The OBSERVER

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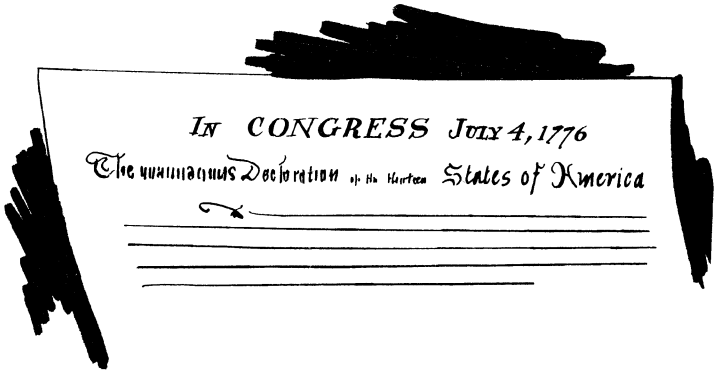
200 YEARS



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NEXT GENERATION OF RECEIVERS FOR GREEN BANK

Rick Fisher

Given a control room full of whiz-bang astronomers (heaven forbid) it is probably safe to say that the speed at which they solve the problems of the universe depends on the quality of the observing instrumentation at their disposal. In supplying this instrumentation the trick in electronics at NRAO has been to stand as close to the state of the art as possible without giving up too much reliability. Usually this means cleaning a little more noise out of each new receiver or using faster and more complex logic in new digital equipment. At this point, however, it looks like a sharp change in receiver techniques is in order. The gain in sensitivity should be well worth the retooling delays.

The criteria for receiver sensitivity in radio astronomy are system temperature (the lower the better), bandwidth (the wider the better) and stability, and one would like each receiver to tune over as wide a frequency range as possible.

In the early days of NRAO the best receivers used room temperature parametric amplifiers (paramps) which, if you lived right, provided system temperatures a little over 100 K* up to a few GHz. These have continued to improve, but back in the late '60's NRAO invested a lot of effort in cooled paramps. The added complexity of pumps and refrigerators pushed system temperatures to as low as 50 K and advances in diodes have extended paramp use to 10 GHz or so, albeit with somewhat poorer sensitivity. We now have ten cooled paramp receivers, two of which will actually be retired this summer. Jim Coe's 25/6 cm and Bill Brundage's 9 cm systems are the culmination of a lot of experience in this area.

The new generation of receivers is going to be based on a 1.3 cm maser receiver developed by Bob Clauss' group at JPL at Sandy Weinreb's request. Masers have been around for quite a long time, but use in radio astronomy has been somewhat limited because of their relatively narrow bandwidth, small tuning range, and very low operating temperature requirements. In fact, some of the first uses of this technique were in the NRL Radio Astronomy Group using liquid helium batch cooling. NRL, Haystack, Onsala, U. Mass., and JPL presently use masers for one or more of their receivers, but because of the special requirements of a national observatory, namely, continual long term operation and wide frequency coverage, the masers used elsewhere have not fit NRAO's bill.

The new JPL design hits the nail right on the head. It tunes from 18 to 25 GHz with an instantaneous bandwidth of 300 MHz. With parametric upconverters, another old idea just finding an application at NRAO, it should be possible to cover from 0.5 to 25 GHz almost continuously with relatively few receivers. After adding up all the contributions from the sky, waveguide losses, spillover and the maser/upconverters themselves, it looks like system temperatures of 30 K are entirely possible below 16 GHz. Above this frequency atmospheric absorption overshadows the receiver noise. As we learn more it is probable that we can whittle a fair number of Kelvins off this system temperature in the 1 to 5 GHz range. The accompanying table shows a comparison of where we stand now and the expected performance (system temperature/bandwidth) of the new systems. One occasionally wonders to himself whether a factor of two gain in sensitivity is worth all the effort. However, a look into the history of NRAO receivers almost invariably shows that any comparable improvement has generated a large number of new observing requests. There is no reason to believe that the new maser systems will not have the same result only on a larger scale.

Frequency Band	Present	Expected
22 GHz	500 K/500 MHz	60 K/300 MHz
15 GHz	100 K/500 MHz	40 K/300 MHz
10 GHz	70 K/500 MHz	30 K/300 MHz
5 GHz	60 K/600 MHz	30 K/300 MHz
3 GHz	50 K/250 MHz	30 K/300 MHz
2 GHz	60 K/ 30 MHz	30 K/100 MHz
1.4 GHz	50 K/ 25 MHz	30 K/ 50 MHz
0.5 GHz	150 K/ 30 MHz	50 K/ 50 MHz

* K = degrees Kelvin above absolute zero.

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The JPL maser arrives about August 15th. Craig Moore has participated in its construction, and he and Howard Brown's cryogenics group are already on their way to building a second in Green Bank. They should start turning them out at the rate of about two a year.

The first system will be the basic 18 - 25 GHz maser in the 140-ft Cassegrain system by roughly March 1st next year. The second system will be a single channel 8 - 25 GHz receiver using two upconverters in the 8 - 11 and 12 - 16 GHz ranges now under study by AIL. Chuck Brockway is in charge of the systems work on both of these first projects, and he expects the 8 - 15 receiver to be along in the 2nd quarter of '78. At that point the first receiver will come off the telescope and will be modified to be a second channel from 8 to 25 GHz.

In parallel with this Bill Brundage will be looking into the design of upconverters in the 0.5 to 5 GHz range. By the middle of next year he should have outlined the direction to go for prime focus receivers for the 300-foot and 140-foot below 5 GHz. With some luck that frequency range should be covered by the first part of '79.

Lower amplifier temperatures make losses in waveguides and spillover noise more significant so George Behrens is looking hard for improvements in these areas. Low loss, tunable filter design is being pursued by Jim Coe, and as other requirements become better defined other engineers will get involved.

Sebastian von Hoerner and the engineering division are putting a lot of effort into improving the pointing accuracy of the 140-foot. They are also in the final design stages of a deformable Cassegrain subreflector to compensate for gravitational distortions of the dish and greatly improve the short wavelength efficiency of the 140-foot at low elevation angles. Both of these improvements are necessary to make full use of the 8 to 25 GHz system.

These are ambitious plans. There has not been as large scale an effort at improving NRAO instrumentation since the 300-foot was resurfaced. There are a lot of problems to be solved, but none of them are unsolvable. The basic maser element operation has been demonstrated at JPL, and it is just a matter of time until it arrives in Green Bank.

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R.C. MODEL AIRCRAFT

Jerry Turner

For almost two years I have been building and flying radio controlled model airplanes. Several people have seen me at the NRAO airstrip in the past few months and have asked questions about my hobby, so I would like to briefly write about it.

R.C. (radio controlled) airplaines exist in many types and sizes. They are all basically small aircraft with a wingspan between twenty-five and one hundred inches that are controlled by a pilot on the ground. The most simple type is one that flies very slowly and can only be controlled left and right. At the other extreme are models that look and fly like real aircraft. Racing models capable of high speed and quick maneuvers, multi-engine models, and scale models built from large airplane blueprints are common. Even R.C. model helicopters are rather common now. In addition, non-powered R.C. sailplanes are very popular with many modelers.

Some modelers with a lot of experience build their models from scratch, but most models are now built from kits marketed by any of several different manufacturers. A typical kit consists of balsa wood and plywood parts that are machine cut or band sawed, a hardware package, and a set of plans. Some models are either part or entirely styrofoam and some have fiberglass fuselages. In addition to most kits, a modeler must buy glue, paint or plastic film finishing material, a fuel tank, wheels and various other bits of hardware. An engine is required on powered airplanes, but many times one engine can be used for several models.

The engines used to fly R.C. model airplanes are two cycle glow plug type engines that run on a mixture of alcohol type ingredients, and either castor oil or synthetic oil for lubrication. Engines are available in many sizes to suit different sized models.

The electronics necessary to fly an R.C. model airplane is available from any of several manufacturers. This equipment has improved greatly with advances in semiconductor technology and is now very small and light in weight. A radio control system is usually classified with regard to the number of channels it has. One channel is required for each

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function to be controlled on the aircraft. This means a four channel system can control rudder, elevator, ailerons, and engine speed. Radio systems are available now that have from one to eight or more channels. Channels above four can be used for functions such as retractable landing gear, flaps, bomb drop, etc. This is limited mainly by the imagination of the modeler.

Jerry's three-channel, 50-inch wingspan Trainer. A good first airplane for multi-channel flying.

The hobby of R.C. model airplanes requires a great deal of patience, determination, time, some modeling skill, a suitable work area, and a fair amount of money. Flying an R.C. model requires a lot of skill that must be learned. The best way to learn is to have an experienced R.C. flier help. This can save many needless crashes and extra building time. It is very disheartening to spend two or more weeks building a model and then crash it the first time out. My suggestion is to start with a slow flying, single channel airplane and progress from there.

The cost of R.C. model airplanes is rather high, especially at first. The largest single monetary investment is radio equipment, but with reasonable care a radio system should last for many models. A single channel model with radio costs about $100. The cost of a four or more channel model with radio can vary greatly, but in my opinion a minimum cost would be about $250. Again, cost varies greatly with radio quality and type of model.

In this article I have covered R.C. model airplanes briefly. The hobby of R.C. modeling also includes boats, cars, and various other models. Airplanes have always been my primary interest, but many other people also enjoy these other types of models.

I would like to see a few more people in this area get started in the hobby of R.C. model airplanes. At present I know of only two other active R.C. modelers in this county. I will be glad to answer questions and help anyone who is interested.

R.C. modeling is somewhat expensive and requires time, but the feeling a modeler gets when his model flies through the air under his complete control is unique and very exciting indeed.

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FAMOUS PHRASES

Who spoke each of the following famous phrases?

1. The way to be safe is never to be secure.
2. Let facts be submitted to a candid world.
3. Liberty and Union, one and inseparable, now and forever.
4. Observe good faith and justice toward all nations.
5. Crown thy good with brotherhood.
6. Congress shall make no law respecting an establishment of religion.
7. With malice toward none, with charity for all.
8. Give me liberty, or give me death!
9. All the ills of democracy can be cured by more democracy.
10. These are the times that try men's souls.

Answers may be found on page 11.

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BOWLING

Those men interested in bowling in the 1976-77 season, which starts 31 August 1976, contact Dick Hiner, Extension 309 - GB.

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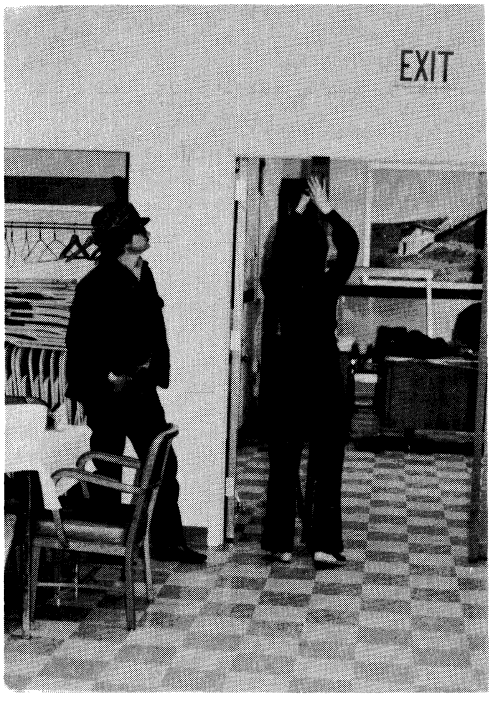
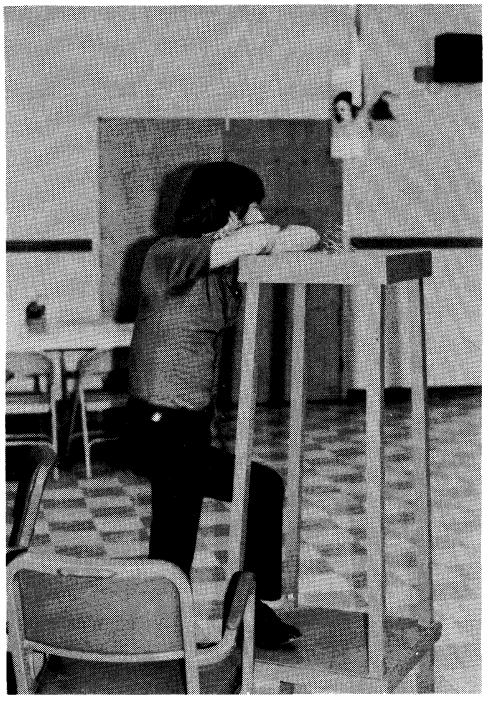
A DANCER'S DELIGHT

By "Hay Ray"

The annual NRAORA April Fool's dance was held in "Wally's Wearhouse" last April 3rd, where many friends and enemies met under the skillfully hung decorations and accessories provided by our NRAORA.



Both men and women serve equally graciously on the decoration committee. Here, two committee members are shown blocking off this main exit. (Some people pay to leave)



Here is a view of the supervisor's stand.

In the interest of ecology, much planning went into our solid waste disposal as demonstrated by our supervisor & corncob technician.

Here is the economy model with it's **HAIR** conditioned seat.

Here, "D.J. Ray" is seen with one of the high performance sound systems.

Solid material to nibble on was provided by our "Potato Chip Operator" shown here with the machine.

