The OBSERVER

VOL. 18, No. 1 MARCH 1977 PAGE 1

In grateful recognition for 10 YEARS faithful service 20 YEARS

Left to Right: Lewis Beale, James Garland, Dave Heeschen, Duane Sizemore, John Findlay, Mary Ann Starr, Ralph High, Dwayne Scheibel.

Story on Page 2.

SERVICE AWARDS

Bob Moore

The tenth annual NRAO Service Awards Banquet was held in the Green Bank Cafeteria on January 14, 1977. The event honored employees who completed ten and twenty years of continuous service as of December 31, 1976.

Certificates and lapel pins were presented to the ten year awardees by Dave Heeschen, Director, NRAO. Dave also presented a twenty year award to John Findlay. Ken Kellermann presented a twenty year award to Dave Heeschen. In spite of inclement weather, the event was well attended.

Twenty Year Awardees

John W. Findlay
David S. Heeschen

Ten Year Awardees

Lewis C. Beale
James W. Garland
Ralph F. High
Dwayne R. Schiebel
Richard D. Sizemore
Mary Ann Starr

This brings to 129 the number of employees who have completed ten or more years of service. Of this number 3 have completed 20 years. 112 of the 129 are still employed by the NRAO.

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THE FUNDAMENTAL CONSTANTS OF PHYSICS: ARE THEY CONSTANT?

Robert L. Brown

In the most general sense the study of science--or natural philosophy--has as its purpose an elucidation of the nature and character of the world around us and the things in it. In the case of the particular scientific discipline most familiar to us, astronomy, the name of the game is to discover and describe the large-scale nature of the universe--stars, clusters of stars, galaxies, clusters of galaxies, and so forth. Other branches of the physical sciences, most notably physics, concentrate instead on describing the nature of matter on the microscopic and sub-microscopic level. Given the fact that astronomers are eagerly attempting to unravel the principles of the universe on the largest scale while physicists are equally enthusiastically pursuing the study of matter on an increasingly smaller scale, it would appear at first blush as if the ground commonly plowed by astronomers and physicists was getting ever smaller. But this is in fact not the case; nor can it ever be the case owing to the fact that physics and astronomy share a common foundation.

There are a few "laws of nature" so fundamental that they transcend the scale on which they apply. Among these are, for example, the Gravitation principle: two masses will attract each other with a force that is proportional to the product of their masses and inversely proportional to the square of their separation. This law holds irrespective of whether the "masses" are galaxies containing a hundred billion suns and separated by millions of light years or two atomic particles separated by a small fraction of a millimeter. A similar law holds for the force between two charged particles. Other fundamental physical principles are of a more experimentally defined character. For instance, the atomic particle we call an electron has a unique mass and charge (call them m and e respectively) irrespective of whether that electron is found meandering alone in the cosmos or is bound in the terrestrial rock. Other such examples are (1) that the speed of light c has a particular and well-defined value as measured in the laboratory on earth or anywhere else in the universe, or (2) that the energy E of a particle or wave is related to its characteristic frequency f by the equation E=hf where h is called Planck's constant and again h has a very specific value which one believes to be the same everywhere.

But I said we believe these numbers, these constants of physics e, m, h, c to have the same values everywhere in the universe that they have on earth. It seems that they represent physical concepts so fundamental that they must apply unaltered everywhere in the universe, and they must have applied at all times in the evolution of the universe as well. But can we prove this assertion? Or --a prudent person may inquire--is it necessary to prove anything so fundamental?

Necessary? Obviously not. But desirable? Yes, certainly.

In 1937 Dirac was struck by what he regarded as a most remarkable coincidence between two numbers that are formed from ratios of the fundamental physical constants that are the same irrespective of one's standard of length, mass, or time. These numbers are first, the ratio of the electric and gravitational forces between an electron and a proton

$$e^2/GMm = 2.3 \times 10^{39}$$

and the magnitude of the present age of the universe T expressed in any quantity with the dimensions of time that can be constructed from fundamental atomic constants, e.g.,

$$T/(e^2/mc^3) = 6.7 \times 10^{40}.$$

While these two numbers are not of course equal, they are close enough that Dirac regarded the similarity more than simply fortuitous. Rather, he speculated, the agreement reflects a casual relationship between the fundamentals of cosmology, gravitation and electromagnetism and, if so, then owing to the changing age of the universe the coincidence of the numbers can be preserved only if one or more of the fundamental constants varies with time.

The time variability of the fundamental

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constants over time scales comparable with the age of the universe can be uniquely tested by astronomical observations. This results from the fact that when we observe very distant objects we are looking at the light (or radio waves) that were emitted eons ago. Extragalactic sources are distant from us both in space and time. To carry out these tests the required observations are the redshift of an object computed from its spectral lines emitted in the optical part of the spectrum and the redshift of the same object as determined from the 21-cm radio line. Although the manner in which these tests could be made has been known for many years, the limits have not been particularly interesting because the hydrogen 21-cm line could not be detected in any very distant objects. However, recently all this has changed.

At the suggestion of E. M. Burbidge, several of us at the observatory (Mort Roberts, Martha Haynes, Bill Brundage, Arnold Rots, Art Wolfe, and myself) looked for the 21-cm line in absorption toward the BL Lac object AO 0235+164. The optical spectrum of this object Dr. Burbidge and her collaborators found consisted of a smooth emission continuum superposed on which were several very narrow absorption lines attributed to absorption by once-ionized magnesium, iron, and manganese at a redshift of 0.524. It appeared that the 21-cm line could be detected toward this object because the gas that gave rise to the optical lines was apparently cold, present in great quantity, and was dynamically quiescent. At the redshift of the optically absorbing gas the 21-cm hydrogen line would appear at 932 MHz so we began a search for this line on the 300-foot telescope with the 740-1000 MHz tunable receiver. The spectrum we obtained is shown in the accompanying figure.

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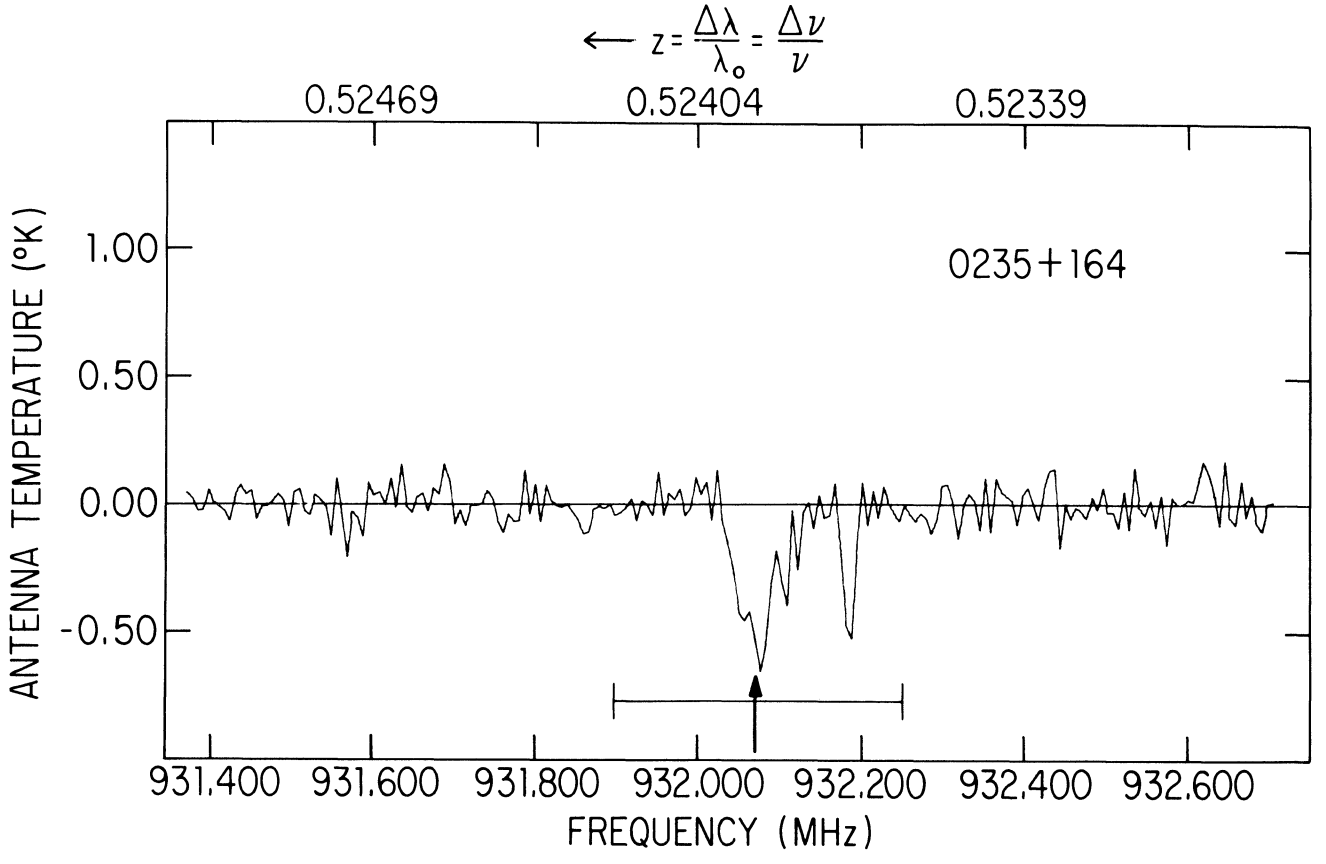

21-cm absorption line in AO 0235+164, BL Lac object

Here you can see that the radio line is seen in absorption and that it consists of several components each of which is very narrow. The frequency at which we would expect to see the 21-cm line based on the optically determined redshift is shown by the arrow on this figure--the length of the horizontal bar represents the uncertainty in the optical measurement. Note that the optical and radio redshifts are in remarkably good agreement.

What does this say about the constancy of the physical constants?

The frequency of the optical magnesium lines depends on the fundamental constants through the Rydberg constant

$$F(Mg^{+}) \propto R$$

while the frequency of the hydrogen line depends on the constants in a more complicated way

$$f(H) \propto R\alpha^2 g(m/M)$$

where α is the fine structure constant $\alpha = 2\pi e^2/hc$, and m and M are the mass of the electron and proton respectively and g is the form factor of the proton (another "fundamental constant"). Hence by comparing the observed wavelength of these 2 lines in the laboratory and in the absorbing gas toward AO 0235+164 which is distant (in time) from us by about 7 billion years (assuming the redshift is representative of the Hubble expansion of the universe) we may conclude that the product of atomic constants ($\alpha^2 gm/M$) has varied by less than 2 parts in 10^{14} per year over all this time. The most straightforward implication is that this limit also applies to the variation of any one of the quantities e, m, M, c, h, and g.

As a result of this observation it is our conclusion that the fundamental atomic constants are indeed constant. They have the same values on earth as they do in an object located nearly across the universe from us, and they have the same values now as they did shortly after the expansion of the universe began.

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GREEN BANK RECREATION NEWS

Ray Hallman

Your new Recreation Association Board of Directors has been busy hammering out the activities calendar for 1977. Among the activities that are planned within the next few months are:

MOVIES! There have been movies each month since November, except December. More are planned for the fall. We need movie title suggestions from those interested in this function. Please contact our movie committee: Dave Shaffer, Winston Cottrell, and Cliff Barkley.

BINGOS! There will be bingos this year, the first one being scheduled for March 12, with $300 worth of prizes. You may make comments regarding these events to the bingo committee: Janet Warner, Harry Wooddell, and Wendell Monk.

HUMANITIES! Excellent humanistic programs sponsored in part by the West Virginia Arts and Humanities Council and your Recreation Association will be presented at the Observatory and at local area schools. The "Booger Hole Revival" is one program that we hope to present in April. Your suggestions are welcome to your humanities program committee: Omar Bowyer, Bruce McKean, and Dave Shaffer.

EASTER EGG HUNT! For ages 0-13 years in three groups at the Rec Area, at 2:30 p.m., Sunday, April 3. There will be prizes and 264 colored eggs! If you're older, come and watch the kids scramble. Comments may be made to the Easter egg committee: Janet Warner, Bruce McKean, Cliff Barkley, and Winston Cottrell.

DANCES! Starting with one in May. In June a special pot-luck picnic and outdoor dance at the Rec Area shelter with Roland and Larry Armstrong's "Hillbilly Rangers". Your comments may be directed to the dance committee: Janet Warner, Dave Shaffer, and Cliff Barkley. Your suggestions for any good bands and entertainment would be greatly appreciated.

PICNICS! Bring your own food and nibbles to swap, for the picnic in June as mentioned above. The NRAO Annual Picnic will be a gala event scheduled for July. Your comments may be directed to any director.

