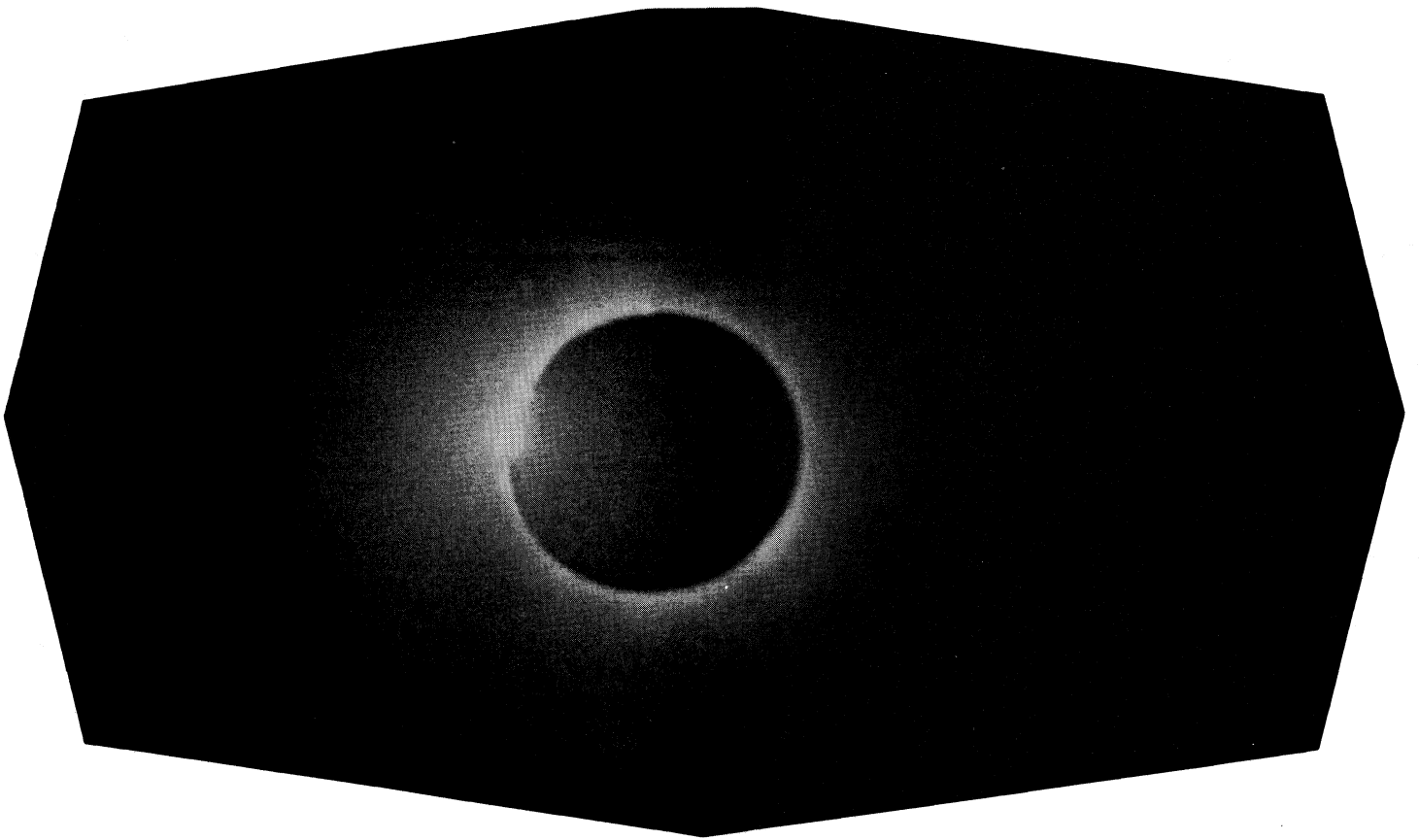


OBSERVER

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PAGE 1



DIAMOND RING EFFECT SECONDS BEFORE TOTALITY

The Solar Eclipse From Winnipeg

story on page 7

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FASCINATED BY PYTHAGOREAN NUMBERS
AND LITTLE COMPUTERS

Sebastian von Hoerner

Numbers and their relations have a beauty of their own. They can be just as fascinating as geometrical shapes, or as a well-designed bridge can be, or a fine piece of music. And one can strongly feel this beauty even if one does not understand the laws behind it. Just as a layman can marvel at the beauty of a clear night sky without knowing any astronomy.

Originally I had only planned to make a comparison between various programmable pocket or desk calculators, for finding out which one to buy for myself. I have done a lot of programming since 1950 in many different systems, and in different machine languages for many years before Algol and Fortran got invented. And I know that the best way to learn a new system and all of its tricks (and its shortcomings as well) is to play number games. Thus I made a little program for our newly acquired HP-97, which should find and print a complete series of Pythagorean numbers, a nice tricky program especially if one demands that it works as fast as possible, and with the limited memory. But when it finally worked, I got so fascinated by the results that I got completely sidetracked, forgetting about the planned comparison, and discovering one rule after the other about these amazing numbers.

As to the meaning and history of these numbers, the ancient Egyptians knew already that one gets an exact right angle between sides A and B of a triangle, if the three sides have, in any units, the lengths $A = 3$, $B = 4$, and $C = 5$. A special priest, the "rope knoter", would take a very long rope and tie knots into it at equal distances, yielding 12 equal lengths, and he would tie both ends together. This loop was then held at knots 3, 7, and 12 by three men, and pulled outwards until it stretched into a triangle, yielding 90° between its two shorter sides. This was actually the method by which they made the base of their pyramids rectangular to a very good accuracy, more than 4,000 years ago.

Later it was realized that the special quality of the numbers (3, 4, 5) given above is the fact that $3^2 + 4^2 = 5^2$, and that any set of three numbers (A, B, C) will give a right angle if

$$A^2 + B^2 = C^2$$

and, vice versa, that all rectangular triangles fulfill this relation. A mathematical proof was given by the Greek philosopher, Pythagoras, about 530 B. C. Although this quality of rectangular triangles holds for all kinds of numbers, integer or not, Pythagoras got especially interested in integer solutions. It is said that he found the following rule: take any odd number A, then $B = (A^2-1)/2$ will give a solution, with $C = B+1$. With this rule one can construct an infinite series: (3,4,5), (5,12,13), (7,24,25) and so on, but the series is not complete and gives only a fraction of all possible solutions. This method, for example, gives (15,112,113) but it omits (15,8,17).

I started by making a program which gives, for increasing C, a complete listing of all solutions (A,B,C) fulfilling three conditions: (1) that $A^2+B^2 = C^2$; (2) that all three are integer numbers; (3) that A and B have no common divisor. This last condition is needed for excluding all the many trivial solutions which are just multiples of some previously obtained proper solution. Since there is an infinite number of solutions, one must stop the calculation at some time, and by "complete" I mean that no solution has been omitted which has a C smaller than the last one listed. I had it first only run up to $C = 205$, found a lot of interesting rules, had bought a TI-59 plus printer meanwhile, and then made a variety of special programs to check these rules up to high numbers. The table printed on the following page is complete only for $C = 65$.

In the following I will list all the rules I found. And that is all I can do. Here I am in the situation of the above-mentioned layman marvelling at the stars: I do not know number theory and cannot give any explanation or proof (except for a few

--continued, next page--

A	B	C	S = A+B	C-A	C-B	a	b	s = a+b
3	4	5	7	2	1	2	1	3
5	12	13	17	8	1	3	2	5
15	8	17	23	2	9	4	1	5
7	24	25	31	18	1	4	3	7
21	20	29	41	8	9	5	2	7
35	12	37	47	2	25	6	1	7
9	40	41	49	32	1	5	4	9
45	28	53	73	8	25	7	2	9
11	60	61	71	50	1	6	5	11
63	16	65	79	2	49	8	1	9
33	56	65	89	32	9	7	4	11
		⋮						
39	80	89	119	50	9	8	5	13
99	20	101	119	2	81	10	1	11
		⋮						

trivial cases where I won't do it either).

Rule 1. One number of the couple (A,B) is always odd, and this one is called A in the table; the other one, called B, is always a multiple of 4. The reverse is also true: every odd number from three on occurs as an A, and every multiple of 4 occurs as a B.

Rule 2, the multiplicity of A. Every odd number which is a prime number (for example 3), or some power of a single prime ($9 = 3^2$), occurs even in a long list only once as an A; the product of two different primes ($15 = 3 \times 5$) or of powers thereof ($45 = 3^2 \times 5$) occurs twice; a case with three different primes ($2205 = 3^3 \times 5 \times 7^2$) occurs

four times; and in general, if the decomposition of a given A yields m different prime factors and any of their powers, then this value of A will occur M times with a multiplicity of $M = 2^{m-1}$. But in order to show all possible cases of A (to be complete in A up to this value), the original listing would have to be complete in C up to $C = (A^2+1)/2$. These would be very long lists for the more interesting cases, thus multiplicity was checked in a different way with special programs.

Rule 3. The multiplicity of B follows the same rule, $M = 2^{m-1}$. For example, $B = 8 = 2^3$ occurs only once; $B = 12 = 2^2 \times 3$

--continued, next page--

has $m = 2$ different primes, 2 and 3, and thus occurs $M = 2^{2-1} = 2$ times. $B = 60 = 2^2 \times 3 \times 5$ will occur $M = 2^{3-1} = 4$ times in a long list.

Rule 4. The complete list of all C can be obtained this way: take all multiples of 4 (4, 8, 12, 16, 20, 24 ...), add one (5, 9, 13, 17, 21, 25 ...) and select all primes only (5, 13, 17 ...). The series of these primes, and of all their possible powers and multiplications ($25 = 5^2$, $65 = 5 \times 13$, $2873 = 13^2 \times 17$, ...) yields the complete list of all C, and nothing but C.

Rule 5. The multiplicity of the C follows the same rule as that given for the A. For example, $65 = 5 \times 13$ occurs twice, $1105 = 5 \times 13 \times 17$ occurs $2^{3-1} = 4$ times as a C, $2873 = 13^2 \times 17$ occurs twice, while all prime numbers and their powers ($25 = 5^2$) occur only once.

Rule 6. The sum $S = A+B$ is also shown in the table. The complete list of all S is obtained in a similar way which took me a long time to find out: take all multiples of 8 (8, 16, 24, 32, 40 ...), subtract 1 and add 1 (7, 9; 15, 17; 23, 25; 31, 33; 39, 41; ...) and select all primes (7, 17, 23, 31, 41 ...). The series of these primes and of all their powers and multiplications yields every S, and nothing but S.

Rule 7. The multiplicity of S follows the same rule, $M = 2^{m-1}$ for m different prime factors ($119 = 7 \times 17$ occurs twice as S).

