

The Green Bank Tattler

You better read it, we could be talking about you!

Volume 4, Number 2 September 1996

Edited by F.Ghigo

Regular activities:

Aerobics every Tuesday and Thursday from 5:30 to 6:30 p.m. in the Tour Center. Call Janet Ghigo for info at 456-3298.

TaeKwonDo every Monday at the Tour Center: kids 5-12 at 6:00 to 6:30 pm; 12 & up at 6:30 to 8 pm. See Rich Hall for info.

Volleyball every Sunday and Monday evening at the Hannah House, until the weather turns cold.

Sunday Menus at the Cafeteria

- Sept.8 Country style steak, mashed potatoes, carrots, peas.
- Sept.15 Baked ham w/ potato salad, green beans, corn.
- Sept.22 Baked chicken w/ noodles, peas & carrots, broccoli.
- Sept.29 Pepper steak, parsley potatoes, mixed vegetables, winter blend.
- Oct.6 Beef stew with cornbread.
- Oct.13 Hot roast beef w/ gravy, mashed potatoes, succotash, baked apples.
- Oct.20 Meat loaf w/ gravy, macaroni & cheese, carrots, peas.

Farewell and best wishes to

Len Howell, who retired after more than 30 years with NRAO.

Tom Bania, returning to Boston U., after five months on sabbatical in Green Bank.

Naomi Bates, our star astronomy student, starting college this fall at Princeton.

Calendar of Upcoming Events

- Sept.12 Colloquium: Bob Brown: the MMA. 3:30pm
- Sept.17 Colloquium; Tony Zensus. "Twisted Jets". 3:30pm.
- Sept.18 Fall Golf Tournament with CV at Canaan Valley.
- Sept. 19 Colloquium: Elizabeth Waltman (NRL): Evolution of outbursts in Cygnus X-3. 3:30pm.
- Sept.23 Colloquium: Tom Wilson. 11am. Isotope measurements and solar system formation.
- Oct.10-11 GBT advisory committee.
- Oct.14 Holiday (Columbus Day)
- Oct.17-19 Deer Hunt on site.
- Oct.28-29 Local astronomy symposium in Charlottesville.
- Oct.29 Jansky lecture by Jim Moran in Charlottesville, 8pm.
- Oct.30 Jansky lecture by Jim Moran in Green Bank, 7:30pm.
- Nov.28-29 Holidays (Thanksgiving)
- Dec.9-14 Deer Hunt on site.
- Dec.19-21 More Deer Hunting.
- Dec.24 Half-day holiday
- Dec.25 Christmas holiday.
- Jan. 4-11 Teachers' Institute.

Who's New?

Welcome to:

Bill and Jan Tift, from the Univ.of Arizona, will be spending a sabbatical year here.

Nathaniel Thomas Langston Born July 7 at 9:01 pm EDT.

Project Phoenix, a whole flock of people and equipment, settling in at the 140-ft to carry out a search for intelligent extraterrestrial signals.

Don't forget to sign up with Bob Vance or Dave Williams for the GB/CV Fall **Golf Tournament** to be held Sept. 18th at Canaan Valley.

Test Observations of the Iridium Satellites

M. M. McKinnon

Many of you may have read about Iridium in a magazine or perhaps you overheard someone talking about it in the Jansky lab. Odds are you will be hearing more about Iridium in the very near future.

First of all, what is Iridium? Iridium will be a constellation of 66 satellites evenly distributed among 6 polar orbits. The orbits are roughly circular, and a single satellite will travel around the Earth in about 100 minutes. The satellites will radiate their signals over a frequency range of 1621 to 1626 MHz. The satellites will provide wireless telephone communication services around the world. In other words, the service Iridium will provide is similar to that of cellular telephones, except that Iridium will operate on a global scale whereas cellular operates in specific geographical areas.

For a specific example, suppose you climb Mount Everest and happen to have an Iridium handset in your backpack. You can call your friends and family in Pocahontas County to let them know you arrived safely at the summit.

The first set of satellites will be launched in mid-November of this year, and we will make test observations of these satellites in January 1997.

Why do we want to perform these tests? Radio astronomers do not want the "spurious emissions" from the satellites to interfere with their observations of the hydroxyl radical (OH) in a portion of the electromagnetic spectrum that is reserved for radio astronomy (1610 - 1614 MHz). The Iridium consortium, led by Motorola, does not want to jeopardize their multi-billion dollar project by radiating signal power levels that exceed those established by appropriate rules and regulations. Both the NRAO and Motorola recognized the importance of test observations, and agreed to work cooperatively on a test program. The objective of our test observations is to measure the power level of the satellite signal in the radio astronomy band to insure

that it does not exceed the harmful level of interference as recommended by the International Telecommunication Union. This level is -238 dB (watts/m²/Hz) or about 158 Jy.