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Anyone who doesn't have a current Membership Card should contact Janet Warner.

Remember, the 11 directors serve on the Board in an entirely voluntary function which shows the directors' interest in serving you, the employees of NRAO. Your suggestions are treated with great interest, with some directors volunteering to spearhead some suggested activities. If your activity or suggestion is not implemented, it probably means that no Board member was interested in directing your specific suggested activity. This doesn't mean, however, that your suggestion is dead. You, the suggester, may be willing to undertake the responsibility for a project. Remember any employee may help with any approved project with the gratitude and appreciation of the NRAORA directors and employees. It is important to the Board that all activities be executed to the fullest benefit of all employees of NRAO! A suggestion box is provided in the reception area of Jansky Lab. Also, you as an NRAO employee are most welcome at any Board of Directors meeting.

You have a new Board of Directors as of the first of the year!

Your directors assuming their role in the March 21 meeting. Around the table from left: Winston Cottrell, Harry Wooddell, Dick Hiner, Regie Atkins, Wendell Monk, Ray Hallman, Omar Bowyer, Dave Shaffer, Bruce McKean, Janet Warner.

1977 NRAORA BOARD OF DIRECTORS

Members	Function
Ray Hallman	President
Omar Bowyer	Vice President; Finance Committee Chairman; Humanities Committee Chairman
Janet Warner	Secretary; Bingo, Dance, Egg Hunt Committees
Dick Hiner	Treasurer
Harry Wooddell	Finance, Dance, Bingo Committees
Regie Atkins	By-laws Committee
Bruce McKean	Central Purchasing Officer; Humanities Committee
Winston Cottrell	Finance, Movie Committees
Wendell Monk	Local Sports Advisor; Finance and Bingo Committees
Cliff Barkley	By-laws, Bingo, Egg Hunt, Dance, Movie Committees
Dave Shaffer	Remote Sports Advisor; By-laws Committee Chairman; Movie Committee Chairman; Dance and Humanities Committees

* * * * *

A MICROWAVE AIRCRAFT LANDING SYSTEM FOR THE 1980'S

John Brooks

As you are all probably aware by now, Mike Balister recently returned from an 18 months stay in Australia working for the Division of Radiophysics, CSIRO. I recently joined the electronics division at Green Bank from Radiophysics and so might be classified as one of the bad habits Mike picked up in Australia. I will take this opportunity to warn readers that Australian humour is fairly dry, mostly sarcastic, and often crude. I've deleted the crudities at the request of the Editor, but the rest will have to stay.

Australia is situated in the South Pacific Ocean, a long way from everybody, and in a continent roughly the size of mainland USA our population is about 13½ million. Most of the inhabitants cluster around the coastal regions, mainly on the east coast. The largest city in Australia is Sydney - a city of about 3½ million people, and incidentally, where the Division of Radiophysics is located.

This division, the Australian counterpart of NRAO, is part of an organization called the Commonwealth Scientific and Industrial Research Organization which is funded by the Federal Government. The CSIRO has 40 divisions in all, and employs about 8,000 people. Most divisions, e.g., Animal Husbandry, Food Research, etc., are involved in solving problems connected with primary and secondary industries. Whereas, Radiophysics until quite recently was unique in being the only division doing pure research, e.g., radio astronomy.

About five years ago Radiophysics became involved in the quest for a Microwave Landing System for civil aircraft. This involvement was prompted, no doubt, by the changing political structure in Australia. At that time a division doing pure research may have had difficulty in justifying its existence. I would now like to briefly describe some aspects of a new microwave landing system.

In 1973, member countries of the International Civil Aviation Organization (ICAO) were invited to submit proposals for a worldwide aircraft instrument landing system to be introduced about 1980. Australia's proposal has the name INTERSCAN, derived from 'time INTERval SCANning' which describes its method of operation. The device was invented and developed by the Division of Radiophysics at the request of the Australian Government Department of Transport (roughly equivalent to the American FAA). After a great deal of discussion and mutual collaboration, over a two to three year period, between Australia and America, the FAA decided that America's proposal would be essentially the same as Australia's, but with a slightly different method of generating the signal in space.

The basic requirements for a blind landing system could be set down as follows:

1. An accurate measurement of distance from a specified point near the runway (out to 30 nautical miles).
2. Accurate measurement of azimuth angles with reference to the runway centerline (± 60° azimuth angle coverage).
3. Accurate measurement of elevation angles from a point beside the runway near the touchdown zone (0° - 20° elevation angle coverage).
4. Especially accurate measurements of height throughout the touchdown zones to give guidance during the plane maneuver (i.e., the flattening of the glide path before landing).

All this information must be updated at least 5 times per second. Requirement (1) is achieved by a highly accurate conventional radar. Requirements (2), (3), and (4) present the problem of angle measurement which is the heart of the new landing system.

Taking the azimuth system to demonstrate the concepts, we can see with the aid of Figure I that the INTERSCAN solution is achieved by generating a narrow beam of radio energy and scanning it "to" and "fro". Any aircraft in the coverage zone receives two pulses of energy and its azimuthal position is directly related to the time interval be-

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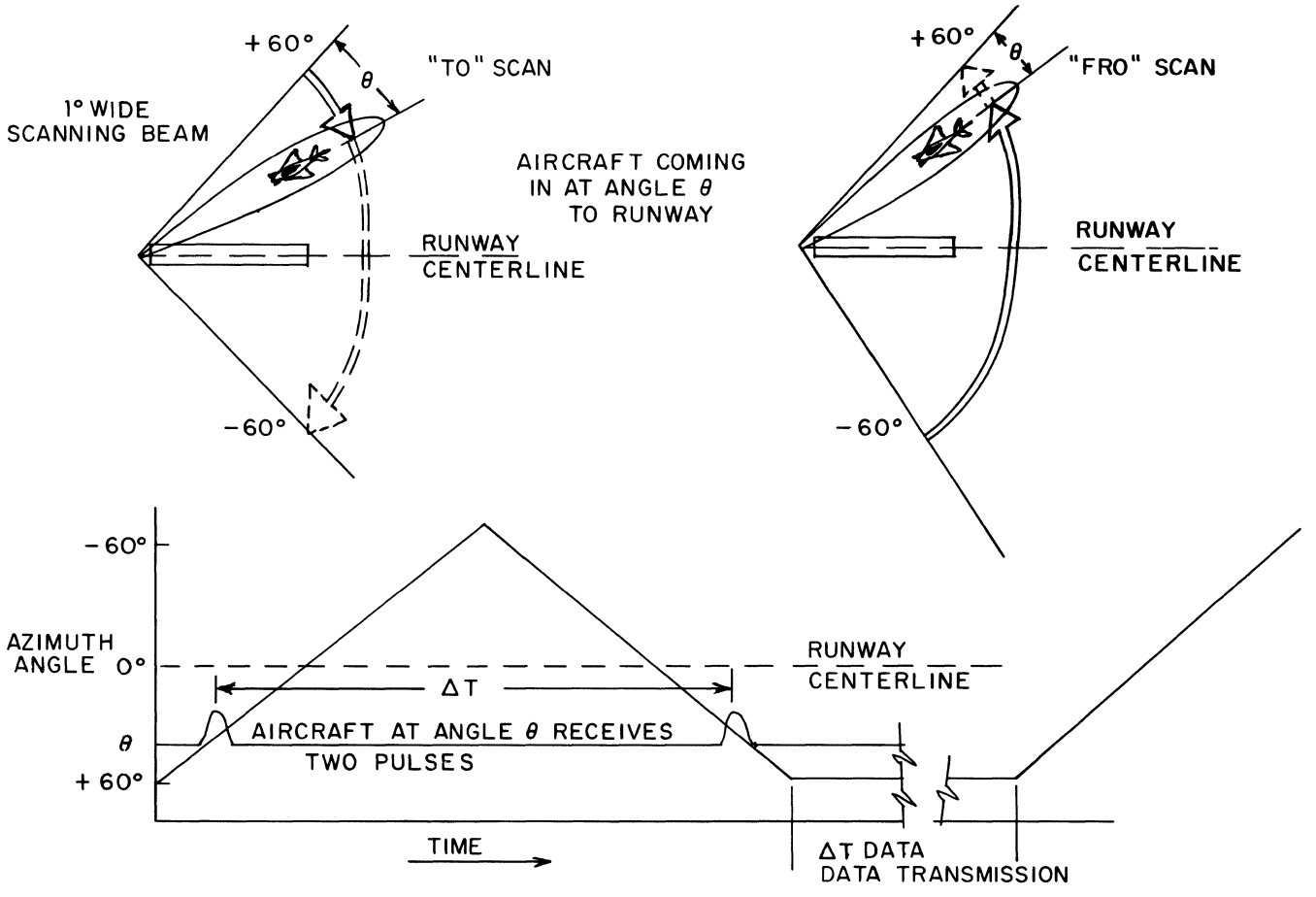

AIRCRAFT AT ANGLE Θ RECEIVES TWO PULSES SPACED BY A TIME INTERVAL ΔT. SINCE THE SPEED OF THE SCANNING BEAM IS KNOWN, A SIMPLE CALCULATION WILL DETERMINE THE AIRCRAFT'S AZIMUTH POSITION. THE TIME INTERVAL T DATA IS MADE GREATER THAN THE TOTAL TO-FRO TIME SO THAT AMBIGUITY IN THE PULSES MAY BE AVOIDED.

FIG. 1

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tween the two pulses. The elevation scanning beams are obtained by a similar configuration to the azimuth case operating in the vertical plane. The angular accuracy of the system is better than .02°, which means with an azimuth system installed at one end of a runway, say 10,000 feet long, an aircraft can be guided to within ± 1½ feet of the runway centerline!

Of course, while Australia and America have been busy developing this landing system, the rest of the world, particularly Great Britain, has also been working on alternate systems. When the expected turnover for the first year of marketing such a landing system is estimated to be $1,500,000, it is no wonder so much effort is being expended!

At present the indications are that the All Weather Operations Panel (AWOP), the technical panel of ICAO, who have to choose the best system, are deadlocked. However, the final vote is yet to be taken and I'm sure that there will be intensive lobbying between now and then (probably early March 1977) to persuade some of the abstainers in the voting to change their minds.

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POCAHONTAS COUNTY

Pocahontas County, named for the famous Indian Princess, was formed in 1821. Before the white settler came, Pocahontas was the hunting ground of the Shawnee Indians whose home was in Ohio. The original Indian Trail, known as "The Warriors' Road", established by the Iroquois along the mountains from northern New York to Georgia, went through Pocahontas and may be seen at several points still today.

Varying from 2000 to 4842 feet above sea level, Pocahontas County has an average altitude exceeding that of any other county east of the Rockies. It lies on the eastern border of West Virginia, slightly south of center, and is the third largest county (area) in the state. Its 942.61 square miles contain a score of mountain peaks above 4000 feet, copious springs, beautiful mountain streams, 55 caverns, the famous Cranberry Glades, interesting geological formations and fossils, and its beauty of mountains and valleys is unsurpassed. It is known as the "Birthplace of Rivers" for from its highlands flow the Tygarts, Cheat, Elk, Greenbrier, Williams, Cranberry, Cherry, and Gauley Rivers westward to the Ohio, while a very small area drains to the east into the Potomac and James.

Pocahontas is bounded by Pendleton, Randolph, Webster, and Greenbrier Counties, and on the east by the State of Virginia. The eastern part of the County lies in the folded Appalachians and the western part in the Appalachian Plateau with the Greenbrier River as the approximate dividing line. Irregularly shaped, the greatest length of the county is 56 miles and its greatest width about 30.

The average annual rainfall is 49 inches. Winters are relatively mild in the valleys, more severe at the higher elevations. Summer weather is ideal, one of the county's intangible assets "marketable" to city dwellers and those living in lower altitudes.

Of its 942.61 square miles--603,270 acres--over a half are owned by the United States of America and the State of West Virginia. The Monongahela National Forest covers 277,037 acres, Seneca State Forest 11,186 acres, Calvin Price State Forest 10,658 acres, Watoga State Park 10,057 acres, National Radio Astronomy Observatory 2,650 acres, Droop Mountain Battlefield 269 acres, and Edray State Trout Hatchery 28 acres. Of the remaining land, 179,457 acres are in farms, of which 38,420 acres are in cropland, 51,341 acres in pasture, and 85,957 acres are in woodland. There are 1,526 acres in water, and 1,476 acres taken up by municipalities, and business and industrial sites.

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He who can no longer pause to wonder
and stand rapt in awe is as good as dead.