Rule 8. The differences $A-B$ are also all contained in the S-list, but their multiplicity is different and never complete; they follow a distribution which is highest for small values and falls gradually off for larger ones.

Rule 9. Every difference $C-A$ (and also every sum $C+A$) is twice a square ($2 = 2 \times 1^2$, $8 = 2 \times 2^2$, $18 = 2 \times 3^2$...), and also the reverse is true; every $2 \times n^2$ gives a value of $C \pm A$.

Rule 10. Every difference $C-B$ (and also every sum $C+B$) is the square of an odd number; and in reverse, every odd number squared gives a $C \pm B$.

Rule 11. This one came as a complete surprise. Not only every C^2 , but also every C itself is the sum of two squared integers, a and b in our table, where we called the larger one a:

$$C = a^2 + b^2.$$

Rule 12. Every possible combination of two integers, a and b, which have no common divisor and where one is odd and the other is even, will give a Pythagorean set (A,B,C), where $C = a^2 + b^2$, $A = a^2 - b^2$, and $B = 2ab$. This actually is, to my knowledge, the fastest way for constructing a complete list of sets (A,B,C), including all possible multiplicities.

Rule 13. Every odd number occurs at least once as the sum $s = a + b$, also shown in the table. I had quite some difficulty in finding the rule for its multiplicity, and here it is. If s is decomposed into m different prime factors, $p_1, p_2 \dots p_m$ (and any of their powers), then

$$M = \frac{1}{2} s (1 - 1/p_1)(1 - 1/p_2) \dots (1 - 1/p_m).$$

If s is prime, $m = 1$, it simply means

$$M = \frac{1}{2} s (1 - 1/s) = (s - 1)/2. \text{ For example,}$$

$s = 7$ is prime and occurs $M = (7 - 1)/2 = 3$ times; $s = 9 = 3^2$ has also $m = 1$ but gives

$$M = \frac{1}{2} 9 (1 - 1/3) = 3; \text{ while } s = 225 = 3^2 \times 5^2$$

has $m = 2$ and occurs with

$$M = \frac{1}{2} 225 (1 - 1/3) (1 - 1/5) = 60.$$

Rule 14. If $S = A+B = 8n+1$, then b is even, but if $S = 8n-1$, then b is odd. In case of a multiple S, this holds for all of its b. For example, $S = 119 = 8 \times 15 - 1$, thus $b = 5$ and $b = 1$ are both odd, see the table.

Rule 15. The density of the C (counting also their multiplicities) is amazingly constant. In the range $0 \leq C \leq 100$ we have $N = 16$ sets (A,B,C); in the range $0 \leq C \leq 1000$ we have $N = 159$, and 9 samples of 1000 each showed that up to 71,000 there are, for a range of 1000,

$$N = 158.7 \pm 2.2 \text{ (standard deviation of single N).}$$

Well, this is as far as I have got. Would anyone try to find some more rules? It would be nice. Most probably, all this has already long ago been discovered and

--continued, next page--

proven by some experts; if so, I would be very interested to learn about it.

I would like to add that I also got quite fascinated by these tiny modern computers themselves, especially if I recall my very first experience with computers. In the Max-Planck-Institut for Physics, which is now in Munich but was then in Göttingen, a special lab developed and built the first electronic computers on the European continent, starting with the G1 (G for Göttingen) and going up to G3. Theoretical work began in 1947, the construction of the G1 started in 1950 and was finished in 1952, and I was always part of the group of "scientific advisors" or (hopefully) future users, meeting once a week with the electronics people. At this time, all this was so brandnew and never-heard-of, we had days and nights of long discussions about the tremendous possibilities, difficulties and powers of this new development, we got heated-up by debating whether or not "machines can think", and we somehow sensed the beginning of a new area, not only of computers but of cybernetics in general.

The first tangible result, our G1, was a technical marvel as seen then, and an amazing monster as seen now. It filled a whole big room with its many racks (as compared to the pocket-size modern things). It used 476 vacuum tubes and 101 telephone relays, whose limited lifetimes produced many nervewracking mistakes and about one complete breakdown per day (of machine and/or user) with 15% repair time; whereas in our time of transistors it will be your fault for sure if you get a wrong result. This G1 made 5 operations per second, which was at least 10 times faster than a good hand-operated desk calculator; but our little pocket calculators make now over 10 operations per second. The G1 had a memory on a fast rotating magnetic drum, for only 26 numbers. But we soon invented an "external memory" (before the advent of magnetic tape) by letting it produce a long punched tape with data, guiding it gently about several table legs, and feeding it back into a reader. This needed careful programming, with a constant balance between punching and reading, in order to avoid a

tangled-up tape as well as a torn one. Our modern tiny magnetic cards are a bit easier to handle.

A few other things I should mention which we now take for granted even in a good pocket-sized computer: built-in mathematical functions, as sine, cosine, and log, for which we had to use our own home-made sub-routines; indirect addressing and flags had to wait for our G2 and G3; and the very important activity for which the selling-oriented manufacturer uses the euphemism "editing your program" while the more honest user just calls it "debugging your mistakes", this activity is now made easy by displaying or printing your program and by deleting or inserting a step with a few key strokes. But with the G1 you had first to learn how to read punched tape, and you would delete with a pair of scissors and insert with scotch tape. Only one thing was much better then: we didn't take anything for granted.

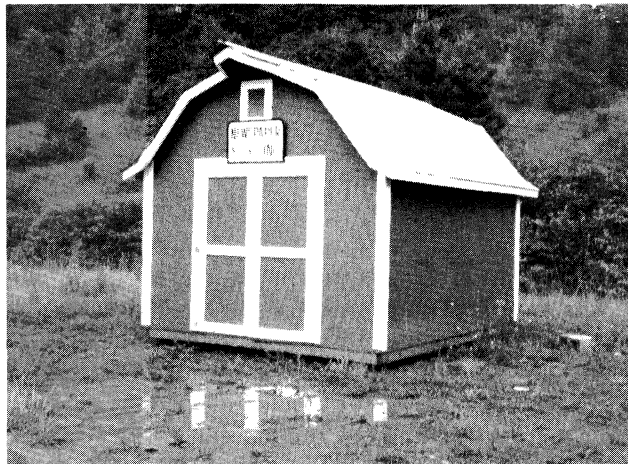
Many things have changed meanwhile. Mathematicians, too. Our G2 was already a fast and powerful machine, containing many new ideas and inventions of its main designer who wanted to use this design for a Ph.D. thesis. There was no electronics department or anything similar at the university, so one of our Max-Planck professors asked the head of the applied mathematics department about it. He looked quite amazed and slightly annoyed, and answered, "Do you really think, Herr Kollege, that one could receive a doctor's degree, at Göttingen, with the construction of a slide rule?"

RECYCLING NEWSPAPERS

Newspapers for recycling may be taken to the small, red barn located at the Cass intersection. The building is open every Saturday from 10:00 a.m. to 5:00 p.m. Please tie papers in flat bundles or stack flat in large paper sacks. Tied bundles and flat sackfuls make stacking and loading easier.

Please do not bring magazines with your
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newspapers. The company that buys our newspapers will not buy old magazines.



*Red Barn Recycling Center
at Cass Intersection*

Starting this spring the recycling program will be expanded to include aluminum cans. For your convenience there will be a large box for cans at the red barn. Hint: flattened cans take a lot less space than unflattened ones.

Money received from the sale of newspapers and aluminum cans collected in the Marlinton and Green Bank areas will be used to purchase a red barn for Hillsboro. After this purchase, all money will go to the Pocahontas County Library System.

OFF TO WINNIPEG!

Marc Damashek

The 1979 NRAO unofficial eclipse expedition was honestly worth every moment, every last degree-day spent in its pursuit. But you don't get something for nothing, especially at latitude 50°.

It became clear in late December of 1978 that railroad travel to Winnipeg is impossible if you embark at Green Bank, so grim resignation to see the last North American total solar eclipse of the century

required that our small and hardy delegation (Pat Crane, Marc and Nina Damashek, Dave Shaffer) actually go ahead and use our airline reservations. A friend once described the feeling of walking up to the \$100 window at the racetrack for the fifth time, having lost the first four races of the evening, as having something to do with wearing lead shoes. That thought crossed my mind as we dutifully headed for the sub-zero northlands on the off-chance that the weather might be clear (after all, there was a 46% chance of it), for a sum of money which in a warmer climate could buy you about 2016 bagels.

Dave Shaffer's was the guiding hand that rounded us up last fall. At that time, there were about ten willing to risk a tainted reputation for the chance of seeing the Sun go black. There was some talk of chartering an airplane, just in case (whatever that meant). There was talk of renting a car. There was talk of taking the train. For those of us who are not too talkative by nature, it was a great chance to practice.

As the event drew near, various reasons were offered for not attending:

a) I have to wash my hair that day.

b) I just remembered I'm afraid of the dark.

c) My gerbil has to go to the vet. AND

d) What if it's cloudy?

Pat, Nina and Marc drove up to Pittsburgh on Friday, February 23rd. What is normally a 4½ hour drive took 6½ hours as we bludgeoned our way through fog all the way to Morgantown, all of us certain in our heart of hearts that this is what it is always like in Winnipeg. Our Allegheny flight left for Toronto promptly forty minutes late on Saturday morning; that is, it left the gate forty minutes late. The captain notified us that the plane was too heavy, and some fuel would have to be taken off. I saw visions of native women carrying straw baskets on their heads, queuing up under the wings to get their weekly ration of Jet A. A scant hour later, we were off the ground, and an hour later than that, we were starving in Toronto.

The first bright spot in a rather subdued day came at the money changing counter

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in the airport. You can get more Canadian dollars for an American dollar than you would dream possible--at the moment, there is about a 20% discount. The bright spot faded somewhat when we noticed that prices in the cafeteria were--you guessed it--approximately 20% higher than what you might expect. However, Allegheny had provided us with lunch vouchers after we had threatened their agent with bodily harm, so it was simply a free lesson in economics.

Having missed our flight to Winnipeg, and with four hours to wait for the next one, we spent a leisurely and relaxing (really!) afternoon at the Toronto airport. Dave Shaffer connected up with the main group there. There were quite a few eclipse tour groups there by now, and we were sure that if we were going to be disappointed, we would at least be in good company. We also talked with an undergraduate at nearby Queen's College, who said he had just returned from Las Vegas and had realized only after he was in Toronto that he could have come by way of Winnipeg at no extra cost. The guy was inconsolable. CP Air, the non-government Canadian Airline, provided just about the most comfortable flight (Toronto to Winnipeg) any of us could remember, and fed us to perfection--with real coffee, real cream, and real railroad-vintage silver. The airline is said to be doing poorly.

