropriately amplified and combined together to form 12 simultaneous beams separated by 3 sec δ minutes of arc in declination. Each beam can be individually slipped north or south by 36 sec δ minutes of arc. This arrangement makes it possible to cover the moon continuously without having to track continuously in declination also. Each of the 12 beams can be operated simultaneously, in the total power system by adding, and in a "phase-switched" system (multiplying type) by correlating the output of the 11 north modules with that of 11 south modules. The right ascension beamwidth is 2^{o}.

The telescope has an effective area of about 8700 m^2 and for a time constant of 1 s and band width of 4 MHz the minimum detectable signal for a signal to noise ratio of 5:1 is about 0.35 Jansky. Because of the broad beam the confusion limit is about 1.5 Jy. However, with the above parameters, occultation of a 0.25 Jy source can be easily recognized on the output of the chart recorder. The outputs of the 12 receivers are recorded on magnetic tape as well as chart recorders. A Varian 620-i computer is used for some on-line processing of the data. Except for the computer and a few mechanical parts the whole antenna and electronic system were designed and built indigenously with Swarup, Sarma and Joshi sharing the major responsibilities. The whole project would have been impossible but for the personal interest and influence of Prof. Bhabha and the unusual administrative system set up by him at the Tata Institute. The total cost of the original project was a little less than a million dollars.

The main research programs have been lunar occultation studies of weak sources, interplantary scintillation of sources, pulsars, flare stars, etc. So far about 600 occultations have been observed and it has been found that in general the position of sources can be determined with an accuracy of about 1 arc sec in both coordinates and resolution of 0.2 to a few secs of arc can be obtained depending on the signal to noise ratio. The structures of about 200 sources have been published so far and the rest are in various stages of analysis.

A comparison of the maximum angular extent of the weak occultation sources with similar data for the 3CR sources has led to the conclusion that, statistically, the weaker sources are more distant than the 3CR sample. This suggests that as we look at weaker sources down to about 0.3 Jy at 327 MHz we are not seeing any new class of nearby weak sources but mainly more distant strong sources. The implications of this result for determination of the radio luminosity function have been discussed by Kapahi in a recent paper. Extensive optical identification work has been carried out by Joshi for over 400 sources and a lot of optical work on suggested identifications needs to be done to confirm the identifications.

The large collecting area and full tracking ability of the telescope make it an ideal instrument for the study of pulsars. The recent acquisition of an atomic clock has made it possible to study the variations in period of a large number of pulsars as well as undertake a major search program for new pulsars. As a first step in the further expansion of the instrumentation capabilities, the big cylinder is being used as one leg of a synthesis interferometer system linking it with two 15 m dishes at a distance of 3 km. The system uses a microwave link for both the local oscillator and data transmission from the 15 m dishes. The above system is expected to have a sensitivity of about 0.02 Jy and a fringe spacing of 5' x 50". Observations of clusters of galaxies and several individual galaxies are under way at the present time. It is hoped to extend this system by distributing a larger number of small dishes over a wider area and connecting them by radio links to form a synthesis array with resolution of a few seconds of arc at 327 MHz.

In addition to the facilities at Ooty, there are small solar radio astronomy

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groups at the Indian Institute of Astrophysics at Bangalore and Physical Research Laboratory at Ahmedabad. The Radio Astronomy Centre at Ooty is officially a national facility and hence is available for visiting scientists from India and abroad.

* * * *

BUT WHERE IS IT? -- PART II

Sarah Martin

In the last issue of The Observer, you were given a brief guide to interpreting notes on catalog cards so you'd know at a glance if a particular title was supposed to be available in a particular branch of the NRAO library. Now we tackle the real sticky wicket: i. e., how to locate a book that is supposed to be in the library but isn't.

For example, say you are in the Charlottesville library and upon checking the card catalog, you see that book X is supposed to be in Charlottesville. You rush with frothing anticipation to the shelf, only to discover it isn't there. First possibility: the book is misshelved (bookworms sneak into the libraries at night and rearrange books just to irritate nice librarians); so check adjacent and surrounding shelves. Still not there? Second possibility: some other enterprising individual has borrowed it. Go to check-out file on top of card catalog and verify. Possibility 2a: sure enough, it's been signed out to enterprising individual, Sam Scientist. So you go barreling off to Sam's office; rummage through and "borrow" book from him. This brings us to possibility 2b: Sam Scientist checked it out alright, but he then lent it to Raymond Radar, who in turn gave it to his summer student, who has since returned to the University of Tanzania--with the book in his hot little hand. At this point, your favorite librarian can try to contact said student and retrieve volume, but by then it'll probably be too late for you. Point--if you borrow a book from a colleague, let the library know.

Okay, suppose possibilities one and two don't pan out? We're now reduced to pure guess-work; the volume has simply disappeared. But everyone knows volumes don't simply disappear. Some bright person has decided he just needs the book for a short time--too much trouble to check it out just run to the xerox machine. Of course, as often happens with bright persons, on the way to the xerox, bright person A runs into bright person B and in the ensuing bright conversation, book is forgotten. We can sometimes track down such missing volumes by the processes of simple logic and elimination--certain people are drawn to certain books and a midnight office raid can often turn up a wandering title or two. However, these processes work only on very specific titles - a volume of ApJ may take years to track down. Point - it's for your benefit that you're asked to sign out books before removing them from the library. If you consider this too much of a hassle, suggestions for alternative methods of keeping up with title locations are gratefully accepted at any time at your nearest NRAO library. Meanwhile, SIGN IT OUT!!!!!

* * * *

OBSERVATORY EMERGENCY ORGANIZATION AT GREEN BANK

Medic Alert

Bill Brundage

A conversation between two men came to an end when one of them was stung by a bee. Thinking little of the sting, the two men parted. A few minutes later one saw the stung man collapse on the other side of the street. Immediately he recalled that the collapsed man once had a severe reaction to a bee sting - an allergic reaction. Running over, he found him trembling weakly and struggling for breath. He and a neighbor lifted him into a car and rushed him to the nearest doctor's office. While giving artificial respiration, the doctor was told of the bee sting and past allergic reaction. After prolonged resuscitation and injections of medication, the man was revived and stabilized sufficiently for an ambulance to take him to a hospital.

That man narrowly missed death. What

(continued--next page)

if no one witnessed the bee sting? What if his allergy were unknown to those trying to help him? What if his extreme reaction, called anaphylactic shock, were not diagnosed in time? He was a lucky man - not just unlucky for being stung because that could happen again.

That man and any person with any "hidden medical problem" might save his life someday if he had some means of alerting anyone giving emergency medical care. Tragic or even fatal mistakes can be made in emergency medical treatment unless the problem is known. A diabetic could be neglected and die because he seemed intoxicated. A shot of penicillin, or other antibiotic or tetnus serum could kill one who is allergic to it. Persons dependent on medications must continue to receive them at all times. Even a person wearing contact lenses could suffer eye damage or even blindness if the lenses were left in the eyes for too long during unconsciousness. If a victim cannot speak for himself due to unconsciousness, shock, delerium, loss of speech or whatever, how can he alert those trying to help him?

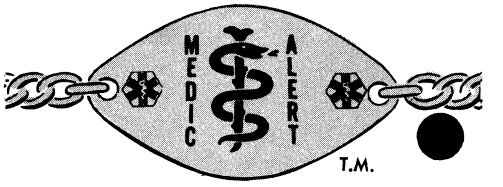
Fortunately, an internationally recognized emergency identification emblem warning medical personnel of the problem does exist. It is called MEDIC ALERT. The MEDIC ALERT emblem is worn on the wrist or neck. On the front is the easily recognized symbol of the medical profession, the Caduceus (serpent entwined staff), along with the words "Medic Alert" and the American Medical Association's six-sided emergency medical symbol. On the back is engraved the wearer's medical problem (s), his membership number and the telephone number of Medic Alert's Central Registry, where complete vital emergency information on members is available 24 hours a day via collect call. Additional emergency information is printed on the plastic wallet card which each member carries. Instructions for organ donation in case of death may be included if desired.

MEDIC ALERT Foundation is a charitable, nonprofit organization. Its services are maintained by a one-time only membership fee of $7 to $12 and by voluntary contributions. For further information and application form, write to:

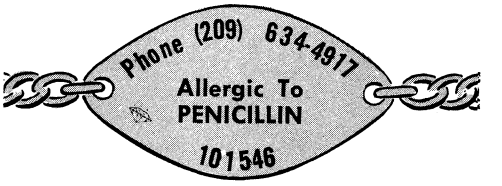
Medic Alert Foundation
P. O. Box 1009
Turlock, CA 95380

Also, the author has some additional information and forms.

EMBLEMS SHOWN IN ACTUAL SIZE



STANDARD BRACELET



EXAMPLE OF REVERSE SIDE
OF MEDIC ALERT EMBLEM

NECKLACE
With 26" Chain

Medic Alert Emblem

In addition, Green Bank employees having medical problems may wish to make them known to the NRAO Ambulance Squad. Doing so could result in faster and better emergency medical care if the need occurs. It just might save a life someday. All information will be kept confidential. Contact George Patton, Ambulance Squad Chief.