--Albert Einstein

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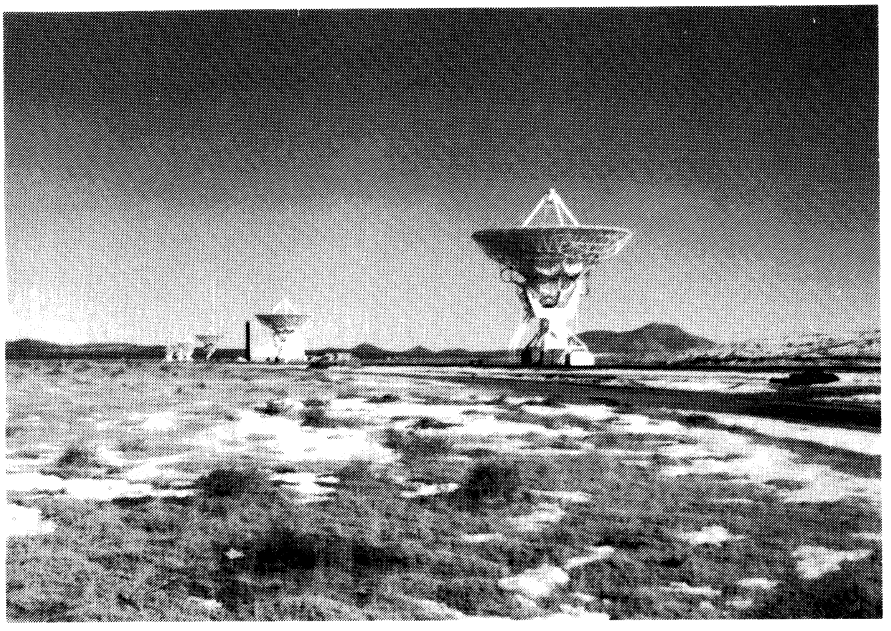
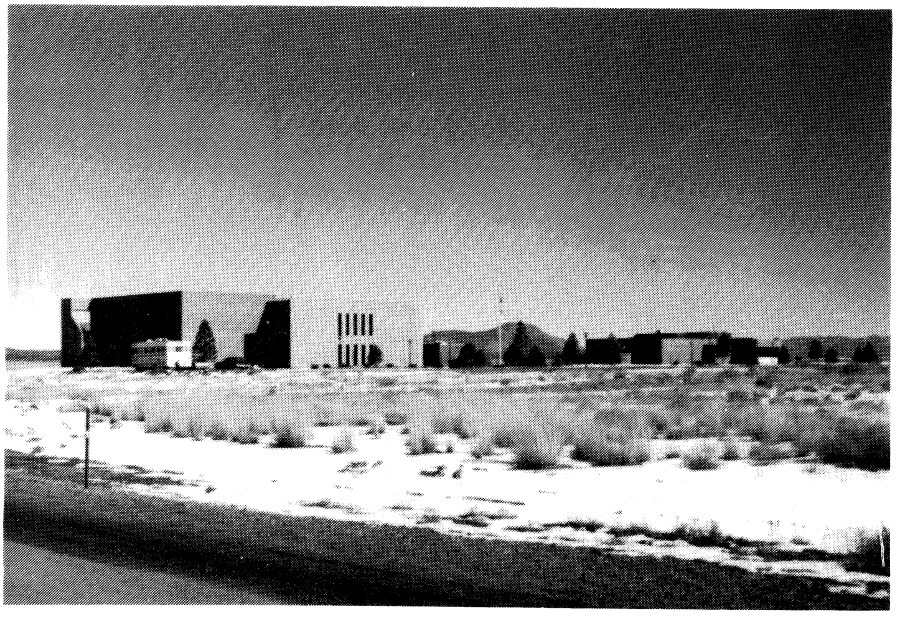
VLA - CIRCA DECEMBER 1976, JANUARY 1977

photos by Dave Coombs and Skip Lagoyda



To the right of the first antenna is Tres Montosas with the Gallinas Range in the background. The second antenna (also on the west arm) is framed by the Assembly Building.

Looking in the same general direction the Tres Montosas again is evident between the Control Building on the left and the Cafeteria on the right. That thar in the foreground is broom grass sprouting from the snow.



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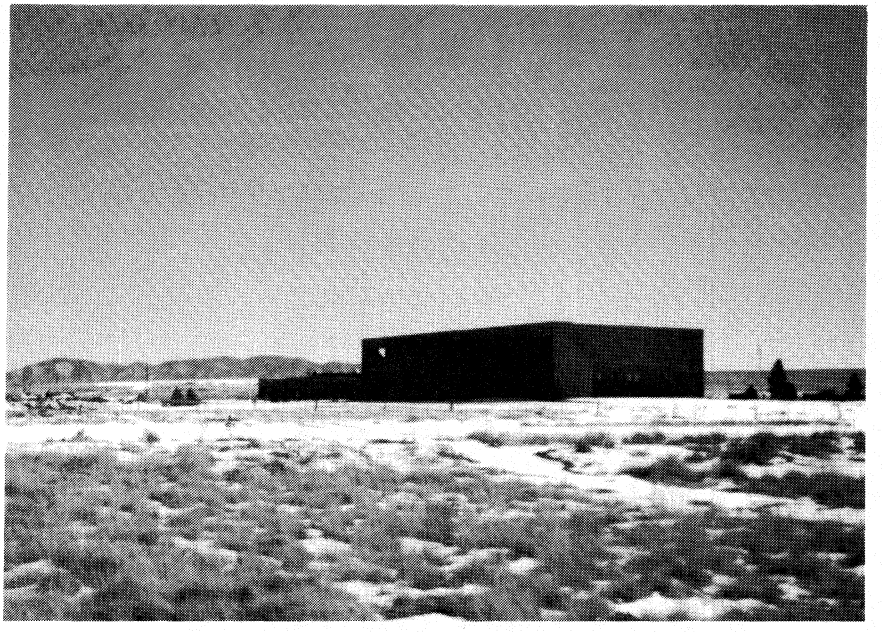

This is the reverse side of the Control Building showing the San Mateo Mountains to the left. Those pines in this picture as well as the preceding picture are not native to the Plains but are imported from northern New Mexico as part of the landscaping accomplished this past summer.

Looking down the east arm of the Wye one can see snowcapped South Baldy, 10783', in the Magdalena Mountains.

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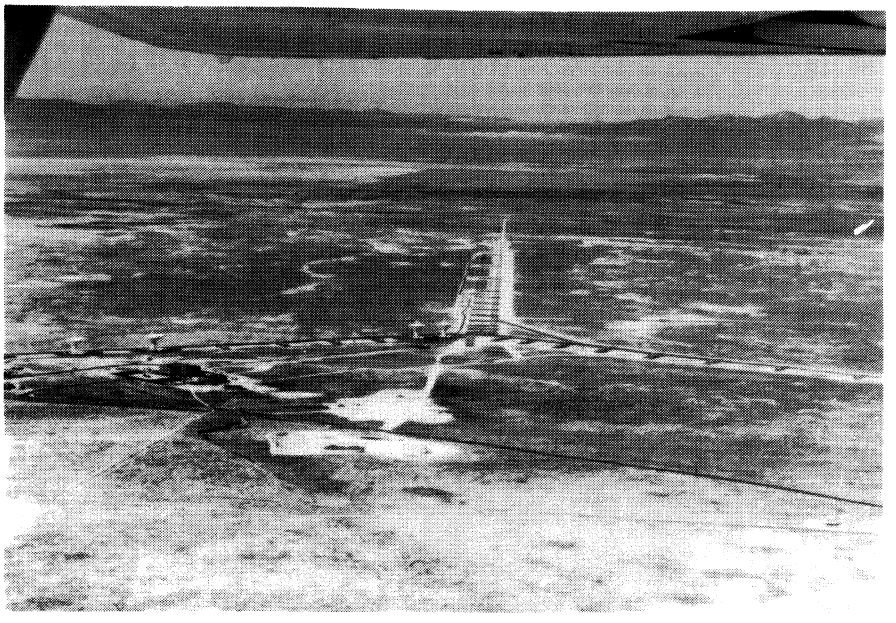
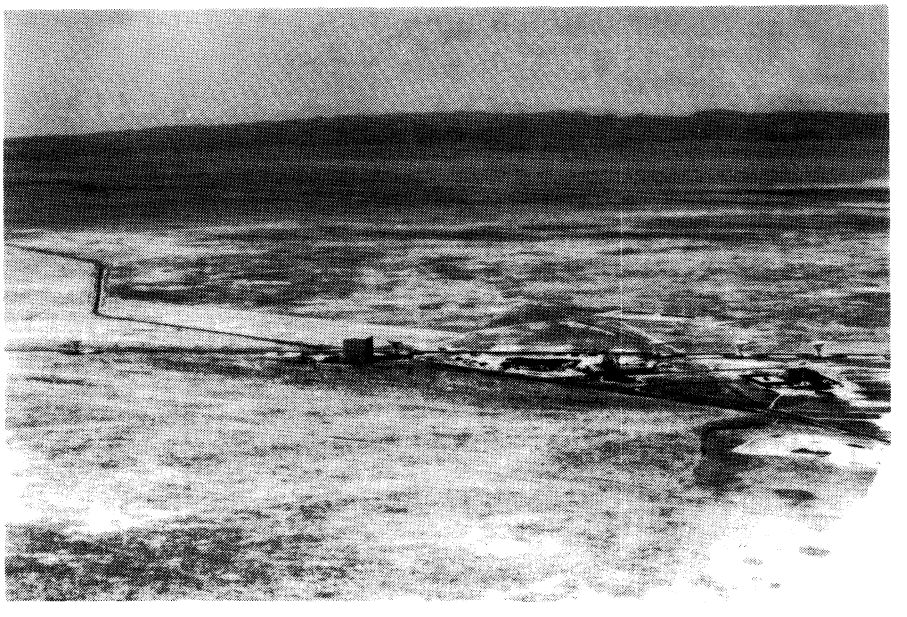


This is looking up the north arm (that is really not N at 0° but 355°).



This shot of the complex is of the west arm and off in the distance are the Datil Mountains.

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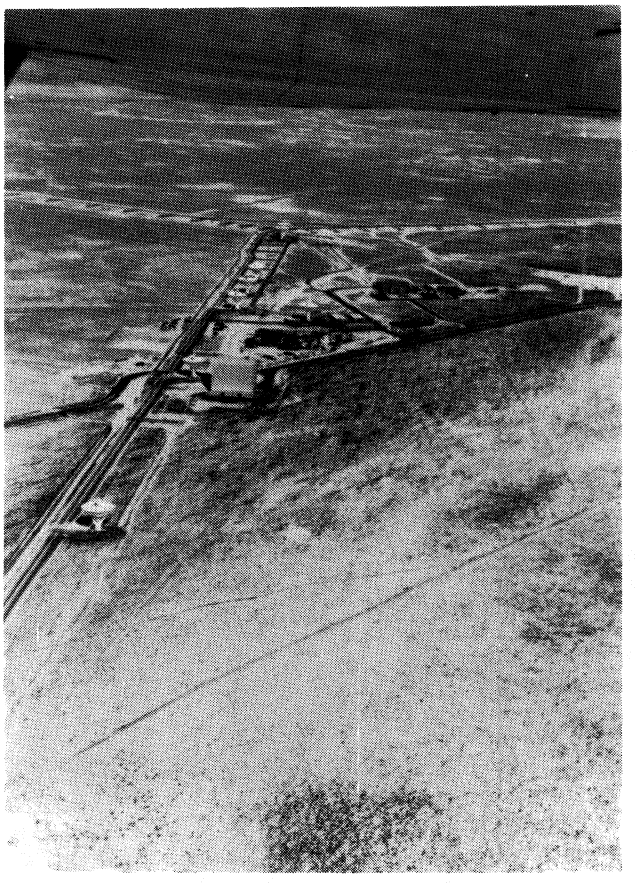
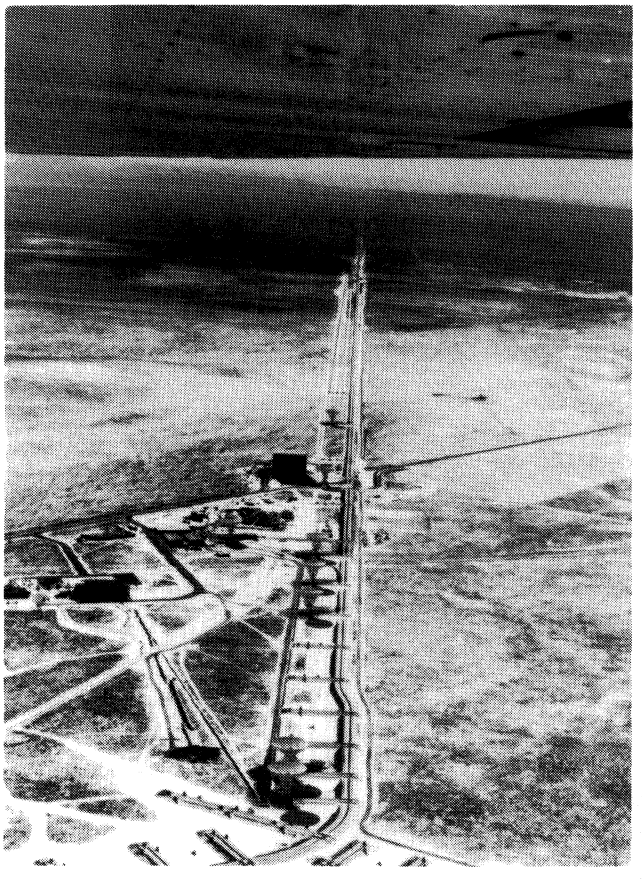


The west arm looking towards the center of the Wye. Number 9 antenna just out of the assembly building, 6 antennas on the west arm and 1 on the maintenance pad. (No, I didn't goof, the other antenna is in the south pasture and over the hill on the west arm.)



