

Volume 5, No. 2

Summer 1999

Why is the MMA Changing Its Name? *by R.L. Brown*

Recently, many of us have become aware that the Millimeter Array, the MMA, is becoming something called ALMA. What is ALMA and why is this happening?

For more than fifteen years the MMA concept has been developed by astronomers at the NRAO and in the university community who are interested in having an imaging instrument at millimeter wavelengths that is similar to that provided at radio wavelengths by the VLA. Associated Universities, Inc., (AUI) proposed the MMA to the National Science Foundation (NSF) in 1990 and the first funding for the project arrived in 1998. But this funding was not funding to build the MMA, rather it was funding to conduct the *Design and Development* of the MMA; A decision on construction funding was to be made later. That construction decision depended on the project meeting specific goals. The three most critical of those goals were: (1) partnership in the project by international or other U.S. agencies; (2) selection and availability of a site; and (3) a secure construction cost estimate.

As you know, a truly superb site has been selected in northern Chile. At our request the site has been reserved by the Republic of Chile for science, and the officials in Chile have been very gracious in welcoming the MMA to their country. Second, a detailed construction cost estimate is complete and is being audited by the NSF. But what about the partnership?

Over the years several countries have expressed to us their interest in being partners in the MMA. Discussion were held toward this end. Then in 1997 many of the European countries involved with planning for a MMA-like instrument, the Large Southern Array (LSA), approached the NRAO with the suggestion that the MMA be merged with the LSA to create a single, larger, instrument. This idea was embraced by scientists in the U.S. and Europe

(continued page 2)

New AUI Leadership Takes Office *by Paul Martin*

On July 1st, Dr. Riccardo Giacconi moved into the Washington headquarters of Associated Universities, Inc., (AUI) and assumed his responsibilities as the organization's President. It was also the first official day on the job for Patrick W. Donahoe, AUI's newly recruited and elected Vice President for Administration, Treasurer and Controller.

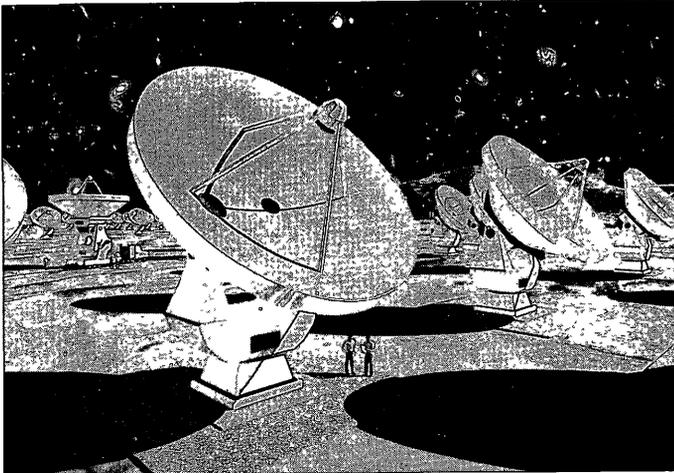
Dr. Giacconi's scheduled arrival at AUI, on completion of six-and-a-half-years as Director General of the European Southern Observatory in Garching, Germany, has been awaited for many months. His legendary accomplishments as a scientist and scientific administrator in x-ray astronomy at Harvard and in optical astronomy at the Space Telescope Science Institute in Baltimore have been described in an earlier issue (Fall 1998). Of particular importance to NRAO as the Millimeter Array is launched, Dr. Giacconi led ESO during the final phases of construction of the Very Large Telescope on Cerro Paranal in northern Chile and has been pivotal in forging the European involvement in the Atacama Large Millimeter Array (ALMA) Project.

Mr. Donahoe was recruited this spring after a wide search by a committee of the Board of AUI in consultation with Dr. Giacconi. His experience and expertise in the broad range of corporate affairs for which he will bear responsibility at AUI have been accumulated in senior administrative positions in government and in private industry. Most recently, Mr. Donahoe was Treasurer of DynAir Services, Inc., located in Dulles, Virginia.

Mr. Donahoe and his family currently reside in the northern Virginia area. Dr. and Mrs. Giacconi have taken up residence in Chevy Chase, Maryland.



Why is the MMA Changing Its Name? (continued)



Artist's concept of ALMA

because it held the prospect for an instrument larger in scientific scope than either the MMA or LSA alone. However, this requires that the LSA be *added* to the MMA—the Europeans had no intention of simply *buying into* the MMA. The proposal was to form a 50-50 partnership between the U.S. and Europe in a common project. The idea was accepted by the NSF and discussions to this end have been in progress for nearly a year.

In March of this year the NSF and the European organizations agreed to the outlines of the merger. The merger would take place in two steps: first, the design and development phase of the two projects would be done in common for the merged array; while this is underway negotiations would take place for the actual construction of the merged project. But one thing was missing: the common project needed a name. A name that carried the sense of place and scale. A community straw ballot led to selection of the name Atacama Large Millimeter Array, or ALMA. Atacama is the name of the extremely dry desert that dominates all of northern Chile, and the word *alma* means *soul* in Spanish. It is a fitting and satisfactory choice.

The NSF and the European organizations signed a Memorandum of Understanding for the design and development phase of ALMA on June 10, 1999. On this day the MMA became ALMA.

ALMA involves an equal partnership, in an observatory to be built outside of the U.S.—both new ventures for the NRAO. How will that affect us? First, let me say what ALMA is not. ALMA is not an observatory apart from the NRAO. ALMA can be thought of as a marriage of ALMA/U.S. with ALMA/Europe. ALMA/U.S. is what we previously thought of as the MMA. It is a NRAO user facility,

identical in every institutional respect to the VLA, VLBA, 12 meter, and GBT. ALMA/U.S. will build half of ALMA and will be responsible for half of the ALMA operations costs. The other half of ALMA will come from ALMA/Europe. The ALMA Project itself will serve to coordinate the efforts of the two partners but will not attempt to replace or eclipse the partners. The partners are the project.

How well will this marriage work? It's impossible to say. But as with any marriage it will depend on the commitments of the partners and their willingness to resolve differences. In this case, not only do the partners need to agree on how to do new things, they need to agree on how to do things together that each partner has been doing in different ways for years. We'll wish them well. The union has the prospect for yielding enormous scientific riches. It is a delight to have the NRAO share in the bounty and the adventure.



Scientific Staff Holds Long Range Planning Retreat in Green Bank

by P. Vanden Bout

After an absence of more than ten years of an Observatory-wide staff meeting, the scientific staff and other members of NRAO gathered in Green Bank for a discussion of the future of the Observatory. The emphasis of over a decade ago was future instrumentation. This time the agenda was set by the need for an Observatory long range plan. The meeting was attended by R. Giacconi, president-elect of Associated Universities, Inc (AUI). In sessions covering 2 1/2 days, the status and plans of all the functional units of the Observatory were reviewed. In addition, there were discussions of new technology and how we develop new instrumentation at the NRAO. The meeting ended with a tour of the GBT.

The event successfully introduced the Observatory to the new AUI president, provided much material for the construction of a long range plan, and provided a forum for discussion among the sites that has been missing for a long time. We can look forward to these retreats as annual events, alternating sites between the east and west.