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STRANGE HAPPENINGS AT KITT PEAK

Bill Schonecht

A visitor to the 36-foot radio antenna at Kitt Peak in mid-August would have been surprised to see, instead of starry-eyed astronomers searching the heavens for extra-terrestrial radio emanations, a group

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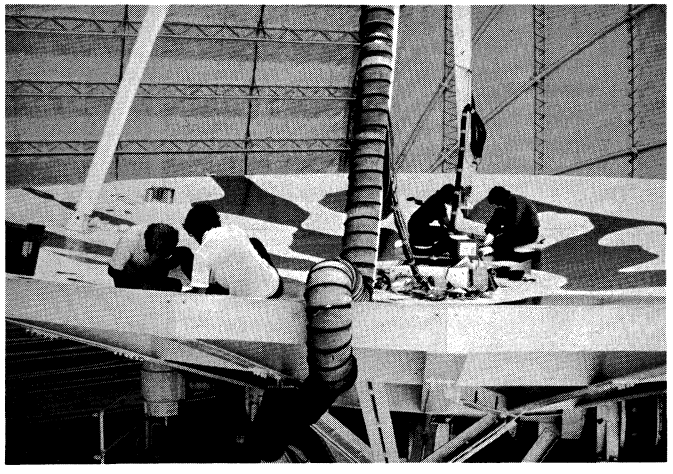
of people looking suspiciously like linoleum layers and working like a small army of ants inside the upright dish of the antenna itself.

But wait, one of those "linoleum layers,"



Foil layers at work.

wearing a wooly cap and muttering about the coatimundi stew served at the cafeteria, is that ubiquitous English engineer, John Payne and the "linoleum" being affixed to the surface of the dish is far too shiny to be linoleum - it looks more like aluminum foil. A hurried inquiry shouted to the mysterious band in the dish brings an explanation.

It seems that the dish although designed to be a precise geometrical shape, is alas not quite perfect. It has small bumps and wiggles on its surface left by the vagaries of the milling machine that produced it. It even has one giant wiggle, that remaining evidence of a monumental impact sustained in the not too distant past. These bumps and wiggles scatter the radio waves that the astronomers are trying to detect and thereby make the antenna less efficient that it would be if the dish were perfect in its configuration.

So the group in the dish is indeed cutting out various shaped pieces of adhesive-backed aluminum foil and pasting them onto previously determined and carefully marked out areas of the dish. Low spots are filled in and the dish is "built-up" to the smooth geometric shape it is supposed to have.

The story goes on that all this is the result of a long investigation of the efficiency of the antenna and the geometric characteristics of the dish. Long hours were spent by project overseer John Payne and his trusty cohorts, Mike Hollis, Bill Schoknecht, Mike Hersmann, and Neil Albaugh, and innumerable others, in measuring the ups and downs of the dish surface with a small "trolley car" instrumented with a special height sensing device and then calculating with a computer just where this meant the foil should be applied.

Just as Rome wasn't built in a day, the foil laying scheme was not an immediate triumph. The first effort produced a change in the efficiency of the antenna of about the anticipated size, but in the wrong direction - down. Foil was stripped off the dish and one could hear muffled intonations of "Curses, foiled again!" But after much additional data taking, computer calculating, and several abortive measures such as also removing the paint from the dish, new foil was applied and the viability of the method was finally confirmed.

Laying a piece of foil

Evidently the biggest obstacle to success is in determining the location of the bumps and wiggles with sufficient accuracy. The first crude attempt, which can now be judged with the benefit of hindsight, was based on undersampled data. (The data was satisfactory; there just wasn't enough of it.) Many of the variations in the surface are too small in their lateral dimensions to be charted accurately unless the spacing of the data is made small also. With the additional data that was taken during August, maps of the surface could be drawn

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that were just accurate enough to permit some improvement of the antenna by laying the new foil.

John Payne estimates that this improvement amounts to about a 15% gain, although the exact figure is difficult to determine due to masking by temperature related effects. Everyone at the Tucson operations is excited by the results and hopes to lay another new, and even more improved layer of foil sometime in the future after surface measurements are carried out at an even higher sampling density.

* * * *

HOW FAR IS IT TO CHARLOTTESVILLE (or to Green Bank If you Live on the Other End)

Dave Shaffer

Several years ago, before the era of the "energy crisis", there was informal competition to make the quickest trip between Green Bank and Charlottesville. Various records were claimed, legal and illegal. See past issues of The Observer for details. Now that energy conservation is in vogue, I propose a new competition that is always legal and even the slowest car can enter. The contest is to find the shortest distance between the two East Coast centers of NRAO. (The distances to Kitt Peak and Socorro are left to a more enterprising author.)

The two end points should be the guard house at Green Bank and the driveway entrance at Edgemont Road in Charlottesville. The line-of-sight distance is less than 80 miles, and I think it would be possible to drive it in less than 100 miles.

Here are some hints and suggestions to potential competitors. Don't forget to calibrate your odometer. The distances given here are thought to be good to 1% or better.

A straight-forward trip, using US 250 to Monterey, Virginia, and I-64 between Staunton and Charlottesville is 111.4 miles long. Going south, through Frost, to Monterey adds 6.1 miles. Thus, the "standard" route usually taken by the shuttle is 117.5 miles.

The most obvious short-cut is to take one of the back roads up Allegheny Mountain and join US 250 just into Virginia. That can save at least 8.3 miles and reduces the total distance to about 103 miles. Other possibilities for minor improvements are the various options between I-64 and US 250 between Staunton and Charlottesville. There are at least three cross-over points between these two roads. The intersection at the bottom of Shenandoah Mountain is 0.2 miles closer to Charlottesville via US 250.

There's the challenge. Now it's up to you. I will gladly keep track of various attempts and would like to know of any alternatives that I've missed. Next time you take the trip and aren't in a hurry, try a different route and see some different scenery (and save a little gas).

* * * *

WOODLANDS INSTITUTE

Jennifer Taylor-Ide

The Woodlands Institute is an experimental education center on Spruce Knob Mountain, West Virginia. It uses the out-of-doors as a classroom for people of all ages and backgrounds to study a wide range of subjects. While offering specific programs with specific educational objectives, Woodlands concommitantly pursues the broader goal of understanding and developing the potential of the out-of-doors as a teaching medium.

During the academic year, Woodlands programs are designed primarily for school groups, from second grade to graduate school. These courses are individually designed to suit the needs and interests of the participating school.

One course, for example, introduced a class of second graders to the basic concepts of an ecological system. For second graders to grasp the idea of such a system, they must experience it. We chose the ecosystem of the beaver because it was fun and easy to identify with. An excellent beaver sit was available.

During the first day the children were introduced to the wilderness environment and made to feel at home in it. Group activities on the second day bonded the class together as a working unit.

The third day they met their ecosystem. All day they pretended to be beavers. After hiking to a beaver colony they scrambled in-

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to the stream. Like real beavers they industriously repaired a leaky dam. Cradling wet mud in their arms they packed it carefully between the limbs of the trees. When a limb needed to be moved, and was too much for one to carry, others pitched in to help.

Powered by the tremendous imagination of young children, they sensed what it must be like to be a beaver, how important the streams are, what the role of the forest is, how meadows are sometimes formed, what could happen when they worked together as a group, and how much fun it is to work like a beaver.

After this sort of real life, physical adventure, follow-through in classroom literature and science lessons can continue to develop new insights and learning.

At the other end of the academic scale are courses for college and graduate students. An American history course for students at Davis and Elkins College, Elkins, West Virginia illustrates this kind of program. The students descended the Potomac River in canoes for 250 miles, from near Woodlands to the Watergate, in Washington, D. C. Concommitantly they studied the history of the area through which they passed.

One specific lesson from the course was a study of the Battle of Antietam. Students role-played the battle as Confederate soldiers. They marched seven miles from the Potomac to Sharpsburg, studied the campaigns as they walked over the battlefields, then trudged the seven miles back as defeated soldiers. Reliving the defeat, and walking the 20 miles, made them ache more than just physically. Writing in their journals they reflected on what it was like to be Confederates fighting (and losing) for something they believed in. They came to understand what a soldier's motivations might be, what Abraham Lincoln's motivations were, what their personal motivations might have been had they been there.

About 1,200 pages of historical reading were assigned to cover 400 years of American history. Much of this was done on the river itself. This produced the picturesque scene of the bow person in the canoe reading, while the one in the stern paddled. Seminars were held around campfires in the evening.

Other courses for school groups sometimes focus on interpersonal relationships and self-development, more than on academic subjects. These courses use adventure, different and often stressful living situations, and group problem-solving exercises to help participants come to new self-understanding and more effective group relations.

During the summer, courses are run for family groups. These programs provide a different sort of vacation for most families, in which they enjoy the outdoors together while learning some new skills which they can pursue together later. They learn the introductory skills necessary for them to be able to take care of themselves while exploring park and wilderness areas.

The family courses are divided into two types -- those for whole families (including just couples) and those for one parent with an adolescent child: One objective of these courses is to strengthen family relationships, and the parent-adolescent pair is perceived to be a relationship of special significance and vulnerability.

In addition, programs of a varying nature are offered during the summer, according to the staff's perception of particularly effective areas to explore. Two such courses, which suggest the range of interest, are a teacher-training course, and a women's course. The first prepares teachers to run their own outdoor programs for their classes. The second opens outdoor experience to a group of people who traditionally do not have much opportunity for getting into the wilderness and feeling the exhilaration of natural beauty and physical challenge combined.

A final area for Woodlands' courses is programs planned for the community around Woodlands. These include church groups, weekends with high school students, and 4-H camping experiences. They are especially rewarding to the staff because they involve fellowship with the community in which we live.

As may be surmised from the preceding course descriptions, the Woodlands program is flexible and open to new ideas.

The Woodlands staff consists of 4 full-time residents -- King Seegar, Jennifer Taylor-Ide, Daniel Taylor-Ide, and Laura Wray -- and a broader community of part-time instructors with specific interest and expertise. All are comfortable

(continued--next page)

in and enthusiastic about the out-of-doors. In addition, each has particular skills, training and interest, including such areas as geology, ecology, caving, rock climbing, ethics, and counseling.

