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The MMA Consolidates Its Presence in Chile by Eduardo Hardy

NRAO has now consolidated its legal situation in Chile. On June 30, 1998 a decree signed by the President of Chile, Eduardo Frei Ruiz-Tagle, was published granting AUI the same legal status enjoyed since the sixties by AURA and the Carnegie Institution of Washington, the other U.S. organizations operating observatories in Chile. The MMA is not only the first radio astronomical observatory to come to Chile, but NRAO is also the first, new foreign astronomical organization in a generation.

But securing a legal status for NRAO was only the first step needed to build the MMA in Chile. Guaranteed access to the Chajnantor site and protection of the area is an equally essential part of the process. Thanks to the enthusiastic collaboration of the University of Chile, the National Commission for Science and Technology (CONICYT), and the Chilean political authorities at all levels, this has now been accomplished.

In July, the President of Chile issued an invitation for a ceremony to take place in Santiago at La Moneda, the presidential palace. The invitation was for "the signature of a Supreme Decree declaring Chajnantor a Scientific Preserve area and an agreement for the prosecution of radioastronomical projects in fiscal land." The ceremony took place on July 22nd in the presence of close to 100 guests representing the Chilean and foreign resident scientific community, as well as representatives of the government, particularly of the ministries involved in the signature. It was the largest Chilean public act associated with astronomy in memory. We were represented by Martha Haynes, AUI Interim President, Robert Brown, Project Director, and Eduardo Hardy, NRAO resident scientist and AUI legal representative in Chile. The National Science Foundation was represented by Robert Dickman.

The decree, signed by the President, the Secretary of Mines, Mr. Sergio Jimenez Moraga, and the

A Message from the AUI Interim President, Martha Haynes

While I am known to many members of the NRAO staff from my days as a student in Charlottesville, from my stint as site director in Green Bank, and from my many observing runs and committee meetings in Socorro and Tucson, it is probably not obvious to anyone why I am currently the Interim President of AUI. So, I thought I'd take this chance to talk a bit about current issues facing AUI and its Board of Trustees.

As you all know, AUI no longer runs Brookhaven National Laboratory. The story of the termination of the AUI contract to run BNL is one that is very involved, so I won't go into it, except to say that no one of us at AUI think that the termination was justified, fair or wise. However, it happened, and there was little we could do about it at the time. Thus, AUI is becoming a different organization, focused for the time being only on astronomy and NRAO. We have a smaller corporate income and a smaller staff.

AUI is confronting its new situation and future head-on. A bold step was to install a new President with stronger astronomical interests and more ties to the National Science Foundation. My predecessor, Lyle Schwartz, had other interests and experience; he did a great job trying to ease the transition for Brookhaven and AUI, but felt it was best, when AUI ceased managing BNL, to turn over the helm to someone more familiar with the NRAO operation. Since finding a new president of an organization like AUI is a complex process, the Board of Trustees looked amongst itself for an available astronomer, familiar with the Board, AUI and NRAO, who might take over in the short term. I was on sabbatical leave from Cornell University at the time and felt that I might be able to help out. So here I am.

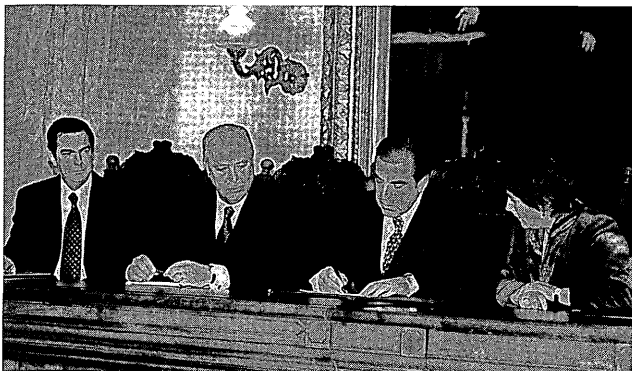
Officially, AUI is the entity with which the National Science Foundation has a cooperative agreement for the operation of NRAO. The Corporation is responsible for oversight and audit of the operation of NRAO. It appoints the Observatory Director;

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The MMA Consolidates Its Presence in Chile (continued)

Secretary of Public Properties, Mrs. Adriana Delpiano Puebla, protects the area from mining claims. The text of the decree, which makes specific references to the MMA, clearly acknowledges that the government of Chile agrees that Chajnantor is the best known place on Earth for millimetric astronomy.



The President of Chile signs the decree declaring Chajnantor a Scientific Preserve. From left to right, The President of CONICYT, the Secretary of Mines, the President, the Secretary of Public Properties

In June, the local authorities of the region of Chile where the MMA site is located (the 2nd Region) had already transferred the administration of the Chajnantor area to CONICYT. The agreement between the ministry of National Properties and CONICYT signed at La Moneda on July 22nd, insures that the land will be devoted to astronomical research. Specific reference was made to the MMA which is considered to be in the development stages there already. A formal agreement between NRAO and CONICYT will follow.

The written texts, as well as the speeches pronounced by the President of CONICYT, Dr. Mauricio Sarrazin Arellano, and Secretary Delpiano contained statements that revealed the degree of interest the government of Chile has taken in our project and in astronomy in general. Chile has said loud and clear that it is waiting for the MMA.



Dr. Martha Haynes, president of AUI offers the President of Chile a satellite picture of the Chajnantor area. The President is flanked by Drs. Martha Haynes and Eduardo Hardy

12 Meter Observations Support a "Colder" Mars by Nancy Clarke

Galileo made the first telescopic observation of it in 1610. Schiaparelli created a stir in 1877 by announcing he had seen *canali* on its surface. Lowell moved to the deserts of Flagstaff, Arizona to dedicate himself, and an observatory, to its study.

In spite of all the attention, Mars remains a mystery in many ways. Even the numerous unmanned spacecraft sent in its direction — from the first Mariner fly-by in 1965, to the more recent Pathfinder mission — have failed to fully answer questions we have asked for centuries. But, with help from NRAO's 12 Meter telescope, Dr. R. Todd Clancy hopes to force the red planet to reveal some of its secrets. In the process, he has provided critical ground support for another unmanned craft — the Mars Global Surveyor (MGS).

Mars has always had a very special fascination for us. It is the only planet in our solar system upon whose surface we can observe seasonal changes, including the formation and evaporation of ice caps. Many still believe it may be the only planet in our system, besides Earth, capable of supporting life.

One important ingredient for the development of life is an atmosphere. Not only does it provide air to breathe, but also protection from damaging solar radiation.

Until recently, models of the Martian atmosphere had been based mainly on data obtained from the Viking I and II landers. However, Clancy, a Senior Research Scientist at the Space Science Institute, has used the 12 Meter telescope since 1982 to observe molecules in the Martian atmosphere which have supplied temperature — and dust — information radically different from the Viking model.

"Viking didn't have temperature profilers," Clancy said. What it did have were devices which measured atmospheric opacity. Those devices supplied evidence that the Martian atmosphere was very dusty and, since dust absorbs sunlight, scientists extrapolated a very warm Martian climate. Clancy's model, based on observations of molecules such as carbon monoxide, depicts a less dusty, and therefore, colder climate. His 12-meter research has been confirmed by other observations, including imaging he has done with the Hubble Space Telescope.

"It is very clear that [Mars] is always colder than the Viking model...throughout the whole orbit, it is consistently less dusty and colder than the Viking [data]," he said. This colder atmosphere has serious implications for the MGS mission. The MGS spacecraft uses a technique known as aerobraking to help it attain a proper orbit around Mars. Simply

Satellite Telecommunications Services and Iridium Observations

by Mark McKinnon

put, ground controllers send instructions to the craft to make it dip into the Martian atmosphere at a critical point in its orbit. The resulting friction, or drag, slows the spacecraft down as it approaches another crucial orbital point. The maneuver has to be done repeatedly in order for the craft to attain the proper altitude and, thus, the proper orbit.