A Photonic Local Oscillator for ALMA – Idea Developed from Submarine Technology

by J.M. Payne, B. Shillue, A. Vaccari

The newly established ALMA project will consist of over sixty 12 meter antennas situated on a 5000 meter (16,500 feet) high site in Chile. The antennas will be linked together to operate as an interferometer, similar to the VLA, with a frequency of operation between 30 GHz and 850 GHz. The receivers will all be superheterodyne, which means to combine signals, so a pure local oscillator signal (LO) will be needed at each antenna to mix with the incoming radio signal.

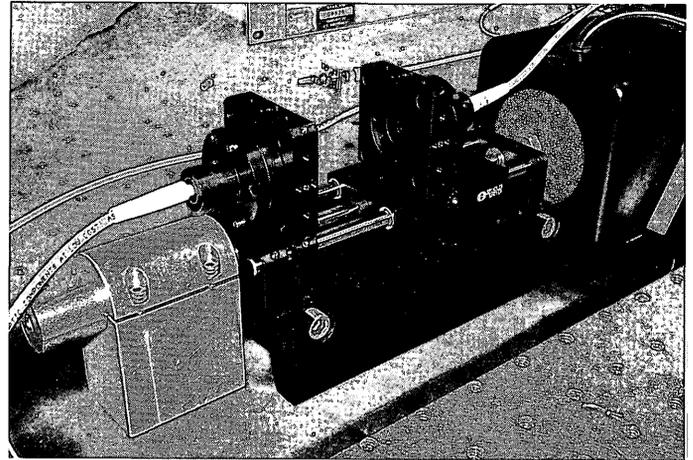
This leads to a very difficult requirement: the transmission distance for the LO signal needs to be known or kept constant to better than 17 microns (4 times thinner than a human hair) over a distance of up to 20 kilometers (12 miles). The cable used to transmit the LO (or a microwave reference for an LO generated at each telescope) will suffer from delay changes due to temperature change and mechanical stress where it passes through the telescope structure on its way to the receiver. So there are two challenges here:

- Generate a signal that is readily tunable over 30 GHz to 800GHz.
- Deliver this signal to each antenna with delays matched to less than the time it takes light to travel 17 microns.

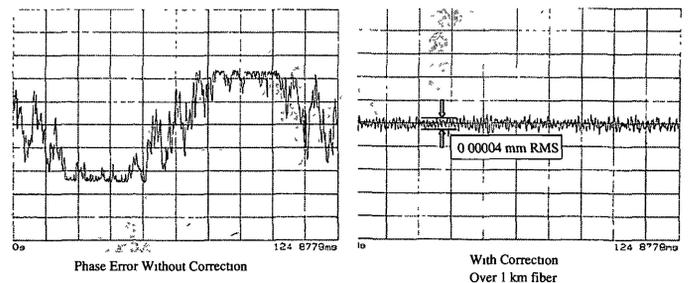
A group in Tucson has been working on a photonics system that is far removed from our usual technical endeavors but which could solve both problems using mainly off-the-shelf optical components. One big development in recent years has been the boom in fiber optic communications. This has led to the easy availability of many optical components that are familiar to the microwave engineer. Couplers, isolators, and circulators are all used in fiber optics at a wavelength of 1.5 microns, or a frequency of about 200 Terahertz. Yes, that is two hundred thousand gigahertz!

With newly developed fiber lasers that have amazing stability and spectral purity, the Tucson group set up an optical interferometer to maintain a constant path length over a one kilometer length, roughly 2/3's of a mile, of optical fiber. An optical interferometer uses the actual wavelength of the light (1.5 microns) as the unit of measure, so very fine length stabilization is possible. The laser is sent down the fiber, and a fraction of the light is turned around at the far end. After traveling back to its starting point it is combined with a portion of the outgoing light and the resulting

signal is used to drive a simple servo system, a feedback mechanism, which consists of the following two devices to keep the path length constant. It turns out that for small fast changes, such as vibration noise, a commercially available piezo-electric line stretcher will do the job; and for the slower larger changes, such as temperature, the University of Arizona has built us a "free space line stretcher" as shown in the photo below.



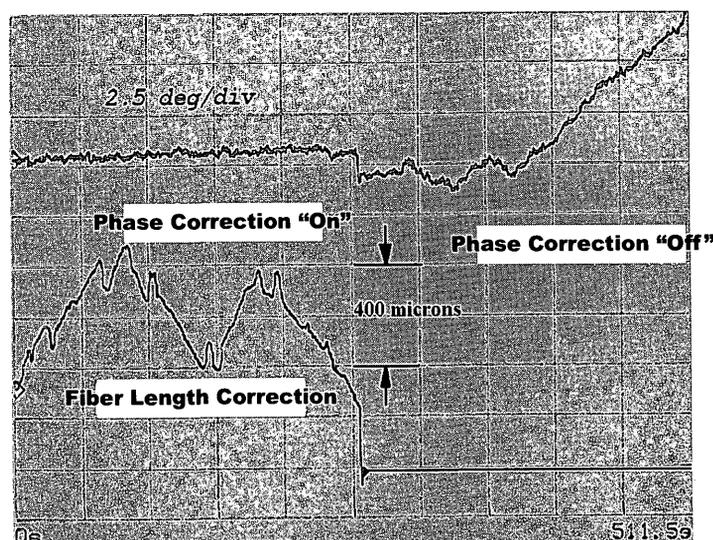
How well did it work? In the diagram below you can see the effect of turning on the servo. Without the servo on, all kinds of length changes are seen. These are mainly due to acoustic effects. With the servo on these effects are removed and the resultant length is held constant to about 0.00004 mm! What led us to use this technique was the discovery that submarines are tracked using hydrophones that consist of aluminum cylinders wound with fiber. When a submarine acoustic wave hits the cylinder the fiber length changes slightly and the submarine's presence is detected.



So now we can keep the fiber length constant, but what about generating the LO signal? Suppose we send down the same fiber another laser signal different in frequency from the first one by an amount equal to the desired LO frequency. Then at the far end, at the receiver, we feed the two laser signals into a photo-detector to get the desired LO frequency. If this were to work and be combined with the length stabilization described above, we should be able to supply each antenna with a stable LO signal. So, the first problem

A Photonic Local Oscillator for ALMA (continued)

to be addressed here was pretty simple. Can the difference frequency between two lasers oscillating at around 200 THz be locked to a microwave standard with sufficient spectral purity for our purpose? With a few days work the answer was a resounding "yes." The next thing to do was to try to transmit an LO over a fiber and see if everything worked. We were limited to commercially available components for this test so we decided to try it over one kilometer of fiber at a frequency of 11 GHz. In the results seen in the figure below we compare what corresponds to the arrival time of the 11 GHz signal at the far end of the fiber with the time of departure. We do this with the tracking servo turned on, as reflected in the left side of the figure, and then with the servo turned off as reflected in the right side. The top trace is the difference in the arrival time, and the bottom is the movement of our air gap moving to keep the fiber length constant. With the servo on we can show that the stability of transmission, when corrected by our servo, is sufficient for observing with ALMA, even at the highest frequency, at least with one kilometer of fiber. We plan to extend the experiment to higher LO frequencies and longer fiber lengths in the near future.



The next stage in the project is the development of higher frequency photo-detectors, perhaps cooled so that they could be mounted directly inside the 4K dewar, a vacuum chamber with a temperature nearing absolute zero. Anyone wanting a more detailed description of this work is directed to the ALMA memo series. In the meantime, we have been invited to give a talk on our work at an international conference in Australia in November and we hope to have more results by then.