Winnipeg, Canada's fourth largest city (population approximately 750,000), materialized abruptly out of the night; the borders of the city are so sharply defined it seems to be in geographical quarantine from the surrounding plains. We made a feeble attempt at the airport to find a rental car, thereby confirming that every car in the city was already taken, and had been a week before. The idea was to try to chase down a clear spot in the sky at the last minute should it prove to be partly cloudy (perish the thought!) on eclipse day. Of course, this simplified matters, and the only feasible crazy alternative was to find some compliant cab-driver who would truck around a bunch of real, live (radio) astronomers for an exorbitant sum.

There is 35¢ bus service from the airport to the motel. One must simply sample the Canadian night air for 15 or 20 minutes

in wait of the driver.

The motel: really not bad at all. Pat graciously explained to the night clerk how to use a credit card embossing device, and the imprint came out noticeably better on the second try. For travelers with a busy schedule, the Gordon Downtowner boasts a feature few can match: there are telephones in all the bathrooms. There were regrettably no instruction cards nearby on reviving electrocution victims.

Sunday was densely overcast and cold, but it was our day on the town, and it (the town) is in fact a remarkably nice one. Our stops included an excellent art gallery (with the niftiest chain-locking coatroom hangers we had ever seen), which featured modern art and sculpture, Eskimo art and sculpture, and nineteenth-century Canadian painting; the Museum of Man and Nature, which along with numerous well-organized and interesting geological and wildlife exhibits, also had a very appealing nighttime mock-up of nineteenth-century Winnipeg with walk-through shops and offices (all indoors); a great Chinese restaurant, in which we seemed to be the only non-Chinese customers; the Planetarium, which gave a good show and what we were sure was our only view of an eclipse; and finally, a gory Sherlock Holmes movie at New York prices. The weather all day had been densely overcast and COLD.

But now things were starting to get interesting. It was 1:00 a.m. Monday morning, and there were STARS visible. We had by this time found out that there was a tour group bus leaving a local hotel at 5:00 a.m. in search of clear sky, and that we might be able to get seats on it. A crucial decision had to be made. We rushed back to the motel, and turned on the 24-hour cable news and weather. The prediction: terrible, except for southwestern Manitoba, where we weren't. Pat once again restored a measure of sanity to our wild-eyed group by declaring, "Well, I'm not getting up at four o'clock." The man must be clairvoyant.

At 7:00 a.m. Monday morning there was not a cloud in the sky (or it was completely overcast; it wasn't light enough to tell). A half-hour later, there wasn't any doubt--

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we were actually going to see this mythical eclipse! For the next four hours, everybody we came into contact with (well, almost everybody) behaved like a seven-year-old waiting for Santa Claus. After bolting down breakfast, we all played with our cameras for awhile, talking gently to them and warning them not to look directly at the uncovered Sun. It was then indeed time to go out, get set up, and start freezing. There was a large, large open park directly across the street where two people were already fiddling with tripods, cameras, and telescopes. We joined them, dug our trenches in three feet of snow, set up, and set down --to waiting.

High clouds had moved in now, with about 45 minutes to go--ample cause for anxiety. By this time, however, we were so drastically enfeebled with excitement that we were barely capable of remembering our own names, and relocating was completely out of the question. This brings up an interesting point: eclipses seem to induce amnesia, at least of the short-term variety. I was repeating to myself over and over, "Marc, DO NOT forget to snap some color slides with Nina's camera during totality." I forgot. Dave was mumbling "Don't forget to look through the binoculars during totality." He forgot. No wonder they call it totality.

The character next to us was keeping a careful record of temperature throughout the partial and total phases. With a half-hour gone and a half-hour to totality (the Sun was 50% covered now), the temperature was down 4° F. The change in light was unnoticeable. (Camera fans might recall that the difference between a bright, sunlit day and an overcast day is about five or six f-stops, or a factor of perhaps 50. In other words, you need about 98% totality to cause a really significant change in scene brightness. The Sun is very bright.) The streetlights came on with about fifteen minutes to go. Dave had now started the tape recorder which he brought along at the request of Yervant Terzian, and we were making astute comments along the lines of, "Boy is it cold." Traffic continued to move as if nothing was happening (this was incomprehensible to an astronomer, of course). After totality traffic was also completely

normal. Nobody could remember a blessed thing about traffic during totality.

With five minutes to go, things started getting hectic. The Sun was 85% covered, and the light was thinning out. I was beginning to wonder whether I could make my hands work fast enough to change shutter speeds, remove dark slides, replace dark slides, and flip film holders on my 4x5 camera without inducing some major disaster. Time to take the protective filter (for focusing) off the camera lens. Check all the camera settings six times. Blow on hands. Watch the progress of the moon on the projection set-up at the small telescope next door.

With a minute to go, we were in another world. The shadow bands, due to focusing of the thin sliver of the sun onto the snow by thermal currents just above the snow level, were easily visible. (These appear to be commonly regarded as a great mystery due to causes unknown. We must have been lucky to have none but the slightest breeze; it was blatantly obvious what the shadow bands were. They look precisely like the light and dark pattern at the bottom of a swimming pool on a sunny day, but on a finer scale, of the order of inches.) It was twilight. The pigeons were flying in flocks in large circles overhead. And then the sky behind us, to the west, got VERY dark. Through the dense photographic negative I was using as a viewing filter, I could see the Sun going, going...

Take a picture, you fool! Almost succumbed to rapture of the eclipse and missed Bailey's beads, the Sun shining between the mountain peaks on the edge of the Moon (see cover). There were exclamations of "Look! Look! Look at the prominences!" and "Oh my God, look at the corona!" As we had heard described, people cheered and applauded, and they laughed and cried too. And after the initial shock wore off, it was very quiet.

I had seen many pictures of eclipses, but I was totally unprepared for the colors that were visible. The sky above us was very deep blue, and the horizon was dusky yellow on all sides, as it is about 15

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minutes before nightfall. The corona was a clear, pearly white behind the high clouds which were still with us. And the two prominences which I could see were so brilliantly red-orange that my first reaction was that something must be wrong with the Sun--it was in all ways as if somebody had pulled the plug. The sight of a black disk streaming red and white on a dark blue backdrop was indeed the stuff of which dragons are born.

Totality lasted a little more than two minutes, a terribly short time. When the Sun revealed itself from behind the Moon once more, I could feel the straining of everybody around me to push it back where it had been; it's clear that "third contact" is where more eyes must be damaged than at any other stage of an eclipse, because you just don't want it to go away (depending on what century you happen to be living in, of course).

The temperature had dropped by 7° F, but nobody except our friend had noticed.

And on our way back to the airport, everybody we encountered acted as if a very special sort of ordeal had just ended; the eclipse had generated enough fraternal warmth to overcome the blasted Canadian winter.

That left only the snowstorm in Pittsburgh to contend with.

And Hawaii, July 11, 1991.

THE TRAIN ON THE PLAIN

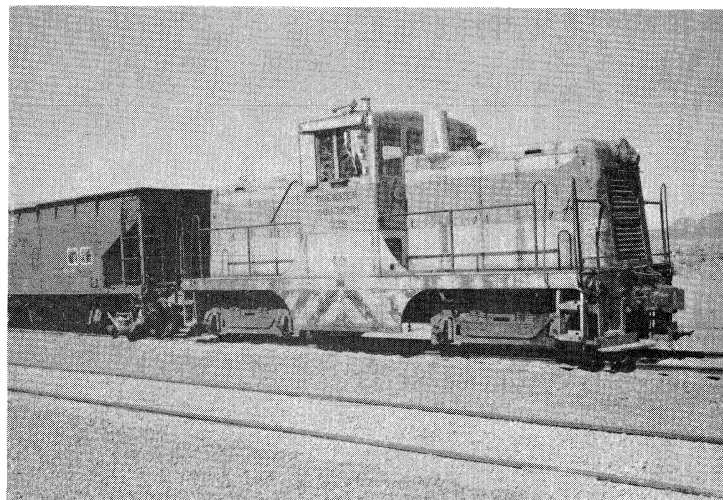
Jon Spargo

On or about February 1, 1979--we were all so excited we forgot to record the exact date (Doris wasn't all that excited about the choo-choo, it was Friday, January 12)--Pacific Railroad Constructors deposited a diesel locomotive on the VLA rail system. Since then 6 large hopper cars have appeared as well and our "Train" is now hard at work hauling gravel ballast to various points along newly placed trackage.

The saga began early last year as gravel contractor Richard Wood and company

began slowly to amass a huge pile of crushed stone along the east arm near Antenna 12. This prompted speculation that a train would sooner or later appear to haul it to its final destination.

Well, a Santa Fe or Amtrak it's not - but it does get the job done. For you



railroad buffs, the following (copied directly from the engine nameplate) are the engine specifications:

Weight: 44 tons
 Horsepower: 380
 Type: Diesel Electric Locomotive
 Class: B-B-88/88-4GE733
 Gauge: 56½
 Engines: 2
 Total Displacement: 17,000 cc
 Built for: Northern Railway Company,
 Sacramento, California
 Built by: Alco Diesel Electric,
 October, 1946
 Current Owner: Pacific Railroad Constructors.

The "Tidewater Southern" remains a mystery. The engine was delivered to Socorro by the Santa Fe, engine running (it is hard to start) but drive motors disconnected. It was then loaded onto a LARGE lowboy-type trailer, engine running, and hauled by a rather circuitous route to the Plains of San Augustin. Numerous bridge weight restrictions prevented use of the direct route from Socorro via US 60, so it was hauled south of Socorro to the NM 107

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exchange, brought back north to the west side of Magdalena and then out to the Site via US 60. Unloading was accomplished by laying rail right up onto the trailer and driving it off.

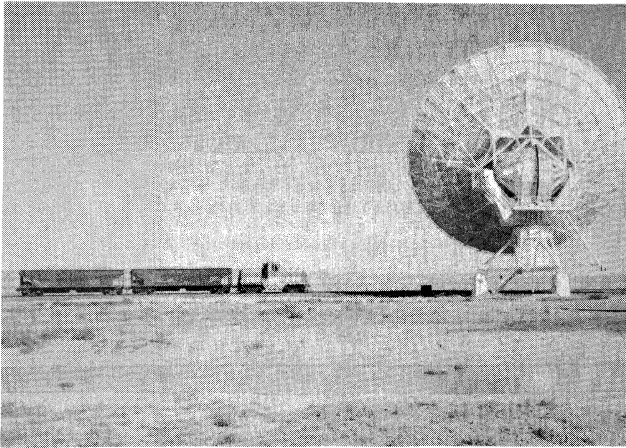
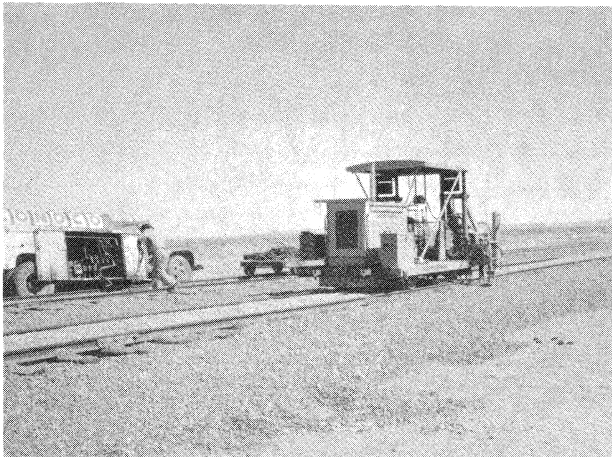


Photo 2* (above) shows engine and loaded cars headed out the west arm past Antenna 1 to deliver a load of ballast to the extremities of the west arm where final guaging, ballasting and tamping activities are underway (see photo 3, below).