"It makes a difference if [the atmosphere] is warmer or colder," Clancy said. The reason is that warm air expands and thins as it does so; cold air contracts and is more dense. This would affect how low, and how long, the MGS craft would need to dip into the Martian atmosphere during aerobraking.

So, which model was more accurate?

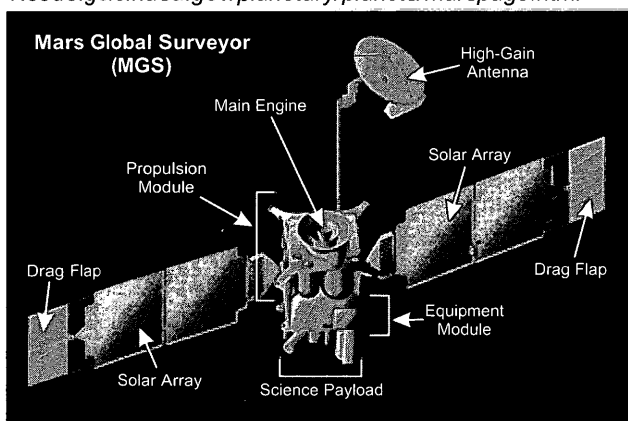
"The MGS data show good correlation with the Kitt Peak data," Clancy said.

All the evidence seems to favor a less dusty, cooler Martian environment. However, Clancy is awaiting results from upcoming MGS and 12 Meter observations concerning water vapor and cloud formation for additional confirmation of this model. Observations of both in the Martian atmosphere is further indication of a cooler climate; a warm dusty environment would tend to limit the amount of available atmospheric water vapor and, thus, inhibit cloud formation.

Clancy acknowledges the importance of the MGS mission, as well as the sheer amount of scientific data it will produce during its lifespan. But, like the rest of us, he admits to experiencing a certain amount of excitement as Pathfinder landed on the surface of Mars. "It was very dramatic. Just the fact that it had been twenty years [since the Viking landing] and that we were getting pictures back...it was very striking," Clancy said. "It was a beautiful engineering accomplishment."

For more information on the planet Mars, and the Mars Global Surveyor, visit the following websites.

*Mars.jpl.nasa.gov/mgs/
Nssdc.gsfc.nasa.gov/planetary/planets/marspage.html*



Most NRAO employees have experienced the "telecommunications revolution" in the form of the Internet and cellular phones. The culmination of this revolution will most likely be satellite systems which provide voice, data, and multimedia telecommunications services around the world.

While these satellite systems can provide an enormous amount of useful information for each of us, they also have the potential for interfering with radio astronomy observations. Unlike a source of terrestrial interference such as a television station, the signal from an Earth-orbiting satellite is more likely to be detected with the main beam of a radio telescope. The satellite signal can easily saturate the telescope electronics and ruin the astronomical data because both the strength of the satellite signal and the gain of the telescope main beam are large. Additionally, the motion of a satellite makes it difficult to remove satellite interference from the data because the measured strength of the interference varies due to the changing distance to the satellite and to the fact that the satellite signal can be detected with different sidelobes of the telescope beam. Telecommunications satellites may also require large amounts of spectrum because they must transmit and receive large amounts of data, but radio astronomers also need large bandwidths to improve the sensitivity of their observations.

We can minimize the problems for radio astronomy that may be caused by telecommunications satellites in a number of ways. By actively participating in spectrum management organizations, such as the International Telecommunications Union (ITU) and the United States Commission on Radio Frequencies, radio astronomers and engineers can estimate the impact of a proposed satellite system upon radio astronomy observations, identify potential conflicts in the use of the spectrum, and possibly rectify problems before a satellite is launched. We can also build special data recording equipment to overcome satellite interference. However, hardware solutions tend to be satellite-specific and are therefore expensive to build and maintain if a large number of different satellite systems are placed in operation.

Another way to minimize interference to radio astronomy observations is to work directly with satellite operators to insure that satellite emissions comply with applicable rules, regulations, and recommendations of spectrum usage. In February and March of this year, the NRAO and Motorola worked cooperatively to measure the strength of the downlink signal from an Iridium satellite in the

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A Message from the AUI Interim President, Martha Haynes (continued from page 1)

approves appointments of tenured staff and senior managers; reviews ongoing programs and budgets; and oversees long-range planning and proposals for new, major facilities. These actions are reviewed by the NSF, with NSF approval required for all major commitments.

AUI is governed by a board of trustees, which elects corporate officers to serve the Board in carrying out the day-to-day business of the Corporation. The Board consists of 21 individuals plus the AUI President, who serves as 'Trustee Ex Officio.' At least one trustee comes from each of the nine founding universities. Since AUI is an independent corporation, not a consortium, individual trustees serve as fiduciaries and do not represent their home institutions on the Board.

A great strength of AUI is the fact that its Board of Trustees deliberately maintains a broad balance of expertise in all major areas of science, as well as extensive experience in senior administration. As corporate activities have changed, the Board has likewise restructured itself to ensure a wide range of institutional participation and individual expertise in its membership.

The Board of Trustees delegates certain review functions to its subsets, including standing committees. Board members, in concert with corporate personnel, participate in audit and financial planning of the corporate budget and reserves as well as of those of the NRAO. AUI also employs a visiting committee of independent experts to review the quality and scope of ongoing and planned scientific programs at NRAO. The Committee is composed of distinguished scientists drawn from universities and industrial organizations all over the world.

The corporate office is located in Washington, DC and now consists of a small support staff. Here, we interface with the NSF, not only with the Astronomy Division but also at higher levels and with the Office of Grants and Contracts. We orchestrate the functions of the Board of Trustees and its various committees on Observatory oversight. We worry about investing corporate reserves, represent the Corporation and NRAO in Washington, deal with legal matters, and a hundred other issues related to managing NRAO for the NSF.

To accomplish our responsibilities for NRAO, we receive a management fee from the NSF (less than 2% of the NRAO yearly operating budget, not counting the MMA). A portion of the fee is normally "refunded" to the NRAO in the form of AUI Trustee Scholarships and discretionary funds to cover expenses that cannot be paid from NSF funds. But, in this year, we have also given \$250K of that back to NRAO: \$50K to defray the cost of the GBT arbitration and \$200K in matching funds to construct the optical fiber link to the Pie Town VLBA antenna. (The NSF program granting the other half of the money required a matching grant.) Furthermore, we are in the process of trying to figure

out a way to advance about \$750K from corporate reserves to NRAO to cover the high cost of mounting a strong defense against the (unjustified) COMSAT claims with respect to the GBT construction. The Board of Trustees realizes that NRAO should not have to pay this cost out of its operating budget, yet the process of getting extra money from the NSF to cover these expenditures is not one that moves swiftly. In order to ease the burden on the Observatory, AUI will sacrifice the interest the corporation would earn if this money were invested. AUI will need to be repaid at a later date, but hopefully, not at the expense of NRAO operations. Such an advance transfer also allowed the NRAO to build the Socorro Guest House several years ago.

One of our major efforts this summer is associated with the MMA. In approving the initiation of the MMA design and development phase, the NSF and the National Science Board wanted assurance that AUI would oversee the project closely and would become involved in its international aspects. AUI is the legal operating entity in the Republic of Chile. We have appointed a Trustee committee to work with the Observatory on management and programmatic aspects of the MMA project. It is this kind of oversight function that the NSF expects from an organization like AUI, quite distinct from what it expects of NRAO itself.