Tucson Offices Expand with ALMA in Mind by Dale Webb

Since 1984 the Arizona Operation has operated out of an 11,700 square foot office space in the Steward Observatory building located on the University of Arizona campus. For several years that was sufficient for the operation of the 12 Meter Telescope and limited involvement with the VLBA Telescope on Kitt Peak. Several years ago NRAO started building up the MMA (recently renamed Atacama Large Millimeter Array, or ALMA) staff and the antenna design group, causing a shortage of office space. A small laboratory was added that had previously been part of the University's area and other lab space was converted to office space. By 1998, this amount of space was inadequate for the anticipated new ALMA staff and, worse, completely inadequate in terms of laboratory space needed for the design of receivers and equipment for the Atacama Large Millimeter Array.

Discussions undertaken with the University of Arizona resulted in the leasing of 15 offices (about 2,500 square feet) about a block and a half from the main office. By November, 1998, the newly leased offices were occupied by ALMA staff, leaving space at the Cherry Avenue site to significantly increase the size of the laboratory. The NRAO/University of Arizona discussions also resulted in an agreement with the University to add approximately 8,300 square feet of space. This will be accomplished by adding another floor to the building beside us, to be connected to our existing building.

This addition will provide the much needed offices for the ALMA and scientific staff, bringing all of Tucson local operations back under the same roof. The University will pay for all building costs, and will lease this additional space to NRAO.

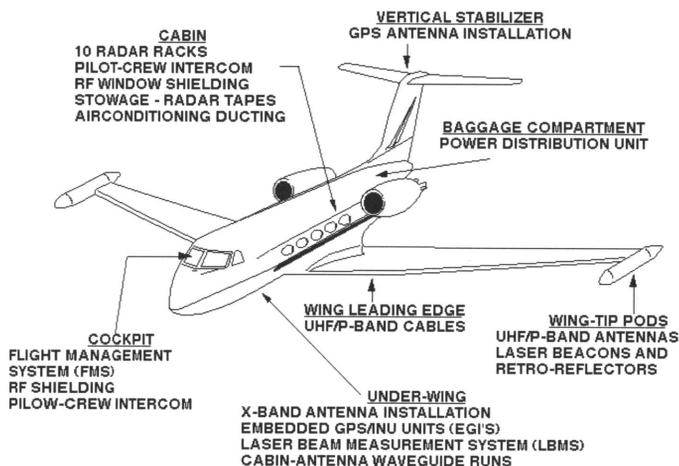
The project bidding process is almost complete. Construction is expected to start this August, with a projected completion date of June, 2000. We expect to move in no later than August, 2000. At that time, additional office areas at the existing Cherry Avenue facility will be converted for laboratory use and those employees housed at the auxiliary location will move into the new space.

All this is very exciting for the Arizona NRAO staff. Since moving into this building, we have enjoyed a close working relationship with the University of Arizona and have shared many facilities with Steward Observatory and several other observatories in the area. This expansion will definitely enhance collaboration with other University of Arizona organizations.

The GeoSAR Project by John Payne, Dave Parker, John Shelton, Bill Radcliffe and Mike Hedrick

The development of the laser ranging equipment in Green Bank has led to some unexpected and exciting applications in the outside world. One of these is the GeoSAR project under construction at the Jet Propulsion Laboratory (JPL) in Pasadena, California. This is a project that involves a high-power radar in an aircraft that is designed to map the surface of the earth with a very high resolution—less than one foot. By the use of two wavelengths, the radar is able to map both the foliage and the surface below with this resolution. One very interesting possible application for this system is the location of buried objects, like land mines. The aircraft being equipped for this task is at Van Nuys Airport in California and has been completely stripped of all passenger facilities, the only remaining seats being the pilot and co-pilot seats. The figure below gives some idea of the extensive modifications to the aircraft.

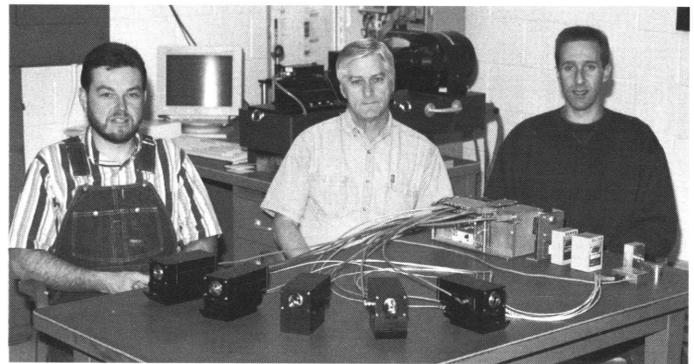
GULF STREAM-II AIRCRAFT MODIFICATIONS



The problem the designers faced in the initial design was that knowledge of the exact location of the wingtip antennas was required at all times. The precision required was high – about 20 thousandths of an inch at a range of about 30 feet. This accuracy had to be achieved even with the wingtips moving up and down by many inches. No commercially available system was suitable for this application and an initial look at the requirements by John Payne and Dave Parker led them to believe that a modified GBT rangefinder could satisfy these requirements. So NRAO entered into a contract with JPL to produce a suitable system. After much heartburn and many late nights worked by the whole team in Green Bank, a prototype system was delivered to JPL and accepted.

The total system delivered by NRAO consisted of two basic kinds of components plus spares. The first one of these is known as the FGS (Frequency Generation System), a module that provides all the necessary power and reference signals to the second module known as the LMU (Laser Measuring Unit). There are three LMUs mounted on the aircraft to measure the distances required for correct operation of the radar. An LMU transmits a laser beam to an optical reflector situated at the far end of the path to be measured and by measuring the time of flight of the laser light, the distance may be calculated. All the computer interfacing was undertaken by JPL.

The whole system has now been delivered and the picture below shows the people that did the real work together with the finished components. The first test flights of the total system are expected within the next few months and, if the system performs as expected, it may be deployed world wide for a variety of applications. The NRAO participation in this project was very interesting and it was nice to see instrumentation developed for radio astronomy being used for a commercial application, to say nothing about the infusion of much needed funds to the NRAO budget!



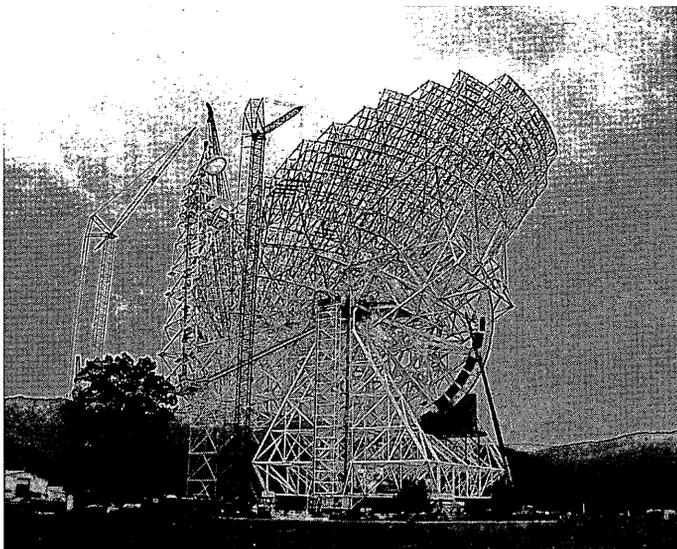
M. Hedrick, B. Radcliff and J. Shelton with laser unit.