Measuring a 158 Jy signal should be a trivial observation, but the test observations of the Iridium satellites pose a number of interesting technical challenges. First, the satellites move really fast. The speed of a satellite is about 33 degrees per minute when it is directly overhead, which means it will pass through the beam of the 140-ft telescope in about half a second! We won't be able to track the satellites. We will probably park the telescope near the horizon, and let each satellite pass through the telescope beam. Second, since the satellite signal will be received by a handheld telephone, it is no surprise that the signal will saturate the amplifiers in our telescope receiver. We can actually make some simple modifications to the receiver to avoid saturation while still providing the sensitivity we need to make the required measurement. Third, there is the problem of what I call "satellite confusion". Other satellites are in the sky, and they can radiate signals in the radio astronomy band. The GLONASS satellites, the Russian equivalent of the US Global Positioning System (GPS), are notorious for this. GLONASS poses a serious problem because we don't want to attribute the spurious emissions from GLONASS to Iridium in our test observations. As luck would have it, the Iridium signal will be modulated in such a way that we may be able to synchronize data collection with the modulation, thereby isolating the Iridium satellites in the test observations. The list of challenges goes on, and, fortunately, we have been able to at least propose viable solutions to these challenges. I just hope that we identify most of the problems associated with these unusual observations before January!

Good news:

Rumor has it that sometime in mid October, staff will be able to occupy the new addition to the Jansky Lab. However the new building does not as yet have an official name.

Ergo, let us start an unofficial contest in which staff can submit recommendations for a name. Send your contributions to the editor and he might list the best ideas in a future Tattler issue.

Because of the pioneering work of Grote Reber, special emphasis should be on names that form an acronym for REBER or GROTE. [.....Ron. M]

RFI Monitoring at the 140-ft Telescope

M.M. McKinnon

About a year ago, we started monitoring radio frequency interference (RFI) with the 140-ft telescope. The primary objective of this program is to document the interference environment at Green Bank. We usually conduct our monitoring observations every time a receiver is changed on the telescope, but we only monitor frequencies below about 3 GHz. The telescope is pointed to the zenith, and spectra are recorded at one second intervals for a total duration of about five minutes. This process is repeated at different sky frequencies until the entire passband of the receiver is covered. This particular telescope orientation was chosen because, during an actual observation, most man-made interference originates on the local horizon and is received by the far sidelobes of the antenna beam. The information we can extract from the data includes the location of the RFI in frequency, the strength of the RFI, and how often it occurs.

Samantha Fore, an undergraduate at Virginia Tech, has analyzed the vast majority of the RFI monitoring data. Samantha has been working at NRAO through a student cooperative work program. Samantha has documented her results in a nice technical report entitled "Summary of RFI Monitoring". You can ask me for copies of this document. You can also find Samantha's results on an RFI Monitoring home page at <http://sadira.gb.nrao.edu/~sfore/>.

So how might one use these data? We can identify relatively clean observing bands for continuum observations. Samantha has done just that, and those bands are listed in her summary.

The data can also give some indication of whether or not a spectral line observation is even worth pursuing. For example, suppose relatively weak RFI occurs a small fraction of the time at some frequency of astronomical interest. An observer might be willing to discard a small fraction of her data in pursuit of the line. But if strong RFI occurs all the time at the frequency of interest, the observation will certainly fail.

For particularly annoying interference, we can make follow-up observations to determine its direction. This was actually done for a signal at 753 MHz which is TV channel 61. Wesley Sizemore found the channel 61 TV stations that were closest to the observatory, and the telescope was then pointed at the appropriate azimuths on the horizon to determine which station was the strongest source of RFI. Signal was detected from all stations, but WTSF in Ashland, KY was definitely the dominant source. Ashland resides on the KY-WV border, and is almost due west of the observatory at a distance of 139 miles. The observer asked the chief engineer at WTSF if the station transmitter could be turned off in the early morning. Surprisingly, the engineer agreed on a moment's notice, and Gilligan's Island was preempted in favor of Search for Red-shifted HI. This particular observation was not a complete success, but its story does have a moral: thanks to our RFI monitoring program and Samantha's results, an observer can improve his chances of a successful observation with planning, coordination, and, most of all, persistence.

SETI Settles in at the 140-foot.

J. Lockman

A Search for Extraterrestrial Intelligence (SETI) will soon be getting underway at the 140 Foot Telescope. The project will be conducted by the private, non-profit SETI Institute, which has raised enough money through donations to be able to rent the 140 Foot telescope for their work. The 140 Foot is now becoming available for non-astronomical research as astronomers (and Green Bank Staff) shift their attention to the GBT. If the paperwork is approved by the folks in Washington, the SETI Institute will use the 140 Foot for a few weeks later this year, for a much larger fraction of the time in 1997, and likely full-time for a few years starting in 1998.

They will be looking for radio emissions from hundreds of nearby stars. The program used to be funded by NASA, but when Congress decided to cut off all Federal support for searches for signals from other civilizations, the SETI Institute successfully raised the money from private sources, and renamed their effort "Project Phoenix".

The SETI Institute is supplying all the equipment that will be needed for this research. Their electronics arrived on site last week in a trailer known as the MRF (for Mobile Research Facility) that is located beside the 140 Foot. The equipment was last used at the Parkes radio telescope in Australia and seems to have survived its trip to Green Bank. Dr. Jill Tarter, Director of Project Phoenix, should be visiting the Observatory in the next month and we hope to persuade her to give a talk.

Billiards Tournament

C. Beverage

The NRAOGB Residence Hall Billiards Room was the site of a tournament April 18, 1996. NRAO employees were eligible to sign up for \$2.00. The fee was used as prize money for 1st and 2nd place, with 75% going to 1st and 25% going to 2nd. Participants played the best of 3 games of 8-ball.

Fifteen participants signed up for the tourney with every division on site represented. Brackets were selected randomly before the tournament and when the chalk dust settled, Brian Ellison was champion. Brian (Fast Eddie) was in the championship match against Tom Bania. A good time was had by all participants (even the losers) and another tourney will hopefully be held next winter.