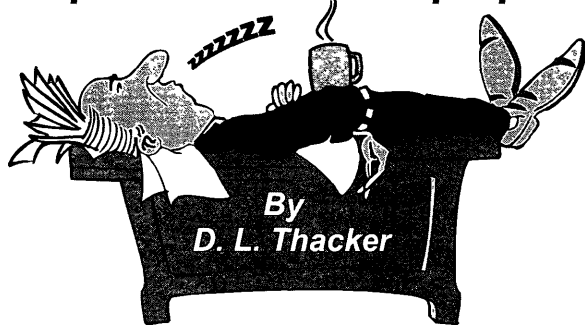
What makes me feel best about AUI is that it consists of a core group of hardworking and dedicated employees and a highly respected and committed Board of Trustees who give their time, wisdom and experience without pay because they believe that science management by scientists is important. All in all, I am proud to be part of this organization, as its Interim President, as a Trustee and as a radio astronomer.

Currently, a committee is at work seeking a permanent president. Ken Kellermann is the Observatory representative on this committee, Irwin Shapiro (Harvard-CFA) is the outside member, and others are members of the Board. A national search is being conducted. I feel very strongly that the new president will take over an excellent and financially sound organization with a long tradition of managing outstanding science. AUI will continue its efforts to maintain NRAO as the world's premier institution for radio astronomy. Hopefully, a new president will be named in the very near future.

While I have very much enjoyed the opportunity to serve as AUI Interim President, both to help the Observatory in the short term and to benefit personally from the experience, I look forward to ending a hectic commute from Ithaca, New York. For the same reasons that I left Green Bank with sadness in 1983, I need to return to my husband, my house, and my students. But I'm sure you'll see me roaming the halls and telescopes of NRAO one way or another for years to come.



Sleep Disorders – Sleep Apnea



Are you tired and sleepy all of the time? Do you fall asleep at inappropriate times? Have you had a near miss while driving or operating dangerous machinery when your brain seemed to tune out for a few seconds for a little nap? You may have **sleep apnea**. People with sleep apnea have their sleep disturbed with literally hundreds of brief breathing interruptions per night.

Most sleep disorders are fairly obvious—you can't sleep; therefore you are tired, upset, depressed, and sometimes fall asleep uncontrollably. Sleep apnea is more subtle. Most victims seem to be sleeping normally or even excessively and may not even suspect that their difficulties are due to this type of sleep deprivation. Before discussing sleep apnea, it is helpful to understand some basics of normal sleep. A typical sleep pattern begins with the body progressively undergoing three to four levels of increasingly deeper sleep for about 70 to 90 minutes and then rousing up to lighter sleep before progressing into a special mode of sleep for a few minutes called REM (Rapid Eye Movement) sleep. Science does not understand the details of REM sleep very well, but there is general agreement that it is essential for proper mental health. From the REM mode, the body goes back to level 2 of the non-REM mode and this cycle repeats itself. It is in the deeper levels of sleep that the body is the most relaxed and certain critical restorative functions take place. Obstructive sleep apnea (the most common kind) occurs when the muscles surrounding the airway in your throat relax to the point that the airway collapses and breathing is interrupted. Almost immediately your body reacts to the lack of oxygen in the blood stream by rousing up to a less deep level of sleep which causes an increase of the muscle tension surrounding the airway and breathing is restored. The end result is that the body never reaches the deep levels of sleep and misses the associated restorative effects of these deep levels. With the natural cycle disrupted the mind misses much of stress relieving benefits of REM sleep. All of this is without the sleeper being conscious of what is happening except for the general feeling that his life is slowly going down the tubes.

Most apnea situations are first noticed by the victim's spouse who hears their partner snoring loudly (snoring is a sign of an airway just beginning to collapse) followed by a brief cessation of breathing with perhaps a gasp or snort followed by more heavy snoring. It is acknowledged that the bed partner of a person that snores and snorts all night long may have a different viewpoint on who is the victim in this situation.

Sleep apnea affects 4% of men over 50 and 2% of women over 50, and is usually associated with heavy snoring, high blood pressure, headaches, higher than average amount of body fat, and a large neck. Alcohol and sedatives greatly increase the chance of apnea events. It can be life threatening. The good news is that the condition is easily diagnosed with an overnight sleep test either at home or in a sleep center and can be treated with a variety of techniques.

Treatment ranges from simple devices that keep you from sleeping on your back (where most apnea events occur) to expensive and risky surgery. In my case, a tennis ball taped to the back of my night shirt and an inexpensive dental appliance (from the Snoring and Headache Center in Charlottesville) put me on the positive side of getting restful sleep. Weight loss can cure many cases of sleep apnea, but doctors now realize that sleep deprived people have little chance of losing weight. Current philosophy is to first treat the apnea with one of the other techniques and then recommend weight loss in hope that the earlier treatment can be discontinued. More information can be found on the web, for example www.dpap.com and www.newtechpub.com. Sleep well.

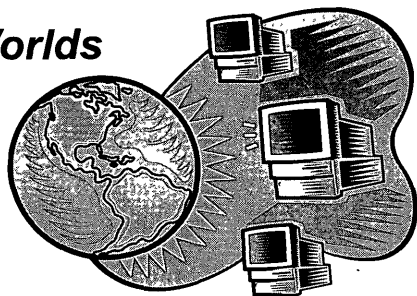
Satellite Telecommunications . . . **(continued from page 3)**

1610.61613.8 MHz portion of the spectrum that is reserved for radio astronomy observations. Although the downlink signal of an Iridium satellite is licensed and designed to operate at 1621.351626.5 MHz, "spurious emissions" were expected to be generated by the downlink in the radio astronomy band. According to a recommendation to the ITU, the strength of these spurious emissions could not exceed certain thresholds for different types of radio telescopes. The results of the Iridium satellite observations showed that the strength of the spurious emissions would not exceed the thresholds for the VLA and VLBA but would exceed the threshold for the single dish telescopes in Green Bank. The NRAO has made the results of the satellite observations public and expects that Motorola will make appropriate operational modifications so that the downlink will comply with the ITU recommendation.

All the remedies for minimizing satellite interference require the investment of observatory resources, primarily in the form of employees' time. For example, many people from all NRAO sites were involved in the Iridium satellite observations. Dick Thompson coordinated the observations with Motorola from Charlottesville. Jeff Clarke and Darrel Emerson observed the satellite from the Steward Observatory in Tucson. Members of the Iridium testing team in Socorro included Durga Bagri, Larry Beno, Chuck Broadwell, Bill Brundage, Everett Callan, Phil Dooley, Ray Ferraro, Tim Hankins, Paul Lilie, Dennis Polyard, Bob Treacy, and Greg Taylor. In Green Bank, Bob Simmons, Roger Norrod, Rick Fisher, and Mark McKinnon modified and used the 140 Foot Telescope for the satellite observations. Some of us have some unusual experience in the telecommunications revolution!

When Worlds Collide

by
Ruth
Milner



In The Beginning – well, OK, 1985 – there were PCs and there was UNIX.

Why 1985, which wasn't really The Beginning? That was the year that NRAO entered the UNIX world, with the purchase of our first Convex C1 mini-supercomputer. It was more than a hundred times faster than the systems being used for most computing tasks at the time.

Back then, many NRAO staff used a "dumb" terminal to talk to a central computer, if they used a computer at all. But a few people had "personal computers" running something called DOS. In 1985, the performance of these computers was about half that of the VAXes used for most general-purpose computing, though their very poor I/O resulted in vastly slower overall results. On the other hand, only one person used a PC at a time, whereas several competed ferociously on each VAX. (Astronomers from all over the world flew to New Mexico just to get a share of the system from 2 to 6 a.m.!)