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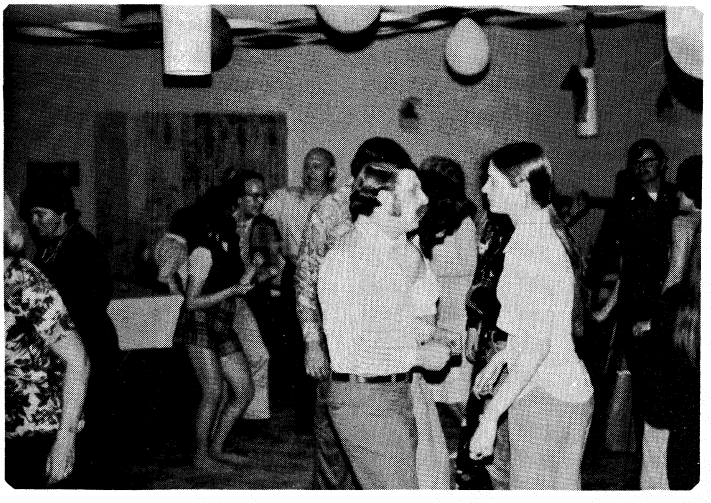
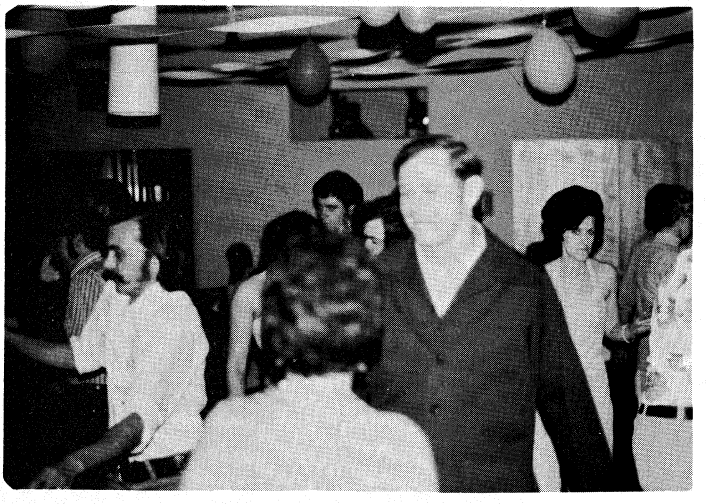
YOU HAVE 20 SECONDS TO GUESS WHAT'S GOING ON HERE.

YOU HAVE 20 SECONDS TO GUESS WHAT'S NOT GOING ON HERE.





HERE ARE THE STARS. NOTE THE SPECIAL TECHNIQUES THEY USE AND ALSO THE DECORATIONS HUNG AND FLUNG FROM WALLY'S WALLS.

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PSYCHICS AND SCIENTISTS

Lee Rickard

It had all seemed perfectly normal at first. I had been standing at the rack with the new journals, flipping through the March Proceedings of the IEEE. I was skimming a very long article, some sort of review called "A Perceptual Channel for Information Transfer over Kilometer Distances: Historical Perspectives and Recent Research". It looked very uninteresting. And very long. There were lots of pictures, accompanied by crude drawings. That seemed a little strange. I turned back to the title. "A Perceptual Channel..."? Wait a minute, that's telepathy! ESP in the IEEE? I looked at the authors' names: Harold Puthoff and Russell Targ. Ah, of course, I should have recognized them - they're the Geller groupies!

Targ and Puthoff are laser physicists who work at the Stanford Research Institute (SRI). They are less known for their work on the light fantastic than for their interest in the just plain fantastic. In 1974, they published an article (in Nature) devoted largely to Uri Geller's telepathic abilities. (Geller is an Israeli psychic who became very popular after he bent some spoons on the Mike Douglas Show, using only - he said - brain power.) They interpreted the results of their six days of tests on Geller as follows: "In certain conditions significant information transmission can take place under shielded conditions." In other words, ESP (extra-sensory perception) exists, and Geller has it.

The Geller investigation made quite a splash in the news media, particularly in England. The New Scientist devoted 16 pages of its 17 October 1974 issue to an investigation of Geller and the SRI report. (The reporter, Joseph Hanlon, was unconvinced.) The controversy still rages. Geller has been idolized by many. (He was even made a guest superhero in an issue of Daredevil Comics.) He has also been soundly denounced, especially by professional magicians, who say he claims psychic ability in order to turn a profit on an otherwise mediocre talent for stage magic.

But Geller was only one of the many subjects studied by Targ and Puthoff, and it is these less newsworthy experiments that are reported in the Proceedings of the IEEE. The tests are not of the variety that most people are familiar with. J. B. Rhine, the famous American parapsychologist, and his students (who included Charlottesville's own J. Gaither Pratt) had their subjects guess the order of cards in a shuffled deck or the top face on a mechanically thrown dice. They then applied statistical tests to the mass of results, searching for success rates in excess of chance. But Puthoff and Targ argue that experiments with cards or dice are boring, and depress the psychic abilities of their subjects. Instead, in the experiments at SRI the investigator studies a drawing or a picture, and the subject attempts to duplicate it. The subject's attempts are compared with the target drawings and are assigned a rank between 1 and 9, depending on the quality of the match.

The scoring system seems less quantitative and more subjective than for cards or dice. But drawing tests are very popular in modern parapsychology. Montague Ullman uses them in tests (funded by the National Institute for Mental Health!) at the Dream Laboratory of the Maimonides Medical Center in Brooklyn. Thelma Moss uses them in her experiments at the University of California, and so does ex-astronaut Edgar Mitchell at his Institute for Noetic Studies. In fact, drawing tests have been used throughout the history of psychic investigation - by Upton Sinclair in the 1930's, by Sir Oliver Lodge in the 1890's, and by the British Society for Psychical Research in the Smith-Blackburn experiments of 1882.

But the long history of positive results achieved with these tests doesn't impress me. It worries me. Because, for example, the Smith-Blackburn series is one of the better documented cases of fraud in psychic research. In a series of newspaper articles, Blackburn explained many of the tricks that he and Smith used to simulate telepathy. They included various coin-jingling, coughing, and eye-winking codes by which Blackburn, who could see the drawings, told Smith what to draw. They also used an occasional palming of a copy of the test drawing when a description wouldn't fit the code. These tricks are very similar to the ones that modern magicians - like Milbourne Christopher and James Randi - identify in the operation

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of the "Geller effect"! Could it be that things haven't changed much in ESP research?

Targ and Puthoff certainly don't do anything to relieve my worries on this point. Indeed, one remark in the historical perspective section of their paper gives more perspective on this question than they may have intended. They state that "experiments by reputable researchers yielding positive results were begun over a century ago (e.g., Sir William Crookes' study of D. D. Home, 1860's)". Psychic investigators have a reputation for selective memory; they tend to remember the hits and forget the misses. That quote has a lot of misses. First of all, Crookes' experiments with D. D. Home were not made in the 1860's. They were done between 1870 and 1872. That's an important hair to split because it means that the experiments were done after Home's May 1868 conviction for criminal fraud. (Home had bilked the widowed Jane Lyon of 60,000 pounds of sterling after convincing her that he was communicating the wishes of her dead husband.)

Shortly after the Fox sisters kicked off the spiritualism craze in America, D. D. Home started summoning spirit raps in his aunt's home in Connecticut. His mediumship was soon quite successful. He never charged for his spiritual work, at least not directly. He was usually content to be a sort of professional house guest, trading seances for hospitality. He is often called "the medium who was never exposed", presumably because his exposures were seldom public. He was certainly caught in private frauds. On one notable occasion, the poet Robert Browning grabbed one of Home's spirit materializations - and found himself holding the medium's bare foot! Stuart Cumberland says Home had to cut short his tour of Russia after he dematerialized some emeralds and was unable to rematerialize them. (The police found the jewels in a pocket in his coat tail.) So, contrary to popular belief, Home's reputation was not unsullied by scandal.

Crookes, on the other hand, had a very distinguished reputation. He had started his scientific life as a chemical engineer, working on photography. He became interested in spectroscopy, discovered a new element (a hobby of the times), and was elected to the Royal Society. He became interested in spiritualism after the death of a brother. It was not an unusual interest among scientists of the time. Indeed, many hoped that the investigation of psychic phenomena would enable experimental verification of the spiritual world, and bring about a great synthesis of natural philosophy and theology. The active membership of the Society for Psychical Research included physicists Lord Rayleigh, J. J. Thomson, and Oliver Lodge, astronomers John Couch Adams and E. C. Pickering, mathematician W. W. Rouse Ball, chemist William Ramsay, and naturalist Alfred Wallace. But while they were all candid about their interest in the supernatural, most avoided any reference to it in their "normal" scientific work.

Crookes, however, made spiritualism his only scientific work for several years. He wanted, he said, to make a proper laboratory examination of psychic phenomena, to "weigh, measure, and submit it to proper tests". But his tests of Home don't seem to have been very careful. All exhibitions were done under conditions specified by Home, and often with the assistance of other mediums. No precautions were taken against trickery; after all, Home was "one of the most lovable of men - whose perfect genuineness was above suspicion". (Apparently, Crookes didn't read the newspapers in 1868.) Home's seances featured levitation and the mysterious playing of musical instruments under the table. They impressed and convinced Crookes of Home's psychic abilities (although the same phenomena were being reproduced on the London stage, evenings and matinees, by professional magicians). Once a believer, any scientific impartiality that Crookes might have had vanished. Thus, when Crookes' friend John Spiller offered a non-psychic explanation of some of Home's tricks (specifically, how he played the accordion with his feet), Crookes publicly denounced him and reaffirmed his faith in Home.

It seems to me that Crookes utterly demolished his reputation as an impartial, scientific observer when he verified the psychic abilities of the pretty, young mystic, Florence Cook. His experiments appeared to be careful and precise. For example, he had the medium complete an electrical circuit and monitored a galvanometer to make sure that she didn't move around to produce her

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materializations. But when possible signs of such movement were pointed out by other observers, Crookes angrily dismissed them. His experiments were, in practice, no better controlled than a stage performance. Any good magician could get around his equipment, as Washington Bishop showed when he exposed the tricks of Anna Fay, another medium certified in Crookes' laboratory. The evidence is now fairly strong that Crookes' stout defense of Florence Cook's psychic powers in the face of her many exposures was motivated less by evidence than by infatuation.

Given all this, I'd say that Crookes was not a reputable researcher (at least not of psychic phenomena) and that his tests did not give positive results, just more cases of fraud and foolishness. But one week after Crookes' death, Lord Rayleigh praised his work on psychical research, and especially singled out the D. D. Home tests. (He discretely avoided mention of Florence Cook.) And that's the way it's been remembered by parapsychologists, down to Targ and Puthoff today.

According to The Peter Principle, an executive tends to rise in his company until he reaches a position that he is not competent to handle. The history of psychic investigation reveals a horizontal variation. Scientists (especially in the physical sciences) seem to move away from the fields in which they have demonstrated expertise, until they involve themselves in experiments that they are not competent to control. Marie and Pierre Curie were certainly excellent chemists, but they were thoroughly fooled by Eusapia Palladino, an extravagantly fraudulent medium. (They say she even cheated at croquet.) Thomas Edison was a practical man in the laboratory, but he was utterly duped by Bert Reese, whose "telepathic abilities" were no different from those of most stage mentalists. M.I.T. physicist Daniel Fisk Comstock was baffled by the manifestations of Mina Crandon (known as Margery, the great Boston medium) - until he saw Houdini reproduce her feats. Even Einstein had an unfortunate brush with the paranormal; he wrote the introduction to the German edition of Upton Sinclair's Mental Radio, a collection of poorly controlled drawing tests conducted by Sinclair with his wife. And I'm sure you can guess (without clairvoyance) my opinion of how well Targ and Puthoff fared with Uri Geller.

Of course, there have been notable exceptions. The great biologist T. H. Huxley was never impressed by the "spirit raps" of mediums like D. D. Home. He could make them himself by unobtrusively cracking the joints of his toes. Camille Flammarion, the French astronomer, was one of the many people who caught Palladino cheating. (She was using a nearly invisible hair stretched between her hands to tip a balance scale.) Michel Chevreul, a French chemist, conducted a series of experiments between 1833 and 1854 to prove that subconscious muscular action, not spirit force, was the sole agent affecting dowsing rods and divining pendulums. And I must certainly include Isaac Kelzon, a professor of physics at the University of Tel Aviv, who debunks Uri Geller by duplicating his tricks. He uses no supernatural power, just his skill as an amateur conjurer. (A good example of a scientist who attempts to understand a phenomenon by constructing a model that reproduces it.)

Why do so many scientists end up badly when they try to do psychic research? I suspect that part of the problem lies in the popular belief that people who do science are scrupulously trained to "investigate nature, impartially and without prejudice". Some scientists actually believe it, forgetting how difficult it is to prepare careful, accurate experiments even within their own narrowly specialized fields of research. It doesn't occur to them that, despite all their training, their competence is still limited. Crookes responded to critics of his psychic researches: "Will not my critics give me credit for some amount of common sense? Do they not imagine that the obvious precautions ...have occurred to me also in the course of my prolonged and patient investigation?" Well ...no. In matters of psychic phenomena, I'd rather have Houdini in the laboratory than Fermi.

I see in the newspaper than the American Humanist Association is forming a committee to investigate paranormal phenomena. History suggests that they are in for more trouble than they expect. A good experimental scientist is just not necessarily a good, critical observer of supernatural phenomena.

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As Philip Morrison says: "There is order deep in his world, which sufficiently cunning experiment will disclose. But that is no stance in which he can safely buy a used car, appraise the operative statements of a White House press officer, or bet against an artist with the cards."

As usual, H. L. Mencken said it better: "Next to English physicists, American psychologists seem to be the easiest marks on earth for transcendental wizardry." And American physicists. And English psychologists. And French chemists...

If you're interested in further details on the scientific investigation of sorcery, I recommend some of the books that I've used to prepare this article: Milbourne Christopher's ESP, Seers, and Psychics and Mediums, Mystics, and the Occult; Trevor Hall's The Spiritualists; and Houdini's A Magician Among the Spirits.