GBT PROGRESS - Dave Seaman 22 July 1996

There has been steady progress in the construction of the GBT. The Elevation Box and Wheel structure is nearing completion. Nine of the ten trusses that form the box are in place and welded, 16 of 22 counterweight boxes are in place, and the elevation drives are installed, but not aligned. The final truss should be lifted into place soon and will take 3 to 4 weeks to weld. It is expected that the Box and Wheel structure will be completed in its entirety, including the panel actuator control building, El gear and drive alignment, and installation of the walkways, late this fall.

The upper vertical feed arm trial erection is complete and is being outfitted with cable trays and associated wiring for the subreflector and prime focus feed mechanisms. The entire feed arm servo system will be tested later this year. The electronics cabinets, motors, and other hardware are also being installed for these upcoming tests.

The subreflector will be installed on the upper feed arm during the testing. The subreflector truss structure is fully assembled on the construction site and the panels are expected to arrive soon.

The major effort in recent months has been expended on the main reflector Back-up Structure. During the last few months the crew has been working in the area of the structure where the final permanent support beams will interface to the back-up structure. This area has the largest beams in the back-up structure, which obviously take more time to properly fit and weld in place. Once this area is passed they will be able to progress more rapidly. Currently they are 30% complete with the back-up structure. [40% complete as of Sept.].

A lot of unnoticeable tasks are also happening. The servo building on the alidade is now being kept cool with the computer controlled air conditioning system, which will run continuously from here on out to maintain the temperature and humidity in the room. The receiver room has been outfitted with the turret drive and locking systems, and has had all the electrical wiring installed. Next time you cruise by the construction site slow down and really look for the progress and the 60+ men working on the site.

1996 Summer and Co-op Students F.Ghigo and R. Maddalena

Another group of hard-working and productive summer students was here at Green Bank working on various projects in astronomy, engineering, and computers.

Chris Norris, an Electrical Engineering major from VPI&SU, worked with Wes Sizemore on the RFI monitoring station.

Samantha Fore, a Physics major from VPI&SU, worked with Mark McKinnon on RFI monitoring.

Amy Petticrew, an Electrical Engineering major from Univ. of Cincinnati, worked with Dave Parker's group on the GBT laser ranging project.

David Bradley, an Electrical Engineering major from Drexel Univ., also worked on the GBT laser ranging project.

Naomi Bates, a graduate of Franklin High School, worked on high velocity gas in face-on galaxies using observations made with the 140-ft telescope. Her supervisor was Ron Maddalena. She won numerous awards for this work at the International Science and Engineering Fair in Tucson last spring.

Gregory Holsclaw, an Electrical/Computing Engineering major from West Virginia U, worked on electronics and programming for the 40-foot telescope, supervised by S.A.Heatherly.

Jason Ray, an Electrical Engineering major from WV Inst. of Technology, worked with Wes Grammer writing software for testing and calibrating GBT receivers.

Matthew Weatherly, an Electrical/Computer Engineering major from West Virginia Univ., worked with John Ford on the remote control and reset hardware for GBT on-line computers.

Julie Zuber, a physics major from Dennison Univ., worked with Glen Langston on the survey of the northern sky using the 45-foot telescope.

Ryan McCowan, an Engineering major from Tennessee Technological University, worked with Dave Parker on calibration of systematic effects in the GBT laser measurement system.

Justin Jesselli, a student at Pocahontas County High School, worked with Rick Fisher on computer programming.

Plant Maintenance News

Mike Holstine

Plant Maintenance (PM) has had a very busy summer season, as many of you know. Since our last publication, Fiscal has settled into their PM remodeled office space and the site has undergone some upsets and changes.

ROADS

Most noticeable on the site has been the work ongoing on the site roads. The shoulders are being "pulled" to cut away the growth of sod along the pavement edge and allow drainage from the road surface. New ditches have been cut along the roads, to keep water off of and out from under the roadway surface, thus extending the life of our pavement. One day, when budgets permit, we hope to start a paving cycle on the site roadway system. Those traveling to the Laser Lab area know how nice that would be.

SETI

SETI is here and PM has been very active in making their systems operational. First, Rusty and his crew ran 480V power out of the pedestal of the 140' to the slab to the west of the telescope. Two transformers were installed to provide the project with all of their power and lighting needs in the Mobile Research Facility (MRF). Fiber-optic cables were also installed from the 140' as well as telephone cable. The MRF arrived at 4:20pm on August 30 and PM worked until dark to make the final connections. Water is being provided to the MRF from the pedestal base; 208V power has been run from the Cassegrain house to the prime focus on the 140'. Once the materials arrive, PM will start installation on new fiber-optic cable to tie the SETI group and the rest of the site to the Jansky Lab through the Lab Addition. Hopefully, soon, PM will once again be available to many of you for your other projects.

COMPRESSOR

As is usually the case, in the midst of the SETI project work, other emergencies required PM to pull off and tend to them. Most important of these is the failure of the A/C compressor at the Interferometer Control Building (ICB). After tearing down the compressor, Carl and John found one of the pistons and rods had disintegrated into about 25 pieces. The pieces were brought to the shop in a rag. Actually, this unit has served us quite well, lasting about 10 years without fail. Many of our compressors last only 4 years. PM has installed a temporary cooling unit in the back doorway of the ICB in an attempt to cool the equipment while the compressor is being rebuilt. Daryl has driven the con

Aliquippa, PA for this purpose. The rebuilder there was the closest, least expensive, that we could find, in as much as that unit is no longer in manufacture. The A/C unit will be returned to full operation as soon as the rebuild is complete and returned to us.