Employee Alert: Changes In Family Status Important

It is extremely important that you let the Personnel Office know about any changes in your family status and family member eligibility in a timely manner. We want to help you avoid problems that surface when these important changes happen and proper notification is not provided. If you divorce, have a spouse with a change of employment status or employer, or have a full-time student who drops out of school or graduates, please let us know immediately so that we can be sure that the appropriate action is taken. Such changes in family status do affect your insurance coverage. They are important to identify immediately. Please take note of this request as it will save everyone time and effort in the long run.

The Green Bank Telescope Measurement Program

by Bob Hall



July 20, 1999 photo showing construction progress of the GBT

From the beginning of the Green Bank Telescope project, we realized that implementation of millimeter wave operation on a telescope the size of the GBT—with its radical offset design—would be a real challenge—especially since the “as delivered” antenna is only specified to be operational at frequencies up to fifteen GHz which is comparable to the Effelsburg 100 Meter.

To advance the GBT to the next level the reflector surface accuracy must be optimized, the pointing errors attributable to the control and mechanical systems must be minimized, and the pointing accuracy improved from its initial accuracy achieved at commissioning.

Concerns over structural overweight problems and the correctness of the telescope’s finite element analysis have lead us to the conclusion that the structure will have to be modeled more accurately. This will allow us to diagnose and deal with the structural, mechanical, electrical, and servo problems which will occur with this complex new antenna.

The way we will define the static and dynamic performance of the structure and identify problem areas is by use of a measurement program. The measurement results and their analysis will provide a tool to obtain technical solutions and improvements which can bring the GBT to a condition where it is capable of working at high frequencies.

The core of the measurement program is a laser rangefinder metrology system. Twelve ground-based rangefinders surrounding the telescope and six

rangefinders mounted on the telescope’s vertical feed arm provide non-invasive measurements of surface shape, alignments, location of critical telescope structural joints, and thermally and gravitationally induced deformations of the structure, to the 100 micron level. The rangefinders are supplemented by other standard metrology instruments: accelerometers, tilt-meters, theodolite/total-stations, and strain gauges which are strategically located on the structure.

The system capabilities will include: the ability to check critical alignments, to test finite element models of the structure, to identify structural anomalies and fault conditions, to provide data for optimizing servo algorithms, to allow independent measurement of acceptance criteria, to improve surface setting accuracy, servo performance and pointing accuracy. They will also provide data sets for an ongoing performance change analysis needed for an effective GBT maintenance program.

Rangefinder monuments, instrumentation, and local area net fiber optics have been installed at all ground stations. Nine of the ground-based rangefinders are currently operational, and the remaining three instruments will soon achieve that status. The locations of all ground stations have been surveyed. Some target mounting plates and rangefinder targets have already been placed on the telescope, and the placement of targets is a continuing process.

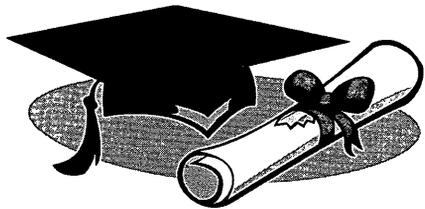
A laser rangefinder measures distance precisely between the optical center point of a retro reflecting target prism on the telescope and a unique point on the rangefinder’s target scanning mirror. Range distances are measured to each target from four or more rangefinders at known positions. The distances are analyzed using standard survey reduction methods to give precise locations of the target points, together with standard errors for the target coordinates.

The GBT measurement system will be a unique tool, possessed by no other radio telescope. It will be available to bring the GBT to its full potential far more rapidly than the decade-long time scale needed for earlier radio telescopes.



National Radio Astronomy Observatory

AUI Scholarship Recipients



Congratulations!



Margaret J. Clark

Margaret attends Pocahontas County High School in Dunmore. She was selected as a National Merit Commended Student and earned the Girl Scout Gold Award by holding a series of workshops at schools throughout the county on

creating competitive social studies' projects. She has been active in theater both as an actress and lightperson. Margaret has been selected the last two years to the West Virginia Honors Band and was captain of the high school Science Bowl team at the state competition. She plans to attend Mt. Holyoke College.

Margaret is the daughter of Mark and Marilyn Clark. Mark is a Senior Programming Analyst in Green Bank.



Carolina J. Gutierrez

Carolina is a senior at Magdalena High School. She will be graduating as salutatorian of her class. Carolina has been a member of the Spanish Club, Drama Club, and Varsity Club and was recently selected to the National Honor Society. She is

listed in the Who's Who in Academics, Who's Who in Sports and was selected Girl's State representative. Carolina plans to attend New Mexico Highlands University and will major in Psychology or Occupational Therapy.

Carolina is the daughter of Ramon and Elsie Gutierrez. Ramon is a Technical Specialist at the VLA.



Dmitriy L. Kogan

Dmitriy is a senior at Socorro High School. He is a member of the German and French clubs and the National Honor Society. He is a National Merit finalist and has successfully participated in state and national math competitions in middle and high school. He has been a member of the varsity soccer team for 3 years. In college, he will major in Computer Science. Dmitriy plans to attend Harvey Mudd College.

Dmitriy is the son of Leonid and Lyudwika Kogan. Leonid is an Associate Scientist in Socorro.



Michael J. Lacasse

Michael attends Pocahontas County High School in Dunmore. He has held several offices, including President of the Student Government Assoc., Vice President of the Senior Class, Vice President of the National Honor Society, and Treasurer of the French Honor

Society. He is involved in the CAMEO Project that sends high school students into the elementary schools once a week to tutor students. Michael has won many awards as a member of the High School Science Bowl Team, Math Field Day competitor, and in foreign language festivals. He has been a member of the PCHS Marching Band, Concert Band, and jazz band. Michael plans to major in computer engineering at West Virginia University.

Michael is the son of Richard and Martha Lacasse. Richard is an Electronics Engineer in Green Bank.

Congratulations is extended to the recipients of the 1998-99 AUI Trustee Scholarship competition. These students will each receive an award of \$2,500 per year to aid in defraying expenses at the college of their choice.

NRAO-GB/PCHS “Partnership” Awarded 1999 Gold Star

The employees at NRAO Green Bank, WV are the proud recipients of a coveted “Gold Star” award of excellence for their joint educational efforts with Pocahontas County High School (PCHS). This unique partnership between business and education is explained in the following article that was published in the Education Alliance newsletter.

Students involved in this partnership can say, “I helped to build that,” with pride. This partnership has been building for many years. It is a well-organized program, including activities coordinated by a Steering Committee comprised of various PCHS and NRAO staff and a student representative. The committee meets bimonthly, alternating locations between the school and the business site.

Highlights of this partnership include:

- A cookout at the NRAO recreation area for PCHS and NRAO staff and families as they begin each new school year.
- Many NRAO career-focused programs such as presenters for mini-career days at the school, mentorships for upperclassmen, tutors to help struggling math and science students and employee-student partnerships in projects for enterprising science students.
- PCHS students annually spend a day at NRAO exploring the various job fields available.
- A strong student participation component encouraging PCHS students to “give back” to their business partner, which involves -
 - a. The Forestry Class participating in a major landscaping project for NRAO;
 - b. Student assistance in physically relocating the NRAO library;
 - c. Development of “hands on” construction and blueprint reading skills by Building Construction class students in constructing picnic tables and information kiosks for NRAO.
- A team effort of students, employees and faculty to construct a PCHS pressbox for the football stadium. This project directly involved welding and electronics class students in the construction, wiring and equipping with electronic apparatus of a two-story, 648 square foot pressbox atop a steel tower, twenty-eight feet in the air.