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America is a tune. It must be sung together.
--Gerald Stanley Lee

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LOW CALORIE DIET

MONDAY

Breakfast: Weak Tea
Lunch: One Bouillion Cube in One-half Cup Diluted Water
Dinner: One Pigeon Thigh; Three Ounces Prune Juice (gargle only)

TUESDAY

Breakfast: Scraped Crumbs from Burnt Toast
Lunch: One Doughnut Hole (without sugar); One glass of Dehydrated Water
Dinner: Three Grains Cornmeal, Broiled

WEDNESDAY

Breakfast: Shredded Egg Shell Skin
Lunch: One-half Dozen Poppy Seeds
Dinner: Bee's Knees and Mosquito Knuckles Sauted in Vinegar

THURSDAY

Breakfast: Boiled-Out Stains of Old Table Cloth
Lunch: Belly Button of a Navel Orange
Dinner: Three Eyes from Irish Potato (diced)

FRIDAY

Breakfast: Two Lobster Antennas
Lunch: One Tail Joint of Sea Horse
Dinner: Rotisserie Broiled Guppy Filet

SATURDAY

Breakfast: Four Chopped Banana Seeds
Lunch: Broiled Butterfly Liver
Dinner: Jelly Vertebrae a la Centipede

SUNDAY

Breakfast: Pickled Humming Bird Tongue
Lunch: Prime Rib of Tadpole; Aroma of Empty Custard Pie Plate
Dinner: Tossed Paprika and Clover Leaf Salad

NOTE: A seven-ounce glass of steam may be consumed on alternate days to help in having something to blow off.

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ANSWERS TO FAMOUS PHRASES

(from page 5)

1. Ben Franklin.
2. Jefferson in Declaration of Independence.
3. Webster in Reply to Home.
4. Washington in Farewell Address.
5. Katherine Lee Bates in America the Beautiful.
6. First Amendment to Constitution (in "Bill of Rights").
7. Lincoln in Second Inaugural.
8. Patrick Henry in Speech on the Stamp Act.
9. Alfred E. Smith.
10. Thomas Paine in The Crisis.

*****

SOARING FOR SILVER
PART II

Ken Barbier

In our last episode we saw how our hero tried valiantly on several occasions to stay aloft in a glider for five hours in order to earn his Silver Badge for soaring. Hundreds of glider pilots make this flight each year, but our hero so far has managed, by virtue of incredibly bad judgement and a total lack of planning, to come nowhere near this goal. After trying this sport in California and Arizona, we find him in the spring of 1975 in Charlottesville, Virginia -- not exactly a hotbed of soaring activity.

* * *

Shortly after getting my private license to fly powered airplanes, I tried a "cross-country" flight in a Cessna 150 from Borrego Springs, California to Green Bank, West Virginia. After all, Rick Fisher had done this twice (2 round trips, that is) in his Cessna 140 when that tired old bird (the 140, not Rick) was about a million years old and belonged in the Smithsonian. It was on this first trip to the East coast that an indelible image was formed in my tiny brain of what things were like east of the Mississippi. For one thing, for as far as the eye could see there is green, green, dismal green. Not a single 3 mile high pile of bare granite in sight. No lovely dust storms. And no fifty mile visibility, either.

I never made it to Green Bank in my 150 that year. I ran into the moisture left behind by Hurricane Agnes. I tried for 3 days to get from Kentucky to Green Bank. Every day was solid clouds. So I gave up and parked the plane and took the airlines to D. C. and rode to G. B. in the right seat of a Datsun 240 Z, which was scarier than flying in clouds, and another story for another time.

Now I was back in this part of the country again, where water runs around all over the ground, and grass grows wild with no need to import it from Mexico. And the skies are all cloudy all day.

It is one thing to try to find your way around in a strange country in poor visibility in an airplane, quite another without an engine. While I wanted to try soaring in Virginia as soon as I arrived, discretion (cowardice, really) was the better part of valor and I did my first exploring from a rental airplane.

Early one spring morning I departed Charlottesville airport headed southwest to see if my green-blinded eyes could locate L B Gliderport, just the other side of Lexington. Knowing how difficult it is to find anything in this country, I took an airplane equipped with three navigational radios and the latest aeronautical chart, and in case that was not enough, a road map.

Some kind of a front must have moved through the night before, clearing the skies, and I didn't even notice that the visibility from the air was more than 20 miles. Before engaging my brain, I let overconfidence overtake me. "This is no sweat," I told myself, "you can see for miles in this country." And you could -- that day. Filing away the misinformation that weather and visibility in the Shenandoah Valley was nothing to worry about, I concentrated all my limited facilities on finding an airport among the hills and valleys.

High atop the ridge just east of Steele's Tavern sits a radio transmitter for airplane navigation. I crossed over this point, set up a course of 244^{o}, and knew that my little airplane would be right over the gliderport in exactly 12 minutes. Beats reading street signs.

Ten minutes. Everything I've flown over so far looks just like everything else I've flown over so far. No sign of a little airport anywhere.

Eleven minutes. The town of Lexington is right off my right wing. I should be nearing the gliderport. But all my West coast eyes can see is green hills, green valleys, farms, and no place to put an airport if you could find one.

Twelve minutes. No airport in sight. I should be right over it. It should be right down there where that farm is. The one with all the airplanes and gliders parked around the barn.

Hey! That can't be it! No runway. No place for a runway. I circle around and scan the surrounding countryside. No place anywhere big enough and level enough to put a runway on. I <u>know</u> what an airport looks like. An airport has a big paved runway about a mile long and paved taxiways and hangars and a control tower and a coffee shop and lights and

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wind direction indicators, and stands out like a sore thumb even in this green, green country. That silly little place below me can't be an airport!

But sure enough it is L B Gliderport. I cut the power and drop some flaps to slow me down and descend in a big circle to look things over. What I see is not too reassuring. I can finally make out what they use for a runway. It is awfully short, has a fence and a farmhouse at one end and a tree covered hill at the other. Between these two obstructions the runway runs up hill for a while, then downhill for a while, narrows down considerably in order to cross a gully, and then deadends at the base of the hill. While spiraling down I open my Airport Directory (yes, I even brought that along!) and find good old LBG: "...Runway: 3-21/1500,turf. Obstructions: hills and trees. NOTE: Private airport. Use at own risk." A 1500 foot runway, complete with hills, trees, and risks!

L B Gliderport, Virginia - a soaring pilot's paradise, with a backyard full of runway, airplanes, gliders, and etc.

I had thought it was pretty one-way of the people who rented me this airplane to include in their contract that I was not to land on any unpaved airports. Now after looking over LBG I am glad to have that contract in my pocket to prove to the world that I AM NOT A COWARD. I wasn't afraid to try to land at that place. My contract wouldn't let me do it! Oh, beautiful contract.

* * *

Having reconnoitered the route from the air, the very next weekend I drove to L B Gliderport. The host at this establishment, Col. Lynford Bachtell, is a man who lives in a pilot's paradise. In his backyard is a sort of a runway, and a flock of airplanes and gliders. Not selfish, he shares this heaven with his fellow enthusiasts, who are indeed fortunate to have a man like him around.

Since there were no cute blonde instructors at LBG, like I'd found in Arizona, my checkout was a quick flight with the Colonel himself in the back seat of the trainer, and I learned the secret of operating out of this field. Take off downhill at all times (the wind is always right across the runway anyway) and as soon as both glider and towplane are airborne, turn left, fly between the two hills, where you will encounter severe turbulence (or worse) because of that crosswind, and suddenly you find yourself out over the valley with lots of room all around you. If you encounter any sink at this time you may find yourself below the level of the airport you just left, but that shouldn't bother any experienced carrier pilot in the least.

Returning to the field, just reverse things. Fly along beside the runway to count all the pedestrians and just-landed gliders completely covering it, make a left turn around the tree covered hill so that the trees block your view of the runway (giving those on the ground a chance to forget you are about to land on top of them), and when the runway suddenly reappears it is way off to the left and you are too low or too high or too fast and you have to put this damn thing down right the first time because with no engine there is no place, NO PLACE, else to go.

They do primary training at LBG. Students who have never been off the ground in anything learn to fly there. Believe me, the survivors are excellent pilots. The wash-outs are excellent ulcer patients.

They tell the story of the girl (it just had to be a woman driver!) who had learned to fly from this field, and who had been flying the Schweizer 1-26 single place glider. She had accumulated enough time and ability that the Colonel decided she could fly his pride

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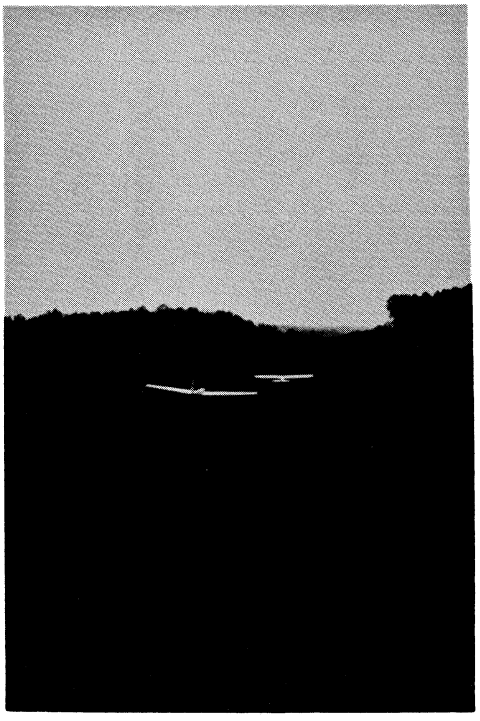

Take off straight toward the tree covered hill, then.....

make a hard left turn.

and joy, a fairly rare and very beautiful 20 year old Schweizer 1-23. Now it is impossible for an instructor with a lot of experience to know how things are going to appear to the eyes of a student or low time pilot. Since the 1-23 is a single place bird, there is no chance to go along and help the first time. In this case, there are not too many differences between the 1-26 and the 1-23, but the differences turn out to be critical.

The 1-23 instrument panel is several inches higher than the 1-26's. The spoilers, which pop out of the wings and allow you to land a machine that inherently wants to keep flying, are half the size of the 1-26's. The spring loaded spoiler handle is in an awkard location and takes a lot more pull than the 1-26's, and is really hard to hold onto.

So this relatively inexperienced pilot, on her first 1-23 flight, came back to LBG to land. She flew her normal pattern down the length of the field, around the hill, and lined up with the runway. Oh, yes, I forgot to add that the 1-23, although older than the 1-26, is a much cleaner aircraft, aerodynamically. So our pilot finds herself lined up on this runway-with-no-place-else-to-go, flying way too high and way too fast. To make matters worse, when she put the nose down to where it looked right for the 1-26, she was really diving instead of gliding slowly, because of the higher panel in front of her. So, on with full spoilers, except that the handle is harder to pull the faster you go and the spoilers aren't very effective anyway.

The onlookers estimate she was doing 90 mph when she touched down in a normal landing attitude. She should have been at maybe 50 mph. The little extra impact caused her to let go of the spoiler handle, and it's spring snatched it away from her. So this little lightweight glider reached the crest of the hill on the up-hill runway with all sorts of excessive speed, no spoilers, and no wheel brakes.

Remember the house at the end of the runway? Well, our lightly loaded overspeed sailplane simply bounced off the top of the hill, flew over the house, turned around, flew back

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to the take off point, and made a perfect landing, this time headed the other way. No one hurt, no damage.

* * *

Way out West, puffy little white cumulus clouds (Cu's) in the sky mean LIFT. Back East, puffy little white clouds in the sky mean that there are puffy little white clouds in the sky. Being a stranger (considerably stranger than most, I'm told) I was not aware of this. So with high hopes of making my five hour flight I took off on tow early in the morning on my second weekend of flying at LBG, just because there were little white clouds forming over the ridge to the west of the field.

As we flew away from the field we encountered more and more little white clouds. They seemed to be materializing all around us -- because they were! I wasn't too worried because I could see the ground below and knew that all was clear below the base of the clouds at 2500 feet above ground. As we got to the ridge and our 3000 foot release altitude, we had to make a detour around one cloud and so arrived on the far side of the ridge and the far side of the cloud. The tow pilot started a gentle turn back toward the field and I glanced around to orient myself before the release. I wasn't sure I knew where I was exactly, but I looked back in front of me as I reached for the release, and the tow plane had disappeared, along with the rest of the world!

Instantly shifting my miniscule brain into high gear, I erroneously decided that the only problem was that we had turned toward the sun in a cloudy sky so the visibility had diminished due to the glare. No problem, just turn around 180^{o} and all will be right with the world.

This sparkling bit of logic was inspired by my fairly recent flight training in modern airplanes, where even the trainers have three gyroscopic instruments to use for flying in clouds: an artificial horizon, a directional gyro, and a rate of turn indicator. A glider has none, because you are not supposed to be in a cloud. As I moved the stick and rudder pedals in a way to start a turn, I looked out and realized I couldn't even see the ground straight down. I wasn't even sure where straight down was.

"Well," I thought to myself, "I've still got my compass." But the compass was acting as magnetic compasses do in such a predicament: it was tilted at a strange angle and spinning in a totally undecipherable manner. Well, at least I knew I was turning, so I moved the stick and rudder the opposite way and within seconds flew back out of the cloud. Headed away from the field, of course.

Looking back I could see that the top of the ridge was now completely in clouds, except for a gap about 100 yards wide through which I could see the valley on the other side. I aligned the glider with this rather steep line of sight and tried not to notice the air speed indicator as I drove through the gap to safety.

Well, relative safety. Below the clouds the visibility was pretty poor, and although I knew the general direction back to the field I could not see it, and remembered my difficulty in finding it on a perfectly clear day. Now, flying straight and level, loosing altitude each second, at least the compass had settled down. But it was still useless as I had stupidly never noted a heading to fly from the ridge to the field. And except for my one checkride one week before, I had never been to the ridge before, so didn't know the landmarks to follow home.