Although NRAO did not invest in them right away, UNIX desktop boxes also began to become popular around this time. UNIX was (still is) an operating system that ran on many different kinds of computers from many different manufacturers – a totally different concept than DOS or the VMS operating system that ran on the VAXes; those were "proprietary," meaning they could be purchased from only one company. UNIX offered the promise of being able to buy whatever was the most cost-effective computer hardware at any given time, without having to make massive changes in the environment.

For a long time after this, the PC and UNIX worlds stayed separate. The systems were designed for different purposes, they ran different software, and they performed best on different tasks (their prices were a lot different, too!). So for the most part they were used by different people.

But in the early 1990's, things began to change. A young man in Finland named Linus Torvalds decided to write a version of UNIX for himself. He then opened up the project for others to contribute to. The result was known as "Linux," and rapidly became popular. Its first audience was, not

surprisingly, people who liked to fiddle with the guts of operating systems. Later it began to show up in academic environments, where inexpensive software and hardware is always welcome (Linux is free). In the past couple of years, it has started to make inroads in corporate computing installations, thanks partly to Linux itself, and partly to the fact that PCs are now much faster, for similar or lower cost, than they were a few years ago, and can compete with more conventional UNIX desktops.

So what does this mean to us?

Although Linux, in longstanding UNIX tradition, runs on several different kinds of computers, the most common of these is Microsoft's favorite: the Intel x86 line. (Some attempts to popularize UNIX on Intel processors had been made before, but few gained much of a following.) This means that there is a very cost-effective desktop computer which can run either UNIX or Microsoft Windows. Until earlier this year, the performance of our main scientific application, AIPS, was not particularly good on these systems, so for many of our UNIX users Linux was not very attractive. But this problem has now been solved (using another piece of free software, from the GNU project). Linux systems now make very nice scientific desktops. Roughly 40 of the 50 UNIX upgrades NRAO-wide this year will be Lintel boxes ("Lintel" = Linux + Intel, as opposed to "Wintel" = Windows + Intel).

The old dichotomy where PCs and UNIX existed in separate worlds, and never the twain shall meet, is disappearing. Much of the same add-on hardware works with both Windows and Linux, which simplifies support. It is possible – though not always useful – to install both operating systems on the same computer, and boot whichever one you need. As we upgrade PC hardware in the future, we will have more choices of how to use the older computer. There are many potential long-term benefits for NRAO in this shift.

For those of you who are wondering, we won't be getting rid of all our Sun systems any time soon (we're government, remember: we never throw anything out). There are still some things we need to do that can't be done under Linux. In particular, some commercial software we use isn't available (yet?); and PCs also can't compete in performance with the kind of systems we need to make available to visiting astronomers. But the combination of Linux software with PC hardware makes for some interesting changes in our computing world.



Decision Driving by Jon Spargo

Beginning in October of 1997, there have been a series of driver training courses given at the AOC and the VLA. The course is called Decision Driving and was developed by our vehicle insurance carrier, Liberty Mutual. To date we have had four course sessions and several more are planned until all employees at NRAO-NM have attended.

This course is very unique in that it builds on some of the concepts of "Defensive Driving," adding to the areas of driver awareness and decision making. It is not my aim to go into great detail, but rather summarize a few simple principles taught in the course, while adding some useful practical tips that you can put to use in your daily driving.

In a typical driving situation in a town or city, we have to make 100 decisions per mile on average! 95% of all accidents are caused by indecision or poor decisions made by the driver. There are 5 basic steps we can take to help us make better driving decisions. They are:

- 1. Expand Your "Look Ahead" Capacity**
- 2. Size Up The Whole Scene**
- 3. Signal Your Intentions Early**
- 4. Plan An Escape Route**
- 5. Take Decisive Action**

Expanding your "Look Ahead Capacity" simply means that most of us don't look far enough ahead, regardless of the speed we are traveling. We should be looking at least eight to twelve seconds ahead. In city traffic at typical speeds, this means that we should be able to look at least three full city blocks ahead. You should be aware of the state of traffic signals at that distance and be on the lookout for potential problems such as parked cars, pedestrians, and particularly children.

"Sizing Up The Whole Scene" means using all the tools at your disposal to get a complete picture of all that is going on around you. Mirrors should be checked every five to ten seconds. Learn to scan your environment and not stare at anything for too long. A good habit is to check one mirror and then look straight ahead. Then scan the next mirror and repeat. Scanning all mirrors consecutively diverts your attention from what is in front of you for too long. Scan intersections for approaching vehicles and pedestrians by looking left, right and then left once again before entering the intersection.

We've all seen drivers who have suddenly turned in front of us without using a turn signal or giving any indication of wanting to make a turn. Learn to communicate your intentions. Use your lights, horn, hand signals and directionals. A short tap of the horn alerts others that you are near and that you are

starting to take action, such as backing out of a parking space. Establish eye contact, avoid driving in others' blind spots and warn following traffic. Be predictable and give other drivers time to react.

To "Plan an Escape Route" means maintaining adequate following distance. You should always strive to maintain at least a two second interval between you and the car in front of you. Pick out an object along the side of the road and begin counting (one thousand and one, one thousand and two, etc.) when the vehicle ahead of you passes the object. If you are less than two seconds behind the vehicle in front of you when you pass the same object, back off until you have re-established the proper interval. In city traffic and when approaching a red traffic signal, stop your vehicle so that you can see the rear tires of the vehicle in front of you touching the pavement. This will give you enough room to maneuver around that vehicle if you have to. When the light turns green and the vehicle in front of you starts to move, count two seconds before starting your vehicle. This automatically establishes your minimum following distance.

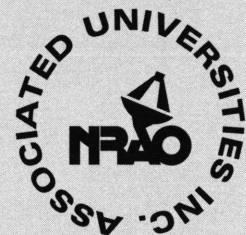
These are just a few of the many driving tips learned in this course. There are many more too numerous to list here. We've had a lot of positive comments from employees who have taken the one day "Decision Driving" seminar. The real payoff comes when you put these principles into action. It is my hope that all NRAO employees will be able to take this course at some point in the future. Until then, I welcome your comments and questions.



Logo Winner Chosen!

Congratulations go out to George Kessler of Charlottesville for submitting the winning design in our logo contest. In the last issue of the Point Source, we included an invitation for readers to submit designs for a new AUI corporate symbol which incorporates the NRAO logo. We received a number of different designs from employees so thanks to all of you for participating. The winner was chosen by Dr. Martha Haynes of AUI, Carol Whitley of AUI and Dr. Paul Vanden Bout of NRAO. George's winning logo design is shown below. We promised him lots of publicity along with his \$100 prize, so feel free to congratulate him!

**Nice logo
George!**



Genealogy: A Trip Down Memory Lane by Richard Fleming

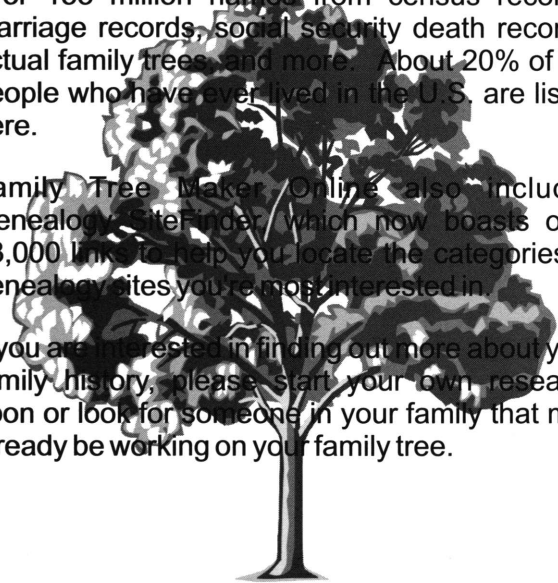
You may not realize it, but you have already begun collecting information for your family tree. Your personal memories and the stories you've heard from others have created a collection of genealogical information. The information that you already have probably includes the names, birth dates and birthplaces of your close relatives, along with other facts that you may know. To start growing your family tree, all you need to do is record the facts that you already know. It doesn't matter how few or how many facts you know, because even the smallest seeds can grow into enormous family trees!