Living and working responsibilities -- cooking, maintenance, teaching, and administration -- are shared by all 4 resident staff members. Students commonly help in the daily tasks, and this becomes an important part of their learning experience. This, in a sense, is its own social and management experiment. It is part of a Woodlands interest in exploring new ways of doing things. This interest is further illustrated in the architecture of the buildings. They are round, wooden structures called yurts, based on Mongolian tents, and constructed by the staff, students, and friends. Another example is a plan for a windmill to provide power in this day of energy shortage.

Woodlands is located near the summit of Spruce Knob Mountain. It is about 400 acres of meadow and forest land, with a couple of streams, a fine cave, and many special spots for those who enjoy the outdoors. Visitors are welcome when courses are not being run.

* * * *

FALL FOREST FIRE SEASON

Natural Resources Director Ira S. Latimer, Jr., today reminded West Virginians that statutory fall forest fire season begins October 1 and lasts through December 31.

West Virginia forest fire laws state: "No person shall during ANY fire season, except between the hours of 5:00 p.m. EST and 5:00 a.m. EST, set on fire or cause to be set on fire any forest land, or any grass, grain, stubble, slash, debris, or other inflammable materials. Such prohibitions of fires between 5:00 a.m. EST and 5:00 p.m. EST shall not be construed to include (1) small fires set for the purpose of food preparation, or providing light or warmth around which all grass, brush, stubble, or other debris has been removed for a distance of ten feet, and (2) burning which may be conducted at anytime when the ground surrounding the burning site is covered by one inch or more of snow.

"Before leaving ANY fire for ANY period of time, it must be totally extinguished.

"Permits to burn during the prohibited periods may be issued by the Director of the Department of Natural Resources or his authorized representative.

"Escape of ANY fire at ANY time to the lands of another shall be in violation of the provisions of this section.

"All sawmills, power shovels, or an engine or machine capable of throwing sparks must be provided with an adequate spark arrestor if operating in forest land or within one-eighth mile.

"All inflammable waste disposal areas on ANY land must annually have removed all grass, brush, debris and other inflammable material adjacent to such disposal areas to provide adequate protection to prevent the escape of fire to adjacent lands.

"The state shall recover from the persons, firms or corporations whose negligence or whose violations or any provisions of this article cause ANY fire at ANY time on any grass or forest land the amount expended by the state.

"A landowner must take all practicable means to suppress ANY fire on his property. If he fails to do so, the state shall collect from him the amounts expended by the state for such purposes."

In addition to the foregoing, the Director advises that all individuals who need to burn anything should check for compliance with air pollution regulations and local municipal ordinances.

* * * *

HEY, BEEKEEPERS WATCH OUT FOR BEARS

A 265-pound adult male black bear was live-trapped near Montrose in Randolph County September 7 and transported to the Big Ugly Public Hunting and Fishing Area in Lincoln County, according to Wildlife resources chief Dan E. Cantner.

The bear had caused extensive damage to beehives before conservation officers were requested by landowner Roscoe Martin to remove it. As of August 31, approximately $5,800 has been paid this year for bear damage to personal property.

After the bear was captured in a culvert live-trap, it was taken to the Department of Natural Resources Operations

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Center where biologists immobilized the bear with a specially prepared drug (M-99). They then pulled a pre-molar tooth for aging, weighed, sexed, then ear-tagged and lip-tattoed a number on the bear for identification purposes. The bear recovered in an air-conditioned building before being transported to Big Ugly.

Cantner noted that this is the second damaging bear to be caught, transported to and released on this area in the past two weeks. Big Ugly Wildlife Manager Dave Lambert noted that the first bear is doing well in its new 10,000-acre home.

* * * *

A SHORT HISTORY OF GREEN BANK HIGH SCHOOL

Our history of Green Bank High School begins in 1916. Early in that year the District Board of Education called for a vote at the upcoming election asking for authority to float bonds to build a high school to be located somewhere between the villages of Arbovale and Green Bank. The recommendation of the board to build the new high school between Arbovale and Green Bank was largely based on the fact that such a location would be in the center of school population, whereas both Durbin and Cass were too far away from the center of school population. Durbin accepted the recommendation of the board, but Cass balked. The people of Cass wanted the new school in Cass and they set their minds and their energies to see that it was put there. Their plan to get the new school was simple and straightforward: first, they could campaign hard to defeat the bond issue (sixty percent of the vote was necessary to carry the bond issue); next, they would work to elect a school board sympathetic to a Cass location; and later, they would campaign vigorously to pass a school bond issue. It was a good plan and it almost worked -- almost.

By election time in the fall of 1916, feelings were running high. Many people were speaking out against the bond issue because it would raise their taxes. Other equally vocal voters said that they were going to vote against the bond issue because they felt the district already had enough schools. Such talk was encouraging to the Cass District. With their votes they could defeat the bond issue. Board members who had the foresight to see the need for a new high school recognized and understood this opposition and knew that they had to speak up for the bond issue. J. W. Goodsell, Uriah Hevener, Reverend Harry Blackhurst, and Dr. L. H. Moomau are due a lot of credit for carrying the fight for the new high school.

J. W. Goodsell was a business man of influence and determination and used both of advantage. Largely through his efforts, the Durbin District went along with the Board's recommendation for the school's location near Green Bank. Uriah Hevener spent election day at Cass actively campaigning for the bond issue. It was reported that he returned that night to Arbovale minus his good hat and the sole missing from one shoe, both lost in a fist fight. Over at Wildell on the Greenbrier, Reverend Blackhurst preached and campaigned among the Wildell voters to get out on election day and vote for the bond issue. Few people realized before the election that the Wildell vote might be crucial to the outcome of the bond issue.

Late election night, when all the precints had reported in - except Wildell - it looked pretty certain to Cass that the bond issue would be defeated, and they were jubilant. Only Wildell was left to report in and they felt confident that the voters of Wildell would vote against the bond issue. They misjudged the people of that little lumber town at the head of the Greenbrier. Except for two voters, the forty some voters of Wildell voted as a block for the bond issue. Their vote was enough to give the sixty percent margin and the bond passed.

After the passage of the bond issue, the school board bought four acres of land from the Moomau estate for $400.00. Shortly thereafter, for $583.00, they engaged the services of architech Charles Bates to draw up plans for the new high school. The contract to build four classrooms, a library, and an office on the third floor; four classrooms on the second floor; and a auditorium, two toilets, furnace, storage, and engine rooms on the basement floor was awarded to John Ward for $20,752.00.

The original survey would have had the school building running parallel with the

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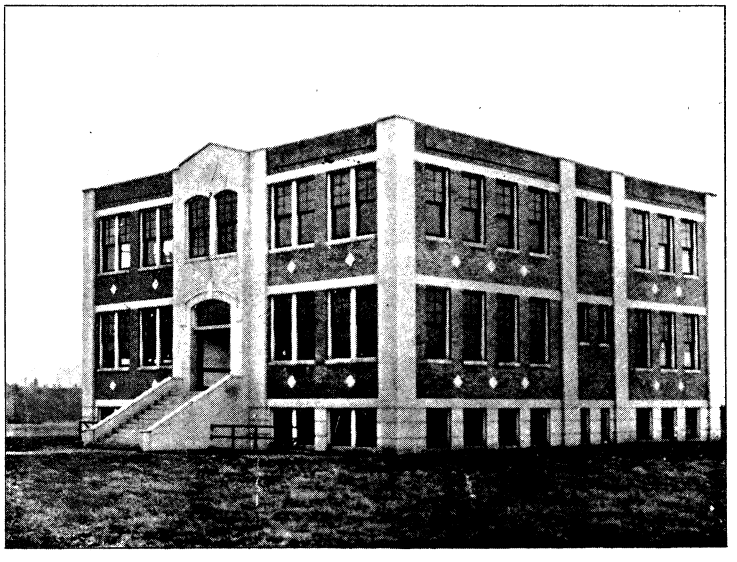
highway and, except for R. W. Brown, that's the way it would have been. The night before excavation was to begin, Mr. Brown, a school member and a civil engineer, made the contractor change the stakes so that the building would run parallel with the valley. Thus, Mr. Brown is given credit for the proper orientation of the Green Bank High School.

On September 24, 1917, the new high school opened for classes under the principalship of W. P. Haught of Bristol, Virginia. His assistant was Miss Louise Ebering who taught English and French. Enrollment for the first year was thirty-five; twenty-nine freshmen, five sophomores, and one junior. For the first time since the old Green Bank Academy burned, the children of the Upper Greenbrier had the opportunity for education beyond the eighth grade.

The following term, 1918-1919, Mr. Haught was still principal. His faculty consisted of Lucy Meridith, Margaret Hunt, and Lillian Moomau.



Green Bank High School, 1917 - 1918

Home Economics was added to the curriculum and eight students were enrolled. The first graduation class was at the end of this year. Miss Grace Curry was the only graduate of the class of 1919. It was during this school year that the first bus to transport students was used. Mr. J. M. Belcher owned and operated a bus that carried students from Cass. This transportation was not free; parents had to pay Mr. Belcher a fee to haul their children.