Waiting in the wing is the east arm, where new trackage is proceeding at a rapid pace. Soon ballasting will begin there as a grade crossing on NM 78 has been installed. Completion of the current contract for the west and east arm is scheduled for some time

in mid-year. Shortly thereafter work will begin on extending the north arm across US 60. Indeed, another monstrous pile of gravel ballast is beginning to grow near where the north arm will cross US 60.

* Photographs courtesy of Mike Duggan.

LIFE ON A TROPICAL ISLAND

Martha Haynes

Those of you in the frozen northland will be glad to hear that here in Puerto Rico, spring is just around the corner. The days are getting longer (though they never got very short), the tomatoes are ripening on the vine, and the hibiscus blossoms are filling our backyard with yellows, oranges, and pinks. So don't give up hope, friends. We have been taking good care of the sunshine for you through the winter.

After spending two Januaries fighting the ice, snow, and cold at the 140-foot telescope, I decided to try out the warmth of the Arecibo Observatory, located in the hills just south of the city of Arecibo on the northwestern coast of Puerto Rico. The additional facts that Arecibo is the site of the world's largest radio telescope - all 1000 feet of it - and the residence of Riccardo Giovanelli (my husband), also made the prospect of becoming a postdoc at A. O. attractive, I must admit. On the other hand, leaving Charlottesville for the island paradise wasn't easy; I had to sell my beloved green junkmobile and my trusty bicycle and turn in my membership card in the Friendly Uncles' Bicycle Club, not to mention the trauma of cleaning out my desk. I also had to enroll in Spanish 101 at PVCC for three quarters. But now that I am here, just passing through a winter in which the low temperature recorded outside our house, which is located in one of the coolest sections of Puerto Rico, was 59° F (average daily high 85° F), I can confess that I don't miss shoveling snow.

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Being a child of the Northeast Corridor, born and raised less than 10 miles from downtown Boston, I find that simple living in rural Puerto Rico is an education experience of itself. Riccardo and I live in a four bedroom house in the bottom of an isolated valley in the small community of Esperanza about three miles from the observatory. Esperanza has no gas station or post office and there are no telephones at all this far out (7 miles) from the city. However, Esperanza is full of friendly and helpful people. We are also neighbors to horses, cows, goats, and lots and lots of chickens. Actually, we claim to be the godparents to a calf whose mother grazed in our valley. Not bad for a city kid like me.

The Arecibo Observatory is located in a very peculiar topographical area called a "karst" region consisting of alternating steep hills and valleys. The roads wind their way up and down in true roller-coaster style. There are 88 blind curves along the 10 miles between the observatory and the city of Arecibo. The 1000-foot dish itself fills a natural sinkhole. Yet along the coast, one encounters a perfectly flat coastal plain. Even though the island is small, the contrasts are large. The tropical scenery is never dull.

With warm weather all year round, one spends a lot of time in the fresh air - even at home. Since there is neither air-conditioning nor heating, the windows are always open and there is always a breeze. Surprisingly, the summers are not too hot (Charlottesville is much worse). The climate is moderated by the surrounding ocean, and the average temperature varies by only 5° from summer to winter. Very, very nice.

Nature is all around, with delicate orchids growing wild, the flaming red African tulip trees offsetting the green ferns, and the tiny tree frogs, called coquilles, chattering long into the night. In October, we had our own grapefruit, and later, oranges. During the summer, we started our banana plantation. Riccardo, by the way, looks quite charming in his white linen suit and straw hat, sitting on the front porch sipping a piña colada.

Outdoor life is very pleasant.

Normally, when one thinks of Puerto Rico, one thinks of long sandy beaches, blue ocean and matching skies, tall, slender palm trees, and gentle breezes. Well, yes, that is Puerto Rico. Swimming, snorkeling, surfing, sailing - all are part of the sport scene on the island. Puerto Rico is a tropical paradise...or almost.

The drawbacks to life in Puerto Rico exist also, of course. Despite the warm December breezes and the sunny skies, life is not always like a summer vacation. For one thing, work gets in the way of play, and it is, after all, our employment as staff astronomers that brought us to Arecibo. Riccardo and I have the dubious distinction of being advisers to users of the Arecibo Observatory's spectral line systems and we also live closer to the site than any other scientist. Alas, although there are no phones in Esperanza, we are plagued by seemingly incessant calls to us at "Radar 12", our in-house radio net. So we have learned a lot about autocorrelators, power supplies, encoders, decoders, tape drives and calibration noise tubes. For those of you who are not familiar with the lay-out of the Arecibo Observatory, let me remind you that a trip to the front-end means a 5 minute ride in a cable car to a 525-ton platform suspended by cables 435 feet about the surface of the dish. It is, by far, the cheapest thrilling ride around.

Then of course, there are many days spent inside the control room when we are using the telescope for our own observations instead of lying on the beach. For that, we can only blame ourselves...and the lure of the super-telescope. The Arecibo telescope is, after all, the Big Dish in the Jungle.

The tropical paradise has other problems also. For one, there is rain, tropical rain; when it rains, it pours. Humidity in Puerto Rico breeds extremely strong strains of mildew. The makers of Lysol receive strong support here. But the rain is needed to keep the vegetation lush and green, so we really can't complain.

And of course there are problems of overpopulation, with 3½ million people crowded into a rectangle 100 miles long and

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35 miles wide, much of which is too mountainous to be densely populated. The traffic is horrible, the roads are worse, the bureaucracy is overwhelming, unemployment is high (~ 20%), the water pressure is low, and the voltage during peak evening hours is marginal. But the Puerto Ricans have learned to cope with their circumstances. A typical evening scene in Esperanza is a porch crowded with people making their own music and singing. To my native instincts towards being cold and more reserved (the product of my upbringing), their gregarious nature is quite a contrast, and, in fact, arouses my admiration.

So, I now find myself immersed in a foreign culture, living a country life, in a land of strange plants and flowers. And it's fun. I only wish I had learned in my Spanish class at PVCC more useful phrases like "I have a flat tire; can you fix it?" or "Excuse me, sir, could you move your car? It is double-parked in front of mine."

ACCESS TO RECREATION AREA FACILITIES

Rich Lacasse

Member and guest cards will be used again this year to control access to Recreation Area facilities.

All members, as defined in Article III of the Constitution and By-laws of the NRAORA, (see bulletin boards) must present their cards upon request, in the Recreation Area. Cards will be routinely checked at the pool and equipment shack, but may be checked elsewhere.

Members may invite guests, as restricted in Article IV of the Constitution and By-laws. In addition, members may obtain guest cards for their guests. Guest cards will be honored just as member cards. The following policy shall apply to guest cards:

1. Guest cards may be obtained by a member for his out-of-town friends, for the duration of their stay.

2. Guest cards may be obtained by a

member for local friends. However, the following restriction applies: a given local friend may hold a guest card for no more than two weeks per year.

3. Guest cards may be obtained from the president or secretary of the Recreation Association. These officers do not commit themselves to being available on weekends, so some foresight in obtaining guest cards is advisable.

WHAT'S COOKING?

APPLEBUTTER CAKE

*from the kitchen of
Becky Warner*

½ cup brown sugar
1 teaspoon cinnamon
½ teaspoon nutmeg
½ cup pecans, chopped
1 cup sugar
½ cup margarine
2 eggs
¾ cup applebutter
1 teaspoon vanilla
½ cup All-Bran cereal
2 cups flour
½ teaspoon salt
1 teaspoon soda
1 teaspoon baking powder
1 cup sour milk

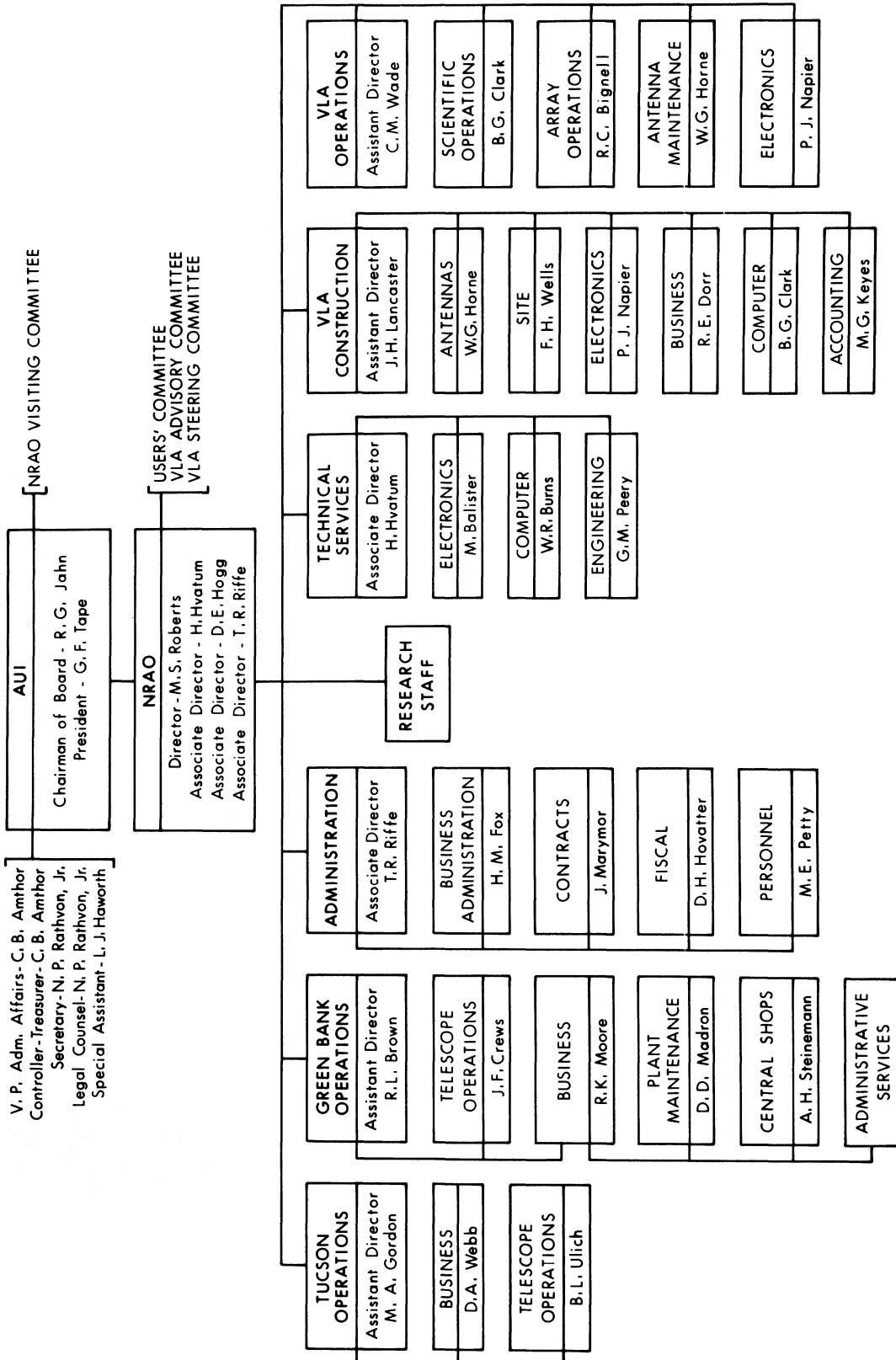
Combine brown sugar, cinnamon, nutmeg, and pecans; mix until consistency of crumbs. Set aside for topping.