And of course my panicky dive through the gap in the clouds had burned off lots of my altitude, so I didn't have more than just enough to get me back to the field. If I could figure out where in all that murk the field was.

About forty degrees to the left of my course I noticed an airplane in the distance. "I wonder where he is going," I thought, before realizing that it was the towplane! Showing me the way to home, safety, and cold beer!

As you are doing now, I had read about such miraculous saves, where a totally undeserving pilot, having made a succession of stupid mistakes, suddenly is granted a last minute stay of execution. I never really believed these stories before. Now I believe.

* * *

My logbook shows that I had sufficiently recovered my composure by the next day to fly the unfriendly skies of Virginia once again. This time I was deemed ready to try my hand at

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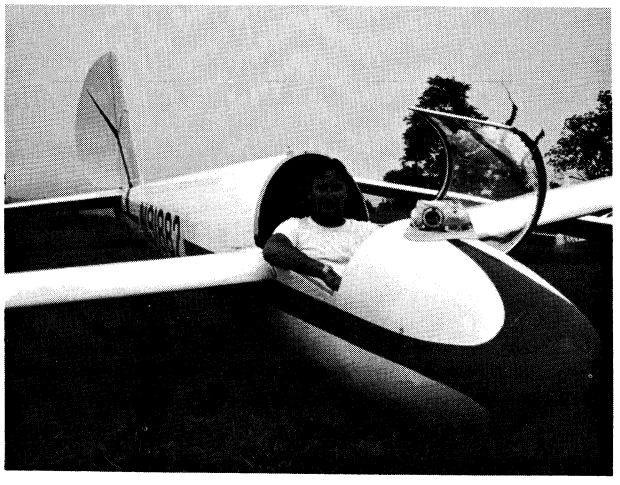
the 1-23. I had previously flown a lot hotter sailplanes, but I was still unprepared for the unusual aspect over the high instrument panel, and the ineffective spoilers. Just as the girl (whom I have unjustly derided earlier) had done, I found myself on final approach too high and too fast, about to overshoot the field. With all my weight in the glider I knew there was no chance to make a 360° turn, so I took advantage of the skid on the nose of the Schweizer, drove the poor glider onto the runway at about 80 mph, pulled on the brakes as hard as I could, pushed all the way forward on the stick to firmly embed the skid plate in the grass runway, and plowed a new furrow up to the top of the hill where I came to a shaking stop.



A real classic, a 20 year old Schweizer 1-23, with a somewhat more ancient pilot aboard.

Only a confirmed Male Chauvinist Pig like me could repeat the story of the woman driver after making such a mess of the first 1-23 landing myself!

* * *

Meanwhile, back at the five hour flight attempts, the next chance I had involved a beautiful May weekend that brought every glider pilot within driving distance to LBG. In addition to the Colonel's three Schweizers, a local glider club based two more at LBG, and private owners there added about six more. But this beautiful weekend attracted another two owners who trailered their birds to LBG to join the inevitable gaggle in the one big thermal of the day. Almost everything on the field that could fly was in the sky that day, and I was going to try for the five hour?

Why not? What's a little traffic, when the sky is so big? Well, the big sky that day seemed to contain one and only one thermal, and everybody was in it, since it was located only a half mile northeast of the field. I managed to climb to the top of it at 5000 feet.

Actually, to be perfectly honest, I wasn't on top, exactly. There were a couple of local pilots who had managed to get a few hundred extra feet out of the column of hot air, but when the rate of climb in the thermal had tapered off near the top I set out toward Lexington to find one of my own.

Back again at the bottom, I tried the same trick again with yet another direction of search in mind. But this time the one and only thermal was dying, and it was all I could do to maintain my altitude at about 1000 feet above the field. Well, I'd been there before, so there is nothing to do but hang on and wait for the lift to either regenerate or die, keeping one eye on all the other gliders to see if anyone can find any other lift.

And weren't there a lot of other gliders to keep an eye on! As I circled gently at the bottom of the stack I noticed that they became easier and easier to keep one eye on. They were all getting closer, is why. The thermal was dying from the top down, and our ten or so gliders were being compressed into less and less airspace, with me on the bottom.

Maybe it is true that I have quit more races than I ever started, but after all I have a physical disability -- a broad yellow streak down my back. When it looked like all the gliders in the world were on my tail I made a high speed run back to the field, cutting off the tow plane in the process. I never did figure out what HE was doing in the air too, but there he was. He saw me coming and pulled out of his approach to let me go by. It was a while before he got another chance to try to land.

During the turn around the trees I looked back and saw all the gliders in the whole universe hot on my trail! No time to land short! I made sure I touched down long and hot, and didn't stop until I was at the

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top of the hill. Being the first chicken home to roost I got to watch the spectacle of the whispering herd all falling out of the sky at once, jockeying for landing position, and fluttering down onto the runway like snowflakes.

Chicago's O'Hare is the busiest airport in the world, but L B Gliderport, Virginia, was running a close second for about ten minutes that day. And O'Hare has lots of runways. Because gliders have such perfect airspeed and glide path control in the spoilers, and land so slowly, there were no close calls. But then, there were no woman drivers that day, either.

* * *

No sense in keeping you in suspense any longer. During my two month sentence in Charlottesville I journeyed to LBG almost every weekend. I didn't manage the five hour flight there -- my longest was one hour six minutes. It was with no reluctance therefore that I pointed my Ford westward in June, bound for the VLA site and the great soaring conditions in New Mexico. The National Soaring Championships were to be held in NM in July, so you know conditions there must be ideal. My goal was at last in sight!

(to be continued, interminably)

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OBSERVATORY EMERGENCY ORGANIZATION THE FIRST YEAR

Bill del Giudice

The Observatory Emergency Organization at Green Bank has been in operation for over a year now and we have compiled some statistics between April 1975 and March 1976. In that time the ambulance responded 33 times and carried 30 patients. If you wonder about the difference between those two numbers, there were times when the ambulance did not carry a patient after responding for any number of reasons. Of the patients carried, 40% were employees or their family members, or an Observatory visitor. 80% of the patients were seen by a physician before we saw them or before we transported them. The Fire Brigade responded to 23 alarms, but only 12 calls were for working fires.

All of this activity represents 416 man-hours, 99 hours (31%) on Observatory time and 317 (69%) on the employee's own time. This does not include training time of about 700 man-hours, virtually all of it on the employee's time. There was some special effort expended in support of a search for a downed aircraft that consumed 150 man-hours of which about 35% was Observatory time.

While preparing this summary I received several questions on how the Observatory Emergency Organization operates, in particular, who we will or will not provide service for. The articles which appeared in the June and August 1975 *OBSERVER*'s did not cover the policy in detail so here is a synopsis of the rules established by NRAO management, under which we have operated since April of 1975.

The Observatory Emergency Organization provides emergency care and transportation of sick or injured persons in the area when one or more of the following conditions exist:

1. The victim is an active employee.
2. The victim is a visitor on the site.
3. The victim is a member of an active employee's family residing in the employee's household.
4. The request for ambulance service comes from an area doctor.
5. The request is from one of the county public ambulance services unable to respond or responding to multiple casualty situations beyond their capacity.
6. It has been otherwise determined that public ambulances are not available and cannot respond.
7. The emergency is apparently a life threatening one, and the Observatory can provide the fastest response because of its relative location to the incident. In such cases, the public ambulance will normally be requested to respond also as it is possible the Observatory personnel can provide initial care and the public ambulance will provide continuing care and transportation.

The Observatory Ambulance Squad has a

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primary responsibility to provide immediate emergency care to sick or injured employees and therefore cannot handle non-emergency transportation. Employees requiring elective transportation to or from the hospital are expected to make their own arrangements with a public or commercial carrier.

The Observatory Emergency Organization also provides fire protection for the site and extends this service to our immediate neighbors in a support roll for the public fire protection agencies. Any such response off the site is according to a formal mutual aid agreement with the public fire services in Durbin and Marlinton. The entire agreement is not reproduced here, but in general it affirms that the Fire Brigade's first duty is to protect the site but, when requested by Durbin or Marlinton Fire Departments, we will respond to structural fires in the immediate area and will send limited apparatus and manpower, as determined by need, to major fires outside of this area. As an example, we would send one of our two engines and several men if there was a large fire in Durbin.

If you have any questions, please do not hesitate to ask. It is much better to know what services are available to you as an employee before you need them than to wait until the need arises.

*****

MINIMUM RANCHING REQUIREMENTS
(OR WHAT IT TAKES TO BE A COWMAN)

contributed by an anonymous VLA employee

1. A wide-brimmed hat, one pair of tight pants and $20* boots.
2. At least two head of livestock, preferably cattle--one male and one female.
3. A new airconditioned pickup with automatic transmission, power steering and trailer hitch.
4. A gun rack for the rear window of the pickup, big enough to hold a walking stick and rope.
5. Two dogs to ride in the bed of the pickup truck.
6. A $40 horse and $300 saddle.
7. A gooseneck trailer, small enough to park in front of the cafe.
8. A little place to keep the cows, on land too poor to grow crops.
9. A spool of barbed wire, three cedar posts and a bale of prarie hay to haul around in the truck all day.
10. Credit at the First National Bank.
11. Credit at the feed store.
12. Credit from your veterinarian.
13. A good neighbor to feed the dogs and cattle whenever the owner is out in Colorado fishing or hunting, or in New Mexico at the horse races.
14. A pair of silver spurs to wear to barbecues.
15. A rubber cushion to sit on for four hours at the auction ring every Friday.
16. A second-hand car for going out to feed the cows when your wife borrows the pickup.
17. A good pocket knife, suitable for whittling to pass away the time at the Sale Barn.
18. A good wife who won't get upset when you walk across the living room carpet with manure on your boots.
19. A good wife who will believe you when you come in at 11:00 p.m. saying, "I've been fixing the fence."
20. A wife with a good full-time job teaching school.

* Apparently this is a 1950 price.

*****

ENERGY CONSERVATION

Buck Peery

The Green Bank site has made a diligent effort to conserve energy since the 1973 crisis and the total units of energy consumed in 1975 show good results. In fact, the conservation program started with fuel oil as early as 1971.

Reduced use of energy here on the site can be credited to the

1) concerted effort of each employee,
2) lowering of thermostat settings,
3) turning out lights,
4) improvements to equipment, and
5) improvements to control systems.

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Our two main sources of energy for the site are electricity and fuel oil.

History indicates that up through 1972 the consumption of electricity increased each year approximately 2.5 percent over the previous year. If this trend had continued, it meant that in 1975 we would have used 7.5 percent more electricity than was used in 1972. In actual usage we used approximately 15 percent less in 1975 than we did in 1972. A theoretical saving of (15 + 7.5) 22.5 percent.

The best figures available indicate fuel oil consumption was fairly constant through 1970. After 1970, a decline in the amount of fuel oil used each year started. In 1975 the total amount used during the year was approximately 40 percent less than the amount used in 1970.

The annual cost for energy is a different story. The total cost for the electricity used in 1975 was up approximately 50 percent over the total cost for electricity in 1972, even though we actually used 15 percent less. The fuel oil picture is very much the same. The total cost for fuel oil in 1975 was approximately 50% over the cost for the fuel oil used in 1970, even though we actually used 40% less.

*****

WHAT'S COOKING?

Rhubarb Surprise Pie

1 cup sifted flour
1 tsp. baking powder
½ tsp. salt
¼ cup butter
1 egg, beaten
2 T. milk
3 cups diced raw rhubarb
1-3 oz. pkg. strawberry gelatin
½ cup unsifted flour
1 cup sugar
½ tsp. cinnamon
¼ cup melted butter

Sift together 1 cup flour, baking powder, and salt. Cut in ¼ cup butter. Add egg and milk; mix. Press into a greased 9-inch pie plate.

Arrange rhubarb in pie shell. Sprinkle with gelatin. Combine remaining ingredients; sprinkle on top of pie. Bake at 350° for 50 minutes or until rhubarb is tender.

French Dressing

2 cups oil
2 cups sugar
1 cup vinegar
1 cup catsup
1 tsp. salt
1 large onion (grated)
Garlic to taste

Mix in blender. Makes about 1 quart. Keeps well in refrigerator.

Salad Dressing Cake

2 cups flour
1 cup sugar
4 T. cocoa
1 tsp. vanilla
2 tsp. baking soda
1 cup Salad Dressing (not Mayonnaise)
1 cup warm water

Combine all ingredients together in mixing bowl. Bake in 9" x 13" greased and floured pan at 325° for approximately 30 minutes.