When school started in 1919, Green Bank High School had a new principal - C. M. Koon, Miss Virginia Dare Moomau was appointed Librarian. Vocational Agriculture was added to the regular curriculum, and girls' and boys' basketball and a glee club was started as extra-curricular activities. Along with sixty new books and several new magazines, the library moved into its own special room, and all library books were catalogued according to the Dewey Decimal System. The new Vo-Ag course emphasized soils and crops and was taught by Mr. Winkler. The first year twenty-two students enrolled in his course - eighteen finished. Because the school accepted a federal grant of $800.00, Vo-Ag students were required to complete a summer project under the supervision of the agriculture teacher.

In 1921, N. Phay Taylor of Beverly, West Virginia, was appointed principal and he remained principal until the fall of 1923. It was in 1921 that the first trees on the school campus were planted. The class of 1921 planted a sugar maple on each side of the front entrance.

In the fall of 1923, T. P. Harwood from Virginia was made principal. It was Mr. Harwood who introduced Physical Education to the school and organized a community council which met once monthly with the purpose of bringing the people of the community together.

Green Bank High School's first football team was in 1924 coached by F. W. Hedrick, the Vo-Ag teacher. That season, GHS played a five game schedule. It was interesting to note that two of the games were scoreless ties. The number of students entering GHS was increasing rapidly and by 1924 it was apparent that more room was needed. A contract for $32,000.00 was awarded to A. S. Killingsworth to build an addition consisting of two rooms on each of the three floors and a gymnasium. The classrooms and gym were ready to use in the fall of 1925.

In the fourth year of football, 1927, Green Bank won the Greenbrier Valley Championship. They were to win this same championship in 1937 and again in 1947.

There were still relatively few trees

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on campus by 1928. That year the Vo-Ag students planted a row of maples on the north side of the building and a row of larches (a member of the pine family that sheds its needles in winter) and some hemlocks on the east (road side). Later in 1935, students and a WPA crew under the supervision of C. E. Flynn set out a double row of white pine to separate the playgrounds.

In 1931 the Vo-Ag department had to have more room. Money for a new addition wasn't available so they acquired additional space by moving a one room school house from Arbovale and setting it on concrete pillars. This was done by S. H. Elliott for $250.00. Since that first addition to the Vo-Ag building, five more unused, one-room school houses were torn down and their lumber used to add more space to the Vo-Ag building. Eventually the Vo-Ag building came to house the hot lunch room, cook room, storage room, one class room, and one of the best equipped Vo-Ag shops in West Virginia.

In 1936 a second addition to the main building was completed. For $11,332.00, A. S. Killingsworth built two classrooms, a boys' toilet, and a library over the gymnasium. It was also in this year that they built a new brick garage for buses. It had room for six buses and a repair shop. This was not the first garaging facility at the school. Back when the original building was completed, there was already another building on the campus, a large, frame structure. It was used to house twenty horses and six buggies. After horses and buggies gave way permanently to automobiles, they tore this building down.

Buses behind Green Bank High School garage
1935

The information for this short history was taken from a student's report written while she attended Davis and Elkins College. Incidentally, she got an A on the report. Her report ends with a listing of principals, coaches, and Vo-Ag teachers. We will do the same. Perhaps someday someone else will complete the history from 1936 to 1970.

Principals

W. P. Haught.....1917 - 1919
C. M. Koon.....1919 - 1920
N. Phay Taylor.....1920 - 1922
T. P. Harwood.....1922 - 1930
John D. Roach.....1931 - 1935
Claude A. McMillion.....1936 - 1945
Mack Brooks.....March to June 1945
Virgil Harris.....1945 - 1970

Coaches	Vo-Ag Teachers
Robert Winkler	Robert Winkler
T. P. Harwood	Tracy O. Fling
F. W. Hedrick	Walter Snoop
Rev. George Mauze	F. W. Hedrick
Ralph Lanham	David Smith
Louis Sturbois	Raymond Swadley
Bardon Harper	
June Riley	
Warren Blackhurst	
Harold Mosser	

* * * *

PERU

Ed Fomalont

Every three years the International Union of Radio Science (URSI) holds an international meeting. This year the gathering was in Lima, Peru, and about 500 radio scientist delegates, including 40 radio astronomers, joined forces to discuss the important scientific advances since the last meeting in Warsaw, Poland. Over the last year there was considerable doubt that the meeting would ever take place. The relations between Peru and the USA have been strained because of massive expropriations of American business interests by the militaristic, communistic Peruvian government. In addition, the pro-

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posed conference building at the Catholic University was burned by dissidents, but a new site outside the city at another university was finally arranged.

At 5 a.m. on August 11, the first day of the conference, a moderate earthquake shook the city. Reaction among the delegates varied considerably. Some quickly grabbed their clothes to run outside while others, still exhausted from the plane trip, just buried themselves under the covers. The tremor lasted about ten seconds but caused no damage to the city. But was it only preshock?

In the morning session we received the usual welcoming piels with several puns relating to the earthquake, and various Peruvian dignitaries extolled their scientific accomplishments in ionospheric science. The minister of Education, a balding general in uniform, praised the social revolution now taking place in Peru. While he did not say that basic science was a waste of time, he thought the people had important problems to solve and possibly some long-range solutions might be found with the help of basic research. In conclusion he said that the people overwhelmingly supported the present regime of "humanistic militarism" (or was it militaristic humanism -- in any case a contradiction in terms to my way of thinking). Lukewarm applause.

The entire conference lasted until August 18. Generally there were two sessions each day with the radio astronomers forming their own small group. The scientific sessions contained review papers of recent developments and short contributions of new results from most of the participants. At the business sessions we argued about the future of URSI, the dangerous problem of increased radio interference and other matters of a more technical nature. The sessions were interesting and constructive.

Lima is a cosmopolitan city of three million inhabitants. It contains most of the big city problems including massive traffic jams between 5 and 7 p.m. when it is much faster to walk than drive. Busses in all shapes and sizes are available if you don't mind being squashed or having your wallet taken. Taxis are an experience in terror not because they are unsafe but because one never knows how much it will cost or where you might end up. Meters are never used and the rate depends on how much the driver thinks he can get from you. The city is only 12 degrees south of the equator but the weather is unexpected. From May to October it drizzles each morning and evening; the afternoons are just cloudy. The temperature varies between 55 and 65. The moderate climate is caused by the cool Humboldt current (remember Kon-Tiki) flowing along the Pacific coast. In all fairness, we did see the sun once but my Green Bank tan certainly suffered.

However, by travelling 20 miles from the city into the foothills of the Andes, the sun appeared and the density of people decreased. Many of the delegates made weekend excursions into the interior of Peru and extended trips before and after the meeting. Most of the coastal area is arid and looks much like the California desert. As one travels into the mountains, the air becomes cool and semi-arid vegetation appears. The character of the people change from mostly Spanish descendents in Lima to the Indians in the Interior.

Most of us visited the city of Cuzco, the capital of the Inca Empire until 1530 when Pizzarro and the Spaniards captured the country. It is now a charming Spanish city with Inca ruins still in evidence. About 60 miles to the north down a narrow river gorge, a good train trip brings one to Macchu-Picchu. In 1911 this old Inca town buried in the mountains near the Amazon jungle was uncovered by an American archeologist Hiram Bingham. Unlike all of the Inca cities, this one was not ransacked by the Spaniards because they never found it. Until 1911 it was buried beneath the brush. Only in this city-fortress can a visitor to Peru see and feel the technology and organization of the Inca Empire.

* * * *

To err is human. To forgive is divine.

Don't expect to see a ship in if you haven't seen one out.

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OBJECTIONS TO ASTROLOGY

"Objections to Astrology", a statement signed by 186 top scientists, including 18 Nobel prize winners, who dismiss astrologers as charlatans, was drafted by Dr. Bart J. Bok and appeared originally in the September/October issue of The Humanist. The statement was followed with a list of signers. In this issue we reprint "Objections to Astrology", in case our readers missed reading it in the national news media and because we think it is worth repeating.

A Statement by 186 Leading Scientists

Scientists in a variety of fields have become concerned about the increased acceptance of astrology in many parts of the world. We, the undersigned - astronomers, astrophysicists and scientists in other fields--wish to caution the public against the unquestioning acceptance of the predictions and advice given privately and publicly by astrologers. Those who wish to believe in astrology should realize that there is no scientific foundation for its tenets.

In ancient times people believed in the predictions and advice of astrologers because astrology was part and parcel of their magical world view. They looked upon celestial objects as abodes or omens of the Gods and, thus, intimately connected with events here on earth; they had no concept of the vast distances from the earth to the planets and stars. Now that these distances can and have been calculated, we can see how infinitesimally small are the gravitational and other effects produced by the distant planets and the far more distant stars. It is simply a mistake to imagine that the forces exerted by stars and planets at the moment of birth can in any way shape our futures. Neither is it true that the position of distant heavenly bodies make certain days or periods more favorable to particular kinds of action, or that the sign under which one was born determines one's compatibility or incompatibility with other people.

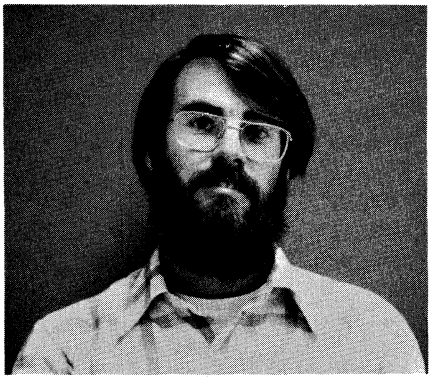
Why do people believe in astrology? In these uncertain times many long for the comfort of having guidance in making decisions. They would like to believe in a destiny predetermined by astral forces beyond their control. However, we must all face the world, and we must realize that our futures lie in ourselves, and not in the stars.