LAB ADDITION

The Lab Addition construction is still plodding along. Much of the project is complete, however some major items are still incomplete and are requiring a lot of attention from Richard Fleming and Mike Holstine. Of utmost importance is the lack of shielding performance on the 2nd floor of the building. Several consultants have been hired by the Architect/Engineer (A/E) and the Navy to delve into the matter and correct the situation as soon as possible. Many thanks are due to Electronics for the use of test equipment and to Richard for spending a great deal of time aiding in the testing procedures.

TANK

As the saying goes, anything that can go wrong, will go wrong. So it is with the newly installed, shiny, fresh-from-the-factory fuel tank behind the Jansky Lab. The tank is leaking, but not into the ground. We spec'd a double-wall tank in the contract and the leak is occurring between the inner wall and the outer wall in what is called the interstitial space. At this time, two temporary 2000 gallon fuel tanks have been installed out back, and the contractor is going to pipe them in place, clean the "new" tank, open it up, and have a manufacturer's representative try to find the leak while it is in place. If possible, they will repair the tank without removing it. If not, and maybe anyway, the tank will be removed and another tank will be installed. All this and we should see frost within a few weeks.

THE HUNT

(Don't wear your antlers this fall!)

NRAO-GB will once again sponsor a controlled hunt on the property. This year the hunt will be 3 days shorter than previous years but will be longer in the firearms seasons. The dates for the hunt are October 17-19 for bows only, December 9 - 14 for bows, muzzleloaders, and shotguns w/slugs, and December 19-21 for bows and muzzleloaders. As always, you are welcome to come to the Works Area and observe the hunt in process. You can even show up at 5:45am any of these hunt dates, listen to the safety briefing, and participate as a walk-on. Please keep in mind these dates, and be aware that we will have many guests on the property and in our woodlots. If anyone would like a map of the hunt areas, please see Mike Holstine.

Plant Maintenance News, continued

PARKING LOTS

The paving has been completed for the Lab Addition project and we are waiting only for the parking lot striper to do his work. This should start around Monday, September 9. Once the striping is complete, we hope to be able to utilize the parking lots fully. As you have no doubt noticed, the other site roads and parking areas around the Jansky Lab have also been paved. These were not in the building contract, but done while the paving contractor was on site through PM. Once the striping contractor arrives, we may be able to get these lots striped as well. If not, PM will perform this task. New parking blocks will also be installed. The front parking area near the flag pole will probably be angled 90 degrees from what everyone is used to now, since the main entrance to the buildings will be from the West entrance road. This lot will be available to anyone once the diesels are placed back on the South end of the main lot. Stay tuned.

Records of weather extremes for July and August

From records kept by the Interferometer staff going back over 25 years, these tables list, for each day of the month, the year in which there was the highest and lowest temperature for that day.

JULY TEMPERATURE RECORDS

DAY	YEAR	TEMP. F		DAY	YEAR	TEMP. F	
		HI	LO			HI	LO
1	1967	97		16	1988	96	
1	1988		28	16	1987		47
2	1983	88		17	1988	92	
2	1988		31	17	1993		42
3	1983	89		18	1977	90	
3	1988		37	18	1976		45
4	1993	88		19	1977	91	
4	1996		41	19	1976		44
5	1993	87		20	1980	90	
5	1967		39	20	1995		44
6	1988	89		21	1977	90	
6	1979		40	21	1968		39
7	1988	92		22	1987	91	
7	1983		37	22	1971		49
8	1988	93		23	1987	90	
8	1984		39	23	1977		46
9	1988	90		24	1987	91	
9	1984		41	24	1968		37
10	1988	90		25	1993	91	
10	1976		45	25	1968		38
11	1993	89		26	1993	89	
11	1983		42	26	1976		46
12	1967	87		27	1993	89	
12	1978		40	27	1967		44
13	1993	89		28	1993	92	
13	1973		43	28	1971		41
14	1995	90		29	1988	86	
14	1974		45	29	1973		48
15	1995	93		30	1988	88	
15	1987		43	30	1981		41
				31	1980	87	
				31	1981		39

AUGUST TEMPERATURE RECORDS

DAY	YEAR	TEMP. F		DAY	YEAR	TEMP. F	
		HI	LO			HI	LO
1	1975	92		16	1987	89	
1	1981		46	16	1979		35
2	1988	92		17	1988	93	
2	1976		45	17	1979		36
3	1987	89		18	1987	89	
3	1976		38	18	1981		37
4	1987	89		19	1987	88	
4	1976		44	19	1976		43
5	1988	86		20	1983	91	
5	1985		44	20	1981		38
6	1987	87		21	1983	91	
6	1994		43	21	1981		36
7	1967	93		22	1983	91	
7	1994		40	22	1969		39
8	1988	89		23	1975	87	
8	1989		41	23	1981		38
9	1987	89		24	1975	87	
9	1989		38	24	1971		39
10	1988	91		25	1993	88	
10	1972		42	25	1971		36
11	1988	89		26	1975	90	
11	1967		41	26	1968		41
12	1988	88		27	1993	88	
12	1967		38	27	1968		37
13	1975	87		28	1973	88	
13	1979		43	28	1968		32
14	1988	90		29	1967	91	
14	1967		38	29	1968		32
15	1967	93		30	1973	90	
15	1979		43	30	1986		31
				31	1973	88	
				31	1976		34