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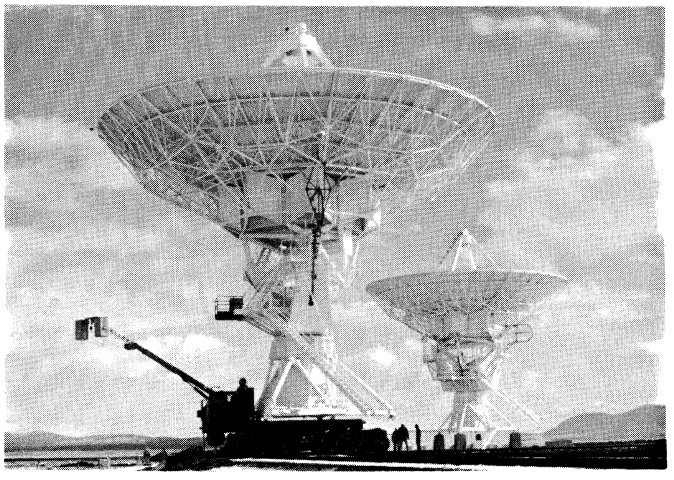
24 Hour Salad

2 eggs, beaten
2 T. vinegar
4 T. sugar
2 T. butter or oleo
1 pkg. Dream Whip, whipped
2 oranges, cut in small pieces
2 bananas, sliced
2 cups white grapes, sliced and seeded
1 small can crushed pineapple
2 cups miniature marshmallows, drained
½ cup nuts

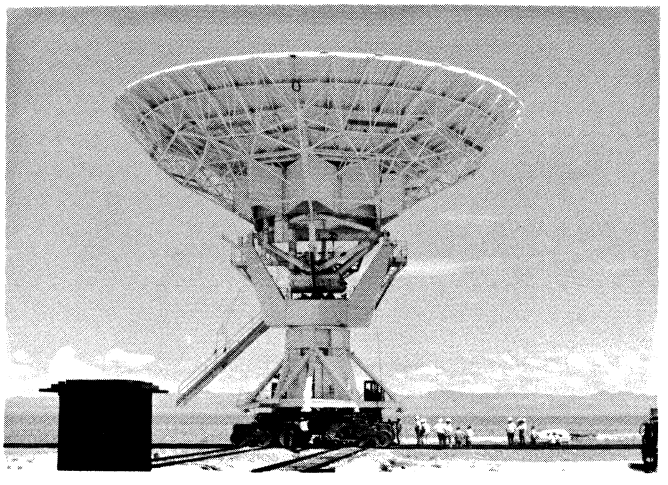
Combine eggs, vinegar, sugar, and butter; cook until thick. Chill. Add Dream Whip to dressing and beat. Add remaining ingredients. Cover and refrigerate for 24 hours.

AN ALBUM OF VLA CONSTRUCTION SNAPSHOTS

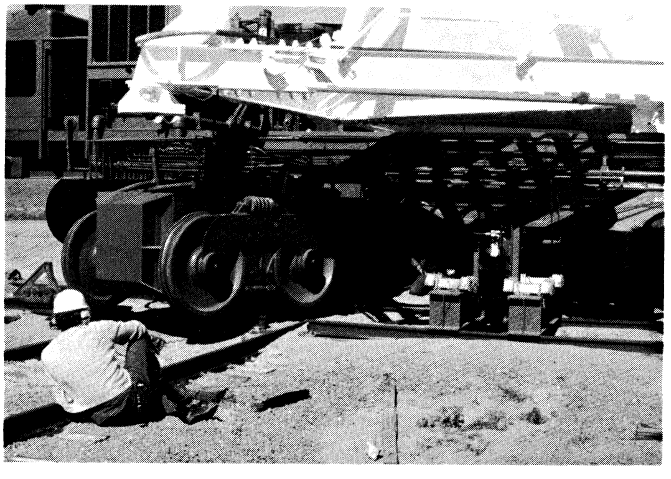
Vic Herrero



Antenna No. 1 in the background, and No. 2 in the foreground, being moved from the maintenance pad to CW9 in preparation for interferometer tests. You can see clearly the big loop, on #1, of the 20 mm waveguide that carries all data, commands, and telemetry up and down the antenna.



The very first VLA antenna move, carried out by E-Systems' personnel in July 1975 (described by Bill Horne in the December 1975 *OBSERVER*).



This is a close up of the first track exchange operation performed by the observatory. The first antenna move took about 16 hours. The antenna division has now cut that down to under 4 hours.

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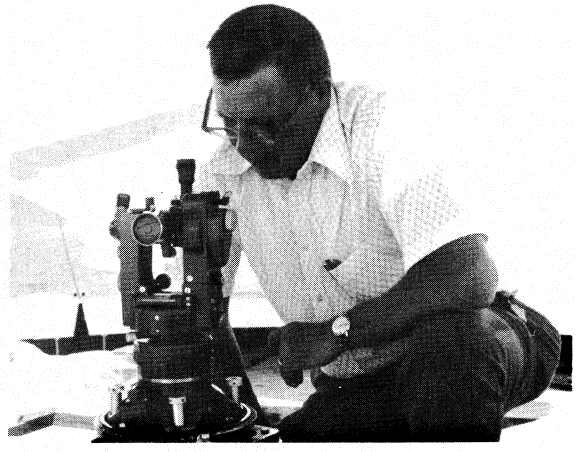
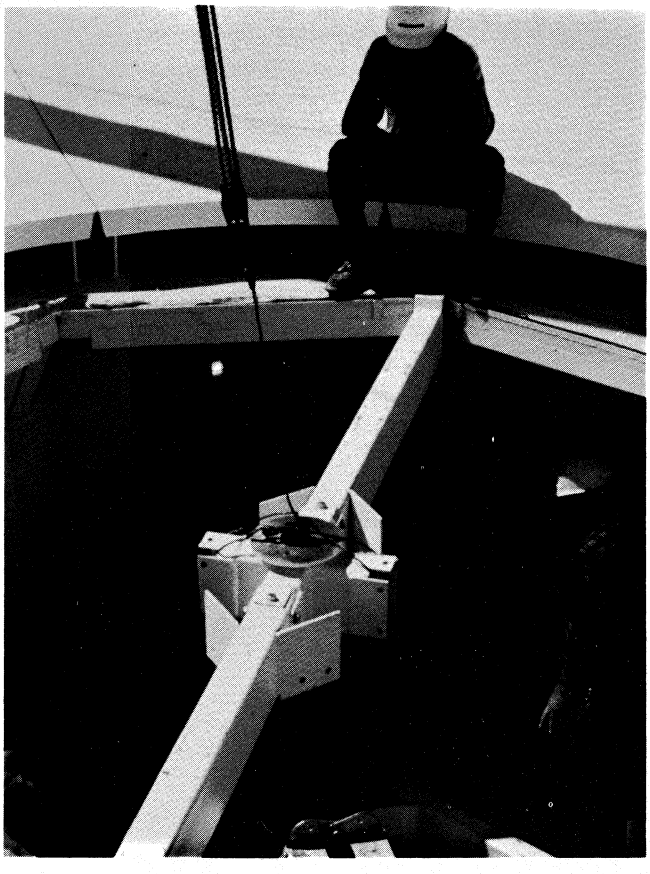
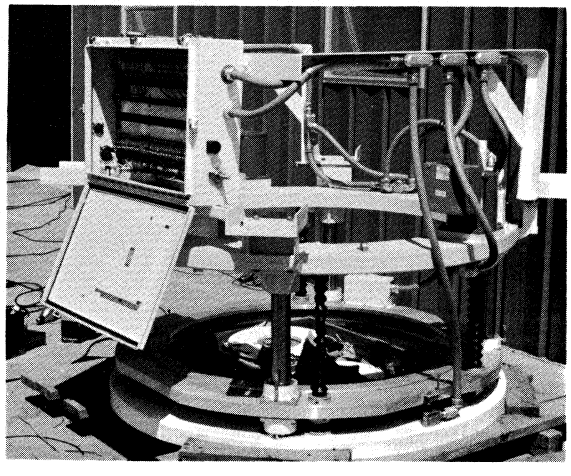
Bill Horne working with the precision theodolite used to accurately set the panels of the VLA telescopes. With this instrument he can measure the location of targets on the rim of the dish, some 40 feet away, to an accuracy of a few thousandths of an inch.





Ramon Molina, with the rest of the antenna mechanics crew, installing the "spider" that supports the theodolite while setting the antenna panels.

This is the Sterling Detroit drive mechanism that positions the subreflector for focusing and frequency selection. The electrical installation on the first two antennas were performed by Jon Spargo and myself. The Antenna Division is outfitting succeeding units.



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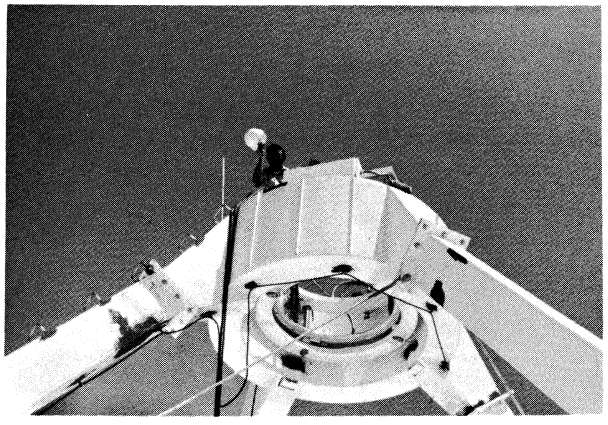
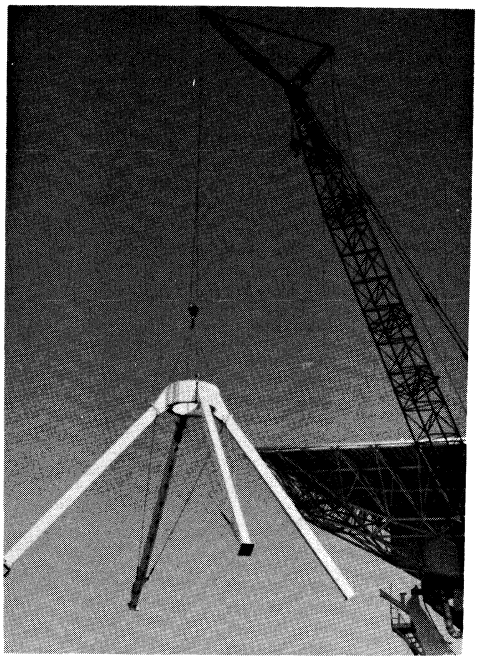
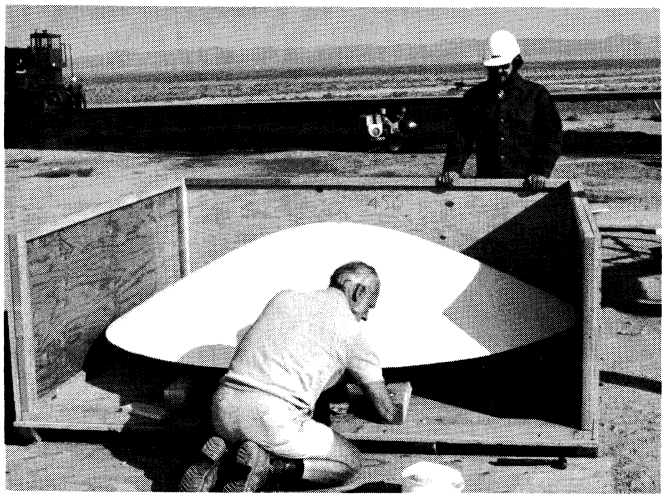


Hi there! Nice view of the plains from up here. In New Mexico, 50 mile visibility is common.



The subreflector support legs are assembled on the ground and lifted as a unit.



Peter Napier and Bob Schweigert checking the subreflector for Antenna 1, just received from California.

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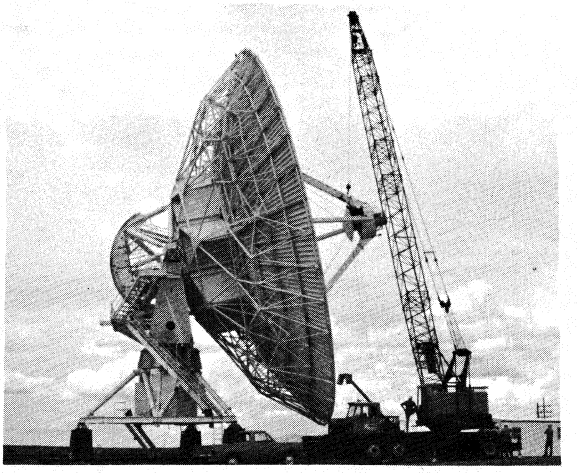
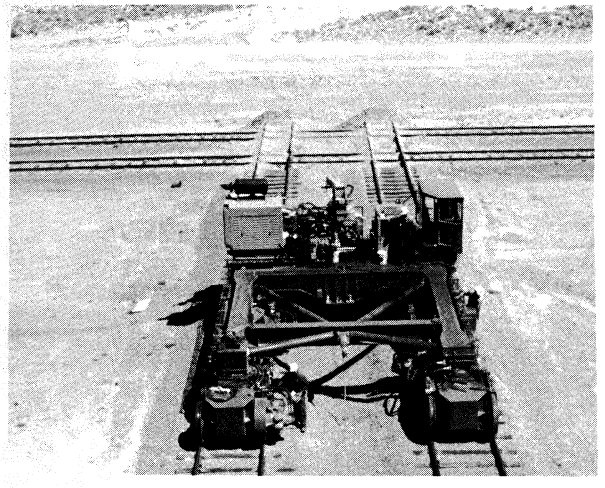
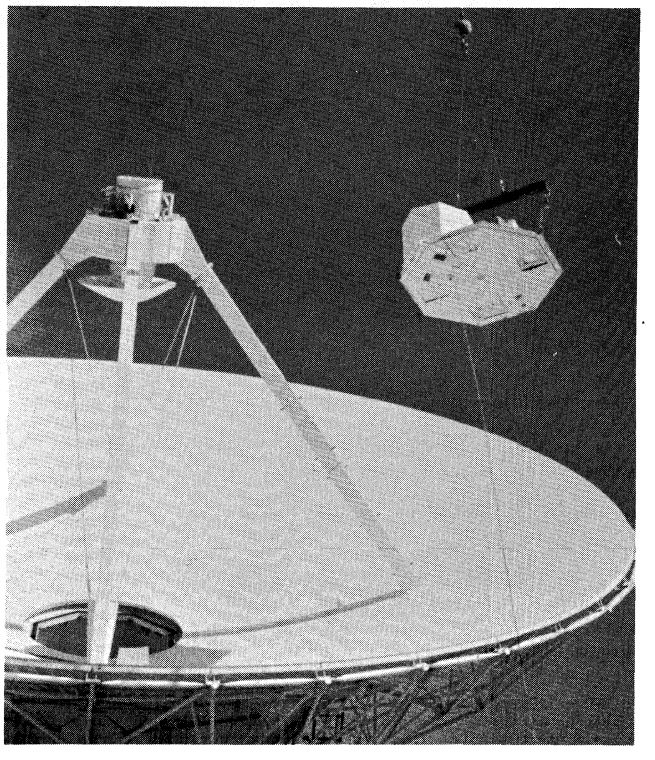


Subreflector installation in progress on Antenna No. 1.