This is just the reverse.

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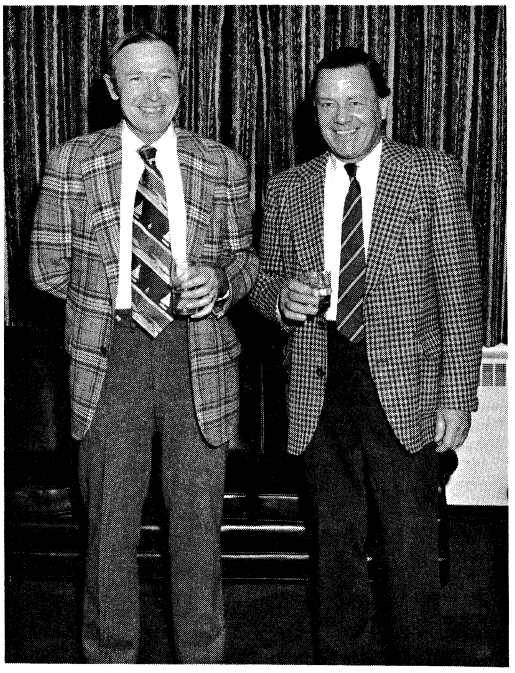
THE FIRST TWENTY YEARS

J. W. Findlay



"FOUNDER MEMBERS"
Dave Heeschen and John Findlay

The photograph shows that two of the "founder members" of NRAO have survived the first 20 years, and it also allows us, if we wish, to start publishing short notes with the title "20 Years Ago Today".

Twenty years ago in January 1957 the plan and work to build NRAO at Green Bank had been a reality for several months. The planning, of course, goes back before that (see Richard M. Emberson's article in Science, November 13, 1959, Vol. 130, No. 3385, pages 1307-1318). The real start at building was the first contract between the NSF and AUI to build and operate the Observatory and this was signed in November 1956.

By January 1957 David S. Heeschen, Richard M. Emberson, and John W. Findlay were all working for AUI in its central office on the 72nd floor of the Empire State Building. DSH had joined AUI from Harvard in the summer of 1956 - he continued to live in the small town of Harvard, near the Agassiz radio telescope, for several months until he moved to Green Bank. JWF came to the U. S. at the end of 1956, having been recruited to the project by Lloyd V. Berkner, the president of AUI. RME was Lloyd's right-hand man in AUI. He is now on the HQ staff of the IEEE in New York.

All the early work of studying and planning for NRAO had been done by RME working under Lloyd's general guidance. Sometime I shall write more fully of the debt that U. S. scientists owe to Lloyd Berkner and to those associated with him and with AUI in those early days. I believe it is not an over-statement to say that NRAO would not exist had it not been for Lloyd's efforts.

The first weeks in New York were full of a variety of tasks. The 140-foot design was already essentially decided, as far as its concept went, and the work on preparing the design for bidders was going ahead. The design engineer was Professor Ned L. Ashton of Iowa State University. The project had help from M. Karelitz of Brookhaven and of course was overseen by at least one committee.

Within AUI the early days of NRAO were watched over by Lew Burchill (who died in 1975) and Charles Dunbar, who is retired and lives not far from Brookhaven. When we began we had help from Lynn Bruhn, Mary Beth Fennelly, and Jean Corwith in New York.

Perhaps the first thing we did to modify the original NRAO plans was to buy the first 85-foot telescope. DSH and I met for the first time at an AAS meeting in New York in January 1956, and almost at once we said we should try to buy a telescope - in advance of the completion of the 140-foot. Things went so fast in those days that we had the word - yes - from Lloyd (who was acting as director of the non-existent observatory) within weeks. We were thus able to join JPL and Fred Haddock in buying one of the first three 85-foot antennas built by Blaw Knox.

By May 1957 DSH and I decided to move our operations to Green Bank. The land buying was going ahead, and we asked the Corps of Engineers to get us the use of the Kessler House (then empty) for offices. This

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they did. Lewis Taylor, Grover Taylor, and others cleaned out the coal, and built me an electronics lab in one of the attached rooms. French Beverage was hired to drive us around, and Harry Wooddell followed shortly. Beaty was almost our first secretary (my recollection was that "barefoot" Colley was the first), and Swede Westman was our construction man.

By the ground-breaking on October 17, 1957 we were deep in the mud - but we had started.

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NRAO ROUNDUP

Reprinted from the NRAO Quarterly Report for October 1, 1976 - December 31, 1976:

ELECTRONICS DIVISION

Charlottesville

Work is continuing on the VLB Mark III system. The objective is to have sufficient equipment built and tested to run a VLB experiment between Green Bank and Haystack mid-1977.

Development of Model 4 autocorrelator is continuing.

Testing of U. Va. Josephson junction devices has continued, and at the moment is directed towards getting reliable DC operation of the device when mounted in a 100 GHz mount at a temperature of 4 K.

A subharmonically pumped mixer for 230 GHz is being developed. This type of mixer is attractive because it is driven at half the signal frequency and consequently sufficient LO signal can be supplied using currently available klystrons.

The Tucson operation has been supported with the supply of diode assemblies for all the cooled mixer receivers. An evaluation of the assembly has been made in order to improve the reliability of operation when cooled.

Tucson

During this quarter several projects have been completed and tested at the telescope.

A quasi-optical polarizer has been constructed for 100 GHz. Rotation of a quarter wave plate that is positioned in front of the receiver feed switches the receiver between RH circular and LH circular polarizations. The addition of a second plate allows the receiver to switch between orthagonal linear polarizations. The switching rate is 0.5 Hz which proves to be sufficiently fast for continuum work under good atmospheric conditions. The polarizer has been tested in both modes on the telescope and gives good performance. Several more plates are being constructed for different frequencies.

The 9 mm, four-channel receiver has been tested on the telescope. The double sideband noise temperature of the four channels was somewhat better than anticipated, varying from 450 K to 500 K. The bandwidth of each channel is 1.1 GHz. The receiver performed well on the telescope although the overall sensitivity was somewhat less than we had anticipated. The reasons for this are currently being investigated.

The 128-channel, 30 kHz filter bank has been tested at the telescope and performs well.

The 33-50 GHz/80-120 GHz receiver is almost finished, and if no further diode problems are encountered it should be complete within the next three months. This receiver has been modified to permit the mounting of a high-frequency room temperature mixer on top of the dewar enabling us to take advantage of the low noise I.F.

A 130-170 GHz room temperature mixer receiver with cooled I.F. amplifier is currently being assembled, and should be available for evaluation soon.

Green Bank

Improvements have been made on the 6/25 cm and 9 cm receivers after the first observing sessions.

The electronics for the 300-foot telescope tower level is complete and awaits integration with the computer. Nearly all of the interface electronics are constructed between the 140-foot on-line Modcomp and existing equipment. Mark III VLB terminal I.F. electronics work is well underway.

The superconducting magnet and refriger-

--*continued, next page*--

ator for the first NRAO-built 18-25 GHz maser were delivered by cryogenics and the Green Bank shop in December. The AIL study of an 8 to 11 GHz upconverter is going more slowly than expected, but shows promise of a working system. Parts procurement and design of the NAIC 6/25 cm receiver is proceeding.

A complete overhaul was performed on the cooled 21-cm receiver and some housecleaning was done on the 250-500 MHz receiver to improve its sensitivity.

Design and performance studies of a C-band upconverter, waveguide losses, and Cassegrain feeds were begun this quarter.

ENGINEERING DIVISION

Routine engineering assistance was provided Green Bank, Charlottesville, and Tucson operations. Field engineering support was given the VLA project. Conceptual design and research continued for a 25-meter millimeter telescope structure, astrodome, surface panels, and radome materials. Further research along with modification of the design and specifications of a deformable sub-reflector for the 140-foot telescope was continued.

COMPUTER DIVISION

300-foot telescope - An on-line data processing system will be installed at the 300-foot telescope. The system will be nearly identical to that now in use at the 140-foot telescope. The computer has been procured. Installation will be scheduled for late spring.

VLA post-processing - Work has begun on preparing programs for VLA post-processing programs to analyze data, particularly map data, prepared by the DEC 10 at the site. For the present, however, efforts are concentrated on preparing programs similar to the Green Bank interferometer package to aid in the test and calibration of the instrument. These programs will be used for approximately one year.

140-foot telescope - Work is progressing on the software for the replacement of the DDP 116 control computer. Installation of the new system is planned for spring of 1977.

- The first edition of a manual describing the operation of the on-line data processing system has been completed, and will be available soon.

Optical/hybrid processor - A design review was held between personnel from NRAO and ERIM (Environmental Research Institute of Michigan) in mid-December. The design work should be completed in the next few months. The special processor is being investigated for use with the VLA data.

VLA PROJECT

Antennas No. 7 and No. 8 were accepted from E-Systems during the fourth quarter, and the electronic outfitting of antenna No. 6 has been completed. On October 18, 1976 a four-element array obtained first fringes. On December 9, 1976 a five-element array was successfully operated. Following this, station BW8 was occupied by an antenna, and on December 12, 1976 the five-element array operated with maximum spacing on a 5.2 km baseline.

The Electronics Division has successfully completed the redesign of the L-2 and L-3 modules of the local oscillator system. The measured phase stability has improved by a factor of 10 over the previous design.

The Phase III construction is now 99% complete, with the subcontractor mainly involved in final alignment of the wye trackage. The waveguide installation is now completed along the southwest arm from the center of the wye to station BW8.

An open house for the public was held on Saturday, November 7, 1976 with over 2000 people attending.

JANSKY LECTURE

Professor Edward M. Purcell delivered the Eleventh Annual Karl G. Jansky Lecture on November 10, 1976 in Charlottesville. His lecture topic was "A Story of Spinning Particles, from Protons and Electrons to Interstellar Dust".

Professor Purcell, Gerhard Gade University Professor at Harvard University, is an experimental physicist known chiefly for his work in nuclear magnetism and radio astronomy. Purcell shared the 1952 Nobel Prize in Physics with Felix Bloch of Stanford for their independent discovery of nuclear magnetic resonance. Most of his career has been spent at Harvard, where he received his

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Ph.D. in 1938.

Professor Purcell has served on several national advisory committees. He has been involved in innovations in physics teaching and was awarded the Oersted Medal for the American Association of Physics Teachers in 1968. In 1970 he was president of the American Physical Society. He is a member of the National Academy of Sciences, the American Philosophical Society, and the American Academy of Arts and Sciences.

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GREEN BANK WEATHER

John Brooks

Since arriving here from Australia we have been constantly asked how do we like Green Bank weather. The temperature in our home town of Sydney is currently averaging 90° F, so perhaps my feelings can be explained as follows:

In the central desert regions of Australia, although the days may be quite warm, the nights can be fairly cold. In these areas there are still a few tribes of aborigines and these people describe how cold a particular night might be by stating how many dogs are brought into their huts to sleep with them for extra heating, e.g., a two dog night. After the past six weeks here in Green Bank, I can't think of a better place for a dog importer to set up business.

Although it is probably not the place, I would like to thank all our friends and neighbors for their help and hospitality during our first few weeks in Green Bank.