MAX. PRECIP	RAIN	MAX. HEAT	DEGREE-DAYS
1994	7.8	1976	72

MAX. PRECIP	RAIN	MAX. HEAT	DEGREE-DAYS
1996	9.97	1985	89

MIN. PRECIP	RAIN	MIN. HEAT	DEGREE-DAYS
1983	1.63	1993	0.5

MIN. PRECIP	RAIN	MIN. HEAT	DEGREE-DAYS
1983	1.2	1975	2

Travels with Grote

by S.A. Heatherly

John Steinbeck's "Travels with Charlie" is about a man traveling around the country in a beat-up pickup truck with his dog. The book wasn't so much about the scenery as it was about the man rediscovering some nice things about people as he and Charlie stopped along the way. At the end of his journey the man was a little more optimistic about life.

Well, the time I spent with Grote Reber this summer had a similar effect on me - hence the title of this article. In case you didn't know - but since Grote got a little work out of just about everyone at the Observatory - you all *should* know: Grote Reber spent two months here this summer. I picked him up at Dulles Airport on July 6, and our trip into West Virginia presaged the lessons I would learn from Grote. Here are a few of them:

1. It is preferable to be accurate.

On Grote's first day, on our way back from the airport, we stopped for supper. He wanted some ice cream for dessert and asked me to summon the waitress. Before she came over I attempted to ascertain exactly what Grote wanted. "Do you want an ice cream cone?" I asked him "Well, he said, "I once had something ... not really a cone, more like a cylinder made of edible material into which ice cream was piled and more was piled on top." How is that for being accurate!

2. Persist! and you shall get it done.

This is a lesson you could learn from reading about Grote's early work in radio astronomy in Wheaton, Illinois. Grote persisted in his interest in radio astronomy after Jansky indicated he would not be doing any more work, after failing to interest professional astronomers in the subject and after failing to detect anything with his first set of receiving equipment. The results of his persistence are well known. Evidence of his persistence are on display in the NRAO front yard.

What I learned this summer, though, was that the persistence need not fade with age! One of the projects Grote involved himself in was putting the Jansky Antenna in useable condition. This had never been done, you know. The replica was originally built to be a show piece. No one thought it would ever be used. But, in 1995 a bunch of NRAO employees decided it would be fun to re-do Jansky's experiment. Since then, the Jansky Fellers, as the bunch calls themselves, have been using the antenna more-or-less as is. The antenna was fixed to rotate under motor control, but Fellers had to be present to bang the chain back on the gear every few minutes! Even worse, every two rotations, the antenna had to be stopped so that the Fellers could untangle co-ax cables which get wrapped around the center post.

The Fellers had hoped to interest Grote in making some observations with the antenna this summer. But he took one look at our set-up and said it was a mess! And it was. Under Grote's supervision, a coaxial slip joint was installed which allows the antenna to be rotated while connected to a receiver without tangled co-ax lines. This was no easy feat since it required drilling through about 18 inches of concrete (ask Harley). He instigated reconstruction of the gear box which was absolutely necessary in order to keep the chain on the gears and not tear the motor up. The shop guys and mechanics did a beautiful piece of work there, by the way.

Grote accomplished in 3 weeks what the Jansky Fellers had not thought possible at all! It might have something to do with having the name 'Grote Reber, but I think his tactics had something to do with it. If Grote decided something had to be done, then we did it "now". If he needed a part machined he might just wait in the machine shop till it was ready! Or he would sit on the Jansky Antenna and wait while I (or Carl, or Dave Vandevender or H.A. or whomever) went to do his bidding. You can't just sneak off to coffee while Grote Reber is sitting in the hot sun waiting for your return!

(I must add that Grote thought there was an awful lot of sitting around going on in the Jansky Lab. He made note of the level of activity on the second floor every time he walked down the hall, and couldn't understand all the sitting and staring you guys did (at your computers!!!))

3. All of life can be an experiment.

Grote is not a man that rests on his laurels; he is cooking up new experiments all the time. While he was here this summer, Grote pursued, with characteristic persistence, an experiment to test the feasibility of extending the long-wave radio astronomy research he has conducted in Tasmania. As he said to Gibbs Kinderman in a live radio interview on WVMR:

"I made observations at a wavelength of 144 meters down in Tasmania which is about 1000 times as long as what most radio astronomy observations are. Now at meter waves and down, the radio sky looks much like the optical night sky.. It is dark all over with a few bright spots here and there, some of which correspond with optical objects and there is a bright band coincident with the Milky Way ...At hectometer waves (that's hundreds of meters), it reverses: the radio sky is like the optical day sky. It's bright all over; brightest near the Galactic Pole and there are a whole series of dark absorption areas coincident with the Milky Way; darkest near the center. This background radiation obviously comes from outside the Milky Way at what distance we don't know. And the absorption regions are caused by ionized hydrogen gas in the plane of the Milky Way. I would like to make observations at still longer wavelengths.