A view of the antenna transporter sitting on a spur. The big diesel engine with a prominent muffler provides the main hydraulic drive power.



The feed ring being lifted onto the antenna. It supports the 4 feeds and the electronics cabinets. With the antenna stowed, it forms the roof of the vertex equipment room and the electronics racks hang from it. You can notice the very pronounced asymmetry of the subreflector.

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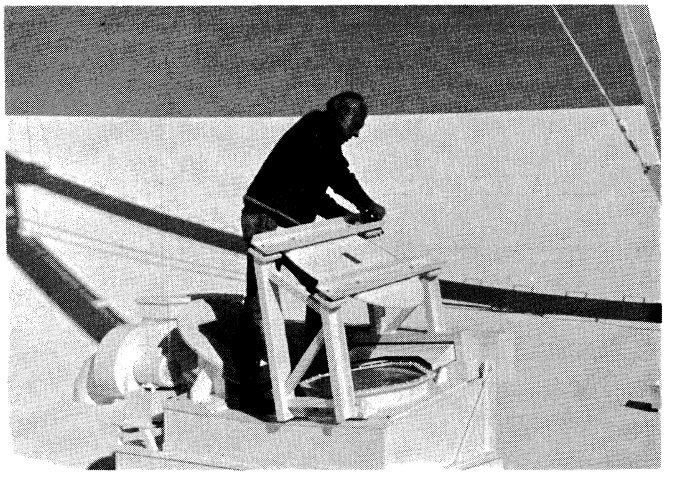
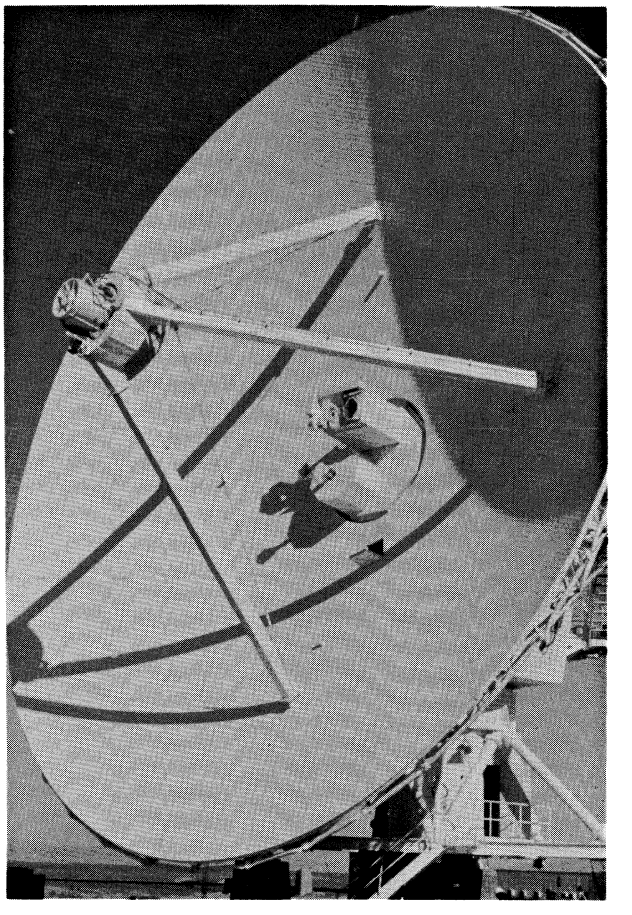
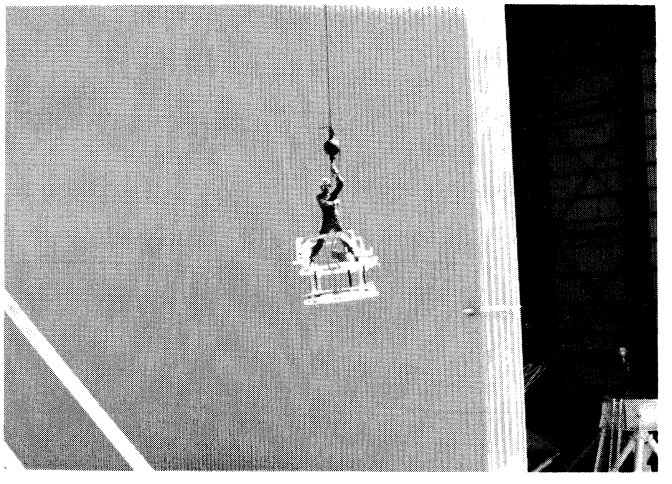


Bob Schweigert adjusting the dichroic assembly that permits simultaneous operation at two frequencies. The big 6 cm feed is just by Bob's feet.



Note in this photograph the hatch giving access to the dish when in stow position. The apex support legs have a rather massive looking box construction, appropriate for a precise 1.3 wavelength reflector.



And up it goes! This is one of the Box brothers, crane operators and riggers from Roswell, New Mexico, working for E-Systems, antenna contractor.

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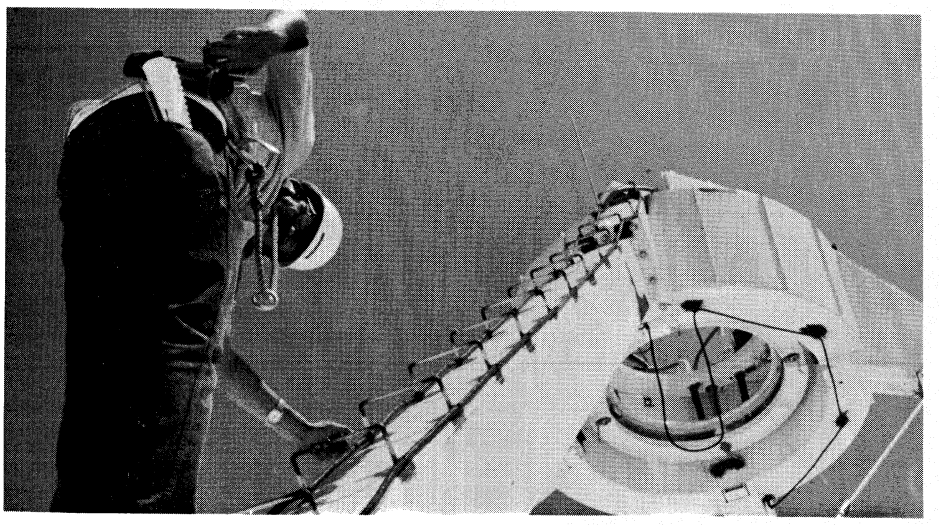

Jon Spargo finishing the installation of some temporary cables used to verify the precise alignment of the Sterling mount, seen inside the doughnut, shortly before the subreflector was installed.

* * * * *

THE LITTLE WHITE HOUSE BEHIND THE 40-FOOT

Buck Peery

The little white building behind the 40-foot control building is definitely not a new model comfort station or an intermediate relief station for site personnel who cannot make the trip from the telescopes to the works area. No, it is not for similar use by engineers buzzing in and out of the 40-foot control building these days. No half-moons, please!

Research and conceptual design for a future 25 meter diameter, millimeter wavelength radio telescope is included in our long range plans. To provide useful data, this telescope will have to be located at a high elevation. At such elevations it will be necessary to enclose the telescope part of the time, or possibly all of the time, to protect it from the elements. The big question is what to make the enclosure of. This little white house is made of a material that is being considered for an enclosure.

A house type enclosure was made so a typical surface panel for a radio telescope could be placed inside the building and temperature measurements made to determine the effects of solar energy that penetrates the material. This is commonly referred to as the "Greenhouse Effect".

Another important question that will be answered will be the durability of the material. How long does it last when exposed to sunshine, ultra-violet, rain, snow, wind, and wide temperature changes? It is anticipated weather conditions might be more severe at higher elevations, so smaller framed samples are being exposed on Kitt Peak, Mount Lemon, and Mauna Kea to determine durability at these locations.

Smaller samples of the material are being tested for radio frequency energy transmission (pass thru) qualities. Other electrical characteristics are being tested along with tear strength, rupture pressures, breaking strength, and burning characteristics.

*****

GROAN AND GRONIGEN

Seth Shostak

Sometimes, for variety, one takes the northern route to Green Bank. It's late at night and gently raining. You're alone--both in the car and on the road--so your foot goes heavy on the accelerator. No reason to speed, really--your only welcome will be a white envelope containing a few keys--but something about being alone imperiously hurtles you through the darkness. It's a scenario for you, the car, and the night. Up front the motor groans a background to the rhythmic swish of the windshield wipers, and a dull green glow rises from the instrument panel. On either side of the road hunch the massive black mountains of West Virginia, secretly laced with coal galleries and mine shafts. The thought crosses your mind that the plundering of these mountains is, in a very subtle way, responsible for the fact that you're on that road at all.

Now picture another road on another continent. The car is smaller and the mountains are gone. The rain remains, rinsing a pastoral, Old World landscape under a grey sky. In a very brief time, for distances are short in Europe, you pass by the tidy Dutch town of Westerbork, a village rendered infamous on account of its use as a detention site during the last war. Beyond, the farmland is intermittently punctuated by rectangular stands of pine forest. A line of trees to the northeast grabs your attention with a row of metal triangles which poke unexpectedly above the pines. This is the Westerbork Synthesis Radio Telescope, presently the world's most sensitive instrument for the mapping of radio sources. And very definitely the reason why you're in that car in the rain.

Holland. Most people think of a picture-book land of tulips and windmills, dikes and canals. Well, those things are here, of course. But just as America is far more than merely cowboys and hamburgers, so too is Holland a good deal more subtle than Rembrandt landscapes and silver skates. As a seafaring nation, dependent for survival on overseas trade, Holland was early-on compelled to foster astronomical studies for purposes of navigation. These studies ultimately went quite beyond the requirements of shipping, however.

Mass transit in Groningen. Frequency of service is 50 cycles per second.

The Dutch pursued both galactic and extragalactic research with enthusiasm and considerable success. Names such as van Rijn, Kapteyn, de Sitter, van de Hulst, Westerhout, Schmidt, and Oort may serve to illustrate the disparity between the size of this country and its contributions to astronomy. Viewed with historical perspective, Westerbork is seen to be part of the continued evolution of Dutch astronomy, not simply a whimsical, and expensive, scientific showpiece.

Much of the research staff using Westerbork is to be found in Groningen, a compact university town about twenty-five miles from the telescopes in the north of Holland. Here your transplanted correspondent simultaneously pursues studies of galaxies and the "continental" existence. The former is possible here, the latter is less obviously so. Groningen has a population more than three times that of Charlottesville, but unlike that jewel among metropoli, Groningen is not a mere two hours from fun-loving D. C. It is three hours from fun-loving Amsterdam. As a result, most of the residents (including twelve thousand hirsute students) have to fabricate their own excitement on the weekends, "big city" pleasures being just too far for casual commuting. So, on Saturday night, attractive Dutch girls and their bearded consorts head out to the local pizzeria for an early dinner. The entrees, looking more or less like anchovy

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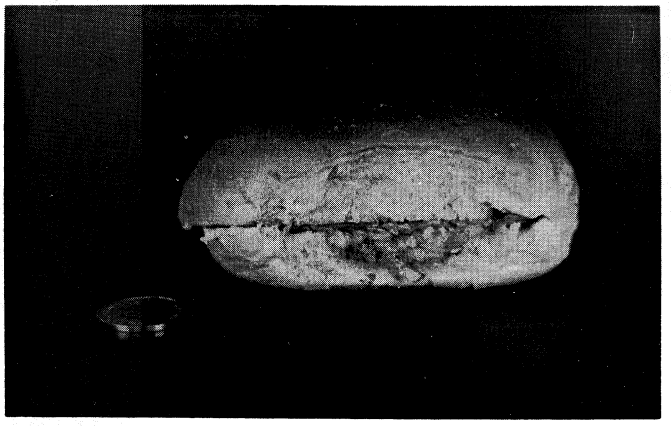
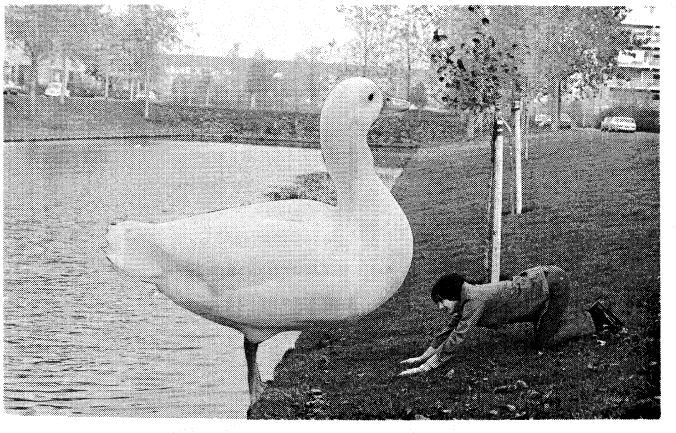


Kapteyn Memorial Eating Thing, or "broodje". For lunch, a fairly standard standard fare.