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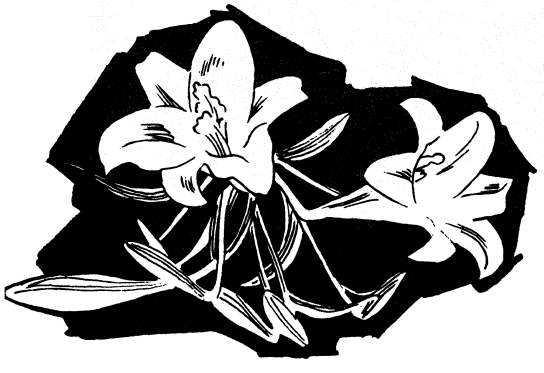

SAVE WILDERNESS*

Another wilderness area in West Virginia has reached a point of crisis as conservationists seek to prevent mining that would destroy its unique character.

A suit has been entered in the U.S. District Court in Southern West Virginia to prevent the mining of the metallurgical coal located in the 36,000 acre Cranberry Backcountry of Pocahontas and Webster counties.

Title to the coal has been held for some 50 years by the Chessie System which purchased mineral rights for as little as one dollar per acre. At that time, we have no doubt that the area was regarded as a worthless swamp.

Now, however, Dr. Earl E. Core, biologist at West Virginia University and an eminent authority on the Appalachians, describes it thus:

"Located only 100 miles from Washington, D. C., it is a refuge for as many as 200 black bears, wild turkey, deer, and native brook trout are in abundance. Two endangered species, the bald eagle and the rare Eastern golden eagle are known to roost in the Cranberry Backcountry."

The glades are known for rare carniverous plants. It is believed, too, to be the sole home of the swamp scheuchzeria, a rare plant identified in 1901 and not found elsewhere.

The National Forest Service recognized the unique properties of the area several years ago with the construction of an information center, one of the few in the Monongahela National Forest, and the building of boardwalks near the center so that the swamp would be untrampled by the boots of sightseers.

Dr. Harold Robinson, curator of botany of the National Museum of Natural History, describes it as a study area unduplicated on the North American continent. "Despite its closeness to the urbanized eastern seaboard, a complete biological survey has yet to be undertaken."

The director of the endangered flora project of the Smithsonian Institution, Dr. Robert DeFilipps, warns that the current lawsuit, which seeks an injunction against imminent mining is almost a matter of life or

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death of the area. "Extraction of the coal," he says, "will lower water tables, and the tundra, which depends upon wet ground will dry up and this unique and valuable portion of our national heritage will be lost forever."

Several years ago two other natural areas in the state - Dolly Sods and the Otter Creek watershed, were officially designated by Congress as wilderness areas. They were among the first such areas to be so designated in the Eastern United States.

The naming of Dolly Sods and Otter Creek as wilderness areas was facilitated by the prompt action of the Nature Conservancy in buying the coal rights under the portion of the Monongahela National Forest that contains the two preserves. This is one of the special functions of the Conservancy, which is so organized to allow quick action in protecting natural areas. Usually, the money advanced by the Conservancy is reimbursed when the areas are brought under federal protection.

Such action may not be possible in the case of the Cranberry Backcountry since some estimates of the value of the coal underlying the area are as much as a billion dollars.

The coal rights were bought when the land was privately owned. Now the Backcountry is a part of the National Forest System - except, perhaps, for the coal beneath it. What are the mineral rights worth - one dollar an acre paid for them 50 years ago or the billion dollars it is estimated the coal might be worth today?

Or to put it another way - is the coal under Cranberry worth the bears, the eagles, the sundew, and the dozens of unique ecologies that will be attracting naturalists and students to West Virginia for years to come?

If you have an answer, write your Congressman - if the injunction is granted, the final decision on Cranberry as a wilderness area will be up to Congress.

* from the Wheeling News Register, Tuesday, March 1, 1977

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A SLICE OF THE SOUTHWEST

Doris Gill

New Mexico to me is truly the Land of Enchantment. I thoroughly enjoy getting acquainted with the past as well as the present phases of the southwest. Not as a critic but as a recent fan of the southwest do I even attempt to pass judgement on recent excursions into the literature concerning the southwest.

On Sunday, February 27, 20 Magdalena residents and 4 Socorro townspeople (Linda Blankenship, Doris Gill, Doug and Judy Harris, Dave Rosenbush, Ken Sowinski, and Nancy Vandenberg - VLA folk) went to see the New Mexico premiere of "A Place on the Magdalena Flats". Playwright Preston Jones uses the setting west of Strawberry Peak and north of Water Canyon for his play dealing with the "killing drought of 1956...and the ambitions of two brothers who were separated by age, World War II and bitter disappointments..." The College of Santa Fe cast and the lead, guest artist Drexel H. Riley of Texas, provided 2½ hours of enjoyment at the Greer Garson Theatre.

The play is optioned for production at Kennedy Center and Broadway as was the Jones' play "A Texas Trilogy" in 1976.

Do capture a little of New Mexico when the opportunity presents itself. Even those from Magdalena who could identify the people in the play said - "yup, that's the way it was" - and that wind howling in the background was apropos for our windy March.

New Mexico libraries have a large section of Southwest literature. Many new residents may not have dipped into this area. Not only can you read about history, but also the art of jewelry making, turquoise history and identification, lost gold mine stories, Indian rug designs, and factual narratives of places that are now home.

Maybe, too, back east some of these books may be available:

Magdalena comes out in Eight Rattles and a Button, Merle Blinn Brown, published in 1967 by the Naylor Company, San Antonio, Texas. The jacket indicates, "the writer delves into

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the rich scrap basket of her fabulous memory to bring out bits of family history, amusing experiences of children...all the small episodes of daily living..." relating mostly to the time period 1880-1905. Places and names from Magdalena - to the Plains - to Winston.

These Also Served, Susan E. Lee, Book Craftsmen Associates, Inc., New York - eighteen pages of biographical data of past residents of Magdalena -- a hanging tree story of Socorro -- but mostly so-so-reading of 200 pages of amateur biographical sketches with pictures.

No Life for a Lady, Agnes Morley Cleaveland - it has been said that "that's not the way it was." But it is an easy reading book with easily identifiable places -- stories of her treks across the Plains of San Augustin - White Lake (that's us at the VLA) - Magdalena - Datil - it's all right there.

The Popular Science article refers to Magdalena as a "sleepy" town and Socorro isn't what it used to be either. But the trials of pioneering, homesteading, mining, ranching don't go back generations - there are old timers still around to tell first hand accounts. Try a little "southwest" - you'll like it.

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NEW MEXICO MADNESS

VLAPRA - Latest plans by the organization include a St. Patrick's Day Pot Luck Supper. This is scheduled for March 18 and this time, if our staff of photographers have sufficient film and "flash bulbs", we might be able to provide details on the event in the next issue.

BASKETBALL - Latest word is that the VLA basketball team is in the finals of the Tech Tournament. However, this appears to be somewhat of a dubious honor as that is only in the "loser's bracket". Pictured is our team, left to right, front row - Larry Carlisle and

Skip Lagoyda (team captain, coach, and whatever else the team calls him). Left to right, back row - Jay Carlisle, Jim Osborne, Emilio Vallez, Tom Cote, and Dave Gibson (he recently joined the Tech faculty with a project involving line-of-site microwave communication between New Mexico Tech's optical observatory on top of South Baldy in the Magdalena Mountains and the VLA). Not pictured are Barry Blaisdell, Mike Keyes, George Patton, Jon Spargo, and Linda Martinic (yup, this is a coed league). Past notable players have been Joe Ortiz, Dave Rosenbush, Peter Napier, Bill Randolph, and our now retired referee, Joe Lee.

BRIDGE ANYONE? - A few willing experts and some enthusiastic beginning bridge players have banded together one night a month. The VLA Women's Bridge Club is now composed of Marlene Blaisdell, Helen Caloccia, Dottie Carlisle, Roberta Keyes, Alice Oty, Charlene Temple, Libby Horne, and Carolyn Krieger.

BOWLING - We have a ways to go for bowling but several stalwart bowling fans journey to the Sugar Bowl in Belen on Friday evenings to participate in a mixed doubles league. Jim and Alice Oty and Al and Audrey Miller have the honor of being the first place team. Coming up fast are Ernie and Helen Caloccia, Jon and Dora Spargo, and alternates Larry and Dottie Carlisle. It is worth noting that Al Miller scored a 616 series on February 18, which included a 255 game and a low of 138.

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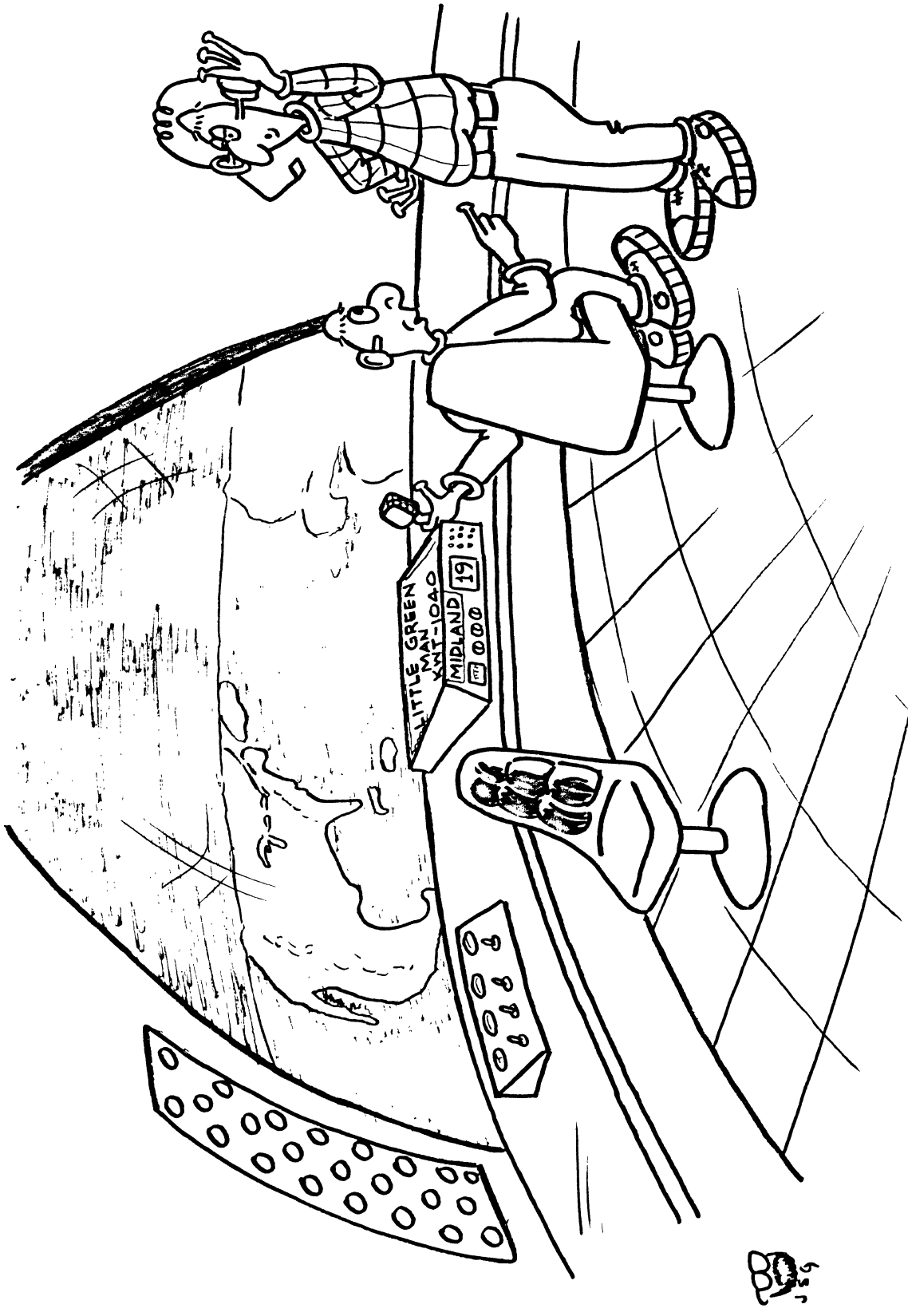
LITTLE GREEN MAN
KMT-1040
MIDLAND
19
"V.L.A!... V.L.A!.. THAT'S ALL I HEAR..... CAN YOU SHUT UP
LONG ENOUGH FOR ME TO GET A SMOKEY REPORT ON RTE. 60 ?"

BIBLIOPHILE BITS

Sarah Martin

---HAVE YOU SEEN the new Astronomy and Astrophysics Monthly Index? This is published by a librarian, naturally, to aid those of you with selective memories, who visit the library seeking things like "the recent article in one of the major journals on observations of 3C264" but don't remember the author, journal, or exact title. A & A Monthly Index indexes completely, with title and citation for each author, plus a keyword index to titles, each with the complete citation. So far it is only available in the CV library (since a tool that does such marvelous things does not come cheaply), but we in CV will be happy to search something for you when you get desperate.