[Travels with Grote, continued]

"This phenomenon is probably enhanced as you go to a longer wavelength. Now 144 meters is 2 megs (MHz) and that's above the broadcast band. The smallest change that's worth anything is 2 to 1 and that would take us into the broadcast band. So, I got the handbook out and picked out I think it was 27 stations at 1010, 1020 and 1040 kilocycles. I wrote to the station managers suggesting we swing a deal where they go off the air in the early hours of the morning and call that public service hours for my benefit. They could save money and wouldn't be polluting the air and I could make observations (at 1Mhz) during the time that was least desirable for them. Peculiarly enough they were dead set against it!... In the mean time I'd made listening tests in Canada and Tasmania and there's an empty channel at 520 kilocycles, apparently worldwide. Nobody is using it. Its empty. And so, I thought it would be nice to set up and make observations at 520 kilocycles, that's about 610 meters. Well, if you are going to do that you have to do something about the ionosphere so the radio waves will come through, so I'm in the process of negotiating with NASA about sending up some rockets to clean up the ionosphere. That's the future. I was born on 22nd of December 1911, so on the 22nd of December I'll be 85. By the time I'm 90 maybe NASA will give me the go ahead!"

For Grote, there was an experiment to be done even in idle moments. While sitting out on the Jansky Antenna waiting for me to come back with a wrench, or in his office waiting for a letter to be typed, Grote would conduct experiments with what ever was at hand. Example: for several days while out at the Jansky Antenna, Grote counted the cars that went north and south on Rt. 92. He noticed that more cars went north than south, and thought that was odd. By expanding his observations to other times during the day, Grote was able to report that it "evened out"! Another example: Grote also made numerous tests on Sue Shear's calculator. He found out that an average time of 28 seconds elapses between the last entry you make and the time it automatically shuts off!

4. You can use a handicap to your advantage.

If you spent any time at *all* with Grote this summer you will know that his hearing aid was NOT a handicap! Witness the fact that he turns it off before taking questions at the end of his talks!!

5. No use crying over spilled milk.

Did you know that Grote Reber could have discovered the 21cm spectral line that is emitted by neutral hydrogen (the most abundant element in the Universe!) ? He began building the front end 6 years before the detection was made by Ewen and Purcell at Harvard but he never completed the task. Darrel Emerson heard the story for the first time this summer when he and Reber toured through the exhibit in the little building beside the Reber Telescope. Here is a bit of their conversation:

Darrel says (as he and Grote look at the 1420 Mhz equipment): "Now that was one of your later experiments, and that was, what, in the 50's or 60's - it must of been the 60s - when you were doing that?"

Grote replies: "1946, See I'd been operating my equipment all during the war -- and it ran automatically while I was working in the city. Then as soon as the war ended the Dutch sent Van de Hulst to Yerkes Observatory at the University of Chicago, and they knew that I was doing Radio Astronomy, but they didn't know much of anything about it. However, Van de Hulst wanted to come and talk to me, which he did. This was maybe late 1945. And, he told me about his theoretical investigations of the hydrogen line and wanted to know if I could do something. Well, I was just getting my 480 Meg system working, so there wasn't anything I could do immediately but I put it on hold and in the meantime I took a job with the Bureau of Standards. And the idea went along with me and the B of S fellows didn't know anything about it and they seemed to care even less so, it failed (chuckle). It's hard to believe, but that's the bureaucracy."

D: "Now the H line was finally discovered 7 years after that, wasn't it?"

G: "Yes that was Ewen and Purcell . That was about 1951- about 6 years later."

D: "So about 6 years later than when you nearly discovered it."

G: "(Chuckle) Well I didn't really, but I could have."

[Travels with Grote, continued]

**6. It is important to challenge Dogma
(the Big Bang May Not Be Bunk)**

Grote inaugurated the new auditorium in the NTBN* Reber Building by giving the first colloquium. He gave his controversial talk entitled "The Big Bang is Bunk!" He based this notion on his observations at long wavelengths in Tasmania and an alternate explanation he has cooked up for red-shifts. He says: "I'm not a theoretical man. I'm an operating technician type of man who builds stuff, tries them out and if it fits the theory, fine; if it doesn't, you change the theory. You don't change the observations."

*NTBN=Not To Be Named

On his last day here, just before leaving to do some face-to-face "negotiating" with NASA at Wallops Flight Facility, he hinted that the talk wasn't so much about his theories about the big bang (He admitted that while most of the talk was based on fact, in the middle he waved his hands a bit.). The talk was really intended stir things up; to challenge dogma: "Young people don't have any trouble embracing new ideas" he said. "When I set out as a young man, the old boys in astronomy weren't a bit interested in the new idea of radio astronomy. But I was. I didn't know enough not to be interested."

Is Grote surprised how radio astronomy has grown as a science? He says: "Well yes, and it still surprises me. Apparently radio astronomy has been a popular scientific sport, and people can get money to do it as evidenced by NRAO and why I'm here..... so.... I'm in favor of it!"

**NRAO-PCHS Partnership
C. Beverage**

As of April 2, 1996 the Pocahontas County High School and the National Radio Astronomy Observatory in Green Bank officially became "Partners In Education". The project recognizes that education is a joint venture between schools and communities; schools are an integral part of every community, a key element in economic growth, and everyone has a stake in quality education; and the most effective unit of educational improvement is the individual school. The State of West Virginia encourages school and business interaction at every level. Becoming partners means that the school and business must subscribe to the following standards:

1. To begin the partnership with the support of the chief executive officers and top management.
2. To set objectives which support school and curriculum goals.
3. To include a participative learning component.
4. To have a positive impact on students.
5. To utilize human resources as a basic element.