In addition to your family memories, you may have or know about photo albums, scrapbooks, Family Bibles and other family keepsakes and memorabilia. These are excellent places to look for genealogical information about your family. Once you have recorded all of the basic genealogical information that you and your family can recall, you may want to dig deeper into the family memory and collect stories that will give all of those names and dates a little bit of character. Information that your older family members have only in their head will be lost eventually, unless you make a permanent record of it.

The largest and most complete online genealogy resource is the excellent web site Family Tree Maker Online (www.familytreemaker.com) from the creators of Family Tree Maker, the #1 selling genealogy software. I have used this software for about five years very successfully. Look at the FamilyFinder Index on this web site. It is a good place to start your genealogy research. It contains over 153 million names from census records, marriage records, social security death records, actual family trees, and more. About 20% of the people who have ever lived in the U.S. are listed here.

Family Tree Maker Online also includes Genealogy SiteFinder, which now boasts over 33,000 links to help you locate the categories of genealogy sites you're most interested in.

If you are interested in finding out more about your family history, please start your own research soon or look for someone in your family that may already be working on your family tree.



Genealogy by Al Wootten

My interest in genealogy awakened one Thanksgiving when my wife Ida Lee's Aunt Polly casually remarked that we were using her great grandmother Eliza's dessert spoons. A little mental arithmetic (Polly is 90) told me that these were old—indeed Eliza Poole Hays (1807-1824) married in 1825, when they were given to her, I later found out. I decided to find out more about the people whose genes had molded our family, and whose treasured but few belongings had helped make my life more comfortable, as it had theirs.

I began asking all of my older relatives for stories and facts. They sparkled as they reminisced, telling me old family stories, identifying family members in old photographs. Gradually I put together the trunk of my family tree. As I contacted relatives known to each other but not to me, branches filled out and new stories and photographs came to light, including a letter from my great great great grandmother Edith Richards Davis (1794-1866), born not far from Charlottesville in Bedford County. She had written to tell the folks back home in Columbiana County, Ohio about her wagon trip west to Iowa in 1839. It was written in pokeberry juice, yet was still easily readable! But getting to the roots of the family tree required digging.

The Internet provides an easy store of information, as does the local Mormon Church. Unfortunately, I found that those secondary sources were full of errors, often contradictory and usually made no reference to source material. At one point I was exchanging information with a distant cousin I had met on the Internet via private email. I sent her my hypothesis on our relationship which I knew to be wrong in detail for her criticism, based on her research. Months later I was surprised to receive an email from another distant cousin containing the very incorrect material I had sent in my private email. He had obtained it from a CDROM distributed with Family Tree Maker software. I learned to beware commercial sources who may want to provide content but have no interest in accuracy. The Mormon Church does provide access to primary sources which your local library may not have, but usually these must be ordered, and they may not have the detail you seek. Many records, notably the early records of Virginia counties, may be obtained on microfilm from the State Archives through interlibrary loan.

If you know the region where your ancestors lived, a good way to obtain accurate information is to visit the web site for their county, since chances are good that relatives still live there that know a lot about the family. Nearly all counties are listed at the U.S. GenWeb sites at

<http://www.rotswev.com/~usgenweb>. Many other good sources are available. If a relative is known to have been a DAR (Daughters of the American Revolution) member, for example, but her papers have been misplaced, you can find many of these online at <http://www.ancestry.com/ancestry/search/3174.htm> where the first 110 volumes of the lineage books have recently been placed online. For areas sufficiently endowed with history, local contacts can be enormously valuable. My father's roots lie on the Eastern Shore of Maryland and Virginia. I sometimes think it is impossible to cite a name from the 1600s which one of the locals there does not know! Some of my own genealogy, and links to resources are on my WWW page, <http://members.tripod.com/~astral>. I completely endorse the LifeLines genealogy program, which can be obtained through links there. It is especially good for those who can program and want complete control over their data - like AIPS, it comes with its own programming language. Users have contributed dozens of report programs written in this language to provide output from the database in just about any form one might want; even allowing mixed Arabic, Chinese and European texts, should your ancestry be so varied!



Finding My Roots by Mark Gordon

Fourteen years ago when my mother died, I found myself with a thick manilla envelope filled with information about her ancestors. There were yellowing newspaper clips (usually obituaries), applications for membership in the Daughters of the American Revolution with the requisite genealogies, and lots of old photographs with identifications written on the backs in a script that I found difficult to read. "What should I do with this?", I asked myself.

By accident, I learned of a PC program that would provide a solution. One of my graduate school teachers had married a distant relative of mine after his retirement. He told me that the Church of the Latter Day Saints (LDS or Mormons) were distributing a specialized database program for genealogy called Personal Ancestral Files. Not only was it inexpensive, but my former teacher claimed "if you also use the LDS genealogical libraries, you can probably trace your family back to Noah!" I immediately wrote the LDS church in Salt Lake City and bought the program for, at the time, \$35.

What a program! First of all, it was — and is still — written for DOS. By design, it has a small enough "footprint" that it will even run on small, old PCs. The

manual is clear and educational. The program has several parts: the specialized database with a record for each individual that can be linked to others through marriage, parents, children, and siblings; a notes section where you can enter extensive source information regarding each entry; a print section allowing you to print the databases in a wide variety of formats like a family tree, a descendancy chart and, its opposite, an ancestral chart. It displays data in the form of a graphical tree where you can click on any individual to access that particular record. Finally, it can import and export data in a standardized format (GEDCOM) understood by most genealogical programs.

Armed with this program, I began entering, marrying, siring, and parenting all of the people in the manilla envelope. By the time I'd finished, I had entered a few hundred names. The entering process itself was interesting. What would you think about 18th century parents naming their firstborn girl "Mindwell"? Another ancestor named a son "Blackjack."

Fascinated, I printed several copies of family trees and mailed them to relatives. The process was like sowing seeds. Within a year, they began sending me packages of additional information. I had become the family archiver. My database swelled to several hundred names for this line alone and my reference material now included many more clippings, personal descriptions of heritage, etc. And, I had yet done no genealogical research. All of this material had been a windfall. Soon, I began another database for my father's family.

As with my mother's line, there were surprises. A cousin had sent me information about his family. His father, my second cousin once removed, graduated from medical school in 1919, and became a medical missionary in rural Brazil. The villages had no electricity, the nights were long, and the family correspondingly became large. Evidently, I had many relatives still living in Brazil, married to Brazilians.

By this time, I wanted to flesh out my records with solid facts. I wanted birth, marriage, and death dates. I wanted places. And, I wanted documents. It was time to visit the "Family Records Center" of the LDS church.