---DID YOU REALIZE that approximately 32,500 reprints pass through Berdeen O'Brien's office annually [some of the lesser papers don't pass through--they just stay there], so don't be impatient when you phone Berdeen with a reprint request. Think of her sifting through that mountain of material looking for that paper for you and be glad she's there to do it.

---PREPRINTS have made it to the boonies. The VLA now has a growing preprint collection, so let's hear no more of those complaints that we don't know you're out there; believe it, we know.

---SPEAKING OF PREPRINTS, did you ever wonder what happens to those little goodies after publication? Most are summarily discarded, but for those that are part of a series (Owens Valley yellow jackets, Center for Astrophysics purple passions, etc.), we keep a list of them complete with journal citation in the exchange sections of the GB and CV libraries. We keep the preprint itself if it was published in a journal to which we don't subscribe.

---A NOTE to last issue's call for donations to our duplicate exchange program: don't assume that because "everybody" subscribes to it, we can't find a happy home for a particular issue somewhere. The latest want list we received sought such "everybody gets 'em" titles as Physics Today and Science.

---RECOMMENDED READING for bureaucrats, administrators, and other wordy people: Edwin Newman's two recent books, Strictly Speaking and A Civil Tongue. I have a copy of the latter title, if you're interested in borrowing it.

---FINALLY, a note to all you naysayers about the library roof: it's been an entire year with nary a droplet of water seeping through and although it was a fairly dry summer, it wasn't that dry. We consider it fixed. (Gee, I hope I'm not tempting the fates....)

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THE OTHER OBSERVERS

Bruce McKean

At various times through the year groups of observers arrive at Green Bank to observe, but the observers I am writing about have yet to use the telescopes. These observers are usually quickly pegged as "other" by the amount of time they spend carrying binders, books, financial statements, checks, and invoices from the Fiscal Division to their assigned observing office at the other end of the second floor. To answer the questions about what fascinating phenomenon keeps drawing these observers back to Green Bank year after year, let me first explain who they are.

Once a year NRAO is audited by Associated Universities, Inc. internal auditors, often referred to around Green Bank as the Brookhaven auditors. Although the AUI auditing staff offices are physically located at Brookhaven, they are not Brookhaven employees; they audit the Brookhaven financial records the same as they audit the NRAO financial records. The AUI auditing staff is composed of one chief auditor, three senior auditors, two junior auditors, and a secretary.

In addition to the yearly internal audit, NRAO is also annually audited by the Long Island office of the public accounting firm, Haskins and Sells. The Haskins and Sells

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auditors are usually accompanied by an AUI internal auditor to serve as a liaison person between the NRAO personnel and the external auditors.

In addition to these two groups of auditors, various state, federal, or corporation auditors could request audits of NRAO. At present we are audited annually by an auditor from the Liberty Mutual Insurance Company to determine the actual charge for our insurance policies. The reason that we are audited by both AUI and Haskins and Sells auditors yearly is simple. The AUI Board of Trustees requires both an internal and an external audit of NRAO books, because it is a good, sound business practice. The auditors seek to determine that NRAO is in compliance with both contractual and procedural requirements of the National Science Foundation. An auditor always checks to see that generally accepted accounting principles are being followed and that financial statements are fairly presenting the financial position of the corporation.

What qualifies a person to be an auditor varies from one employer to another. Training and experience in auditing is what makes an accountant an auditor. An auditor usually holds a minimum four year accounting degree. Most auditors pursue advanced degrees while studying to pass the Certified Public Accountant examination. Passing the CPA examination by an accountant is equivalent to passing the Bar examinations by a lawyer.

An audit program is the written directions to an auditor specifying what is to be audited. The NRAO audit program changes very little from year to year. Although the same areas are checked each year, the emphasis placed on certain areas may change for various reasons. The NRAO staff may ask for assistance in some area that is new or changing. If a previous audit locates a problem area, the area will probably be emphasized in following audits. At the conclusion of each audit, an oral and a written presentation of the audit results are delivered to the designated NRAO personnel. What is changed, corrected, improved, or forgotten depends upon what fascinating phenomenon was observed by the "other" observers.

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THE FAULT, DEAR BRUTUS, IS NOT IN THE NATIONAL ENQUIRER

Lee J. Rickard

While I am sure that the Daily Progress is an excellent small-town newspaper, it does seem to have a twelve-month-long silly season. I recall a recent October, by way of example, when the Progress carried reports of UFO attacks on power plants in New York, visits by extraterrestrials recorded in cuneiform tablets, the empirical establishment of survival of bodily death, and the interpretation of the Tunguska explosion in Siberia as the crash of a flying saucer. All this, mind you, within eight days, and only two weeks before the presidential election (not normally considered a slow news week). Not to mention the daily astrology column.

Actually, I meant from the very start to mention the daily astrology column, since it's probably the most significant phenomenon in that list. The Daily Progress may be one of several newspapers subscribing to the National Enquirer wire service, but it's only one of some 1200 daily papers that carry astrological forecasts. (That, by the way, is more than two-thirds of all daily newspapers in the U.S.) And these columns carry a lot of weight. Of the thirty-two million Americans (counted by a Gallop poll in 1975) who believe that the stars do influence their lives, all but a few percent get their astrology from the daily paper alone. And, at least among the 33 papers of the Daily Progress chain, the astrology column is consistently among the three most-read items in the entire newspaper.

The irritation that this all brings about in astronomers is not soothed by the popular supposition that astrology was the proto-science from which our field is descended - that astrology was the mother of astronomy. Actually, it was more of a younger sibling. The Babylonians were keen astronomical observers before 1000 BC. They were predominantly concerned with the upkeep of the calendar, which was needed to time the sowing of crops and fix the dates of tax collections and square dances. The metaphysics came later. Even then, it was primarily of the beaurocratic variety (mundane astrology) described in

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the Book of Daniel, dealing mainly with the fate of nations. The natal astrology of the newspaper horoscopes was mainly the creation of the Macedonian Greeks, codified in the second century AD by Ptolemy. In much the same way, alchemy was the philosophy of the Macedonians tacked on to the practical metallurgy of the Egyptians. Modern chemists have a respectful, even nostalgic feeling towards alchemy, probably (as R. F. Smith has pointed out) because there are no alchemy columns on the funny pages.

Worst of all, I think, is the fact that many people don't know the difference between astronomy and astrology, or even that there is a difference. Any candid university astronomer will tell you that a goodly fraction of the students in an elementary astronomy class arrive expecting to be initiated into the Chaldean arts. And we have printed evidence that one of the typesetters at the Daily Progress doesn't know the difference: in the January 30 issue, he brazenly captioned the daily forecast "ASTRONOMY!" In 30-point sans-serif, no less. Several weeks after this, I phoned up the Daily Progress to ask how many angry phone calls, how many irate letters they had received from their outraged public. (Remember, Charlottesville has an unusually large community of professional astronomers.) The answer: zilch. But in defense of the town (and the paper), my source pointed out that the error had been corrected in the later editions.

Astronomers cannot dwell on this subject too long without gnashing teeth and waxing wroth. But I think that they don't know just how bad the situation really is. I recently did a little investigation, hoping to find out something about the relative troop strengths of astronomers and astrologasters, and to get some measure of their popular support. It turned out that the numbers were not very easy to get, which leads me to think that most astronomers aren't aware of them. In particular, the only figures I could get for astrology referred to the year 1973; I have thus had to do the figures for astronomy for the same year. I must leave the extrapolation to the present to educated guesses, favoring the pessimistic ones myself.

The most direct comparison to make is of numbers of practitioners. According to the NAS, there were 2177 self-identified U.S. astronomers in 1973, of whom 1906 were actually employed in astronomy. (Of these categories, 1553 and 1139, respectively, were specifically trained as astronomers.) So for a rough figure, say 2000. U.S. News and World Report estimated the number of full-time professional astrologers in the U.S., in 1973, to be 10,000. Which means that the good guys were outnumbered five to one. (Worse yet, there is some evidence that this number of astrologers actually refers to an earlier date. If true, this would probably aggravate the difference. And I've got enough aggravation already.)

Astronomers are better joiners, though. The AAS membership in 1973 was somewhere between 3000 and 3500 (including non-professionals); the American Federation of Astrology had fewer than half that number. Maybe we have better conventions.

I don't want to appear cynical, but I'd wager that the best way to monitor popular support for something is to see how much money the public is willing to squander on it. It's a particularly hard number to get - for astronomers because they're funded through a variety of federal conduits, for astrologers because they don't like to itemize. (I think they consider it indelicate.)

The NSF estimated that 79% of the basic research in astronomy (in 1973) was done by astronomers in universities and colleges, with another 16% done by government employees. Academic astronomers are paid by their institutions, of course - with median annual salaries around $20,000 - and these finances don't necessarily represent public support. I prefer to consider instead the total federal obligations for astronomical research in colleges. (I assume that astronomy gets no more than the taxpayers are willing to give, probably a very optimistic assumption.) For 1973, that was 26.5 million dollars. Adding in the annual budgets of the four national observatories brings the number to 50 million dollars.

That 50 million counts for 80% of the science, but only 60% of the astronomers. Most of the remaining science and scientists can be found in federal agencies (like NASA)

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or federally-funded R&D centers (like NRAO). The dominant component of their budget is that fraction of NASA's equipment that is used for astronomy. When counted with the rest, it brings the total federal commitment to astronomy to an annual $200,000,000. (Remember the old saying: space is money.) And the astrology budget for 1973? Again using the estimate of U.S. News and World Report: the total amount paid by the public for the doing of astrology was approximately $200,000,000. Parity city.

It's interesting to consider what 200 million dollars represented in 1973. A business with 200 million dollars in total sales wouldn't have made the Fortune 500; that figure was more like the net annual profit of Bethlehem Steel, or the net monthly profit of Exxon Corp., or the annual advertising budget of GM. Internationally, it was slightly more than the total monetary reserves of Kenya, and slightly less than the GNP of Rwanda. Allowing for inflation, it was about equal to our present annual foreign aid to Jordan (neglecting bribes), slightly more than the cost of two B-1 bombers (neglecting cost overruns), and slightly less than the investments of the Teamsters Union Pension Fund in Las Vegas casinos (neglecting fiscal improprieties).

I don't think that we can complain that too much money is spent on astrology. Two hundred million dollars is not an outlandish sum on the scale of human frivolity. (Americans spend 100 million dollars annually on snuff, 45 million annually for jigsaw puzzles.) But the fact that the astronomy and astrology budgets are so nearly equal, that there are so many more astrologers than astronomers, that astrology gets so much more exposure in the press - these things are a little scary. They are especially perturbing when you remember that public support of astronomy is generally an involuntary thing, drawn from the tax coffers; public support of astrology is purely voluntary.

A year and a half ago, 186 scientists issued a statement to the press in which they flatly asserted that astrology is bunk. Astronomers are seldom moved to such authoritarian gestures, probably because so many are themselves a bit shady. (The only other occasions of note involved Velikovsky and the ubiquitous UFO, and even in those cases the response was more that of concerned individuals.) I think that the numbers quoted above tend to justify the quasi-paranoia behind that statement.

After all, if it ever came down to hand-to-hand combat, we'd be done for.

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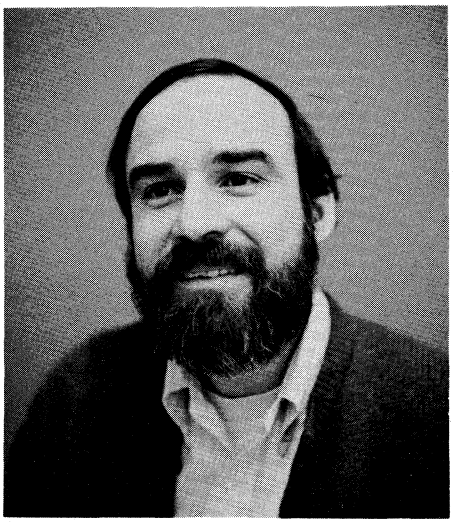
NEW GREEN BANK SITE MANAGER

Come June 1977, NRAO-Green Bank will have a new site manager. On February 23, 1977, Dr. Heeschen, NRAO Director, announced the appointment of Dr. Robert L. Brown as Assistant Director for Green Bank Operations. Until June, Dr. Ken Kellermann will continue as acting Assistant Director.



Dr. Robert L. Brown

Dr. Brown received his Ph.D. from the University of California, San Diego, in 1969 and has been with the National Radio Astronomy Observatory since then. He was recently granted tenure by the AUI Board of Trustees.