6. To conform to school and company policies.
7. To exhibit non-discriminatory practices (i.e., race, creed, sex) and to respect human dignity.
8. For flexibility to characterize the relationship.
9. To create mutual relationship in which both parties share in the planning, implementation, accountability, and benefits.
10. To share pertinent information with the Education Fund staff on a regular basis so that others may benefit from our experiences.

All this and a picnic, too!

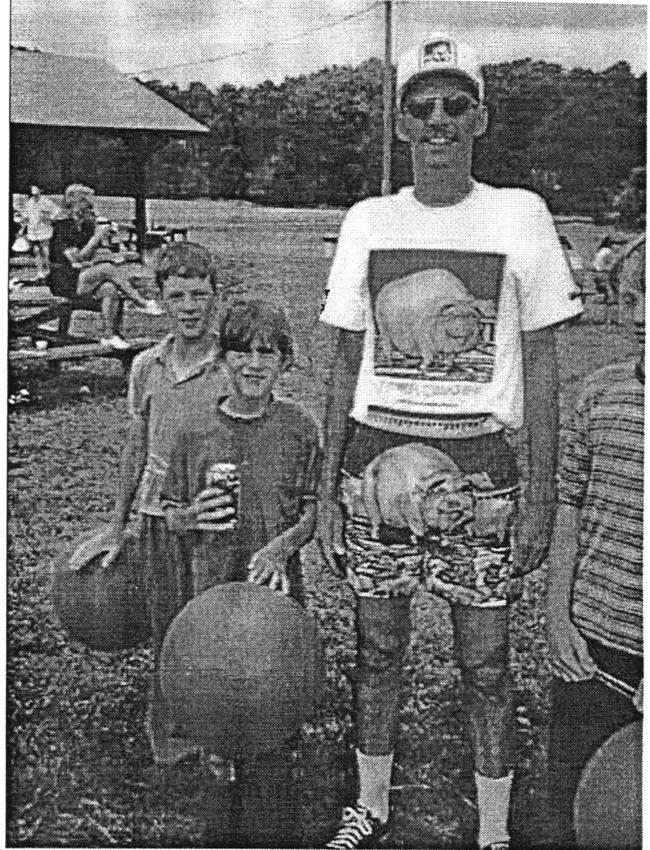
NRAO-GB was the site of a partnership picnic June 1, 1996. The PCHS and NRAO staff were invited and asked to bring a covered dish. Hamburgers and condiments were provide by PCHS and NRAO jointly. This was a informal family mixer to allow both staffs to meet each other. A good time was had by all.

The first proposal for a name for the new building comes from G. Langston:

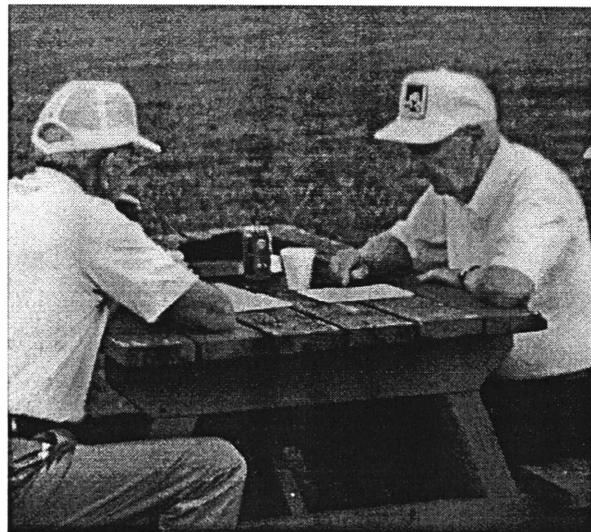
Research Electronics Building for Electronic Research

NRAO Picnic, August 3, 1996

Sartorial highlights department



Although no fashion contests were held at the picnic, it is clear that if there were, the winners could well have been Nathan (at right) for his all-pig attire, and Sue Ann with the new bingo-caller's tie.



Grote Reber (on right) learns bingo with advice from Carl Chestnut.

Picnic games and contests

Some, but not all, results:

Winners of the **mini-golf** tournament were Bob Vance and Wendell Monk.

Golf Driving:

Wendell (at right) shows his driving form, but was bested by Chuck Beverage (1st) and Russ Poling (2nd) on distance, and Russ (1st) and Sid Smith (2nd) on accuracy.



Frisbee:

Accuracy winners were Nathan and Diane Sharp; Toney Minter for distance and hang time; Sherry Chestnut and Carol Morgan for distance and hang time in the Women's division.