PCHS features its partnership in numerous broadcasts on the local radio station and in its weekly student news program produced at the school, allowing students to learn to film, edit and produce acceptable programs.

This partnership is one of the most mutually beneficial yet observed, and includes an exceptionally strong student participation component, thus the reason why it has been named as a 1999 Gold Star Award Winner.



Is Almost an Accident?

**by Jody Bolyard,
Safety & Environmental Engineer**

What is your definition of an accident? A mishap, injury, casualty? How about the sports definition of “No blood, No fouls?”

One definition for an accident is an unexpected consequence of an action resulting in personal injury or property damage. Based on this definition, if someone almost gets injured but escapes without a scratch, the event is not considered an accident. This *almost* accident is called a “near miss”. Frequently, a near miss won't even get reported.

The main goal of an effective safety program is to prevent accidents from happening. Accident investigations are necessary if not reactive. “Near miss” investigations are proactive. The same way your automobile fuel gauge warns you that you should fill up, a reported “near miss” provides a warning of the potential for an accident.

As you are aware, every accident involving injury or property damage must be reported to your supervisor. Your supervisor has the proper forms to complete following an accident and is familiar with the reporting requirements for accidents. Serious accidents are even required by OSHA to be recorded. However, reporting a “near miss” is up to you. When you report a “near miss” to your supervisor, the following investigating steps will be initiated:

- * The supervisor will report the “near miss” to the site safety officer.
- * A thorough investigation will be conducted to determine the true cause of the unsafe method.
- * The investigation will focus on solutions.

Is Almost an Accident? (continued)

* A decision will be made that will likely solve the problem.

The solution will be monitored to ensure that the fix has been made.

"Near miss" investigations are to be taken seriously and can be used to help prevent future accidents. While on the job, if you are involved in a "WOW, that was close!" event, report it to your supervisor. The accident you prevent may be your own.



Annual GB/CV Golf Tournament Scores a Hole In One by Bill Porter

Ting . . . Thwack . . .
"D#@ it!" Ah, the warmth of summer and the sounds of the annual

Green Bank/Charlottesville Golf Tournament are in the air!

The boys of a good walk spoiled took a day of vacation and met on the links of the Lakeview Golf Course in Harrisonburg, VA on June 24 to renew what has become an annual rite of low score, long drive, and closest to the pin competition where no holds are barred. Seventeen men*--employees, retirees, fathers and sons--took to the fairways and greens of one of the Shenandoah Valley's most beautiful and popular rolling courses in teams of three and four for a captain's choice, low raw score round. The weather was perfect, the course was in great shape, and the competition was fierce!

Now, if you're a traditionalist who loves the proper gentle manliness and self control of the old game, or if you're looking for a display of golfing skills that one can see on a Sunday afternoon TV broadcast, you might not appreciate this particular tournament. On the other hand, if you're looking for a little sports-in-the-fresh-air comic relief, this is the event for you. And, on the third hand, if you're one who thinks "golf" and "fashion" don't belong in the same sentence, you'd probably relish the sartorial abominations put together by this group (you can see everything from cut-off Levi's and knee high socks to the latest in plaid shirt and striped shorts combinations).

But, that's OK, because this tournament is not about great skill or great fashion and all that; it's about getting out, having fun and getting to know the guys from the other site better. The golf tends to become an

excuse to make new friendships, renew old ones that have languished over the winter (primarily Green Bank's fault), and to get caught up on the latest news from the other side of the mountain. And, that's exactly what happens every year . . . fun, food and friendship abound, and at the end of the day all agree that regardless of how we play, it was good, proving once again that a bad day on the golf course is still better than a good day at work.

OK, enough of the maudlin stuff. The really important news is who won, right? Well, this year the Imaginary Testosterone Tournament Trophy went to Sid Smith, Steve White and Roy Norville who burned up the course with a team score of 3 *under par!* [Unprecedented in this venue.] Second place also-ran honors went to John Ralston, Ray Hanshaw, Harold Crist and Greg Monk for a respectable team score of 1 under par. Everyone else says "wait'll next year." And, all the guys who participated join in a big-birdie thanks to Sid Smith who organized the event this year.

*It must be noted that the GB/CV Tournament is gender non-specific (this is the 90s, after all), but neither CV nor GB has been able to muster any women golfers. This article is an open invitation to our female employees, retirees, wives and daughters to come on out and give it a try (it can't possibly be any more painful or embarrassing for you than it is for us). Also, if you're visiting from another site, we would love for you to join us. Call ahead for tee times.

Social Security Statements to be Mailed Annually

In October the Social Security Administration will begin mailing Social Security Statements (formerly known as "PEBES", the Personal Earnings and Benefit Estimate Statement) to all workers age 25 and older who are not already receiving monthly Social Security benefits.

The four-page Social Security Statement is intended to help you plan your financial future by providing estimates of the monthly Social Security retirement, disability and survivors benefits you and your family could be eligible to receive now and in the future.

NRAO matches your Social Security and Medicare taxes dollar-for-dollar. This investment serves as a base for your retirement planning when you combine it with your pension and individual savings.

The Social Security Statement also will provide you with a means of protecting your earnings record. It's an easy way to determine whether your earnings are accurately posted on your Social Security record. Making sure the name and Social Security Number your employee has on record matches your Social

Social Security Statements (continued)

Security card is the best way to ensure earnings will be accurately posted. And that's important because the amount of your future benefits will be based on your Social Security earnings record. The Statement will tell you how to go about correcting any inaccurate or missing earnings entries.

You can expect to receive your statement each year about three months before your birthday month. For example, if your birthday falls in February you can expect to receive your Social Security Statement in November.

There are some additional ways to use your Social Security Statement:

- plan your financial security for today and tomorrow by knowing the amounts of Social Security benefits that could be available to you and your family if you become disabled;
- determine whether you have sufficient insurance to protect your survivors when you die.

For more information about Social Security benefits, call or visit your local Social Security office, call 1-800-772-1213 or visit the Web site, www.ssa.gov.

Good News About Group Life Benefit Taxes

For those of you paying income tax on your life insurance coverage, we have some good news. Yeah, GOOD news! But first, to refresh your memory on how this tax is calculated we unearthed an article written for this very publication in 1995.

...If you've ever wondered why your income tax withholding and FICA taxes don't add up to the standard amounts based on your wages, it may be because you're having to pay taxes on part of your group life insurance. The Internal Revenue Service requires that state and federal income taxes, as well as FICA taxes, be paid on employer provided life insurance amounts whenever the coverage exceeds \$50,000. The value of such taxable life insurance is referred to as "imputed income" and it appears on your pay stub under the heading "Other Benefits and Information: Taxable GTI" (For those of you unfamiliar with the term, "imputed income" is something you can't spend at the grocery store but you get taxed on it anyway.)

Each eligible employee at NRAO is covered by a Basic Group Life Insurance policy which provides coverage equal to one times annual salary, rounded to the next highest \$1,000 amount. IRS regulations permit

employees to receive their first \$50,000 in group life insurance coverage with no tax consequences. (Supplemental life insurance, which is now fully paid by the employee, is not subject to imputed income tax). But when the coverage exceeds \$50,000 certain calculations must be made by the employer which will result in additional taxes for the employee. The amount over \$50,000 results in imputed income, the precise amount of which depends on the employee's age. The older the employee, the greater the value of the free insurance, and hence the greater the imputed income.