One would imagine, in this day of widespread enlightment and education, that it would be unnecessary to debunk beliefs based on magic and superstition. Yet, acceptance of astrology pervades modern society. We are especially disturbed by the continued uncritical dissemination of astrological charts, forecasts, and horoscopes by the media and by otherwise reputable newspapers, magazines, and book publishers. This can only contribute to the growth of irrationalism and obscurantism. We believe that the time has come to challenge directly, and forcefully, the pretentious claims of astrological charlatans.

It should be apparent that those individuals who continue to have faith in astrology do so in spite of the fact that there is no verified scientific basis for beliefs, and indeed that there is strong evidence to the contrary.

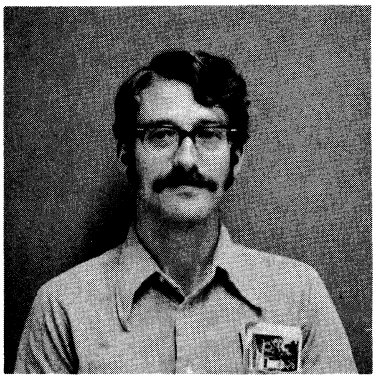
NRAO scientists who signed this statement include: William E. Howard III, Kenneth Kellermann, Mark A. Gordon, and Campbell M. Wade.

NEW EMPLOYEES



John W. Armstrong
Research Associate
Basic Research - CV

Ellen N. Bouton
Library Assistant
Scient. Serv. - CV



Thomas W. Jones
Assistant Scientist
Basic Research - CV

Gary Steigman
Vis. Asst. Scientist
Basic Research - CV

Mauri J. Valtonen
Research Associate
Basic Research - CV

Matthew R. Wordeman
Co-Op Student
Scient. Serv. - CV

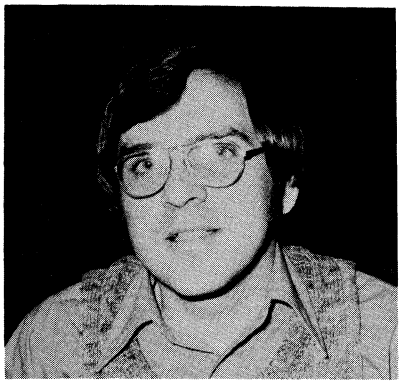
PHOTO NOT AVAILABLE

David B. Shaffer
Assistant Scientist
Basic Research - GB

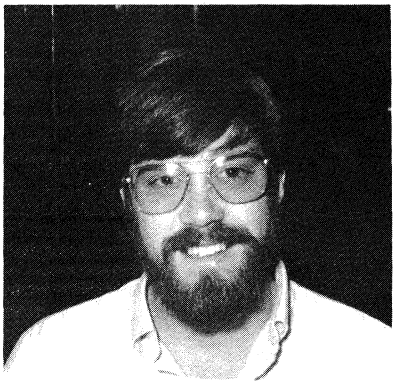
Rebecca A. Warner
Secretary
Adm. Services - GB

Sharon E. Compton
Secretary
Adm. Services - GB

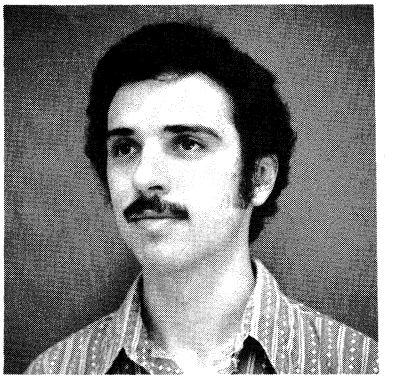
NEW EMPLOYEES



J. Bruce McKean
Accountant
Fiscal Div. - GB



Richard J. Howard
Electronics Eng.
Elect. Div. - GB



James M. Huntley
Jr. Res. Associate
Scient. Serv. - CV

OTHER NEW EMPLOYEES (PHOTOS NOT AVAILABLE)

Socorro/Magdalena, N. M. - VLA Project

Larry O. Carlisle	Draftsman
James L. Guin	Maintenance Trainee
Donald L. Krieger	Transporter Equip. Oper.
Rudy Latasa	Maintenance Trainee
*Isidro M. Lopez	Maintenance Trainee
Linda S. Martinic	Accounting Clerk
Nicholas A. Montoya	Telescope Mechanic
James L. Oty	Tech. Specialist
Robert S. Runyon	Draftsman
Rey Serna	Sr. Technician

Green Bank, W. Va.

*Robert M. Morgan	Jr. Technician
Andrew V. Klein	Scientific Associate

Tucson, Arizona

Lynn S. Fischer	Technical Specialist

Leave of Absence - June E. Thomas - VLA Project - CV

*Rehires

TERMINATIONS

*Mary R. Purifoy	Scient. Serv. - CV
*Jack O. Burns, Jr.	Scient. Serv. - CV
Edwin J. Grayzeck	Basic Research - GB
*Robert M. Morgan	Electronics - GB
*Kevin H. Baines	Scient. Serv. - CV
*Jeffrey S. Waldhuter	Scient. Serv. - GB
*David M. Berg	Scient. Serv. - CV
*Kenneth R. Cosner	Scient. Serv. - CV
*Walter L. Gorman	Scient. Serv. - GB
*Richard A. Glassco	Scient. Serv. - CV
*James C. Jafolla	Scient. Serv. - CV
*Alice L. Kust	Scient. Serv. - CV
*Jerry Krassner	Scient. Serv. - CV
*Michael J. Carter	Scient. Serv. - CV
*Edwin M. Teyssier	Scient. Serv. - GB
*Alan P. Marscher	Scient. Serv. - CV
*Judith E. Soukup	Scient. Serv. - CV
*Chiu Y. Ng	Scient. Serv. - NM
*Dayton L. Jones	Scient. Serv. - GB
*John D. Liebenrood	Scient. Serv. - NM
*Michael S. Hersman	Scient. Serv. - Tucson
*Stephen D. Burgan	Scient. Serv. - CV
*Andrew V. Klein	Scient. Serv. - GB
Carl R. Preddy	VLA Project - NM
Michele DeBell	Electronics - CV
John R. DiMarco	VLA Project - CV
Joseph S. Fine	VLA Project - CV
Rosalie G. Douglas	Tucson Operations
Stephen L. Galhouse	Electronics - Tucson
*Paul D. Kuhlken	Plant Maintenance - GB
Harvey S. Liszt	Basic Research - CV
Robert H. Sanders	Basic Research - CV
*Alfred M. Collins	Plant Maintenance - GB
Harlan Martinez	VLA Project - NM
*John C. Brasunas	Scient. Serv. - CV
Ellen Z. Mufson	VLA Project - CV
Stuart L. Mufson	Basic Research - CV
Beverly W. Workman	Adm. Services - GB
David M. Gibson	Scient. Serv. - CV
*Kris D. Kuhlken	Plant Maintenance - GB
*Doris E. Hungerbuhler	Adm. Services - GB
Patricia B. Fry	Business Mgmt. - CV
Stephen T. Gottesman	Basic Research - GB
Samuel E. Okoye	Basic Research - CV
Nina B. Seaman	Electronics - CV
Bernard Pasternak	VLA Project - CV
*Mary Jane Oref	Adm. Services - GB
James L. Carpenter	Plant Maintenance - GB (RETIRED)
Sue Ann Seldomridge	Adm. Services - GB
*Gary A. Cassell	

*Summer Students

HOW CAN PIPE AND WOOD BE HISTORICAL?

Dayton Jones

Since its construction at Green Bank in 1964, the Jansky antenna has been little more than a stopping point for all tours and an example of free-form sculpture. In July it was decided to try to resurrect this unique telescope -- in other words, to repeat Jansky's original observations with an identical antenna. There was some historical interest in this project because Jansky's records were destroyed just a few years before decametric radio bursts from Jupiter were discovered.

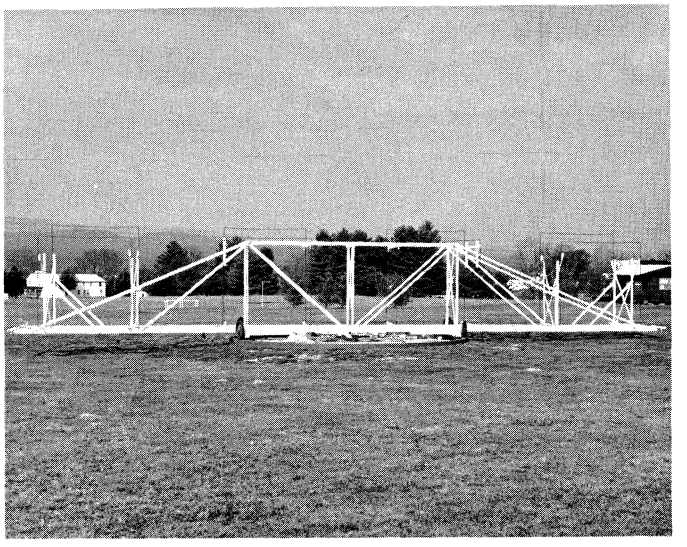
The original Jansky antenna and receiver should have been able to detect these bursts so it would be interesting to see if some evidence for them might have been on his lost chart records.

A quick inspection of NRAO's replica showed flat tires, a disconnected and badly rusted drive chain, and old animal nests all around the motor and reduction gears. The antenna is designed to rotate approximately once every 20 minutes, but it clearly had not been moved under its own power for years. Rotation is necessary because the antenna has an extremely wide beam pattern and the 20-minute time variations are the only way to distinguish real signals from receiver gain fluctuations.