WEATHER FACTS AND FIGURES

Duane Sizemore

Presented here are some weather data taken from the 24 hour continuous recording thermometer at the Green Bank interferometer. Temperatures monitored at the interferometer are forwarded to the weather bureau and are considered "official" data.

January 1977

Average Low: 2.6° F
Average High: 24.7° F
Monthly Average: 13.7° F

There were 15 days when temperatures fell to 0° or lower -

Low: -18.5° on January 13 and 18
High: +39.0° on January 28
Blizzard Alert: January 28

February 1977

Average Low: 12.5° F
Average High: 37.9° F
Monthly Average: 25.2° F

There were 8 days when temperatures fell to 0° or lower -

Low: -20° on Febraury 8
High: +69° on February 26

(This was the lowest temperature reading since February 8, 1972 when a -20° F was also recorded. These are the lowest temperatures since the interferometer began keeping records in 1967.)

Average temperatures for January and February : 19.45° F (that's for 59 consecutive days)

Low Temperatures For 1967 - 1977

Year	Date	Low Temp - F°
1967	25 February	-16
	30 December	-17
1968	02 January	-18
	12 January	-11
	17 January	-13
1969	?	-06
1970	11 January	-12
1971	01 January	-10
1972	15 January	-11
	16 January	-18
	08 February	-20
1973	11 January	-03
	18 February	-10
	11 November	+10
	18 December	-01
1974	13 January	+07
	27 February	+05
	27 November	+06
	05 December	-08
1975	21 January	-06
	10 February	-08
	09 March	-01
	24 November	+15
	24 December	+03
1976	20 January	-12
	02 February	-04
	14 November	+01
	30 November	+01
	25 December	-07
1977	13 January	-18.5
	18 January	-18.5
	08 February	-20

* * * * *

Cheese Straws

from the kitchen of
Jane Peery

1 pound sharp cheese, grated
¼ pound butter, creamed
2 cups flour
1 teaspoon salt
¼ teaspoon red pepper

Cream butter and work in flour, salt, and pepper. Knead in grated cheese.

Run through cookie press or cut out with biscuit cutter and place half pecan on each.

Bake in 400° oven until golden brown.

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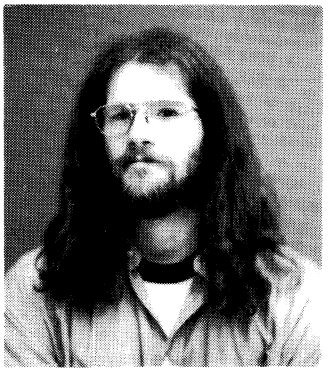
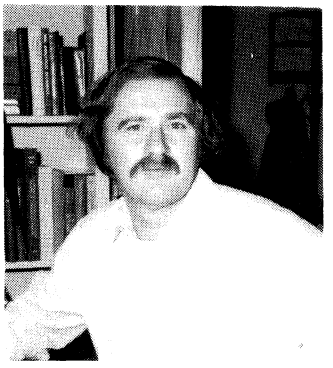
PERSONNEL UPDATE

New Employees

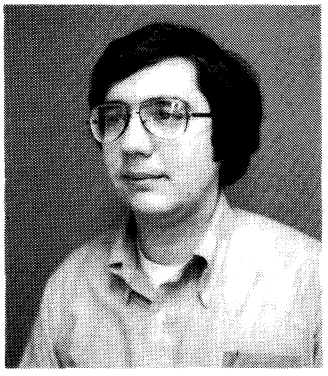


Francis F. Bocchino
Technician
Electronics - CV

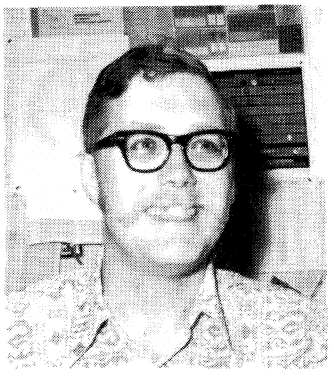


John W. Brooks
Electronics Engineer
Electronics - GB

Walter A. Brown
Technician
Electronics - CV

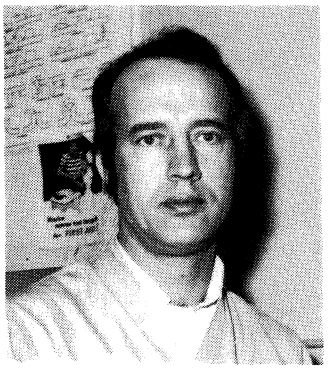


Jack O. Burns, Jr.
Jr. Research Assoc.
Scient. Serv. - CV

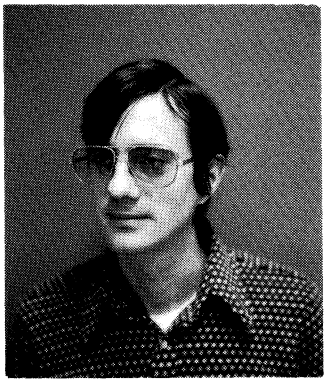


Patrick C. Crane
Research Associate
Basic Research - GB

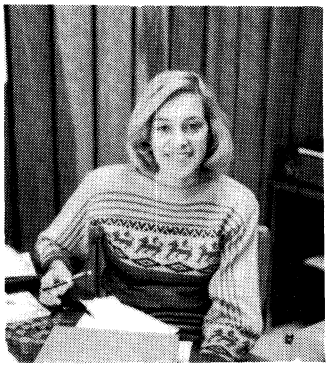
Edward N. Haigh
Computer Division
Computer Div. - CV



Ray F. Hanshew
Staff Shop Tech.
Central Shops - GB



Paul A. Lane
Computer Operator
Computer Div. - CV



Harriette Marcus
Secretary
VLA - New Mexico

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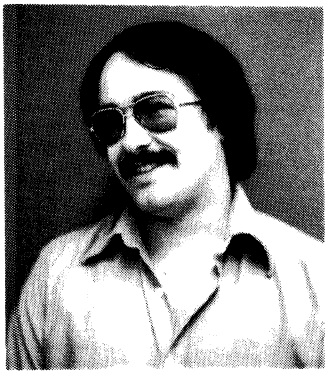
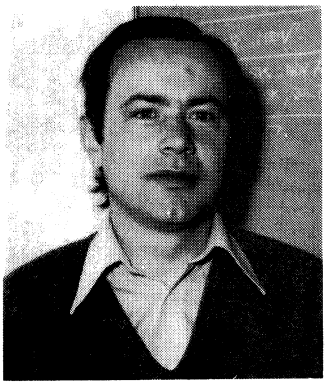
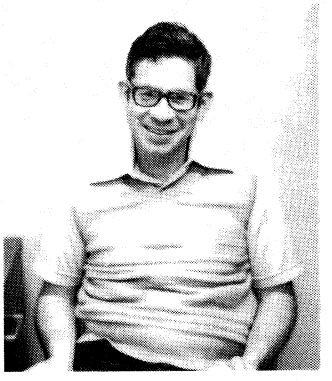
NEW EMPLOYEES (continued)



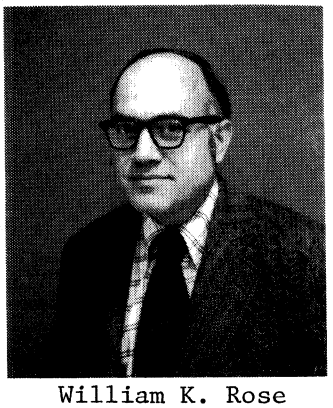
Harold S. Morton
Computer Operator
Computer Div. - CV



Eugen Preuss
Vis. Assoc. Scient.
Basic Research - GB



Henry Richards
Engineer
VLA - New Mexico

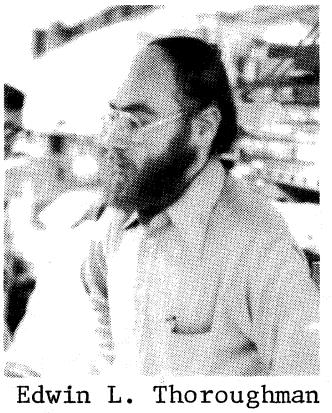


William K. Rose
Visiting Scientist
Basic Research - CV

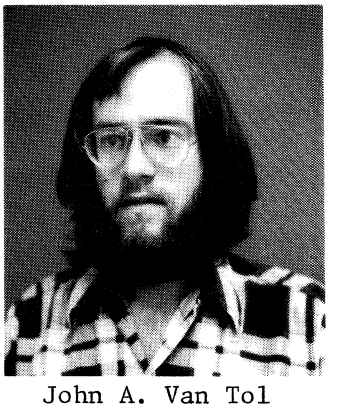
Ruth E. Saunders
Technician
VLA - CV

Alice S. Shiflette
Technician
VLA - CV

Cheryl W. Slocum
Technician
VLA - CV



Edwin L. Thoroughman
Technician
VLA - New Mexico



John A. Van Tol
Draftsman
Electronics - CV

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OTHER NEW EMPLOYEES - PHOTOS NOT AVAILABLE

George D. Harris	Diesel Mechanic	VLA - New Mexico
Feliz M. Landavazo	Assistant Cook	VLA - New Mexico
Gustave E. Mortenson	Janitor	Tucson Operations
Gopalkrishma G. Nadkarni	Technician	VLA - New Mexico
Robert L. Stevens	Engineer	Tucson Operations

REHIRES

Basil M. Gum	Staff Shop Technician	Central Shops - GB

TRANSFERS

Joseph B. Burch	Technical Specialist	Computer - CV
William F. delGiudice	Mechanical Engineer	VLA - New Mexico
Welford C. Luckado	Machine Shop Foreman	Electronics - CV
Charles F. Pace	Technical Specialist	Electronics - CV
Jean P. Ray	Executive Secretary	Electronics - CV
Garnett A. Taylor	Staff Shop Technician	Electronics - CV
Claude N. Williams	Scientific Associate	Computer - CV

TERMINATIONS

Victor P. Anderson	Steven D. Peterson
John W. Armstrong	Juan R. Pimentel
John C. Bishop	Arnoldus H. Rots
Harold F. Gardner, Jr.	Sharon L. Spooner
William E. Howard, III	David L. Vandevender
David W. Paul	Dorman L. Williams

* * * * *

GREEN BANK BOWLING

Dick Hiner

On January 4 we completed the first half of our league bowling schedule with a record of 32 wins and 40 losses. This put us in ninth place going into the second half.

During the first half of the league season, Wendell Monk bowled the high series with a 623 on December 21, 1976. Wendell was also high for the total number of pins for the first half.

Members of the NRAO team for the first half were Jim Gibb, Bruce McKean, Harold Crist, Bob Vance, Dick Hiner, Wendell Monk, Larry Miller, Howard Brown, and Rufus Chappell.

On January 11, 1977, the second half of league play started. The team members for the second half are Edward Burke, Albert Wu, Don Hovatter, Wendell Monk, Bill Vrable, Dick Hiner, Russ Poling, and Larry Miller. As of March 8, 1977, in the second half we have a record of 18.5 wins and 17.5 losses. Larry Miller has the high series with 581.

* * * * *

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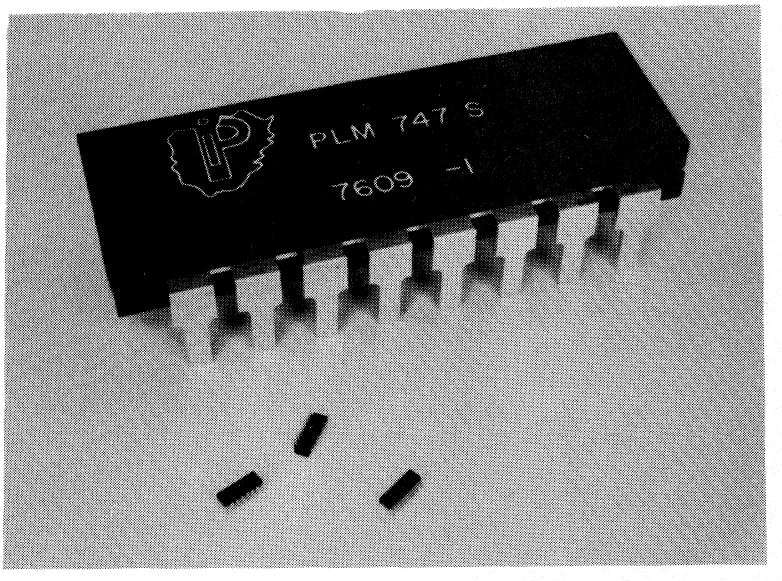
THE COMING OF SUPERCHIP!
or
What's New In Electronics At The VLA

Jon Spargo

We have all become so familiar with miniaturization in electronics, that at times new concepts of electronic packaging seem hard to accept. After all, who wants to wear a 5 lb. digital watch? However, a revolutionary new breakthrough by a major East European manufacturer (P.I.) may go a long way towards reorienting our thinking.