If you are required to pay income tax on your group life insurance coverage the appropriate amounts are being deducted from your regular wage payments. If you are paid on a bi-weekly basis, one salary payment out of the month is affected by these requirements. When you receive your W-2 form next year, the additional imputed income from your taxable life insurance, if any, will be listed in Box 13 with the Code Letter "C" next to it.

Now the GOOD news about all this tax talk, and the main reason most of you have read up to this paragraph: the IRS is lowering the rate at which it taxes your group life insurance coverage. The longer life expectancy of today's average American means that group life insurance is now *less expensive*, and therefore should be taxed at a lower rate. Because the IRS rates changed July 1, which coincides with NRAO's salary review period, the change may not seem dramatic, but it is. The IRS rates dropped by as much as 52.1% in some age categories, which can result in some sizeable tax savings. Please consult the rate table below to find out how much money you won't be giving to the Federal Government, or take a close look at your pay statements for the pay periods after July 1st. Still have questions about your life insurance taxes? If so, please contact Roy or take a Fiscal employee to lunch.

5-Year Age Bracket	Value per \$1,000 of coverage per month		
	Old Rates	New Rates	% Change
Under 25	\$ 0.06	\$ 0.05	-37.5%
25 to 29	0.08	0.06	-25.0%
30 to 34	0.09	0.08	-11.1%
35 to 39	0.11	0.09	-18.2%
40 to 44	0.17	0.10	-41.2%
45 to 49	0.29	0.15	-48.3%
50 to 54	0.48	0.23	-52.1%
55 to 59	0.75	0.43	-42.7%
60 to 64	1.17	0.66	-43.6%
65 to 69	2.10	1.27	-39.5%
70 and above	3.76	2.06	-45.2%

1998 Service Award Recipients

Charlottesville, Virginia



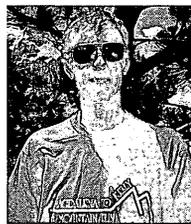
Ernest Allen, Jr.
30 Year



Joanne Nance
30 Year



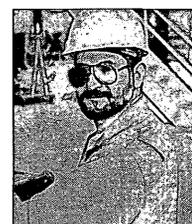
Jim Condon
20 Year



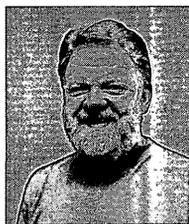
William Brundage
30 Year



Robert Hjellming
30 Year



Steve Aragon
20 Year



Danny Boyd
10 Year



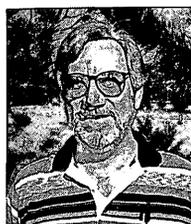
Robert Treacy
10 Year



Carolyn White
10 Year



John Benson
20 Year



Phillip Hicks
20 Year



Wayne Koski
20 Year

Green Bank, West Virginia



Fred Crews
40 Year



Sidney Smith
40 Year



Frank Ghigo
10 Year



Paul Lilie
20 Year



Arthur Pino
20 Year



Sheila Reasner
20 Year



Mark McKinnon
10 Year



Mary Morgan
10 Year



Charles Barham
10 Year



Virginia Goret
10 Year



Selfa Lucero
10 Year

Tucson, Arizona



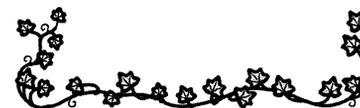
Cedric Clark
10 Year



**Congratulations
To All**



Johnny Montoya
10 Year



VLBA



Paul Johnson
10 Year



Fidelity Expands and Enhances Its Services

Fidelity Investment Services, in cooperation with NRAO, has begun providing employees with two updated services. Now your quarterly statements show greater detail and you can manage your Fidelity retirement accounts online.

Enhanced Quarterly Statements

Beginning with your second quarter statement, your 401(a) retirement plan assets are shown as a separate column from your 403(b) tax deferred savings. You will continue to receive one consolidated statement from Fidelity; however, now you can easily identify your Supplemental Plan 403(b) tax deferred savings from your 401(a) NRAO plan assets.

NetBenefits - Online, Anytime.

Now, in two minutes or less, you can access your retirement plan account information for a quick account analysis. It's never been faster, easier, or more convenient to keep an eye on your retirement savings plan.

NetBenefits is an easy-to-use planning tool that gives you online access to your retirement account 24-hours a day, seven days a week. Now you can check your current account balance and history, review historical fund performance, and make changes all with a click of a button. Since *NetBenefits* is part of Fidelity's main website, www.fidelity.com/non-profits, you'll have a seamless link to investment education tools and information, including interactive worksheets and calculators.

To enable online access, call 1-800-343-0860 to receive your Personal Identification Number (PIN). In less than three minutes, you'll be ready to go online. If you have questions as you're completing the activation process, representatives are available to assist you.

To enable online access

1. Call toll free 1-800-343-0860 to enable access to your account and establish a PIN (personal identification number).
2. Go to <http://netbenefits.non-profits.com>.
3. Click on the "Access My Account" icon and begin to enjoy all the advantages of this quick and easy form of account access.

You can take a look at the complete picture—with your account information right in front of you, it's easy to see how your retirement plan dollars are invested. Anytime you choose, with the help of your mouse, you can change your mix so that it can keep up with your goals for the future.

Scoping the Sites . . .

AOC

LeFebre Honored

Kathleen LeFebre has been honored with a \$500 contribution made in her name to American Association of University Women (AAUW) Educational Foundation. This fund is one of the nation's largest sources of private funding for educational programs that directly benefit women and girls. Each



spring the Socorro Branch of the AAUW is allowed to honor an outstanding woman. Kathleen, an active member of the AAUW since 1965, has been recognized for dedicated service to the organization through a wide variety of Educational Foundation positions, as well as a multitude of leadership roles. She was cited for her family devotion, along with a desire and determination to promote programs that assist children and the parents of children with special needs. Kathleen's award recognized her continued interest in physical fitness through sports and her active role in library development at the middle school in Socorro, then NM Tech library, and now NRAO. Kathleen was honored with a certificate at a special ceremony.

AOC Renovations

Nine additional offices at the AOC were made possible through MMA funding. The unfinished shell space, located on the main floor and at the west side, adjacent to the Correlator operations center of the AOC, was renovated. This project started in mid-December and was completed March 30, 1999.

With assistance from New Mexico Tech, the computer room located on the main floor, directly off of the lobby, has also been renovated with partitions. This area will provide office space to students who work at the AOC, including students from New Mexico Tech and the NRAO summer students.