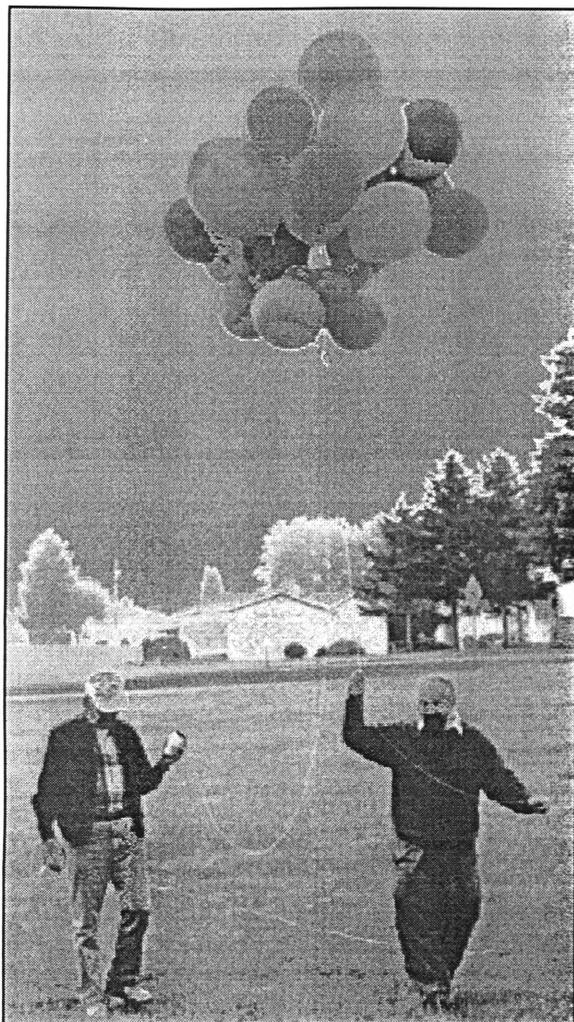
Horseshoe winners were Libby Childers' team in the women's division and Carl Stone's in the men's.

Dave Seaman and Rachel Wayne distinguished themselves in high-speed **Pie Eating**.

In the adult **Tug-of-War**, the over-35's smashed the younger wimps.

And in the under-12s division (photo on right), the girls are shown in action toppling the boys.





Calibration of the beam pattern of the Jansky antenna involved the launching of a small transmitter with 20 helium balloons. Carl Chestnut and Darrel Emerson supervise the flight.

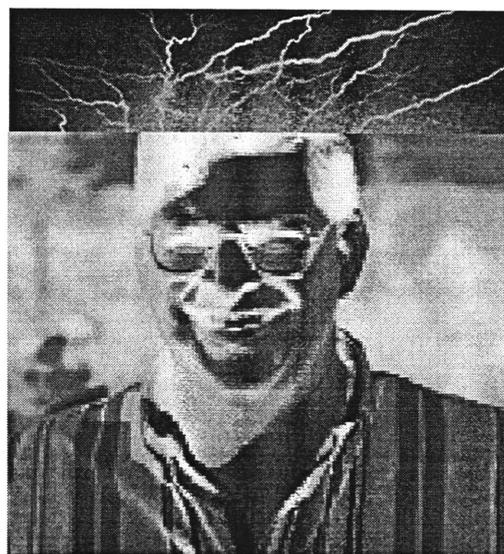
Toney regrets his experience gave him no superpowers, but at least he can pick up AM radio on his glasses!

Astronomer zapped!

Toney before



Toney Minter, while walking across the parking lot on July 19th, was struck by part of a lightning bolt that hit just in front of the Jansky Lab. The lightning followed underground power wiring and blew a hole in the ground where the diesel vehicles were parked, showering them with mud. Known now as "Sparky", Minter appears to have suffered no permanent injury, and seems, as before, quite normal for an Astronomer.



.....and after

National Radio Astronomy Observatory

Green Bank, West Virginia

September 1996

Sunday *Monday* *Tuesday* *Wednesday* *Thursday* *Friday* *Saturday*

1	2 Labor Day HOLIDAY!!! Tae Kwon Do Tour Center 6:00 - 8:00 pm	3 140' Mtg. - Upst. 11:00 am Aerobics Tour Center 5:30 - 6:30 pm	4	5 11:00 - Upst. A/D Meeting 1:00 - Bsmt. Safety Meeting Aerobics Tour Center 5:30 - 6:30 pm	6 11:00 - Upst. Adm. Computer Meeting	7
8	9 GBT Mtg. - Bsmt. - 9:00 am OVLBI Mtg. Upst. - 1:00 pm Tae Kwon Do Tour Center 6:00 - 8:00 pm	10 GBT Coord. Mtg. Upst. - 9:00 am Aerobics Tour Center 5:30 - 6:30 pm	11	12 3:20 - Bsmt. Colloquium Aerobics Tour Center 5:30 - 6:30 pm	13	14
15	16 9:00 - Bsmt. GBT Meeting OVLBI Mtg. Upst. - 1:00 pm Tae Kwon Do Tour Center 6:00 - 8:00 pm	17 11:00 - Upst. Sci. Staff Mtg. Aerobics Tour Center 5:30 - 6:30 pm	18	19 11:00 - Dir. Ofs. Div. Hds. Mtg. 1:00 - Upst. Iridium Meeting 3:20 - Bsmt. Colloquium Aerobics Tour Center 5:30 - 6:30 pm	20 11:00 - Upst. Adm. Computer Meeting	21
22	23 GBT Mtg. - Bsmt. - 9:00 am OVLBI Mtg. Upst. - 1:00 pm Tae Kwon Do Tour Center 6:00 - 8:00 pm	24 GBT Coord. Mtg. Upst. - 9:00 am Aerobics Tour Center 5:30 - 6:30 pm	25	26 Aerobics Tour Center 5:30 - 6:30 pm	27	28
29	30 GBT Mtg. - Bsmt. - 9:00 am OVLBI Mtg. Upst. - 1:00 pm Tae Kwon Do Tour Center 6:00 - 8:00 pm					