-covered frisbees, arrive with all the speed of continental drift, but nobody seems to mind. After a leisurely repast (during which some of the patrons can be seen to visibly age), everyone piles out of the restaurant and heads for the movie houses--sometimes to see an exciting new release (example: "Ben Hur"), but more likely to thrill to some sophisticated action film (example: "Clint Eastwood Meets Bruce Lee"). The theaters are run a little differently than in the States: for example, the seats are not all the same price, the most expensive location being the back of the theater. This particular perversity of the Dutch is a boon to the author who, by buying a cheap ticket, can examine the grain structure of films completely unperturbed. Halfway through the feature, a ten minute intermission occurs. The audience files out to the lounge to refresh itself with coffee, chocolate milk, or beer. Suitably fortified (or drugged, as the case may be), they return to that dark cavern of adventure to watch the final reels.

The movie houses disgorge around midnight, but their loss is the cafes' gain. More than any other institution, the cafes typify Dutch life for me. Dimly lit Victorian interiors are packed to the gunnals with students. Slowly rotating overhead fans battle ineffectively against viscous cigarette smoke, while painted Reubenesque cherubs peer down innocently from the ceilings. In the aural background, music from "The Sting" makes counterpoint to the animated conversations. The students, gayly attired in black cordouroy, are tall, friendly, and attractive. (During a recent visit to a Groningen cafe, Bob Sanders, acknowledged connoiseur of feminine beauty, claimed to feel "like a mosquito in a nudist camp".) One soon recognizes a number of cafe "regulars": Jean-Pierre, self proclaimed last of the accursed poets, suited like a guard in Rembrandt's "Night Watch" and surrounded by groupies of both sexes. And the "World's Almost-Perfect Master", a fiftyish gentleman dressed Navajo-style who discusses in hushed tones the eternal truths over a foamy draft. Truly, the life of Groningen is to be found in the cafes.

Around two in the morning some couples migrate to nearby discotheques to dance. Others snack at automat-style restaurants which serve breaded geometric forms on paper-thin plastic plates. By four the streets are abandoned to the dogs and ducks. The latter, incidentally, are ubiquitous and semi-sacred (see photo).



Author cowers to power of sacred Dutch duck. Core samples later showed this animal to be over two thousand years old.

Well, I'm just getting into my material here, but in deference to you, dear reader, I will save additional drivel for a later article. For those of you who are wondering whether all Dutch guys look and act like Gerrit Verschuur, I can only say "Of course they do!".

*****

A SEQUEL: WHAT AM I DOING IN TUCSON?

John R. Dickel

Would you believe: (multiple choice)

(a) observing Cas A (before checking this one please read the March issue of this distinguished magazine)
(b) making radio "pictures" of supernova remnants using the IPPS (see below)
(c) visiting Lanie's aunt and uncle
(d) attending a Beethoven concert (2 piano concerti)
(e) observing Titan (one of Saturn's satellites for the uninitiated in planetary lore)
(f) observing Pluto with the 36-foot at the same time another group was looking at it with the 4-meter telescope - meaning that the two largest telescopes on Kitt Peak were both looking at Pluto at the same time!
(g) getting lost on the trail between the cafeteria and the 36-foot
(h) detecting the thermal continuum radiation from a faint H II region (cloud of ionized hydrogen) in the direction of the supernova remnant W49B (half of a source discovered by Gart Westerhout 18 years ago - actually there are 2 separate ones but he couldn't resolve them with the telescope available then)
(i) finishing up some Scotch kindly left by _____ (please fill in the blank if you know)
(j) all of the above
(k) none of the above

The honest answer is (j), even the Cas A part. It never has been mapped at this high a frequency before and, recalling our discussion of last time, there may be spectral features which would make this map way out at one end of the spectrum valuable.

Note that except for a few extraneous matters all of the items have involved two specific pieces of equipment and it is really those which I would like to describe for you. These are: (1) the Interactive Picture Processing System (IPPS) of KPNO and (2) the continuum radiometer on the 36-foot telescope. First let's discuss the IPPS, colloquially called by some "Wells' machine" after Don Wells, the Kitt Peak astronomer responsible for this superb instrument. This is an "on-line" color TV set attached to a mini computer and through a link to their large CDC6600 computer at Kitt Peak. With this system, it is possible to simultaneously display up to three separate pictures in different colors on the TV screen and vary the contrast and brightness of each one individually. The pictures can, of course, include radio brightness maps similar to those produced by the Dicomed, optical photos, etc. The possibilities are limitless for displaying composites of radio and optical maps to look for the coincidence or associations of various features or for 2 epoch pictures to investigate motions, etc., and all with the continuous variations in color, contrast, and brightness which are vital for the investigation and understanding of the subtle differences which are often present. The interactive capability might also make this very nice for VLA analysis. A few of the readers may have seen the copy of my optical and radio picture of Tycho's supernova remnant - the first such overlay which was made with the instrument. Those who haven't seen it are referred to the upside down, out of focus, and improperly captioned copy in Astronomy magazine for October 1975. For the even more ambitious, Bob Hjellming has a small version of this in his back room just waiting for someone to program it.

With that note, let's now turn to the 3-mm continuum radiometer. This dual-channel cooled mixer system first developed a few years ago by Tony Kerr is certainly a joy to use. The cooling in a cryogenically controlled refrigerator keeps the receiver cold enough so that it doesn't create much noise itself and we can more easily measure the sky signals which themselves appear noiselike. At this point I should interject the caution expressed recently to me by several people, in particular John Spencer - "No, don't tell people how good it is; we certainly don't need even more proposals for the 36-foot.". One-flux unit (jansky)

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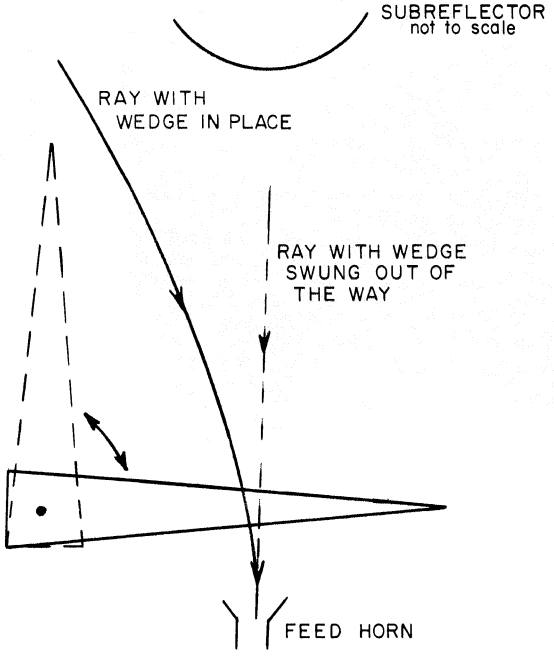
sources stand out easily after a few minutes integration time and observations of such things as the major planets and their satellites become trivial, except for the confusion by sidelobes on the planet itself. Lest the engineers get too complacent, however, I should here mention that we predict it will still take over 100 hours of integration time to detect Pluto so that the 25-meter telescope and better receiver systems are still desirable.

An interesting improvement to the system which John Payne, Bobby Ulich, and Co. installed for me was a "wedge switch". Normally we switch the beam of the telescope back and forth between the source and the sky and measure only the difference signal in order to remove background noise. I wanted to map a fairly large region of the sky (about ½ degree) and the normal beam switching which is done by rocking the subreflector has a mechanical limit of only about 8 arcminutes before it shakes the dish apart. Therefore, both the "on" and "off" beams would be zero so we needed something to go farther. What they came up with was a prism (or wedge-shaped piece of plastic) which went in front of the feed horn and bent the beam so it missed the subreflector altogether. This made the beam several degrees off the source position and also very wide - sort of like the old sky horns that have been used sometimes in the past. Next came the problem of switching it in and out of place at some reasonable speed so that the difference could be recorded. After much discussion about oscillating cams, etc., it was finally decided to pivot the wedge about an axis just off the edge of the feed horn as shown in the sketch. When the wedge was folded out of the way the beam went directly toward the subreflector, but when the wedge flapped down into place the beam was deflected.



The system worked beautifully with the wedge flapping back and forth for 3 days at a flap frequency of once per second. Incidentally, the term "flap frequency" is now the official designation of the switching frequency with the wedge system. It was coined the first morning at 5 a.m. when, in order to complete his log properly, Dave Myers asked me, "At what frequency are we... uh...uh...?". At that point we decided upon "flapping". (I actually don't remember now whether it was flip, flop, or flap, but at 5 a.m., who cares?.) In good clear weather the system was about 1½ times noisier than the beam switch - not at all unreasonable for the added light path, etc. When the weather deteriorated, the system got considerably worse as the nonidentical beams went through different parts of the earth's atmosphere and the compensation was not complete.

There were, of course, a few minor problems such as a beat between the flap frequency and the "thunk" frequency of the refrigerator pump used to cool the system but this was (sort of) tuned out. As an aside here, let me state that every cooled receiver I have ever used has had some trouble with the refrigerator shaking at some time or other in its history. Therefore I hereby offer (Dave Williams and colleagues take note) a bottle of my grandfather's best - his name was George (but unfortunately no relation) - to the person who can provide a good permanent refrigerator for a radio astronomy receiver that doesn't require a pump. Anyway, the 3-mm continuum system on the 36-foot telescope is a super instrument and I recommend it to anyone with only 2 admonitions: (1) don't tell John Payne and company how good it is or they might get complacent, and (2) don't

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tell Mark Gordon I sent you on your observing request.

As a third sequel to all this and to explain why the above may be a bit incoherent, I will ask one final question: "What am I Doing in First Class (with a Tourist Class Ticket)?". This is being written on the plane home and for some inexplicable reason, the person assigning seats gave me a first class one. Applying the old adage "I'd rather drink than switch", I haven't complained too bitterly to the stewardess but I'll also offer half the profits (one free drink) to anyone who can tell me how to get it to happen again.

*****

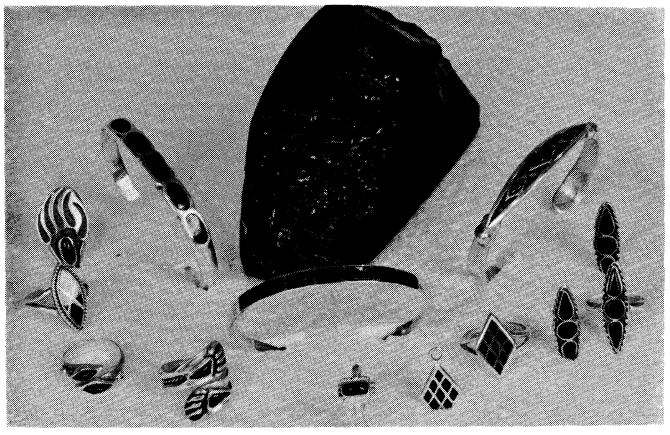
BLACK DIAMOND JEWELRY

Omar Bowyer

While working at the VLA Site early in 1975, I (like many others) became interested in turquoise and silver Indian jewelry and spent my nights and weekends looking, comparing, pricing, and talking to silversmiths about jewelry. Most of these jewelers made jewelry from turquoise, corals, mother of pearl, and jet black. Further investigation of jet black, a dark stone found in a coal seam in the West, made me wonder if our West Virginia coal could be worked into the silver inlay.

I purchased two rough silver bracelet castings from Forrest Wells (whose son does turquoise jewelry), and brought them back to Green Bank. Shortly after returning to Green Bank I set about gathering different grades and types of coal. With no previous experience in jewelry making or the lapidary field, I started sawing, sanding, buffing, gluing, and polishing. After 2 - 3 months of this I produced 14 pieces of coal less than ¼" square. These were then glued into the channels in the silver bracelets. This (in my estimation) made a good-looking piece of inlay jewelry. I showed these to several craftsmen. Their approval of my work encouraged me to make some rings, necklaces, and other jewelry pieces.

My experience now tells me that coal for making jewelry must be hard and strong. Some of the coal I have found in the Appalachian Mountains is extremely dense, hard as glass, jet black, and has a carbon content of 80 - 90%, occasionally even more. Coal is called Black Diamond because a diamond is also made out of carbon.



These pieces of cut coal inlay jewelry were made from a lump of coal (center).

As far as I know, no one else makes, or has made, silver and cut coal inlay jewelry. Most so-called coal jewelry is a mixture of coal dust and plastic that melts when overheated. The coal I use is sawed from large, rough pieces and is shaped and polished exactly like a precious or semi-precious stone. Coal polishes to a very high black luster that looks much like black onyx, and as the popular saying goes, "Black is Beautiful".

*****

BLEU CHEESE DRESSING

Bill Greene

Grind the following:

- 2½ lbs. bleu cheese
- 2 pints spanish olives
- 3 medium onions
- 4 bell peppers
- 2-2 oz. pimentos

Mix above with 1 gallon Kraft's mayonnaise, juice from 1 lemon, and 1 tablespoon white pepper. Yields approximately 2 gallons.