It seems that every city with a large LDS congregation has a Family Records Center. In Tucson, this is a well-stocked library attached to one of their churches. Not only does it have lots of genealogical books but, more importantly, it has hundreds of CD-ROMS containing searchable genealogical information. It usually has a volunteer staff that will help you. Part of the LDS belief is that

(continued page 10)

Finding My Roots (continued from page 9)

each church member has the obligation to search out ancestors and posthumously bring them into the LDS church. Accordingly, the LDS church has acquired genealogical records from all over the world — from wherever it can find them. Volunteers have entered this information into searchable formats eventually published as CD-ROMS. Searching the CD-ROMS either produces the information you need or refers you to a microfilm that you can borrow from the central depository in Salt Lake. There is no charge except for postage to get a microfilm reel sent from Salt Lake. The LDS church tacitly hopes that you will donate your findings to their archives so that others may access them.

Searching these records yielded many dates, places and names. It also yielded the marriage record of the earliest Gordon ancestor known to me, in Brechin, Scotland, in 1772. Unfortunately, I also learned that searching records of Highland Scots is usually unproductive. Except for the property owning Lairds, most families were extremely poor. They seldom had property enough to warrant a probate process upon their deaths. The Highland climate is harsh. The infant mortality rates were so high that given names like David or Sarah were used over and over again within the same family until a child lived to maturity so that birth or baptism records were often meaningless. And, most frustrating of all, the poor families who took up crofting for the laird of a clan usually changed their last names to his, thereby obliterating traceable ancestry. Sometimes you just hit a dead end.

In summary, mostly by chance I have accumulated information covering 7 generations of my father's family and 13 generations of my mother's. You can do this as well. There are many "how to" books. There are resources to help you within your family, from the LDS church, and from genealogical libraries available in your own neighborhood or nearby communities. There are land records, birth records, marriage records, death records, records of passengers arriving on ships, naturalization records, military service records, census records, and probate records all available for your inspection. Some, I'm told, are searchable on the Web. Genealogy has become popular, the July 13th issue of TIME contains an article on it. Genealogy research is fun and it gives you a sense of place on this earth.



Are Tuition Refunds Taxable?

by Tim Kelly

Currently the I.R.S allows NRAO to reimburse employees up to \$5,250 per year for tuition costs on a "tax free" basis. However, graduate level courses are not included in this category and will be taxed based on your federal W-4 withholding allowances on file. For further clarification, we recommend that you consult your accountant or tax advisor.

In Memory of Harley Carpenter

by Mike Holstine

The National Radio Astronomy Observatory - Green Bank lost a fine employee and good friend July 16, 1998 with the passing away of Harley Carpenter, 54. Harley had worked for the NRAO for over 10 years as the carpenter for Plant Maintenance in Green Bank before he contracted cancer. As the sickness continued to overcome him, all Harley could say was that he was going to get better and return to work. He truly loved to work at this facility and could not wait to return. His influence at Green Bank can be seen everywhere. At 6'2" and about 170 lbs., Harley was not hard to notice either. But it was his friendly disposition and infectious laugh that drew people to Harley. Always the optimist, he was always appreciative of the job he had with the Observatory, and was not afraid to say it. It was not uncommon to hear him tell an employee who may not have had the rosiest outlook on his/her job how lucky they were to be employed at a facility with such good people to work with. How true!

An accomplished musician, Harley could be heard singing wherever he was working on the site. He was a founding member of the Black Mountain Bluegrass Boys and had just had a CD made of his music called "Harley's Bluegrass Band." For the 4th Grade fundraiser at the GB Elementary Middle School last year, Harley's band played for the public at a dinner concert called "Beans and Bluegrass." For the price of admission you could have all of the pinto beans, cornbread, ham, and coleslaw you could eat and then retire to the gym for some true showmanship and bluegrass music. What a hoot, in more ways than one!

In my travels, I don't think I have ever met anyone with a better sense of humor. Harley didn't know a stranger and loved a good joke, practical or otherwise. This attitude alone made coming to work a lot of fun for a lot of people with whom he associated. A true mountain man, no one could blow a turkey call better than Harley could, especially one with flour in it.



Harley was a man who grew up in hard times in the Williams River country of Pocahontas County, but had fond remembrances of his past. He told me many tales of his father and his life as a young man. Growing up in difficult times gave Harley a sense of worth and self-sufficiency. The ripples of his life are felt in many places, in many ways, and by many people. He worked on the Bath County, Virginia power project, was a Constable in the town of Hillsboro, West Virginia, worked for a paving contractor, built homes and raised a family. Harley loved his life and will be surely missed by many. As for me, as Harley would say, I am a smarter man because I worked with him.



Scoping the Sites . . .

AOC

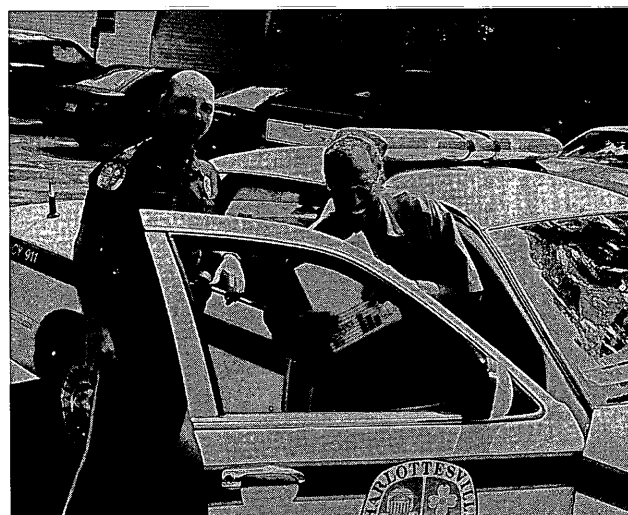
The annual NRAO NM Spring Picnic was held on Saturday, June 6, at Sedillo Park (see pictures below). Under sunny skies, Dan's Catering served up barbeque ribs, chicken, brisket, hamburgers, hot dogs, veggie burgers, beans, green chile, and fruit. Cookies, apple and cherry turnovers, and snow cones rounded off the menu. Yummy! Volleyball was played throughout the day with various players coming and going. A messy but hilarious pieeating contest was won by 6 ft. plus Michael Perley. The younger ones enjoyed breaking a piñata, a water balloon toss, and a sack race. Music was provided by Pat Murillo (brother of our very own Richard Murillo) wrapping up a good day.

by Theresa McBride



Charlottesville

Charlottesville employee Ernie Allen was recently spotted being escorted out of our facility by the local police (see the picture of him getting into the squad car)! But it was for a good cause. Ernie was taking part in a fund-raising campaign to raise funds for the Muscular Dystrophy Association and "Jerry's Kids." He was "Locked-Up" at a local hotel and was not released until he had raised his bail money. The event was a tremendous success overall and raised over \$17,400 in donations and pledges for the MDA cause. *by Tessy Schlemmer*



Scoping the Sites . . . (continued)

Green Bank

The NRAO GB annual picnic was held August 1st. ERA members organized games for children, teens, and adults. First, there were games in the pool for all ages, including a greased watermelon contest and coin toss. After the festivities at the pool, field games for all ages were held. The tug-of-war, soccer kick, frisbee throw, and the water balloon toss were some of the favorites. While the kids were playing, the adults were getting started on games of their own. A horseshoe tournament was held for men and women. The golfers also participated in the festivities. A Long Drive contest was held, and a putting contest. Following these games, a softball game was organized for young and old. Volleyball games were played throughout the afternoon and evening. Dinner was served buffet style, including barbecued beef, pork, and all the fixings, along with pies and cakes for dessert. The food was delicious! After dinner, ice cream was provided for a cool treat.