Cream sugar and margarine; add eggs and beat well. Add applebutter, vanilla, and All-Bran.

Sift dry ingredients together; add alternately with sour milk to creamed mixture.

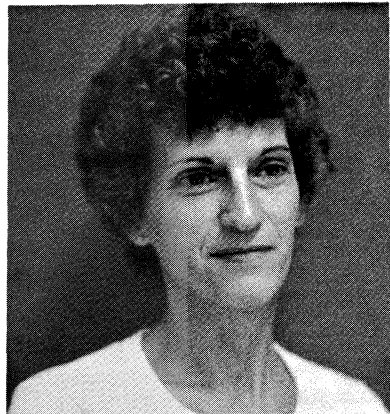
Pour half of batter in a greased and floured sheet pan (9" x 13" x 2"); sprinkle on half of crumb topping. Repeat layers. Bake 40 minutes at 350 degrees F.

NATIONAL RADIO ASTRONOMY OBSERVATORY
ORGANIZATION CHART
December 1, 1978

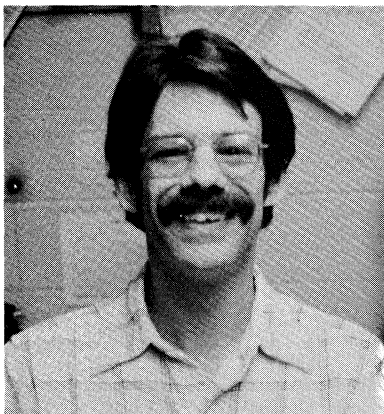


PERSONNEL UPDATE

NEW EMPLOYEES



Barbara A. Coerper
Technician Trainee
Charlottesville



Richard M. Davis, Jr.
Technical Specialist
Telescope Operations - GB



Dorothy A. Larkin
Executive Secretary
VLA - New Mexico

OTHER NEW EMPLOYEES - PHOTOS NOT AVAILABLE

Inez R. Carbajal	Assistant Cook	VLA - New Mexico
Walter E. Clayton	Senior Technician	VLA - New Mexico
Robert K. Hill	Technical Specialist	VLA - New Mexico
Mark R. Kostora	Intermediate Technician	VLA - New Mexico
Alison McGee	Secretary	VLA - New Mexico
Bengie Montoya	Secretary	VLA - New Mexico
Michael F. Plaster	Computing Aide Trainee	VLA - New Mexico
Jake F. Sanchez, Jr.	Maintenance Trainee	VLA - New Mexico

RETURN FROM LEAVE OF ABSENCE

Stanley S. Hansen

LEAVE OF ABSENCE

Lawrence Rudnick

TERMINATIONS

Ellen G. Ary	Floyd Jackson
Deborah J. Brawley	Michael G. Livesay
David L. Ehnebuske	David J. Peralta
Marion B. Gallagher	Cheryl W. Slocum
Robert J. Greiner	Simon D. M. White
George D. Harris	Alfred M. Zerwas

* * * * *

WHY RUNNING?

Pepper Moore

For more than 10 million Americans running or jogging has become not only a habit but a way of life. Anywhere you go nowadays you are apt to see someone running. Some of my friends complain you can't walk on the sidewalks in Charlottesville for fear of being trampled by a sweaty jogger. I don't know about that, but I do know running is a phenomenon that's not likely to disappear. Those of us who do run understand why--running makes you feel good and it's fun.

The physical benefits of running have become fairly well documented in the past 10 years. "Running gets the heart pumping and the blood flowing. It eats up fat, tones up flab, strengthens muscles, relaxes tension and gets you out-of-doors." This may sound like doctrine from Dr. Kenneth Cooper's New Aerobics but in fact it's a quote from a Connecticut Mutual Life Insurance advertisement which declares "We want you to run for your life." Some insurance companies now offer life insurance rate reductions to runners. Can there be a better endorsement for the physical benefits of running?

Most people begin running to feel and look better but soon discover running has psychological benefits they hadn't anticipated. I started jogging a year and a half ago to firm middle-aged muscles and lose extra inches. Somewhere along the way I discovered I not only enjoyed my daily runs but that I needed them. The time I run is my very own and as the mother of young children this is important to me. I asked some other NRAO runners why they run. Bill Brundage started running last May for "better physical health" but gradually found it more and more enjoyable. Now he contends the joy is his primary reason for running. Rich Lacasse (a serious enough runner he is a candidate for torch bearer for the 1980 Winter Olympics) is less poetic about his reasons. He started running four years ago for lack of any other exercise and continues to "keep in shape". He says he enjoys it

"most of the time".

But why running? There are other forms of exercise that can give many of the same benefits as those derived from running. Swimming, tennis, cycling and basketball are all good forms of exercise but jogging or running requires the least investment of time and effort for the same results. You don't need special equipment (just a good pair of jogging shoes); you don't need anyone else--you can jog alone starting from your own front door in just about all kinds of weather all year around.

I would be the first to admit that running is not for everyone. (My own husband claims it's boring. I do not agree--the variety of routes you can jog along--the varying weather conditions and the thoughts you carry with you offer never ending variety and challenge.) If you think you would like to try jogging, my advice would be not to start until you invest in a good pair of running shoes. Secondly, I would advise reading one of the many good books available on the subject. To this advice Rich Lacasse suggests not starting unless you commit yourself to trying it for a period of time. Aches and pains pass eventually. Bill Brundage advises not trying to push too hard in the beginning. Most running programs for beginners suggest you start with 20 minutes of exercise. Run until you are tired, then walk until you feel rested. You will gradually work into running the entire 20 minutes.

One final word on running. According to the volumes of literature now available on the subject, runners make better lovers. I asked about this and received one "no comment" and one hearty laugh. I guess if you want to know the answer to this question, you'll just have to try running yourself.

Editor's Note: Most authorities recommend a thorough physical before beginning a running program, especially if you are over forty.

NRAO ROUNDUP

*Reprinted from the NRAO Quarterly Report
for October 1, 1978 - December 31, 1978*

ELECTRONICS DIVISION

Charlottesville

The Model IV autocorrelator hardware is now 80 percent complete and the software is 40 percent complete. Delivery to Green Bank in approximately six months is expected.

Completion of the first of two Mark III VLBI terminals will be on schedule, at the end of January. Construction of a second terminal will then commence.

FET amplifiers at ~ 1.5 GHz have been constructed using Plessey and Hewlett-Packard transistors, with noise temperatures of 40 K and 25 K, respectively, at a physical temperature of 77 K. A two-stage 1.5-GHz amplifier will be constructed and tested at 20 K. Design of 5- and 15-GHz amplifiers is proceeding.

Cooled mixer performance in the 80-120 GHz range has been greatly improved with the use of diodes provided by Bell Telephone Laboratory. At 90 GHz and 115 GHz, single-sideband receiver noise temperatures have been improved from 600 K and 700 K to 340 K and 480 K, respectively. One mixer has a mixer noise temperature of 86 K SSB at 90 GHz and a physical temperature of 12 K. This is the lowest value reported for a non-superconductor device.

Further work on varactor-mixers for 115 GHz has resulted in units with conversion gain. However, noise-temperature measurements with a maser I.F. amplifier gave high receiver noise-temperatures of ~ 400 K. Some of the noise may be due to a quasi-optical LO diplexer. This is being investigated, but work on varactor mixers will taper off due to their poor performance relative to the new cooled BTL diode mixers.

Green Bank

Work has been progressing well on the first channel of the 5-26 GHz upconverter/maser receiver for the 140-ft telescope. Tests on the 8.2-10.8 GHz upconverter indicate that we will be able to obtain our

objective of a 50 K system temperature over most of this frequency range. AIL will soon deliver the 12-16 GHz upconverter and has started manufacturing the 4-8 GHz upconverter. This receiver should be operational by the end of 1979; the second channel will follow in 1980.

The 300-1000 MHz cooled upconverter/FET receiver is progressing. Cold testing of the prototype upconverter is currently taking place in the receiver dewar. Construction of the new traveling box track has started and it should be ready for testing and installation by mid-1979.

Development work on a circulator for a 40-50 GHz maser is continuing, with the main emphasis on the design of a circulator. A low pass filter has been developed for insertion between the K-band maser ruby structure and circulator to eliminate pump power leakage which is a minor problem with the current 18-26 GHz maser.

The development of the IF section for the Model IV autocorrelator is progressing. Testing and installation of the complete system at the 140-ft telescope is likely late summer of 1979.

The digital group has completed the 14 video converters for the first VLB Mark III terminal. The construction of a further 14 for the second Mark III terminal is well underway. A new inductosyn readout system to replace the Baldwin strobe lamp encoders on the 300-ft telescope has been developed and is ready to be installed.

Tucson

During this quarter work has started on a high voltage power supply for the 180-230 GHz carcinotron. Work is progressing on a system for phase locking this device to permit its use for spectral-line observations.

The performance of our 80-120 GHz cooled mixer receiver has been improved by diodes donated by Bell Telephone Laboratories. The improvement factor at 90 GHz is approximately 1.5.

Work on the 2-mm room temperature receiver has continued, and we now have a receiver temperature of 2000 K SSB at 150 GHz. A cooled version of this receiver has been started.

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The design of a 1-mm bolometer system operating at 0.3 K has been started. We expect to start construction of this receiver soon.