There is no obvious way to connect a feed time to the driven element (which can be distinguished from the parasitic reflector only by measuring their separation and small difference in size), so it was decided to use a gamma match because of its ease of construction and unbalanced output.

An unused HRO-500 short-wave receiver, running off of a 12-V car battery, was mounted on the antenna support structure, along with a spring-driven chart recorder. The audio output from the receiver was to be rectified, filtered (integrated), and recorded on the chart as the antenna rotated. However, several problems were encountered, such as the drive chain falls off whenever you turn your back on it, and the rain-proof plexiglass box which houses the receiver, battery, and recorder acts as an excellent greenhouse, frying everything within it on clear sunny days.

In spite of these minor annoyances, preliminary observations were made during August.



The Jansky Antenna. An exact replica of the original used by Jansky at Holmdel, N. Jersey.

They revealed the existence of cars and a strong source to the west. The identity of this source remains unclear, but it is interesting to note that the Jansky lab is almost directly west of the antenna. Further work is planned.

* * * *

VEN YOU UND I VOS BOYS, HEN

Ven you und I vos boys, Hen,
Our hair vos cut quite thin,
Now them vot is called "nice young men,"
Hav it reachin' to their chin.

They curls it with un iron, Hen,
And greases it vith soap,
Vich mikes it look like oakum, Hen,
Fore it's twisted into rope.

They don't know vot it is Hen,
Ven ve talks about the joys,
Ve had in "other days," Hen,
Ven you and I vos boys.

--Pennsylvania Dutch Poem,
circa 1840

* * * *

HOW I SPENT MY SUMMER VACATION OR "YES, BUT THERE'S NO HUMIDITY"

Bill Meredith

Late last winter or early this spring, Bob Burns approached me and asked if I would like to spend the summer in Tucson, Arizona. Caught completely off guard, I agreed to take the matter up with my family. That evening at the supper table I said to my family, "I ran into Bob Burns today and he wanted to know if we would like to go to Tucson this summer." None of us knew anything about Arizona, so we all decided it would be a fun summer. Little did we know.....

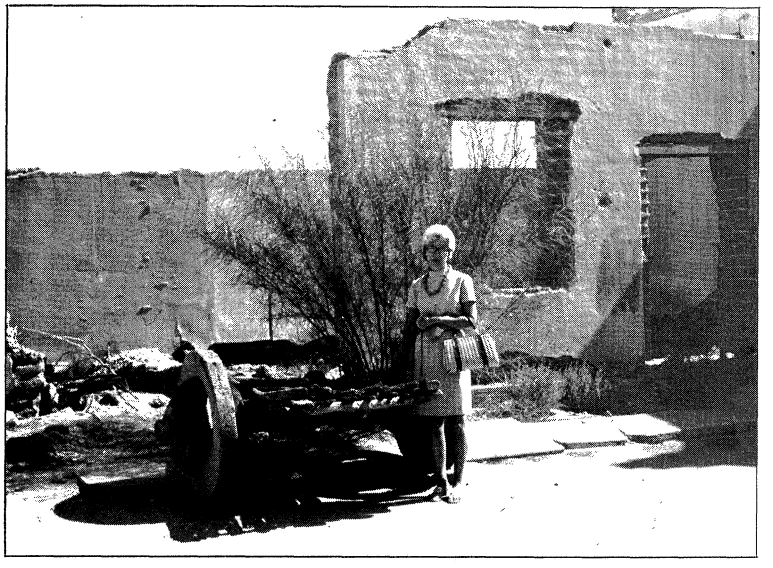
The reason for this apparent generosity on Bob's part was for me to carry some coals back to Newcastle -- return " F O R T H " to NRAO. For the uninitiated, " F O R T H " is an interactive computer language written by Chuck Moore, formerly of NRAO. "F O R T H" is used extensively at Kitt Peak National Observatory (KPNO) and NRAO, Tucson.

My wife and I soon became aware of the logistics involved. She had to get a leave of absence from her job, as well as arrange for her vacation. We tried to get someone to inhabit our house, mow the lawn, feed the cat, and take care of the myriad details of normal living. Our plans did not materialize, so the cat was fed by a neighbor girl, the lawn mowed by a neighbor boy, and the house occasionally inhabited by Pat Armstrong Fry and Ann Jackson. We are indeed grateful for their help.

We eventually got our jalopy packed to overflowing, and on June 14 set out for the Old West. We stopped in Almost Heaven to see the folks and to regroup. Five days and four nights from W. Va. we arrive in Tucson. As part of the big deal, we were to occupy Mark Gordon's house. Mark was spending the summer in CV, living in Bill Howard's house. Bill was living in Green Bank and I have lost track of who is living in whose house from there on.

The trip west was fairly uneventful. We tried to go about 400 miles per day and to stay in a cheap motel with a swimming pool. We usually stopped at a roadside park and fixed sandwiches for lunch. If there were no convenient parks, we just pulled off the road somewhere. Donuts, milk and coffee were our usual breakfast. We ate supper in restaurants, trying to get our daily vitamins and nourishment then. We traveled on interstate highways almost all the way.

We spent our last night in Socorro, New Mexico. I had wanted to visit the VLA site, but was voted down by my family, who was tired of traveling. The old car averaged 18-19 MPG at about 55-60 MPH. I was satisfied with this considering the load in the car.



Mark Gordon's House

On the afternoon of June 20, we entered the city limits of Tucson, Arizona. The traffic was unbelievable. Mark had sent us a map of Tucson with the route to his house well marked. We followed the route from the south side of Tucson, through the city, heading north, then began climbing the foothills of Santa Catalina Mountains. Up, up, up we went, finding it difficult to believe anyone really lived there. Finally we reached the turnoff street and found Mark's house. We still couldn't believe people really lived here.

Picture barren mountain peaks to the north, thrusting up from rocky, sandy foothills. Strange looking vegetation growing apparently without the benefit of water or

(continued--next page)

nutrition. Enormous Saguaro cacti overwhelmed the landscape. In between everything else were the prickly pear cactus, Occotillo, and Palo Verde trees. This was Mark Gordon country. We unpacked the car and moved in. The hillbillies had arrived!

Knowing Mark, we weren't sure what to expect in his house. One of the first things we noticed was that the house was completely devoid of cuspidors (spittoons for Green Bank people). This was somewhat embarrassing until we realized we could use the atrium. For the less cultured, an Arizona Atrium is an inside outside. The next thing we noticed was the outhouse was an inhouse. The Arizona climate discourages going out during daytime, we figured. Early afternoon temperatures were running slightly over 100 degrees.

June 20 was a Saturday, so next day (Sunday, Carl Davis) I drove to the NRAO offices -- Mark had left me his key. Mike Hollis was there and he showed me around and we made plans for the work week. The office was about 12 miles from Mark's house (straight down) and the trip consumed about 1/2 hour traveling time.

The crew at NRAO, Tucson is a real "gungho" bunch. It reminds me of the early days at Green Bank. The people are dedicated, hard-working and crazy. The first thing Neil Albaugh said to me was, "Now we have them outnumbered." I asked who "we" were. He replied, "West Virginians." There are an awfully lot of misplaced West Virginians there. The funny thing is they all love it. I finally figured this out. It is a well known medical fact that elevated temperatures are harmful to brain cells. It takes just one summer in the boiling Tucson sun to fry the cortex to such an extent the person becomes somewhat feebleminded. Hence, the Tucson contingent.

There are many interesting places to visit in the West. Just outside Tucson is the Desert Museum. This is a really facinating place. All plants and animals indigenous to the Tucson, Arizona area can be found there. And, they are all living. We spent part of one day there. Since most of it is outside, the heat drove us away just after lunch.

We drove the 66 miles south to Nogales, Mexico and came back loaded with pots and baskets. Having been cautioned by many sources, we parked our car on the U. S. side and walked across the border. Everything in Nogales is for sale. There are great bargains to be had if one looks long enough. Pottery, woven baskets, leather goods, clothing and cheap booze are everywhere. Most shops are small, and specialize in one or two products. There is one American type department store where practically everything can be purchased. The clerks all speak English, but do their adding in Spanish.

On our way to Nogales, we visited the old Spanish Mission of San Xavier. It is in the process of being restored and they hold regular services there. We stopped at Tumacacori on our way back. It was designated a national monument by T. Roosevelt. This mission has quite a history. It was started 300 years ago and never really completed. Vandals and the years have destroyed much of the original works, but there is enough left to be impressive. I am fascinated by these old ruins (in fact, I'm married to one) and could have stayed all day, but the mosquitoes drove us off. The vegetation undergoes a rapid change just south of Tucson. In fact, halfway to Nogales it appears lush -- trees, grass, and flowers abound. Obviously, there is more water there and this brings out the mosquitoes.

After we had been in Tucson for 2 or 3 weeks, the monsoons began. These are annual occurrences and the weather makes a dramatic change. Tucson has the worst of all possible seasons. Typically, after lunch, clouds will begin forming over the Catalinas and a tropical downpour results. The lightning displays are spectacular. Strangely enough, Tucson has no storm sewers. When it rains there is no place for the water to go except down the streets and arroyos. These washes are usually dry and innocent appearing. When it storms, they quickly fill up and become extremely dangerous. Signs are everywhere, warning the traveler not to cross when flooded. Hurricane force winds are common during this season, which lasts for several weeks. Another minus for Tucson.