The weather was beautiful, with sun all day, and clear skies in the evening. Some tents were set up so that people could find shade in the mostly treeless recreation area. As is usual in Green Bank, the evening temperatures fell enough so that by the time the fireworks display was ready, jackets and sweatshirts were needed! The fireworks display was excellent, and did a remarkable job of competing with the full moon. (Maybe we'll consult the lunar phase before scheduling next year's picnic!) The fireworks display is one of the trademark features of the NRAO GB picnic, and all the local residents enjoy the show as well. Many thanks to J.D. Nelson, Nathan Sharp, and Wesley Sizemore, who put on the show, and to Steve Reeves, who manned the 140 Foot telescope so that Nathan could run the show! **by John Ford**

Tucson

An internal review meeting for the MMA Project was held in Tucson July 27 - 29. There were approximately 60 people participating in this meeting, including team members from OVRO, BIMA, and the University of Chile, as well as several members of the MMA Advisory Committee.

This three-day internal meeting was designed for the project team to discuss specifications and to make recommendations on the design of the MMA. Project members gave talks on array configuration, system design, fiber optics, cryogenics, amplifiers, and mixers. There were two antenna design descriptions presented. There was also discussion on site and development planning, as well as operational issues. The meeting concluded with members creating an action list. The action items

are important issues that are of concern to the MMA community and will be addressed by the appropriate project staff.

Everyone left Tucson enthusiastic about the progress of the MMA Project, and with a clear sense that there is a lot of work to do over the next three years! **by Carolyn White**

VLA

Clint Janes reports some interesting and very positive statistics to report relating to the VLA track crosstie replacement project which has been ongoing all summer. The track crew, along with nine summer temporary laborers, worked from April until August replacing crossties on the track. The project was completed ahead of schedule, with the group replacing a grueling 4,700 ties in 15 weeks, including removal of the old crossties, replacement with another, gauging, addition of ballast, and spiking of the ties. Looking at the numbers involved, that's 600 hours of work involved, with 8 ties being replaced per hour on average, or 1 tie every 7.5 minutes of every working day. Very impressive numbers - keep up the good work! **by Patty Lindsey**

VLBA

Natalie Sylvester, 10 year old daughter of our Mauna Kea, Hawaii VLBA Station employee Tony Sylvester, deserves recognition for a recent accomplishment. Her artwork was entered in the Intergalactic Art category of the 18th annual Space Science Student Involvement Program (SSIP) student award program sponsored by the National Aeronautics and Space Administration (NASA) and administered by the National Science Teachers Association (NSTA). Natalie was a second-place state winner in the Elementary School category. Natalie was one of a small group of winning youngsters who were chosen from nearly 10,000 entrants so this is well-deserved recognition. Congratulations to Natalie and her father, Tony, who is very proud of her. We hope to be able to display her artwork in the next issue of the Point Source. **by Tessy Schlemmer**

Fiscal Notes . . .

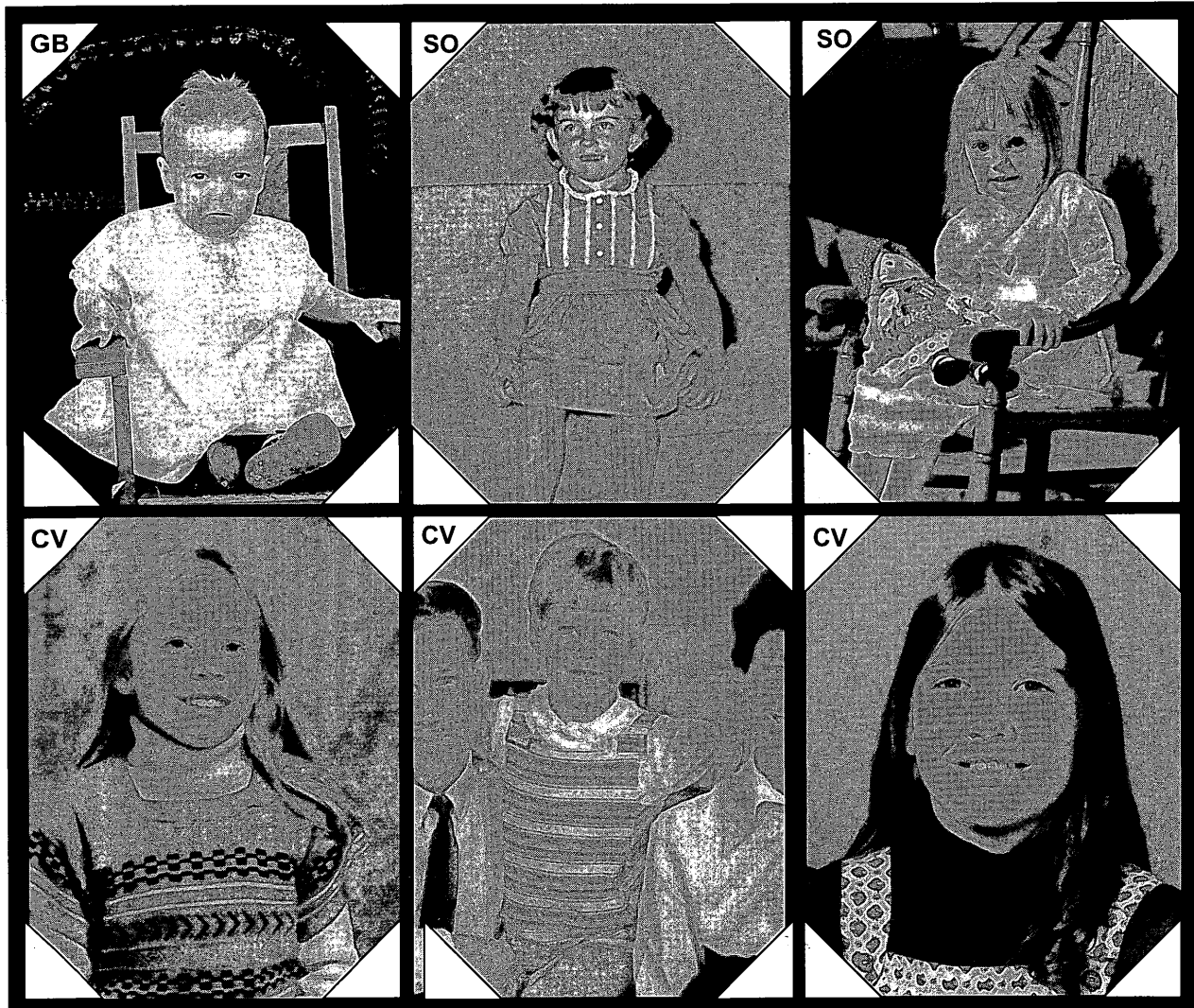
Just a reminder to anyone terminating employment with NRAO, your final paycheck cannot be deposited directly into your bank account. Instead, it may be given to you directly or mailed to a forwarding address.

WHO'S WHO?

Can you identify any or all of the pictures below? Employees were asked to send in a picture of themselves between the ages of 3 and 10 for this contest. Below are some of the pictures chosen at random, with the appropriate site indicated in the upper left corner as a clue.

Thanks to all who participated in the last Who's Who contest. Julie Euart of Socorro's Fiscal Department was declared the winner and claimed a nice NRAO golf shirt as her prize. An NRAO shirt will be awarded to the employee who correctly identifies the most employees first. The winner will be announced at a later date.

Good luck to all!



Spring 1998 Answers:

Nancy Ortiz - SO
Bruce McKean - GB
Stumper - Hayden Mattox

Stumper - doll
Jo Helen Cason - SO
Gayle Dodson - CV

Julia Euart - SO
Leonid Kogan - SO
Josette Chavez - SO

Regular Retirement Plan Changes for 1998

Vanguard funds are no longer offered under AUI's Regular Retirement Plan. Due to this change, four new funds from Fidelity were added to replace the Vanguard funds.