ENGINEERING DIVISION

Preparation of detail drawings for the 300-ft telescope traveling feed continued. Some parts of this system are now being built in the shop. Detail design of the drive system for the traveling feed progressed to the final stages. The 140-ft surface was measured on 72 radii, using the "stepping bar" method. Refinement and cross checking of the conceptual structure system for the 25-m millimeter-wave telescope was developed further. A contour map and conceptual site plan were developed for the proposed 25-m telescope. Studies and engineering assistance was provided the VLA project. Routine engineering assistance was provided operations and maintenance in Charlottesville, Green Bank, and Tucson.

COMPUTER DIVISION

Map Processing Development

Work is continuing on the map/image processing system. The software development projects at the VLA site and in Charlottesville are being coordinated so as to produce a single software system.

Spectral-Line Data Reduction

Single dish spectral-line data reduction may be done on a time available basis using the Charlottesville Mod Comp. The IBM 360 remains the primary data reduction path, in large part because of the use of the Calcomp.

IBM 360/65

The combination of VLA and VLBI data reduction programs has strained the input/output and the disc resources of the IBM 360/65. Replacement of this machine is not planned before 1981. We are investigating some channel configuration changes to relieve the difficulty.

VERY LARGE ARRAY PROGRAM

During the month of December the array operated for the first time with 15 antennas over approximately an 18-km baseline.

New suppliers have been found for the C- and L-band feeds and for the L-band circular polarizer. The need to find new suppliers for these feed components will delay the installation of the L-band circular polarizers until approximately April, 1979, but should not affect the schedule for the L- and C-band feeds. The new laboratory facility for the cryogenic and front-end groups was completed and occupied during the quarter. A review of the reliability of the CTI cryogenics systems currently operational on antennas shows that in the 11300 compressor hours accumulated to date on 4 antennas, no cryogenic failures have occurred. This is a very significant improvement over the reliability obtained with the Air Products systems. The new spectral processor was brought into operation at the end of October.

In the waveguide area, the final-design couplers have now been installed at all stations on the west arm out to AW8 at 17.2 km where the completed waveguide ends. Tests of the newly installed waveguide on the east arm show a mean attenuation of 1.04 dB per km at 50 GHz for the 5.62 km from BE6 to AE5.

The PDP-11/70 mapping software works and is improving. A character generator for the Dicommed film writer has been designed and is nearly complete. We have completed our analysis of our need for a second graphics terminal and have recommended purchase of a H-P 2648 and a Versatec printer to serve as a hard copy unit.

Arizona Railroad Co. is continuing the take up of 4500 feet of railroad trackage at Fort Huachuca, Arizona, and shipments are being received at the site.

The procurement activity has centered around exercising a number of options on major subcontracts thus utilizing the \$3.5 million in advanced 1979 funding, initiating procurement actions for the early part of 1979 and completing the 1978 purchasing requirements. In all, some \$4.3 million in

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procurement activity has been commenced or completed this quarter. In a number of instances, it has been possible to place orders for quantities to complete the requirements for the program. This has allowed price advantages to be taken of larger quantities and elimination of potential inflation.

Bids were received on the second antenna transporter. Arrangements were made to meet with the bidders early in December in order to evaluate their capabilities and also to conduct price negotiations.

On November 30, 1978, the General Accounting Office denied the Burn Construction Company, Inc., Request for Reconsideration and affirmed their previous

decision in favor of NSF-NRAO.

On October 26, 1978, two attorneys from the New Mexico Department of Taxation and Finance and experts from the U. S. Department of Justice visited the site to observe the movement of an antenna.

During the period November 28, 29, December 1, the Commission appointed by the U. S. District Court to consider the Ake-Taylor-Dunlap request for additional compensation for the land taken for the VLA held a final hearing in Las Cruces, New Mexico. It is expected that the Commission will visit the site before making their recommendations to the Judge.

Phase IV Site & Wye construction work went along on schedule and was 52 percent complete at the end of the quarter.

* * * * *

THE ROOFER*

Sarah Martin

Once upon a midday dreary, while I pondered, weak and weary,
Over many a quaint and curious tome of astronomic lore--
While I nodded, nearly flipping, suddenly there came a dripping,
Something, someone gently dripping, dripping on my library floor.
"'Tis some scientist," I muttered, "spilling coffee on my library floor--
Only this and nothing more."

Ah, distinctly I remember it was in the bleak December;
And each separate falling droplet wet its spot upon the floor.
Eagerly I wished the sunshine;--vainly I sought the bright sign
Thro' the windows shining bright sign, bright sign on the library floor--
But only gloom was there to greet me, clouds descending ever lower,
Bringing rain to the library floor.

And the years ebbed ever onward, onward thro' the bleakest seasons,
Bringing only briefest respite from the dampness on the floor--
Soggy dampness of the floor. "Repair!" I cried to unhearing minions;
"Stop the dripping, please, forever, this I fervently implore."
But still the rain fell ever downward, downward to the library floor,
Soaking into the soggy floor.

Presently my soul grew stronger, hesitating then no longer,
"Sir," said I, "or Madam, truly your forgiveness I implore;
For whatever evil done to cause this constant dripping, dripping
On my library floor. I repent, but please, the dripping--
Stop it from the library hitting, hitting on the soggy floor;
Cease it now forevermore."

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"'Tis the skylight," they responded, "letting in this ghastly flow.
It leaks," they said, "and we shall stop it, stop the dripping evermore."
So with copper ore they topped it, figuring now they'd finally stopped it;
"'Twill squish no more," they radiantly beamed, pointing at the library floor;
"We've stopped the horrid, madd'ning dripping, dripping on the library floor--
We have stopped it evermore."

Ah, they stopped the sunshine leaking, not a ray could be seen peeking,
Seeping to the library floor. But the rain came ever downward,
Downward to the library floor and they muttered, muttered only--
"Should have stopped it evermore. Can't understand it," they pouted,
"Should have stopped it evermore." "But it's dripping still," I shouted,
"Dripping on my library floor."

Now they tell me all is figured, figured out the library leaking,
"Needs a roof to stop the leaking, leaking on the library floor."
(Water makes a soggy floor.) "Needs a roof," they sputter vainly,
"Only this and nothing more. Once the roof's in place it's over,
No more leaking thro' the ceiling, leaking to the library floor--
Repaired forever--ever, ever, evermore."

"Be that word our sign of parting, man or fiend!" I shrieked, upstarting--
"Get thee from the ceiling and the leaking to the library floor!
Leave no dreaded skylight cover, sign of the lie thy soul hath spoken!
Leave my trashcans unmolested!--Quit the roof above my floor.
Take thy tar from off my cover, and take thy form 'way from my door!"
Quoth the turkeys "Evermore."

Many times repaired the leaking; many times repaired the ceiling;
Still the trashcans wait with unending patience upon the library floor--
Bathed in ghostly light fluorescent, holding ducks and penquins pleasant,
Swimming in the leakage pleasant, suspended above the soggy floor.
Nought use have I for you, oh bumbling repairpersons of yore,
The roof shall leak forevermore.

** With humblest and sincere apologies to the memory of Edgar Allan Poe.*

* * * * *

SPRING FOREST FIRE SEASON BEGINS MARCH 1

Statutory spring forest fire season begins March 1 and runs through May 31, according to Charles R. Hall, Assistant State Forester in charge of fire control.

Last fall's fire season which ended December 31, showed 613 fires burned 20,967 acres. This was the worst fall fire season in recent history in terms of damage to the forest resource.

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

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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 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. However, this permit does not cover Air Pollution regulations.

Escape of ANY fire at ANY time to the lands of another shall be in violation of the law.

All sawmills, power shovels, or an engine or machine capable of throwing sparks must be provided with an adequate spark arrester 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 of 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, Hall advises that all individuals who need to burn anything should check for compliance with Air Pollution and Health Department regulations and local municipal ordinances.

CREF UNIT VALUES - 1979

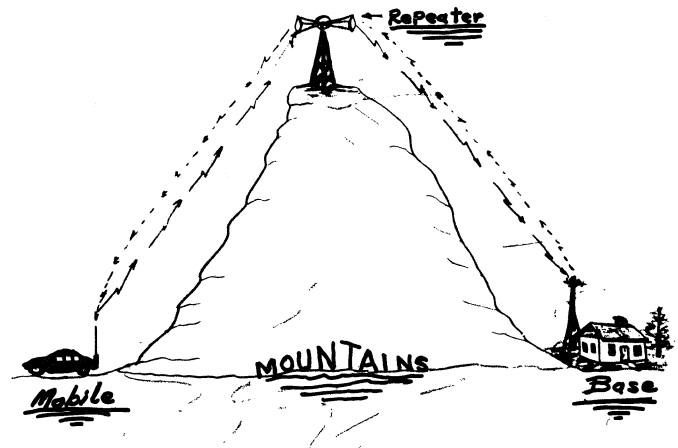
January - \$40.90 February - \$39.47

QUIET ZONE UNDER ATTACK

Reginald D. Atkins

In March of 1977 the observatories (NRAO and NRL) asked the Federal Communications Commission to consider bringing the Amateur Radio Service and the General Mobile Radio Service under regulation of the quiet zone coordinating procedures.

There was a recent article in the *OBSERVER* on amateur radio, so you have a general idea about that service. The General Mobile Radio Service is a class of CB service operating in the 460 MHz region of the radio spectrum. Both of these services make use of radio repeaters to relay radio signals across mountainous terrain or greater distances.



Why have we become concerned about these radio services? At the time the quiet zone was established (1959), repeater stations were not allowed in the Amateur Radio Service, and the General Mobile Radio Service repeaters were not popular. During the mid-1960s, amateur radio repeaters came into use and were exempt from the quiet zone regulation.

Over the past few years the use of repeaters in the Amateur Radio Service has become very popular resulting in a proliferation of amateur repeater stations. The General Mobile Radio Service has also become very popular and has intentionally been used to circumvent the quiet zone regulation of Business Radio Service.

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These repeater stations are usually placed on high mountain peaks which are very exposed to Green Bank and Sugar Grove and have caused us to restrict the limits of some observations. So by a joint effort the Navy-NRL and NRAO have asked that these services be brought under the quiet zone regulations.

Because of our request for rulemaking, we have been struck by fire and brimstone from the amateur community. Understandably, the radio amateur radio operators are strongly against us. They are sending their comments to the FCC, congressmen, city councils, etc. I don't object to the resistance of the new regulation; everyone has a democratic right to express their viewpoint. My complaint in this area is that in most cases the comments to the FCC contain incorrect information and show a gross misunderstanding of our intent. Most comments are based on assumptions, not fact.

Copies of the public comments to the FCC are available in my office for anyone who may care to read them over. Comments from any of you are welcome.