At first we counted the weeks until we could leave. After awhile, we acquiesced to our fate and the time passed more rapidly until finally it was time to leave. We

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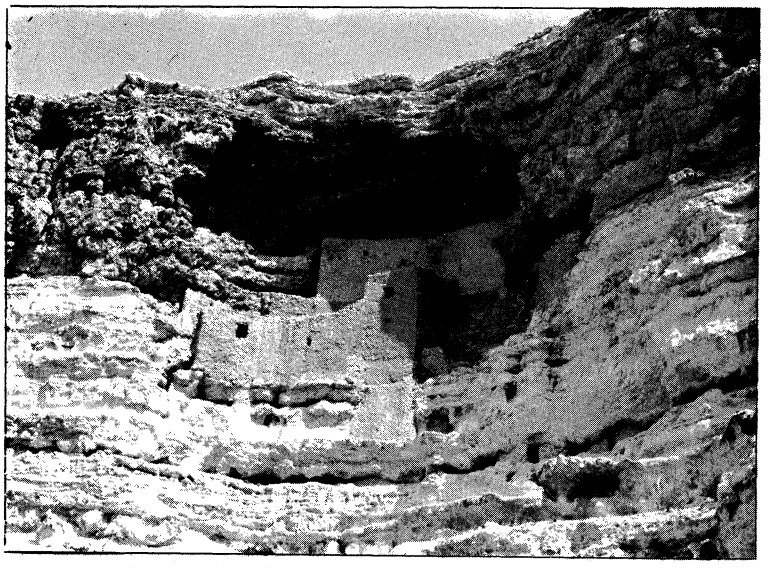
had purchased so many souvenirs, there wasn't room in the car for everything so we shipped a lot of things by parcel post and bus. On the afternoon before we were to leave, I noticed the tail pipe ahd fallen off the car. I frantically called auto parts stores and eventually located one at Midas Muffler. On my way to ship a footlocker by bus, I picked it up, and with only moderate difficulty installed it on the car in Mark's carport, leaving him with a pile of rust. I had had 2 new tires mounted on the rear wheels a couple of days previously, and had installed a new headlight, changed the oil and filter, so I felt we were in pretty good shape for the trip back.

There is a saying that the only difference between men and boys is the price of their toys. I bought and installed a Citizen's Band Transceiver 2 weeks before our trip back, and had gotten a lot of pleasure from listening to Tucsonians yak at each other. I soon discovered the trucker's channel and listened to them all the way back to Charlottesville. They use channel 21 west of Oklahoma City and channel 10 east. It was necessary to acquire a new vocabulary in order to understand them. The big tractor-trailers are 18 wheelers (count them), cars are 4 wheelers, police are county mounties, town clowns, or smoky bears. There is a camaraderie among professional truck drivers that is seldom seen nowadays. Very few drivers passed a stopped truck without attempting to call him on their radio to see if he needed assistance. Truckers within a 10 mile radius know every time a police officer goes to the bathroom. Just by listening, I knew well ahead of time the locations of radar units and police cars on the move. It was reassuring to know that we could have called for help, had we needed it.

In the mountains north of Phoenix, there is a cliff dwelling ruins called Montezuma's Castle. This was built in the sheer face of a chalk-like cliff. Most of it was inaccessible but some of it could be visited. It is an eerie feeling to visit a place constructed by people hundreds of years ago.

We visited the Grand Canyon during the late afternoon of our first day heading back East (it is funny how one says back East, but out West). This made the entire trip worthwhile. All my wife could say was that it looked just like its pictures. It is without doubt the most impressive natural site I have ever seen.

Our trip back was as uneventful as our trip out. We stayed in St. Albans, W. Va. with the folks and had to replace the battery and buy another new tire. My self-installed tail pipe had begun to rattle and while the car was up on the lift, the mechanic noticed one of the front tires had a large tumor. I was grateful he spotted it, but sorry for the added expense.



Montezuma's Castle

Our house in Charlottesville never looked so good when we finally got back. It seemed to have weathered the summer very well without us. All 3000 children on our block were there to welcome us. The nightmare was about over.

It may appear I have a bad feeling for Tucson. This is true. I can't think of a worse fate than to have to live there. It was pointed out that we were there during the worst part of the year -- it was either hot and dry or hot and humid. As a child we played a little game. We would approach a friend and say, "I'll bet I can make you say who." The friend would of course reply, "I'll bet you can't." Then we would say, "Well, maybe I can't, but I know someone who can." The poor boob would then ask, "Who?" then we would gleefully say, "Aha, I made you say who."

Similarly, one can make a Tucsonian say,

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"Yes, but there's no humidity" just by remarking how hot it is. I think this should be added to the 2 certain things in life - death and taxes, because it invariably works. The next time you are in Tucson, just say to one of the locals, "Boy, it is 105 (110, 120, ad infinitum) degrees." If he doesn't reply, "Yes, but there's no humidity," don't worry about dying or paying your taxes, because they probably aren't certain either.

Last night at supper I remarked to my wife, "I was talking to Bob Burns today." She immediately fainted, the kids turned deathly white, and had nightmares all night. I could not convince them I was only kidding.

* * * *

A GREEN BANK HERB GARDEN

Claude Williams

After studying last year's returns from my garden questionnaire (see Dec. 1974 Observer), and noting that only one person had planted any herbs other than dill, pepper and onion, I decided to experiment with a small herb plot. (The definition of herbs used here is any plant whose seed, leaf, bark, or root is used as a fragrance or as a spice.)

My herb collection came from seeds, cutting bulbs, commercially grown plants, and out of spice jars. I also investigated the different kinds of wild herbs in this area. Below I briefly summarize when these herbs were planted, how well they grew, how I processed them for storage and what I plan to do next year to improve my crop.

ANISE was planted for its dill-like seeds which are used in bread. The plant grows about 18 inches high and resembles dill but has white flowers. The seeds, greyish-brown, hairy, and about 1/5 inch long, are sweet, spicy, and aromatic. The seeds were planted April 15, but unfortunately, I planted them in a very shady location and after growing about 5 or 7 inches, they withered and died. Next year I'll grow them in full sun. Anise is dried and stored like Dill.

BASIL grows into a small bush about 1½ ft high and has shiny, green, oval leaves. It can be grown indoors or out. Much used in cooking, Basil flavors many foods, including meats, vegetables, macaroni, and rice. I made two plantings: one in January for indoor use which I later transplanted outside after the weather warmed, and a second planting outside on June 3. The transplants did well and made seed for next year. The second sowing grew a foot high but none made seed. I'll bring a few plants inside for fresh leaves. It is best to keep the flower buds pinched back, for Basil, as an annual, dies after seeding. Pinching back not only keeps the plant growing, but it also encourages suckers which will produce leaves too. Pull up the whole plant when harvesting, divide branches, rinse lightly, blot dry, tie together, and hang upside down in paper bags in a warm place. After the leaves dry thoroughly in 3 to 5 weeks, crush and store in airtight jars.

CARAWAY is another dill-like plant and what I said for Anise holds for Caraway.

CHIVES were a gift from a previous resident. They are planted in a shady location and flower in light purple balls in the spring and fall. They look and taste like onion, but rarely grow more than 10 inches high. Fresh leaves are cut as they grow. Their compact growing habit makes indoor transplanting easy. Chives can be dried by inter-layering with noniodized salt on a baking pan, and baking at 200°F for 15 min. Besides dried chives, this method also gives you chive salt, a substitute for garlic salt. This year my chives got overcrowded, so next year I'll have to divide them.

CORIANDER is another dill-like plant growing about 2 ft. in height with globular seeds 1/8 in. in diameter. Crushed seeds are used in curry powder and for spicing rhubarb. Sown by June 3 in a partially shaded location, coriander matures and seeds well before frost. Dry like you do dill or basil (although unlike basil the leaves are not used), and then simply shake seeds out. Ants like coriander's sweet-tasting flowers. A sprinkling of baby or talcum powder around the plants will keep the ants away. Next year I'm going to plant more coriander than I did this year.

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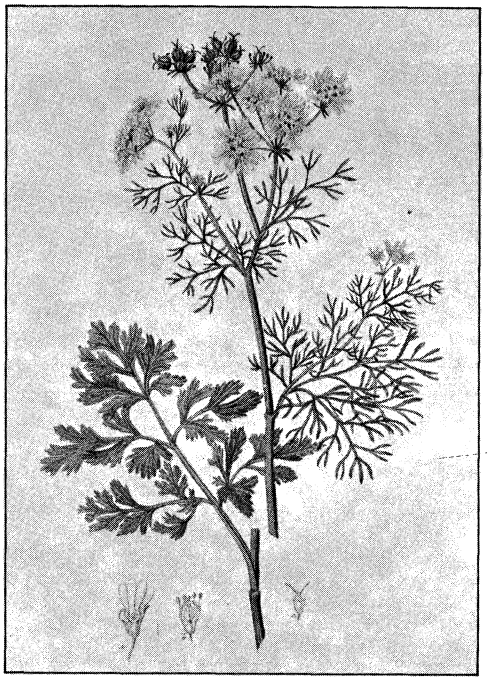

Coriander - a member of the aromatic, umbelliferous plants like Anise, Cumin, Dill, Fennel, Caraway, Yarrow and Parsley.

CUMIN dittos anise and caraway. None of my seed came up. One reason could have been that I planted old seed.

DILL came up beautifully. Same planting places and planting times as for cumin, anise, and caraway. It sprouted well before the last frost in the spring. Dill is used for pickling. I harvest just as the seed on an umbel turn brown. The 10 or so plants are still flowering as of Sept. 25. When they stop, I'll pull the whole plant, tie in a bundle, and hang in a dry place for the winter. Next year, I'll plant this year's seed to maintain good yield.