The breakthrough has come with the introduction of a new integrated circuit (chip) shown here in comparison with standard run of the mill integrated circuits. The PLM 747 S (S=super)



PLM 747 S Superchip towers over three standard integrated circuits.

has been undergoing rigid testing here at the VLA and so far has met or exceeded all manufacturers specifications. The accompanying data will give you an idea of the capabilities of this revolutionary new device as well as some examples of typical applications.

PLM 747 SPEC SHEET

Congratulations, you have been fool enough to "procure" a PLM 747 Super Integrated Circuit. This device, designed especially for those who have difficulty with their thumbs when inserting a skimpier integrated circuit, has several unique features:

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1. Flat response from 10^{-5} Hz to 10^{-20} Hz (AC coupled)
2. Calibrated gain of 0.00186754358k98 ± 60 db
3. Exceptional HV Holdoff and isolation of 4700v[1]
4. Lead spacing sets a standard, hopefully to be accepted industry wide of 1.49129086 X 10^{-4} furlongs.

Physical Specifications:

Length	About a Foot
Width	10.600 cm
Height	Less than length
Volume	0.073 Imperial gallons
Weight	23,040 grains
	=967.68 pennyweight
	=1.3605 X 10^{-3} metric tons
Lead Width	1.055 X 10^{-14} Astronomical Units
Lead Spacing[2]	
Lead Thickness	More than enough
Storage Temperature	273.000 to 273.001 degrees Melvin
Operating Temperature	What ever she'll take

Installation:

For obvious reasons, there is no difficulty inserting the chip, as the leads are sturdy (45,000psi tensile strength). For solder-in applications, a heliarc unit is recommended as the leads are made of aluminum. Lead soldering temperature at 300 degrees is infinite. Note: outer coating is hi-temp barbecue paint.

Maintenance/Disassembly/Corrosion Control:

Your PLM 747 should have relatively few mechanical problems since both moving parts were removed at the factory. The unit should not require disassembly but, since boys will be boys, disassembly is as follows: remove coffee cup from top of unit. Consult any application note. Put coffee cup on application note so as not to mar top of maintenance bench. Turn chip on its back with leads facing upward (the unit will not like this and will try to scramble back on its feet. It may be necessary to secure its cooperation with a crowbar applied soundly anywhere you can catch it.) Remove four caphead screws exposed. Unit will promptly fall apart into several pieces. Good luck on re-assembly.

The magneto should be checked after 5000 hours.

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1. HV Holdoff and isolation can be increased if chip is mounted in special 747 OB socket/oil bath, requiring 3.5 liters of either transformer oil or used SAE 30 motor oil from a 1927 Daimler-Benz Roadster.

2. See above.

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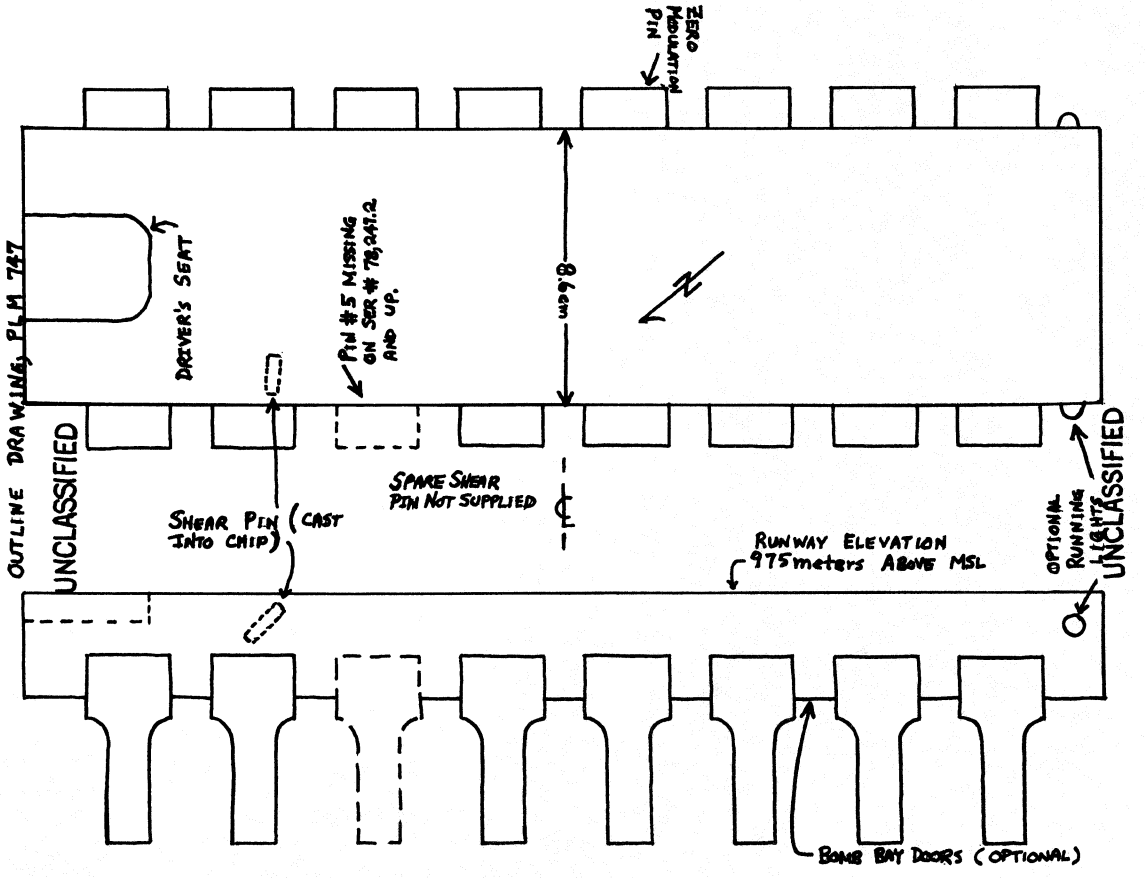
Power Requirements:

The chip is "BI". It will go with either AC or DC.

Applications:

The primary use of the PLM 747 is as a receiver. Note that the unit is incapable of transmitting data it has received but should not, by any means, be confused with the "write only memory".

You will note from the enclosed schematic that leads 1-8 are all tied together. Leads 1



and 8 can be tied to a low voltage high current source. This allows the unit to be used in its alternate mode as a space heater. Also note that leads 9 through 16 are also tied together but isolated from leads 1-8 (see HV Holdoff specs). Leads 9 and 16 can also be tied to a second low voltage high current source to use the unit as a dual channel space heater.

The PLM 747 also has a huge potential for the home entertainment market. It makes an excellent coffee table conversation piece. Its size and weight also make it handy as a deter-

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rant to unruly guests, pets, and as a strategic counterforce weapon against flying pots, pans, china, and rolling pins. This device can also be used as an elephant comb.

TROUBLE SHOOTING CHART

Symptoms	Explanation/Remedy
Unit found on its back, leads in the air.	Dead chip. Now you get to "procure" another.
Above 5000 rpm, unit missing.	Local security precautions excessively lax. Some clown stole your chip.
Unit intermittently inop.	Unit has Thursday afternoons off.
End pins stained red.	Unit has been used as a lethal weapon.
Unit totally inop upon receipt.	Unit is unconditionally guaranteed until 90 days before delivery.

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SPRING FOREST FIRE SEASON

Natural Resources Director David C. Callaghan reminds West Virginians that statutory spring forest fire season begins March 1 and lasts until May 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."

*****

CREF UNIT VALUES - 1976

January	$40.31
February	39.76
March	40.75
April	40.10
May	39.69
June	41.60
July	41.21
August	40.94
September	41.59
October	40.62
November	40.40
December	42.66

*****

CREF UNIT VALUES - 1977

January	$40.28
February	39.30

*****

WHAT'S COOKING?

Candid Comment Cake

from the kitchen of
Cleo Harper

Combine: 1 box Duncan Hines yellow cake mix
2/3 cup Crisco oil
4 eggs
1 can (11 oz.) Mandarin oranges (including juice)

Mix 3 minutes. Pour into 3 9-inch greased and floured layer cake pans. Bake according to package directions. When layers are cool, fill layers and frost cake with the following:

Mix well: 1 pkg. Instant Vanilla Pudding mix
1 small can (8¼ oz., or 1 cup) crushed pineapple (including juice)

Fold in: 1 container (9 oz.) Cool Whip

Store cake in refrigerator after frosting.

Frozen Fruit Salad

from the kitchen of
Leta Shears

Beat together: 1 pkg. (8 oz.) cream cheese
3/4 cup sugar

Blend in: 1 pkg. (10 oz.) frozen strawberries
1 can (No. 2) crushed pineapple (including juice)

Add: 2 or 3 bananas, cut in cubes
1 cup chopped nuts
2 cups miniature marshmellows
1 large bowl Cool Whip

Blend well and freeze* in 9" x 13" pan. This will keep up to 6 weeks in the freezer.

* When the salad is partially frozen, cut salad into serving-sized pieces. This makes it much easier to remove servings from container when it is completely frozen.

Butterscotch Pie

from the kitchen of
Debbie Ervine

1 cup brown sugar
¼ cup water
3 tablespoons butter
1½ cups milk
2 egg yolks
4 level tablespoons flour
1 teaspoon vanilla

Boil brown sugar, water and butter until mixture becomes like syrup. Remove from stove while you mix together milk, egg yolks, and flour, beating very well so there are no lumps.

Pour flour mixture into boiling mixture. Return to stove and boil again, stirring constantly, until it forms pudding consistency.

Remove from stove. Add vanilla. Pour into pie shell.

Using the 2 egg whites left over, make meringue to top pie. Spread over pie and brown in oven.

Cheese Balls

from the kitchen of
Edythe Davis

Mix together:
2 lbs. longhorn cheese, grated
1 pkg. sharp cheese, grated
1 8-oz. pkg. cream cheese
1 container bleu cheese whip
6-12 dashes Worcestershire sauce
1 medium onion, grated
Garlic salt to taste
2 tablespoons salad dressing or mayonnaise

Roll in crushed pecans. Age three weeks in refrigerator, then freeze.

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Grape Salad

from the kitchen of
Edythe Davis

2 pkg. grape jello
1 cup crushed pineapple (drained)
2 cups boiling water
1 cup cold water
1 can blueberry pie filling

Dissolve jello in boiling water; add cold water and let cool. Add pineapple and blueberry pie filling. Jell completely in a 9" x 13" pan.

Topping

1 8-oz. pkg. cream cheese
½ pint sour cream
½ cup granulated sugar
1 teaspoon vanilla

Beat together until fluffy. Spread on jello mixture and let set.

You can use any combination of jello and pie filling.

Makes 12-15 servings.

7-Up Salad

from the kitchen of
Debbie Ervine

1 pkg. lime or lemon gelatin
3 teaspoons sugar
1 teaspoon vanilla
1 cup boiling water
1 pkg. (8 oz.) cream cheese
1 small can crushed pineapple (drained)
½ cup chopped nuts
1 small bottle (6 oz.) 7-Up

Combine gelatin, sugar, and vanilla with boiling water; stir until dissolved. Soften cream cheese at room temperature; mash with fork. Stir cheese, pineapple, and nuts into gelatin; blend in 7-Up. Pour into mold or flat pan. Chill until firm.

Choco-Dot Pumpkin Cake

from the kitchen of
Beaty Sheets

2 cups regular all-purpose flour
2 teaspoons baking powder
1 teaspoon baking soda
½ teaspoon salt
1½ teaspoons ground cinnamon
½ teaspoon ground cloves
¼ teaspoon ground allspice
¼ teaspoon ground ginger
2 cups sugar
4 eggs
1 can (1 lb. or 2 cups) pumpkin
1 cup vegetable oil
2 cups All-Bran or Bran Buds cereal
1 pkg. (6 oz. or 1 cup) semi-sweet chocolate morsels
1 cup coarsely chopped nuts

Stir together flour, baking powder, soda, salt, spices, and sugar. Set aside.

In large mixing bowl, beat eggs until foamy. Add pumpkin, oil, and All-Bran cereal. Mix well. Add flour mixture, mixing only until combined. Stir in chocolate morsels and nuts. Spread evenly in ungreased 10" x 4" tube pan.

Bake in oven at 350° F for about 1 hour and 10 minutes or until wooden pick inserted near center comes out clean. Cool completely before removing from pan. Drizzle with confectioners' sugar glaze, if desired.

*****