The four new Fidelity funds are: **Dividend Growth Fund, Diversified International Fund, Spartan U.S. Equity Index Fund and U.S. Bond Index Fund.**

Further information concerning these funds may be obtained by contacting Fidelity Investments Tax-Exempt Services Company at 1-800-343-0860 or by visiting their website at www.fidelity.com.

Life and Long Term Disability Insurance Changes

NRAO has introduced a number of positive changes to the life, accidental death and dismemberment and long term disability plans effective July 1, 1998. An overview of the changes follows:

The **Basic Life Insurance** continues through Connecticut General and is provided at no cost to the employee. The Basic Life Insurance coverage is equal to one times annual salary rounded up to the next \$1,000.

The **Supplemental Life Insurance** has been moved to the Hartford Life and Accident Insurance Company, also known as The Hartford. Supplemental life insurance is available in amounts equal to one or two times the employee's basic insurance amount. Employee premium rates are now based on the age of the insured.

The basic **Accidental Death & Dismemberment** insurance provided to each employee at no cost is equal to his/her basic life insurance amount. Previously the maximum AD&D coverage was \$12,500. If additional life insurance is purchased by the employee, he or she may also purchase an equal amount of Supplemental AD&D insurance. The premium for this coverage is 2.9 cents per \$1,000 per month.

In addition to the Accidental Death & Dismemberment insurance, The Hartford has a new feature called **Worldwide Assistance Services (WAS)**. This program provides medical and personal assistance to covered employees who are more than 100 miles from work or home, whether traveling for business or pleasure, in over 200 countries worldwide.

NRAO's **Long Term Disability Insurance** is now provided by UNUM Life Insurance Company. Eligible employees age 30 and over are required to participate in the LTD Plan. Participation is optional for employees under age 30. The monthly income benefit has increased from 50 to 60 percent of the employee's basic monthly earnings, less any benefits received from Social Security or Worker's Compensation. The minimum monthly benefit is \$100. The new LTD premium has been reduced from $\frac{1}{3}$ of 1% to $\frac{1}{4}$ of 1% of basic salary.

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Personnel News . . . (continued)

Contact the Charlottesville Personnel Office for further information concerning these benefit changes.

MEDICAL CLAIMS

The address for filing medical insurance claims has changed. Effective 7/1/98, the new address is:

CIGNA HEALTHCARE
Northeast Claim Center
P.O. Box 962
Bristol, CT 06010-0962
1-800-982-8958 PPO
1-800-462-7486 Indemnity

New medical identification cards are being sent to each employee and their covered family members. Until the new cards are received, claims that are submitted to the New York address will be forwarded to the Bristol claims office.

PROMOTIONS

(4/1/98 - 7/31/98)

Loretta Appel to Senior Secretary, SO
Juan Cordova, Jr. to Array Operator II, SO
John Ford to Head of GB Electronics, GB
Christopher Garcia to Drafter I, SO
Victor Gasho to Telescope Operator I, TU
Brian Glendenning to Assoc Sci/ Hd of Computing-MMA, SO
Mark Gordon to Scientist - Continuing Appt, TU
Virginia Goret to Senior Accounting Clerk, SO
Gareth Hunt to Scientist -Continuing Appt, CV
Athol Kembell to Dep Asst Dir/AIPS++ Project, SO
Patricia Lindsey to Senior Secretary, SO
Robert Long to Technical Specialist II, SO
Mark McKinnon to Assoc Sci-
Dep Asst Dir/GB Opns, GB
Mark Metcalfe to Technical Specialist III, TU
William Morris to Staff Shop Tech I, SO
Ernesto Navarrette to Advanced Technician, SO
Patrick Trujillo to Maintenance Specialist, SO
Esther Vigil to Office Services Asst, SO
Annamarie Wester to Tech Specialist III, GB

NEW EMPLOYEES

CHARLOTTESVILLE

Kjersten Bunker, Student Support
John Effland, Millimeter Array
Sheila Marks, Director's Office
Eric Richards, Student Support
Ronak Shah, Student Support
Gregory Stinson, Student Support
Andrew West, Student Support

GREEN BANK

Marc Apgar, Student Support
Jacqueline Arbogast, Administrative Services
Thomas Bania, Scientific Services
Naomi Bates, Student Support
Travis Burner, Plant Maintenance
Joy Carpenter, Plant Maintenance
Keri Eberhardt, Student Support
Sharlean Elliott, Administrative Services
Steven Hicks, Student Support
Stephane Jouteux, GBT Project
Jessica Golub, Student Support
Jennifer Lockman, Student Support
Patrick Matheny, Student Support
Connie Maxwell, Administrative Services
Stephanie Mullenax, Administrative Services
Timothy Rexrode, Plant Maintenance
Doloris Roberts, Administrative Services
Michael Shank, Scientific Services
Amy Shelton, Electronics
Seth Shinaberry, Plant Maintenance
Loretta Sipe, Administrative Services
Nathaniel Sizemore, Plant Maintenance
Hanna Smith, Scientific Services
Richard Thompson, Plant Maintenance
Sarah Weadon, Plant Maintenance
Nicole Wiersgalla, Student Support
Laura Woodney, Student Support
David Young, Scientific Services

SOCORRO

Pablo Altamirano, Student Support
Michelle Barnes, Administrative Services
Peter Barnes, AIPS++ Project
Shamibrata Chatterjee, Student Support
Michael Crawford, Student Support
Frank Dobson, Engineering Services
Joshua Eisner, Student Support
Johnny Gonzales, Engineering Services
Steven Grain, Engineering Services
Chad Jones, Engineering Services
Ken Lakies, Engineering Services
Cornelia Lang, Student Support
Neal Miller, Student Support
Lawrence Minitrez, Engineering Services
Maury Modine, Engineering Services
Richard Moeser, Computing
Gilbert Montano, Engineering Services
Dail Murray, Non-NSF
Melissa Nysewander, Student Support
Brian Olney, Engineering Services
Ricky Rael, Engineering Services
Danny Rhodes, Engineering Services
Jane Rigby, Student Support
James Robnett, Computing
Joe Rodriguez, Engineering Services
Christopher Romero, Engineering Services

(continued on page 16)

Personnel News . . . (continued)

Richard Rupp, Electronics
Jose Sanchez, Engineering Services
Mary Ellen Sanchez, Engineering Services
Eddie Savedra, Engineering Services
Scott Schnee, Student Support
Charles Silver, Student Support
Ellison Thompson, Engineering Services
Alfred Torres, Engineering Services
James Trujillo, Engineering Services
Kenneth Walker, Engineering Services
John Weiss, Student Support

TUCSON

Beth Biller, Student Support
Paul Greve, Basic Research
Alexis Johnson, Student Support
Laura Snyder, Student Support

DEPARTURES

CHARLOTTESVILLE

Antoinette Munch
Eric Schulman
Jeffrey Uphoff
Karen Whitcomb, retired 23 years
Edward Wollack

GREEN BANK

Frans Benders
Sharlean Elliott
Nellie Galford
Jason Ray
Michael Sumner
William Vrable, retired 36 years
David Williams, retired 33 years

SOCORRO

Patrick Baca
Santiago Chavez
Michael Crawford
Steven Grain
Joseph Greenberg
Elliott Kiff, III
Adrian Morris
Melissa Nysewander
Patrick Palmer
Christopher Romero
Jane Rigby
Scott Schnee
Kenneth Walker

TUCSON

Christopher Heckler
Laura Snyder

Photos from the GB Picnic



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Patricia Smiley, Layout and Design

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