THE LITTLE ELECTRON*

Thomas R. Hawkins, Jr.

Once upon a time there lived a little Electron.

(Note from the author: "Now that I have you so deeply engrossed in my story that you can't lay it down, let me give you a short résumé of what you are in for. It's fiction, dear reader, pure simple fiction. If you don't like fiction, now is the time to get out.

Now that my readers are separated from the men, we can proceed with the adventures of our friend, The Little Electron.")

Once upon a time there lived a little Electron, who in his much younger days resided at a place called Atom, deep in the heart of Copper Matter Land. Here he spent all of his growing years spinning merrily

around his Pappa, who was called Father Proton; and his Mommy, who was called Mother Neutron.

Little Electron was very happy with his rotating existence. He had everything that a well-to-do middle class atom family of that time could possibly give to their young. In addition he had many little friends who passed very close to his own orbit, although he had no time to play or chat with them. After all, who in their right mind wanted to pass the time of day with other electrons, when he could be gaily circling, at tremendous speeds, around Pappa and Mommy. Joy was our hero's lot, but not for long.

(Note from the author: "Now is a most appropriate time to change the scene. The plot must thicken, melodrama must prevail. We are going to dwell very briefly on the political situation of an electron's world, so that my readers can get the big picture.")

Near the edge of Copper Matter Land a great foreign country called B-Plus existed. This great power was very jealous of the tranquil life in Copper Matter Land. B-Plus being a rather riotous place, coexistence could not endure. An attack by B-Plus upon its neighbor was soon in the making.

All the great powers in B-Plus gathered a mighty Electromotive army composed of Ampere upon Ampere, augmented by hard-hitting volts. It was a formidable army indeed that threatened defenseless Copper Matter Land.

When the first of the invaders touched the shores of our hero's homeland very little change was felt by Electron and his family. Their daily life went on as usual; but as the Electromotive force pushed on, and occupied atom after atom, a change took place.

Refugees, whole families, countless hundreds of thousands of them fleeing their homes. The younger, faster electrons managing to escape the grinding army; but the older, slower father Protons, and the mother Neutrons were captured. The charging Amperes, and lightning like volts were doing their work well.

As electron upon electron fled the heel of the oppressor, they continually jammed,

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and shoved to get farther into Copper Matter Land. Soon the churning, speeding horde of refugee electrons reached little Electron's Atom. Our friend was swept up in the tide. He was uprooted from his home, torn from his mommy and daddy, forced away from his friends.

Naturally he resisted with all the braveness of the hero he was, but it was all to no avail. Little Electron became a product of the society he lived in; a wandering, refugee electron, doomed to race for all eternity just ahead of the terrifying Electromotive Force, from the land of B-Plus. His only hope - infinity.

(Note from the author: "It is often said that electrons have a negative perspective on life. After reading this short story of their existence, it is understandable why this is true.")

* Reprinted from the OBSERVER, October 31, 1963. Thomas R. Hawkins, Jr. - author.

1979 NRAORA

Rich Lacasse

The NRAO Recreation Association in Green Bank is busy again this year providing entertainment and recreational activities for its membership and their guests. This year's Board of Directors of the Recreation Association includes Rich Lacasse (President), Pat Crane (Vice-President), Bill Brundage (Treasurer), Janet Warner (Secretary), Bill Campbell, Winston Cottrell, Ray Hanshaw, Wendell Monk, Troy Moore, Harry Wooddell, and Al Wu. These people are pooling their efforts to provide many of the activities that people have come to expect in the past few years: dances, movies, bingo, an Easter-egg hunt (April 08 --kids, don't forget that!), the annual picnic, and possibly a pool party, and concert.

The Board highly encourages the membership's input. We have posted meeting minutes on various bulletin boards around

the site to keep the membership abreast of the Board's activities. Our meetings are usually held on the third Monday of every month and are open to the membership. Thus far this year we have had some great support from its members. Marc Damashek has designed a dark room in the Hannah House, and has volunteered some of his equipment and time to get it going. Dave Williams has asked the Board to survey interest in fly-tying, shot reloading, and archery in hopes of spearheading efforts in these directions. Such cooperation is fantastic and the Board is highly appreciative. The 1979 NRAORA is hoping to provide many enjoyable experiences for its members this year, and with a little help and support we hope we'll succeed.

WHAT'S HAPPENING AT NRAO-WEST (36-FT)?

Werner Scharlach

Well now, that's a good question. It's been a while since John Weaver nearly stepped on a rattlesnake inside the dome, and longer still since Mike Hollis passed a mountain lion in the night. But it is rarely dull around here.

In winter we have just enough snow to remind us of our youth. In summer we have tremendous electrical storms. In between we have beautiful sunrises and sunsets. And I should add that our lightning strikes many times more than once in the same place. Arizona weather is mostly unpredictable. Ask John Weaver, he can explain it better than I.

As for operations, we are a close-knit bunch on the job. Off the job we largely go our own ways, however, and that's alright, because familiarity can cause contempt, as the old saying has it. We do get together for picnics and an occasional party.

We are roughly twenty people from the boss down to the sanitary engineer. The telescope works full time, except for emergencies and scheduled maintenance, the latter usually on Wednesdays, and the

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former any old time. Our operators work hand-in-glove with electronics and routine tweaking is handled via phone by the operators. This saves some running up and down the mountain during the night. Major repairs and installations, of course, are handled by electronics with the rest of us assisting. We can, and do, rely on each other, knowing that we have help when we need it, regardless of the time or weather. We are justly proud of our crew - which is us!

Nevertheless, we cannot afford to go to sleep on our laurels, thinking that because we are cracker-jacks then all is well. That attitude would do us in in pretty short order. No, siree, Bob, we

have to keep ourselves up to snuff, too. So we have refresher sessions, and when a new piece of gear or a new program comes on line, we schedule a training period.

The general attitude of the people is easy-going, and professional. We laugh easily. I haven't seen a sour puss lately, unless I count myself yesterday (I had a one-day flu attack). Being able to laugh at ourselves and together is a good safety valve.

So what's happening at NRAO-West is a lot of good things. It's a challenging place. Our track record is good. Our "customers" still line up to get observing time here, and we are working to keep it that way.

* * * * *

GB EMERGENCY SQUAD REPORT

Ron Weimer

At the first of each year I prepare a summary of the emergency organization activities for the previous year. I have thought in the past that this might be of general interest but have never gotten around to putting anything together for an article. This year I decided to bite the bullet and do it. Actually, I would like to cover two areas: first the statistics and second a short report on a training session we had in the past with a small "pitch" at the end.

The organization statistics are presented in the table below. Some discussion

is in order to more fully understand the table.

The 1975 figures are not complete because the records were not broken down as completely at that time. The run hours are a figure that represents the man-hours (or Harry might say woman-hours) during runs, from the time the call out is made until the equipment is back in service again. "On" represents the hours expended during normal working hours. The "off" hours represent those "three in the morning" runs when the squad members are putting in their own time. As you can see, these amount to around twice

Year	Number of Runs	Miles Covered	Run Hours			Grand Total Hours
			On	Off	Total	
1975	37	----	---	---	260	620
1976	60	2560	140	393	533	870
1977	49	2681	242	404	646	939
1978	44	2497	160	318	478	820

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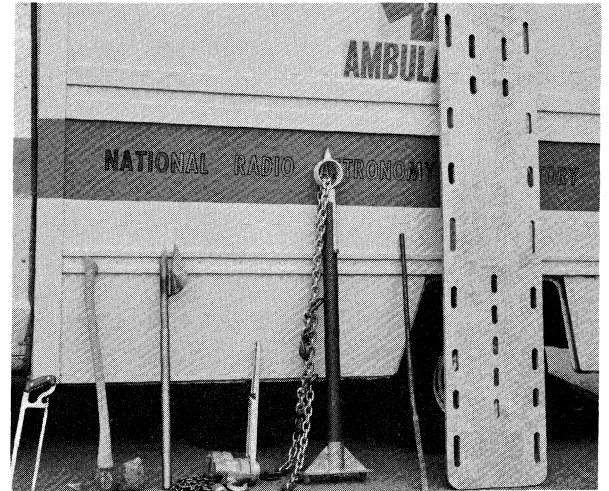
the on duty hours. The grand total hours include the run hours and also any training, servicing, and testing time. Some of this is during working hours, as when we had the fire practices in the Residence Hall last April, but a lot of it is spent on weekends and evenings. The present ambulance squad has eleven active members, four of which are also on the fire squad. All of these are state registered Emergency Medical Technicians-Ambulance, abbreviated EMT-A. Three (Jim Gibb, Buck Peery, and myself) out of the original six NRAO EMT-A's were state recertified last year by taking a 40 hour plus refresher class and passing the National Certification test. The other EMT-A's were certified after taking the 120 hour plus course and passing the state exam that was given at that time (1977). They are Harry Wooddell, Pat Crane, Fred Crews, Jim Rexrode, Howard Brown, Rich Lacasse, Winston Cottrell, and Janet Warner. In addition, Len Howell and Jim Coe assist by driving the ambulance when we are short handed.

A special note of thanks is in order for the people that do the dispatch work for the ambulance and fire squads. During the day Janet Warner and Becky Warner provide this vital service. After hours the load is split between the guards and the interferometer operators. These girls and fellows do a grand job of keeping their "cool" under very trying circumstances. When you have a person that is near hysteria on the other end of the phone line it takes some "cool" to find out the vital information, and then relay that info to the appropriate squad members so that action can be taken.

While we are on the subject of thanks, it would be appropriate to say thanks to the people from the works area who keep the equipment working in good order and also build, modify, install, etc., a lot of equipment that we have on our fire trucks and ambulance. The Electronics Division people have been a big help in keeping the communications equipment going. Thanks also.

Around two years ago we held an auto extraction practice. Actually, it was held in two parts. During the first session some of the NRAO emergency personnel practiced

auto dismantling. The second session was for the then current EMT class to practice both auto dismantling and patient packaging. This was part of their required training for state certification. In the auto dismantling portion of the practice we learned to use the tools that we might need to gain access to an auto wreck patient. This



Tools used in auto dismantling.

is to allow us to get to the patient and safely remove the patient from the auto. Most of the tools are carried right in the ambulance. Photo 1 shows some of the tools used in this practice. Photo 2 shows some of the people who "worked on" Claude Williams' car (photo 3).

The patient packaging portion of the class covered the procedures required to allow the removal of a patient from the auto without further injuring him. This might consist of splinting legs and arms or, if any neck or back injury is suspected, to complete immobilization on a back board. The back or spine board is shown standing beside the tools in photo 1.

In addition to Claude's car, we also had a car donated by Jamie Sheets, one donated by French Beverage (gratuitously towed up here by Neil Snyder), and two donated by and towed up from Sheets' Garage. Our public thanks to Claude, Jamie, French, Neil, and Alfred Ervine at Sheets' for their cooperation.