FENNEL is another dill-like plant but much sweeter and grows 4 to 5 feet tall. Planted June 3, it has just started growing well. If it fails to seed, I can still dry the leaves to make a sweet, mild tea. Next year I'll plant fennel seed the same time as dill. Roots from this year's plants will come up next year. (they are perennial).

FENUGREEK is an annual about 2 ft. high. it has long, narrow pods which contain ten to twenty flat, asymmetrical, brown seeds. Ground seeds give desserts a maple-like flavor. They are also used in curry powder. Planted on June 3, they seeded and matured before Sept. 1. They were dried like dill. Since Fenugreek did not produce as well as expected, I'll try a sunnier location next time.

GARLIC was bought as sets and planted June 1. As of Sept. 25, a plant check showed only a single bulb. Since then, I have learned that garlic must be planted in the fall to produce compound bulbs the following year. I guess I will have to wait until next year.

MARJORAM, a short, viny type plant growing to almost 12 inches, is a well known cooking herb used to blend with other herbs to season almost any food. Started on June 3 the plants have just begun flowering and probably will not seed before frost. I've already harvested them once by picking off the top half and dried them like basil. Later, I will harvest them again. If they die this winter, I'll plant earlier next spring.

MINTS come in a great many of varieties. I planted several, including spearmint, peppermint, common or wild mint, lemon balm, and lemon thyme. Common spearmint and lemon thyme are viny, growing no more than 12" high, while Peppermint and lemon balm are free standing, reaching 2 to 3 feet tall. Each one has a different flavor and I've only begun testing the various tea combinations possible. Sprigs from each kind will be rooted in water and potted for fresh leaves during the winter. Since mints are perennial, they will come up next year.

MUSTARDS were essentially gifts. The white mustard came from a mustard seed spice jar, and the wild mustard weed was already in the garden. Planted June 3, the white mustard weed sprouted in 3 days. Unfortunately, I planted it too close together and failed to pick the seed pods when brown. Otherwise, the yield would probably have been better than marginal. The black mustards are free standing but the white mustards fall to the ground after growing about 1 ft. high. Because the black mustards are more pugnent than the white, I plan to use them as a white mustard substitute. Both mustards are dried and processed like dill.

OREGANO is somewhat like marjoram, except stronger and with minty overtones. It

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is a free standing perennial herb about 2 ft. in height. It germinates slowly and should be started indoors and early, which I did not do. None of my seed sprouted. Oregano is good in meats, sauces, soups, gravies, fish, and shellfish. It is dried like basil. This winter I am going to try to start some indoors for transplanting next spring.

PARSLEY is a well known herb that is often ignored. It is an excellent source of vitamins A, C, and iron. Parsley is a very leafy plant that grows about 10 inches high and takes 2 years to bear seed. I have grown some indoors for over 3 years now using only the outer leaves. It can be planted as early in the spring as the ground can be worked but it is better transplanted because it has to make long root-stock before it bears well. Drying parsley is simple but it takes a lot of leaves. Clip the stalk from the base and nip the leaves off the stalk. Lay leaves in a single layer on a baking sheet and dry in a 400°F oven for 5 min. Turn leaves halfway through. When dry, crush and store.

ROSEMARY grows slowly and will not be used until next year. I use it as a pot herb and move it outside in the summer. It grows only about a 1/2 ft. per year but eventually can reach a height of 3 to 5 ft. to look much like a fig tree. Rosemary adds a wonderful flavor to meats and poultry.

SAGE is the most noble of herbs. The Greeks and Romans used it as a wonder drug, and the Chinese bought it from the Dutch at 4 bales of Chinese tea to 1 bale of sage. Sage is a perennial, and will withstand winters down to -20°F, and bees love the bluish-lavender flowers amid the gray green leaves. Last winter I planted 6 seeds. Of the 4 plants that grew, I gave away 3 and kept one. The one I kept I planted outdoors on June 3 when it was about 1/2 ft. high. Now it's 2 1/2 ft. tall, bushy and has a spread of about 3 ft. I look forward to harvesting the top half for making herb tea and as an important ingredient in making turkey dressing. From now on, I intend to start a sage bush indoors each winter and transplant it outdoors each spring.

TARRAGON, an anise-licorice flavored herb, is another indoor herb. Outdoors in warmer climates it grows to about 2 1/2 ft. but indoors grows only about 1 ft. high. Tarragon requires more care than most herbs because it has to have good drainage, it has to be repotted 2 to 3 times a year, and it has to have at least 4 hours of sunlight each day. Since it does not bear a viable seed, Tarragon can be satisfactorily propagated only by root division. Despite its extra care its usefulness in the kitchen makes it well worth the trouble. Because it does not mix well with other herbs, use it by itself on meat, poultry, soups, and egg dishes.

THYME is a perennial that I planted outdoors on June 3. It is a creeping vine rarely growing more than 8 inches high. Like most of the other traditional herbs (e.g., sage, parsley, and rosemary), Thyme helps flavor almost anything from meats to rice. I planted it as a border around the other herbs and it has done quite well. Dry like sage, but use only the top half so the root can grow next year.

YARROW, a dill-like weed, is native to this area. The leaves are dark green and closely packed. The flowers are white, on umbels like Queen Anne's lace. Harvest during flowering, bunch, and dry like basil. Use with other herbs in teas.

Of all the plants I grew this year, the only ones I will not bring indoors or start inside are those of the large dill family (as fennel, caraway, anise, etc.) Overall, I met with success; when I did not, I learned something which should help me do better next year. Next year, other herbs I want to try are cardamon, sesame, bay, poppy, tabasco and pimento peppers. Hopefully, the above informations will encourage you to try herb growing. Long life and happy gardening.

* * * *

What looks like a hoary hand from a mummy, isn't. It's really a carrot that was put on the editor's desk by some unknown gardener. (Last issue we had an unusual cucumber.)

SPECTRAL LINES IN RADIO ASTRONOMY

YEAR	MOLECULE OR ATOM	SYMBOL	WAVELENGTH	RADIO TELESCOPE	
				LOCATION	SIZE
1951	Hydrogen (Neutral)	HI	21.1 cm	Harvard Obs.	Horn
1963	Hydroxyl	OH	18.0 cm	Lincoln Labs.	84 ft.
1964	Hydrogen (Ionized)	HII	3.4 cm	Lebedev	22 m
1966	Helium (Ionized)	He	18.0 cm	Harvard	60 ft.
1967	Carbon (Ionized)	C	6.0 cm	NRAO	140 ft.
1968	Ammonia	NH_3	1.3 cm	Hat Creek	20 ft.
1968	Water	H_2O	1.3 cm	Hat Creek	20 ft.
1969	Formaldehyde	H_2CO	6.2 cm	NRAO	140 ft.
1970	Carbon Monoxide	CO	2.6 mm	NRAO	36 ft.
1970	Cyanogen Radical	CN	2.6 mm	NRAO	36 ft.
1970	Hydrogen Cyanide	HCN	3.4 mm	NRAO	36 ft.
1970	X-ogen	(HCO+) ?	3.4 mm	NRAO	36 ft.
1970	Cyanoacetylene	HC_3N	3.3 cm	NRAO	140 ft.
1970	Methyl Alcohol	CH_3OH	36.0 cm	NRAO	140 ft.
1970	Formic Acid	CHOOH	18.0 cm	NRAO	140 ft.
1971	Carbon Monosulphide	CS	2.0 mm	NRAO	36 ft.
1971	Formamide	NH_2COH	6.5 cm	NRAO	140 ft.
1971	Carbonyl Sulphide	OCS	2.7 mm	NRAO	36 ft.
1971	Silicon Monoxide	SiO	2.7 mm	NRAO	36 ft.
1971	Methyl Cyanide	CH_3CN	2.7 mm	NRAO	36 ft.

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1971	Isocyanic Acid	HNCO	3.4 mm	NRAO	36 ft.
1971	Hydrogen Isocyanide?	HNC?	3.3 mm	NRAO	36 ft.
1971	Methyl Acetylene	CH_3CCH	3.5 mm	NRAO	36 ft.
1971	Acetaldehyde	CH_3CHO	20.0 cm	NRAO	140 ft.
1972	Thioformaldehyde	H_2CS	9.5 cm	Parkes	210 ft.
1972	Hydrogen Sulphide	H_2S	1.8 mm	NRAO	36 ft.
1972	Methanimine	CH_2NH	5.7 cm	Parkes	210 ft.
1972	Sulphur Monoxide	SO	3.0 mm	NRAO	36 ft.
1973	Methyldadyne	CH	9.0 cm	NRAO	140 ft.
1973	Methylamine	CH_3NH_2	3.5 mm	NRAO	36 ft.
1973	Ethynyl	C_2H	3.5 mm	NRAO	36 ft.
1974	Dimethyl Ether	H_3COCH_3	3.3 mm	NRAO	36 ft.
1974	Silicon Monosulphide	SiS	2.8 mm	NRAO	36 ft.
1974	Unnamed	N_2H+	3.2 mm	NRAO	36 ft.
1974	Ethyl Alcohol	CH_3CH_2OH	3.2 mm	NRAO	36 ft.
1975	Vinyl Cyamide	CH_2CHCN	21.8 cm	Parkes	210 ft.
1975	Methyl Formate	$HCOOCH_3$	18.6 cm	Parkes	210 ft.
1975	Sulphur Dioxide	SO_2	3.6 mm *	NRAO	36 ft.
1975	Nitrogen Monosulphide	NS	2.6 mm	NRAO	36 ft.
1975	Cyanamide	NH_2CN	3.0 mm	NRAO	36 ft.

* Several lines but 3.6 mm is strongest line