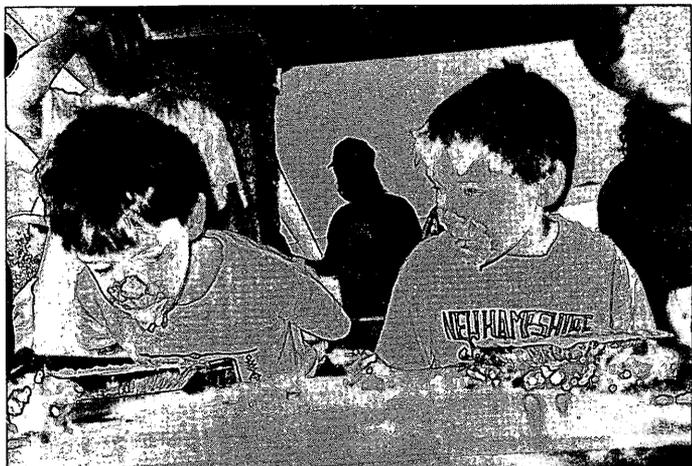
by John Dowling

Summer Fun at the AOC

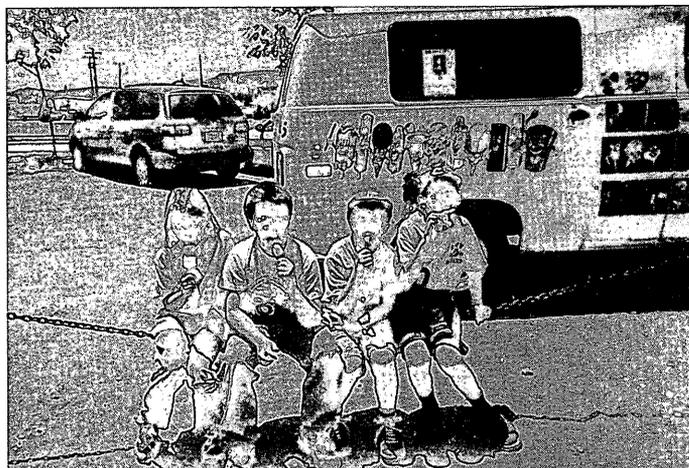


Water Balloon Toss Contest

Summer Fun at the AOC (continued)



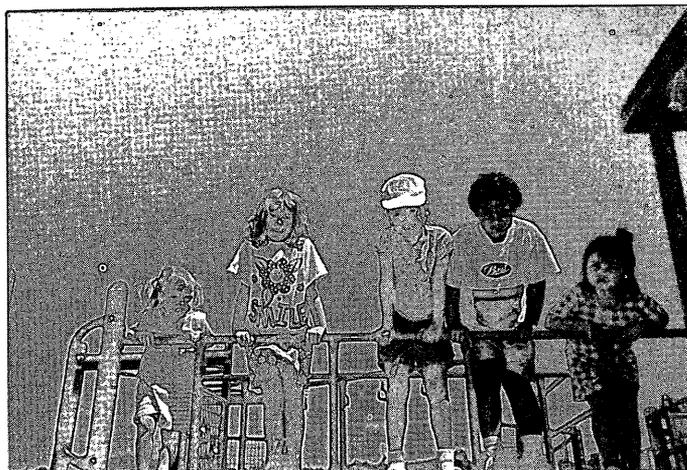
Pie eating contestants - Spencer Baldwin and Sawyer Balwin



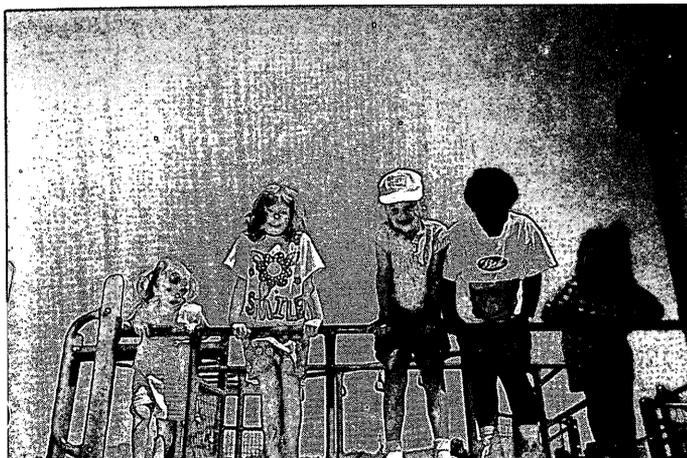
Chaya Barham, Cougar Barham, Thor Johnson, Jeffrey Hertz



Pie eating contestants - Tommy Lubanae, nephew of Shane Baca, and James Cryer, nephew of Mark Sullivan



Kira Hale, Kimberly Long, Shelbi Goret, Matraca Cates, and Shania Mishoe



Marlin Smith, Thor Johnson, Mary Ellen Sanchez, Victoria Lopez and Shane Baldwin



Linda Major, Patty Lindsey and family

Charlottesville

Stone Hall Expansion

The consolidation of the two NRAO facilities in Charlottesville is finally underway. The University of Virginia, Board of Visitors and NRAO have finalized an agreement to build an addition to the Edgemont Road offices on Observatory Hill. This addition will provide space for all of the existing staff and equipment currently located at the Ivy Road location and will make available much needed expansion room for ALMA development.

Alan Bridle has developed an internal web page, <http://www.cv.nrao.edu/~abridle/eraddition/status.htm> that will be updated as development and construction progress of "Stone Hall" continues.

Summer Picnic Fun

It was a beautiful day for a picnic when the Charlottesville NRAO families converged on McIntire Park for this year's summer picnic. The food was prepared by a local picnicker "Homeboy's," and as the name implies, there was plenty of down home cooking including hamburgers, hot dogs, pita veggies for the vegans, potato salad, baked beans and the works. A local musical favorite, Bennie Dodd, kept the crowd entertained with a blend of country music and southern rock. The affair lasted for several hours culminating with some games for all ages. A water balloon toss organized by Roy and Timothy Norville was especially appealing to the children and also a few grown-ups that wanted revenge on an unsuspecting victim. The egg toss, a Charlottesville tradition was again highly competitive. With great distances involved, you would have thought the eggs had been hard boiled. Though there were many tough teams, NRAO employee Tony Marshall and his son, Sam, reign victorious again. The Marshalls won the official balloon toss as well.



Green Bank

Public Servant

Jim Gibb, Fiscal Officer, was recently elected to the Town Council of Marlinton, WV. Jim reports that the race was hotly contested with 13 candidates for 5 council seats.

Golf Tournament Hawthorne Valley

The annual Spring NRAO Green Bank Golf Tournament was held at the Hawthorne Valley Golf Course on May 12, 1999. The weather was good, we played a four man scramble and five teams took part. The scores were 64, 66, 69, 70 and 70. John Ralston, Tony Minter, and Mike Hedrick made up the first place team with the 64. Bob Vance, Kenny Vance, Scott Gibb, and Wally Oref were second with a 68. Russ Poling, Brian Ellison, and Greg Monk were third with a 69. Prizes were awarded for each hole played. The winners, in order, were: Wally Oref, Bob Vance, Mike Hedrick, Scott Gibb, Dave Williams, Wendell Monk, Russ Poling, Sid Smith, Ray Hanshew, Wally Oref, Tony Minter, Sid Smith, Greg Monk, Greg Monk, Ray Hanshew, Greg Monk, Tony Minter and Wendell Monk.

Tucson

Imaging at Radio through Submillimeter Wavelengths Symposium:

Continuing the series of scientific symposia hosted by NRAO Tucson, a symposium on "Imaging at Radio through Submillimeter Wavelengths" was held at the Ventana Canyon Resort in Tucson on June 6-9, 1999. This symposium brought together scientists and engineers working in the rapidly developing field of astronomical imaging at radio through submillimeter wavelengths.

Topics included:

- Single dish heterodyne imaging
- Bolometric imaging
- Techniques for acquiring and processing single dish images
- Interferometric multi-field imaging
- Phase and amplitude calibration techniques for interferometric imaging
- Algorithms for processing interferometric multi-field images

Approximately 125 scientists representing research institutes from at least 14 different countries attended "Imaging99." A total of 49 invited and contributed oral presentations combined with 41 poster contributions offered a plethora of scientific and technological developments. The proceedings from this conference will be published in the Astronomical Society of the Pacific (ASP) Conference Series.