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Part of the training class.



Claude Williams' car after training session.

This brings me to the "pitch" I mentioned way back at the start of this article. We are starting to plan another auto extrication session for this summer. As such we are in need of a couple of autos. Wrecked vehicles are okay. Ones that are completely rusted up are not substantial enough. If they have seats, it provides for better simulation of the packaging phase of the exercise. Anyone

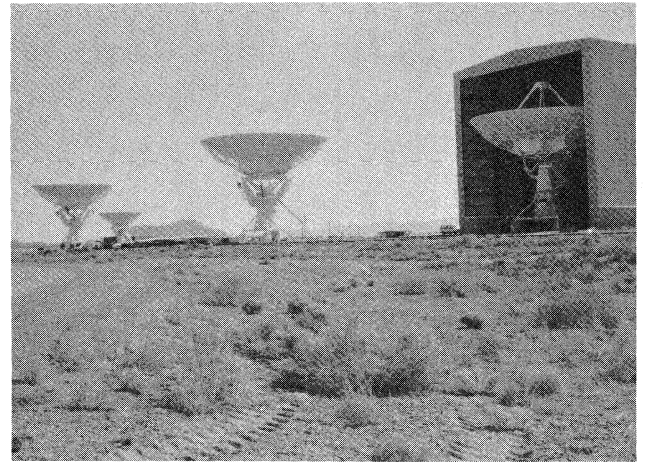
who might have a candidate or know of one should get in touch with Fred Crews or myself so we can determine if it would be useful. This type of practice session is important so that we may maintain the level of skills necessary to do our jobs well. We all hope never to need these skills but try to be prepared just in case.

Sometime in the future I will try to have an article dealing with the fire squad in more detail.

PROGRESS AT THE VLA

Ed Fomalont

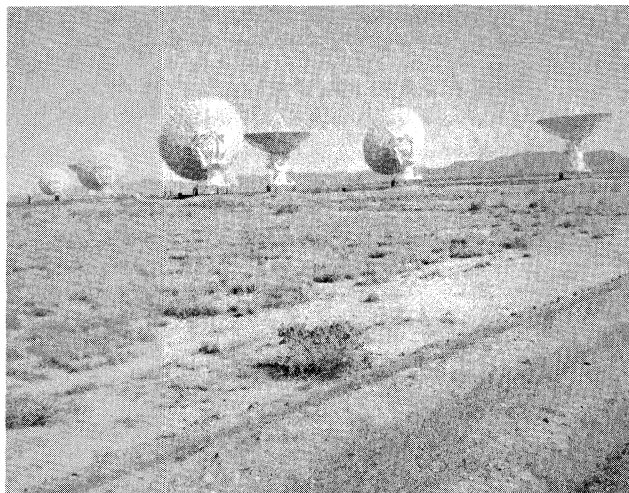
The antennas are rolling out as fast as Pinto's on the Detroit assembly line. In the photo below Antenna 23, nearly completed, is in the construction hangar, Antenna 22 is on the master alignment pad, Antenna 19 is on the CW6 station about to be incorporated into the array, and Antenna 20 is on the maintenance/outfit pad in the background.



Antenna 23 in the construction hangar.

The central region of the 'Y' is filling quickly with antennas as the photo on the following page shows. Going left to right are Antennas 17, 21 (just barely

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LIBRARY ADDITION

Omar Bowyer

In June 1978 the West Virginia Library Commission approved a design and plan for constructing an addition (Green Bank Library Activity Room) to the Green Bank Library. The plan stipulated, among other things, that the major costs of materials and labor must come from private donations. A \$5,589.00 donation from the Benedum Foundation of Clarksburg, West Virginia paid for a large portion of the building materials. Labor expenses were largely eliminated because Pocahontas Countians volunteered their time and talents. A request for \$1,000.00 (for a back porch) is still pending with the Senior Citizens Commission. Smaller, private donations were used to buy furniture for the addition.

The West Virginia Library Commission, a non-private organization, contributed \$2,500.00 for materials. As the addition neared completion, the Commission was so impressed with the volunteer workers' progress and workmanship that they agreed, with just a little encouragement, to pay for enlarging the parking area and black topping the parking lot and driveway.

Work started immediately after Commission approval. Many Observatory people were involved in the project. Sidney Smith, Gail Geiger, Jim Rexrode, Herman Coleman, and Neil McLaughlin excavated and built forms for the floor and foundation. Jo Ann Gardener worked with a Vista crew who laid the steel and finished the concrete. Building construction and painting were done by a volunteer labor force which included Joan Barkley, Ralph Becker, Omar Bowyer, Karen Brown, Bob Brown, Carl Chestnut, Jim Coe, Pat Crane, George Grove, Bruce McKean, Wendell Monk, Ron Monk, Russ Poling, Shep Sutton, Al Wu, Dave Williams, and Boyd Wright.

Questions and head-scratching started with construction; mainly because there wasn't a carpenter directly involved, and because throughout the building construction, changes and ideas had to be resolved to suit the majority. Several changes come to

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The center of the "Y" is filling up.

visible) and 18 on the north arm, and Antennas 3, 5, 10, and 7 on the east arm.

As of March 15 Antennas 1 through 18 are working in the array. However, Antennas 5 and 7 are being retrofitted with second generation electronics and cryogenics systems, and Antenna 11 is used for special electronics observing so that about 15 antennas are used during most observing sessions. About thirty percent of the time is now used for scientific observing, fifteen percent for VLA calibration and debugging, and the remaining time the array is down for construction and maintenance. The number of antennas and percentage of time devoted to scientific observing will probably not increase much over the next year in order to finish construction as quickly as possible.

Spectral line capability for the new correlator system will soon be installed. With the system, radio maps can be made simultaneously at 256 frequencies and astronomers can then study the radiation from hydrogen and other molecules. The amount of data produced from this spectral line system is enormous and a group at the VLA and in Charlottesville is beginning to purchase and design the necessary computer systems to handle the volume of data.

mind immediately: a picture window was added, doors were changed, and a small office was traded off for two cabinets.



Library and activity room addition.

The purpose of the library activity room is for public activities such as meetings and movies. Over a dozen groups have used the addition since it was opened last December. On the average, fifty people use the room each week. If you need a public meeting place, you can make arrangements with Rose Bowyer - 456-4507.

At a later date the library hopes to install a TV tape player in the new addition and show pre-recorded public broadcasting programs. Later in the spring an outdoor flea market is planned to raise money for the library. Please keep the flea market in mind and save your salable junk.

While the future of the library rests with the needs of the community and what it can afford, our immediate needs are for volunteers to help mend fences, paint, and mow grass. If you are asked to help out this spring and summer, a "Yes" will certainly be appreciated.

Orchids to all of you who have involved yourselves in one way or another with the library.

NRAO SERVICE AWARDS BANQUET

R. K. Moore

The 12th Annual NRAO Service Awards Banquet was held in the Green Bank cafeteria on March 16, 1979. The weather was beautiful and attendees from Charlottesville, for the first time in several years, had a pleasant drive to and from this fine event. (Except for spring pot-holes.)

Employees were honored who had completed ten and twenty years of service as of 31 December 1978. Employees included those qualifying from both Charlottesville and Green Bank. In addition, we were pleased that Bob Hjelling from the VLA was in the area and could join us for the occasion.

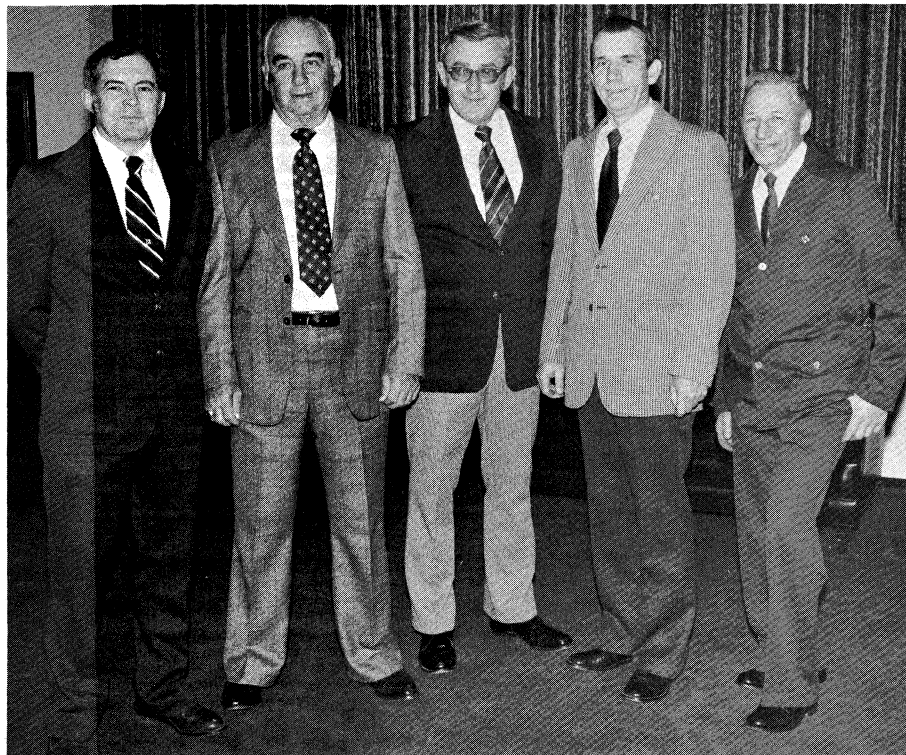
Certificates and lapel pins were presented to the awardees by Dr. Morton Roberts, Director, NRAO. In addition twenty year awardees were presented with a tie tack and tie clasp in recognition of their twenty years of service.

Twenty Year Awardees: James F. Crews
Basil M. Gum
Hanson P. Hall
Sidney C. Smith
Bedford R. Taylor

Ten Year Awardees: Ernest B. Allen, Jr.
Ralph L. Becker
William D. Brundage
Winston S. Cottrell
Harry M. Fox
Robert M. Hjelling
Merle G. Kerr
William F. Lovelace
Welford C. Luckado
Dharl McLaughlin
Joanne L. Nance
Berdeen S. O'Brien

This brings to 159 the number of employees who have completed ten or more years of service. Of this number 11 have completed 20 years. 126 of the 159 are still employed by the NRAO.

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Twenty Year Awardees

- L to R: Sidney Smith
Pat Hall
Fred Crews
Basil Gum
Bedford Taylor

Ten Year Awardees

- L to R: Bob Hjellming
Harry Fox
Ralph Becker
Bill Lovelace
Berdeen O'Brien
Bill Brundage
Dharl McLaughlin
Merle Kerr
Joanne Nance
Ernie Allen
Winston Cottrell
Welford Luckado



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