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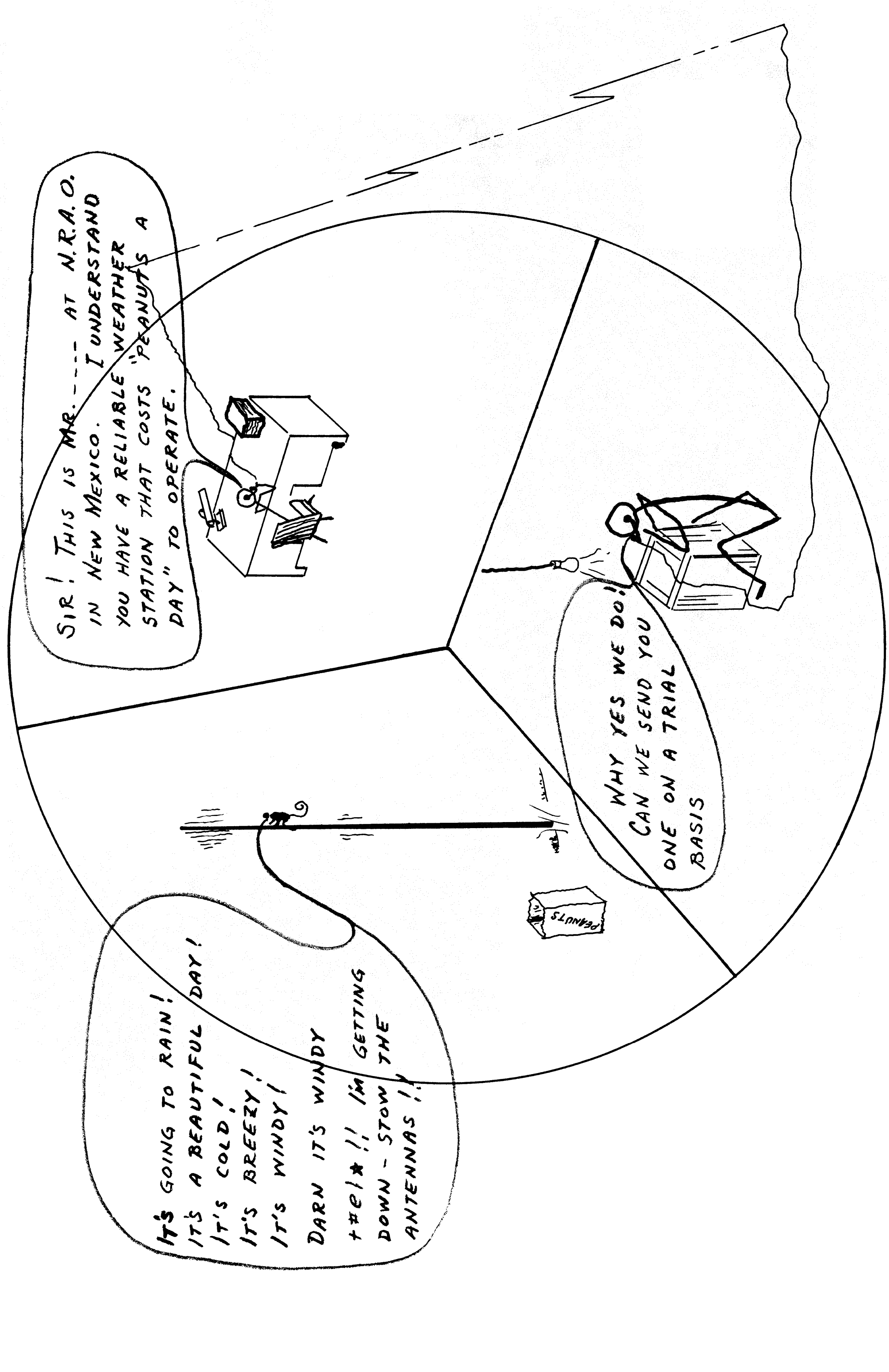
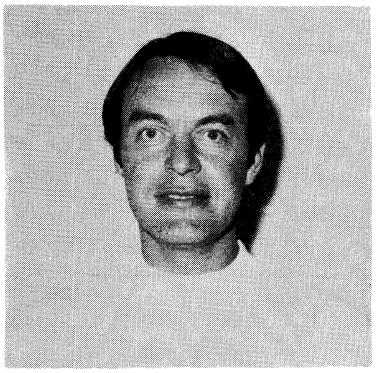
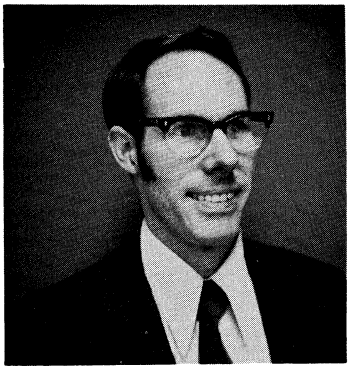

SIR! THIS IS MR. ---- AT N.R.A.O. IN NEW MEXICO. I UNDERSTAND YOU HAVE A RELIABLE WEATHER STATION THAT COSTS "PEANUTS A DAY" TO OPERATE.
WHY YES WE DO! CAN WE SEND YOU ONE ON A TRIAL BASIS
PEANUTS
IT'S GOING TO RAIN! IT'S A BEAUTIFUL DAY! IT'S COLD! IT'S BREEZY! IT'S WINDY! DARN IT'S WINDY +#e!★!! I'M GETTING DOWN - STOW THE ANTENNAS!!

NEW EMPLOYEES

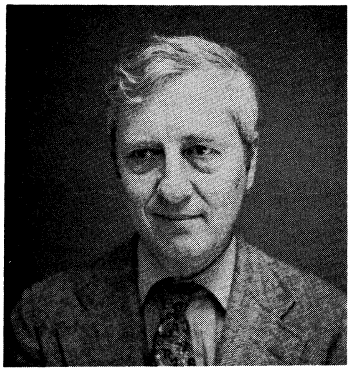


Wayne A. Christiansen
Vis. Asst. Scientist
Basic Research - GB

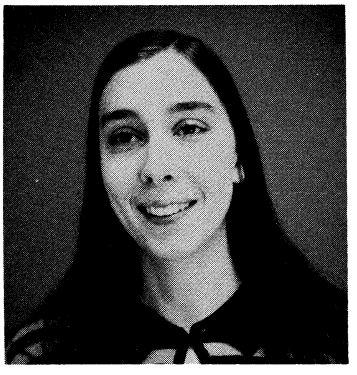


Frank F. Donivan, Jr.
Vis. Asst. Scientist
Basic Research - CV

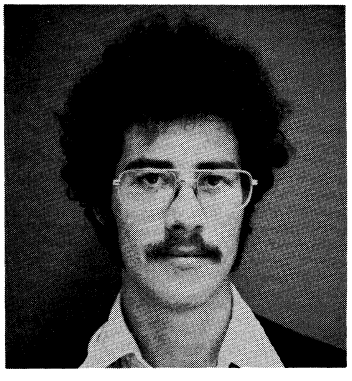
Bernard J. Geldzahler
Jr. Research Associate
Scientific Serv. - GB



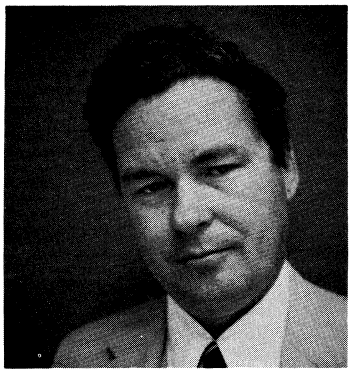
Samuel J. Goldstein, Jr.
Visiting Scientist
Basic Research - CV



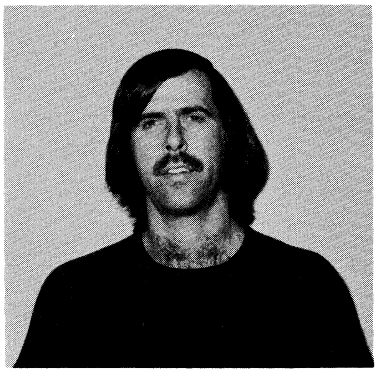
Martha P. Haynes
Jr. Research Associate
Scientific Serv. - CV



Charles R. McCrickard
Computer Operator
Computer Div. - CV



Andrez G. Pacholczyk
Visiting Scientist
Basic Research - CV



John R. Sparks
Graphic Arts Tech.
Admin. Serv. - GB

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NEW EMPLOYEES (continued)

Dan G. Baca	Maintenance Trainee	New Mexico
Ted M. Baca	Jr. Technician	New Mexico
Daniel E. Beeker	Jr. Technician	New Mexico
Michael S. Bielas	Jr. Technician	Tucson Operations
James B. Jones	Res. Asst. (Co-op)	Scient. Services - Tucson
Luis R. Casiano	Jr. Technician	New Mexico
Kathleen Clayton	Jr. Technician	New Mexico
Charles K. Cotton	Waveguide Foreman	New Mexico
Thurman B. Derryberry, Jr.	Driver/Warehouseman	New Mexico
James C. Hall	Jr. Technician	New Mexico
Alvah E. Miller	Sr. Technician	New Mexico
James J. Osborne	Jr. Technician	New Mexico
D. Dawn Reiche	Tracer	New Mexico
Frank A. Reid	Jr. Technician	New Mexico
Louis Serna	Electrician	New Mexico
Patrick A. Temple	Jr. Technician	New Mexico
Stephen W. Troy	A/C Heating/Plumbing Eng.	New Mexico

REHIRES

Jesse E. Davis, Jr.	Electronics Engineer	Electronics - Tucson
R. Jane Gordon	Clerk	Fiscal Division - GB
Harvey S. Liszt	Associate Scientist	Basic Research - CV
Gary A. Pasternak	Computer Operator	Computer Division - CV

TRANSFERS

*Alfred O. Braun	VLA - New Mexico
*David L. Ehnebuske	VLA - New Mexico
*Robert M. Hjellming	VLA - New Mexico
*Jerome A. Hudson	VLA - New Mexico
*David M. Rosenbush	VLA - New Mexico
Thomas A. Royston	VLA - New Mexico
*James M. Torson	VLA - New Mexico
*Nancy R. Vandenberg	VLA - New Mexico

* Effective 1 July 1976

TERMINATIONS

Gary A. Bonebrake	VLA - New Mexico
Lynn S. Fischer	Tucson Operations
Lee J. Garvin	Scient. Serv. - CV
William R. Greene	Adm. Services - GB
Michael C. Mayo	Computer Div. - CV
Judith F. Moore	Fiscal Division - GB
Doreen Morris	Electronics - GB
David G. Steigerwald	Scient. Serv. - CV
June E. Thomas	VLA - Charlottesville
George Wallerstein	Basic Research - CV
Harold W. Ward	VLA - Charlottesville
Anthony Wojtowicz	Electronics - CV
Ronald D. Womeldorff	Tucson Operations

We are sorry to report the death of Jesse W. McLaughlin, who died on 8 June 1976. Mr. McLaughlin was Housing/ Food Service Supervisor at Green Bank. He joined NRAO 1 April 1967.

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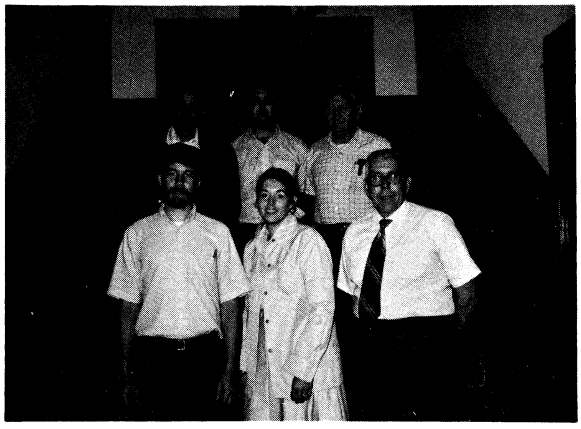
TOUR PERSONNEL



1st row - *Bill Young, Linda Snyder, June Riley*
2nd row - *Paul Kesler, Jerry Matheny, Nathan Fertig*

GB SUMMER STUDENTS

1st row - *Ron Buta, Tony Rothman, Jim Morgan*
2nd row - *Kathy Harper, Mark Kovalan*

GB SUMMER EMPLOYEES

Front to Back -

Paul Kuhlken, Rick Wooddell, Mary Jane Oref, Mike Collins, Shelby McLaughlin, Rick Beverage, David Jonese (not pictured)

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Truly big men are always courteous. It is only "small" men, men with inferiority complexes, who are rude or thoughtless. And smaller than small are those who are overcourteous to their superiors and intentionally rude to those over whom they have some authority.

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CREF UNIT VALUES FOR 1976

January	$40.31
February	39.76
March	40.75
April	40.10
May	39.69

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CRAFT STUDIO NEWS

Perryn Fleming

The Hannah House has been used for many things through the years - an experimental station, summer student quarters, a kindergarten, and is now the home of the Rifle Club and the "Craft Studio".

The facilities of the "Clay House" are open to any NRAORA member and their guests any time they wish to use them. Arrangements were made several years ago for Bette del Giudice and Perryn Fleming to be "custodians of the keys". The reason for this is to make it easier to get keys for the Hannah House after regular working hours. Those who wish to work at the Hannah House may phone or stop by Perryn's or Bette's house and make arrangements. For information concerning the Rifle Club see a Rifle Club member.

With the advent of better weather, a group who is interested in ceramics has been meeting on Monday mornings and is enjoying ceramic projects, using hand built techniques as well as some wheel work. The atmosphere is very informal and we enjoy sharing ideas for new projects as well as offering help and suggestions.

We have available to us clay, glazes, tools, and a kiln for work in ceramics, but we aren't limited just to pottery. Any kind of craft you want to work on could happen. We have done candle making, batik, tie dying, and there is a rock cutter available for those who are interested in cutting and polishing rocks for jewelry. Also, we are in the process of converting one of the downstairs rooms into a studio for exercising, dancing, or perhaps just a place for younger children to play while parents work on a project.

With the privilige of using the Clay House comes responsibility, though. Individuals who work there must clean up after project work, and equipment must be cleaned and cared for because there is no one person responsible. It belongs to all of us who use the Hannah House.

There are a number of items that belong to people who have not come to claim them. Little pots and big pots are beginning to collect here and there. Even though the Hannah House is a big place, those who are working now need room to put new projects on the shelves. Too, there have been a lot of people who have come to the Hannah House and have made things, but not everyone has remembered to put their names on their work. Therefore, it is impossible to tell or remember to whom these things belong. So, if you think you have something at the Hannah House that you want to keep, please stop by for it. Who knows, perhaps your interest might be renewed.

Come by some Monday morning*
The hours are 9:30 until 12:00
The price of clay is 33¢/kg
There is limited instruction.
See you soon!

* This activity rated P. G. (children under 12 should be accompanied by a parent).

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