The complete list of scientific symposia hosted by NRAO Tucson in the past decade is:

- 1999 ==> Imaging at Radio Through Submillimeter Wavelengths
- 1995 ==> CO: Twenty-Five Years of Millimeter-Wave Spectroscopy
- 1994 ==> Multi-Feed Systems for Radio Telescopes
- 1993 ==> New Generation Digital Correlators
- 1992 ==> Observing at a Distance

by Jeff Mangum

Scoping the Sites . . . (continued)

VLA

Road-eo Competition

The New Mexico State Highway and Transportation Department sponsors an annual competition for heavy equipment operators. Various agencies are invited to participate. The VLA has been a participant for the last four years.

In this year's competition, Adrian Pino placed third in the back-hoe competition. Other participants from the VLA included Johnny Gonzales, Phillip Sanchez, Paul Savedra, Ellison Thompson, and Michael Torres.

Also participating from the VLA in the capacity of judges were Charles Chavez, Pat Lewis, and Godin Otero. Judges are not permitted to rate candidates from the same agency they represent. The event took place in Socorro in triple-digit weather! *by Allen Lewis*

Control Room Renovations

Phil Hicks reports that the VLA Control Room has just undergone a tremendous facelift. All renovations were completed in 32 hours, a pleasant surprise to everyone except the crew that made it happen. The job required pulling all of the really worn carpeting and furnishings. Walls were then cleaned and repainted. New carpeting and modernized furnishings were installed. The decades-old look is gone and the modern control room representative today's NRAO, is here. For a complete look at the renovation log on to <http://www.nrao.edu/~lbrother/cru.html> for a great view.



CDL Training

Two regular full time employees and three temporary full time employees passed the Class "A" CDL exam on July 6, 1999. Those employees are: Antonio Guerrero from the Auto Shop; Joel Domschot from the Warehouse; Joe Sanchez, Kee Apachito, and Fernando Torres, all from Track Crew. Their coach/trainer for CDL exam preparation was Paul Savedra. The CDL candidates put in many hours of their own time to train, and it paid off. All did well on the exam! Congratulations to all! And a well-deserved "BUEN JALE" to Paul for preparing all so well.

PROMOTIONS

(2/1/98 - 6/30/99)

Mark Alfero to Technical Specialist III, HN
Anthony Beasley to Associate Scientist-Assistant Director, CV
James Braatz to Assistant Scientist-Research Support, GB
Juan Cordova to Array Operator I, SO
Robin Harrison to Tape Librarian, SO
Billie Jo Mattox to Personnel Assistant, CV
Terry Romero to Senior Administrative Assistant, SO
Robert Treacy to Technical Specialist I, CV
Douglas Whiton to Technical Specialist II, HN

NEW EMPLOYEES

CHARLOTTESVILLE

Walter A. Brown, Millimeter Array
Daniel Koller, Central Lab
Jennifer Edwards, Personnel
Geoffrey Ediss, Millimeter Array
Rebecca Johnson, Public Education
Stephen Muckle, Millimeter Array
Jim Pisano, Millimeter Array
Kamaljeet Singh Saini, Millimeter Array
Mitchell Wharam, Central Lab

GREEN BANK

Thomas Bania, Basic Research
Cecilia Barnbaum, Basic Research
Travis Burner, Plant Maintenance
Mary Clendenen, Fiscal Office
Justin Elza, Plant Maintenance
Erik Heinemann, Scientific Service
Michael Lacasse, Telescope Services
Valarie McGlaughlin, Lifeguard
Mary Meeks, Administrative Services
George Moellenbrock III, Science
Emily Morton, Lifeguard
Eric Ricottilli, Teacher Enhancement
David Rose, Telescope Service
Michael Shank, Scientific Services
Seth Shinaberry, Plant Maintenance
Michael Sumner, Non-NSF
Shawn Taylor, Plant Maintenance
Charles Van Tilburg, Computing
Angela Weadon, Scientific Service
Sarah Weadon, Plant Maintenance

NORTH LIBERTY

Michael Lee Burgert, Electronics

SOCORRO

Kee Apachito, Engineering Services
Gleason Baca, Engineering Services
Terry Bartelt, Array Operations
Frank Broadus, Engineering Services
Carol Claus, Administrative Services
Joel Domschot, Administrative Services
Gary Lee Duff, Electronics
Daniel Edmans, Millimeter Array
Donald Ellis, Engineering Services
Kumar Golap, Non-NSF
Raul Grajeda, Engineering Services
Antonio Guerrero, Engineering Services
Philip Hardee, Basic Research
Mark Krieger, Electronics
Allen Craig Poindexter, Computing

NEW EMPLOYEES (continued)

Adrian Rascon, Electronics
 Joe Rodriguez, Engineering Services
 Elaine Romero, Engineering Services
 Jose Ignacio Sanchez, Engineering Services
 Mary Ellen Sanchez, Engineering Services
 Phillip Sanchez, Engineering Services
 Mark Sullivan, Millimeter Array
 Fernando Torres, Engineering Services
 Jason Wallace, Engineering Services

TUCSON

Michael Brooks, Millimeter Array
 Ricardo Martinez, Computing
 Diane Elizabeth Miller, Operations and Maintenance
 Jonathan Williams, Basic Research

REU STUDENTS**CHARLOTTESVILLE**

Dustin Bambic
 Porter Mason
 Christina Murray

GREEN BANK

Chris De Young
 Jill Kamienski
 David Sand
 Jeanine Wilson
 Scott Zemerick

SOCORRO

Bryan Jones
 Makenzie Lystrup
 Elizabeth McGrath
 Hanna Smith
 Chadwick Young

TUCSON

Sean Andrews
 Andria Schwartz

STUDENT SUPPORT**CHARLOTTESVILLE**

Christopher Power
 Jonathan Levi Durbin

GREEN BANK

Steven Hicks
 Jason Ray

SOCORRO

Crystal Brogan
 Teddy Cheung
 Darrell Osgood
 Andreea Petric
 Niruj Mohan Ramanujam
 Colleen Schwartz

DEPARTURES**CHARLOTTESVILLE**

Tessy Schlemmer
 Desiree Shifflet

DEPARTURES (continued)**GREEN BANK**

Stephanie Mullenax

SOCORRO

Pablo Igor Altamirano
 Shamibrata Chatterjee
 Alison Coil
 Diane Foster
 Amy Jo Mioduszewski
 Gilbert George Montano
 Jaime Montero
 Edward Nowicki
 Ben Otero

TUCSON

Nancy Clarke
 John Butterfield Lugten

RETIREES**AUI**

Robert Hughes, 18 years

CHARLOTTESVILLE

Joanne Nance, 31 years
 Anthony Thompson, 26 years

GREEN BANK

George Liptak, 31 years
 George Behrens, 35 years

SOCORRO

Art Pino, 20 years
 Robert Sefcovic, 21 years

TRANSFERS

Charles Broadwell from SO to CV
 Robert Treacy from SO to CV

A Note from the Editor:

Articles or ideas for the Point Source newsletter are welcomed. If you would like to submit an article, please contact the editor at phone (804) 296-0265 or by email to: rnorvill@nrao.edu.

Deadline for article submission for the upcoming Fall issue is September 10, 1999.

THE POINT SOURCE is published quarterly by the Personnel office for the employees of NRAO.

Roy Norville, Editor

Patricia Smiley, Layout and Design

Printed on
Recycled Paper

